YELLOWSTONE GRIZZLY BEAR INVESTIGATIONS

ANNUAL REPORT OF THE INTERAGENCY STUDY TEAM

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National Park Service
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As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This included fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under United States administration.

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INTRODUCTION

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

Basic research on grizzlies was carried on for several years within Yellowstone Park proper (Craighead et al. 1974). However, changes in management operations by the Park Service - mainly the closing of garbage dumps - have markedly changed some habitat parameters. Thus, current research efforts are needed to define and evaluate grizzly bear population dynamics. Objectives of the study are to determine the status and trend of the grizzly bear population, the use of habitat by bears, and the effects of land management practices on the bear population.

Distribution of grizzly bears within the study area has been determined and results given in the 1976 report. Determination of distribution has been moved from a high to low priority, and efforts formerly extended on distribution have been put into determination of habitat use patterns. Enough data on movement patterns is now available to conclude that the existence of semi-autonomous population segments is unlikely and that determination of population size will be difficult due to the average home range size of individual bears.

THE STUDY AREA

The study area is contained within the following boundaries: Beginning at the junction of 45°20' N. latitude and 111°40' W. longitude, south to 44° N. latitude, then east to 111°10' W. longitude, then south to 43°35' N. latitude, then east to 110°05' W. longitude, then north to 43°46' N. latitude, then east to 109°25' W. longitude, then north to 45°25' N. latitude, then west to 112°40' W. longitude, the point of beginning (Fig. 1).

Most of the area within this boundary either contains or has the potential of containing viable grizzly bear populations. Research efforts will be largely contained in this area, although

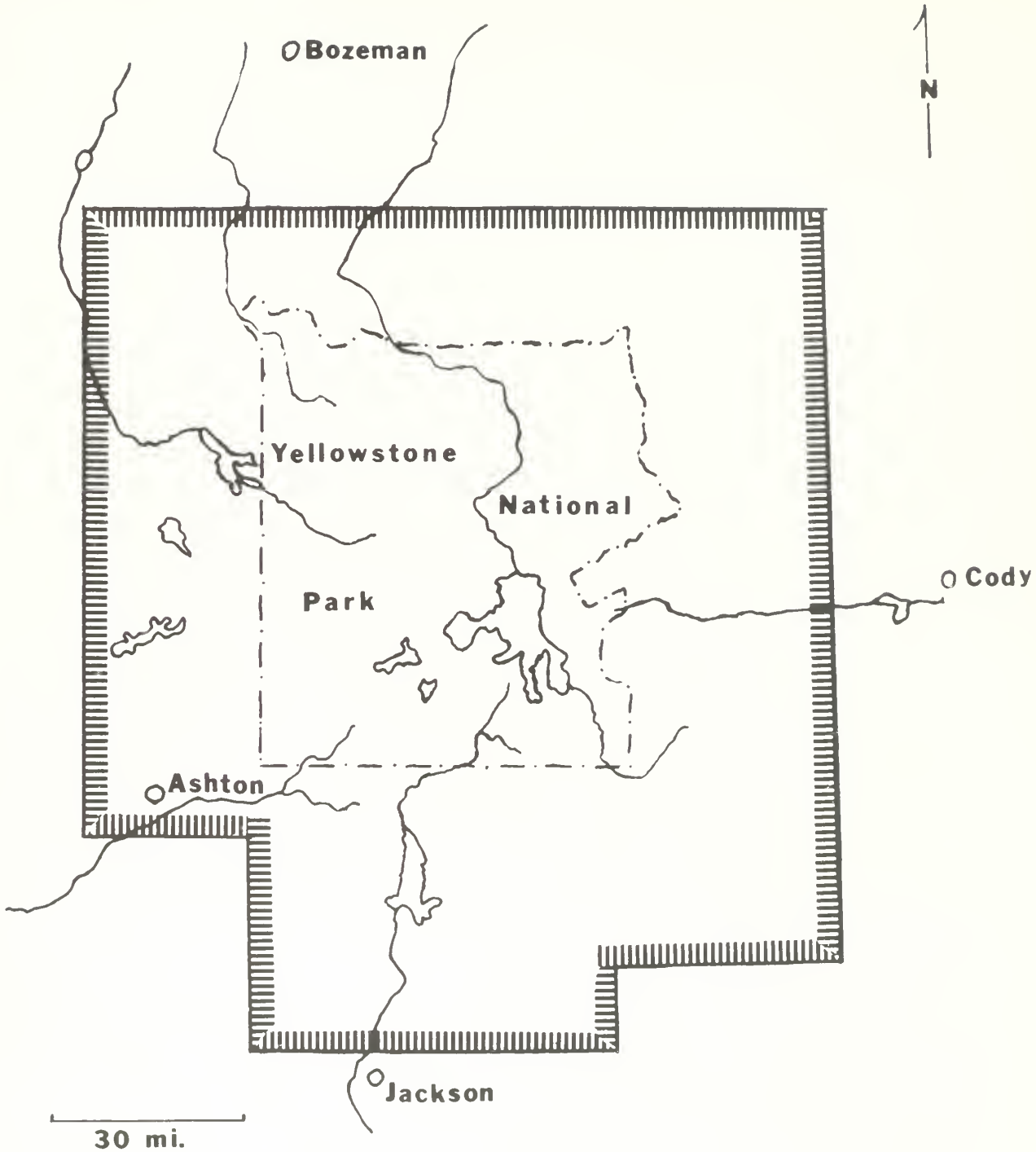

Fig. 1. Interagency study area.

monitoring for distribution will extend beyond the boundaries. The boundaries also contain some tracts such as metropolitan and agricultural areas that are not suitable grizzly bear habitat.

The area is over 70 percent forested. Many portions are roadless or have only limited vehicle access, thus relegating much of the research travel to horseback, backpacking, or aerial reconnaissance.

PHYSIOGRAPHY

The study area is made up essentially of a very large, high-elevation basin and the mountain ranges which encircle it. The area lies largely between 7000 and 8000 feet in elevation. Elevational extremes range from 13,766 feet on Grand Teton Peak to 5100 feet around Emigrant, Montana.

The area is widely underlain by sedimentary strata. These strata have undergone considerable uplifting and faulting. Volcanic activity within the more recent geologic past elevated surrounding mountains and covered most of the area with lava and ash layers. Present geothermal activity is a persisting indicator of recent geologic instability. Former glacial activity is much in evidence in many of the surrounding high relief areas especially on the north and east sides. Deep, steep-walled canyons crisscross the area. Some large, high plateaus add to the relief of the basin proper.

The basic geology of the area was extensively studied and described by Hague in 1899. Intensive investigations into the geology of portions of the area are currently in progress.

VEGETATION

The area is characterized by considerable floral diversity. Over a thousand plant species occur within the system (McDougall and Baggley 1956). Much of the area is forest interspersed with marshes, meadows, steppes, and shrub steppes. This is due in part to the diverse topography with its inherent microclimates which foster a range of vegetative communities from cold-desert to alpine.

Periodic wildfires have played a key role in the development and occurrence of many plant communities in the system. They have prevented much of the vegetation from reaching climax status. Although fire suppression by man over the past 80 years is now allowing many areas to reach or approach climatic climax (Houston 1973), many of the forest habitat types are presently in seral stands of lodgepole pine *(Pinus contorta)* because of these fires.

Forest Vegetation. - Recent studies on the forested areas within the system have described four major vegetative series with their

respective habitat types (Pfister et al. 1977; Cooper 1975). These are the Douglas-fir *(Pseudotsuga menziesii)* series, the spruce *(Picea)* series, the subalpine fir *(Abies lasiocarpa)* series, and the lodgepole pine series.

Major forest habitat types that occur within these series are as follows:

The Douglas-fir series is represented mainly by two major habitat types: D-f/pine grass *(Calamagrostis rubescens)* and D-f/snowberry *(Symphoricarpos albus)* habitat types. These types generally occur on the warmer, drier sites within the system.

The spruce series is represented mainly by three major habitat types: Spruce/ninebark *(Physocarpus malvaceus)*, spruce/sweet-scented bedstraw *(Galium triflorum)*, and spruce/twinflower *(Linnaea borealis)* habitat types. These habitat types are generally found in the cooler, more moist sites such as north and east slopes and along some stream bottoms.

The subalpine fir series has the largest number of major forest habitat types within the system. It is represented by the following: AF/sweetscented bedstraw, AF/twinflower, AF/pine grass, AF/globe huckleberry *(Vaccinium globulare)*, AF/grouse whortleberry *(V. scoparium)*, AF(whitebark pine *(Pinus albicaulis)*)/grouse whortleberry, and WBP-AF -- habitat types.

These habitat types encompass much of the high-elevation forest and timberline vegetation. Some of these habitat types, however, may occur at mid- and lower elevations where topographic features create the required environment.

The lodgepole pine series is represented by one habitat type. Lodgepole pine/bitterbrush *(Purshia tridentata)* is the only presently described lodgepole pine habitat type for the system and is most abundant in the West Yellowstone area. Although much of the tree overstory of the area is lodgepole pine, it is generally a seral stage or community type of some of the other major series.

Other forest series and habitat types occur within the system but are limited or of minor importance in their distribution. The probability also exists that other important forest habitat types may be described for the system as more intensive vegetative inventories are carried out.

Nonforest Vegetation. - Nonforest habitat types and communities within the system have not been studied or described as extensively as have the forested areas. Major groups of meadow and steppe vegetation, however, do occur interspersed throughout the system.

The meadow areas vary greatly in size and also somewhat in vegetative composition due in large part to moisture gradients and topographic orientation, the more mesic ones being populated with grasses, sedges, rushes, and mesic forbs. The sedges and rushes are reduced or lacking and the forb complement changes on the xeric sites. Alpine and subalpine meadows occur at the higher elevations around timberline.

Tentative habitat types have been delineated for the grasslands and shrublands below the alpine zone in western Montana by Mueggler and Handl (1974). The more common of these types occurring in the Montana portion of the study area are the *Festuca idahoensis/Agropyron spicatum*, *Festuca idahoensis/Agropyron caninum*, and the *Artemisia tridentata/F. idahoensis*.

The alpine, marsh, and riparian communities have been even more neglected. Further quantitative information is needed on these complex communities to properly evaluate their role in providing grizzly bear forage during the drier portions of the summer and fall.

Common and scientific names of plants follow Hitchcock et al. (1973) and Asherin (1973) for applicable portions and Davis (1952), Booth (1950), and Booth and Wright (1959) for others.

HISTORY

Grizzly bears were a part of the Yellowstone area long before the arrival of European man. During the fur trapping era, grizzly bears were prevalent throughout the western plains, the Rocky Mountains, and the Great Basin regions. They were frequently killed for food by the mountain men (Haines 1955). This was quite often at great risk to the hunter armed only with a muzzle loader.

Considerable sport hunting of grizzly bears took place in the areas on the east and southeast sides of the newly formed Yellowstone Park during the 1870's and 1880's. Grizzly bears were still reported as quite prevalent further east in the Pryor Mountains, Bighorn Mountains, and the Greybull River country during this period (Rainsford 1897 and Rogers 1897).

Miners and mining towns came and went leaving their impact on the land and the grizzly. Around the turn of the century, livestock men and other settlers began to fill up the areas surrounding Yellowstone Park. Conflicts increased between man and grizzly bears as human populations expanded. Grizzly bears were removed from their habitats until all that remained essentially was the rugged Yellowstone area.

This area remained a virtual wilderness. Although forested, it was too inaccessible for logging and the timber was of the type and

quality that was not in much demand. Climate and terrain prevented any extensive agriculture. Hunters and stockmen were the main users of the area, and neither made many apparent major changes in the grizzly bear habitat.

More recently, since 1960, changes in logging needs and practices have opened up access to many formerly inaccessible areas. Increased recreational demands and developments have opened still more. How this will ultimately affect the grizzly bears and their habitat remains to be seen.

CLIMATE

Winters are long and cold, with summers short and cool. The mean annual temperature as indicated for Mammoth, Wyoming, was 39.8° F (U. S. Department of Commerce Weather Bureau, 1930-59). Temperatures average about 5° F higher at Mammoth than for most other portions of the area. January is generally the coldest month averaging 18.0° F, with July the warmest averaging 62.8° F.

The indicated average precipitation varies considerably over the study area. Annual precipitation ranges from about 13.7 inches in the northeast to 38.26 inches in the southwest. A rain shadow effect causes xeric conditions in the Yellowstone Valley and the eastern edge of the study area. Most precipitation occurs as snow with areas above 7000 feet receiving an average in excess of 150 inches. Snow depths will vary from a few inches at the lower elevations to several feet at the high elevations and on protected slopes.

FAUNA

Populations of large ungulates share the area with grizzly bears. These animals at times become a food source for the bears, especially as carrion during the spring months.

Bison *(Bison bison)* occur in several areas within Yellowstone Park. Elk *(Cervus canadensis)* are probably the most abundant and widely distributed large ungulates on the study area. Both mule deer *(Odocoileus hemionus)* and white-tailed deer *(O. virginianus)* are present. Moose *(Alces alces)* are found as individuals or small groups in some parts of the area. A few Bighorn sheep *(Ovis canadensis)* populations are found in the northern and eastern parts. A small herd of antelope *(Antilocapra americana)* range in the Gardiner-Lamar River area. Mountain goats *(Oreamnos americanus)* occur in some of the high crags.

Populations of larger carnivores also inhabit the study area. Black bear *(Ursus americanus)* and coyotes *(Canis latrans)* are

prevalent throughout the area. Cougars *(Felis concolor)* are present, but numbers are quite low. Bobcats *(Lynx rufus)* are present as are badgers *(Taxidea taxus)* and marten *(Martes martes)*.

Beaver *(Castor canadensis)*, otter *(Lutra canadensis)*, and mink *(Mustella vison)* occur in some of the streams. Porcupines *(Erethizon dorsatum)* are fairly widely distributed.

Pocket gophers *(Thomomys* sps.*)* are abundant in many meadow areas and are at times sought out by grizzly bears for food.

Mice as well as tree and ground squirrels are also quite abundant. Other species of small mammals are found throughout the study area.

PROCEDURES

MOVEMENTS AND HABITAT USE

Radio telemetry techniques were used to determine bear movements and habitat use. Bears were trapped in culvert traps or foot snares, fitted with radio transmitters, and released. A rudimentary premolar was removed from captured bears when possible. These teeth were then decalcified, sectioned, and stained; they were then examined for annuli following Lentfer et al. (1967).

Transmitters were in the 164-MHz range. The most successful packaging technique was to attach the transmitter between two layers of conveyor belting, put it in a mold, and pour uralane plastic around the entire unit, excluding the antenna. The entire unit is then completely sealed from moisture and protected from mechanical damage. The unit is activated by a magnetic switch.

Most flights are now made with the three-element, belly-mounted Yagi only. If any bear is not located on a particular flight, stacked antennas attached to wing struts are used to aid the search on the next flight. One plane has had satisfactory results with two four-element Yagi antennas on the wing struts and pointing away from the plane.

The belly-mounted Yagi is fully rotatable and quite effective in getting a relatively quick and definite fix once signal contact is made. On initial contact the antenna is rotated manually, and by using the null the direction to the transmitter is established. A fly-by is then made with signal strength indicating when the transmitter is passed. A decreasing spiral is then flown around the transmitter until its location is pinpointed. Weather permitting, flights were

made at least three times a week. These location "fixes" are then plotted on USGS topographical maps to within a 100-sq-m plot using the Universal Transverse Mercator.

When an instrumented bear is located, the major habitat features that can be recognized from the air are recorded. This gives an index to major habitat types used by the bear throughout the year. Areas used by instrumented bears were the basis for measuring their habitat requirements. As soon as a movement pattern was established, a team was assigned to the area to evaluate the habitat as described below.

EVALUATION OF MOVEMENTS

Four methods were used to analyze the radio-tracking data to determine home or seasonal home range sizes. The minimum area (Stickel 1954) consists of connecting sites of capture or radio fixes by straight lines and measuring the enclosed area. Because many more locations are usually obtained using radio fixes than through capture-recapture techniques, we have slightly modified the method of connecting points. Outside points are connected based on the sequence of movements of the animals.

The convex polygon (Southwood 1966) is similar to the minimum area except that when connecting the outside points, the resulting polygon must be convex. In most cases this results in a larger area than obtained with the minimum area method.

The third method assumes a circular home range. We used a center of activity (Harrison 1958, Calhoun and Casby 1958). Relocation of each animal was plotted on a map, and a geometric center (center of activity) was calculated by superimposing the relocations on a grid system as described by Hayne (1949). Standard diameters for each animal were then calculated by using Harrison's (1958) formula:

$$S = \sqrt{\Sigma D^2/N}$$

where D is twice the distance from the center of activity to each relocation and N is the total number of relocations. The standard diameter describes the diameter of a circle with the center of activity as its center which contains 68.26 percent of all the relocations and 68.26 percent of the animal's activity during the period considered.

We then used the formula of Calhoun and Casby to obtain area of the home range, as follows:

$$A = 9\pi S$$

The fourth method was that of Jennrich and Turner (1969) which does not assume a circular home range. Here the area of the home range, which may contain either a circle or an ellipse, is given by the formula:

$$A = 6\pi |S|^{\frac{1}{2}}$$

where $|S|$ is the determinant of a covariance matrix of capture points and

$$S = \begin{pmatrix} S_{xx} & S_{xy} \\ S_{yx} & S_{yy} \end{pmatrix}$$

All of these methods do not lend themselves to telemetry data on species with wide freedom of movement. They have been developed from capture-recapture data on small animals. Most of the animals were territorial and therefore more confined in their movements than nonterritorial species. Capture-recapture data are much more limited than telemetry data in that the animal can only be recaptured at certain spots chosen by the investigator. Under these circumstances the data can be expected to be minimal, and home range sizes must be estimated from available data.

Radio telemetry data are more representative of true behavior patterns since, if everything is working right, the animal can be located at any time and at a place it has chosen. A radio location covers only a very small point in time, but fairly accurate patterns develop from a series of fixes.

For our purposes, we feel that the minimum area method gives the best representation of a grizzly bear's home range size, shape, and habitat preferences. The other methods tried tended to be inflationary in area used. For our most widely ranging bear, home range sizes varied as follows: minimum area, 286 sq mi; convex polygon, 485 sq mi; Jennrich and Turner method, 1,159 sq mi; Calhoun and Casby method, 1,917 sq mi. All of these methods, except the minimal area method, include large areas in the home range where there is no reason to believe the bear has been and that it may have avoided. We have found that the standard diameter (Harrison 1958) provides a useful index for comparing amounts of movement among bears in different areas and years.

HABITAT EVALUATION

General Investigations. - Habitat analysis must consider the biological, physical, and cultural features of the environment and their positive or negative influences on the grizzly bear. Cataloging of the biological features was begun with an inventory of the

vegetation resources on selected areas of known or suspected grizzly bear occurrence.

After a series of bear locations were made from aerial flights, the sites where the bear had been located were examined for evidence of activity. Two-person crews were dispatched to examine the location sites for the type of activity and to describe the vegetative community in which it occurred. Data forms used when examining feeding sites and daybed sites are shown in Appendices A and B. Photographs were taken of all sites examined.

Scats were collected whenever encountered in order to supplement feeding site examinations. Feeding site examinations were useful for correlating bear activities to habitat types, but scats were more useful for identifying specific food items in the diet.

POPULATION TRENDS AND DISTRIBUTION

Data on grizzly bear distribution, numbers, and age ratios were gathered through a monitoring system and direct observation by Team members.

A monitoring system was used to supplement data obtained by field personnel on distribution. Cooperation was received from local residents and field personnel from various agencies in reporting all current sightings. Observations from these sources were recorded and verified as far as possible by Team members or other agency personnel of known reliability. Observations of tracks, scats, beds, and other signs have also been compiled.

Aerial surveys were made as often as weather permitted during periods when grizzly bears were active in open areas. The primary purpose of aerial surveys was to obtain the largest sample of grizzly bear sightings possible. Predetermined routes that allowed a maximum amount of time over open areas were followed on each flight. All flights were made with a Piper Supercub. As many bears as possible were photographed with a 35-mm motorized camera to provide permanent records for possible separation of individuals.

Numbers of unduplicated individuals observed were needed to compute cub/sow and yearling/sow ratios and minimum density estimates for selected areas. The minimum number of individuals was determined by methods similar to those of Martinka (1971) where descriptions and locations of observed bears were used. In this study, all bear observations used for unduplicated samples were observed by members of the Study Team, the experienced pilots used by the Team, or one of the time lapse camera systems. Thirty-five-mm

photos were used to supplement and improve verbal descriptions. Color patterns alone appeared to be unreliable for separating individuals during late summer. During August most bears began to undergo a darkening of coat color similar to that mentioned by Pearson (1975). Unless an individual was observed frequently during August, it could appear to be quite different than during July. The 35-mm films taken from the air seemed to be the best aid in identification since the bear could be photographed from several angles in relation to the sun, and this helped to distinguish apparent colorations due to reflections from the guard hairs.

RESULTS

MOVEMENTS

Since 1975, 31 grizzly bears have been fitted with radio collars and monitored for varying lengths of time. Figures 2, 3, and 4 show the length of time each bear was monitored and significant events during time of monitoring for each year. The number of transmitter failures has decreased significantly during the last 3 years, reflecting advances in technology. During September 1977, when over 20 transmitters were being monitored over most of the study area, it took over 10 hours of flying time for each monitoring flight. For purposes of determining movements, it appears that about 20 transmitters are all that can be handled over such a large area at one time.

During 1977, 22 different bears were captured 35 times (Table 1). Thirteen of these were bears that had not been captured in other years. Although a few bears were caught each month during the trapping season, the best success was during August and September.

Three bears (Table 2) were considered too small for radio transmitters and were released after ear-tagging only. Two of these were cubs that were orphaned after their mother had been shot by a poacher. They were moved into the Bridger-Teton Wilderness before release. A yearling male caught at West Yellowstone was just a little over half the size of his litter mate and had a cancerous growth on his jaw. This bear was collected for examination at the Montana State University Veterinary Laboratory.

A large male accused of killing cattle was trapped and dispatched by the Fish and Wildlife Service just north of Yellowstone Park. Another male was trapped in Yellowstone Park after inhabiting a campground for several days This was a bear that had been snared in the Squirrel Meadows area of Idaho the previous summer and had escaped after breaking the snare. He was still wearing a portion of the

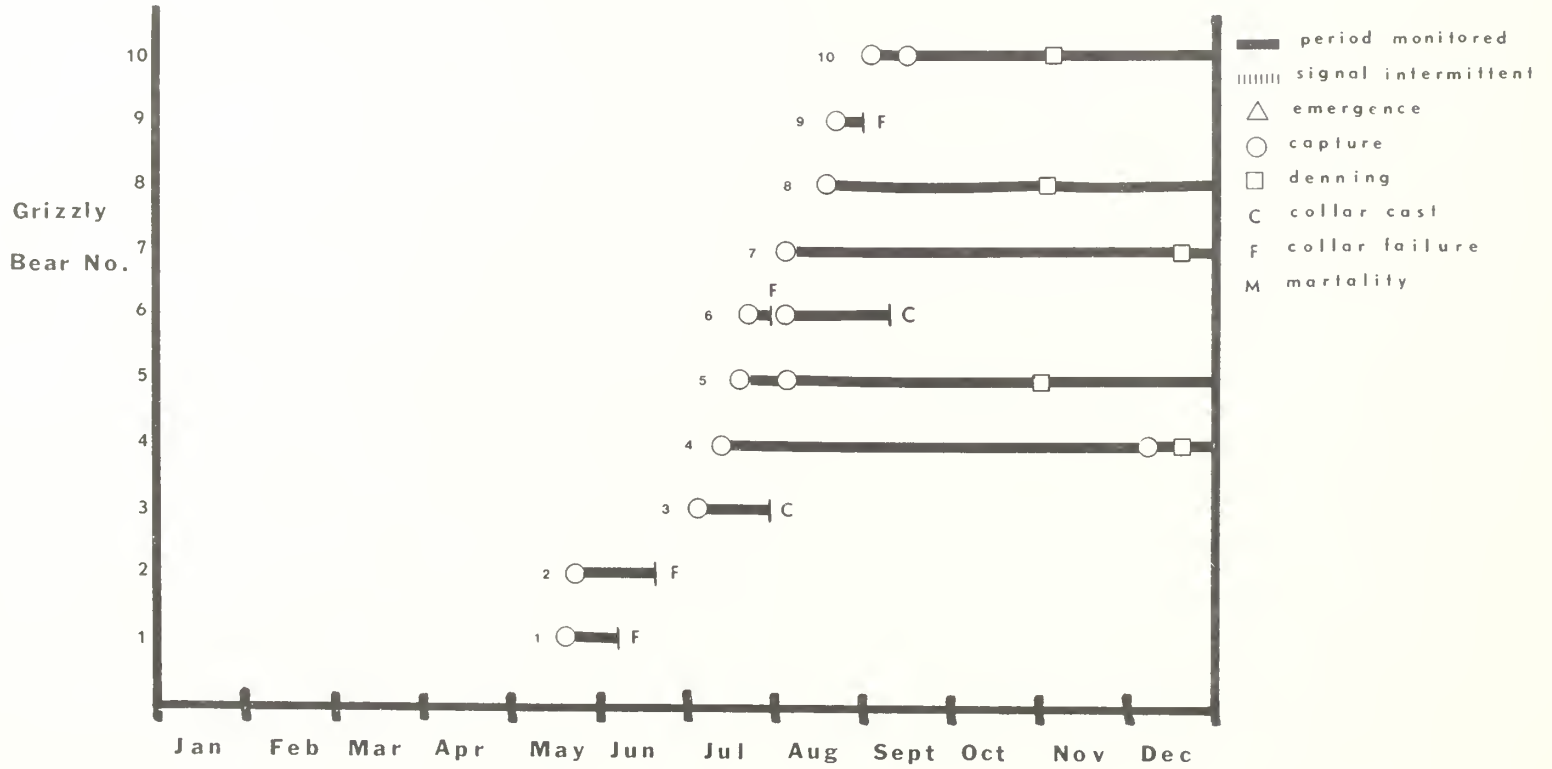

Fig. 2. Instrumentation history for radio collared grizzly bears during 1975.

