Taxonomic Status

Rausch (1963) proposes that the scientific name Ursus arctos horribilis be used for brown bears over the greater part of the range of this species in North America and recognizes Ursus arctos middendorffi as a distinct subspecies. Pearson (1972) suggests six loosely-defined ecotypes of grizzly bears in North America: (1) California grizzlies in the mountains of northern Mexico; (2) Plains grizzlies in the Swan Hills of Alberta; (3) Southern interior mountain grizzly from Central British Columbia and Alberta south to Idaho and Montana in mountains; (4) Northern Interior mountain grizzly in mountains of northern British Columiba, Yukon, Northwest Terrirories and the interior mountains of Alaska north to about the 66th parallel; (5) The barren-ground grizzly in northern parts of Alaska and Yukon and the artic tundra; (6) Coastal grizzly on the West coast of British Columbia and the south coast of Alaska.

This classification has value in that it recognizes the great variation in size, contour behavior, reproduction, diet and activities resulting from different environmental conditions ~~and as~~ these related to the bears' annual cycle. It has value in managing distinct, widely separated populations under varied jurisdiction. Weights and lengths of Yellowstone grizzlies may prove of value and interest when compared with other ecotypes and other subspecies. Average seasonal weights and average total lengths were obtained for fifty-five adult grizzlies during

The research data presented here concerns grizzlies in the Yellowstone ecosystem or the Southern Interior mountain grizzly in the states of Wyoming, Montana, and Idaho

NOTES: April 6, 1974

White Jaws

Two things to do in regard to some of the summer work: (1) Go over the Geographic proposal and funding and see just what I want to do next and how much I can spend. (2) Figure out what I can get accomplished and spend on the New York Zoological Society Raptor Research Program. Also, get the name of the fellow from the American Rifle Association, a representative, and see if he would be interested in helping out on our comparative raptor study here and then I might write Pink Guttermuth(?).

Look up the film I have put together on the cabin and lab in winter and some of the biotelemetry work and project it and see what it looks like.

~~Get Barry Corbett's address and also Bob's address from Derek~~.

Write John and ask him to send me a copy of the statement Jay Sumner made concerning our meeting with Glen Cole when he threatened to push us out of Yellowstone.

Send Zetterberg a copy of my letter to Jim White concerning the Leopold Report. Also send copies of the notes I made following my two conversations with Jerry Schroeder.

Drop John a note asking for return of the negative pictures I sent to the Spokane Exposition.

Paper

John has given me the population estimate for Montana (Glacier) the estimate is about 125 grizzlies, now not over 100; Bob Marshall Area 300 to 350, and the Missions 50.

Paper

Pop.

In treating the density of bears, I think I should start with the density per acre on a two-acre area and go on to show the density throughout the ecosystem when the bears are dispersed. Then take the data from Mullins report showing that very few grizzlies were in the vast areas surrounding the Park at the time of massive concentration at the Trout Creek dump. So this data from Mullins census plus the losses of marked bears outside the Park and plus sightings are all indicative of a population that moved from distant areas outside the Park into the center, so that our figures for the build-up during summer are pretty close to the total population for the entire 5 million acres. Some steps toward management that I made on Yellow paper at the Computer Analysis Meeting on which I had Ken Greer's statement.

Paper

The age of sexual maturity for the male grizzly is 4 years.

Paper

Food

Under the food habits of the grizzly I want to mention habitat preferences and then state that the grizzly seeks out the various habitat according to the availability of seasonal foods. I then want to mention that although the animal is a carnivorous and omnivorous feeder but may feed on vegetation more consistantly but that meat is a major part of the diet of the Yellowstone grizzly. Then bring out the carcasses, small mammals and so on. I want to treat the plant foods by season, and then list the ones that the bear feed on such as Melica, Yampa, Pine nuts, Huckleberries.

over

Baker

Management Section: Treat management generally as I have started to do-on a basis of the biology and ecology. Then briefly outline present-day management by States, and then the management by the Park Service.

After this, focus down to the management of the grizzly in the Yellowstone ecosystem and what I feel would be most helpful here.

Baker Mort.

Under Mortality: The death of bear #183 in 1969 comes under the notes, "Grizzly Bear Incidents". On July 8 John and I had a long conversation with Yellowstone Park Supt. Jack Anderson.

Back

When I write up the Washburn bear incident, I want to bring in moving in slowly, coyotes departing, and the elk, and the grizzly starting to approach us-becoming alerted and climbing up trees. This is written up in a number of places, including the section on the Wilderness Chapter for the Geographic

JOB PROGRESS REPORT

RESEARCH PROGJECT SEGMENT

State of Montana

Project No. W-120-R-3 Name Statewide Wildlife Research

Work Plan IV Title Wildlife Investigations Laboratory

Job No. L-1.1 Grizzly Bear Mortality and Management Programs in Montana During 1971

Period Covered: May 1, 1971 through December 31, 1971

Prepared by: Kenneth R. Greer
Kenneth R. Greer

Approved by: Thomas W. Mussehl
Wynn G. Freeman

Date: May 30, 1972

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ABSTRACT:

A total of 44 grizzly bear (*Ursus arctos horribilis*) mortalities are known for 1971 and included 22 harvested by hunters. Three hunting areas provided about 75 percent of the hunter harvest. Data for all grizzlies are noted. Various criteria were compared for sex dimorphism. Measurements of a lower canine indicated the least overlap (20 percent) between sexes. Age and sex of grizzly mortalities are listed. Events and circumstances required a special management program of trapping and transplanting grizzlies from the vicinity of West Yellowstone during 1971. A total of 17 grizzlies were transplanted and subsequent observations were made for all but three individuals. Various recommendations are presented.

INTRODUCTION

Among the western states, Montana has the largest population of grizzly bears. In the past 30 years liberal annual hunting seasons have prevailed in Montana for the black (*Ursus americanus*) and grizzly bears. A resident or nonresident with a valid big game license was permitted to kill either a black or grizzly bear per license. Black bear seasons commenced in the spring, March 15, and continued uninterrupted into the summer and through the hunting seasons. Grizzly bear seasons were confined to the general big game hunting seasons.

An unknown number of bears were killed each year and in 1947 Department personnel established an estimate of the annual harvest of grizzly bears in Montana. This estimated harvest during 1947-1966 ranged from 10 to 60 and averaged 37 grizzly bears.

Since 1967 the annual grizzly bear hunting harvest in Montana has been determined from special hunting licenses. A complimentary program provides for the recovery of all other grizzly bears known to be killed during the year.

Grizzly bear hunting licenses were unlimited and unrestricted for residents and nonresidents. A subsequent restriction involved the date for license purchase. License fees for grizzly bear licenses were increased for the 1971 season. Quotas are not in effect to restrict grizzly bear harvests in any hunting area.

Events and circumstances required a special management program of trapping and transplanting grizzly bears from the vicinity of West Yellowstone, Montana during 1971.

This report describes the recent hunter harvests, other known instances of man-caused mortality, and the trapping and relocation of grizzly bears in Montana. The reference to mortalities in this report includes only those known to have occurred and unless otherwise noted, all instances were the result of man's action.

OBJECTIVES:

To determine the categories, extent and composition of man-caused mortality of grizzly bears in Montana during 1971.

METHODS:

Licensing

A special grizzly bear hunting license (resident -- $5.00; nonresident -- $35.00) is required to hunt and a grizzly bear Trophy License (resident or nonresident -- $25.00) must be purchased by hunters killing a grizzly bear. The hunting license fees were previously $1.00 and $25.00, respectively. These licenses provide reliable data on the number of licensed hunters and the hunter harvest. Current laws and regulations were previously reported (Greer 1970, 1971.

Hunting Seasons and Restrictions

The hunting season for grizzly bears coincides with the general big game seasons throughout the State. Only a fall season has prevailed for grizzlies, prior to, and since 1967. Cub grizzly bears or female grizzlies with cubs at side may not be taken. No grizzly bear hunting license could be purchased after September 14, 1971.

Successful grizzly bear hunters are not eligible for a similar license for the subsequent 7 years. Unsuccessful grizzly bear hunters may obtain a license for following years.

Tagging Regulations

Regulations require that the grizzly bear hide and head are presented for examination at time of application for special licensing. A numbered, metal sealing tag is recorded and affixed to the hide. The hide is returned to the owner. Grizzly bear heads are tagged and retained for shipment to the Wildlife Lab. Skulls are cleaned, examined, measured, recorded and tooth roots are obtained. After processing, the grizzly skulls are returned to the owner.

Other Mortalities

In addition to hunting, cooperation of various agencies and other personnel report and assist with the recovery of grizzly bear mortalities throughout the year.

Live Grizzly Bears

A special management program was required to live-trap and transplant nuisance grizzly bears in the vicinity of West Yellowstone.

FINDINGS:

License Fees and Numbers

Special grizzly bear licenses were initiated in 1967 with fees established by the Legislature at $1 and $25, respectively, for the resident and nonresident grizzly bear hunting licenses. Successful grizzly bear hunters were also required to obtain a grizzly bear Trophy License at a fee of $25 for either resident or nonresident (Table 1). From 1967 through 1969, grizzly bear hunting licenses were available at any time before or during the general big game seasons.

TABLE 1. MONTANA GRIZZLY BEAR LICENSE FEES.

	GRIZZLY BEAR HUNTING LICENSE		GRIZZLY BEAR TROPHY LICENSE	
	Resident	Nonresident	Resident	Nonresident
1967	$1.00	$25.00	$25.00	$25.00
1968	1.00	25.00	25.00	25.00
1969	1.00	25.00	25.00	25.00
1970	1.00	25.00	25.00	25.00
1971	5.00	35.00	25.00	25.00

During the first year 1,022 licenses were issued for residents and 143 for nonresidents. Licenses increased 12 percent in 1968 and 28 percent in 1969 for residents, and nonresidents declined 4 percent then increased 20 percent for respective years.

For the 1970 season, a regulation prohibited the sale of grizzly bear hunting licenses on or after the opening day of the early general big game season on September 15, 1970. Advance publicity about this regulation was well accepted and resulted in a 20 and 30 percent increase, respectively, for resident and nonresident grizzly bear hunting licenses over the previous year when licenses could be purchased at any time (Table 2).

TABLE 2. GRIZZLY BEAR LICENSES ISSUED IN MONTANA.

	GRIZZLY BEAR HUNTING LICENSE			GRIZZLY BEAR TROPHY LICENSE		
	Resident	Nonresident	Total	Resident	Nonresident	Total
1967[1]	1,022	143	1,165	21	3	24
1968[1]	1,149	137	1,286	9	3	12
1969[1]	1,474	164	1,638	30	3	33
1970[2]	1,769	211	1,980	11	2	13
1971[3]	743	222	965	15	7	22

[1]Hunting licenses available before and during seasons.
[2]Hunting licenses available until the opening day of the early general big game season -- September 15.
[3]License issue restricted to deadline date and increased fees.

The 1970 Legislature increased grizzly bear hunting license fees to $5 for residents and $35 for nonresidents, effective for the 1971 season. As in 1970, these licenses were not available after September 14, 1971 when the "early" big game season opened on September 15 in three hunting areas. The increased fee had a considerable effect on the number of resident licenses sold in 1971 which declined about 58 percent over the previous year. An increased fee did not defer the nonresident licenses as this group increased slightly in 1971.

Hunters and Success

The overall hunting success for all grizzly hunters has ranged from less than 1 percent to just over 2 percent during the past 5 years. Nonresidents harvested 9 to 32 percent of the grizzlies during each year and the greatest number were taken in 1971. Nonresident grizzly hunters represented 10 to 12 percent of the total licenses from 1967-1970 and increased to 23 percent in 1971.

Annual Mortality

Hunting accounted for 50 percent (22 of 44) of the grizzly bear mortality in Montana during 1971 (Table 3). About 64 percent of the hunting harvest occurred during the "early" hunting season of September 15 to opening date of the "regular" hunting season on October 17. However, in 1970 only 25 percent of the grizzlies were taken during the early season. In the previous years of 1967-1970, hunters harvested from 12 to 33 grizzlies and have averaged 21 for a 5-year period.

Excluding hunting, at least 22 instances of grizzly bear mortality occurred throughout the year (Table 4). With a few exceptions, the nuisance or illegal cases are handled by Fish and Game personnel. Some nuisance grizzly bears are taken by the U. S. Fish and Wildlife Service predator personnel. A few grizzlies may be illegally killed and removed without apprehension and data of an individual mortality. While evidence of this may not become available the circumstances and reports of each case will or will not indicate a probable grizzly bear mortality. Some grizzlies are also harvested by residents on Indian reservations. Some grizzlies from Yellowstone National Park were also examined (Table 5). All known grizzly mortalities during the past 5 years are shown in Table 6.

These other grizzly mortalities, except hunting, have ranged from 15 to 17 individuals from 1967-1970. In 1971, 22 individuals were concerned and several were involved with a special management program at West Yellowstone and are discussed later in detail.

The distribution of the known grizzly mortality is indicated in Figure 1. The hunter harvest in various hunting areas from 1967-1971 appears in Table 7. About 45 percent (10 of 22) of the hunter harvest was in the two hunting areas (14 and 15) to the west of the Sun River Game Preserve. The Hunting Area 316, just north of Yellowstone National Park provided about 32 percent (7 of 22) of the harvest. During the past 5 years, the three hunting areas (14, 15, 316) have provided

about 60 percent of the hunter harvest which has ranged from 38 percent in 1970 to 83 percent in 1968 (Table 7). Hunters harvested grizzlies in three of the five hunting areas adjacent to Yellowstone National Park. Although several grizzlies were transplanted in Hunting Area 316 and vicinity, only two of the seven grizzlies taken by hunters were transplanted individuals. Details of the transplant program will be discussed later in this report.

TABLE 3. SOME DATA FOR THE 22 GRIZZLY BEARS HARVESTED BY HUNTERS IN MONTANA DURING THE 1971 SEASON.

Date	Area[1]	Location	Sex	Age[2]	Size of Skull[3]
October 24	13	Rumble Creek	Female	9	20 6/16
October 1	14	Rescue Creek	Female	16	20 3/16
October 13	14	Morrison Creek	Female	14	20 0/16
October 17	14	McNernie Creek	Female	5	16 15/16
November 21	14	Nyack Flats	Male	2	15 4/16
September 15	15	Slick Creek	Female	3	17 10/16
September 16	15	Babcock Creek	Male	5	20 1/16
September 17	15	Gorge Creek	Female	21	20 7/16
September 18	15	Upper Big Salmon	Female	3	17 5/16
September 27	15	Bob Marshall	Female	6	Broken
October 7	15	South Fork Flathead	Male	3	19 0/16
September 28	280	Debora Creek	Female	6	19 5/16
October 12	280	Cabin Creek	Female	Cub	Broken
October 28	310	Sage Creek	Male	5	23 9/16
October 20	313	Crevice Creek	Female	3	17 14/16
September 15	316	Slough Creek	Male	8	23 4/16
September 16	316	Head Slough Creek	Female	3	17 0/16
September 16	316	Head Slough Creek	Female	3	17 2/16
September 29	316	Slough Creek	Male	9	23 9/16
September 29	316	Anderson Creek	Female	6	19 8/16
September 31	316	Slough Creek	Male	8	21 0/16
October 1	316	Hellroaring Creek	Female	21	21 1/16

[1]Hunting area designated on the 1971 hunting map.
[2]In years -- fraction of year implied.
[3]Condylobasal length plus the zygomatic width in inches.

TABLE 4. LIMITED INFORMATION FROM KNOWN NON-HUNTING GRIZZLY BEAR MORTALITIES IN MONTANA DURING 1971.

Date	Location	Hunting Area	Category[1]	Sex	Age[2]	Whole Weight[3]	Total Length[4]	Size of Skull[5]
June 25	10 Miles NE Eureka	101	M	Female	5	---	--	19 5/16
June 25	10 Miles NE Eureka	101	M	?	Cub	---	--	---
June 25	10 Miles NE Eureka	101	M	?	Cub	---	--	---
July 22	Upper Stillwater River	316	A.T.	Male	8	---	--	23 4/16
July 24	Hebgan Lake -- USFWS	361	M	Male	4	---	--	21 2/16
July 25	Independence	316	I.T.	Male	--	---	--	---
July 25	West Yellowstone	361	M	Male	17	534	--	24 8/16
August 5	Charlie White Lake	313	I.T.	Female	15	---	--	22 9/16
August 5	West Yellowstone	361	M.T.	Male	6	470	80	23 10/16
August 13	Hebgan Lake	361	M	Male	11	506	85	24 3/16
August 18	West Yellowstone	361	M.T.	Female	7	207	71	20 2/16
August 19	Elk Creek	424	M	Female	3	205	58	16 12/16
August 28	Boulder River	56	M.T.	Male	8	---	--	22 14/16
September 13	West Yellowstone	361	M.T.	Female	16	395	76	21 4/16
September 16	Park County	361	I.T.	Female	--	---	--	---
September 16	Park County	361	I.T.	Female	--	---	--	---
September 16	St. Mary's Lake -- USFWS	B[6]	M	Male	5	315	77	19 11/16
September 27	North Fork Blackfoot	280	I	Female	6	---	--	18 7/16
November 26	West Yellowstone	361	I	Male	3*	385	--	20 3/16
Summer	Blackfeet Indian Res.	B	N	?				
Summer	Blackfeet Indian Res.	B	N	?				
Summer	Blackfeet Indian Res.	B	N	?				

[1]M = Marauder; I = Illegal; N = Natives; A = Accidental Overdose; T = Transplant.
[2]In years -- fraction of year implied.
[3]Pounds.
[4]Inches.
[5]Condylobasal length plus zygomatic width in inches.
[6]Blackfeet Indian Reservation
*Known age.

TABLE 5. LIMITED INFORMATION FROM GRIZZLY BEAR MORTALITIES IN YELLOWSTONE NATIONAL PARK DURING 1971.

Date	Location	Sex	Age[1]	Whole Weight[2]	Total Length[3]	Size of Skull[4]
May 23	Yellowstone Park	Male	Cub[5]	12	29	---
June 22	Yellowstone Park	Male	23	412	82	Broken
July 7	Yellowstone Park	Male	18	476	86	24 8/16
July 22	Yellowstone Park	Female[6]	12	---	--	21 0/16
July 29	Yellowstone Park	Female	21	247	70	20 8/16
August 5	Yellowstone Park	Male	13	400	81	24 6/16
August 12	Yellowstone Park	Female	7	310	76	21 6/16

[1]In years -- fraction of year implied.
[2]Pounds.
[3]Inches.
[4]Condylobasal length plus zygomatic width in inches.
[5]Natural mortality found on road by Trout Creek.
[6]Accidental death during transplant.

TABLE 6. ANNUAL KNOWN MORTALITY OF GRIZZLY BEARS IN MONTANA AND ADJACENT NATIONAL PARKS.

	1967	1968	1969	1970	1971
Grizzly Bear Hunter Trophy Licenses[1]	24	12	33	13	22
Fish and Game Personnel (Marauders--Illegal)	10 (6-4)	7 (3-4)	4 (0-4)	14 (5-9)	17 (11-6)
U. S. Fish and Wildlife Service	2	3	4	2	2
Other Illegals	1	0	1	0	0
Blackfeet Indian Reservation	4	6	3	0	3
Flathead Indian Reservation	0	0	3	0	0
Total in Montana	41	28	48	29	44
Glacier National Park	4	2	3	1	0
Yellowstone National Park	6	12	11	16	7
Total in Parks	10	14	14	17	7

[1]All hunting seasons are fall, only.