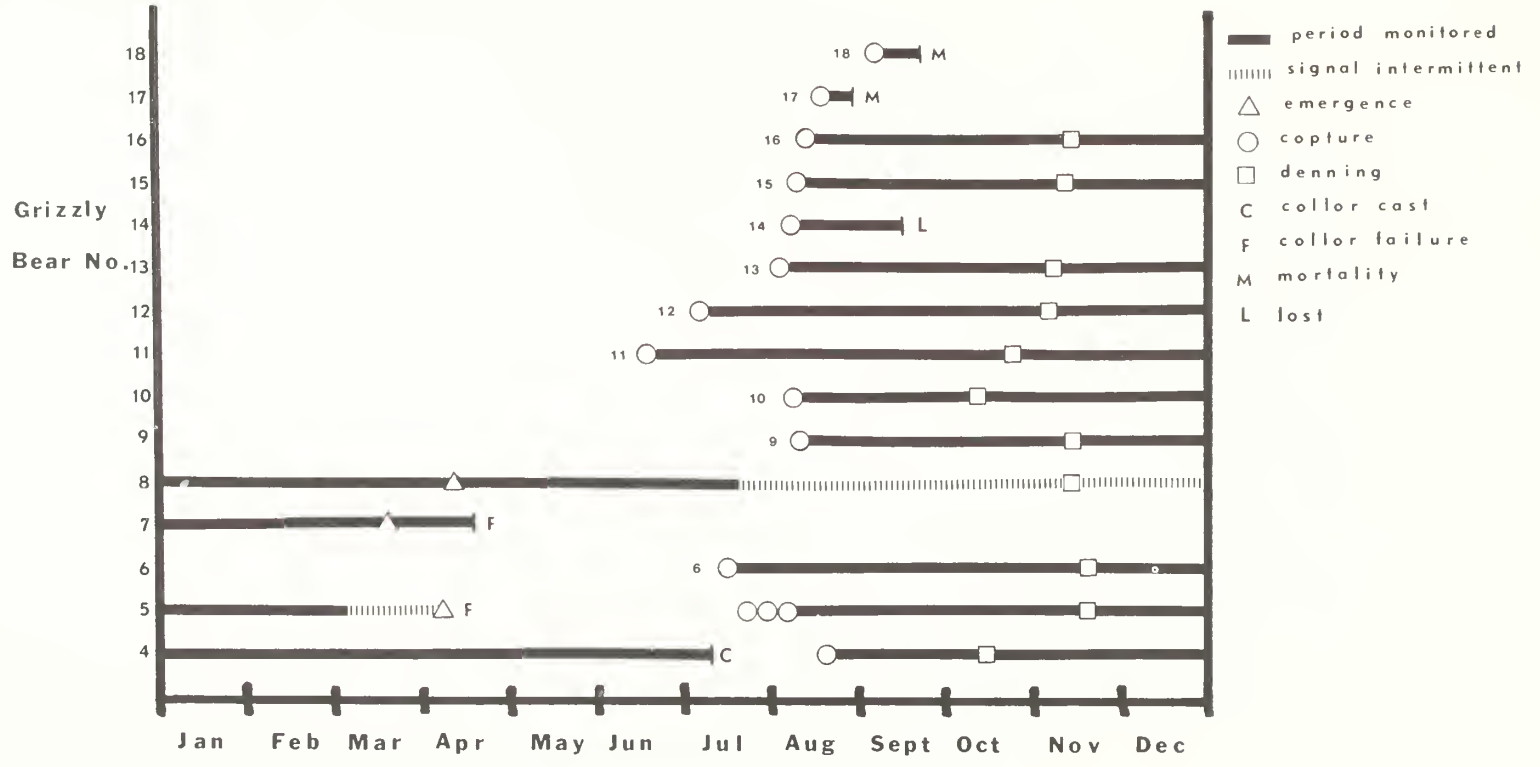

Fig. 3. Instrumentation history for radio collared grizzly bears during 1976.

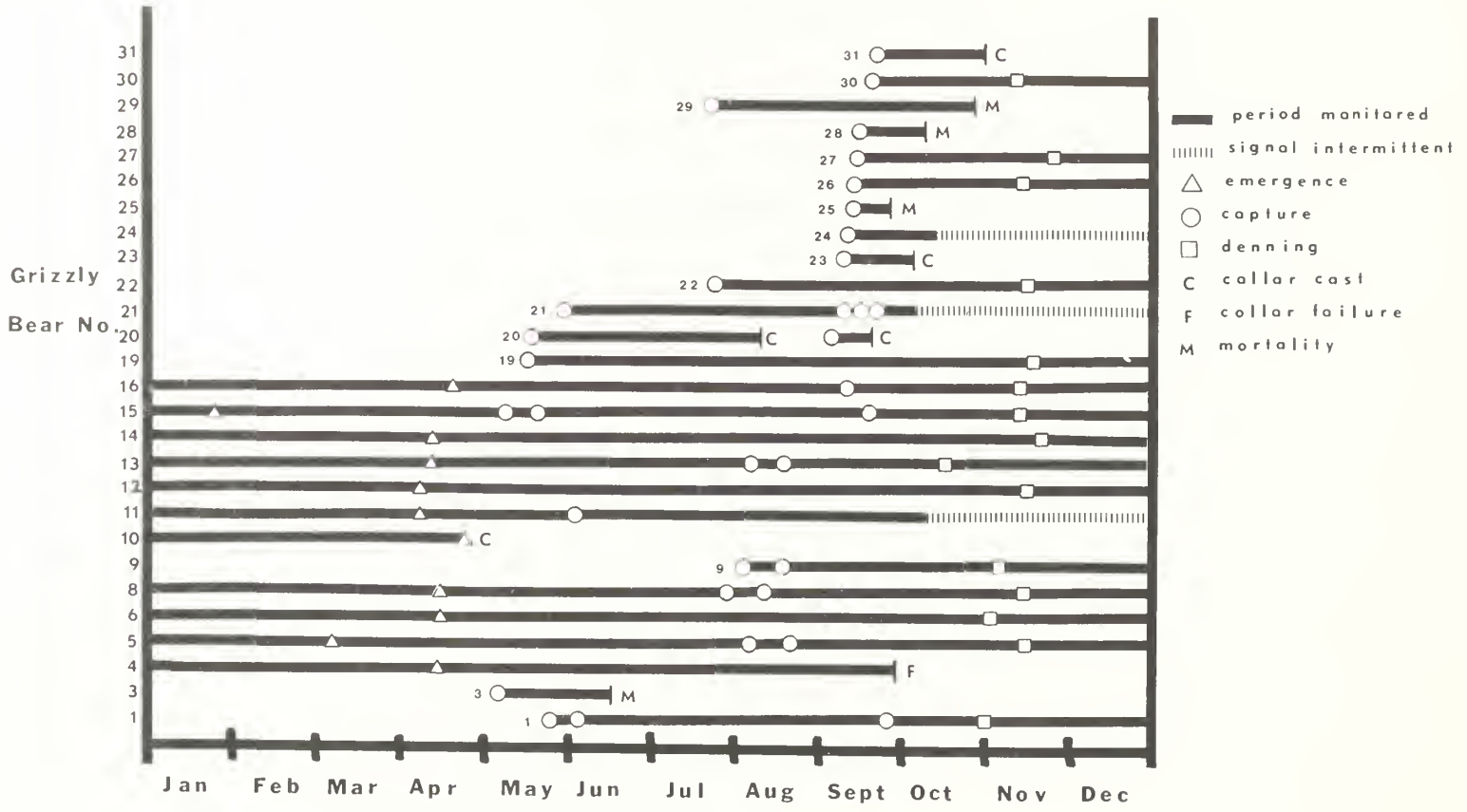

Fig. 4. Instrumentation history for radio collared grizzly bears during 1977.

Table 1. Grizzly bears captured and radioed, 1977
(* indicates scale weight)

Bear No.	Sex	Age	Date radioed	Capture location	Wt. (lbs)
1	M	13	5-27-77 (RI)[1]	Cap and Ball Park, WY	375*
-	-	-	6-01-77	Cap and Ball Park, WY retrap	-
-	-	-	9-29-77 (RI)	Crandall Cr., WY retrap	600 ?
3	F	7[2]	5-12-77 (RI)	Lodgepole Cr., WY	285*
5	M	9	8-09-77 (RI)	Cooke City, MT	505*
-	-	-	8-21-77	Cooke City, MT retrap	-
8	F	11	7-31-77 (RI)	Cooke City, MT	300*
-	-	-	8-07-77	Cooke City, MT retrap	-
9	M	16	8-01-77	Cooke City, MT (Collar removed)	
-	-	-	8-17-77 (RI)	Cooke City, MT retrap	715*
11	M	7	6-08-77	Crandall Cr., WY	450*
13	F	8	8-11-77	Cooke City, MT	265*
-	-	-	8-17-77	Cooke City, MT retrap	-
15	M	6	5-11-77 (RI)	West Yellowstone, MT	400
-	-	-	5-20-77 (RI)	West Yellowstone, MT retrap	375*
-	-	-	9-21-77	West Yellowstone, MT retrap	484*
16	F	11[3]	9-13-77	West Yellowstone, MT	318*
19	M	7	5-18-77	West Yellowstone, MT	350
-	-	-	8-17-77	Chittenden Br., Yell NP retrap	-
20	M	4	5-19-77	West Yellowstone, MT	250
-	-	-	9-01-77 (RI)	West Yellowstone, MT retrap	395*
21	F	4	6-02-77	Lodgepole Cr., WY	200*
-	-	-	9-08-77	Crandall, WY retrap	210*
-	-	-	9-19-77	Crandall, WY retrap	-
-	-	-	9-28-77	Crandall, WY retrap	-
22	M	5	7-27-77	Stonecup Lake, Yell NP	250
23	F	1	9-05-77	Canyon Cr., ID	250
24	F	2[4]	9-06-77	Canyon Cr., ID	200
25	F	5[5]	9-09-77	Gardiner, MT	250
26	F	13[5]	9-09-77	Gardiner, MT	400
27	M	1[6]	9-13-77	West Yellowstone, MT	215*
28	F	16[6]	9-15-77	Phelps Pass, WY	225
29	M	1	7-15-77	Pelican Cr., Yell NP	75
30	M	1	9-21-77	West Yellowstone, MT	218*
31	M	0.5	9-22-77	Island Park, ID	42*

1/ (RI) means bear was reinstrumented.
2/ Accompanied by two yearlings.
3/ Accompanied by two yearlings.
4/ Accompanied by two cubs of the year.
5/ Accompanied by one yearling.
6/ Accompanied by two cubs of the year.

Table 2. Grizzly bears captured but not radioed, 1977

Sex	Age	Date	Capture location	Wt. (lbs)
M	SA	8-24-77	Lodgepole Cr., WY	150*
F	0.5	9-06-77	Mormon Cr., WY (orphaned)	68*
F	0.5	9-06-77	Mormon Cr., WY (orphaned)	63*
M	1	9-13-77	West Yellowstone, MT (#16's yrlg)	125*
M	Ad	9-19-77	Cinnabar Basin, MT (killed)	560*
M	Ad	8-11-77	Bridge Bay, YNP (snare bear)	215*

* Indicates scale weight.

snare on his right front foot when caught. The snare had cut in behind the foot pad and the pad had grown over it. This bear was scheduled to be released in the southern portion of the Park but died of a drug overdose while being transported.

Table 3 gives the minimum annual use ranges for 20 bears monitored during the 1977 season and those available for 1975 and 1976. Six other bears instrumented during the 1977 season were monitored for only short periods and are not included. Minimum home range areas generally appeared larger than in 1976, especially for males. This is probably mostly an artifact of increased data rather than a reflection of actual field conditions. Three males (5, 14 and 15) who had significantly larger range areas in 1977 than 1976 were also tracked for longer periods in 1977. Nine adult males had home ranges averaging 304 mi^2 compared to 155 mi^2 for six females. Movement patterns for individual bears are given in Figures 5 to 28, with accompanying location dates in Table 4.

Bear No. 1 (Fig. 5) was first trapped in May 1975 at Lodgepole Creek, Wyoming. He was relocated once about 7 miles from the trap site before his transmitter failed. In May 1977 he was retrapped and instrumented in Crandall Creek, Wyoming, close to his original trap site. He was not wearing the original transmitter when retrapped. He was retrapped on 1 June at the same trap site. He left the Crandall area by 3 June going southwest into the upper Lamar area of Yellowstone Park and then west to Hayden Valley in 38 days. On 11 July he started back east, arriving back in the Crandall area by 3 August. By 18 August he had moved north to the vicinity of Table Mountain. He apparently had a bio-center in this area which he used for 37 days. He was probably eating carrion and occasionally killing livestock. He was retrapped at Crandall on 29 September and then moved 19 airline miles in 4 days to the head of Miller Creek. In 9 days, between 3-11 October, he made a 42-airline-mile round trip north to Silvergate, Montana, and then to his predenning area at the head of Willow Creek. He stayed in this vicinity until going to his den on 3 November.

Table 3. Minimum annual use range for radio-instrumented grizzly bears

Bear No.	Sex	Age	1977 Annual range (mi^2)	1977 No. of loc.	1977 Length of time (days)	1976 Annual range (mi^2)	1976 No. of loc.	1976 Length of time (days)	1975 Annual range (mi^2)	1975 No. of loc.	1975 Length of time (days)
1	M	13	308	28	161	-	-	-	-	2	9
4	F	5	110	42	160	75	51	160	125	41	156
5	M	9	300	40	227	82	24	99	61	34	112
6	F	8	96	51	179	202	39	131	-	8	28
8	F	11	105	45	210	58	27	95+	24	25	24
9	M	16	60	16	66	45	28	89	-	-	-
11	M	7	158	28	184	114	35	125	-	-	-
12	F	Ad	62	61	226	67	38	118	-	-	-
13	F	8	244	52	181	286	28	90	-	-	-
14	M	10	672	30	166	38	13	34	-	-	-
15	M	6	230	59	290	36	23	85	-	-	-
16	F	11	204	68	241	135	29	86	-	-	-
19	M	Ad	555	52	223	-	-	-	-	-	-
20	M	Ad	351	25	114	-	-	-	-	-	-
21	F	Ad	114	27	125	-	-	-	-	-	-
22	M	Ad	109	27	112	-	-	-	-	-	-
26	F	Ad	16	16	53	-	-	-	-	-	-
27	M	1	204	68	241	-	-	-	-	-	-
29	M	1	10	32	91	-	-	-	-	-	-
30	M	1	84	13	44	-	-	-	-	-	-

Table 4. Location numbers and dates for radio-instrumented grizzly bears, 1977

Obs. No.	Date	Obs. No.	Date	Obs. No.	Date	Obs. No.	Date
Bear No. 1							
2	5-27	10	8-12	18	9-23	25	10-21
3	5-31	11	8-18	19	9-27	26	10-25
4	6-01	12	8-22	19A	9-29	27	10-27
5	6-03	13	9-02	20	10-03	28	11-03
6	6-24	14	9-06	21	10-05	29	11-09
7	7-11	15	9-09	22	10-11	30	11-11
8	7-14	16	9-12	23	10-17	31	11-16
9	8-03	17	9-14	24	10-19	32	12-12
Bear No. 4							
109	1-05	122	4-27	135	6-15	147	7-20
110	1-11	123	4-29	136	6-17	148	7-22
111	1-19	124	5-04	137	6-20	149	7-27
112	1-31	125	5-09	138	6-24	150	7-30
113	2-07	126	5-11	139	6-27	151	8-01
114	3-30	127	5-13	140	6-29	152	8-03
115	4-05	128	5-21	141	7-01	153	8-08
116	4-07	129	5-23	142	7-05	154	8-12
117	4-16	130	5-31	143	7-08	155	9-07
118	4-18	131	6-03	144	7-11	156	9-12
119	4-20	132	6-06	145	7-14	157	9-19
120	4-22	133	6-08	146	7-18	158	9-23
121	4-25	134	6-13				
Bear No. 5							
72	1-19	83	6-27	94	8-08	103	10-05
73	1-31	84	6-29	94A	8-09	104	10-11
74	3-30	85	7-01	95	8-12	105	10-17
75	4-05	86	7-05	95A	8-21	106	10-19
76	4-07	87	7-08	96	8-22	107	10-21
77	4-20	88	7-11	97	9-12	108	10-25
78	4-22	89	7-14	98	9-14	109	10-27
79	4-25	90	7-18	99	9-19	110	11-03
80	5-14	91	7-20	100	9-23	111	11-11
81	6-20	92	7-27	101	9-27	112	11-16
82	6-24	93	8-03	102	10-03	113	12-12

Table 4. Location numbers and dates for radio-instrumented grizzly, (continued)

Obs. No.	Date	Obs. No.	Date	Obs. No.	Date	Obs. No.	Date
Bear No. 6							
53	1-05	71	5-13	88	7-11	105	9-14
54	1-11	72	5-21	89	7-14	106	9-19
55	1-19	73	5-23	90	7-18	107	9-23
56	1-31	74	5-31	91	7-20	108	9-27
57	2-07	75	6-03	92	7-22	109	10-03
58	3-30	76	6-06	93	7-27	110	10-05
59	4-05	77	6-08	94	7-30	111	10-11
60	4-07	78	6-13	95	8-01	112	10-13
61	4-16	79	6-15	96	8-03	113	10-17
62	4-18	80	6-17	97	8-08	114	10-19
63	4-20	81	6-20	98	8-12	115	10-21
64	4-22	82	6-24	99	8-18	116	10-25
65	4-25	83	6-27	100	8-22	117	10-27
66	4-24	84	6-29	101	9-02	118	11-03
67	4-29	85	7-01	102	9-06	119	11-09
68	5-02	86	7-05	103	9-09	120	11-11
69	5-09	87	7-08	104	9-12	121	11-16
70	5-11						
Bear No. 8							
61	1-31	74	6-15	85A	7-31	96	9-19
62	4-16	75	6-17	86	8-03	97	9-23
63	4-25	76	6-20	86A	8-07	98	9-27
64	5-02	77	6-24	87	8-08	99	10-03
65	5-09	78	7-05	88	8-12	100	10-05
66	5-13	79	7-08	89	8-18	101	10-11
67	5-21	80	7-14	90	8-22	102	10-13
68	5-23	81	7-18	91	9-02	103	11-09
69	5-26	82	7-20	92	9-06	104	11-11
70	5-31	83	7-22	93	9-09	105	11-16
71	6-03	84	7-27	94	9-12	106	12-12
72	6-06	85	7-30	95	9-14	107	12-27
73	6-08						
Bear No. 9							
27A	8-01	32	9-12	38	10-13	44	11-03
27B	8-17	33	9-14	39	10-17	45	11-09
28	8-22	34	9-19	40	10-19	46	11-11
29	9-02	35	9-23	41	10-21	47	11-16
30	9-06	36	9-27	42	10-25	48	12-12
31	9-09	37	10-05	43	10-27	49	12-27

Table 4. Location numbers and dates for radio-instrumented grizzly, (continued)

Obs. No.	Date	Obs. No.	Date	Obs. No.	Date	Obs. No.	Date
Bear No. 11							
38	1-09	45	5-13	52	6-20	59	7-30
39	4-22	46	5-21	53	6-24	60	8-01
40	4-25	47	5-23	54	6-27	61	8-03
41	4-27	48	6-08	55	7-08	62	8-08
42	4-29	49	6-13	56	7-11	63	8-22
43	5-02	50	6-15	57	7-14	64	9-19
44	5-09	51	6-17	58	7-22	65	10-05
Bear No. 12							
48	1-05	65	5-11	82	7-11	99	9-14
49	1-11	66	5-13	83	7-14	100	9-19
50	1-19	67	5-21	84	7-18	101	9-23
51	1-31	68	5-23	85	7-20	102	9-27
52	2-07	69	5-31	86	7-22	103	10-03
53	3-30	70	6-03	87	7-27	104	10-05
54	4-05	71	6-06	88	7-30	105	10-11
55	4-07	72	6-13	89	8-01	106	10-13
56	4-16	73	6-15	90	8-03	107	10-17
57	4-18	74	6-17	91	8-08	108	10-19
58	4-20	75	6-20	92	8-12	109	10-25
59	4-22	76	6-24	93	8-18	110	10-27
60	4-25	77	6-27	94	8-22	111	11-03
61	4-27	78	6-29	95	9-02	112	11-09
62	4-29	79	7-01	96	9-06	113	11-11
63	5-02	80	7-05	97	9-09	114	11-16
64	5-09	81	7-08	98	9-12	115	12-12
Bear No. 13							
34	1-05	44	4-20	54	5-23	64	6-27
35	1-11	45	4-22	55	5-26	65	6-29
36	1-19	46	4-25	56	5-31	66	7-01
37	1-31	47	4-27	57	6-03	67	7-05
38	2-07	48	4-29	58	6-06	68	7-08
39	3-30	49	5-02	59	6-13	69	7-11
40	4-05	50	5-09	60	6-15	70	7-14
41	4-07	51	5-11	61	6-17	71	7-20
42	4-16	52	5-13	62	6-20	72	7-22
43	4-18	53	5-21	63	6-24	73	7-27

Table 4. Location numbers and dates for radio-instrumented grizzly, (continued)

Obs. No.	Date	Obs. No.	Date	Obs. No.	Date	Obs. No.	Date
Bear No. 13 (continued)							
74	7-30	80	9-02	88	10-05	95	10-27
75	8-01	81	9-06	89	10-11	96	11-03
76	8-03	82	9-12	90	10-13	97	11-09
77	8-08	83	9-14	91	10-17	98	11-11
77A	8-11	84	9-19	92	10-19	99	11-16
77B	8-17	85	9-23	93	10-21	100	12-12
78	8-18	86	9-27	94	10-25	101	12-27
79	8-22	87	10-03				
Bear No. 14							
14	6-03	22	7-01	31	9-02	39	10-19
15	6-06	24	7-20	32	9-06	40	10-21
16	6-08	25	7-27	33	9-09	41	10-25
17	6-13	26	7-30	34	9-12	42	10-27
18	6-15	27	8-03	35	9-14	43	11-03
19	6-20	28	8-08	36	9-19	44	11-16
20	6-24	29	8-12	37	10-11	45	12-12
21	6-29	30	8-22	38	10-17		
Bear No. 15							
30	1-05	47	6-08	63	7-27	76	9-23
31	1-11	48	6-15	64	7-30	77	9-27
32	1-19	49	6-16	65	8-01	78	10-03
33	1-31	50	6-17	66	8-03	79	10-05
34	2-07	51	6-20	67	8-08	80	10-11
35	3-30	52	6-24	68	8-12	81	10-13
36	4-16	53	6-27	69	8-18	82	10-17
37	4-25	54	6-29	70	8-22	83	10-19
38	4-27	55	7-01	71	9-06	84	10-21
39	5-02	56	7-05	72	9-09	85	10-25
40	5-09	57	7-08	73	9-12	86	10-27
41	5-11	58	7-11	74	9-14	87	11-01
42	5-20	59	7-14	75	9-19	88	11-03
44	5-31	60	7-18	75A	9-21	89	11-11
45	6-03	61	7-20	75B	9-22	90	11-16
46	6-06	62	7-22				

Table 4. Location numbers and dates for radio-instrumented grizzly, (continued)

Obs. No.	Date	Obs. No.	Date	Obs. No.	Date	Obs. No.	Date
Bear No. 16							
35	1-05	54	5-13	73	7-11	91	9-14
36	1-11	55	5-21	74	7-14	92	9-19
37	1-19	56	5-23	75	7-18	93	9-23
38	1-31	57	5-26	76	7-20	94	9-27
39	2-07	58	5-31	77	7-22	95	10-03
40	3-30	59	6-03	78	7-27	96	10-05
41	4-05	60	6-06	79	7-30	97	10-06
42	4-07	61	6-08	80	8-01	98	10-11
43	4-16	62	6-13	81	8-03	99	10-13
44	4-18	63	6-15	82	8-08	100	10-17
45	4-20	64	6-16	83	8-12	101	10-19
46	4-22	65	6-17	84	8-18	102	10-21
47	4-25	66	6-20	85	8-22	103	10-25
48	4-27	67	6-24	86	9-02	104	10-27
49	4-28	68	6-27	87	9-06	105	11-01
50	4-29	69	6-29	88	9-07	106	11-03
51	5-02	70	7-01	89	9-09	107	11-11
52	5-09	71	7-05	90	9-12	108	11-16
53	5-11	72	7-08	90A	9-13	109	12-12
Bear No. 19							
1	5-18	14	7-05	26A	8-17	37	10-05
2	5-21	15	7-08	26B	8-18	38	10-11
3	5-23	16	7-11	27	8-22	39	10-13
4	5-26	17	7-14	28	9-02	40	10-17
5	5-31	18	7-18	29	9-06	41	10-25
6	6-03	19	7-20	30	9-09	42	10-25
7	6-06	20	7-22	31	9-12	43	10-27
8	6-08	21	7-27	32	9-14	44	11-01
9	6-13	22	7-30	33	9-19	45	11-03
10	6-15	23	8-01	34	9-23	46	11-09
11	6-16	24	8-03	35	9-27	47	11-11
12	6-17	25	8-08	36	10-03	48	11-16
13	6-27	26	8-12	36A	10-03	49	12-27

Table 4. Location numbers and dates for radio-instrumented grizzly, (continued)

Obs. No.	Date	Obs. No.	Date	Obs. No.	Date	Obs. No.	Date
Bear No. 20							
0	5-19	7	6-24	13	7-18	19	8-18
1	5-21	8	6-29	14	7-20	20	8-22
2	5-23	9	7-01	15	7-22	20A	9-01
3	6-08	10	7-08	16	7-30	21	9-06
4	6-13	11	7-11	17	8-08	22	9-07
5	6-17	12	7-14	18	8-12	23	9-09
6	6-20						
Bear No. 21							
0	6-02	7	7-01	14	8-18	19A	9-19
1	6-08	8	7-08	15	8-22	20	9-23
2	6-13	9	7-11	16	9-02	21	9-27
3	6-15	10	7-14	17	9-06	21A	9-28
4	6-17	11	8-03	17A	9-08	22	10-03
5	6-20	12	8-08	18	9-12	23	10-05
6	6-24	13	8-12	19	9-14		
Bear No. 22							
0	7-27	7	9-02	14	10-03	21	10-25
1	7-30	8	9-09	15	10-05	22	10-27
2	8-01	9	9-12	16	10-11	23	11-03
3	8-03	10	9-14	17	10-13	24	11-09
4	8-08	11	9-19	18	10-17	25	11-11
5	8-12	12	9-23	19	10-19	26	11-16
6	8-22	13	9-27	20	10-21		
Bear No. 26							
0	9-09	6	9-30	12	10-21	17	11-09
1	9-12	7	10-03	13	10-25	18	11-11
2	9-14	8	10-05	14	10-27	19	11-16
3	9-19	9	10-11	15	11-01	20	12-12
4	9-23	10	10-13	16	11-03	21	12-27
5	9-27	11	10-17				

Table 4. Location numbers and dates for radio-instrumented grizzly, (concluded)

Obs. No.	Date	Obs. No.	Date	Obs. No.	Date	Obs. No.	Date
Bear No. 29							
0	7-15	7	8-03	15	9-12	23	10-13
1A	7-16	8	8-08	16	9-14	24	7-19
1	7-18	9	8-12	17	9-19	25	8-17
2	7-20	10	8-18	18	9-23	26	8-21
3	7-22	11	8-22	19	9-27	27	8-27
4	7-27	12	9-02	20	10-03	28	8-29
5	7-30	13	9-06	21	10-05	29	8-29
6	8-01	14	9-09	22	10-11	30	9-09
Bear No. 30							
0	9-21	5	10-11	9	10-21	13	11-09
1	9-23	6	10-13	10	10-25	14	11-11
2	9-27	7	10-17	11	10-27	15	11-16
3	10-03	8	10-19	12	11-03	16	12-12
4	10-05						

Bear 4 (Fig. 6) emerged from her den with one cub between 7 and 16 April. She stayed in the den area for 17 days before moving into the Cabin Creek Basin for the 40-day period between 9 May through 17 June. During this time she was closely associated with areas of scattered lodgepole and whitebark pine interspersed with grassy swales. On 20 June she moved 4.5 airline miles to another bio-center in Sage and Carrot Basins and stayed there until 5 July. She then moved 14 airline miles to a fourth bio-center where she stayed for 17+ days through 27 July. She moved into the Horse Butte area near Hebgen Lake on 12 August and was in and out of this area at least through 23 September when her radio failed. This bear has been fairly consistent in using the same home range area for the 3 years she has been monitored (Fig. 7). Her 1976 range did not include the Horse Butte area, but she may have gone there during the mid-summer period when she was not instrumented.