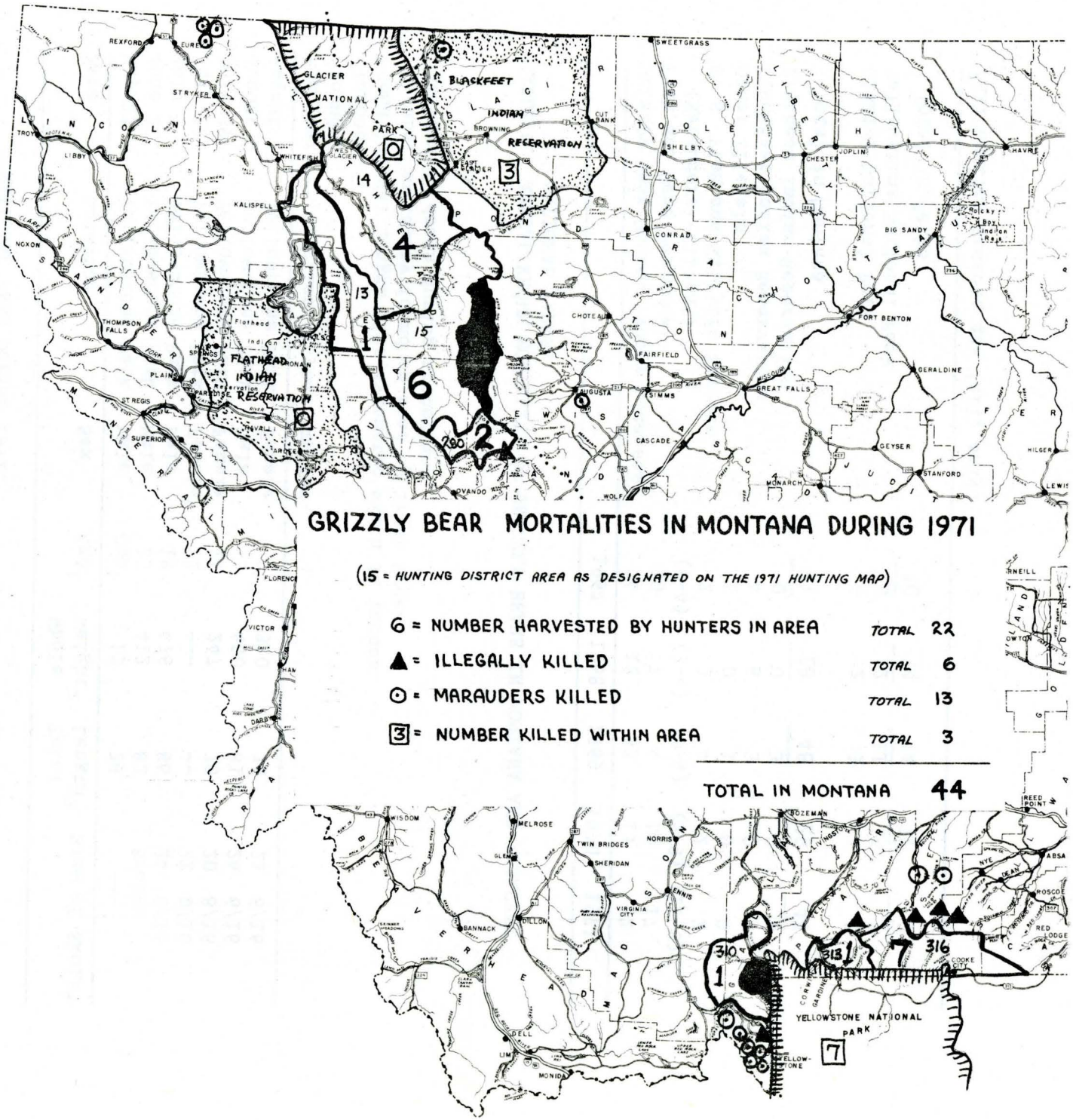

Figure 1. Distribution of known grizzly bear mortalities in Montana during 1971.

TABLE 7. DISTRIBUTION OF 1967-1971 HUNTER HARVEST OF GRIZZLY BEARS IN HUNTING AREAS OF MONTANA.

Hunting Area	1967	1968	1969	1970	1971
11	2	--	1	2	--
13	--	--	--	--	1
14	3	--	5	--	4
15	7	7	12	2	6
101	1	--	--	--	--
131	2	1	--	--	--
21	--	--	1	--	--
28	1	--	--	--	--
280	3	--	1	--	2
281	1	--	--	--	--
310	--	--	1	1	1
313	--	--	--	--	1
314	--	--	1	--	--
316	2	3	2	3	7
361	--	--	1	--	--
41	--	--	1	1	--
42	2	1	7	1	--
TOTAL	24	12	33	13	22

Bear Depredations and Annual Berry Production

It is not unusual for bears to be a nuisance or cause damage at inhabited areas in the State. In most cases these are black bears and only a few involve the grizzly bear. However, in 1971 several grizzlies appeared in these complaints and the reasons are explained later in this report. These depredation complaints are formal contacts from property owners and do provide a recorded trend between areas and between years.

Tisch (1969) and Jonkel (1967) have indicated that berry and pine nut crops are an extremely important forage during late summer and early fall for the black bear. Of the berries, huckleberry (*Vaccinium membranaceum*) was eminent in the diet, but variable between areas and between years. It would be expected that grizzly bears also have a similar interest in the annual berry crops.

Black bears may appear from May to October around farms, ranches, orchards, campgrounds, dumps, town, corrals, garbage cans and others. The appearance and prevalence of black bears is generally in proportion to the annual berry crops with the principal berry being the huckleberry (*Vaccinium* spp.). An exceptional berry year prevailed throughout the State during 1970 (Greer 1971) and black bear de-

predation complaints were not reported for the year (Table 8). The huckleberry crop was considered to be average for 1971 in some areas but many areas were below average. This is reflected in the bear depredations during 1971 in the northwestern section of Montana, a noted region for berries, where many more complaints were reported than in previous years.

Based on limited data, the intensity of black bear complaints may indicate a somewhat similar trend for the hunter harvest of grizzlies. When nuisance black bears are high, the trend for the grizzly harvest is high. The hunter harvest of 33 grizzlies in 1969, 13 in 1970, and 22 in 1971 can be compared with the respective bear complaints in Table 8.

TABLE 8. BLACK AND GRIZZLY BEAR DEPREDATION COMPLAINTS IN MONTANA.

District	1969	1970	1971
1	5	0	77
2	19	0	10
3	25	0	7
4	11	0	0
5	10	0	1
State	70	0	95
Grizzlies:	(3)	(--)	(7)

Classification of Sex in Grizzly Bears

The factual information of grizzly bear mortality is important for evaluating the population harvests and future management directions. Paramount to this information is the accurate designation of the sex. Except for the mature and obvious size of large males the sex of complete animals may be difficult to determine without careful examination of external sex characteristics. Several instances are known where the sex of young and small bears were incorrectly designated by rangers, wardens, students, professionals and hunters.

In recent years the Wildlife Lab has received and processed the complete carcasses of several grizzly bears and the sex for each are known. However, in many cases grizzly bear heads only are received and the sexes are difficult to verify. The latter is the situation with the hunter harvest of grizzlies where the sexes are designated on the form required from the hunter. Some hunters are generally reluctant to admit shooting a female of any species. A few of the sexes designated on the grizzly bear trophy form appear to be questionable upon examination of the submitted grizzly skull. Therefore, some criterion or combined criteria is necessary to validate questionable sex designations.

Sex Variations of Canines

Rausch (1961) and Sauer (1966) reported that with only a few exceptions, some measurements of black bear canine teeth revealed a reliable difference between sexes. Comparable measurements were made with grizzly canines to determine their value for sex determination in this species. Largest circumferences of canines are about in the middle length of the whole tooth which is always in the root portion. This area is formed and present in the developing canine of yearlings. The measurements obtained from grizzly bear canines were: maximum width from anterior to posterior surfaces, and the maximum thickness from left to right surfaces. The two measurements were combined to provide the canine size. Since measurements by the same individual were not precisely duplicated within 0.1 and 0.3 mm, and varied from 0.2 to 0.7 mm between individuals, the canine size is considered the nearest whole mm.

Seven male and 10 female grizzlies of known age were available from the population studies (Craighead and Craighead 1971) and management programs (Cole 1971a) in Yellowstone National Park. Age for known individuals included: males -- 2-1 year; 2-3 year, 2-4 year and 1-5 year; females -- 1-1 year, 1-2 year, 1-4 year, 3-6 year, 1-7 year, 1-8 year, 1-10 year and 1-13 year. A total of 11 cubs-of-the-year, with variable development and age, were also available from Montana and Yellowstone National Park populations (Figure 2).

Canines with authenticated sexes were available from 42 males and 40 female grizzly bears, including 17 known age, and the hunter designated sexes of 35 males and 35 females. About 70 percent of the upper canines were larger than the lower canines but many of the differences were less than 1 mm. Since the lower canines were more conveniently obtained, these were selected for evaluations.

Canine sizes from 7 females and 10 males of known sex and age revealed a significant difference between sexes without any overlap between sizes. Females ranged from 28 to 34 with a mean of 32 and males from 39 to 42, mean 40 (Figure 2).

An index of 152 (75 females, 77 males) grizzly lower canines showed a 33 percent overlap of sizes between sexes (Table 9). Indices for females ranged from 25 to 40, mean 32; and males from 34 to 48, mean 41. Two females had exceptionally large canines and it is quite possible that the sex was incorrectly designated. If so, the degree of overlap between sexes is 20 percent.

It does appear that a lower canine index less than 34 is probably a female, above 37 to be a male, and between these limits the sex is questionable.

Between the three generally designated Montana grizzly populations there is a small indication that the canine sizes are slightly larger in the southern than the central or northern populations.

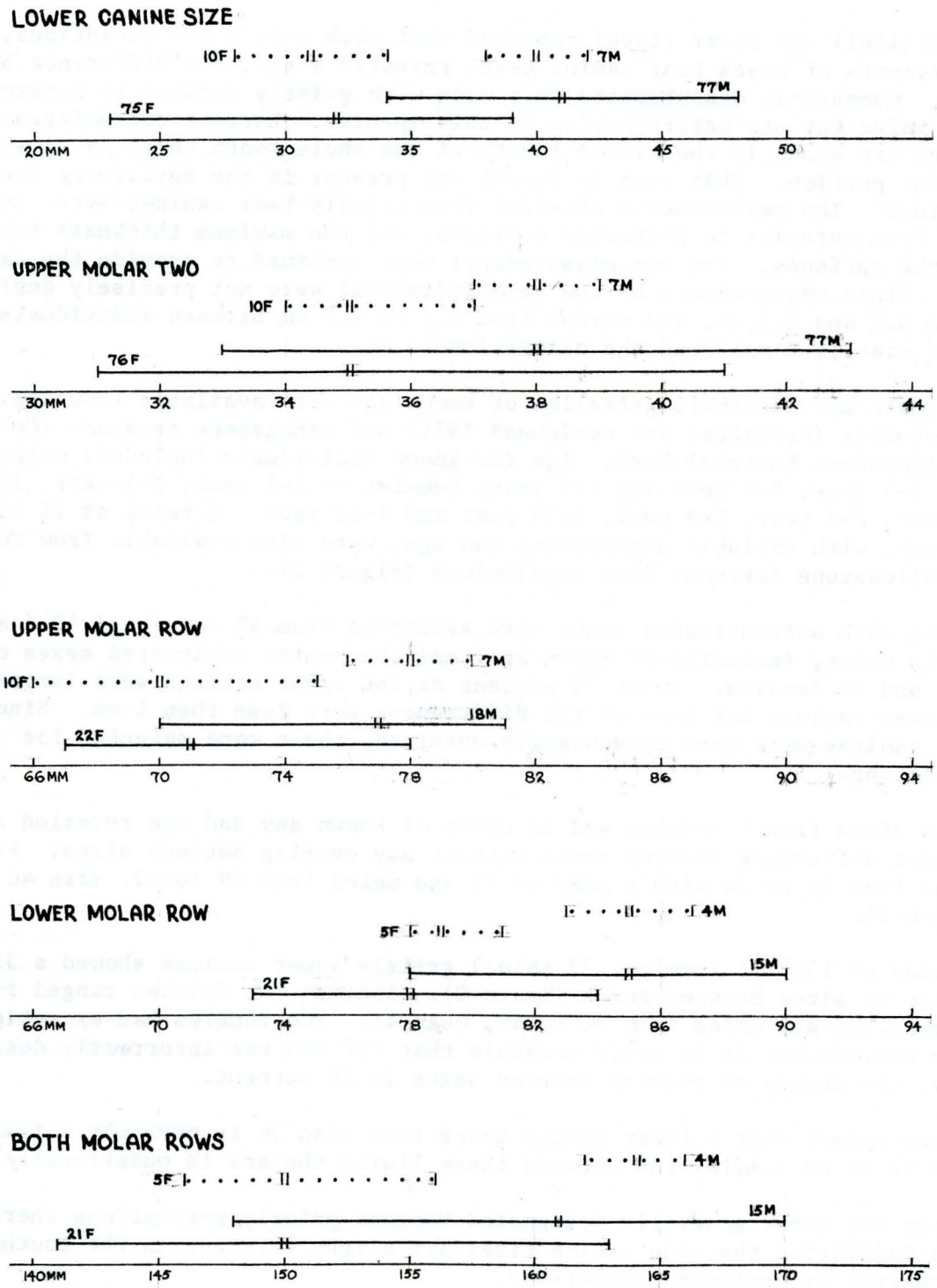

FIGURE 2. SIZE AND LENGTH OF VARIOUS TEETH IN MALE (M) AND FEMALE (F) GRIZZLY BEARS OF KNOWN AGE (···) AND UNKNOWN AGE (—) WITH EXTREMES, MEANS AND SAMPLES INDICATED.

TABLE 9. SIZE* OF GRIZZLY BEAR LOWER CANINES FROM VARIOUS POPULATIONS IN AND NEAR MONTANA DURING 1967-1971.

	MALES			FEMALES		
	Number	Average	Range	Number	Average	Range
Northern	17	40	34-45	21	32	23-37
Central	20	40	34-46	24	32	27-40
Southern	40	42	35-48	30	33	27-39
Total	77	41	34-48	75	32	23-40

*See text.

Sex Variations of Upper Molar Two (M^2)

The permanent upper molar two (M^2) is erupted after the first year of age and the crown shape and maximum dimensions are established and are assumed to be constant throughout an individual's life span. Measurements are from the most anterior to posterior portions of the tooth crown.

Lengths of M^2 in known age grizzlies appeared larger in males than females. Mean lengths of 35.2 mm and 37.9 mm in females and males ranged from 34-37 and 37-39, respectively. This demarkation between sexes of known age encouraged the examination of other specimens. However, the length of M^2 in grizzlies harvested from 1967 through 1971 was found to have about a 95 percent overlap of lengths between the sexes. Lengths ranged from 31 to 41 mm in females and 33 to 43 mm in males. The mean length of 35 mm in 76 females and 38 mm in 77 males is very similar to the known age specimens.

Although the length of M^2 is generally slightly longer in males than in females, this feature is not a useful criterion for distinguishing sexes in Montana grizzly bears.

As with the canine sizes, the M^2 lengths also appear to be slightly larger in the southern population than the central or northern populations (Table 10). In over 200 grizzlies examined from populations in Montana and adjacent parks, the smallest length noted for M^2 was 31 mm. This length is in agreement with a criterion used by Hoffmann and Pattie (1968) to distinguish between the grizzly and black bears.

Sex Variation of Molar Rows

Rausch (1961) noted that tooth crown lengths of black bears in Alaska had considerable overlap between the sexes. Larsen (1971) found about a 5 percent overlap in the upper and lower molar row lengths between sexes in young animals of a particular polor bear population. Molar row measurements were obtained from 40 grizzly bears (Table 11) to determine if sexual dimorphism existed in various grizzly bear populations in Montana.

TABLE 10. LENGTHS OF UPPER MOLAR TWO IN GRIZZLY BEARS FROM VARIOUS POPULATIONS IN AND NEAR MONTANA DURING 1967-1971.

	MALES			FEMALES		
	Number	Average	Range	Number	Average	Range
Northern	16	36	34-39	21	34	31-38
Central	20	37	34-40	25	34	32-38
Southern	41	39	35-43	30	36	32-41
Total	77	38	34-43	76	35	31-41

TABLE 11. LENGTH OF MOLAR ROWS IN GRIZZLY BEARS FROM MONTANA DURING 1971.

	MALE						FEMALE					
	Upper		Lower		Both		Upper		Lower		Both	
	Mean	No.	Mean	No.	Mean	No.	Mean	No.	Mean	No.	Mean	No.
North	71	2	79	2	149	2	70	4	76	4	146	4
Central	76	3	86	3	162	3	70	7	78	7	148	7
South	78	13	86	10	164	10	72	11	79	10	152	10
Total	77	18	85	15	161	15	71	22	78	21	150	21
Range	70-81		78-90		148-170		70-78		73-84		141-163	

Lower tooth rows include one addition tooth(M_3) that is not present in the upper row. Consequently the lower row is always longer than the upper row when the normal compliment of teeth is present. Measurements of lower rows were not obtained for several grizzlies due to the previous removal of PM_4 during research studies. There were two specimens which appeared to have a natural absence of both PM_4.

About 38 percent of the upper row lengths and 47 percent of the lower row lengths did not overlap between sexes. It was expected that the smaller size of females would be amplified by combining the length of upper and lower rows of individuals but it was found that a separation between sexes was only 44 percent. It is evident that the length of molar rows have little value for discrimination between sexes of young Montana grizzly bears.

As with the size of M^2 and canine index, a trend is also indicated that the molar lengths of grizzlies from the southern population is slightly larger than the northern population.

Sex Variations of Skull Sizes

Growth is rapid in both sexes during the juvenile and sub-adult years and the size of males generally dominates females. Most of the skeletal growth is achieved by the fifth year. Thereafter, skeletal maturity and further growth continues at a very slow rate throughout life. Rausch (1961) indicated that about 90 percent of the skull length is attained at the end of the fourth summer for black bears in Alaska. This maturity during adult years increases skull length by an extension of the proximal point of the sagittal crest and the zygomatic width continues to increase through the years (Rausch 1963). Suture obliteration is in progress in skulls of 5 years of age and therefore significant size changes are not expected. It is difficult to determine other noticable skull changes except for the increased dorsal-ventral size of the frontal-squalmosal bones of the zygomatic arch with increased age.

Skull size (condylobasal length and zygomatic width, in inches) did not exceed 18 8/16 inches for 1- and 2-year-old grizzlies of either sex. Three-year-old skull sizes ranged from 16 to 19 and over 50 percent of the 3-year-old males exceed 19 and ranged to 21. The skulls of 5-year-and-older females ranged from 18 to 22. About 33 percent of the 4-year-and-old males overlapped the size of females and 67 percent of the males exceeded 22. The considerable variation and overlap between skull sizes will not provide a reliable indication between sexes of young grizzlies. Sizes above 22 are almost invariably a male (Figure 3).

Trophy Skulls

A minimum score of 24 (inches) is required for a trophy status for grizzlies in the Boone and Crockett North American Records (Alberts 1971). It would appear that a female does not achieve these proportions. Of 43 adult females 5 years and older, only one skull measured 22 9/16. Six female skulls were between 21 and 22, and 11 skulls had sizes from 20 to 21.

Of 54 skulls from adult males of 4 years or older, about 20 percent exceeded a score of 24 and only four individuals (7 percent) were greater than 25. Increasing age of individuals does not necessarily result in the largest skulls. The age of males ranged from 11 to 18 years for skull sizes of 24 to 25. Those male skulls greater than 25 ranged in age from 13 to 19 years (Table 12). The three males of 20 to 24 years of age had skull sizes ranging from 22 to 23 11/16. A few males as young as 5 and 6 years of age had a skull size of about 23 10/16.

Other Sexual Features of the Skull

The lyre or bell-shaped temporal ridges are characteristic for young female grizzlies while the ridges of males are usually only slightly curved. Sagittal crests are larger and quite prominent in males, but reduced in females, and become emphasized with age. Both of these features have been described for black bears (Marks and Erickson 1966).

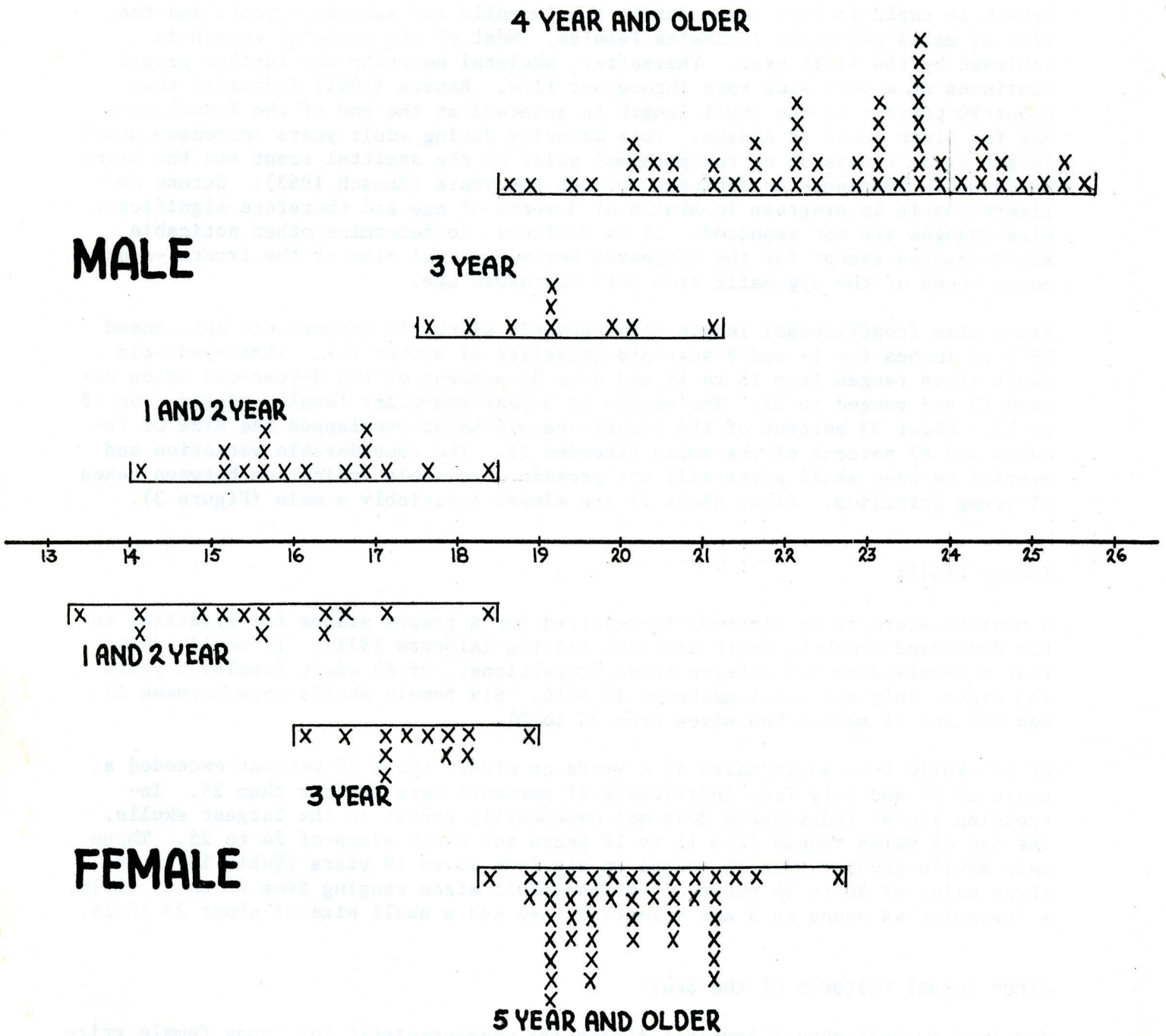

FIGURE 3. SKULL SIZE (CONDYLOBASAL LENGTH AND ZYGOMATIC WIDTH, IN INCHES) OF GRIZZLY BEARS FROM MONTANA AND ADJACENT NATIONAL PARKS DURING 1967-1971.

Whenever the designation of sex is questionable for a grizzly bear it has been of value to examine one or several of the characteristics previously mentioned. In many instances the sex may be confirmed or established within confident limitations.

TABLE 12. AGE AND SKULL SIZE OF 54 MALE GRIZZLY BEARS FROM MONTANA AND YELLOWSTONE NATIONAL PARK DURING 1967-1971.

4-Year	5-Year	6-Year	7-Year	8-Year	9-Year	10-Year
18 11/16	19 11/16	18 15/16	20 12/16	21 0/16	23 1/16	20 4/16
19 8/16	20 1/16	20 7/16	21 7/16	21 11/16	23 9/16	23 2/16
20 1/16	22 2/16	23 10/16		22 14/16	24 11/16*	
20 5/16	22 4/16			23 4/16		
20 10/16	22 8/16			23 4/16		
21 2/16	22 13/16					
21 10/16	23 9/16					

11-Year	12-Year	13-Year	14-Year	15-Year	16-Year
23 5/16	21 13/16	21 10/16	23 14/16	25 10/16*	23 14/16
23 10/16	23 12/16	22 8/16	25 4/16*		
24 3/16*	24 15/16*	24 6/16*			
		25 5/16*			

17-Year	18-Year	19-Year	20-Year	24-Year
23 11/16	23 9/16	22 1/16	23 1/16	22 0/16
24 8/16*	24 8/16*	22 3/16	23 11/16	
		24 12/16*		
		25 6/16*		

*Exceeds minimum requirement for Boone and Crockett: North American Records.

Sex and Age of Grizzly Bear Mortalities

Notwithstanding that mortality data can be considered by some persons to be a biased sample for some species in some areas; the mortality data of grizzly bears in Montana appear to be without much if any selectivity; and are therefore considered without the many complicated and unresolved reservations.

This was the first year (1971) in five that hunters have harvested a preponderance of females. Hunters reported 15 females (68 percent) out of the 22 grizzlies taken. The previous female harvest by hunters was: 54 percent -- 1970; 39 percent -- 1969; 25 percent -- 1968; and 35 percent -- 1967 (Table 13).

TABLE 13. SEX OF GRIZZLY BEAR MORTALITIES FROM MONTANA AND ADJACENT NATIONAL PARKS.

	1967		1968		1969		1970		1971	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Hunting	15	8	9	3	20	13	6	7	7	15
Other	0	0	6	2	1	7	3	5	9	8
Totals	15	8	15	5	21	20	9	12	16	23
Glacier Park	0	4	1	0	2	1	0	1	0	0
Yellowstone Park	0	0	8	3	7	4	5	11	4	3
Totals	0	4	9	3	9	5	5	12	4	3

Tooth development, bone maturation, skull sutures and cementum layers provide age features of the skull. Ages were designated for the 36 available skulls of the 44 known grizzly bear mortalities in Montana during 1971. Similar data were also available for grizzly bears from Yellowstone National Park during the same period (Table 14).

TABLE 14. AGES OF GRIZZLY BEAR MORTALITIES FROM MONTANA AND YELLOWSTONE NATIONAL PARK DURING 1971.

	MONTANA		YELLOWSTONE NATIONAL PARK	
Age Group	Male	Female	Male	Female
Cub		1	1	
Yearling				
2-Year	1			
Sub-Adult (3-4 years)	3	7		
Young-Adult (5-9 years)	9	7		1
Mature-Adult (10-14 years)	1	1	1	1
Prime-Adult (15-19 years)	1	3	1	
Old-Adult (20-24 years)		2	1	1
Very-old-adult (25 years and over)				
Totals	15	21	4	3

Ages of the six sub-adults and nine adult females reported by hunters in 1971 were: 1 -- cub; 5 -- 3-year; 1 -- 5-year; 3 -- 6-year; 1 -- 9-year; 1 -- 14-year; 1 -- 16-year and 2 -- 21-year. An average age of the females from the north, central and southern populations was 11.7, 6.9 and 7.2 years, respectively (Table 15). These ages appear to be a uniform age representation, in the females from a

cub to about 21 years of age. Recruitment into the segment also appears to be highly favorable with the presence of 33 percent 3-year-old and 20 percent, 6-year-old females. It is hoped that the high incidence of 3-year-olds could indicate the probability that many cubs born in 1968 may also have had favorable circumstances to survive the critical age of 1 and 2 years (Jonkel and Cowan 1971) and are present in the populations.

TABLE 15. SEX RATIO AND AVERAGE AGE OF GRIZZLY MORTALITIES DURING 1971.

	SEX		AGE IN YEARS	
	Male	Female	Male	Female
Categories:				
Hunting	7	15	5.7	7.9
Other	8	6	7.8	8.3
Yellowstone National Park	3	3	18.0	13.3
Total:Mean	18	24	8.8	8.7
Populations:				
North	2	4	3.5	10.0
Central	2	9	4.0	6.1
South	14	11	10.1	10.3
Total:Mean	18	24	8.8	8.7
Hunting:				
North	1	3	2.0	11.7
Central	2	7	4.0	6.9
South	4	5	7.5	7.2
Total:Mean	7	15	5.7	7.9

Among the categories of other grizzlies the female mortality approached 50 percent. The total mortality for grizzlies in Montana during 1971 was about 60 percent females.

The grizzly has a reproductive performance of slow maturity, an irregular age for producing a first litter and non-rhymthic, recurring pregnancies for some individuals. Females of productive age are therefore, a critical segment in the grizzly bear populations. The details of population dynamics along with age and sex structures of grizzly populations, and parameters for female mortality, are unknown at this time. There is a potential for overharvest in those areas where excessive numbers of females were shot. Although a few more females were harvested in 1971 than in previous years, the distribution of all grizzly bear mortalities in 1971 does not appear to be excessive or hazardous for the various populations of grizzlies in and adjacent to Montana. The grizzly popu-

lations are considered to range from a few to abundant in various categories of available habitat in Montana. Also, the average age of 8.7 years is similar to former years. Average age for previous years are indicated in Table 16 but these ages are subject to change as teeth from old animals are being re-examined under a modified technique of decalcified specimens. The exceptionally high age for seven females in 1967 was influenced by the four females taken as being involved with the summer tragedy of human contact in Glacier National Park (Martinka 1969).

TABLE 16. AVERAGE AGE IN YEARS OF GRIZZLY BEAR MORTALITIES FROM MONTANA AND ADJACENT NATIONAL PARKS (WITHOUT CUBS).

	1967		1968		1969		1970		1971	
	Age	Number	Age	Number	Age	Number	Age	Number	Age	Number
Male	8.1	7	9.4	18	7.7	23	8.2	13	8.8	18
Female	15.6	7	7.3	6	7.1	21	6.3	23	8.7	24

Parasite Studies

The grizzly heads from hunter kills or the complete carcasses of 40 grizzlies and 11 black bears were examined for parasites in 1971. When the entire carcass was available, a complete examination was performed, including a search for internal parasites. Only the grizzly bear heads were available for hunter trophies and the tongue and masseter muscle were examined for the presence of porkworm larvae (*Trichinella spiralis*). Examinations were conducted by the Veterinary Research Laboratory at Montana State University, Bozeman.

Trichinella larvae were the most frequent parasite found and occurred in 64 percent (25 of 40) of the grizzlies in 1971. This was an increase over the 41 percent incidence during 1970 in 39 grizzlies. In the previous years of 1969 and 1968, larvae appeared in 67 percent and 79 percent of the grizzlies, respectively. Larvae were present in grizzlies of both sexes from 2 to 21 years of age during 1971. Samples from three cubs did not reveal *Trichinella* larvae. Larvae were present in a cub examined in 1970. The yearling age class was not available for examination.

Grizzlies available from Hunting Areas 14 and 15, South Fork of Flathead River and the Bob Marshall Wilderness Area, revealed 100 percent infection in 10 samples during 1971. Only 50 percent of 22 grizzlies from the Yellowstone National Park and the adjacent areas in Montana had *Trichinella* larvae.

Intensities of *Trichinella* ranged from 1 to 394 larvae per gram (LPG) of tissue. Nine infections (36 percent) were rated as light (1 to 4 LPG), nine (36 percent) had an intermediate rate (4 to 20 LPG), three (12 percent) were considered a

moderately high rate (20 to 75 LPG), and four (16 percent) revealed a high concentration of larvae (75+ LPG). Grizzlies with a high intensity of larvae involved two males and two females and all were of young ages ranging from 3 to 5 years.

Eleven black bears were available from various areas in the State and included four from Yellowstone National Park. Larvae of *Trichinella* were not present in any of the 11 black bears in 1971. This is in comparison with one of four in 1970, none of 20 in 1969, and one of two in 1968.

Trichinella has been variable between the years and between areas of free-ranging or garbage-foraging grizzly bears. A question of infection or transmission sources have been speculative. The presence of larvae in all ages of grizzlies would indicate a widely distributed and readily available source to grizzlies. Some aspects of the role of transmission and the life cycle of *Trichinella* in grizzly bears are presently under study by the Veterinary Research Laboratory in Bozeman.

The most common gastrointestinal parasite was the large ascarid roundworm (*Baylisascaris transfuga*). This roundworm occurred in 92 percent (12 of 13) of the grizzlies examined in 1971 which was the greatest incidence for a 4-year period. Previous incidence of roundworms were: 32 percent in 1970; 85 percent in 1969; and 80 percent in 1968. One of the 1971 grizzlies, a 13-year old male, was considered to be heavily infected by the presence of 283 worms. Other infections ranged from 1 to 14 worms.

Tapeworms were present in 5 of 13 grizzlies. Three males of 6, 17, and 23 years had 2, 8, and 45 *Taenia* sp. tapeworm, respectively. A 13-year-old male and 21-year-old female harbored two and five *Diphyllobothrium* sp., respectively.

An undertermined species of hookworm (*Uncinaria* spp.) was found in abundance (103) in the small intestine of a marauding grizzly taken by the U. S. Fish and Wildlife Service personnel in the Blackfeet Indian Reservation. In previous years similar hookworms were recovered from each of the grizzlies examined from Glacier National Park during 1970 and 1969. Both areas are adjacent to each other along the northern border of westcentral Montana.

Seven specimens of an intestinal fluke, probably *Echinostoma revolutum*, were recovered from a 3-year-old female grizzly killed near the town of Augusta. This is the first record of this small (10-20 mm) fluke in Montana bears and possibly the first evidence of fluke infections in bears in the United States. The significance of this parasite on the health of the host is not known.

Replies from Hunters Killing a Grizzly

A letter of inquiry was sent to each of the 22 hunters who killed a grizzly bear during 1971 and 19 replies provided specific information about their trophies.

Eight hunters were registered with guides, three guides killed a grizzly and eight hunters were not guided. About 90 percent of the hunters killing a grizzly were primarily seeking elk but also had an anticipation of seeing a grizzly bear, and the others were specifically after a grizzly. Most hunters recognize the attraction, or baiting, offered by offal piles or fresh meat and especially spoiled carcasses. Four grizzlies were found on or near the entrail pile from an elk kill, one on an illegally-killed moose carcass and two in or around camp. About half of the reporting hunters found their grizzlies away from meat sources: six were sighted in an opening or slide area, two were in sparse timber and one was in the trail.

The remaining 2 of 19 are in a special category. One grizzly followed a hunter and guide and as they rested in the trail the grizzly continued trailing and was shot about 80 yards away. The guide had elk blood on his clothes from a previous elk kill and they considered this to be the reason for being followed. Another grizzly was reported killed under similar circumstances. The hunter, "... was returning to camp in a snow storm and heard a thumping noise behind me and turned and saw a bear." The bear was about 15 steps away when shot.

Of the 19 responding hunters that killed a grizzly, 14 observed only the grizzly they killed, four hunters each sighted from two to four grizzlies and one hunter saw a total of seven grizzlies which included: sow and cub; sow and two cubs; one medium size and one large size. Another hunter reported bear sign around a gut pile but did not think this was made by the one he killed. Most (14 of 19) of the grizzlies were killed soon after being observed and the others were able to stalk closer before shooting. Three were shot at a distance of less than 10 yards, nine at a distance of 30 to 100 yards and six from 150-250 yards.

GRIZZLY BEARS IN THE VICINITY OF WEST YELLOWSTONE

Attraction Areas for Grizzly Bears

About 200-300 grizzly bears are estimated (Craighead and Craighead 1971, Cole 1971) in the Yellowstone National Park population and several of these individuals range into the adjacent town and vicinity of West Yellowstone. Several garbage dumping areas have existed inside the Park for many years. These dumps, utilized extensively by grizzly bears (Craighead and Craighead 1967), have been progressively eliminated and substituted with incinerating facilities. A refuse area at Rabbit Creek was phased out of operation and last used in 1969. The last remaining open-pit dump in Yellowstone National Park at Trout Creek was in operation during the 1970 season, and was scheduled to be phased out in the spring of 1971 (Figure 4). Some apprehension existed with agencies and concerned people about the movements of grizzly bears after the complete elimination of a traditional forage site at Trout Creek. The Park Service established contingency planning in the event that grizzlies frequented the campgrounds or buildings in the Park (Cole 1970).

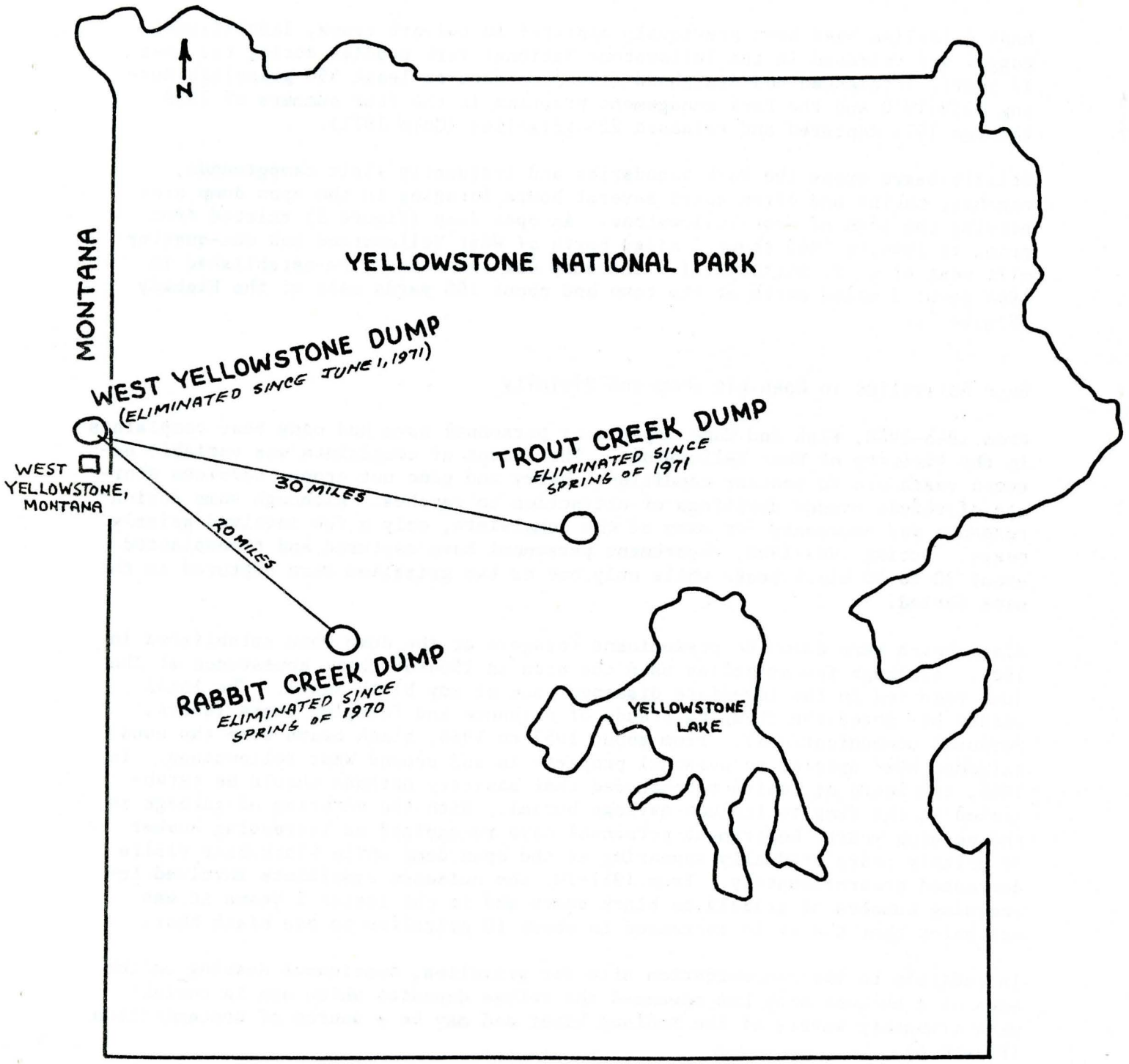

Figure 4. Location of terminated open dumps in and adjacent to Yellowstone National Park.