Bear 5 (Fig. 8) opened his den just a day or so prior to 30 March (from tracks) but was in it on 30 March. He left the den between then and 5 April. This was the second year in a row he used the same natural cave on Plateau Creek as a den. When he came out of his den, his tracks could be followed in the snow to the mouth of Plateau Creek. He followed a rambling route without regard to topography. Twice when he encountered a steep, open slope, he apparently sat and

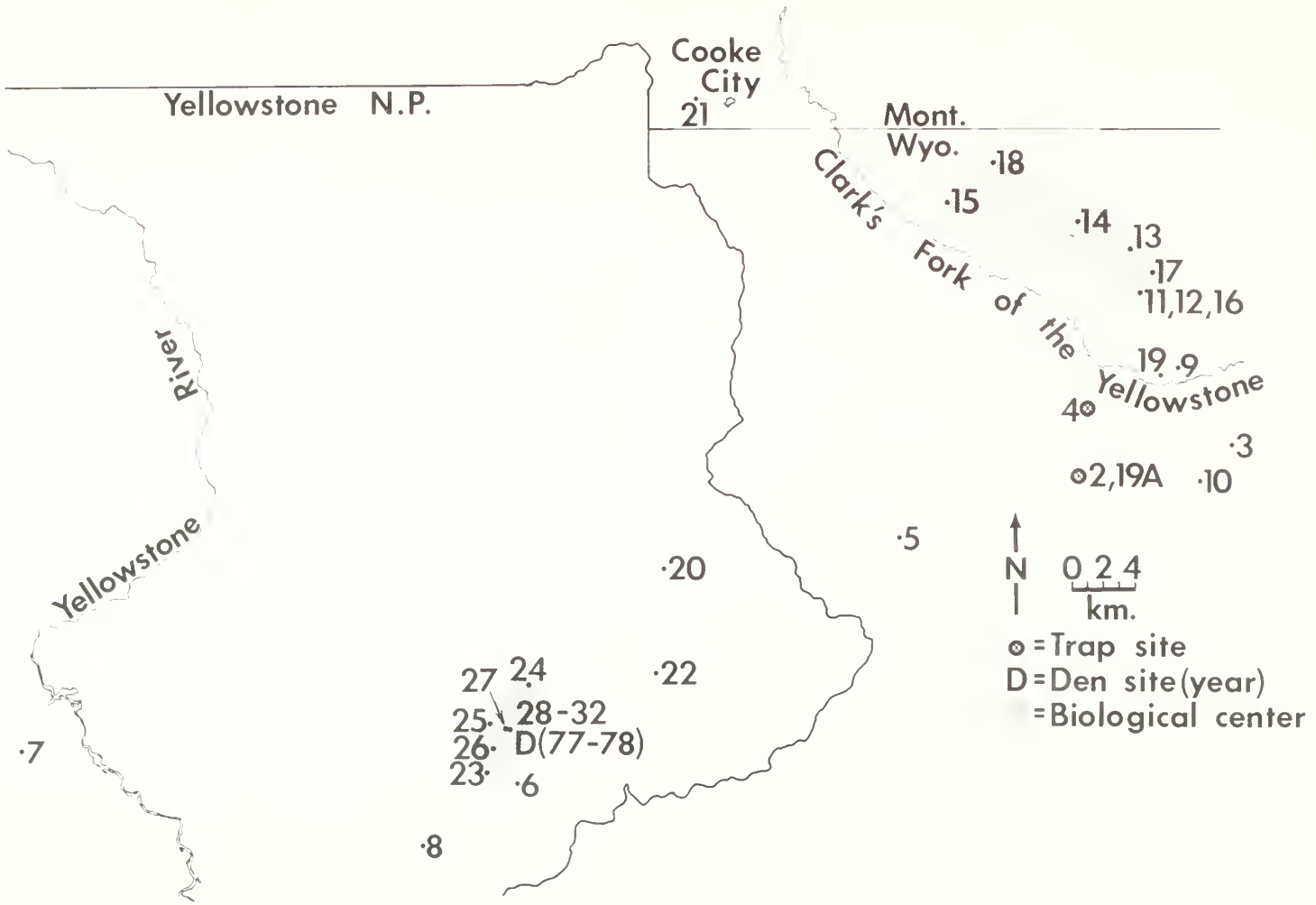

Fig. 5. Movements of grizzly bear No. 1 (adult male) during 1975, 1976, and 1977.

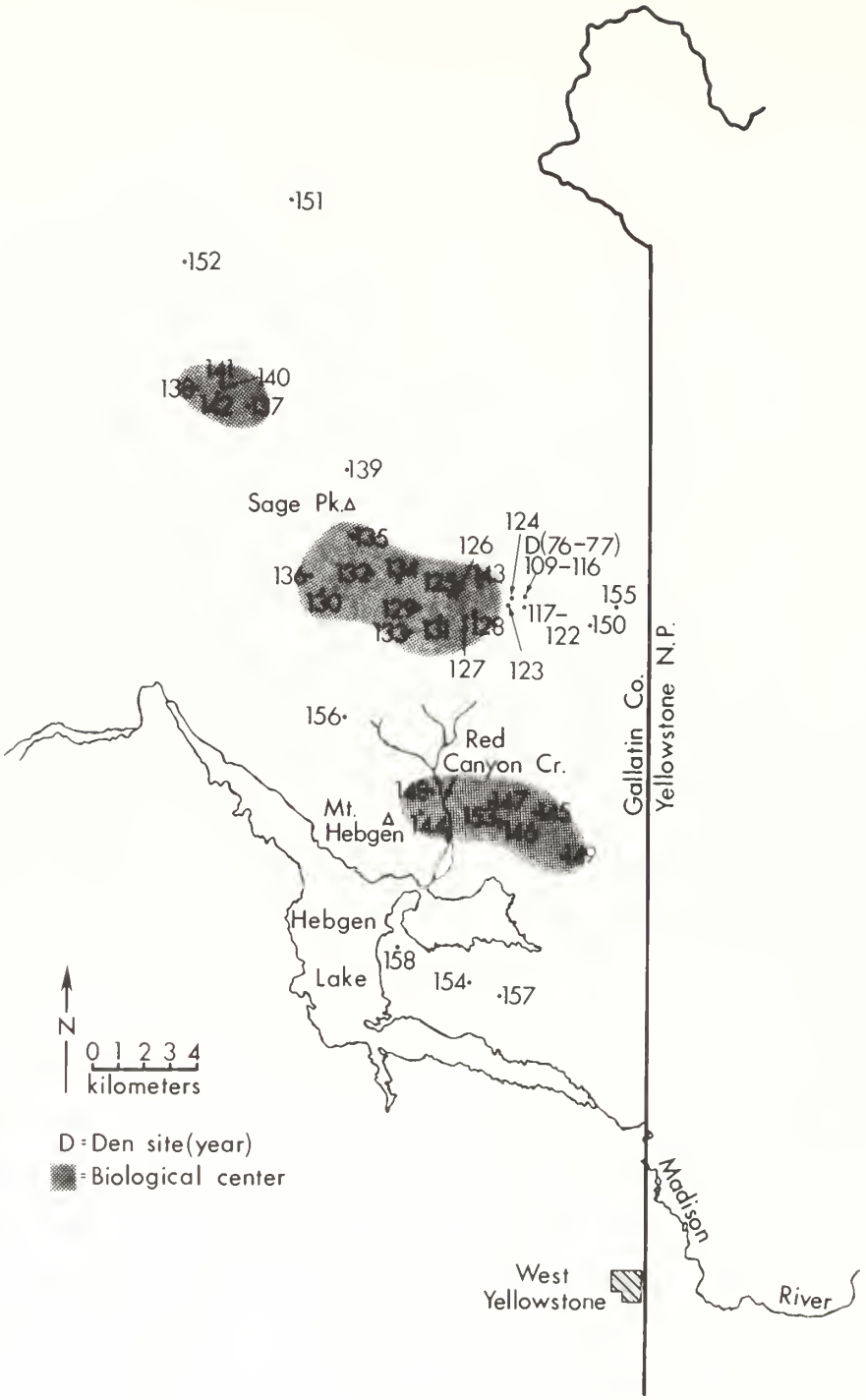

Fig. 6. Movements of grizzly bear No. 4 (adult female with one cub) during 1977.

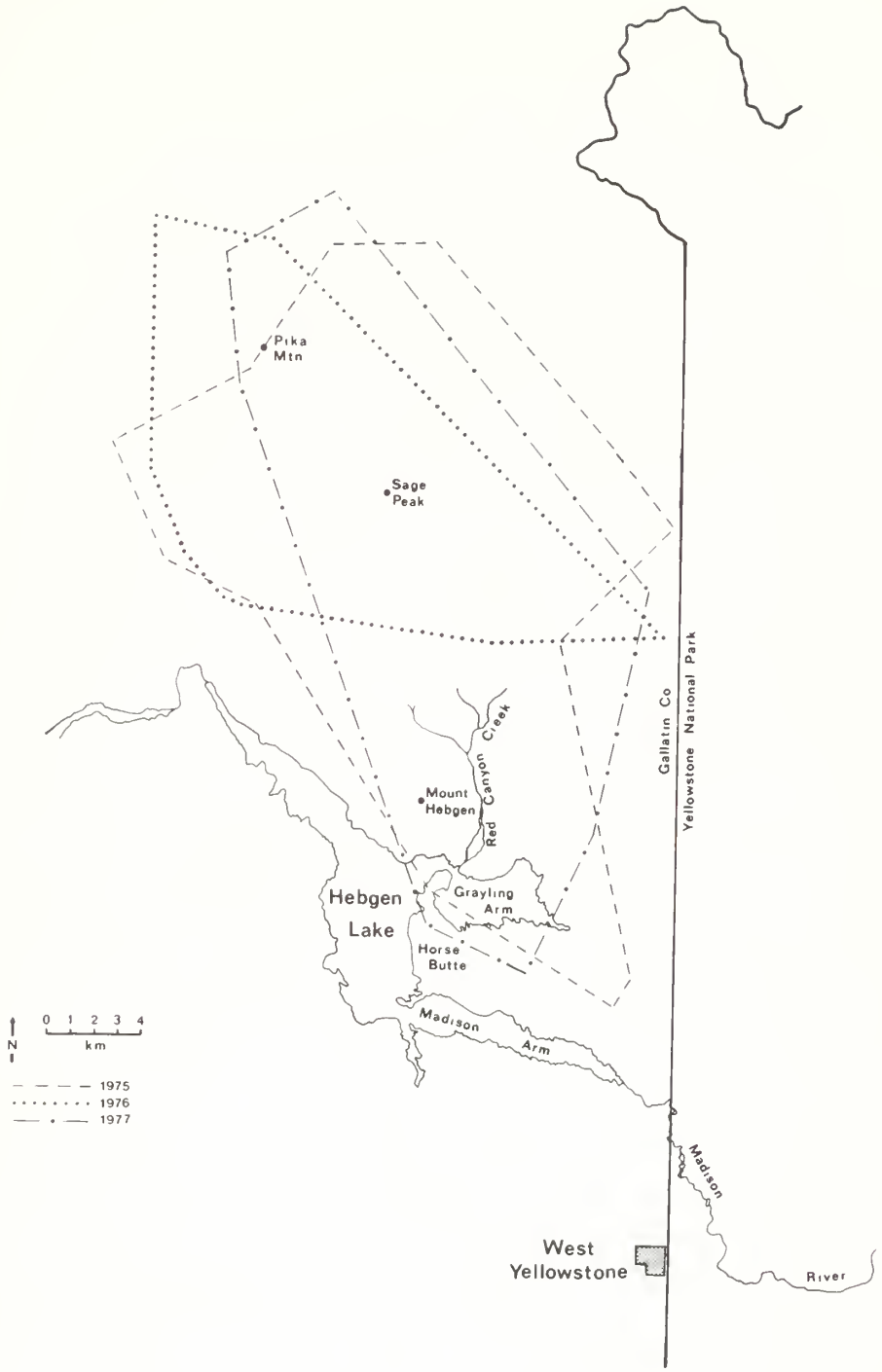

Fig. 7. Home range areas for grizzly bear No. 4 during 1975, 1976, and 1977.

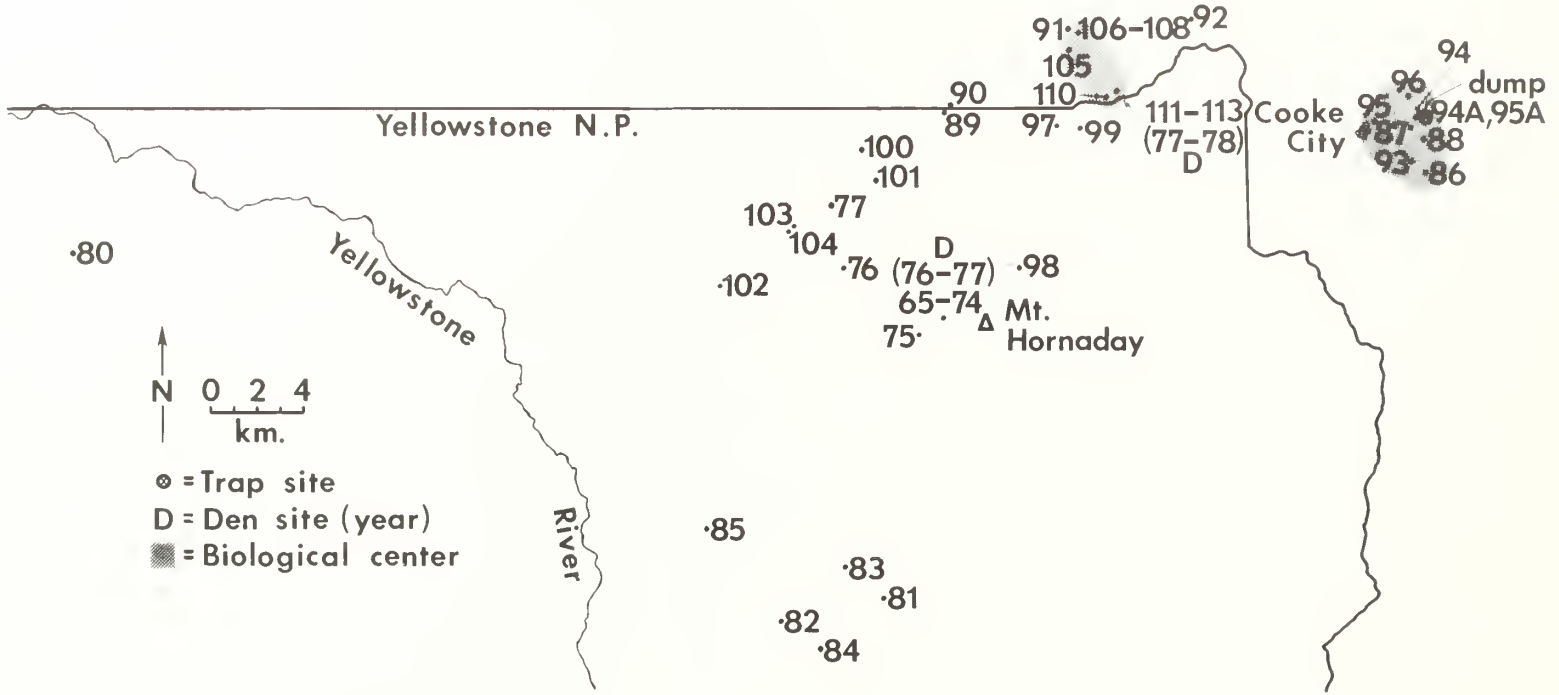

Fig. 8. Movements of grizzly bear No. 5 (adult male) during 1977.

slid downhill. His tracks ended at the top of the slope and continued as a U-shaped furrow, with tracks again at the end of it. One furrow was approximately 25 yards long with the other 75 yards long.

He remained in this drainage until at least 25 April. His transmitter apparently quit just after this date. He was sighted on 14 May on Mt. Everts, about 22 airline miles west of his last radio-located site. His radio was working again on 20 June when he was next located in the Chalcedony area. Four days later on 24 June he was located and sighted with bear No. 13. They remained together for at least 8 days, through 1 July, and on one occasion they were observed breeding. They went separate ways shortly after 1 July, and bear 5 made a 21.5-airline-mile move east to the Cooke City dump in 4 days.

He appeared to have a major bio-center keyed to the Cooke City dump. He used the dump two different periods - 5-11 July and 3-22 August - for a total of at least 25 days. This is comparable to his use of the dump in 1976 when he spent at least 22 days there. He also used the Cooke City dump in 1975, but we lack data to compare 1975 with 1976 and 1977. He was trapped and reinstrumented at Cooke City dump on 9 August and was retrapped there on 21 August. It does not appear that he returned to the dump after 22 August.

He then moved west and ended up back in Slough Creek and was sighted in this area on an elk carcass on 5 October. He remained with the carcass through at least 11 October. He then moved into what appeared to be a predenning area north of Cutoff Mountain in the Lost Creek area, where he had a bio-center. He used this area for 18 to 25 days - 17 October to 11 November - prior to denning between 3-11 November. This apparent den area lies about 8 airline miles northeast of his previous 2 years' den.

This bear's home range area (Fig. 9) appears to have been much larger in 1977 than during the previous 2 years. However, the great extension of his range was associated with early spring and the breeding season. He was not monitored during this period in 1975 and 1976 and may have used the larger area then also. His summer and fall ranges were about the same all 3 years with little deviation from Slough Creek and the Cooke City dump.

Bear 6 (Fig. 10) emerged from her den between 7-16 April and used the area around Heart Lake until 9 May when she moved to Flat Mountain Arm of Yellowstone Lake. This bio-center was keyed to the cutthroat trout spawning runs for the third year in a row. She used this area for 34+ days from about 9 May through at least 8 July. She may have bred during this time as she was with an adult male, No. 14, on 13 and 15 June

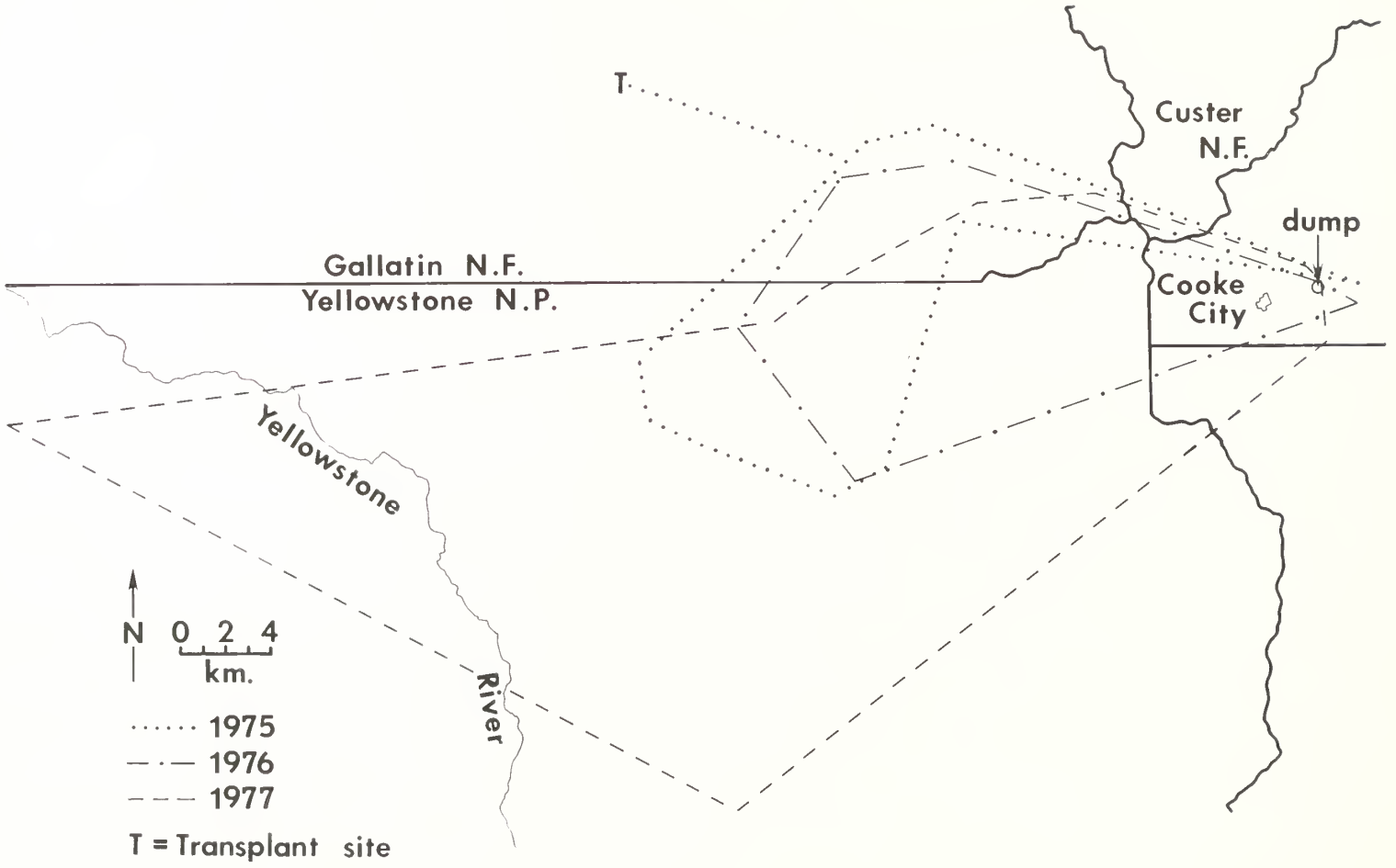

Fig. 9. Home range areas for grizzly bear No. 5 during 1975, 1976, and 1977.

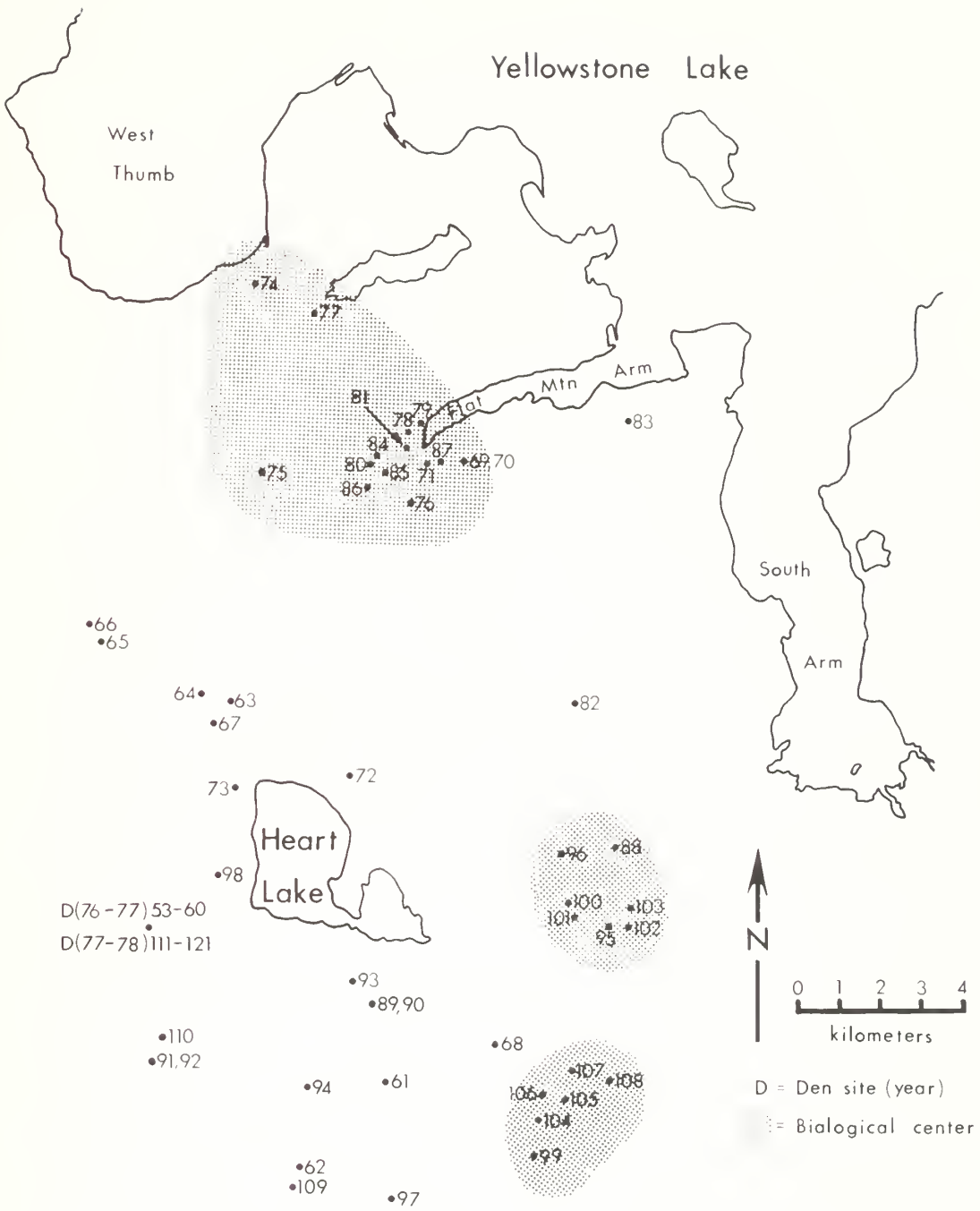

Fig. 10. Movements of grizzly bear No. 6 (adult female) during 1977.