Many grizzlies have been previously captured in culvert traps, immobilized, tagged and released in the Yellowstone National Park studies during the past 13 years. Craighead and Craighead (1971) handled at least 550 grizzlies during 1959-1970 and the Park management programs in the four summers of 1968 through 1971 captured and released 225 grizzlies (Cole 1971).

Grizzly bears cross the Park boundaries and frequently visit campgrounds, ranches, cabins and often spend several hours foraging in the open dump area serving the town of West Yellowstone. An open dump (Figure 5) existed from prior to 1946 to 1963 about 2 miles north of West Yellowstone and one-quarter mile west of U. S. Highway 191. The dump was immediately re-established in 1964 about 2 miles north of the town and about 100 yards east of the Highway (Figure 5).

Bear Activities in Open-pit Dump and Vicinity

From 1945-1960, Fish and Game Department personnel have had many bear complaints in the vicinity of West Yellowstone. The amount of complaints was variable between years due to weather conditions, berry and pine nut crops, careless storage of refuse around dwellings or attraction to ranches. Although some action response was necessary for many of the complaints, only a few involved grizzly bears. During 1961-1968, Department personnel have captured and transplanted about 30 to 40 black bears while only one or two grizzlies were captured in the same period.

Black bears were soon the predominant foragers at the dump when established in 1964. Although few grizzlies used the area in 1964-66 their appearance at the dump resulted in the immediate disappearance of any black bears. The local warden has noted the changing trends of nuisance and foraging bears (Sears, Personal communications). From about 1957 to 1966, black bears were the usual nuisance bear species to personal property in and around West Yellowstone. In 1967, the Board of Health recommended that sanitary methods should be established at the dump to include garbage burial. With the covering of garbage in the ensuing years, Department personnel have recognized an increasing number of grizzly bears gradually appearing at the open dump while black bear visits decreased proprotionately. From 1967-70, the nuisance complaints involved increasing numbers of grizzly to black bears and in the latter 2 years it was estimated that the ratio increased to about 10 grizzlies to one black bear.

In addition to the concentration site for grizzlies, continuous dumping on the edge of a 60-foot bank has advanced the refuse deposits which are in contact with tributary waters of the Madison River and may be a source of contamination (Figure 6).

Dump Relocation and Revised Standards

A new dump site on level terrain about 2 miles north of the former dump was authorized by the Forest Service. The permit-use requirements included current

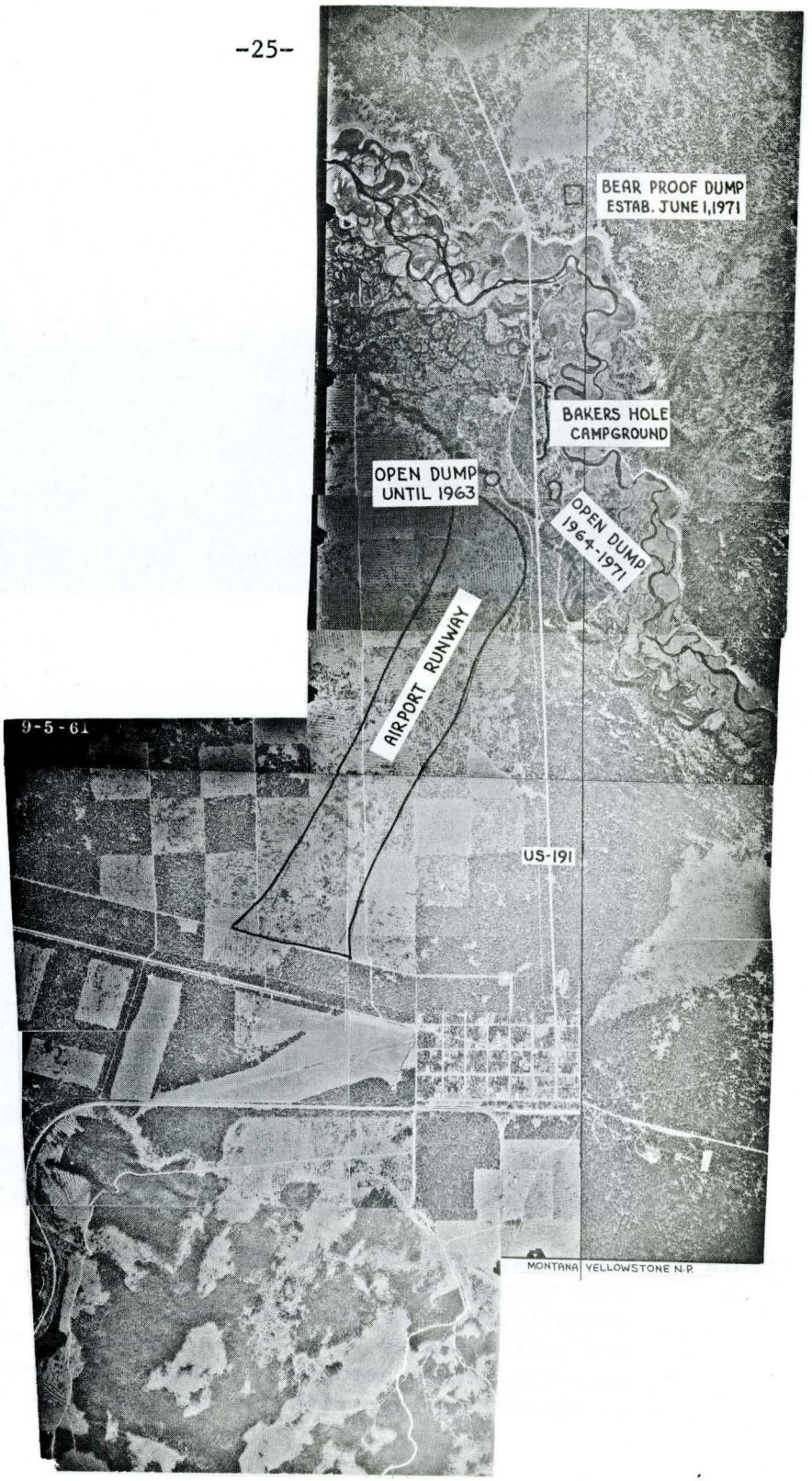

Figure 5. Location of former and current refuse sites serving the town of West Yellowstone, Montana.



Figure 6. Municipal open-pit dump serving West Yellowstone, Montana from 1964 through May 31, 1971. Top: West view of closed dump with rehabilitation in progress. Some garbage deposits continued by the public during June, 1971. Grizzlies visited the area and uncovered fresh deposits. Bottom: Southwest view of recently eliminated garbage site showing high bank edge used for dumping.

standards for the operation and maintenance for a sanitary land fill operation. Since the area still remained within the habitat of a prominent grizzly bear population, an extra precaution was necessary to preclude bear visitations to the land-filled dump. The urgency of this situation was discussed and realized at a special meeting in early April of 1971. Immediate action by various staff personnel expedited the usual delays involved with purchasing necessary supplies. A cooperative agreement between the Forest Service, Montana Fish and Game Department and the Park Service provided the funds for labor and equipment to completely enclose the approximate 10-acre dump area (Figure 7). The enclosure was made with a 10-foot woven wire fence, buried 3 feet in the ground with 7 feet above and topped with two strands of barbed wire. The woven fence was surrounded with three strands of electrified fencing. A 16-foot locked gate maintained unauthorized use of the dump during off hours.

Bear Visits in Dump Areas

A transition situation existed for the West Yellowstone dump area in 1971. Operation continued at the 7-year-old dump site during the spring of 1971. Utilization of the "old" area was terminated in June 1, 1971 and transferred to a standard sanitary operated and bear-proof area. The "old" area was leveled and covered with dirt, except for waste trees, stumps and car bodies on the bank slope.

In the past 10 years only a few, if any grizzlies appeared in the dump of West Yellowstone during the early spring of April and early May. Heavy snow cover frequently persists in the area during this time and some grizzlies have recently terminated their hibernation period. Occasionaly, a grizzly bear's usual hibernating period may be interrupted. This occurred during January of 1971 when a sow grizzly with an accompanying cub or yearling was reported to be in the open dump at West Yellowstone.

A large male grizzly bear was reported in the regular dumping area of West Yellowstone in early April, 1971. Grizzly bears did not appear in the dump during a few evenings of observation in early May. One grizzly appeared in the dump on May 23. A few were seen during three nights of the last week of May and these involved a total of seven individuals.

On June 1, 1971 the old dump was closed and the new dump opened. A few disposals were made by residents before all access was blockaded to the old dump. A bulldozer bladed dirt over the existing garbage but odors penetrated the covering. The habits of grizzlies frequenting the area continued and diggings through the shallow dirt covering revealed various foods. The rewards of edibles diminished as supplies were unreplenished. A total of nine individual grizzlies were recognized in the discontinued dump on June 10, 1971. On June 16, 1971 a total of 10 individuals appeared in the dump during a 3-hour period before midnight. At least 14 individual grizzly bears were known to use the dump area during early June. At least five and nine individual grizzlies were identified in the dump on June 23 and June 29, respectively.

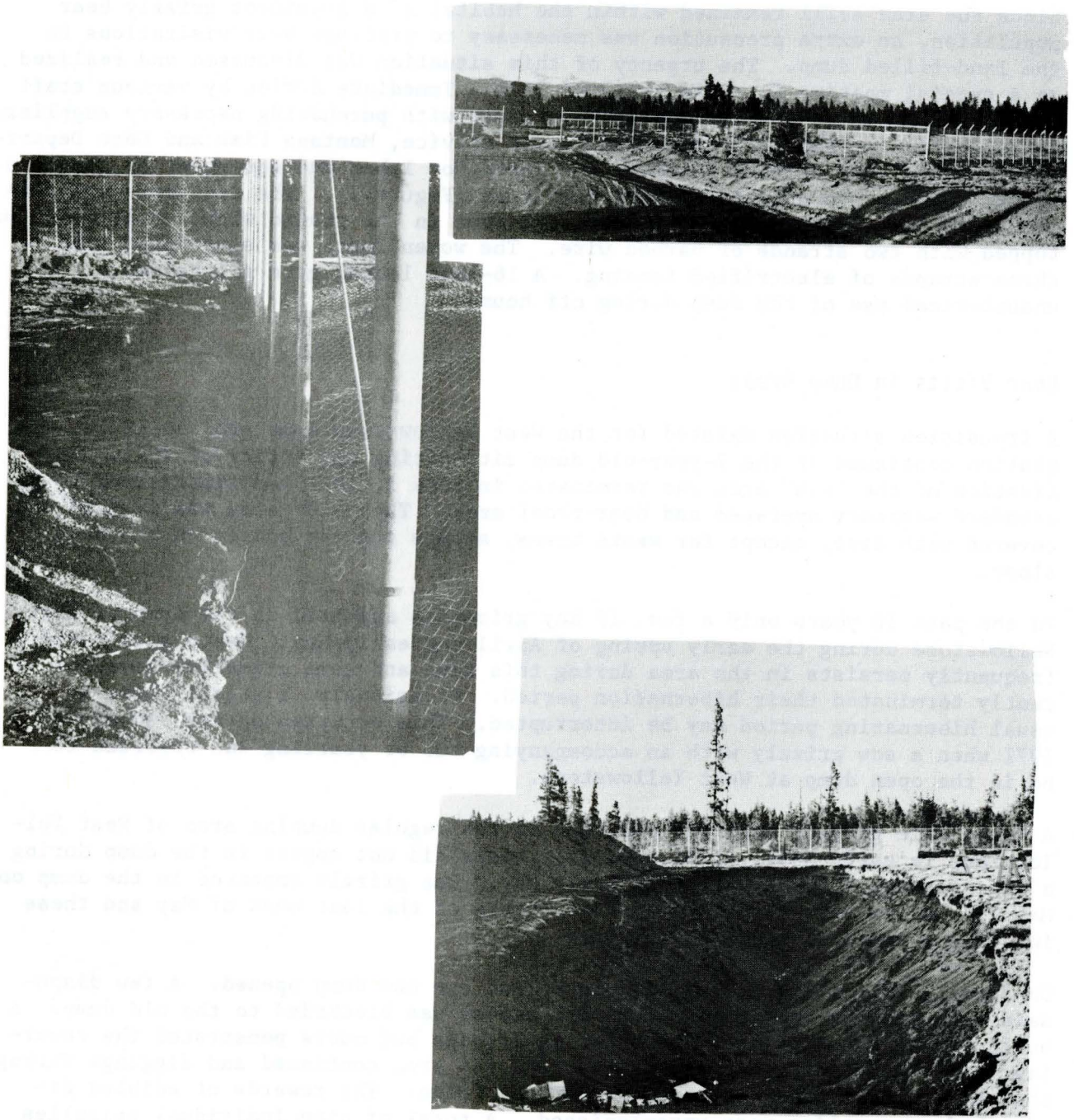

Figure 7. Sanitary land-fill and bear-proof dump under construction and later in operation on June 1, 1971 at West Yellowstone, Montana.
Top: Fenced area of approximate 10 acres on level terrain.
Middle: Woven wire fence buried 3 feet underground.
Bottom: Trenches for compacting, covering and decomposition of garbage. Trees and large metal are segregated for future disposal.

Although six grizzlies were accounted for on July 6, 1971 it was noted that fewer bears appeared in mid- and late-July. The vigorous and rewarding diggings during June diminished to a near absence in late July.

Bear-proof Dump

Several trips around the perimeter of the new dump revealed that bears may not have located, or began to appear in the area until early July -- about 1 month after it was implemented. Several scats and diggings were noted and these mostly around the north fence of the area. This activity was on a downwind side of the dump where garbage odors prevailed. Digging was limited in size and depth and it appeared that this was the result of bears contacting the electrified lower wire of the three-strand fence. In late July and August, fewer scats and diggings were noted from the first appearances in early July.

Transplant Sites and Transfer of Grizzly Bears

It was anticipated that grizzly bear nuisance complaints may occur after closure of the municipal open-pit dump. Consequently, the disposition of captured grizzlies imposed a serious question. Places or sites for transplanting were urgently needed.

Letters to zoos and zoo magazines resulted in only two requests for young females. Other state game departments did not want any grizzlies. Many areas of Montana were already supporting grizzly populations. The required consent and support of landowners and agencies did not favor introduction of grizzly bears into possible grizzly habitat or between National Forests. Transplanting "problem" grizzlies into existing and distant populations may seriously disrupt the social behavior of resident groups.

Provisions existed for transplanting grizzly bears within a National Forest and the Forest Service therefore suggested possible transplant sites (Figure 8) in the Gallatin National Forest as follows:

Area A -- Crow Peak-Pyramid Peak area along divide between Mill Creek and Meatrack Creek.

Area B -- Lake Plateau at heads of East Fork of Boulder and Upsidedown Creek.

Area C -- Buffalo Fork above primitive area boundary.

Area D -- Hellroaring above primitive area boundary and above Hellroaring Guard Station.

Area E -- North Hilgards at drainage heads of Sentinel and Hilgard Creeks.

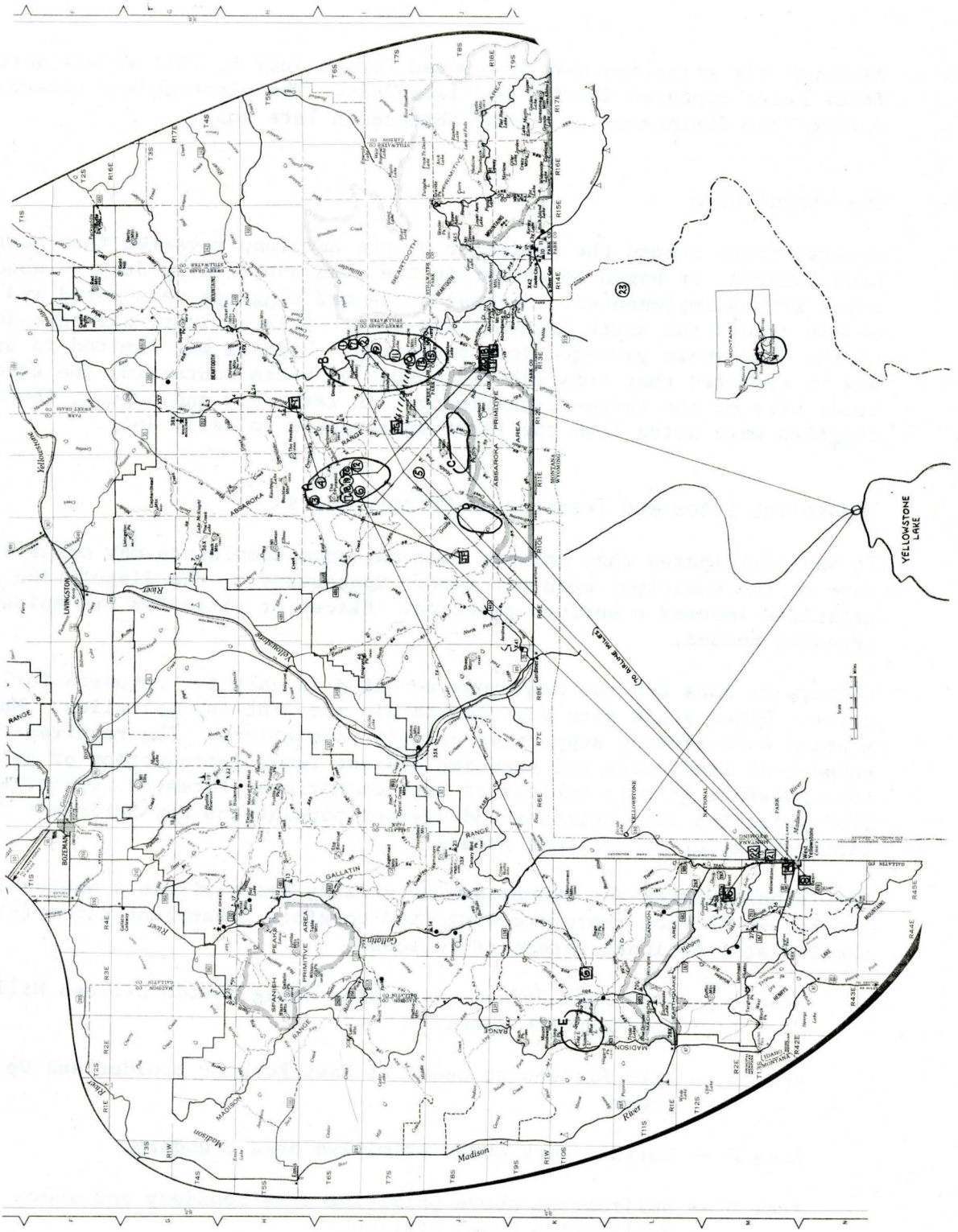

Figure 8. Transplant areas, location of individual transplants and subsequent observation of grizzly bears in the Gallatin National Forest during 1971. (Individual descriptions appear in Table 17).

Restrictions included that transplants be made with helicopter and no landings be made in the Absaroka Primitive Area.

To assure the identity of each it is necessary to mark individual grizzlies handled in this program.

Arrangements were made with Yellowstone National Park for rental of their contracted helicopter, based at Mammoth, during off-hours from scheduled and emergency flights. Grizzlies captured in West Yellowstone were transferred in trailer culvert traps to Mammoth for immobilization, tagging and helicopter transfer to transplant sites in the Gallatin National Forest.

Grizzly Bear Activities after Closure of Open-pit Dump

Department personnel at West Yellowstone received several complaints about nuisance bears during the last week of June. Response action includes setting culvert live traps or snap and snare settings in selected or prepared areas. This activity was the most extensive in the past 15 years and resulted in 23 captures of 19 individual grizzlies between July 2 and September 22, 1971. Information on each grizzly bear can be found in Table 17.