She was sighted on 20 July south of Heart Lake near a bull elk that she had apparently killed that morning. She was in the process of covering the carcass with vegetation and dirt when sighted. A female grizzly with three yearlings and another lone grizzly were within less than 100 yards of her at the time. She was sighted again on 22 July still in possession of the carcass. She was lame in the left front foot at this time, indicating that she had probably actively defended the kill against the other bears.

Bio-center 2 was in the Outlet Creek area and was used for 23+ days. She used the area briefly in early August, but most of the use here was in late August and early September.

Bio-center 3 was located about 3 miles south of bio-center 2. It was used for 16+ days in mid- to late September and appeared keyed to a bull elk that she apparently had killed between 12 and 14 September. A lone grizzly was within 20 yards of her when she was sighted on the carcass on 14 September.

She left this area between 27 September and 3 October headed for her denning area in Basin Creek. She was in the den by 11 October (sometime between 5 and 11 October). She may have come out again between 11-13 October as there were tracks in the snow in the vicinity of her den. No tracks were seen after this date.

The range areas used by this bear during the 3 years she has been monitored have changed significantly (Fig. 11). We lost contact with her in 1975 soon after she left Flat Mountain Arm and moved west almost as far as Old Faithful. She cast the transmitter northwest of Heart Lake in the fall of 1975. She moved east and south from Flat Mountain Arm in 1976 spending considerable time in areas containing whitebark pine and around hunting camps. She contracted her range in 1977 using less than half of the area used in 1976. This may have resulted from her development of the ability to kill elk which provided adequate food without a great deal of movement.

Bear 8's radio was intermittent which precluded pinpointing her 1976-77 den site and close monitoring of her early spring and summer movements (Figs. 12, 13). She and her yearling emerged from the den prior to 16 April 1977. She emerged from the den in 1976 between 10-19 April. She had the same general annual use range in 1977 as she had the 2 previous years. However, she seemed to increase the size of it on all sides, thus almost doubling the total size about 105 mi^2 in 1977 compared to 58 mi^2 for 1976.

From emergence until mid-July she used about the south one-half of her annual range and did not return to the area until mid-October. She appeared to use this area randomly except for a minor bio-center around Mt. Norris that she used 13+ days. Her yearling was still with

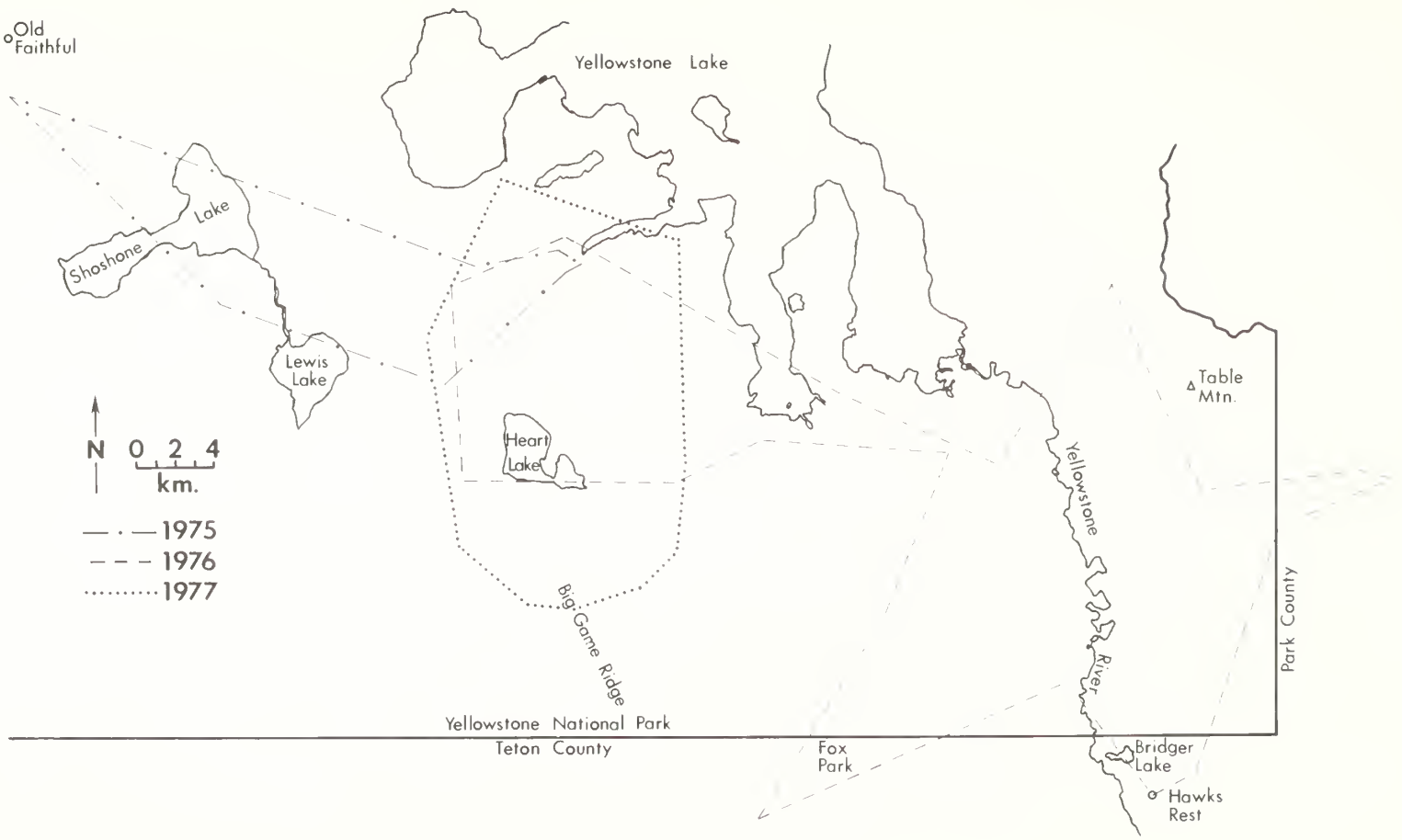

Fig. 11. Home range areas of grizzly bear No. 6 during 1975, 1976, and 1977.

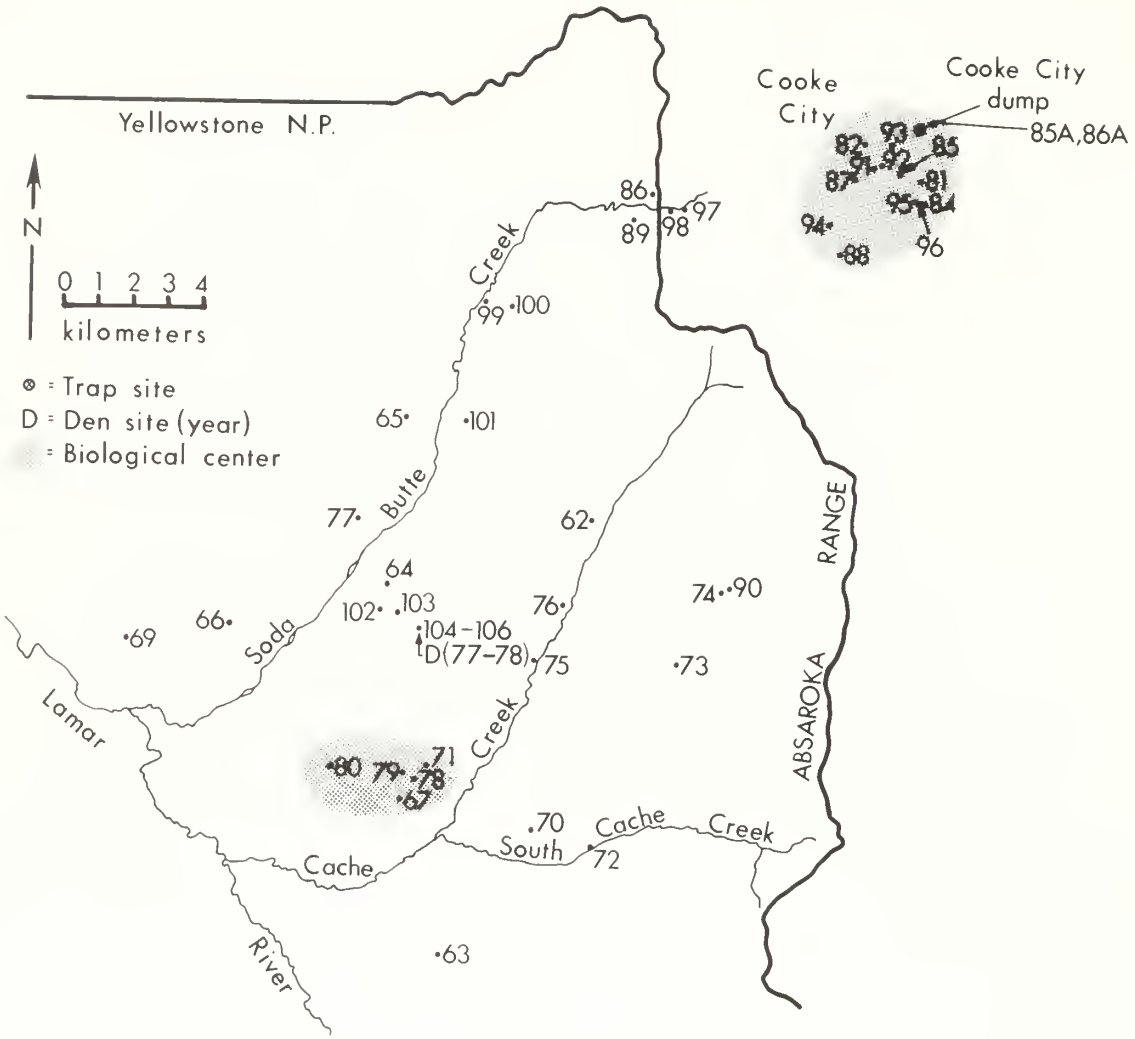

Fig. 12. Movements of grizzly bear No. 8 (adult female with one cub) during 1977.

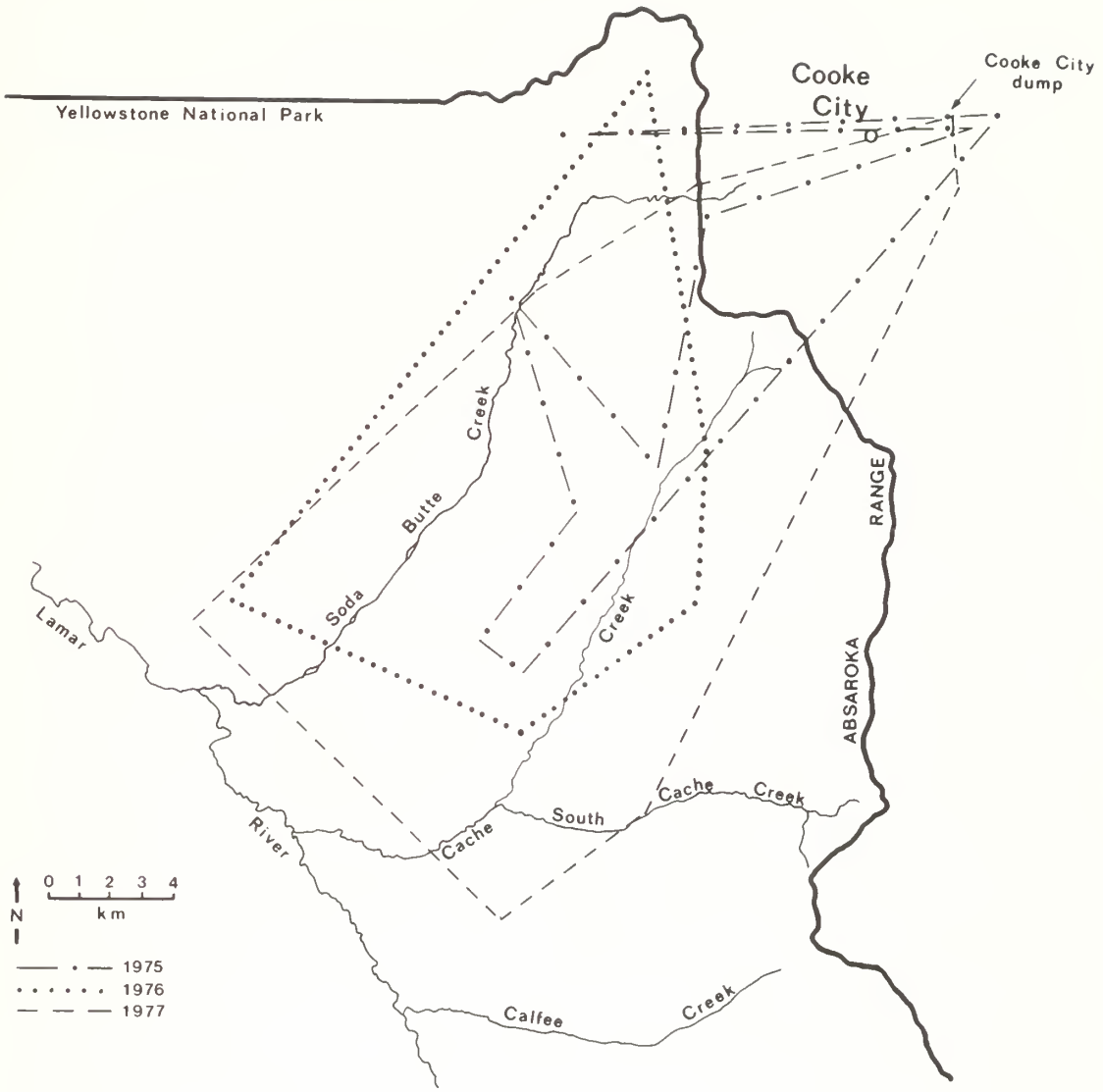

Fig. 13. Home range areas of grizzly bear No. 8 during 1975, 1976, and 1977.

her when she was sighted 26 May. However, she was sighted on 5 and 14 July without her yearling. The yearling was not observed with her again.

She then made a 15-airline-mile move north to the Cooke City dump in 4 days, between 14-18 July. She remained in the north half of her range until mid-October. She had a major bio-center keyed to the Cooke City dump that she used for at least 37 days. This compares with a possible trip or two to the dump in 1976 when accompanied by her cub of the year, and 15 days spent at the dump in 1975. She moved out of the Cooke City area between 19-23 September. She spent a few days on Soda Butte Creek, probably feeding on an elk carcass. She then moved gradually southward to her denning area on the west side of The Thunderer and was at or in the den by 11 November. Her 1977-78 den is about 2+ airline miles west of her 1976-77 den and is over the mountain. She was denned by 14 November in 1975, and in 1976 she denned sometime after mid-October but problems with her radio precluded knowing her denning date.

Bear 9's transmitter failed in late December 1976 so the date of his emergence from the den in 1977 is unknown. He was retrapped at the Cooke City dump on 1 August 1977 and his nonfunctional collar removed. This collar was an old style that had become too tight and had caused some irritation to his neck. He was not reinstrumented until retrapped on 17 August at Cooke City dump. Then within the next 6 days he made a 31-airline-mile movement to the southwest but was back at the Cooke City dump within another 11 days (Fig. 14). There is no readily apparent reason for this move. We feel, however, that this corresponds with long-distance, short-duration, post-trapping moves as reported by Pearson (1975) for some adult males in the Yukon Territory.

Excluding the above, he spent most of the tracking period (33 days minimum) using a bio-center keyed to the Cooke City dump. This compares to a minimum of 22 days spent there in 1976.

He left the Cooke City area between 27 September and 5 October 1977 for his predenning area. He used this area for about 17 days prior to being at or in the den on 21 October. This is essentially the same predenning and den area he used in 1976-77 winter, when he used the area about 18 days before denning. He was at or in the den on 5 November 1976; thus, he denned about 16 days earlier in 1977.

He used his annual range quite similarly in both years with a minimum of 60 mi^2 used in 1977 compared to 45 mi^2 minimum for 1976.

Bear 11 (Fig. 15) emerged from his den on Temple Creek just a day or so prior to 5 April 1977. His 1977 minimum annual use range covered about 158 mi^2. This was in the same basic area as used in

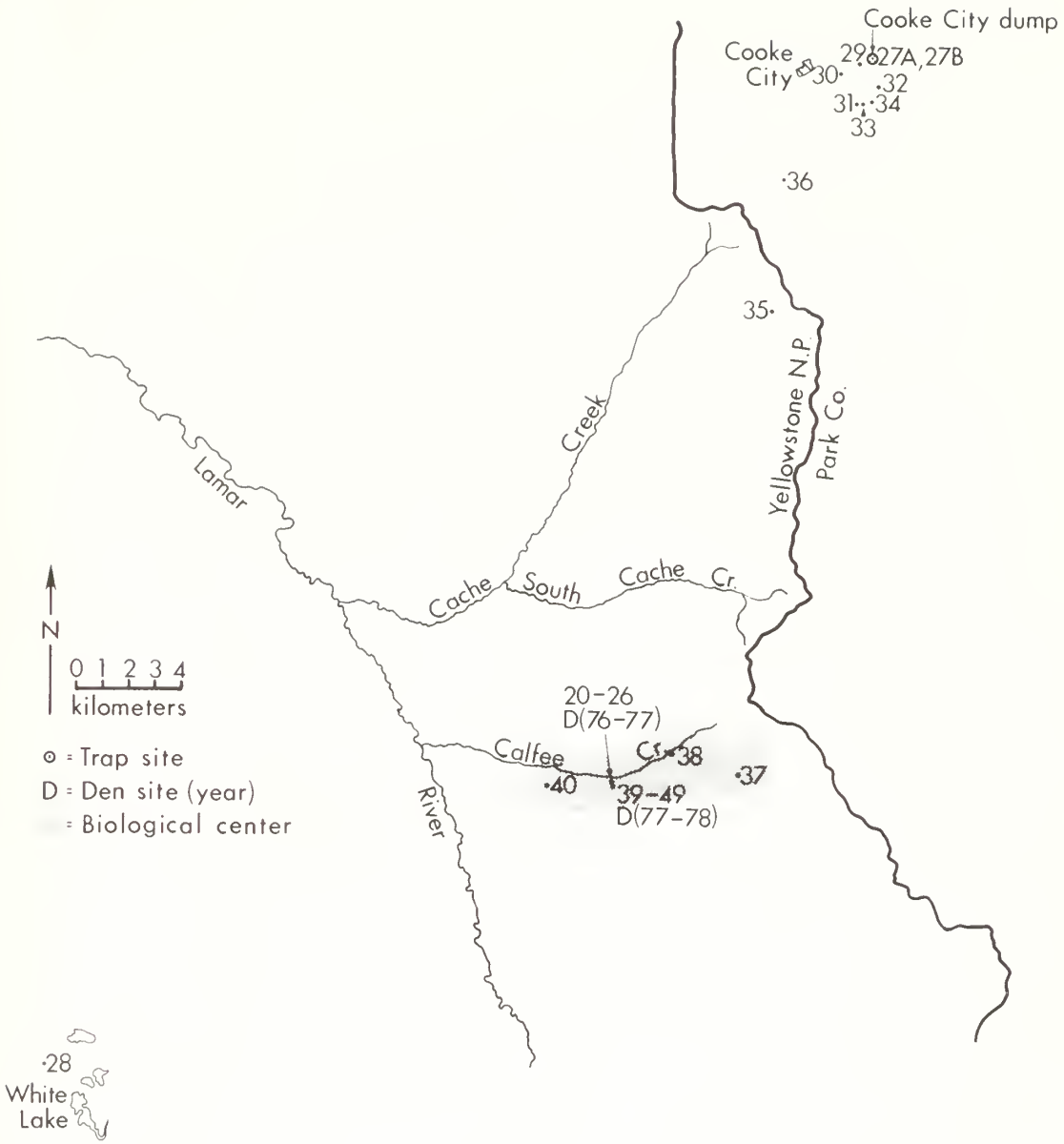

Fig. 14. Movements of grizzly bear No. 9 (adult male) during 1977.

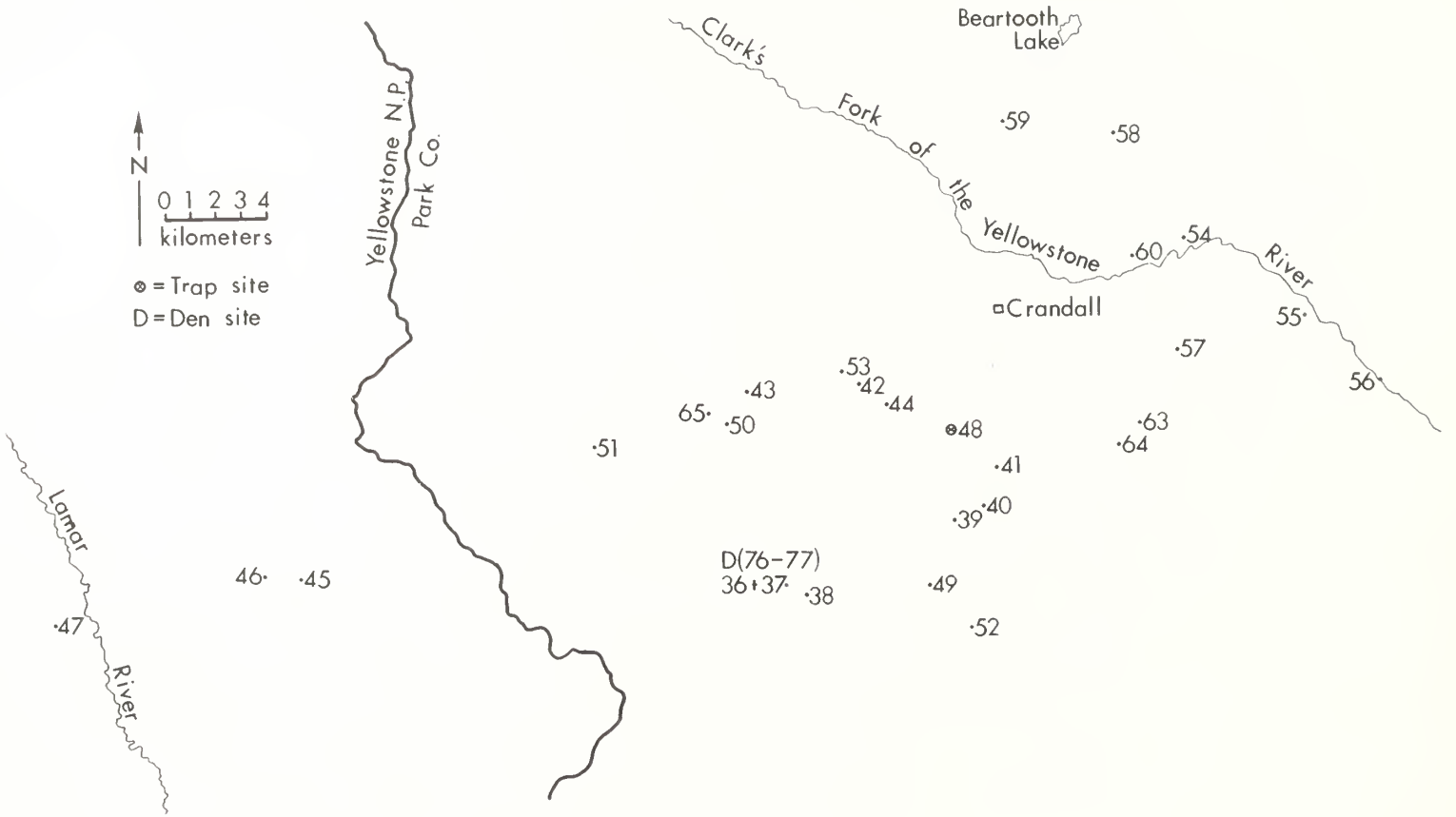

Fig. 15. Movements of grizzly bear No. 11 (adult male) during 1977.

1976 and is comparable to the minimum of 114 mi^2 used then. The whole area appears to have been rather randomly used in 1977 as was the case in 1976. There was one exception to this in 1977 when he moved about 14 airline miles west into the Park during the rut. This may not be an exception, in fact, as he was not radioed until after the rut in 1976. He was located in the Crandall area on 5 October 1977. His radio apparently failed just after this date and he was not relocated.

Bear 12 (Fig. 16) opened her den between 30 March and 5 April 1977 but did not leave it. She was sighted in the entrance with one cub on 5 April. She remained in the den at least through 7 April but had moved north away from it by 16 April, accompanied by her two cubs of the year.

Her movement patterns and annual use range were considerably different in 1977 than in 1976 (Fig. 17), although the minimum area size used remained about the same with 62 mi^2 and 67 mi^2, respectively. She apparently used the cutthroat trout spawning runs in early summer at Flat Mountain Arm. She remained in the area just south of Yellowstone Lake the entire season and ranged essentially between Solution Creek and Surprise Creek. She appeared to use the area somewhat randomly with two possible bio-centers. One of these lay just east of Flat Mountain and the other on Solution Creek. In early August 1976 she moved south to an apparent summer range in the Fox Park-Big Game Ridge area. She did not use this southern area in 1977.