The 19 individual grizzlies included 11 males and 8 females. Until more precise ages can be determined, from cementum and skull features, the ages were tentatively considered as follows: males -- 1 young; 8 adult; 2 old; females -- 3 yearling; 2 young; and 3 adult.

Two of the 19 individuals were not transplanted. An old male was a control action-tagged grizzly from Yellowstone National Park and upon recapture was considered to be excessively dangerous and was intentionally destroyed. Another adult male was already tagged from the Park Service studies before capture in late September. Since a hunting season was in progress in the transplant area, the Park Service accepted this individual for relocation in the northwest area of the Park.

Of the 17 grizzlies relocated in transplant areas, only three (18 percent) remain that are not known to have been killed, observed in transplant areas or seen in other locations.

Two or three grizzlies made intermittent visits to the closed dump in late October. During early November, three grizzlies were observed on subsequent nights in the dump area. At least one large grizzly was reported to be within the town limits of West Yellowstone during the first week of November. This grizzly foraged around garbage cans and attempted entry into sheds and garages where meat was stored.

TABLE 17. SUMMARY OF 23 TRAPPINGS OF 19 INDIVIDUAL GRIZZLY BEARS AT WEST YELLOWSTONE DURING SUMMER OF 1971 (SEE FIGURE 8 FOR LOCATIONS).

Trapping Number	Date Trapped	Location	Sex[1]	Age[2]	Estimated Weight	Previous Tag	Transplanted		Current Status of Individual	
							Date	Area		
1	July 2	Town	F	Y	250-275	No	July 2	B	Retrapped -- No. 21 -- on August 18, from Baker's Hole Campground -- DISPATCHED (1 and 21 same)	DEAD
2	July 10	Town	M	A	700	Yes	July 10	B	Retrapped -- No. 8 -- on July 25, from Madison Fork Range -- 5 miles west of town -- DISPATCHED (2 and 8 same)	DEAD
3	July 12	½ Mile South Town	F	Y	400	Yes	July 12	A	Reported dead on August 5; was poisoned with strychnine -- JF --	DEAD
4	July 16	Town	M	A	450	Yes	July 17	A	Shot on Boulder by camper -- August 28 -- FT --	DEAD
5	July 17	Duck Creek	M	A	500	Yes	July 18	Near C	Retrapped -- No. 14 -- on August 5 at Pulp Camp in Town -- DISPATCHED (5 and 14 same)	DEAD
6	July 23	½ Mile South Town	M	A	400	Yes	July 23	A	Hunter-kill, Sage Creek, Gallatin, November 28, 1971	DEAD
7	July 22	Town	M	A	400	Yes	July 23	A	Hit car -- attempt to plant -- but bear was DEAD on arrival at plant site	DEAD
8	July 25	5 Miles West Town	M	A	(This was No. 2 Above)			-	Retrap -- DISPATCHED	DEAD
9	July 25	Hebgan Lake	M	Y	300-350	Yes	July 25	B	Trapped at Fishing Bridge, August 12, 1971 and transplanted at head of Grayling Creek	In Park
10	July 29	Baker's Hole	M	O	350-400	Yes	July 29	B		UNKNOWN
11	July 29	Baker's Hole	M	A	400	Tattoo	July 29	B	Possibly killed by sheepmen at Independence, Montana July 30, 1970 -- JG --	Probably Dead
12	August 1	Duck Creek	F	A	300	No	August 1	A	Retrapped -- No. 22 -- on September 11 at Duck Creek -- DISPATCHED (12 and 22 same)	DEAD
13	August 4	Town	F	A	300-350	No	August 5	B		UNKNOWN
14	August 5	Town	M	A	(This was No. 5 Above)			-	Retrap -- DISPATCHED	DEAD
15	August 10	Hebgan Lake	M	A	500	No	August 11	B		UNKNOWN
16	August 13	Hebgan Lake	M	O	500	Yes	Tagged by YNP and considered by Park to be a risk for transplant -- therefore, DISPATCHED			DEAD
17*	August 16	Baker's Hole	F	Y	175	No	August 17	A	Taken by hunter -- September 16, 1971, 15 miles southeast of transplant site	DEAD
18*	August 16	Baker's Hole	F	Y	125	No	August 17	A	Reliable report to be illegally killed	Presumed Dead
19*	August 17	Baker's Hole	F	A	300	No	August 17	A	Reliable report to be illegally killed	Presumed Dead
20*	August 17	Baker's Hole	F	Y	125	No	August 17	A	Taken by hunter -- September 16, 1971, 15 miles southeast of transplant site	DEAD
21	August 18	Baker's Hole	F	Y	(This was No. 1 Above)			-	Retrap -- DISPATCHED	DEAD
22	Sept. 11	Duck Creek	F	A	(This was No. 12 Above)			-	Retrap -- DISPATCHED	DEAD
23	Sept. 22	Duck Creek	M	A	550-600	Yes	September 23	Park	In Yellowstone National Park	ALIVE

[1]M= Male; F = Female.
[2]Y= Young; A = Adult; O = Old.
*These four of a group of five trapped in one night -- all were planted together.

JG - Joe Gaab observed this grizzly carcass, without head and three feet killed about July 30.
JF - Jim Ford recovered head. Shot on August 5 -- strychnine present in stomach.
FT - Floyd Thomas recovered head -- Shot on August 28.

Traps and Marked Bears

Culvert type traps, mounted as a trailer, were used to capture grizzly bears in the vicinity of West Yellowstone. Some grizzlies completely avoided baited culvert traps and other grizzlies have successfully foiled the traps operation. Snares set in specially constructed leads on selected sites were used as a substitute or supplement to the culvert traps.

Complaints about nuisance grizzlies were almost without exception during the hours of darkness. Although grizzlies approached within 10 to 30 feet of an observer's station it was considered too hazardous to try to eliminate roaming individuals by free shooting with a rifle or capture gun. Besides the danger to humans or property, this kind of action would manifest open criticism to the management program.

All efforts were made to live-capture or scare away the nuisance grizzlies. At times the three or four available culvert traps were not adequate to carry out actions for all complaints. Carefully made snare sets were utilized with success. Grizzlies caught with a snare are usually violently active with attempts to break away from the restraint. This is in contrast to a docile behavior of black bears captured in a snare. Therefore, whenever a snare was set it was under direct observation at all times. This also permitted the hazing away of dogs visiting the baited areas. Immediately after snaring a grizzly it was immobilized by drugs with a capture gun, placed into a culvert trap and removed from the area. Tags or markings if present were noted.

Of 23 captures for 19 (10 males, 9 females) individual grizzlies, 14 (60 percent) were taken in culvert traps and 9 (40 percent) by snare sets. Several bears were observed to avoid both capture methods. Tag numbers and locations of transplant for individuals are available in Appendix. Eleven of the grizzlies, nearly 60 percent, were already tagged or marked before the first capture at West Yellowstone during the summer of 1971. Each of the nine snare captures involved grizzlies that were previously tagged. Only 6 of 14 taken in culvert traps had tags from a prior capture. The eight grizzlies that were untagged from the first capture at West Yellowstone included: three yearling females; one young female; three adult females; and one adult male.

Movements of Transplanted Grizzlies

It is apparent that most of the grizzlies transplanted from West Yellowstone indicated a homing instinct and may have been attempting a return to familiar terrain. Four individuals made a complete return to the place of capture in West Yellowstone and others were contacted at an intermediate point to West Yellowstone or Yellowstone National Park. One returned to Yellowstone National Park and was captured in the campground at Fishing Bridge.

Eleven of 12 grizzlies were observed, captured or killed in locations south, southwest or southeast from the site of release. The remaining grizzly was the only one contacted at point north of the release site, which was 3 miles north and 7 miles west.

Four grizzlies (two adult males, one young female, one adult female), captured in West Yellowstone and transplanted to distant sites, were recaptured in the vicinity of West Yellowstone. The time between repeat handling of individuals was 19, 41, 46 and 48 days. It is not known how long an individual had been in the area before being recaptured. Another transplant on July 23, 1971 was killed by a hunter on November 28, 1971 about 15 miles north of West Yellowstone.

A young female, the first one transplanted on July 2, 1971, was recaptured in a culvert trap 48 days later on August 18. Examination at the Bozeman laboratories revealed that the outside dorsal surface of the left rear foot had been dragged so extensively that the two distal claws were missing -- and the fur, skin, flesh and portions of the toe phlanges were worn away. The complete area was in a fresh condition as no crusting or healing could be found. The bear appeared to have sustained damage to the leg nerve which prevented full extension and resulted in dragging the foot. A small scabbed area on the right rear foot suggested a similar condition of incapacitation for short duration. After skinning, hemorrhage areas of about 6 by 10 inches were found on the left rear portion of the back, and about 4 by 6 inches in the pelvic area. A source of damage could not be found and the cleaned skeleton did not reveal fractures in the area.

It is reasonably speculated that this female may have been involved with a hard contact with the ground when deposited in the transplant area. If this occurred, it is rather remarkable that she covered a distance of 70 airline miles in 48 days while dragging one of her legs the whole distance. Perhaps the other rear leg was also paralyzed for a part of the time. At necropsy, this female was in very poor physical condition -- thin of flesh and fat reserves were absent.

Mortality and Survival of Transplants

The mortality of 13 and survival of 1 of the 17 grizzlies placed in the transplant areas are known to be as follows:

- 4 -- returned from the transplant area and were dispatched (two males, 6 and 17 years; two females, 7 and 16 years).
- 1 -- returned to Gallatin River and taken by hunter (male 5 years).
- 1 -- dead on arrival at transplant site -- this casualty appeared to have resulted from the combination of a recent vehicle injury and subsequent immobilization drugs used on the individual (male, 8 years).
- 1 -- visited camping area and was shot in a tent opening (male, 8 years).
- 1 -- carcass without head and three feet believed to be killed by sheepmen (male adult).
- 1 -- shot by sheepherder -- later exmination revealed that strychnine was present in the stomach contents (female, 15 years).
- 2 -- legally taken by hunters near transplant area (two females, each 3 years).
- 2 -- reliable reports indicate these illegally killed and removed from area (females, one young and one adult).
- 1 -- trapped at Fishing Bridge, Yellowstone Park 22 days later and about 50 miles south of site released, and subsequently transferred to the east boundary of the Park (young female).

No observations have been made on three transplants which are classified as: one adult male; one old male; and one adult female.

Grizzly Harvest in Hunting Areas of Transplant Sites

Transplant sites are approximately designated on the 1971 hunting map (Figure 9). All but one of the 17 grizzly bears trapped in the vicinity of West Yellowstone during 1971 were placed in Area A or B. One transplant was made about 6 miles south of Area A. The hunting season in Hunting Area 316 commenced on September 15 and in all adjacent hunting areas the season started on October 17 during 1971. All seasons extended through November 28. A total of seven grizzlies were harvested between September 16 and October 4 in Hunting Area 316 for the season: two were unmarked, two were transplants and three had Park tags.

Unmarked Grizzlies

Two of the seven grizzlies killed by hunters in Hunting Area 316 were not tagged or marked (8-year male, 6-year female).

Transplanted and Marked Grizzlies

Hunters harvested three transplanted grizzlies and reliable reports indicate that two transplanted grizzlies were illegally taken during the hunting season.

Four grizzlies from a known group of five individuals were captured in culvert traps at Baker's Hole Campground August 16-17. Individuals were transferred to Mammoth. The immobilized, marked bears were transplanted by helicopter in pairs to the same site, 1 mile east of Pyramid Peak on August 17, 1971. A group of five grizzlies were observed about 9 miles southeast of Pyramid Peak, near the dwellings of Independence, on August 24. A week later, five grizzlies were seen about 2 miles southeast of Monument Peak.

Two tagged grizzlies, both females and each 3 years old, from the group of four transplanted on August 17 were legally killed by hunters 19 miles southeast of the release point and 30 days later -- 9 miles southeast of Monument Peak on September 16, 1971. Reliable reports indicate that two additional female grizzlies were also illegally taken at the same time and vicinity as the legal ones.

A 5-year-old adult male grizzly, transplanted in Area A on July 23, 1971 was killed by a hunter at the head of Sage Creek, Gallatin Canyon, on November 28, 1971.

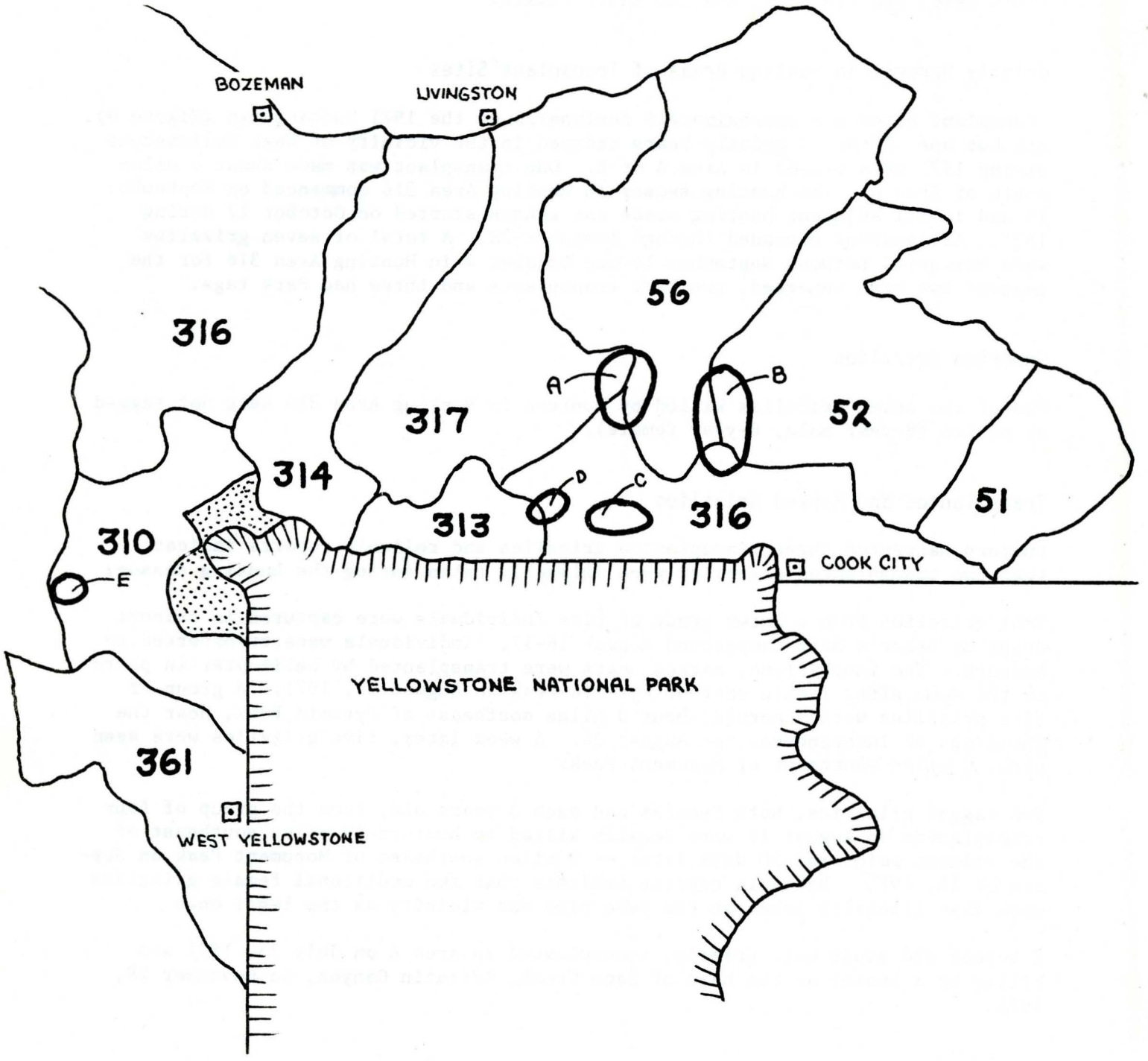

Figure 9. Hunting areas relative to grizzly bear transplant Areas A-E in Montana during 1971.

Grizzlies Marked in Yellowstone National Park

Hunters harvested three grizzlies, marked during Park Service studies, from Hunting Area 316.

The movements of three grizzlies tagged and transferred within Yellowstone National Park were subsequently in a northern location which is in contrast to the southerly movement of grizzlies after being transplanted from West Yellowstone.

A 9-year-old male grizzly (YNP 7199) estimated at 500 pounds was captured at Grant Village on August 5, 1971 and transplanted to the Buffalo Plateau, about a mile south of the northern boundary of Yellowstone National Park between Buffalo and Slough Creeks. On September 27, 1971 this grizzly was shot by a hunter 54 days later and about 10 airline miles north of the release area.

A tagged (YNP 7133) female grizzly, 21 years of age, also had green and white hylon rope markers in each ear and a tattoo number present in the upper lip. The bear, estimated to weigh 300 pounds, was captured in Canyon Village on August 7, 1971 and released on Pitchstone Plateau in the southwest corner of Yellowstone Park. On October 1, 1971 this female was shot by a hunter 45 days after transplant and about 60 airline miles north of the release area.

A male grizzly, marked with a white nylon rope and attached yellow tag in the right ear, was killed by a hunter along Slough Creek on September 15, 1971. This grizzly was captured and marked while a yearling in Yellowstone National Park during 1964 and therefore has an estimated age of 8½ years. There are no subsequent records indicating this male was recaptured or reobserved after 1964.

Other Hunting Areas Adjacent to Yellowstone National Park

The hunters harvested two grizzly bears in Montana hunting areas adjacent to Yellowstone National Park and adjacent to areas of transplants (Figure 9) during the 1971 season. A marked, 5-year-old male killed on October 28, 1971 at the head of Sage Creek, Hunting Area 310, in the Gallatin Canyon was a bear transplanted from West Yellowstone to Area A on Jule 23, 1971. A hunter killed an unmarked 3-year-old female along Crevice Creek, Hunting Area 313, on October 20, 1971.

One grizzly was killed illegally by a hunter not possessing a valid license just north of the town limits of West Yellowstone in November, 1971. This young male carried ear tags from Yellowstone National Park studies and was of a known age of 3½ years.

Disposition of Grizzly Bears

When grizzly bear mortalities (except hunting) are reported arrangements are made for an immediate recovery of the carcass for processing and preservation of the hide. A time of 3 to 20 hours may elapse between the time of death and laboratory examination. Mortalities may occur from May to November. The quality of grizzly hides is usually the least prime during July and August and prime pelts are encountered in April and May or October and November.

The hides of many grizzlies have some degree of fur slippage due to the long delay before obtaining carcasses. All hides are carefully skinned out, thoroughly hosed clean with water and dried out in a cooler before storage in a freezer. Hides with advanced stages of fur slippage and skin spoilage are incinerated.

The Department policy for grizzly bear hides is to consider authentic requests within the State from museums, institution collections, agencies, and other public display and utilization. These requests and endorsements, are submitted to the Fish and Game Commission for an authorization of dispostion. When requests are not forthcoming, the hides are auctioned at a regular Department sale and all proceeds are deposited in the Department's general fund.

Rather than auctioning single grizzly hides as they become available during 1971, the hides were stored for one, well-publicized sale. A total of 10 grizzlies were accumulated during 1971. Seven grizzly hides processed at the Lab brought respective bids of $60, $70, $75, $135, $180, $200 and $400 which averaged $160 for the lot. The field dressed and uncleaned hides of a sow having fur slippage and two cubs sold for $27, $22 and $20, respectively.

The complete skeleton of grizzly bears are retained, cleaned and catalogued. Several requests are on hand for these specimens from museums, colleges, universities and other exhibition and educational institutions.

DISCUSSION

Nuisance Grizzly Bears

During the summer and early fall many grizzlies spend several hours foraging in the open-pit garbage dump serving the community of West Yellowstone. The abrupt transition in changing the long established dump to a bear-proof operation resulted in an associated bear behavior to visit areas of habitation. At times, grizzlies were in close proximity with humans and personal property. Department personnel made continuous efforts to examine dwellings and instruct landowners about garbage storage that attracted bears. Nuisance bears did not linger around dwellings where garbage or edibles were not tempting and available. It is difficult, if not impossible, to establish and maintain a rigid control of all garbage at all times in a public community.

An active control program resulted in the capture of 23 grizzlies from the vicinity of West Yellowstone during the summer of this initial year of readjustment. Many

of the bears were large mature males. Several grizzlies were already tagged or marked before capture and therefore had at least one experience with traps. Grizzlies were frequently observed avoding baited culvert traps. Without the additional use of specially constructed snare sets, the control of nuisance grizzlies would not have been successful for the trap-shy or older individuals.

This program did not completely resolve the situation as many grizzlies are still present in the vicinity and adjacent areas of the Park. With a knowledge that a sizable number of previously marked grizzlies still remain in the populations that use habitat adjacent to Yellowstone National Park, it is expected that some will appear as nuisance individuals around West Yellowstone during the next few years. The volume of complaints is anticipated to be less in the few years subsequent to 1971 and perhaps thereafter involve only occasional individuals. With the removal of older bears it is possible that young bears not having previous experience with garbage dumps or humans and refuse may become established in wild areas and confine movements to an existing ecological niche. Subsequent programs to remove nuisance grizzlies should result in a diminishing predominance of older animals being captured.

The live trapping of grizzly bears required considerable time, effort and experience for a successful capture ratio. An impressive record about the grizzly bear population in Yellowstone National Park is that at least 775 individuals have been marked during a 13-year period from 1959 through 1971 (Craighead and Craighead 1971, Cole 1971). Continuous use of culvert traps has resulted in trap avoidance by some bears. Snare sets were efficiently utilized during specific circumstances. Even with the use of both capture methods there were several grizzlies that generally avoided a trapping area, or skillfully removed bait without being captured.

Additional trapping devices are needed to efficiently conduct the control programs that are anticipated in the vicinity of West Yellowstone for the next few years. The local warden has suggested a trap design that eliminates the structural short-coming of the culvert trap. This different trap design should be constructed for trials. Invariably, modifications will be necessary and thereafter the traps efficiency can be evaluated.

Successful Relocations of Grizzly Bears

A successful grizzly bear transplant may be considered as one where the bear remains in the general area of relocation for a period of 7 to 11 months, or if the bear is legally harvested by a hunter at any time after transplant but in the vicinity of the relocation. This period involves the bear's survival of illegal or nuisance mortality during the summer, legal mortality during the hunting season, hibernation from November to April and foraging movements in April to July that are reasonably in the vicinity of a transfer area. Thereafter, the individual's survival rate would be similar to that of wide-ranging grizzlies in established populations.

By the above criteria, 18 percent (3) of 17 grizzlies were not observed after transplant and may possibly be considered to be successfully transferred to another area. The legal, illegal and intentional mortality for 12 grizzlies occurred from 8 to 48 days after transfer between July 2 and September 11; one was legally killed 95 days after transplant; and one grizzly died of complications at the transplant site.

Transplant areas available for Montana grizzly bears are limited to the designated areas used during 1971 in the Gallatin National Forest. Centers of transplant areas range from 5 to 20 miles north of Yellowstone National Park. It is expected that nuisance grizzlies will continue to appear and be captured from the vicinity of West Yellowstone. Many of the individual grizzlies involved in a control problem may continue the behavior of associating with personal property. Besides the considerable cost involved in the capture, handling and transplanting -- the problem grizzly may remain a problem, but only at another location or at intermediate points.

This initial experience of a control program for grizzlies in the West Yellowstone area during 1971 resulted in a rather low survival rate for the transplants. With only 1 year of information as a guide, it appears that some selection can be made for future transplants. A large male grizzly with characteristics of face scars, neck scars, broken canines or heavily worn incisors usually represents an age of 14 to 25 years. The gene pool of old males or their participation and contributions during breeding seasons are not precisely known. It is expected that the reproductive capacity of the species can be maintained by males of lesser age. Therefore, the immediate elimination of old age male grizzlies captured as a nuisance complaint in West Yellowstone is based upon economic and biological principals. If additional transplant areas become known and are authorized, then the disposition of old males may be reconsidered.

Mature females of at least 4½ years of age are of prime importance for their reproductive performance in grizzly populations. Females of various ages, with and without off-spring, captured in control programs should be carefully examined before transfer to available transplant areas. The culling of trapped females should also continue for animals sustaining injuries from vehicles, damage from trap restraint, those with seriously broken teeth, or females in emaciated physical condition. Each of these conditions were observed during 1 year of the program.

It is apparent that the transplant areas presently available are not distant enough from the point of origin to confound the homing instinct of individual grizzlies from the populations in and around Yellowstone National Park. Observations for most of the grizzly transplants during the first year showed that all ages of both sexes were reported at intermediate points to former ranging areas. The successful transplanting of grizzlies within Yellowstone National Park have been reported to increase from 33 to 80 percent between 1968 and 1970 (Cole 1971). Even with some selection of the grizzly transplants within Montana during subsequent years the success, as previously defined, may or may not exceed the 18 percent of the initial year in 1971.

Deliberation for Restricted Harvest by Hunters

Grizzly bear licensing and regulations have been refined since 1967 by deadlines for obtaining licenses and by increased license fees. The increased fees in 1971 significantly reduced resident hunting licenses by almost 60 percent but did not effect nonresident licenses. The grizzly bear harvest by hunters was similar to previous years but the ratio of reported females was most predominant in 1971. Most of the grizzlies taken by hunters were killed under opportunistic situations rather than a deliberate hunt. Efforts to direct the grizzly harvest by hunters to males will be more difficult to achieve than it is to suggest. Several female grizzlies have been, and will continue to be taken even with strong urging or even restrictions for only males to be harvested. Mnay hunter replies have indicated their grizzly was taken in camp, around entrails or hanging meat or along the trail. Even with the stringent restrictions or limited quotas in various areas, additional grizzlies will be killed as nuisance or threats to personal property. These may or may not be skinned out and reported to Department personnel.

As these age and sex data are acquired each year, the information can only be compared with that of the previous years. When population dynamics and age structures become available from studies now in progress on other grizzly populations, our Montana data may be examined more closely for some early trends of changing population densities in the various populations.

Sexual Dimorphism in Grizzly Bear Skulls

An effort was made to determine the sex of skulls by various characteristics of canine sizes, upper molar two, molar rows, skull sizes and temporal ridges. Of these, the size of canines was most favorable in that it indicated about a 20 percent overlap between sexes. Other characteristics were considerably more restricted in distinguishing the sexes. When the low or high extreme of one characteristic was noted, the same indication was usually apparent for other characteristics.

RECOMMENDATIONS

1. Continue the program for determining the annual grizzly bear mortality to provide data on locations, sex and age of each grizzly.

2. Obtain skulls and carcasses for age information and parasite studies.

3. Seasons, limits or restrictions should remain the same as in previous years.

4. Continue cooperative efforts to procure and process carcasses of grizzlies from the adjacent National Parks for comparisons and evaluations with Montana populations.

5. The bear closure at West Yellowstone should be discontinued since the open garbage dump has been replaced with a bear-proof disposal area.

6. A spring grizzly bear season, of restricted area and limited quoto, be considered in the West Yellowstone area. It is suggested that two males only may be taken by permittees, from a general drawing, during the last 3 weeks of April and; two males only by permits during the first 3 weeks of May.

7. The design, development and use of new traps or techniques should be encouraged to provide efficient and effective methods for the live capture of grizzly bears in the high risk area of West Yellowstone.

8. Continue to seek transplant areas for nuisance grizzlies captured at West Yellowstone or other locations. Coordinate and inventory the potential sites with Forest Service personnel. Public hearings may be required for transplanting grizzlies between different forests in the State.

9. Transplanted grizzlies should be tattooed in the lower lip along with the usual ear tags.

10. Recover and preserve the hides of dispatched, marauding and illegal grizzlies for a public auction.

11. Maintain records of individual grizzly bears involved in a live trapping and transfer program in Montana.

12. The past and current knowledge about grizzly bears in Montana should be reviewed for an evaluation of the current designation of RARE in the Federal Red Book (Committee 1968) of Endangered Species. If the findings do not support this classification, efforts should be made to place the species in the correct perspective of not being in jeopardy in the State of Montana.

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APPENDIX. TAGS AND LOCATIONS FOR GRIZZLY BEARS TRANSPLANTED FROM WEST YELLOWSTONE DURING 1971.

Trapping Number	TAG OR MARKER		Location
	Left Ear	Right Ear	
1(and 21)	MFGD Square Green G-360	---	Sec.27, T6S, R13E
2(and 8)	MFGD Square Red G-463	MFGD Square Red G-714	Sec.25, T6S, R13E
3	MFGD Round Yellow G-634	MFGD, Round Yellow G-635	Sec. 6, T6S, R11E
4	(Tattoo 201 in Upper Lip)	(Red-White Nylon Cord)	Sec.16, T6S, R11E
5(and 14)	MFGD Square Red G-160 (Green-White Nylon Cord with Red Plastic Strip)	MFGD Round Blue G-406	Sec.34, T7S, R11E
6	MFGD Round Yellow G-636	MFGD Round Yellow G-637	Sec.28, T6S, R11E
7	MFGD Round Blue G-672	MFGD Round Blue G-673	Sec.35, T6S, R13E
9	MFGD Round Green G-690	MFGD Round Green G-691	Sec.11, T7S, R13E
10	MFGD Round Blue G-674	(Red-White Nylon Cord)	Sec.22, T7S, R13E
11	MFGD Square Red G-710	(Tattoo 35 or 85 in Upper Lip)	Sec.14, T7S, R13E
12(and 22)	MFGD Round Red G-335	MFGD Round Red G-239	Sec.16, T6S, R11E
13	MFGD Square Red G-462	MFGD Round Blue G-675	Sec.28, T7S, R13E
15	MFGD Round Green G-692	MFGD Round Green G-693	Sec.33, T7S, R13E
16	YNP - 1965	---	Dispatched
17	MFGD Round Yellow G-640	MFGD Round Yellow G-641	Sec.16, T6S, R11E
18	MFGD Square Red G-703	MFGD Square Red G-704	Sec.16, T6S, R11E
19	MFGD Round Green G-695	MFGD Round Green G-696	Sec.16, T6S, R11E
20	MFGD Round Blue G-658	MFGD Round Blue G-659	Sec.16, T6S, R11E
23	MFGD Round Red G-608	---	Sec.15, T56N,R109W

MAXIMUM AND MINIMUM WEIGHTS & TOTAL LENGTH MEASUREMENTS
OBTAINED FROM 55 ADULT GRIZZLIES

FEMALES

	Max. Weight	Min. Weight	Weight Differences	Maximum Total Length	Minimum Total Length	Length Differences
Spring (June-July)	435 lbs 196 kg	225 lbs 112 kg	210 lbs 94.5 kg	78 in 198 cm	67 in 170 cm	11 in 28 cm
Fall (Aug-Sept-Oct)	495 lbs 233 kg	300 lbs 135 kg	195 lbs 88 kg	74.5 in 189 cm	66 in 168 cm	8.5 in 22 cm

MALES

Spring (June-July)	645 lbs 290 kg	310 lbs 135.9 kg	335 lbs 151 kg	91 in 231 cm	69 in 175 cm	22 in 56 cm
Fall (Aug-Sept-Oct)	780 lbs 351 kg	345 lbs 155 kg	435 lbs 196 kg	85 in 216 cm	73 in 185 cm	12 in 30 cm

NOTE: All bears over 5 1/2 years old are considered adults.
All "spring" weights and measurements were obtained in June and July; "Fall" data were obtained in August, September and October.

AVERAGE TOTAL LENGTH AND SEASONAL WEIGHTS OF 55 DIFFERENT ADULT GRIZZLIES

Number Different Bears Weighed & Measured	No. of Weights Obtained	Average Weight lbs.	kg.	Number of Total Length Measurements Obtained	Average Total Length in.	cm.	Number Different Bears Weighed & Measured	No. of Weights Obtained	Average Weight lbs.	kg.	Number of Tot. Length Measurements Obtained	Ave. Total Length in in.	cm.
Females:													
16	21	315	141.8	9	71	180.3	16	18	383	172.4	12	70	177.8
Males:													
13	13	504	226.8	10	78	198.1	10	10	574	258.3	8	78	198.1

NOTE: All bears over 5 years are considered adults. All "spring" weights and measurements were obtained in June and July; "Fall" data were obtained in August, September and October.

Bear Iron Relationships

Cole, Herrera, Brisenia (7.C.C.)

Austins – Milligan, T-bone

Public reputation (truthful)

Prevent cover ups – lead to more problems

False info. signs etc.

Management as Related to Ranges and Movement

Hibernation Requirements To Be Considered In Mgt.

Mgt. as Related to Food Habits & Habitat Preference

Elk Calves (include)

Management Related To Bear-Man Relationships.

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MANAGEMENT AS RELATED TO GRIZZLY BEAR LIFE HISTORY

It is obvious that the management of a species such as the grizzly bear must be tailored to the biology and life history of the animal. It is mandatory that all relevant and available data be gathered and considered in managing this endangered species within the contiguous 48 states. The past history of the grizzly reveals to us that it was both abundant and widely dispersed before the advent of the white man on the North American Continent. It was also a co-dominant with many competing for many of the same foods both plant and animal. Both are omnivorous feeders. Their numbers along with their competing activities and aggressiveness perhaps altered the density of human populations in some regions ( ). Because of his large size, aggressiveness and evolutionary co-dominant position the grizzly did not and does not fear man. This natural balance between man and bear was upset by the appearance of the rifle and particularly the repeating rifle. Man was now undoubtedly the dominant animal ready and willing to assert this dominance. Grizzlies were killed and their numbers diminished. Within a relatively short time the grizzly range in the continental United States shrunk to an area within three states as habitats were altered and destroyed. Their numbers declined from hundreds of thousands to not over 800 animals. Throughout the entire range of the grizzly bear in North America these animals are declining wherever their presence and activites conflict with man's interests.

In other words, the forces that have eliminated the grizzly from much of its former range are still in progress. ~~We~~ The trend continues and is evident.

Early records indicate that grizzly bear populations were concentrated in the foot hills of the Rocky Mountains and in the valleys of the larger rivers. With the near extermination of the bison and the rapid settlement of their habitat grizzly bear range shrunk to currently embrace only rugged mountainous country and expansive wilderness areas. The mountain grizzlies will undoubtedly continue to decline over much of their existing range as human populations and activities expand, but it is obvious that management programs must ensure the preservation of extensive areas of suitable habitat and within these emphasize policies that tend to keep annual mortalities balanced with annual recruitment. In vast areas where grizzlies are still relatively abundant, periodic inventories of population numbers and surveys of habitat will be necessary. Declines in available habitat or estimated populations should be countered by in depth studies of age specific mortality and reproductive rates.

Grizzly bear populations under protective management can increase resulting in movement beyond the confines of a restricted preserve. Grizzlies are dangerous animals, and individual bears are at times a threat to man. Under some conditions particularly where bear populations are expanding they can be detrimental to man's economic interests, ~~particularly where populations are expanding.~~ Management of the grizzly though aimed at preservation should include means of control when and where necessary. Hunting under a special permit basis is recommended where viable populations exist.

MANAGEMENT AS RELATED TO POPULATION RESEARCH

Management as related to the grizzly bear population statistics and trend in the Yellowstone ecosystem should be to minimize grizzly bear mortality especially among mature females. In the Yellowstone population with a maximum of 200 animals and a stable age structure as determined for the 1959-67 period, 87 grizzlies would be adults and of these 47 would be females 4.5 years or older. One third of the adult females in the population breed each year or about 16 females. These produce an average litter size of 2.2 or an average of 35 cubs. The annual increment over an eight year period was 19 per cent. The known mortality averaged 10% a year with unknown approximately the same. The annual increment just slightly exceeded the mortality rate thus the population grew at an average annual rate of about six grizzlies per year from 1959 through 1966. Grizzly bears have a low reproductive rate, thus an increase in the annual mortality rate above 20%, particularly an increase in deaths of mature females, could soon be hazardous to the population. In a three year period (1969-1971) this same population experienced a known mortality of 120 bears. There was a maximum of 46 and 45 known deaths for 1970 and 1971 respectively. In a five year period (1968 through 1972) the known and documented mortality was 160 with 42 per cent females (Craighead, Jr. et al 1973). This is double the known and acceptable 10% average mortality recorded from 1959-1967 in a very slowly growing population of 180 animals. In addition, the magnitude of suspected,

but unrecorded and unconfirmed grizzly bear deaths could have been in excess of 30% of the known recorded deaths for each year. The past history of decline in grizzly bear numbers plus recent losses would indicate the need for prompt action to reduce mortalities.

Management

A major specific management step should be to minimize grizzly bear mortality especially among mature females. In the Yellowstone population with a maximum of 200 animals 87 would be adults and of these 47 would be females 4 1/2 years or older. One third of the adult females in the population breed each year or about 16 females. These produce an average litter size of 2.2 or an average of 35 cubs. ~~on~~ The annual increment over an eight year period ~~it~~ was 19 per cent. The known mortality averaged 10% a year with unknown approximately the same. The annual increment just slightly exceeded the mortality rate thus the population grew at an average annual rate of about six grizzlies per year from 1959 through 1966. An increase in the annual mortality rate above 20%, particularly an increase in deaths of mature females, could soon be hazardous to the population. In a three year period (1969-1971) this same population experienced a known mortality of 120 bears. There was a maximum of 46 and 45 Known deaths for 1970 and 1971 respectively. In a five year period (1968 through 1972) the known and documented mortality was 160 with 42 per cent females (computer analysis). This is double the known and acceptable 10% average mortality ~~of these~~ recorded from 1959-1967 in a population of 180 animals. Of these a high percentage were mature productive females.

Color variations in the grizzly range from dark brown to straw colored blond. Often the hair is lighter, almost white on the distal ends giving the animal a silver, frosted sheen. From this appearance the name "silver tipped" evolved. Collars of light colored hair are common especially among the young.

Bernie draft 2nd.

GRIZZLY BEAR PRE-HIBERNATION AND DENNING

The term hibernation as it applies to some of the smaller hibernators, that is, a periodic phenomenon in which body temperature falls to a low level approximating ambient, and heart rate and other physiologic functions fall to correspondingly minimum level (Hock 1960) does not fit the grizzly bear. Hock proposed the term carnivorean lethargy instead of hibernation. The limited depression of body temperature observed in bears may qualify them as "ecological" hibernators rather than "physiological" hibernators (Morrison 1960). The body temperature of a black bear in its den reached an equilibrium value of approximately 35.3° C with about a 0.6 C day-night variation (Craighead, J. J. et al. 1971). In applying the term hibernation to bears we recognize that in animals of varying sizes hibernation is a matter of degree: some mammals becoming helpless and torpid while the bear hibernates in a lethargic state from which it can be readily aroused to action. The potential energy reserve of large animals is greater than that of the smaller ones and their metabolic rate lower. Thus bears can fast longer than smaller mammals without a modification in metabolic level. A grizzly going into hibernation can fast for six months with only a slight reduction in body temperature. In fact, because of its low thermal conductance the bear cannot maintain a body temperature near the ambient air temperature as can some of the smaller hibernators (Morrison, 1960).

% drop in body Temp.

To study pre-hibernation and denning of the grizzly we made 48 radio instrumentations of 23 different grizzly bears over an eight year period (Craighead and Craighead, 1972).