We feel one of the many reasons for this change in movement patterns was due to the relatively dry conditions that prevailed during 1977. Many small ponds and swampy areas either dried up or were greatly reduced in size. Thus, considerably more roots, stems, etc., of aquatic vegetation were available to the bears than would be the case in years of normal precipitation. We do not feel the fact she had cubs of the year played any major part in changing her movement patterns since other females with cubs of the year are often highly mobile.

She was at or in her den on Solution Creek by 16 November 1977. This is 13 days later than when she denned on 3 November 1976.

Bear 13 (Fig. 18) emerged from the den about 16 April 1977 and had moved about 1/4 mile from the den by 18 April. She remained in her pre- and post-denning area at the mouth of Broad Creek for about 14 days, then moved north out of the area about 2 May. Her cub had denned with her and was accompanying her at this time.

She had a spring-summer range on Specimen Ridge and the west end of the Mirror Plateau. She used this area randomly for 87 days, from 2 May through 27 July. She and her yearling were seen together on 9 May, but we do not know how much longer it remained with her. She

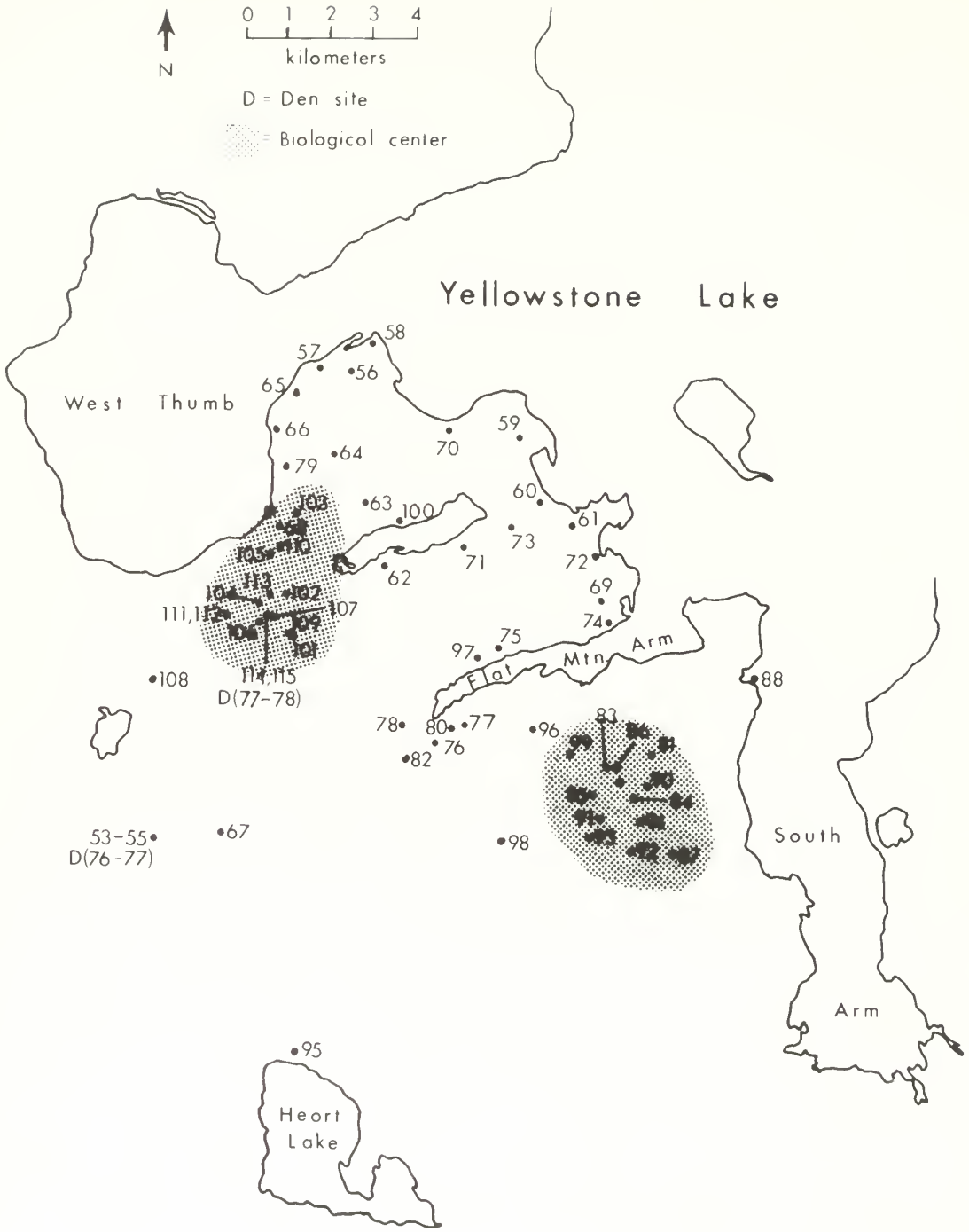

Fig. 16. Movements of grizzly bear No. 12 (adult female with two yearlings) during 1977.

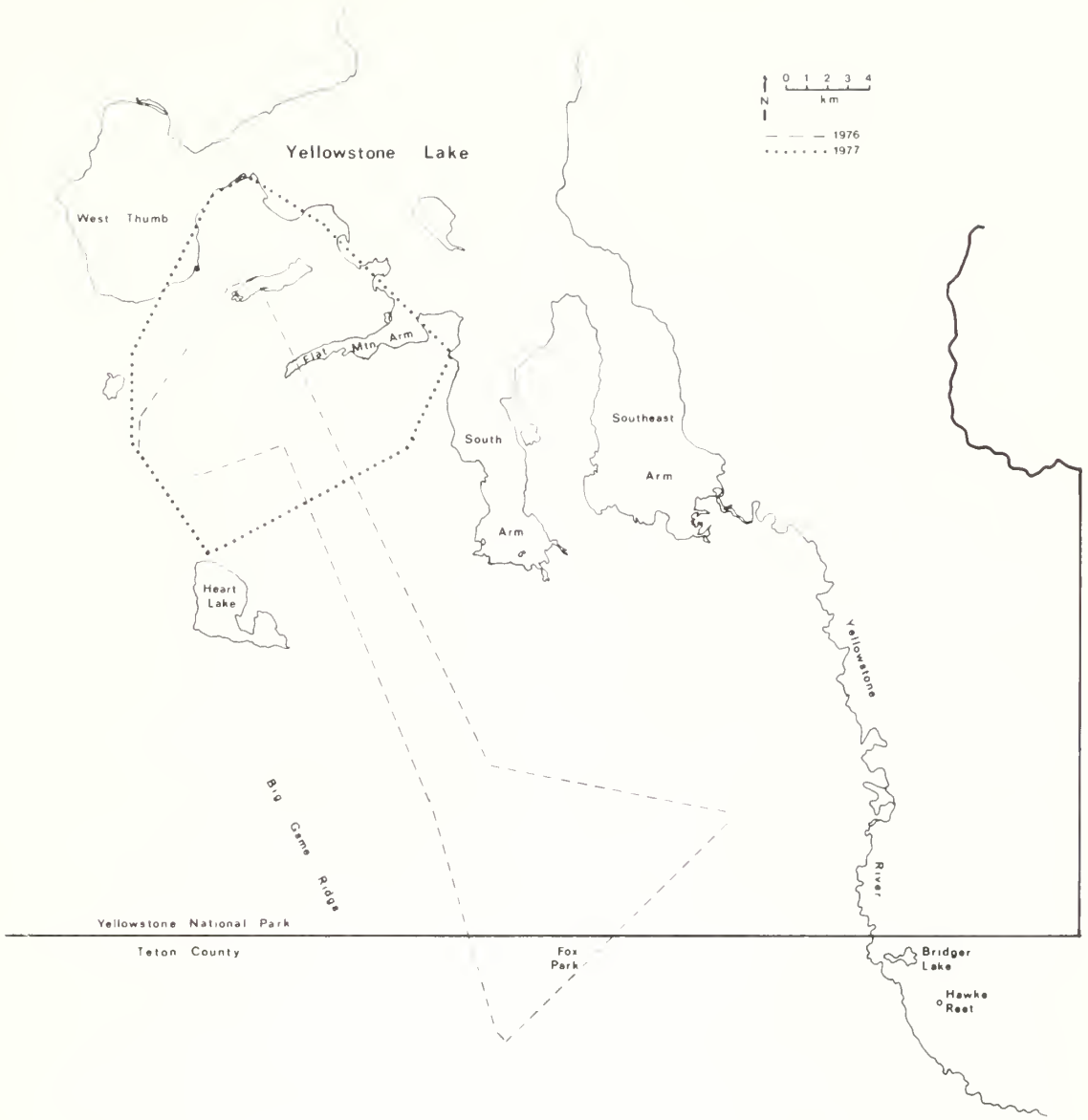

Fig. 17. Home range areas of grizzly bear No. 12 during 1976 and 1977.

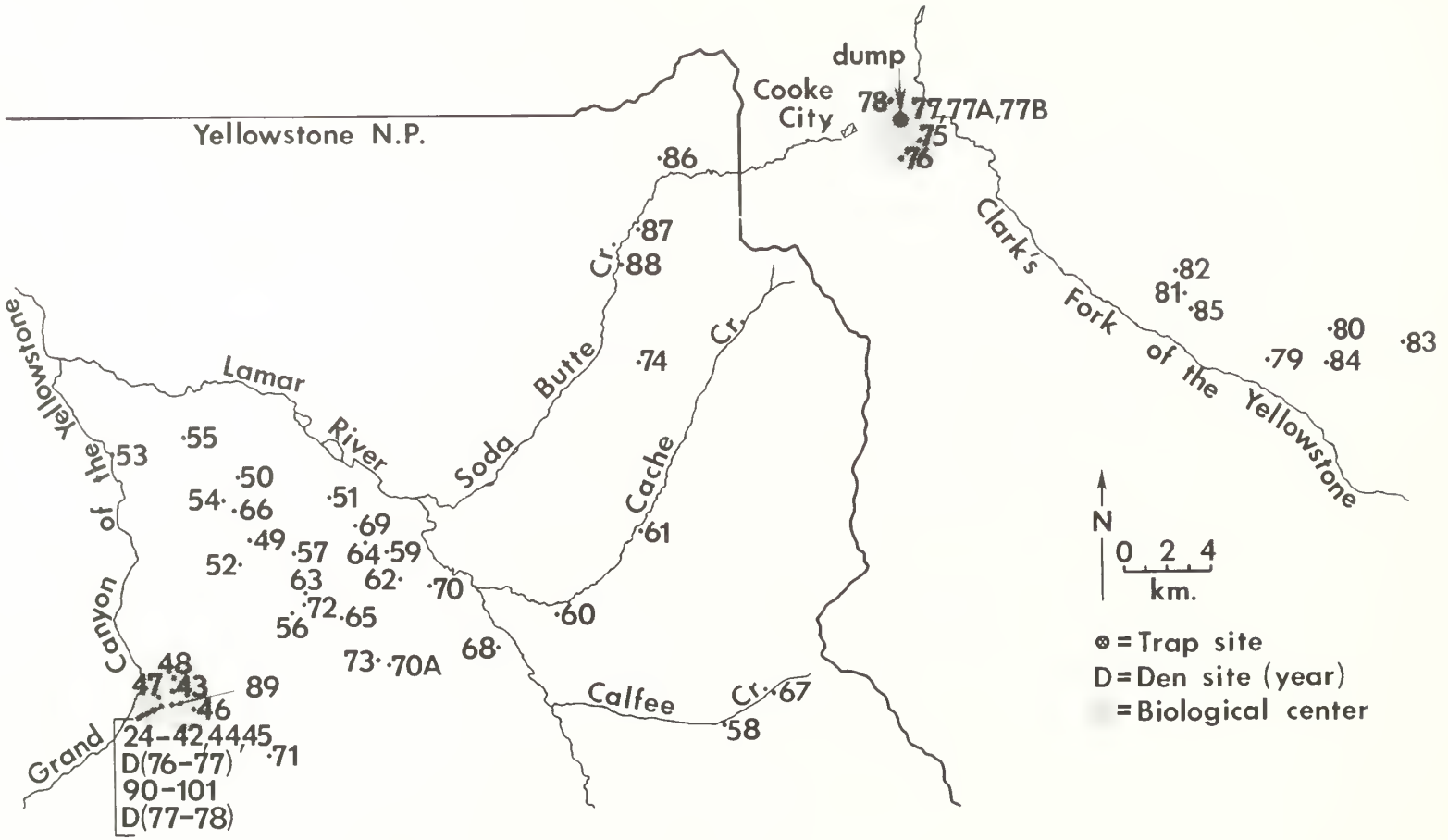

Fig. 18. Movements of grizzly bear No. 13 (adult with one yearling) during 1977.

was sighted on 24 June with an adult male, No. 5, and no yearling was observed. She was sighted again on 27 and 29 June, still with No. 5. This was during rut and they were observed breeding. She moved out of her spring-summer area between 27 and 30 July, traveling 22 airline miles north to the Cooke City dump. She remained there for at least 18 days, with a bio-center keyed to the dump. She was trapped twice while there.

She left Cooke City between 18 and 22 August for a fall range area north of Crandall, Wyoming, where she spent at least the next 33 days. She is strongly suspected of preying on domestic livestock (calves) during this period. She left this area between 23 and 27 September, traveling west-northwest to Soda Butte Creek where she paused a few days to utilize a dead elk while enroute to her den. She was in or at the den by 13 October, which is 23 days earlier than in 1976. In 1976 she was in or at the den by 5 November with her yearling.

In all, she utilized a minimum annual range of 244 mi^2 in 1977 from den emergence to denning. This compares to a 286-mi^2 minimum for 1976. She used the same basic area both years but appeared to spend more time in the western portion of the area and at the Cooke City dump in 1977 than in 1976.

Bear 14 (Fig. 19) was radioed 13 August 1976 in connection with domestic sheep depredations. His transmitter was thought to have failed between 15 and 17 September 1976. However, he turned up near Riddle Lake in Yellowstone Park on 3 June 1977 with his radio working. He was apparently using that area as a spring-early summer range with the whole area essentially one bio-center. He probably used the cutthroat run in Flat Mountain Arm at this time. Radio locations for him for 13 and 15 June indicate that he was with No. 6; because this was during peak of rut, we assume that they were a breeding pair. He remained in this area for at least 25 days and left about 29 June.

He traveled north a short distance, then moved 27 airline miles south-southwest to the Boone Creek-Squirrel Meadows area of Wyoming where he spent about 34+ days - 20 July to 22 August. He was in close proximity to some bands of domestic sheep at least part of the time that he was in the area. However, the sheep owners felt that he did not cause them any trouble in 1977.

He then moved about 28 airline miles north-northeast to Nez Perce Creek in Yellowstone Park. He had a small bio-center here that appeared keyed to natural vegetation and was used about 11 days. We next located him on 11 October south of Fox Park and about 43 airline miles southeast of the previous location. He was in this area for about 17 more days and ate a dead horse and half an elk while there.

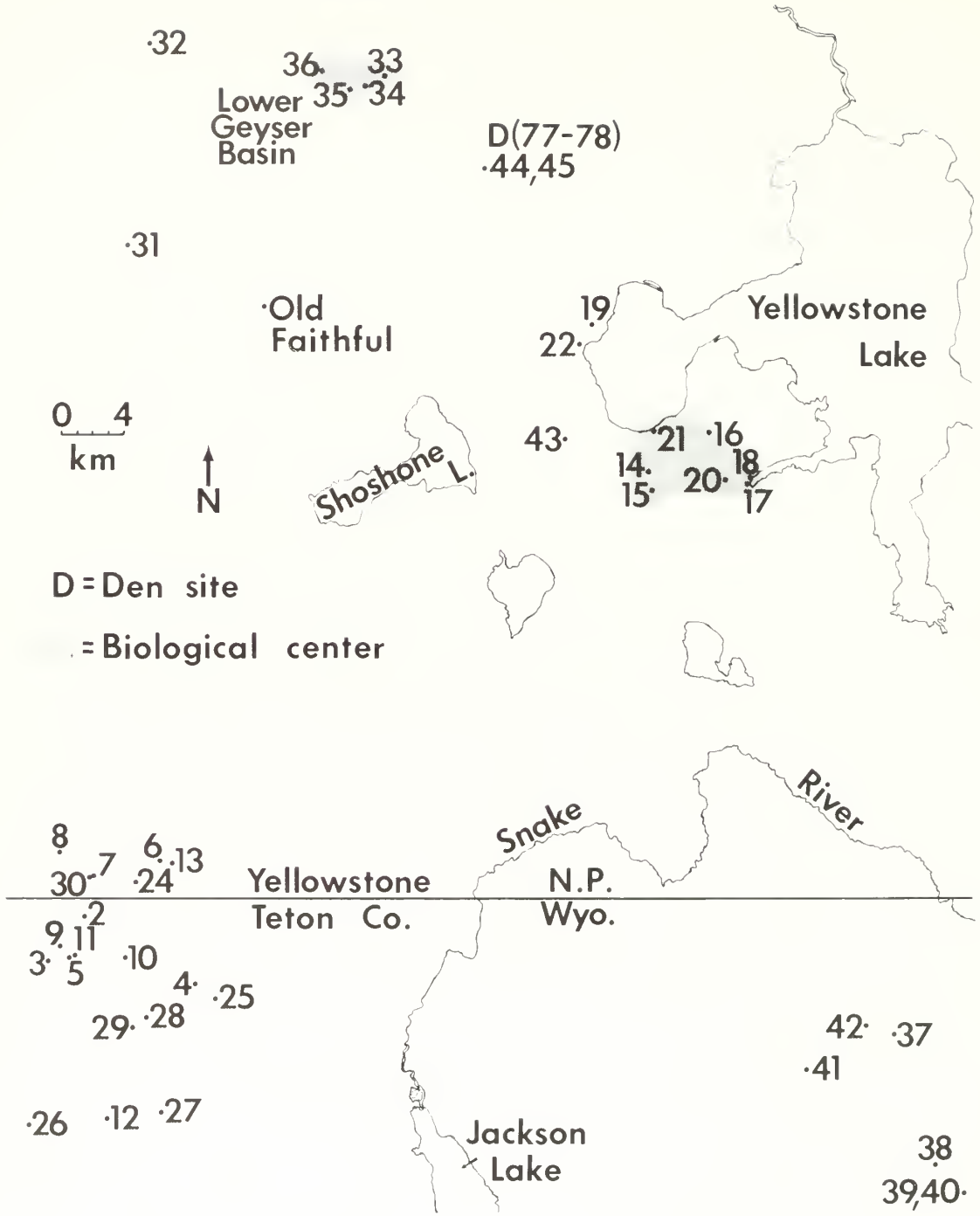

Fig. 19. Movements of grizzly bear No. 14 (adult male) during 1977.

He left the Fox Park area about 27 October going north-northwest towards his denning area on Juniper Creek 34 airline miles away. He denned after 3 November and his den was located 16 November. There were no tracks in the den area and his transmitter, equipped with a motion sensor, was in the hibernation mode. His annual range covered a minimum of 672 mi^2 during 1977. Comparable data are not available for 1976 due to the short time he was tracked.

Bear 15 (Fig. 20) opened his den and came out prior to 31 January 1977. On 31 January he was out but close to the den. He was sleeping or at least quite lethargic since his transmitter was in the motionless mode. He awoke or at least stirred when the plane went over, as the radio went into the active mode. On 7 February he was either in or very close to the den but inactive. He had moved about 7 airline miles from the den by 30 March.

He used an annual range that covered a minimum of 230 mi^2 in 1977. This is much larger than the 36 mi^2 used in the fall of 1976. However, the two are not comparable due to the relatively short time he was tracked in 1976. He appeared to use his 1977 range very randomly. He did have one major bio-center in the Horse Butte area just west of Highway 191. Indications are that this bio-center was keyed to a bear feeding operation by private parties. He was trapped three times in 1977 and reinstrumented twice.

He denned in 1977 on Campanula Creek about 6 airline miles east of his 1976-77 den site. He was in or at the den by 16 November and had gone in between 11-16 November 1977. This is essentially the same time as the previous season when he denned by 8 November 1976.

Bear 16 (Fig. 21) and her two yearlings emerged from the den just prior to 16 April 1977. She moved from the den to the Gibbon River and began digging for roots in the marshy areas. Then by 25 April she had located an elk carcass north of the Madison River and spent at least 5 days feeding on it. She appeared to also be digging roots during this time.

She utilized the same basic annual range in 1977 as in 1976. She did, however, increase the size of it to 204 mi^2 in 1977 compared to 135 mi^2 in 1976. This may be due to two factors: (1) more complete tracking in 1977, and (2) perhaps a larger area was necessary to feed her and her two growing yearlings.

Use patterns are also quite similar between years, with the area being essentially two separate and distinct ranges separated by a movement corridor. The first and largest of the two areas is within Yellowstone Park in the Firehole-Gibbon River area. It was used quite randomly. Natural forage, such as vegetation, heavy to semi-aquatics, and occasional large, wild ungulate carrion appear to be

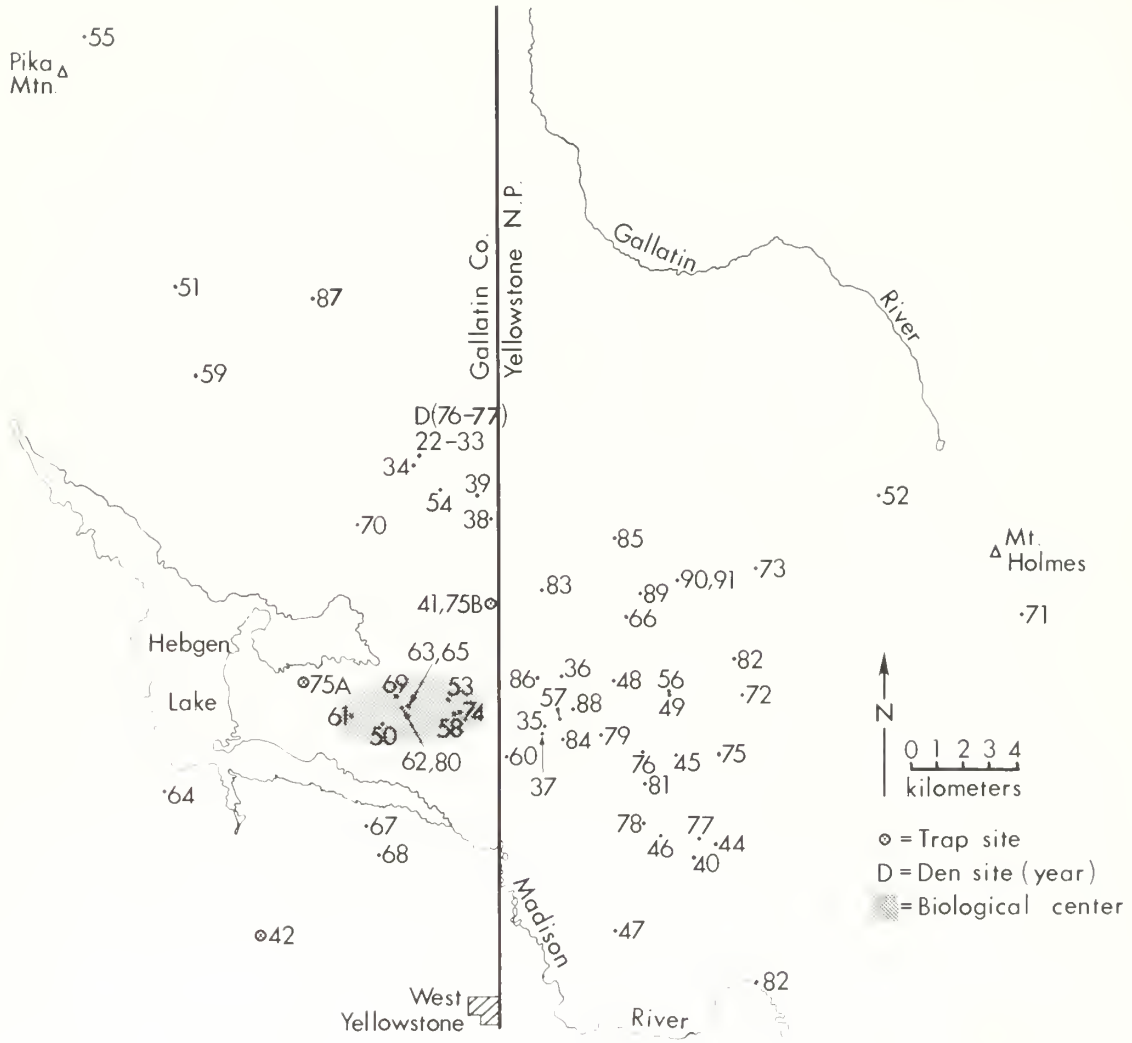

Fig. 20. Movements of grizzly bear No. 15 (adult male) during 1977.