Information was obtained on prehibernation behavior, den digging, site selection and the size and construction of eleven active dens. All dens used by grizzlies were located while they were being constructed or when bears entered them for their winter sleep. Over a nine year period the dates when grizzlies entered their dens for the winter varied by as much as a month October 21-22 (1961), November 19-21 (1966). The earlist recorded den diggings were on 3 and 8, September. The duration of den digging varied but usually the major excavation was accomplished within a week. All of the dens we located were dug by grizzly bears. No natural shelters were utilized through these were available. This seems to be in contrast to the European brown bear which often uses natural shelters (Couturier 1954). Grizzly bear dens were located at altitudes ranging from 7,800 to 9,200 feet. All were dug in timbered areas and all but one on north facing slopes. Seven of 11 dens were dug at the base of trees; 3 at the base of stumps or with entrances beneath horizontal logs; 1 den was located in the open on a timbered slope. Frequently the grizzly digs an entrance at the base of a tree and tunnels in through the large downward and outward sloping roots. The roots limit the size of the den opening and tend to form a ceiling for the bed chamber. Our observations led us to believe that it is instinctive for the grizzlies to dig a den rather than to appropriate or modify a natural cavity.

The size of grizzly dens were just adequate for the number of bears sheltered, whether single individuals or a family composed of cubs or yearlings. Most dens were constructed with an entranceway leading in to the bed chamber. The average size of this chamber, determined from 10 dens, was 56 inches (140 cm) long by 53 inches (133 cm) wide and 37 inches (93 cm) high. The small size of bed chambers is functional; i.e. body heat from the bears substantially modifies ambient den temperatures (Craighead et al, 1971). Dens never contained more than one chamber. Alcoves such as those reported for the polar bear (Harrington 1968) were not observed. All dens were lined with conifer boughs, usually fir or spruce 3 (8 cm) to 14 inches (36 cm) deep. A pregant female lined her den with a combination of moss, grass and tiny rootlets. All dens ~~with a combination~~ were so situated that the entranceways filled with snow forming a sealed chamber with little transfer of air.

The measured distances that instrumented grizzlies travelled from fall or summer foraging areas to den sites ranged from 2.5 (4 km) to more than 30 airline miles (48 km). Grizzlies living under the same environmental conditions on the Yellowstone plateau 7,000 (2134 m) to 8,000 feet (2439 m) in altitude, entered their dens at the same time. ~~This was~~ during a snowstorm regardless of whether the animals were waiting close to their dens or were foraging at some distance. Environmental conditions appeared to be influential in determining the ~~time~~ that grizzlies entered their dens for the winter. Minimum ambient air temperatures as well as maximum temperatures in shaded den sites were below the ~~f~~freezing level and in all cases snow was

on the ground. During one year, 1965, a distinct lethargy was observed in grizzlies prior to hibernation. It appears possible that a cold spell with snow in September initiated lethargy early in the season and thus affected grizzly pre-hibernation behavior. This cold spell appears to have been a factor triggering hibernation processes so that the bears became lethargic and physiologically ready for winter sleep by late October, before the usual environmental stimulus of a final snowstorm caused them to enter their dens for the winter, November 11, in 1965. Circumstantial evidence such as old bedding material in den debris piles suggested that dens might have been used in previous years. However, no radiotracked bears ever re-used a den. Some grizzlies that started treks to their dens hours before storms were apparent to us suggested that they may be able to detect approaching storms; possibly by variations in barometric pressure or through sensitivity to intrasonic waves (Green and Dunn, 1968). Some such stimuli appears to initiate movements to dens before storm signs are usually apparent. All grizzlies hibernated in isolated areas away from the activities and works of man. It would appear that extensive areas of wilderness or undeveloped Park or Forest lands are essential to the welfare of the grizzly and should be considered in management programs.

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I

GRIZZLY BEAR RANGES DETERMINED BY RADIO
1963-1964

Year	Bear No.	Number of bearings used in determining range	Animal Tracking days	Number of Plotted fixes	Area of Ranges in square miles Mi_2	KM_2	Remarks
1963	7	256	44	32	106	274.5	Female with yearlings
	40	140	29	32	8	202.2	5-year old female
	75	145	44	21	36	93.2	Female with yearlings
	76	129	28	21	168	434.6	5-year old male
	150	227	29	35	27	69.9	Female with cubs
1964	6	49	19	11	12	31.1	5-year old female
	14	58	41	5	12	31.1	Large adult male
	34	151	34	26	13	33.7	Female with yearlings
	40	106	67	27	15	38.9	Female with cubs
	158	98	51	14	22	56.9	Yearling (family of female and 3 yearlings)

II

GRIZZLY BEAR RADIO-LOCATING DATA
1967

Bear No.	Days Radio Operating	Days Attempted to Locate by radio	No. of Days No Attempts to locate by radio	Days Successful	Percent Days Successful	Days Visual sightings attempted with aid of signal	Days Visual sightings were made	Percent of sightings successful
40	16	14	2	13	93	1	0	0
101	49	38	11	36	95	16	12	75
187	65	59	6	54	92	9	7	78
188	15	13	2	13	100	0	0	0
Totals	145	124	21	116	94	26	19	72

RADIO-LOCATING DATA
1968

40	106	47	59	42	89	13	12	92
187	33	17	16	15	88	1	1	100
101	6	3	3	3	100	0	0	0
183	unknown	11	-	2	18	0	0	0
	145	78	78	62	79	14	13	93

NOTE: Grizzly No. 183 was located only twice and the signal was not picked up again. It is not known whether the radio collar was operating after 9/6/68.

III

GRIZZLY BEAR HOME RANGES DETERMINED BY RADIO

Bear No.	Sex	Tracking Years	Animal Tracking Days	Area of Ranges Mi_2	Area of Ranges KM_2
7*	F	1963	44	106	274.5
40	F	1963-1968	400	30.0	77.7
101	F	1966-1967	125**	43	111.4
150*	F	1963	33	27	69.3
158	M	1964	51	22	56.9
39	F	1964	51	22***	56.9
187	F	1967-1968	98	40	103.6
202	M	1965-1966	174	125	323.7

* Denning area but not den located

** Includes 76 days of tracking 101 with instrumented 40

*** No. 39 though not instrumented, was always with her yearlings including #158

IV

FEMALE GRIZZLY RANGES DETERMINED BY RADIO

Bear No.	Age	Year	Animal Tracking Days	Area of Range Mi_2	Area of Range Km_2	Type of Range
6	5	1964	19	~~106~~ 12	~~275~~ 31	Summer
7	Adult	1963	44	106 12	~~31~~ 275	Summer & Fall
34	Adult	1964	34	12	31	Summer
40	5	1963	29	8	20	Home
	6	1964	67	15	39	Home
	7	1965	106	20	52	Home
	8	1966	76	7	18	Home
	9	1967	16	11	28	Home
	10	1968	106	22	58	Home
75	Adult	1963	44	36	93	Summer
150	Adult	1963	29	27	70	Summer & Fall
101	Adult	1967	49	43	111	Home
187	Adult	1967	65	41	106	Home
187	5	1968	33	34	87	Home

MALE GRIZZLY RANGES DETERMINED BY RADIO

Bear No.	Age	Year	Animal Tracking Days	Area of Range Mi_2	Area of Range KM_2	Type of Range
14	Adult	1964	41	12	31.1	Fall
76	Young adult	1963	28	168	434.6	Summer & Fall
158	1	1964	30	22	56.9	Home
188	1	1965	19	20	51.8	Summer*
202	1	1965	55	27	69.9	Home
	2	1966	106	125	323.7	Home

*Area determined through instrumented mother

VI

LIFETIME RANGE OF FEMALE GRIZZLY No. 40

Age	Year	Tracking Dates	Animal Tracking Days	Area of Range Mi_2	Area of Range KM_2
5	1963	8/7 - 9/4	29	8.0	20.2
6	1964	9/4 - 11/9	67	15.0	38.9
7	1965	6/28 - 9/6 10/13 - 11/16	106	20.0	51.8
8	1966	9/1 - 10/29 10/30 - 11/15	76	7.3	18.9
9	1967	9/11 - 9/26	16	11.1	28.8
10	1968	7/25 - 9/4 9/5 - 11/17	106	22.4	57.0
		Total Area Lifetime Range ----		30.0	77.7

21.0

sq mi = 2.59 km^2

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Feasibility of tracking free-roaming animals in natural environments.

A female elk was tracked by the Interrogation Recording and Location System (IRLS) of the Nimbus III meteorological satellite on the National Elk Refuge at Jackson Hole, Wyoming, for 30 days in April 1970. This was the first time that an animal had ever been tracked by satellite. IRLS is an experimental system designed to locate and collect data from weather balloons and oceanographic buoys. A prototype instrument collar weighing 11.5 bg was developed for the elk and tested on a semitame elk in a corral at the National Bison Range.

The location varied from 1 to 15 km with a mean error of 4.8 km and 6.2 km in latitude and longitude, respectively. The accuracy can be increased through development of low profile, omnidirectional, circularly polarized antennas. The theoretical limit for IRLS system is $\pm$ 1 km.

IRLS has 28 channels for collecting data. For each of nine sensory points 86 measurements were obtained. Battery voltage strength and temperature, timer status for the "ON" window, signal strength, light intensity, and skin temperature were monitored. Solar cells maintained battery charge near maximum.

Study shows that the instrument collar can be reduced in weight to about 5 kg without microminiaturization. A doppler-shift satellite system could reduce instrument weight to 50 g or less.

Satellite tracking and data-collection systems can provide powerful new tools for studying biological phenomena, the uniqueness lying in being able to combine tracking of animals with simultaneous monitoring of physiological and environmental parameters. (Supported by NASA Contract NASW-1983 and U.S. Bureau of Sports Fisheries and Wildlife.)

Mountain Grizzly Bear Life History And Management
(Ursus arctos horribilis)

Former range and numbers — continental U.S. excluding Alaska
over 1 million
Now less than 800 — high mountain country of Nat'l. For. & Nat'l. Park Wilderness areas.

13 year ecological study of the grizzly to gather data on the life history of the grizzly considered essential for its management & continued survival. Research efforts were concentrated on the largest single population south of Canada — the grizzlies in the 5,000000 acre Yellowstone Ecosystem.

by Dr. John J. Craighead, & & associates
Placed on endangered species list in 1967 and then removed.

Pop. size — censuses - 32+ marked animals
Pop. structure
Breeding pairs
Breeding age
Breeding interval
Longevity

256 grizzlies were captured and individually color marked max. 200
550 + handled

Dev. & application of radiotracking & biotelemetry techniques.
Ranges and movement
Prehibernation and denning

Sex ratio — Adult females outnumber adult males 53.7% to 46.3%
Sex ratio of cubs was 59% male, 41% female

MOUNTAIN GRIZZLY BEAR LIFE HISTORY AND MANAGEMENT

Craighead, ~~Dr.~~ Frank C., Jr.
Senior Research Associate, Atmospheric Sciences Research Center; State University of New York at Albany; Albany, New York, ~~United States of America~~ USA.

Estimates of grizzly bears (Ursus arctos horribilis) within the continental United States placed their numbers at over one million prior to 1800. Now, no more than 800 are found in the high mountain wilderness country of Montana, Wyoming and Idaho. ~~In 1959 my brother,~~ Dr. John Craighead, and I ~~started~~ conducted a 13 year ecological study to gather data on the life history of the grizzly, considered essential for management. Research efforts were concentrated within the 5 million acre Yellowstone ecosystem. Censuses revealed a minimum population of 175 grizzlies, and a maximum of 250. 256 grizzlies were captured and marked, and over 550 were weighed, measured and otherwise handled. The average age composition was found to be: Cubs 19 percent, Yearlings 13 percent, Two year-olds 10 percent, Three and Four year-olds 15 percent, and Adults 43 percent. Radiotracking and biotelemetry techniques were developed and 23 different grizzly bears were monitored for a total of over 1200 tracking days. Data was gathered on breeding and "prehibernation" behavior, food habits, movement and ranges, winter den selection and construction. Eleven active dens were located. All dens were dug entirely by grizzlies and no natural shelters utilized. Over a nine year period, the dates bears entered winter dens varied by as much as a month, ~~and were~~ influenced by environmental factors. Home ranges and 14 seasonal ranges of grizzlies were delineated by radio. They varied greatly in size, overlapped and were not defended. Results of this research have ~~only~~ been meagerly applied in management. Unless management concepts and ~~management~~ policies are revised, the grizzly bear may be eliminated not only from the Yellowstone ecosystem, but from the continental United States. A computer population analysis reveals that continuation of present management policies could exterminate the grizzly in this region by 1990. A cooperative approach by all agencies concerned ~~is~~ has been recommended.

Sr. Res Assoc - At Sciences Res Cent St U of NY at Albany

Eliard

Mountain Grizzly Bear and Life History & Management

Estimates of ~~xxxxxxx~~ grizzly bears (~~Ursus~~ Arctos ~~Horribilis~~ Horribilis?) within the continental U.S. placed their numbers at over one million prior to 1800. Now, no more than 800 are found in the high, mountain wilderness country of Montana, Wyoming & Idaho. In 1959 my brother, Dr. John Craighead, and I started a 13 year ecological study to gather data on the life ~~xxxxxx~~ history of the grizzly, considered essential for management. Research efforts were concentrated within the 5 million acre Yellowstone ecosystem. Censuses revealed a minimum population of 175 grizzlies, and a maximum of 250; 256 grizzlies were captured, ~~weighed and measured~~ marked, and over ~~500~~ 600 were weighed, measured or otherwise handled. The average age composition was found to be: Cubs, 19 per cent, Yearlings, 13%, ~~Two~~ 2 year-olds, 10%, Three & Four year-olds, 15%, and Adults 43%.** Radiotracking & biotelemetry techniques were developed and 23 different grizzly bears were monitored for a total of over 1200 tracking days. Eleven active dens were located. All dens were dug entirely by grizzlies and no natural shelters utilized. Home ranges of grizzlies and 14 seasonal ranges were delineated by radio, they varied greatly in size, overlapped and were not defended. ~~Life history information has~~ Results of this research have only been meagerly applied in management. Unless management concepts & management policies are revised, the grizzly bear may not only be eliminated from the Yellowstone ecosystem, but from the continental United States. A cooperative approach by all agencies concerned is recommended.

19
13
10
15
43
100

(1) Data was gathered on breeding behavior, food habits, movement and ranges, and prehibernation winter den selection and construction.

(2) Breeding occurs from mid May to ~~the~~ mid July. Females attain sexual maturity until 4½ years old. The oldest live bear was aged at 25.5 years and the maximum reproductive age was 23.5. A linear social hierarchy exists where bears concentrate, do not

(3) Over a 9 year period dates of ~~entered~~ dens varies by as much as a month and ~~was~~ influenced by environmental factors. ~~Bears~~ usually enters their dens during snow storms and ~~they~~ under similar environmental conditions entered ~~their~~ dens at the same time. The bears

(4) A computer population analysis reveals that ~~the~~ present management ~~the grizzly bear population~~ could ~~be optimum~~ as ~~early~~ as 1990, policies

↓

determine the grizzly in this region by 1990.

Grizzly Bear Study

From time to time in interviews and for television, I have been asked the question, "Well, whats the importance of studying and preserving the grizzly bear?" The following statement helps to explain it.

The importance of studying the grizzly bear is that he is just one of numerous plants and animals that are intricately interrelated and interdependent. It is this interrelatedness and interdependence of living things on one another that makes continuing upon earth possible. It it vitally important that we learn more about and more fully understand such processes if human life on earth is to survive.

Grizzly Bear

(*Ursus arctos horribilis* Ord)

Description—A large heavy-bodied bear weighing up to 1,100 pounds; tail short, limbs heavy, claws long, slightly curved, longer in spring and among animals that do little digging. Face outline usually concave. Colour extremely variable, from cream colour through brown to black, frequently with whitish tipping, giving a grizzled appearance. The pelage on the back is usually paler than that on the legs and ears.

The grizzly requires separation only from the black bear, and the distinctions are given under that species. The high shoulder and sloping back line are characteristic.

Measurements—An adult male from Jasper, Alta., near the British Columbia boundary, measured, total length, 73 inches; tail, 6¾ inches; hind foot, 10 inches; and weighed 450 pounds. This is a good average specimen, although much larger individuals are on record. The maximum weights actually recorded are in the vicinity of 1,000 pounds. The largest bear so far recorded officially in British Columbia was taken in Tweedsmuir Park. The skull of this animal was 16 by 9 7/16 inches and holds the No. 2 position in the Boone and Crockett Club World Record Series for grizzly bears (excluding Alaska brown bear).

Habitat—Wilderness areas generally. On the Coast, centred in coniferous forests and mountains along the salmon-spawning streams. In the Interior, usually found at higher altitudes around rock-slides, talus slopes, and clearings where berries prevail. Encountered also in open alpine country where hoary marmots dwell. Throughout much of the Province these animals change habitat with the season, feeding on newly sprouted vegetation on the south-facing slopes in the early spring, shifting to berry patches and marmot colonies during the summer, and descending to concentrate on the salmon-spawning streams in the late fall.

Biology—Grizzly bears breed in June and July; young, one to four (usually two), born in January, February, or March (Asdell, 1946). Young are born while the female is in hibernation and measure 9 or 10 inches in length. The female does not ovulate while nursing young, and consequently, like the black bear, these animals produce young in alternate years. Food consists of grasses, forbs, roots, berries, insects, fish, carrion, and any prey, large or small. Mice, birds, deer, and big-game animals are all taken when opportunity presents. Hoary marmots and ground squirrels form part of the diet where they occur on grizzly range. The bears secure them by digging, and evidence of this activity is often seen in the alpine country. Fish, principally spawning salmon, are secured on the shallow spawning-beds, usually by direct seizure with the mouth. The authors, however, have seen grizzly bears knocking salmon out of the stream with the forepaws after first herding the spent fish toward shore.

When the temperature drops in the fall, the grizzly bear retreats to a cave, hollow tree, windfall, or like place to hibernate. The fat accumulated through the summer and fall sustains them until the following spring. Time of hibernation and emergence varies with the climate, but most British Columbia grizzlies are in hibernation in November, appearing again in March and April.

These bears are potentially dangerous as all wild animals are, but as a rule they are shy creatures of crepuscular or nocturnal habit. The appearance of man usually puts the grizzly to flight, and the noisy traveller seldom sees one at close range. Attacks on man are frequent and usually result from a sudden meeting at close range. Unprovoked attacks under other circumstances occur infrequently.

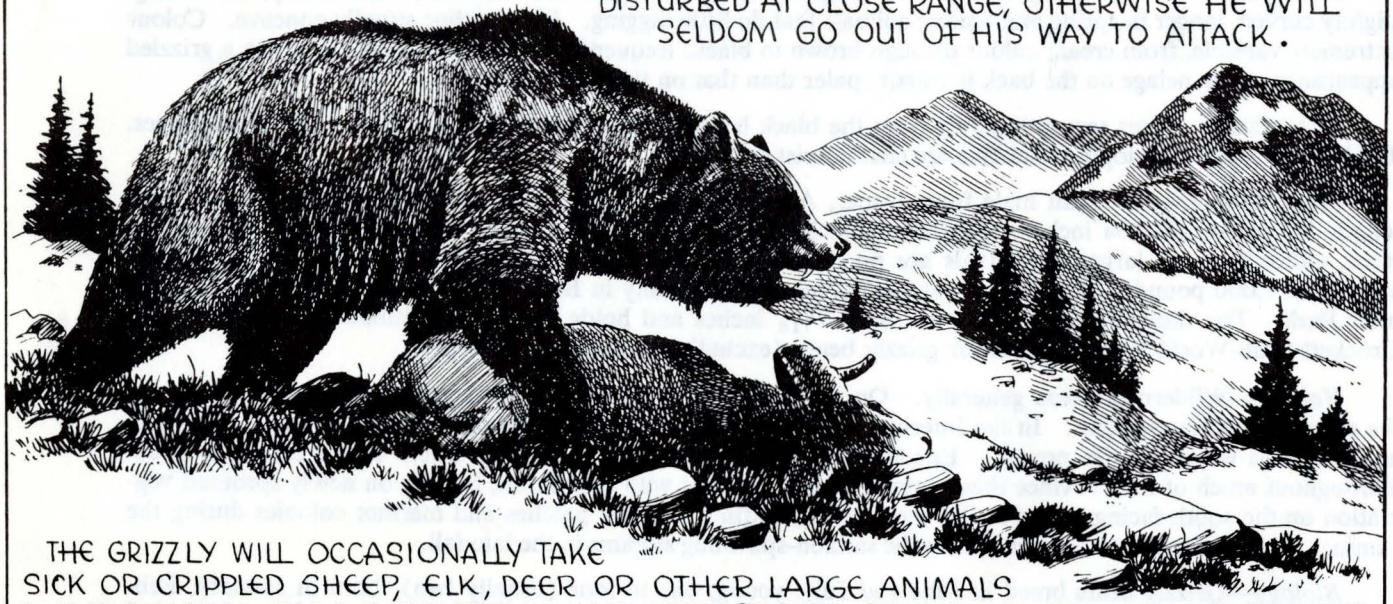
Distribution—Grizzly bears occur throughout the mountainous area of the Province and are found in numbers along the entire coast-line, although so far not recorded from any of the coastal islands. The heads of practically every inlet along the British Columbia coast harbour appreciable populations of grizzly bears.