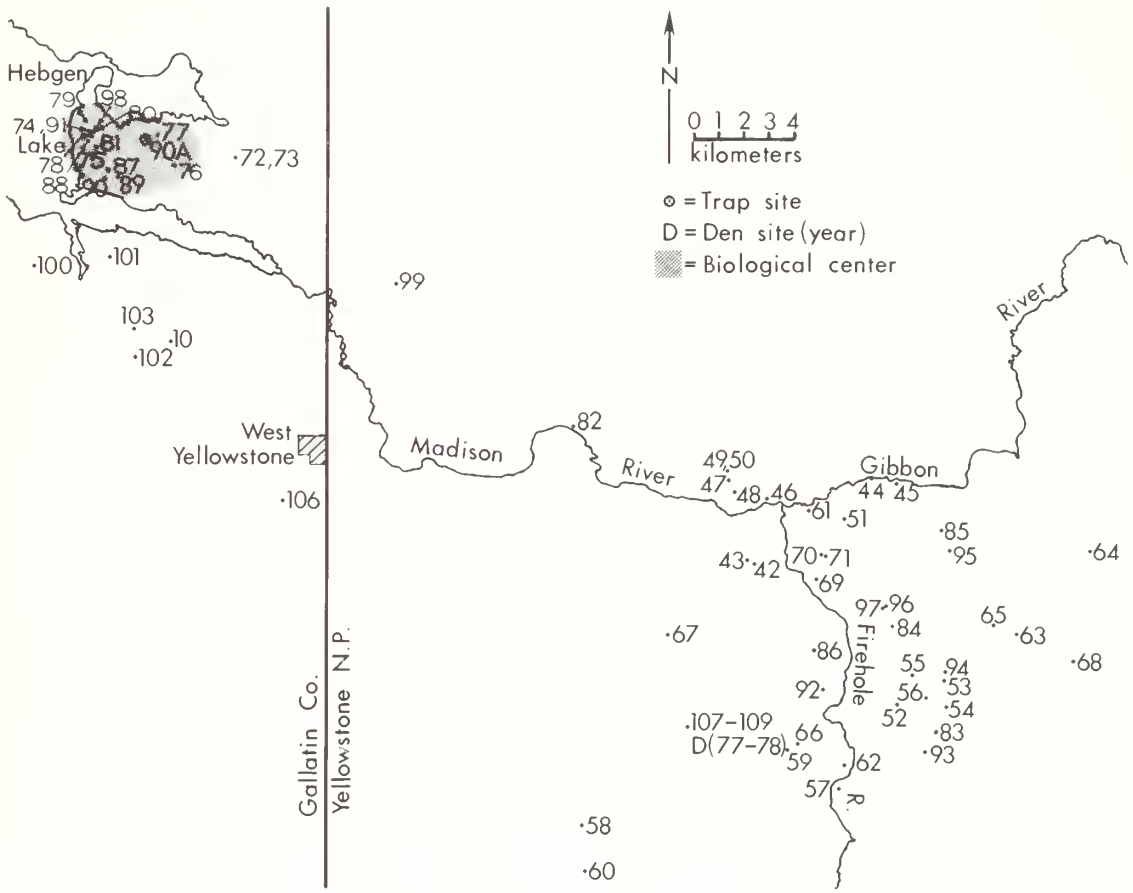

Fig. 21. Movements of grizzly bear No. 16 (adult female with two yearlings) dui ing 1977.

the basis for her use of the area. Her dens are also in this area. She used this area from emergence until 5 July and intermittently thereafter. The second area is Horse Butte north of West Yellowstone where she had a major bio-center that was keyed to livestock carrion and artificial (private dump) feeding by residents of the area.

This bear appears quite efficient at seeking out carrion. Within her natural range in Yellowstone Park we know that she used an elk, a moose, and two bison carcasses. In the Horse Butte-West Yellowstone area she used a moose and at least one domestic cow. All of these animals were carrion.

She made three round trips between West Yellowstone and her range in Yellowstone Park during the course of the season. The last trip was just prior to denning, and she did not leave the West Yellowstone area until between 3 and 11 November. She then traveled fairly directly to her den site on Sentinel Creek and was in or at the den by 16 November 1977. This compares quite closely with the previous year when she was in or at the den on 11 November 1976. Her 1977-78 den is located on Sentinel Creek about 4.5 airline miles south of her 1976-77 den. Her yearling, No. 27, denned with her.

An interesting sidelight occurred on 13 September when she and both yearlings were trapped at West Yellowstone with the intention of radio-collaring the yearlings. The largest - a male yearling, No. 27 - was radioed and released along with the female. However, the smaller yearling, also a male, was found to have a large growth in his mouth. This growth was large enough to prevent proper closing of the mouth, and this yearling was held in captivity by Montana Fish and Game personnel while tests were run on the growth. Subsequently, Montana Fish and Game personnel decided to sacrifice this bear.

Bear 19 (Fig. 22) was trapped and instrumented on 18 May 1977 at West Yellowstone, Montana. He remained in the area through 8 June. He had a bio-center in the Cougar Creek area that appeared keyed to the rut. He was seen twice with another grizzly bear, presumably a female, during this time. He then made a series of long distance moves (14 to 29 airline miles) that took him north to Fawn Pass, then southeast to the Mt. Washburn and Hayden Valley areas. He was sighted, once enroute, in the Indian Creek Campground shortly after sunrise. He did not cause any problems with the sleeping campers or their possessions. In fact, we did not receive any indication that they were even aware of his presence.

He took advantage of carrion when it was available and fed on an elk and two bison carcasses. He also preyed on elk and killed two in early November in Gardners Hole. He ate parts of them and then buried the remainder in a large rectangular hole that he dug which was in excess of 2 feet deep. He had started filling it in by the time we

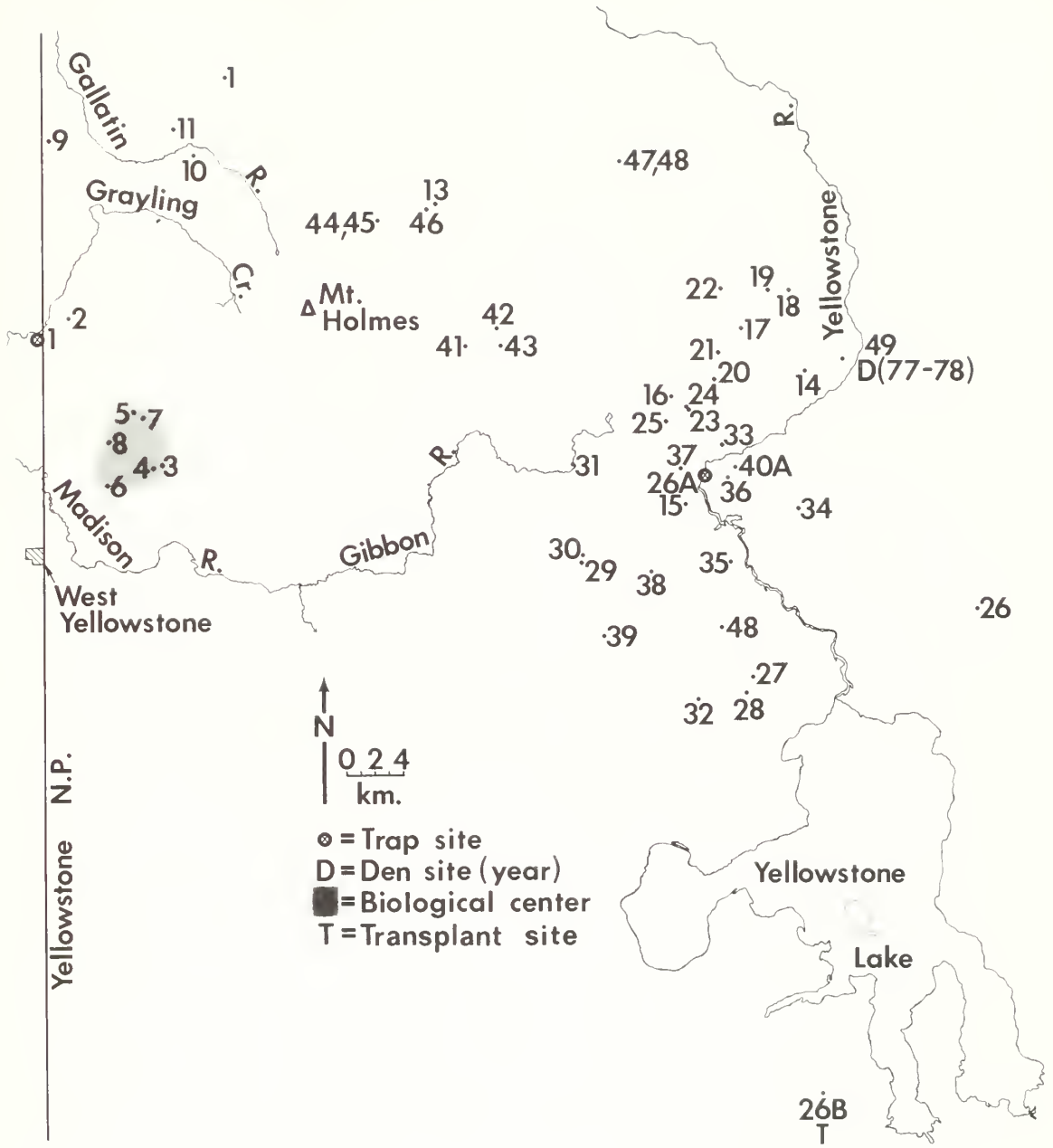

Fig. 22. Movements of grizzly bear No. 19 (adult male) during 1977.

examined it. Parts of one of the bison carcasses were also in a large rectangular hole.

He is the only one of our radioed bears known to have caused a problem with personal property in the Park. In mid-August he did about $700 damage to a car at Chittenden Bridge parking lot while after some groceries in the back seat. Because of this he was trapped by Yellowstone Park personnel on 17 August and transported 28 airline miles south to Surprise Creek on the south side of Yellowstone Lake. He traveled 19 airline miles back north within 5 days but did not cause any further problems even though he was in close proximity to campgrounds on several occasions.

We lost track of him for a short time after 16 November when he was on the Blacktail Plateau. During this time he traveled 13 airline miles southwest and was denned when relocated on 27 December in the Yellowstone River Canyon.

Bear 20 (Fig. 23) was trapped and instrumented on 19 May 1977 at West Yellowstone, Montana. He spent a considerable amount of time in the Horse Butte-West Yellowstone area and had a bio-center there. However, from about 13 June until about 8 July his movements appeared to be a series of long distance moves that took him from Terrace Springs to Specimen Creek and back to West Yellowstone. These movements are probably directly related to rutting activity.

He cast his first transmitter about 12 August near Targhee Pass. He was retrapped and reradioed on 1 September and was tracked until he cast his second radio about 9 September near Grayling Arm of Hebgen Reservoir. He used an annual minimum range of 351 mi^2 during the period tracked.

Bear 21 (Fig. 24) was trapped and instrumented on 2 June 1977 at Crandall, Wyoming. She was in estrus when trapped the first time. We assume that she bred, as at least one large adult male, No. 1, was in the area.

She used a minimum area of 114 mi^2 during the tracking period. She appeared to have two major use areas within this range. One was around Crandall-Lodgepole Creek with a bio-center on Lodgepole Creek. The other was in the Park about 10 airline miles to the southwest in the Saddle Mountain area. She was trapped a total of four times in the Crandall area during the season.

We lost track of her after 5 October. Either her transmitter failed, or since it appears that she bred, she may have denned early in an area of poor radio reception. Some of the areas she frequented around Hoodoo Basin and Crandall have a severe dampening effect on radio transmissions.

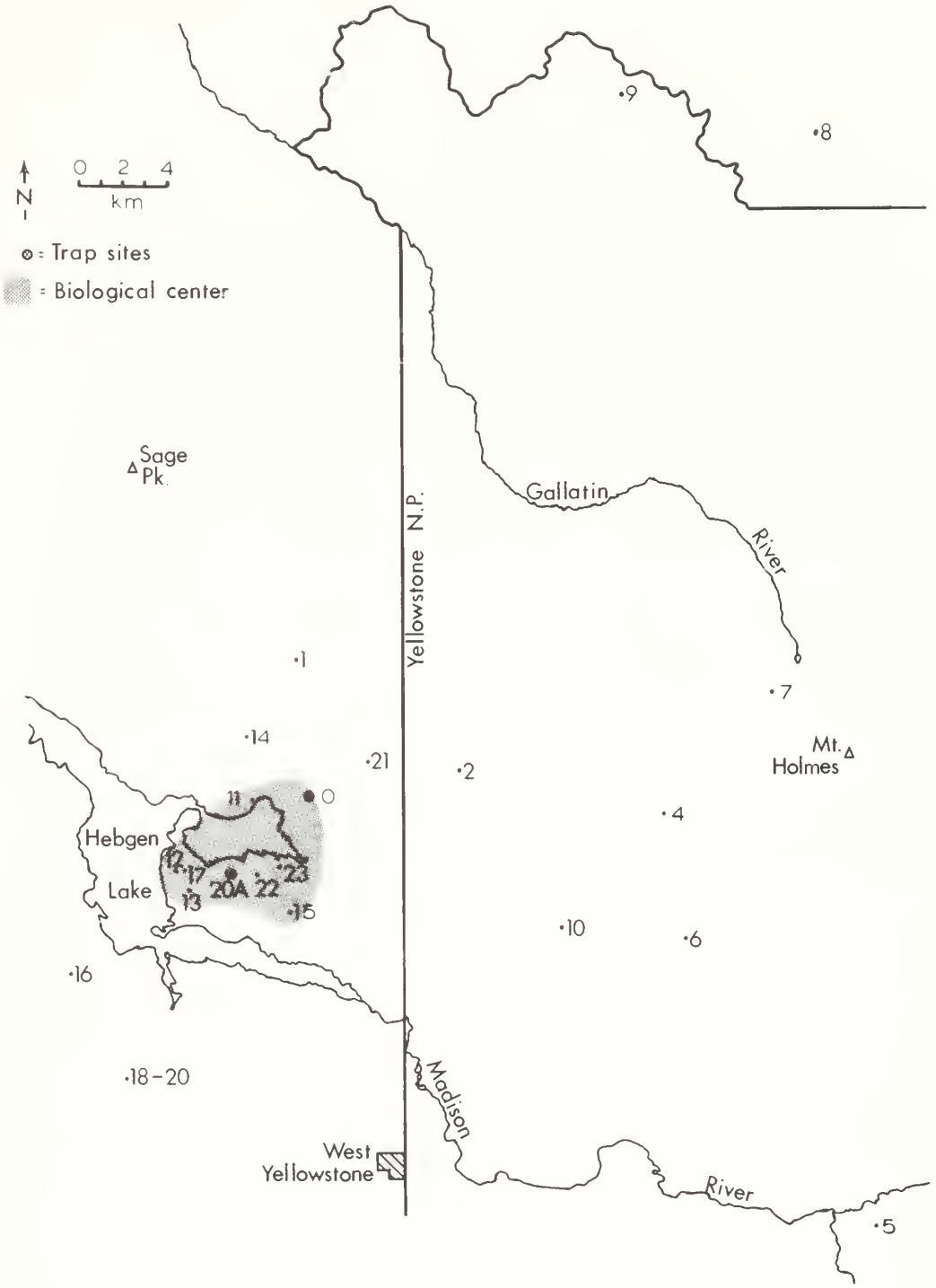

Fig. 23. Movements of grizzly bear No. 20 (adult male) during 1977.

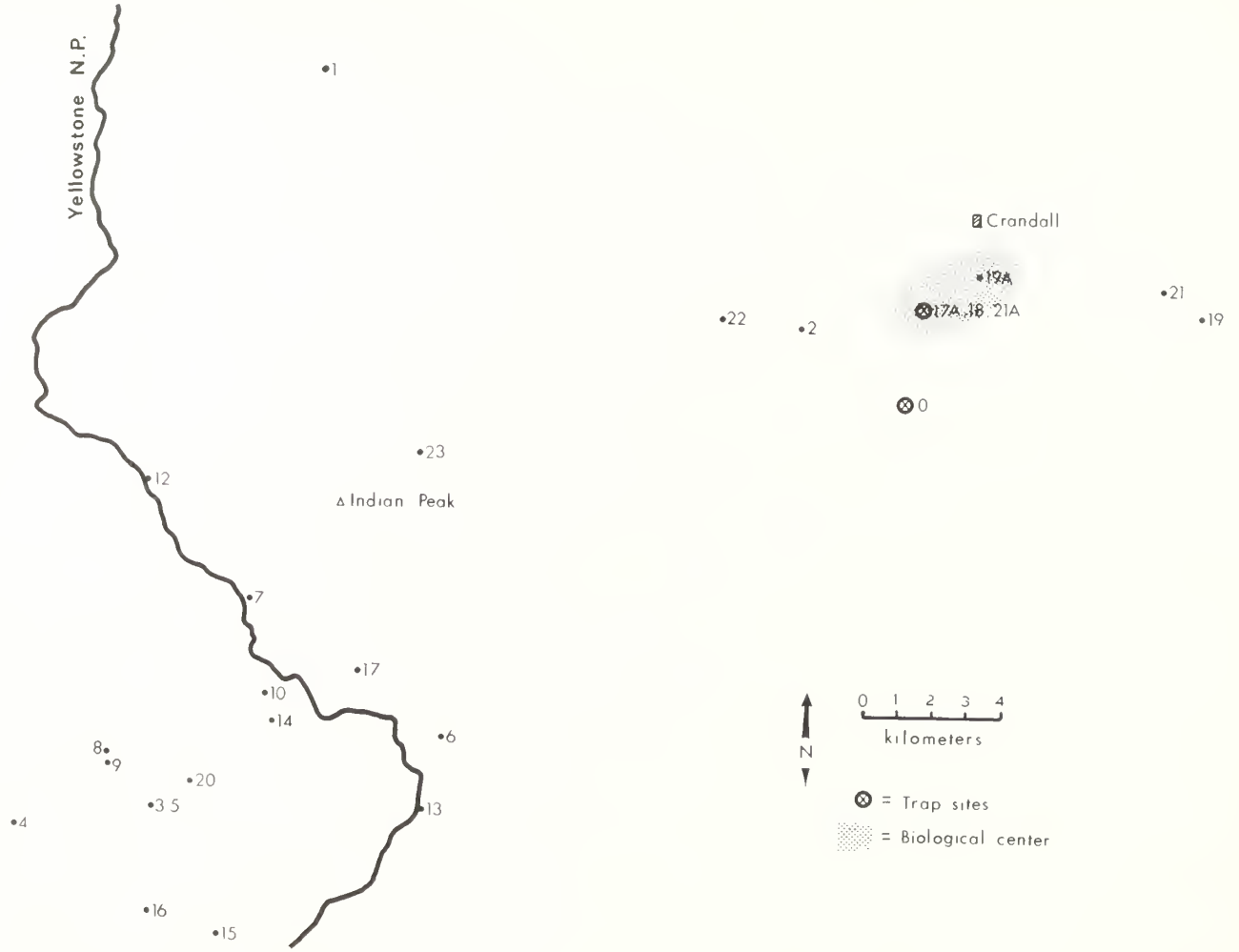

Fig. 24. Movements of grizzly bear No. 21 (adult female) during 1977.

Bear 22 (Fig. 25) was trapped and instrumented on 27 July 1977 near Stonecup Lake, Yellowstone Park. His annual range covered a minimum area of 109 mi^2. It lies primarily in a high elevation, high relief area around the head of Jones Creek where there appears to be considerable whitebark pine. He appeared to use the area somewhat randomly except for a bio-center located on Red and Bear Creeks. He traveled to Hughes Basin on the east side of his range where he denned between 11 and 16 November.

Bear No. 23 was trapped and instrumented on 5 September 1977, and bear No. 24 was trapped and instrumented on 6 September 1977. Both were trapped in connection with depredations on domestic sheep. On the night of 30 July these two bears (and possibly one other) encountered a bedded band of sheep in Canyon Creek, Idaho. They killed 30 sheep in a short time and somewhat scattered the rest of the band. Two days later the rancher moved his sheep out of the area. The two bears were snared using the sheep carcasses as bait.

No. 23, when radioed and released, left the area going north towards West Yellowstone. Within 5 days she was well inside the Park near Mt. Holmes on Gneiss Creek. She then moved back to the West Yellowstone area and remained there at least until 23 September when she cast her transmitter.

No. 24, when radioed and released, remained in the area and apparently continued to feed on the sheep carcasses. She appeared to augment her diet by digging for vegetation around bog holes in the area. We lost track of her after 5 October and assume that her transmitter failed.

Due to the short time that we tracked bears 23 and 24, no attempt was made to plot range or area used.

Bear 25 was trapped, instrumented, and released on 9 September 1977 at Gardiner, Montana. She was accompanied by two small cubs of the year (about 42 pounds each). She was located on 12 September near Sportsman Lake about 7 airline miles west of the trap site. On the evening of 15 September she was sighted just north of Macks Inn, Idaho, about 41 airline miles south of Sportsman Lake. Later that night she was shot and wounded, and one cub was shot and killed by a local resident when she got into some food stored in a cabinet on this person's back porch. She escaped and was relocated aerially on 19 September in a dense willow patch on the Henry's Fork River about 1-1/2 miles east of Macks Inn.

She was relocated on 20 September in the willows by Team members and personnel of the Idaho Fish and Game Department. She was killed when she charged at close range.

Fig. 25. Movements of grizzly bear No. 22 (subadult male) during 1977.

The remaining cub, bear 31, was trapped and instrumented on 22 September 1977 near Macks Inn. He remained in the area for about 30+ days and apparently was feeding on spawned out Kokanee salmon *(Oncorhynchus nerka nerka)*. He cast his transmitter about 21 October but was observed a few times later in the Macks Inn area.

No range or area size was calculated for bears 25 and 31 due to the short time tracked.

Bear 26 (Fig. 26) was trapped and instrumented on 9 September 1977 at Gardiner, Montana. She made a short (6 airline mile) move east following tagging but was back at the Gardiner dump within 4 days. She used a relatively small range of 16 mi^2 during the tracking period. Within this area she had a major bio-center keyed to the Gardiner dump and some timber patches (used as resting cover) just south of the dump. She spent at least 28 days there during the tracking period.

On 3 October she and her yearling and another female with two yearlings fed on apples from a tree just west of the dump near the Park horse corrals on Stephens Creek. Between 11-17 October this same group of five bears took a short interlude away from the dump and traveled east to Mt. Everts where they dug for vegetation. This group of five bears was sighted together on five separate occasions. Bear 26 was in or at her den on 1 November on the south side of the Yellowstone River near Crevice Lake.

Bear 29 (Fig. 27) was one of a litter of three cubs orphaned in 1976 in Yellowstone Park. He became a nuisance around Lake and Fishing Bridge, and on 15 July 1977 Park personnel captured him near Pelican Creek. They instrumented and transported him about 22 airline miles north to the Cooke Peak area. Within 3 days he moved about 8 airline miles south to the Canyon area, then moved into the Chittenden Bridge-Artist Point area where he remained. He used an area of about 10 mi^2 during the tracking period.

He died of unknown causes about 12 October, and his carcass was almost totally eaten by another bear(s). Only the radio collar and a few pieces of bone were recovered.

Bear 30 (Fig. 28) was traveling with his mother and sibling when he was trapped and instrumented on 21 September 1977 at West Yellowstone. He rejoined his family group within a day or two as they were sighted together on 23 September. They remained in the Cougar Creek area for about the next 10 days, then moved about 16 airline miles south-southwest to Canyon Creek, Idaho. They then moved back into Montana to an area just east of Two Top. They used a minimum range area of 84 mi^2 during the tracking period. They were in or at the den near Mosquito Gulch by 3 November.

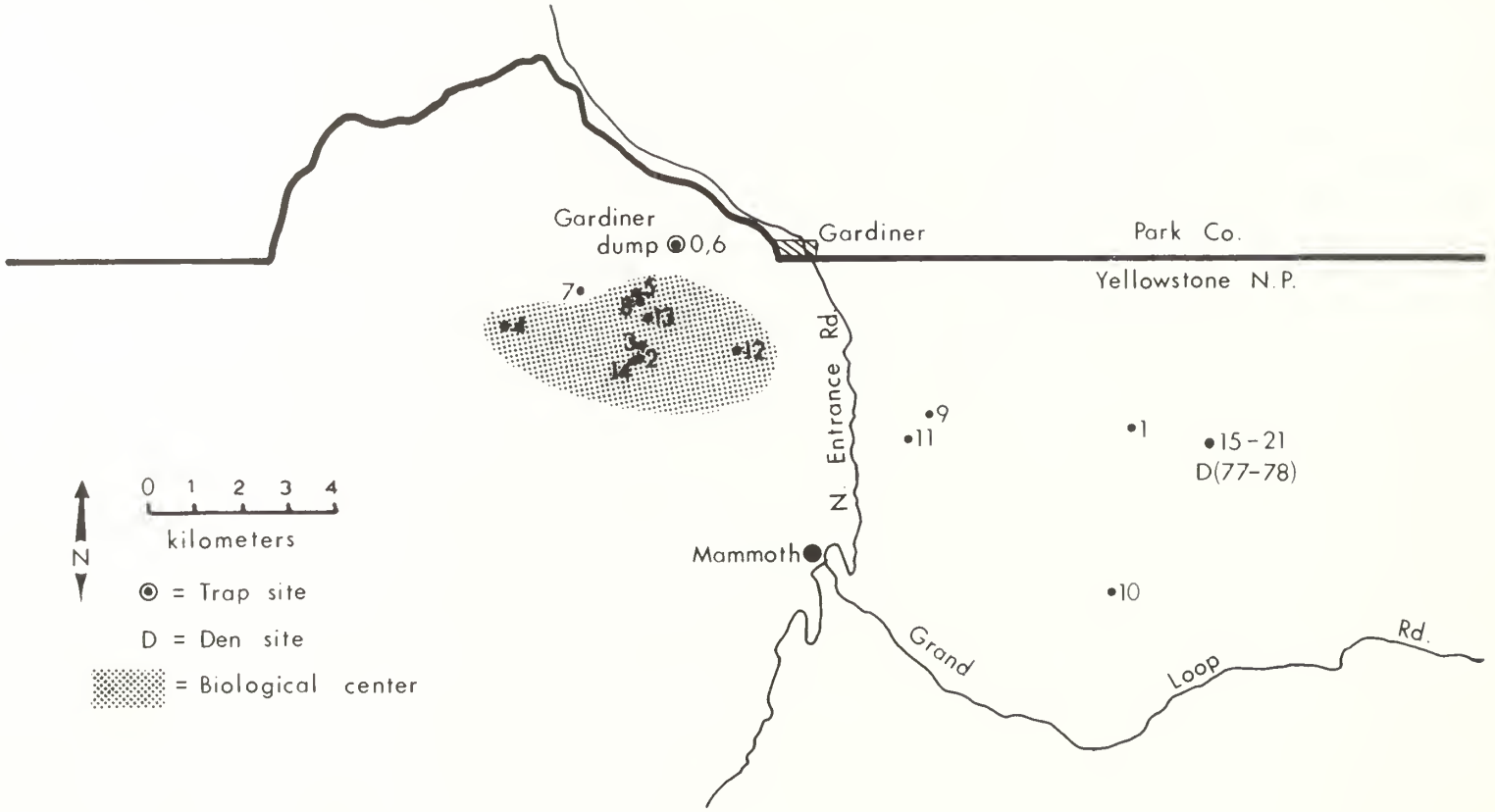

Fig. 26. Movements of grizzly bear No. 26 (adult female with one yearling) during 1977.