Specimen records from Chilkat River, Atlin, Telegraph Creek, Klappan Creek, Dease Lake, Tatletui Lake, Clearwater Creek (branch of Stikine River), Driftwood River, Burns Lake, Big Eutsuk Lake, Bowron Lake, Incomappleux River, Kootenay Pass, Brisco, Beaverfoot Range, Moose Pass, Bridge River, head of Jervis Inlet, Lillooet Lake, Pemberton Lake, Field, Eagle River (Adams Lake), Iskut Lake, Bella Coola, Hagensborg, Stuie, Atnarko.

Remarks—Merriam's 1918 work led to much confusion in the names and distribution of the grizzly bears. At the present time all grizzly and big brown bears in British Columbia and Mainland Alaska have been designated as *Ursus arctos horribilis* (Rausch, 1953). Subspecies certainly exist, but cannot be designated until the group is given systematic revision.

the GRIZZLY

BRITISH COLUMBIA AND THE YUKON TERRITORIES BOAST PRACTICALLY ALL OF NORTH AMERICA'S GRIZZLY POPULATION, WHILE IN THE U.S.A. A FEW HUNDRED REMAIN IN NATIONAL PARKS. THE GRIZZLY CAN BE EXTREMELY DANGEROUS TO MAN IF HE IS SUDDENLY DISTURBED AT CLOSE RANGE, OTHERWISE HE WILL SELDOM GO OUT OF HIS WAY TO ATTACK.



THE GRIZZLY WILL OCCASIONALLY TAKE SICK OR CRIPPLED SHEEP, ELK, DEER OR OTHER LARGE ANIMALS BUT HIS USUAL FARE CONSISTS OF MARMOTS, GROUND SQUIRRELS, GRASSES AND BERRIES.

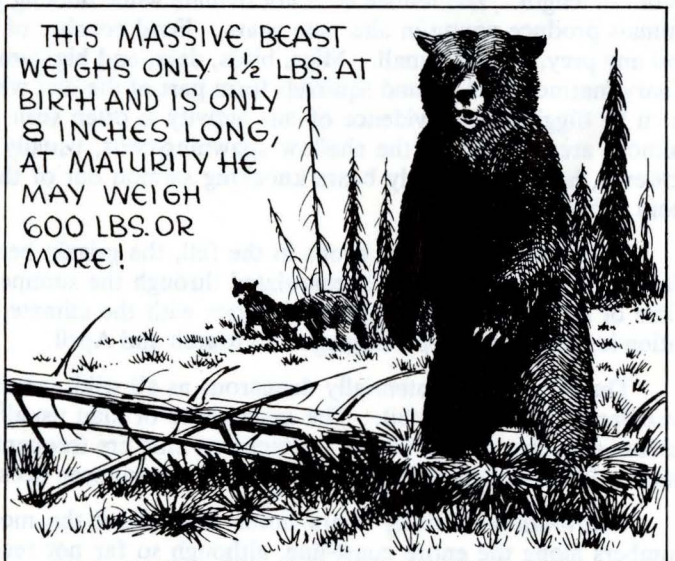


THE LARGER OF THE TWO SKULLS SHOWN ABOVE BELONGS TO THE GRIZZLY, AS YOU CAN SEE IT IS SOMEWHAT LARGER THAN THAT OF HIS COUSIN, THE BLACK BEAR.

THE GRIZZLY'S HIND FEET LEAVE TRACKS ABOUT 11" LONG WHILE THE TRACKS LEFT BY THE FRONT FEET ARE USUALLY AROUND 5½" IN LENGTH. THE SHARP CLAWS LEAVE THEIR IMPRESSION JUST AHEAD OF THE TOE PADS.



THIS MASSIVE BEAST WEIGHS ONLY 1½ LBS. AT BIRTH AND IS ONLY 8 INCHES LONG, AT MATURITY HE MAY WEIGH 600 LBS. OR MORE!



THE CUBS STAY WITH THEIR MOTHER THROUGH THE FIRST SUMMER AND OFTEN LONGER. YOUNG GRIZZLIES WILL CLIMB TREES TO ESCAPE DANGER OR JUST FOR FUN BUT WHEN MATURE THEIR GREAT SIZE AND WEIGHT MAKE TREE CLIMBING IMPOSSIBLE.

4-8-62

BRITISH COLUMBIA'S NATURAL HISTORY

by Tom Hunter

Grizzly Bear Movement

1. 240 lb. male trapped at Thumb, marked and released at Trout Creek. Returned to Thumb 5 days later. Overland distance of 16-20 miles.

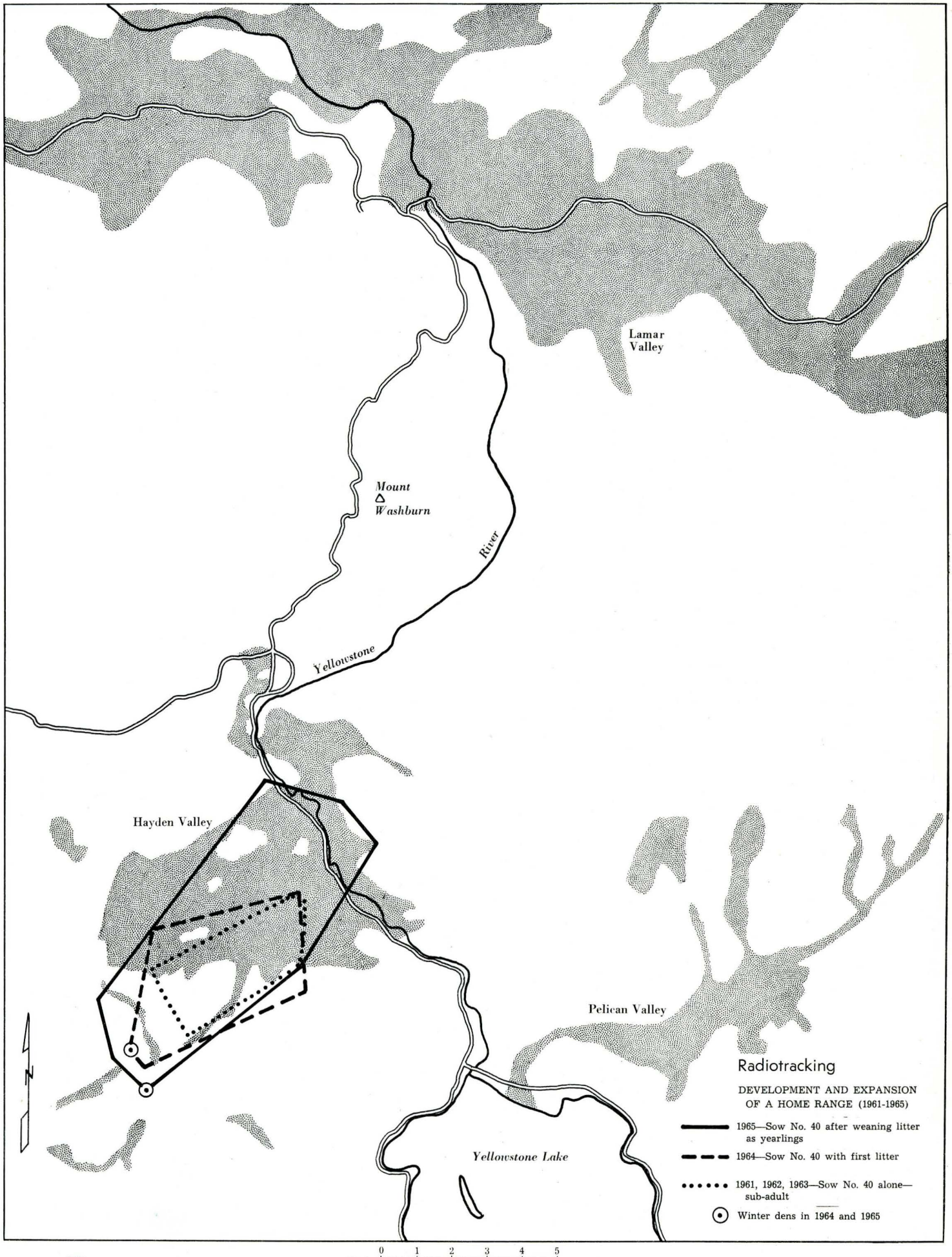
?. Retrapped and released at Carnelian Creek, on other side of Dunraven Pass. Observed at Trout Creek 2 days later. Overland distance of 20 miles (approximately).

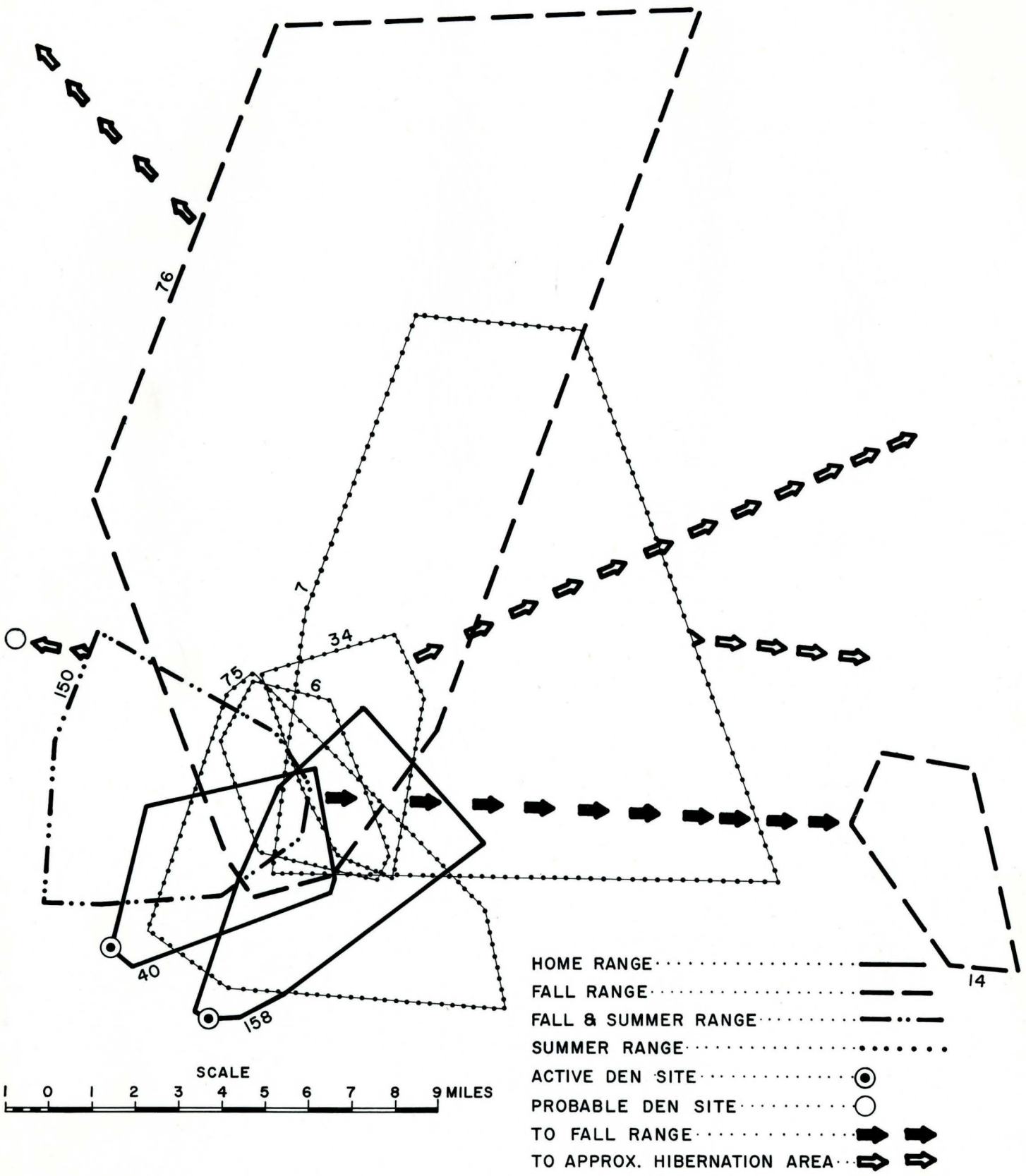
2. 620 lb. male trapped at Fishing Bridge, marked and released at Crystal Creek, on far side of divide. Observed at Trout Creek 3 days later, coming in from south, the opposite direction. Overland distance of 28-35 miles (approximate).

3. Yearling female trapped at Canyon, released at Crystal Creek, observed at Fishing Bridge 9 days later. Overland distance 30-35 miles.

4. Female trapped at Thumb, released at Trout Creek, observed several weeks later at Rabbit Creek. Overland distance approximately 25 miles.

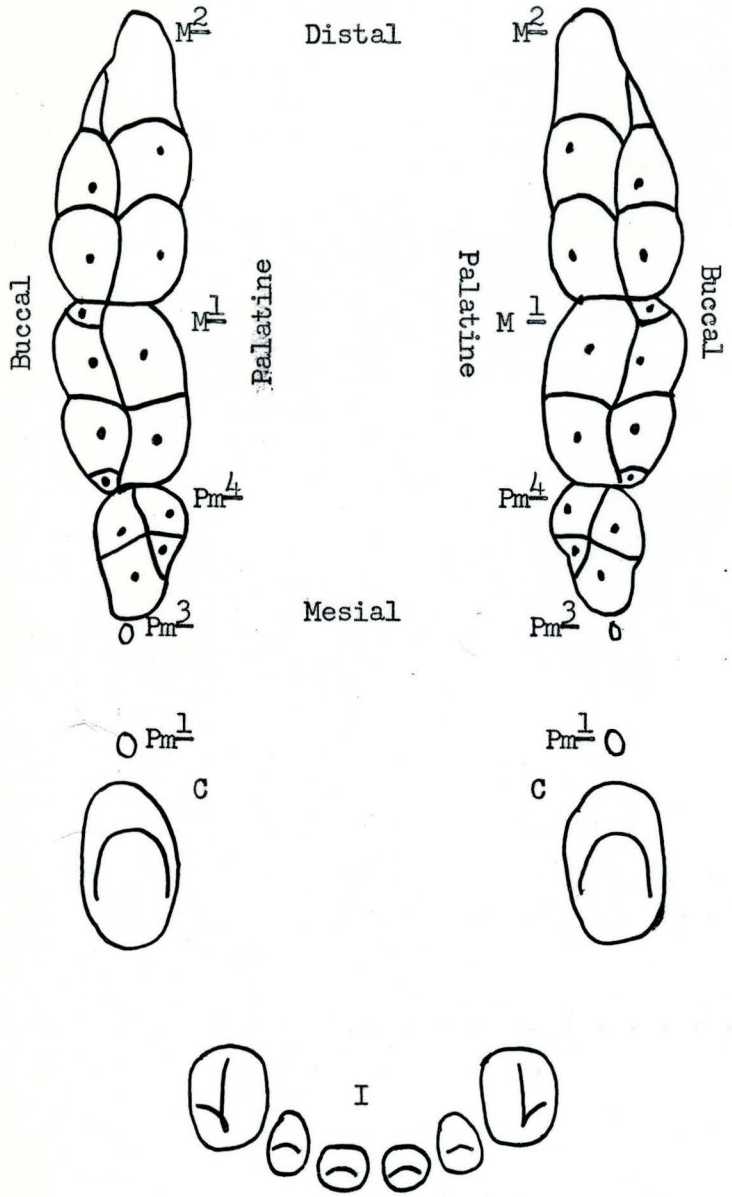
5. Marked bear (?) observed north of Grebe Lake, a distance of approximately 12-15 miles from Trout Creek.


Lamar Valley
Mount Washburn
River
Yellowstone
Hayden Valley
Pelican Valley
Yellowstone Lake
N
Radiotracking
DEVELOPMENT AND EXPANSION OF A HOME RANGE (1961-1965)
1965—Sow No. 40 after weaning litter as yearlings
1964—Sow No. 40 with first litter
1961, 1962, 1963—Sow No. 40 alone—sub-adult
Winter dens in 1964 and 1965
Scale 0 1 2 3 4 5
Meadows and Parklands
Timbered Areas

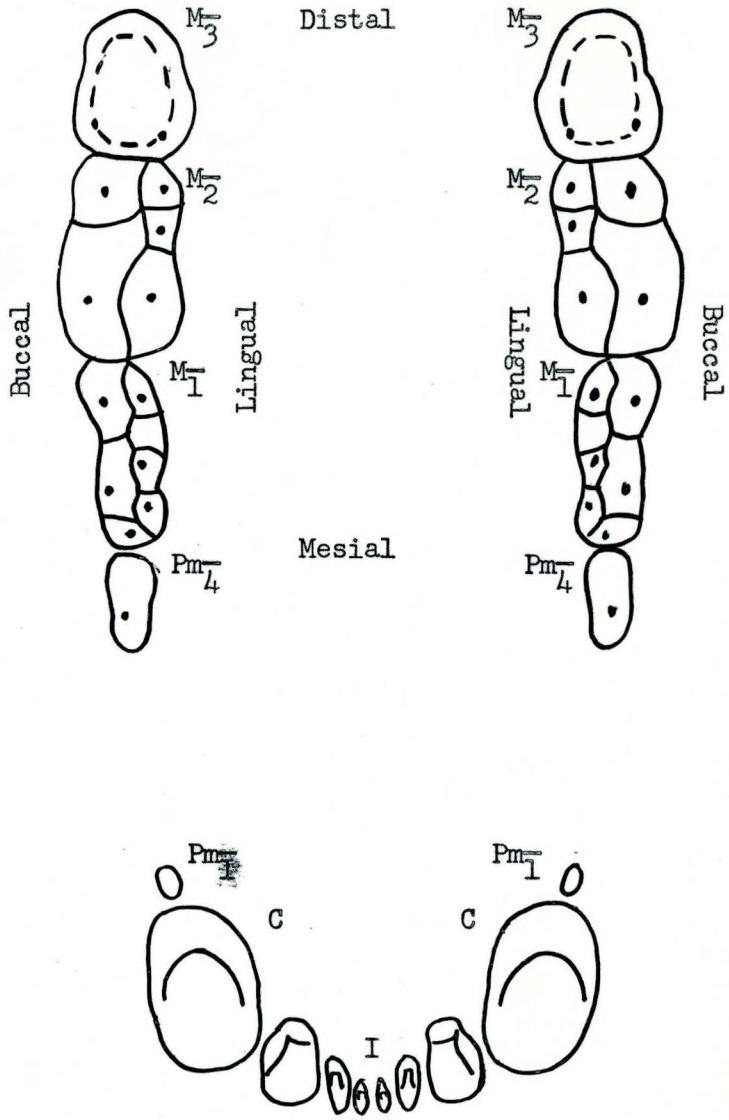

76
7
34
75
6
150
40
158
14
HOME RANGE
FALL RANGE
FALL & SUMMER RANGE
SUMMER RANGE
ACTIVE DEN SITE
PROBABLE DEN SITE
TO FALL RANGE
TO APPROX. HIBERNATION AREA
SCALE
1 0 1 2 3 4 5 6 7 8 9 MILES

UPPER JAW

$\frac{3}{3} - \frac{1}{1} - \frac{4}{4} - \frac{2}{3} = 21$



LOWER JAW



Bear No: _____

Sex: _____

Age: _____

Remarks: _____