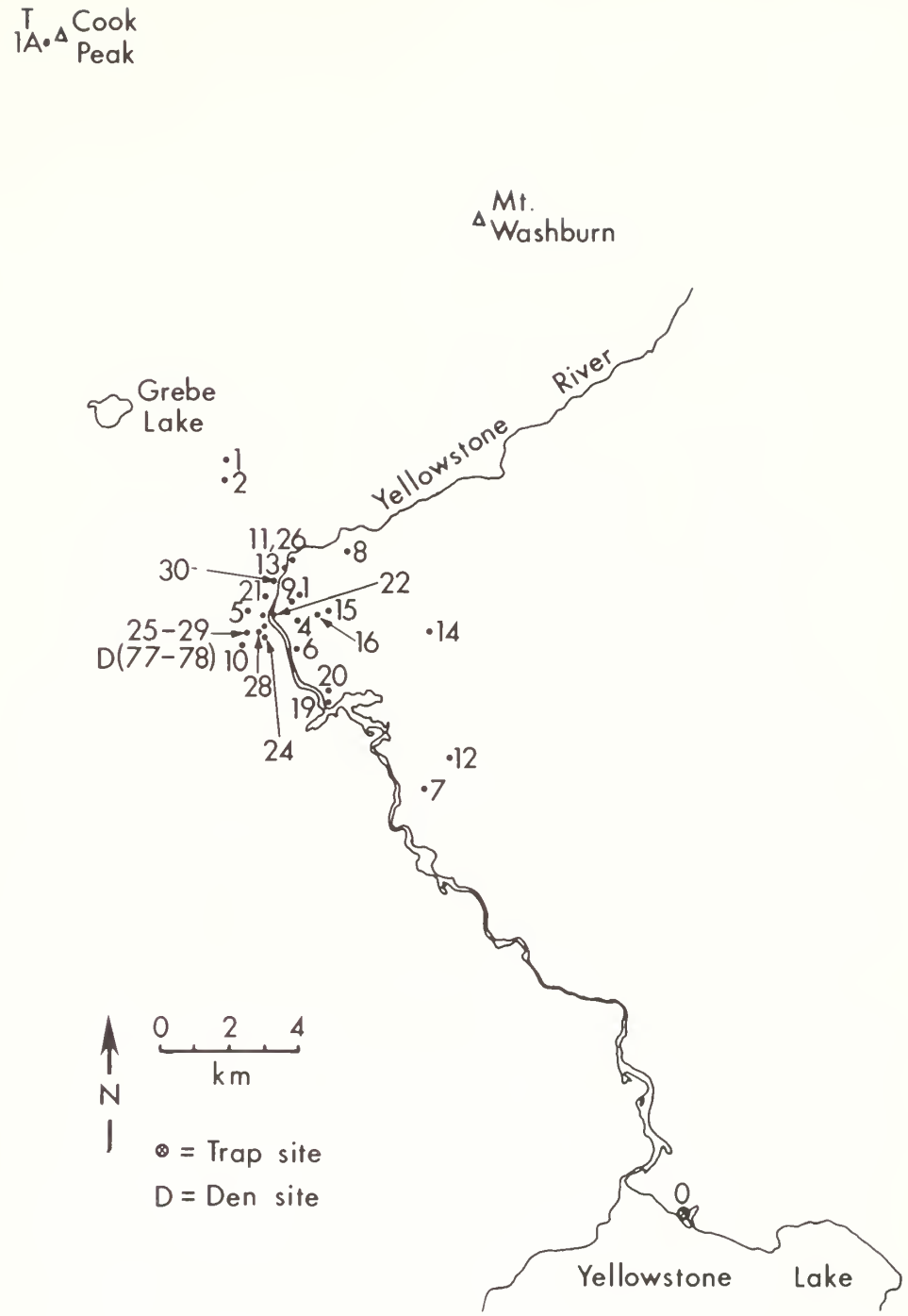

Fig. 27. Movements of grizzly bear No. 29 (juvenile male) during 1977.

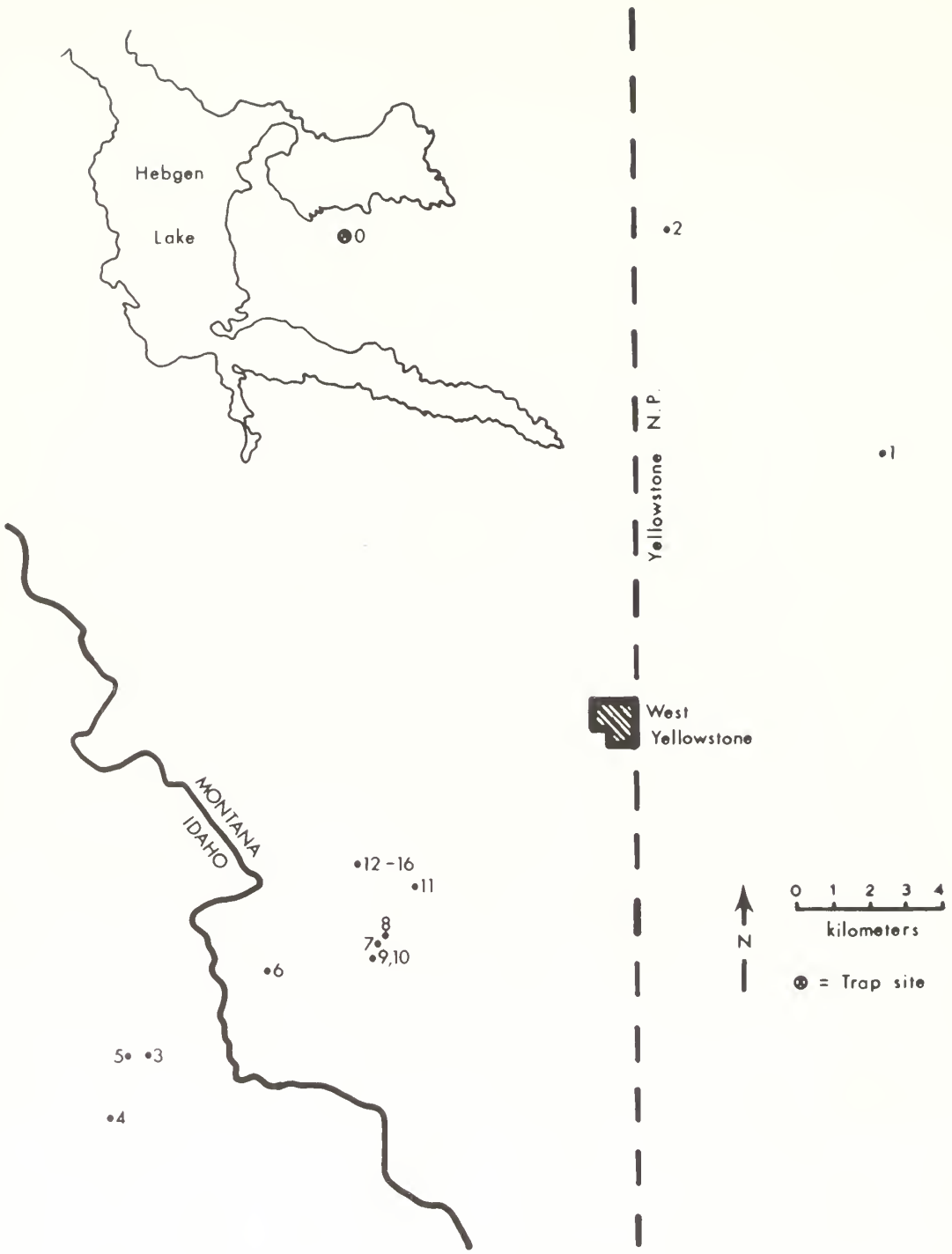

Fig. 28. Movements of grizzly bear No. 30 (juvenile male) during 1977.

Four other bears provided very limited movement data during 1977. Bear 3, an adult female, was first instrumented in 1975 at Crandall, Wyoming, but her radio failed shortly thereafter. She was trapped and reinstrumented on 12 May 1977 at Crandall, Wyoming, and was accompanied by two yearlings when trapped. She was tracked for 35 days in the Sunlight-Little Sulphur Creek area until her radio became stationary. A crew, sent in to pick up the collar, found the collar and a few bones. She had died of unknown causes and her carcass was apparently eaten by her two yearlings.

Bear 10, a 6-year-old female, was tracked in 1976 to the den in the head of Republic Creek. She emerged from the den between 22 and 25 April 1977. Tracks in the snow indicated that she was accompanied by at least one cub. She cast her transmitter near the den site and she was not relocated.

Bear 27, a yearling male and the offspring of bear No. 16, was trapped and instrumented on 13 September 1977 at West Yellowstone. No separate range or movement data will be presented for him as he traveled with his mother, No. 16, the entire season and denned with her.

Bear 28, an adult female with two cubs of the year, was captured with a capture gun as a free-ranging bear on 15 September 1977 at Phelps Pass, Wyoming. She was causing problems at outfitters' camps when captured. She was shot and killed by a hunter on 26 September 1977 while appropriating part of an elk in a hunter's camp. Her two small cubs remained in the area for awhile but their fate is unknown.

Although grizzly bears live a solitary life style, except for females with young and mating pairs, there is considerable overlap in home range areas. Figure 29 shows the composite ranges of two females (6 and 12) that used the area around Yellowstone Lake during 1977. The focal point for both of these bears is the summer spawning run of cutthroat trout on Flat Mountain Arm Creek which bear 6 has used for at least 3 years and bear 12 for 2 years. The rest of the year these two had completely different foraging habits, with bear 6 concentrating on elk and bear 12 grazing and digging around potholes and swampy areas.

Figure 30 shows areas used by two females with young and one yearling male traveling with his mother and sibling during 1977. The focal point for these, which represents six bears, is the area between Grayling and Madison Arms of Hebgen Lake. A great deal of livestock carrion and some private garbage dumps attract bears into this area. Natural foods in the form of ants and mushrooms are commonly associated with lodgepole pine in the area.

Figure 31 shows ranges of two other females with overlapping ranges and a third female whose range overlapped with one other

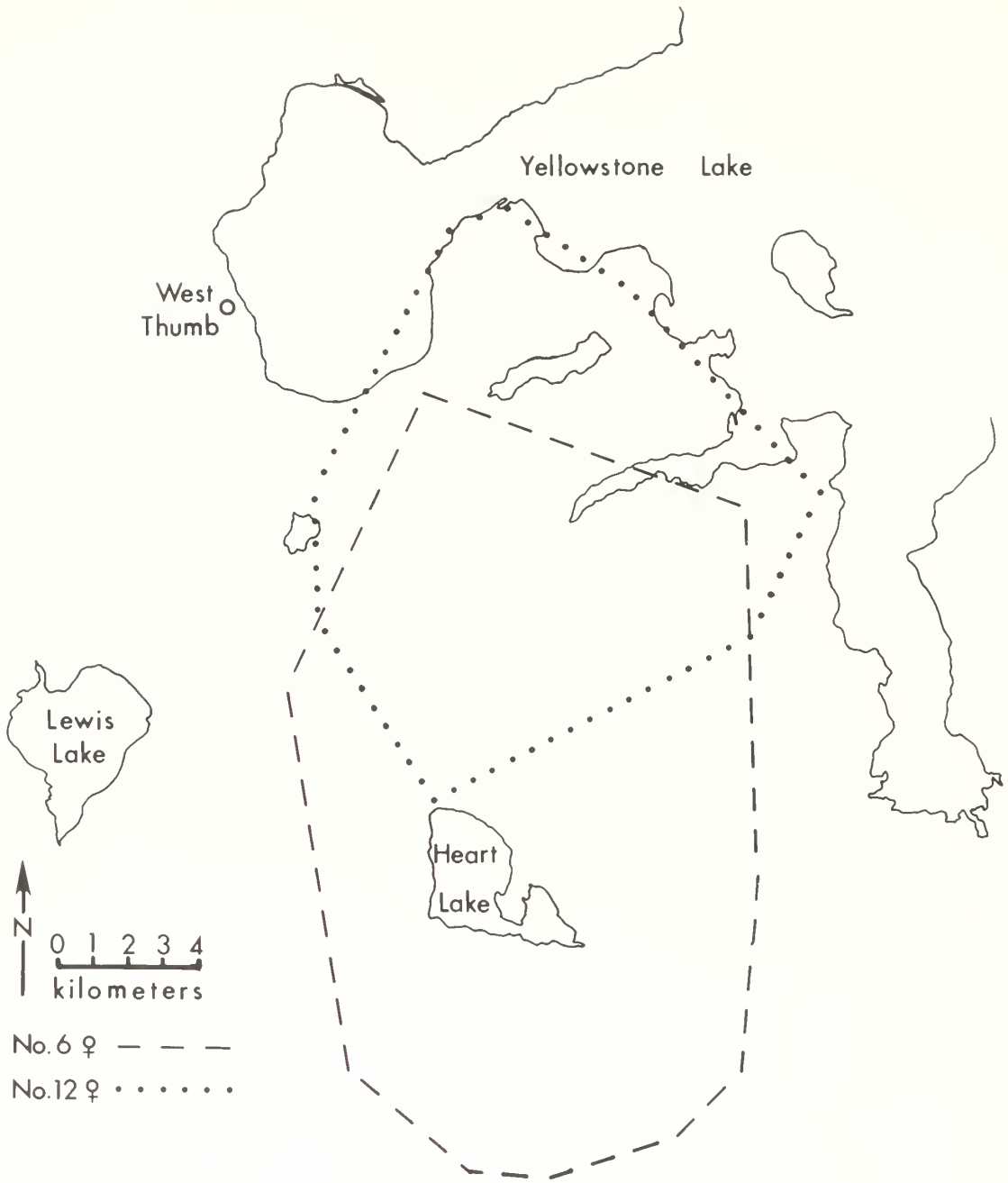

Fig. 29. Composite range areas of two female grizzly bears (No. 6 and No. 12) during 1977.

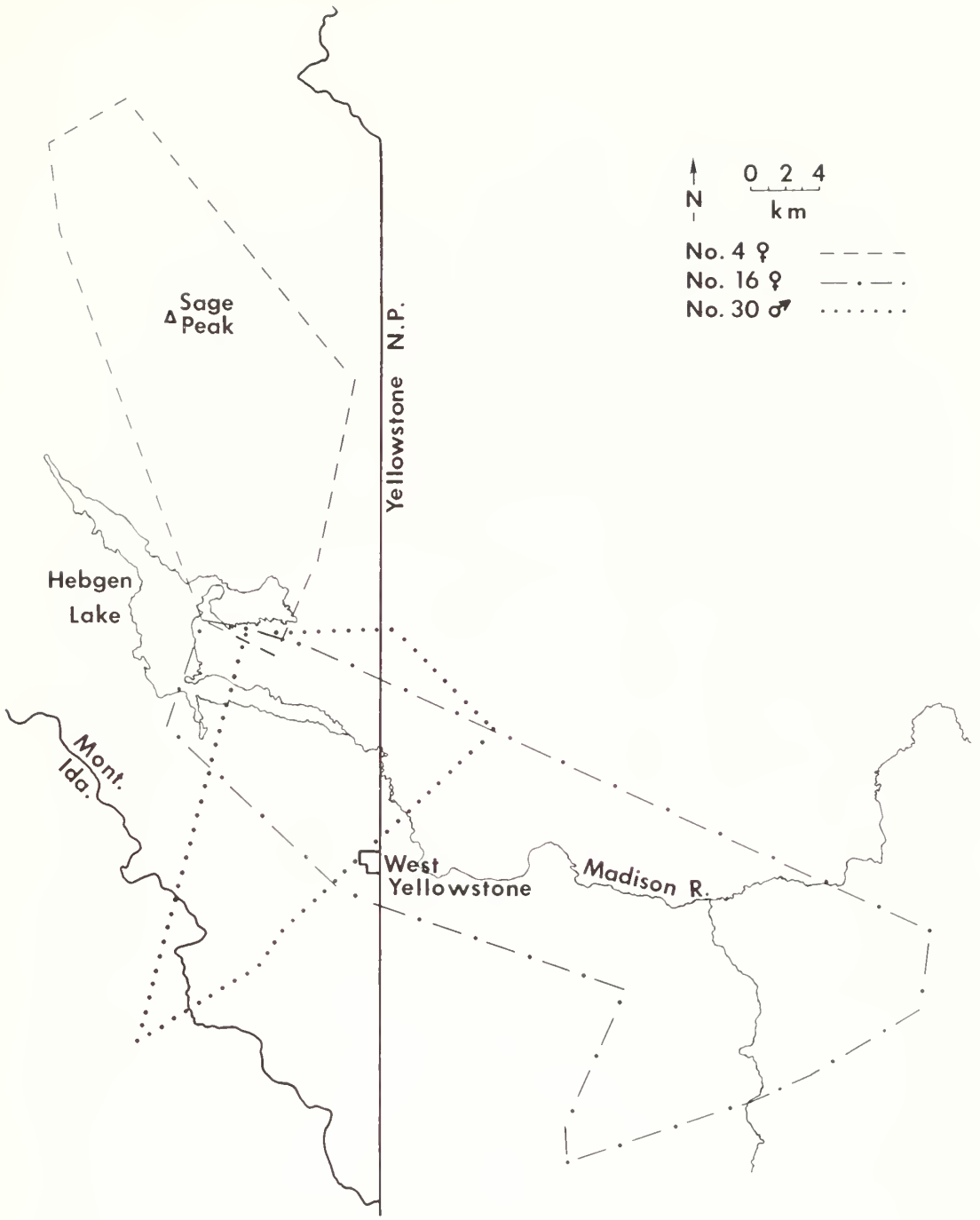

Fig. 30. Composite range areas of two female grizzly bears with young (No. 4 and No. 16) and one yearling male (No. 30) with a sibling and mother during 1977.

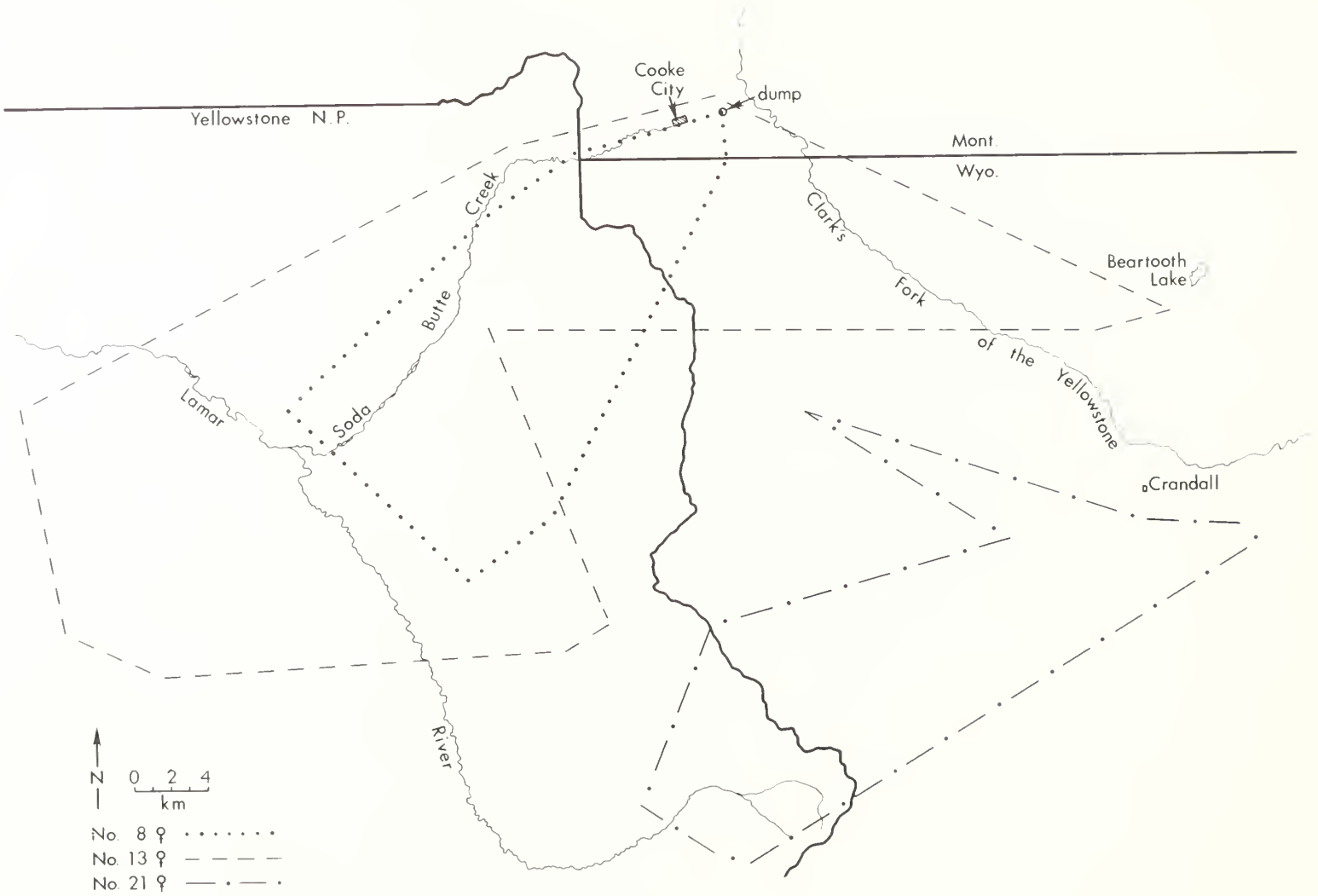

Fig. 31. Composite range areas of three adult female grizzly bears (No. 8, No. 13, and No. 21) during 1977.

instrumented female (not shown) who was only instrumented a short time. Bears 8 and 13 both had single yearlings which they abandoned in early summer of 1977. The major common focal point for these two was the Cooke City dump which they both occasionally used during the summer.

Figure 32 shows overlapping home ranges of four adult males and one young male who did not overlap with any other instrumented bear. Two of these (Nos. 5 and 9) both used the Cooke City dump. Bear 5 used it sporadically and bear 9 almost constantly. Bears 1 and 11 overlapped in the Crandall area at various times during the year. Bear 11 stayed in the general vicinity of Crandall and Sunlight Basin most of the year but moved into Yellowstone Park for the rut where he was sighted in close association with a smaller, presumably female, bear. Bear 1 was trapped during the rut at Crandall and subsequently moved somewhat randomly over his range, also overlapping with bears 9 and 5 in the Cooke City area.

The ranges of three other males (15, 19 and 20) overlapped in the West Yellowstone vicinity (Fig. 33). Like the females using this area (Fig. 30), bears 15 and 20 were associated with carrion and garbage, along with abundant natural foods, in the area. Bear 19 left the area soon after the rut and spent the rest of the summer in central Yellowstone Park. He was transplanted to the southern part of the Park once but returned to his normal area within 3 days.

It is difficult to assess the home range requirements of a grizzly bear. Some of them appear to have a definite home range area, while others seem to move at random. Bears 4, 8, 9, 15, and 16 all seem to have fairly well-defined home range areas, ranging in size from 60 to 230 mi^2. Bears 6 and 12 had small, well-defined home range areas of 62 and 96 mi^2, respectively, in 1977. But bear 6 used 202 mi^2 in 1976; and although bear 12 used only 67 mi^2 in 1976, it was significantly different from her 1977 area. Bear 13 has used a similar area in about the same pattern in 1976 and 1977, but her range area is over twice the size used by bear 8, although No. 13's area almost completely overlaps that of No. 8 and both were females with one yearling.

Bears 5 and 11 appear to have well-defined home ranges during summer and fall with some wider-ranging movements during the rut. Bears 1, 14, and 19 are more erratic in their movements, but we essentially only have 1 year's data on each of them. Bears 1 and 14 appear to have spent the rut within the boundaries of their home range area but made long range movements at times other than the rut. Bear 19 was captured during the rut and was observed in close association with another bear shortly afterward. It is probable that his normal-ranging area is in the central portion of the Park and he was captured during a wide-ranging movement associated with the rut.

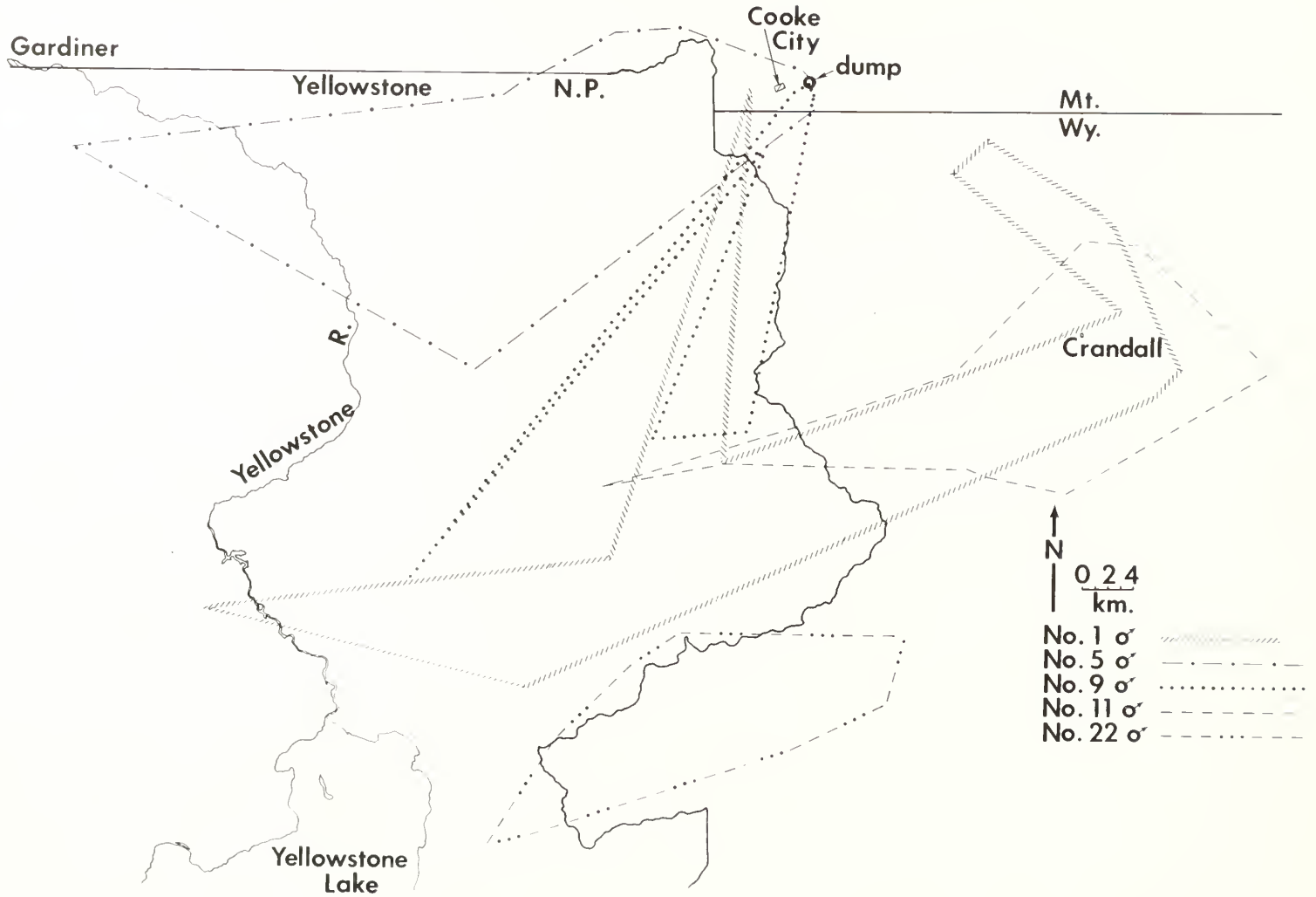

Fig. 32. Composite range areas of four adult male grizzly bears (No.s 1, 5, 9, and 11) and one subadult male (No. 22) during 1977.

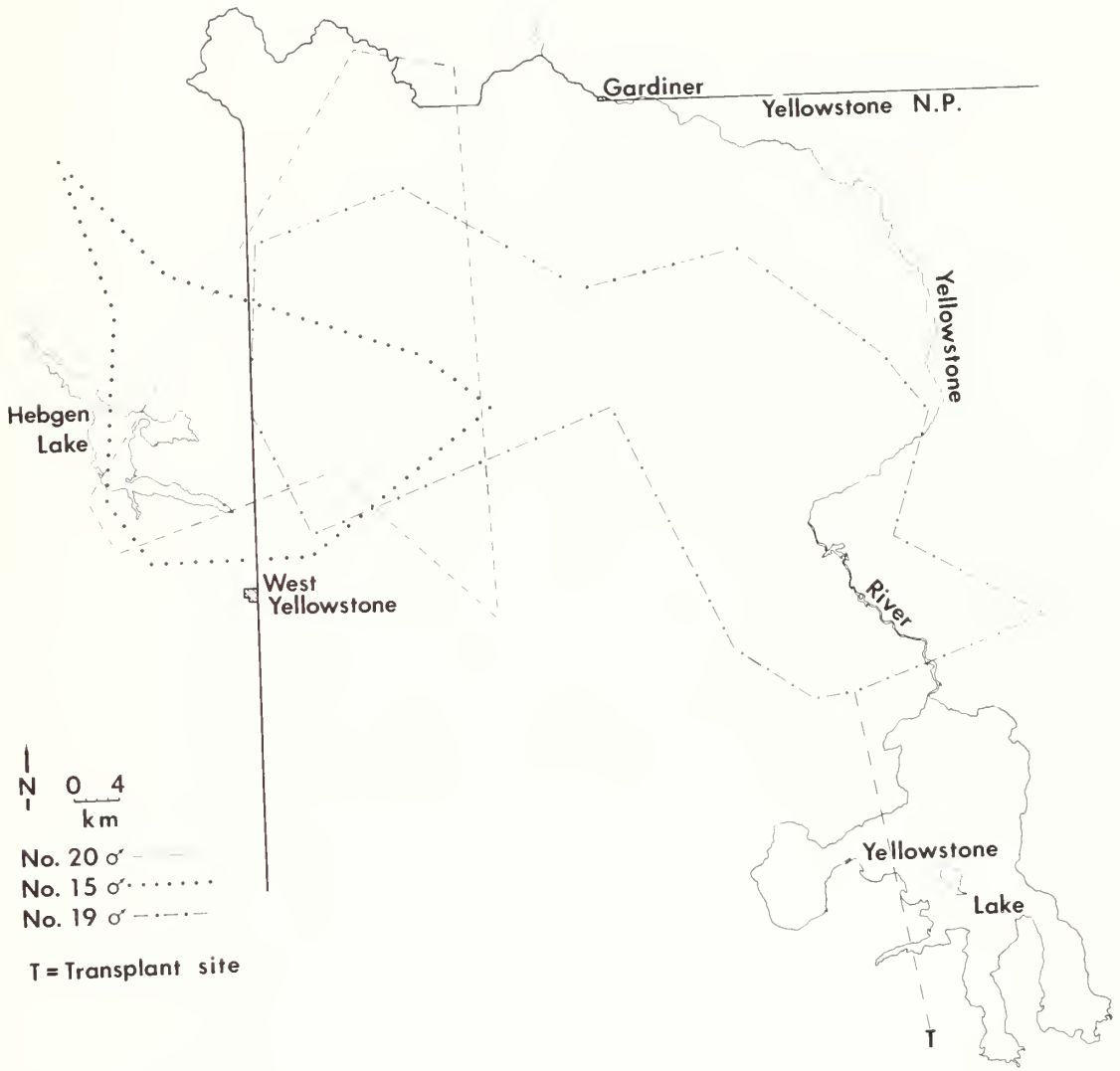

Fig. 33. Composite range areas of three male grizzly bears (Nos 15, 19, and 20) during 1977.

HABITAT UTILIZATION

Food Habits. - Food habits information was taken from two sources: scat collection and analyses, and feeding site examinations. Results are shown in Figures 34 and 35, respectively. Scat analysis represents both black and grizzly bears since in many cases the species of bear depositing the scat was unknown.

The most striking difference in results from the two methods is the sizable contribution of grasses and of miscellaneous items (garbage, pine cone parts, litter, debris, etc.) to scat volume, but their complete absence from feed site analyses. Feed site examinations detect the more obvious and longer lasting evidence of use - digging, torn logs, disturbed middens and ant hills, partially consumed carcasses, etc. Evidence of grass use, on the other hand, easily escapes notice; or, if detected, it is usually in areas with appreciable amounts of fresh ungulate sign, in which case the grazing cannot be attributed with confidence to grizzlies.

Despite these differences, the overall pattern of use of the various food categories was essentially the same under the two methods of determining food habits. And that pattern of use seems to reflect well what we may expect intuitively. Mammals played an appreciable role in the diet of grizzlies in early spring while vegetation was still dormant and largely snow-covered. However, plant materials were not ignored at this time but were taken wherever available, either as standing crop or from caches of small mammals. Plant materials dominated the diet the rest of the year, but insects assumed a major role in the diet in mid-summer. A summary of scat analyses data is shown in Table 5.

Grizzlies consumed meat throughout the year as opportunity permitted. Forty-three instances of grizzly bear use on large mammals were noted in 1977, as shown in Table 6. The 12 instances of feeding on domestic livestock involved 67 animals, 60 of which were killed by bears. The seven instances of cattle use involved 12 head, six of which are believed to have been killed by bears. Four grizzlies were responsible for the 54 sheep killed in three widely separated areas. The one pack horse that was eaten was laden with elk, tethered, and unattended for several days. It is not known if the bear killed the horse or happened upon the carcass.

Except in one instance involving two elk, all incidents of grizzly feeding on wild animals were on lone carcasses. Grizzlies killed five elk in four of the noted incidents and took hunter-killed elk from camps in two other incidents. One deer was taken from a hunting camp. Carrion use is thought to have occurred in all other instances.

Day Beds. - Specific data were collected on grizzly bear day beds during 1977. Sixty-four day beds were found and measured. All but one

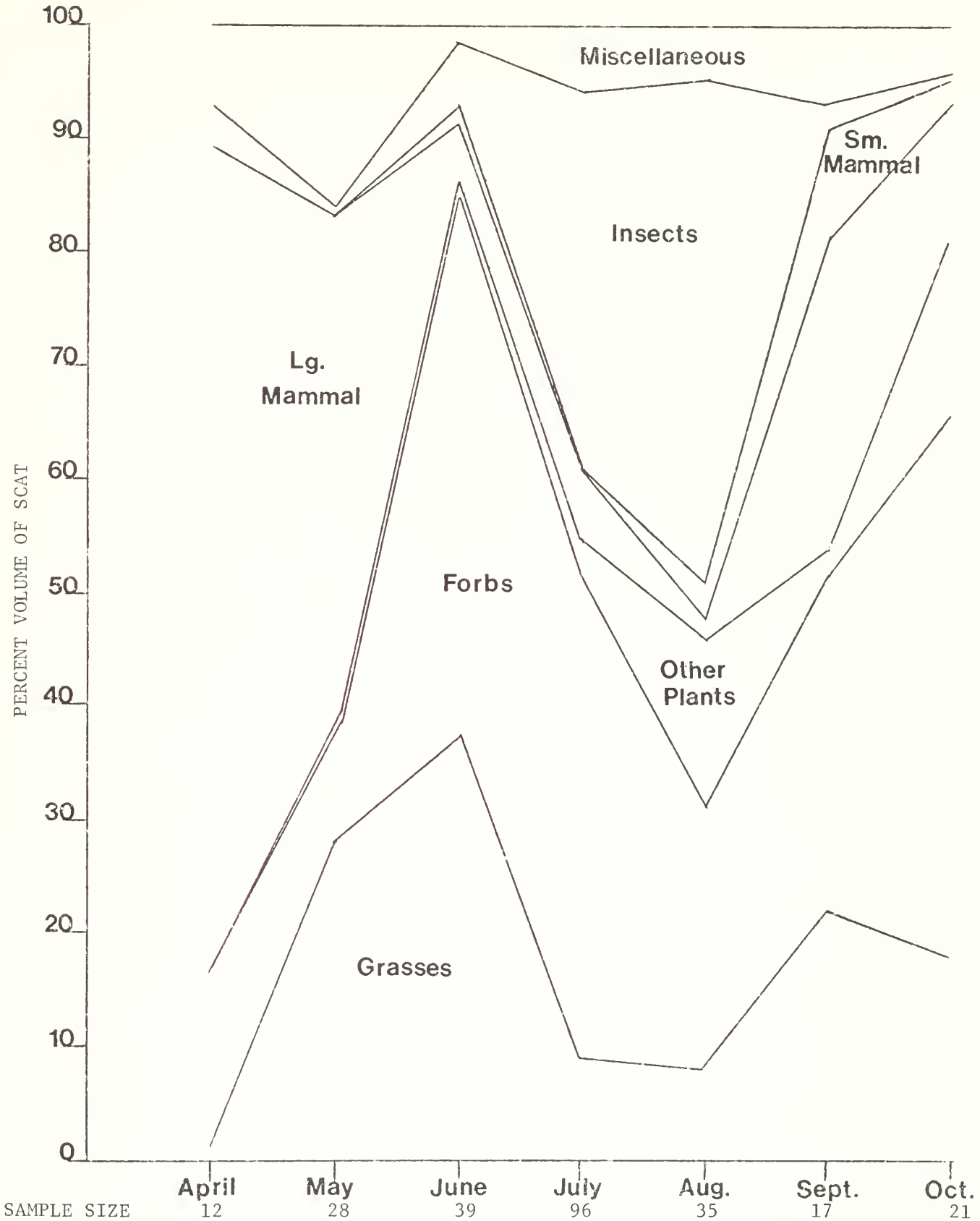

Fig. 34. Monthly distribution of food consumption by grizzly bears as determined from scat analysis.

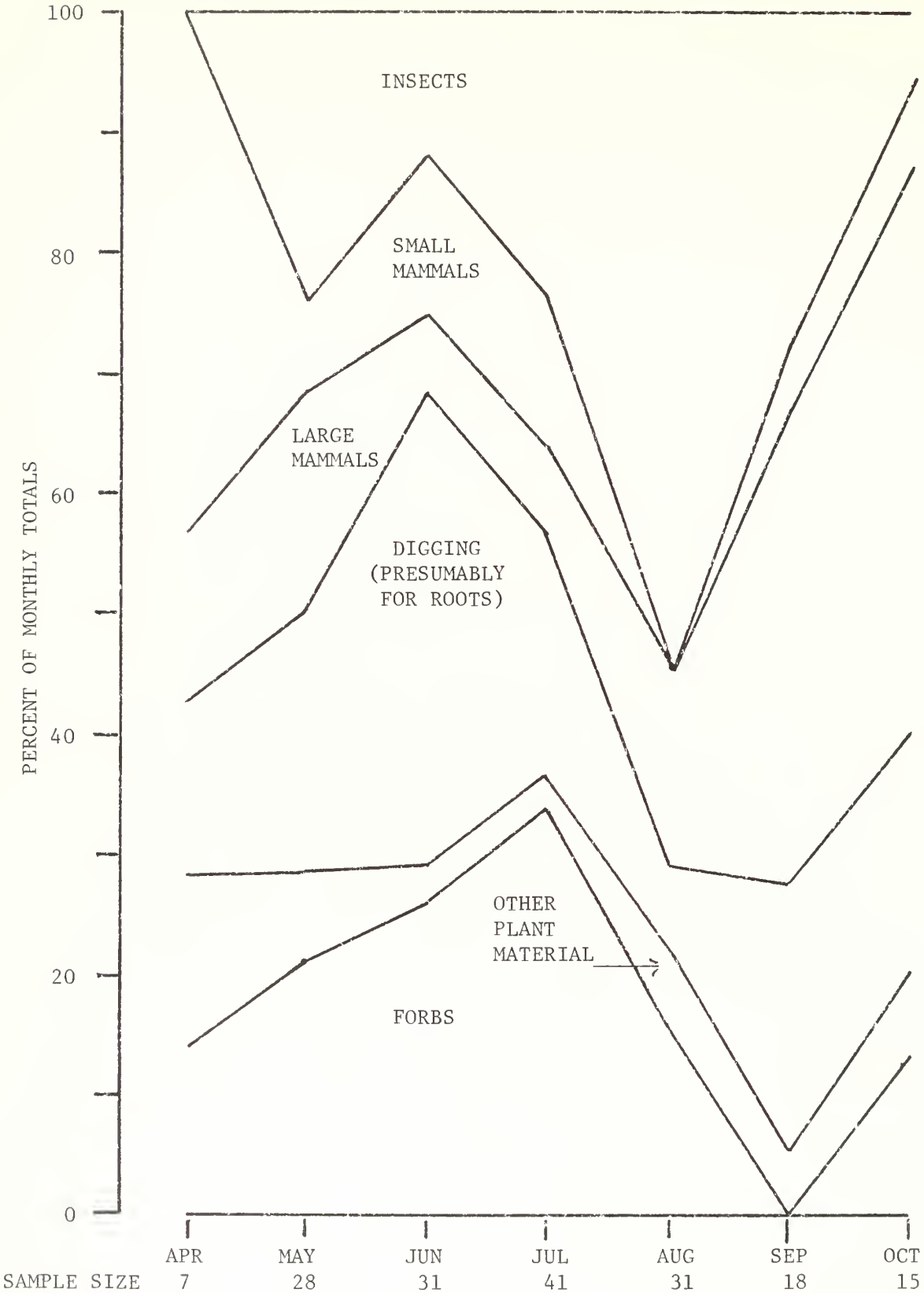

Fig. 35. Monthly distribution of feeding activities of grizzly bears as determined by examination of feeding sites.

Table 5. Analysis of 474 bear scats gathered in 1977

Food Item	Frequency (%)	Volume (%)
Trees		
Pine nuts (*Pinus albicaulis*) (*Pinus flexilis*)	.06	2.26
Populus tremuloides	.02	.03
Wood (cambium)	T	.04
Trees total	.09	2.34
Shrubs		
Arctostaphylos uva-ursi	.02	.43
Betula	T	.01
Crataegus douglasii	.01	.64
Juniperus communis	T	T
Linnaea borealis	.01	.04
Lonicera spp.	T	.07
Purshia tridentata	T	.07
Ribes spp.	.01	.45
Ribes setosum	T	.07
Rosa spp.	T	.02
Rosa spp. (Rose hips)	T	.11
Rubus spp.	T	.01
Salix spp.	T	T
Shepherdia canadensis	.02	.62
Symphoricarpos spp.	T	.01
Vaccinium spp.	.04	1.42
Vaccinium globulare	T	.03
Vaccinium scoparium	.06	1.16
Shrubs total	.15	4.31
Grasses		
Agropyron spicatum	T	.09
Avena spp.	T	.02
Avena sativa	T	.22
Bromus spp.	T	.02
Grass	.26	6.48
Grass/Sedge	.13	9.83
Melica spp.	.06	1.87
Melica spectabilis	.02	.61
Poa spp.	.04	.74
Triticum spp.	T	.02
Grass-like plants		
Carex spp.	.07	1.60
Sedge	T	.04
Grass and grass-like total	.57	21.54

Table 5. Analysis of 474 bear scats gathered in 1977 (continued)

Food Item	Frequency (%)	Volume (%)
Forbs		
Achillea spp.	.01	.01
Boraginaceae	T	T
Brassica spp.	.01	.12
Chrysopsis villosa	T	.01
Cirsium spp.	.17	5.09
Cirsium arvense	T	.04
Claytonia lanceolata	T	.03
Composite	.02	.59
Epilobium spp.	.06	1.26
Epilobium angustifolium	.01	.15
Equisetum spp.	.16	6.43
Equisetum arvense	.01	.19
Forb (unidentified)	.06	1.03
Fragaria spp.	.01	.29
Fragaria virginiana	.02	.11
Geranium spp.	.01	T
Helianthus spp.	T	T
Helianthus annuus	T	T
Legume	T	T
Lomatium spp.	.18	6.32
Lomatium dissectum	T	.07
Penstemon spp.	T	.02
Perideridia gairdneri	.11	5.52
Polygonum spp.	.08	1.87
Polygonum bistortoides	T	.07
Polygonum douglasii	.01	.08
Potamogeton spp.	.03	1.97
Potentilla spp.	.01	.01
Ranunculus spp.	T	.12
Solidago spp.	T	T
Sonchus spp.	T	.08
Streptopus amplexifolius	T	.10
Taraxacum spp.	.02	.51
Taraxacum officinale	.02	.99
Thalictrum spp.	T	.02
Trifolium spp.	.03	1.64
Umbelliferae	.03	1.52
Xerophyllum tenax	T	T
Forbs total	.64	36.25

Table 5. Analysis of 474 bear scats gathered in 1977 (continued)

Food Item	Frequency (%)	Volume (%)
Unidentified Plant Material		
Algae	T	.14
Corm	.01	.05
Flower	T	.01
Fruit	T	T
Moss	.02	.05
Moss (musci)	T	.09
Mushroom	T	.02
Root/Tuber	.02	.07
Seed	T	.01
Unidentified Plant Material total	.06	.44
Large Mammals		
Unidentified Bovidae	T	.04
Bison	.03	3.13
Cattle	.01	.45
Unidentified Cervidae	.01	.46
Deer	T	.01
Elk	.06	5.16
Moose	T	.07
Black bear	T	.21
Grizzly bear	.01	.66
Other unidentified meat	.02	1.28
Large mammal total	.15	11.46
Small Mammals		
Erethizon dorsatum quills	T	.01
Eutamias spp.	T	.11
Marmota spp.	T	.02
Microtus spp.	.01	.24
Thomomys spp.	.01	.84
Unidentified rodent	.02	1.44
Small mammals total	.05	2.65
Insects		
Ants	.38	15.08
Bees	.01	.01
Grasshoppers	T	.05
Maggots	T	.04
Insects total	.40	15.10

Table 5. Analysis of 474 bear scats gathered in 1977 (continued)

Food Item	Frequency (%)	Volume (%)
Miscellaneous		
Debris	.07	2.29
Garbage	.04	2.40
Grouse	T	.11
Pine cone core	T	T
Pine needles	T	T
Pinus contorta litter	T	T
Snail shells	T	T
Unidentified bone	T	.07
Unidentified feather	T	.04
Unidentified hair	T	T
Miscellaneous total	.12	4.92

Table 6. Incidents of large mammal use by grizzly bears, 1977

Species	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Sub-total
Elk	1			1		5	3	1	11
Moose		1	1		1			1	4
Bison		2				1	2		5
Bear		1	1				1		3
Horse							1		1
Cattle				1	3	2		1	7
Domestic sheep					2	2			4
Deer							1		1
Outfitter baits		1	1				4		6
Unknown				1					1
Subtotal	1	5	3	3	6	10	12	3	43

were located in timbered areas (Table 7). It appears that grizzly bears do not construct day beds on any regular basis. They may use a rather localized area for several days and not construct any. Conversely, at times they may construct several day beds in a few days or may use the same bed more than once. Day bed construction varies from a shallow depression scooped out of the duff to relatively deep depressions dug in the dirt or snow.

Table 7. Vegetative data for 64 grizzly bear day beds, 1977 (Grouped by overstory vegetation)

Overstory Vegetation	No. of Beds	Percent by Type
LPP	27	42.2
AF-ES	7	10.9
DF	5	7.8
AF-LPP	4	6.3
DF-LPP	4	6.3
AF-ES-LPP	3	4.7
ES	3	4.7
Combination[1/]	10	15.6
No tree cover	1	1.5
Total	64	100

1/ This is a combination of categories made up of the above species, plus some containing WBP, that comprise less than 4 percent of the beds in each type.

Day beds were located on most all aspects and at elevations that ranged from 6500 to 8400 feet (Tables 8 and 9). Fifty-five day beds, 85.9 percent, were located within 1 m or less of a tree. For 62.5 percent of these beds it was estimated that at least 10 percent of the bear would have been visible from distances of 10 to 50 m (Table 10).

Denning Data . - Ten radioed grizzly bears were tracked to their dens in the fall of 1976. Denning dates ranged from 5 October to 22 November (Table 11). Nine of these dens were examined and measured in 1977. One den, used by an unmarked grizzly bear in 1976-77, was located and measured. Six old dens used by grizzly bears prior to the 1976-77 winter were also located and examined.

Most of the dens were located in subalpine fir-whitebark pine habitat types (Table 12). All dens were on hillsides of varying steepness; slopes ranged from 20 to 75 degrees (Table 13). All aspects were represented with dens facing in all directions. This differs somewhat from data presented by Craighead and Craighead (1972) where all but one of the dens they examined were on north slopes and faced north. Den site elevations ranged from 6640 to 9520 feet. Measurements of individual dens are presented in Table 14.

Fourteen of the 16 dens examined in 1977 were dug by the bears. Two were in natural cavities, one in a natural cave, and one in a hollow tree. Craighead and Craighead (1972) reported that grizzly bears in the Yellowstone system did not use natural shelters as dens. This conclusion may have been due to their small sample size.

Table 8. Topographic features where grizzly bear day beds were located, 1977 season

Elevation			Aspect			Slope			Topography		
Ft x100	No.	%		No.	%	%	No.	%		No.	%
65-69	24	37.5	N	14	21.9	0-10	49	76.5	Flat	17	26.5
70-74	9	14.0	S	3	4.7	11-20	5	7.8	Lower slope	4	6.3
75-79	25	39.1	E	4	6.3	21-30	3	4.7	Mid-slope	19	29.7
80-84	6	9.4	W	4	6.3	31-40	-	-	Upper slope	2	3.1
			NE	16	25.0	41-50	1	1.6	Ridge top	8	12.5
			NW	-	-	51-60	2	3.1	Knoll top	6	9.4
			SE	7	10.9	Unk.	4	6.3	Plateau	1	1.6
			SW	2	3.1				Swale	7	10.9
			Flat	12	18.7						
			Unk.	2	3.1						

Table 9. Grizzly bear day bed data, 1977
(Elevation and aspect, by month)

Month	Elev	No.	Aspect	No. beds	Month	Elev	No.	Aspect	No. beds
May	7700	2	SW	2	Oct	6800	4	NE	4
	8400	1	Unk.	1		7400	3	N	3
		3		3			7		7
June	8000	1	NE	1	Nov	7600	2	SE	3
		1		1		7700	1		
							3		3
July	6600	4	Flat	4					
	7700	1	NE	4	Fall*	6600	1	Flat	1
	7800	3				6700	3	W	3
	7900	4	N	4		7400	1	S	1
		12		12			5		5
Aug	7400	1	SE	1	Spring*	7400	2	N	2
	7800	1	NE	1		7600	2	SE	2
	8200	1	Flat	1			4		4
		3		3					
					1977	6600	3	Flat	4
Sep	6500	2	Flat	2	Season*	6700	2	N	2
	6600	2	N	3		7200	1	NE	2
	6700	3	E	2		7700	1	E	2
	7400	1	W	1		7800	3	S	2
	7500	1	NE	4		8000	2	SE	1
	7800	4	Unk.	1		8300	1		
		13		13			13		13

* Unable to classify as to month.

Table 10. Grizzly bear day bed measurements, 1977 season

Bed Measurements (cm)								
Length	No. of beds	% of total	Width	No. of beds	% of total	Depth	No. of beds	% of total
25.5 - 50	10	15.6	0 - 25	1	1.6	0 - 5	3	4.7
50.5 - 75	24	37.5	25.5 - 50	8	12.5	5.5 - 10	23	35.9
75.5 - 100	18	28.1	50.5 - 75	34	53.1	10.5 - 15	10	15.6
100.5 - 125	6	9.4	75.5 - 100	16	25.0	15.5 - 20	8	12.5
125.5 - 150	4	6.3	100.5 - 125	2	3.1	20.5 - 25	9	14.0
225.5 - 250	0	-	125.5 - 150	0	-	25.5 - 30	3	4.7
Unk.	2	3.1	225.5 - 250	1	1.6	30.5 - 35	2	3.1
			Unk.	2	3.1	> 35.5	6	9.5

			Dist. to nearest tree			Estimated visibility		
Bed material	No. of beds	% of total	(m)	No. of beds	% of total	10% of bear visible at (m)	No. of beds	% of total
Pine needles	10	15.6	0 - 1	55	85.9	0 - 5	7	10.9
			1.5 - 5	8	12.5	5.5 - 10	8	12.5
Duff	26	40.6	Unk	1	1.6	10.5 - 20	13	20.3
Grass	1	1.6				20.5 - 30	14	21.9
Torn log & duff	1	1.6				30.5 - 40	1	1.6
						40.5 - 50	12	18.7
None	22	34.3				50.5 +	3	4.7
Unk.	4	6.3				250	1	1.6
						Unk.	5	7.8

Table 11. Grizzly bear fall denning and spring emergence dates for winters of 1976-77 and 1975-76

Bear No.	1976-77 Winter			1975-76 Winter		
	Fall den date 1/	Spring emergence date	Approx. No. days in den	Fall den date 1/	Spring emergence date	Approx. No. days in den
4	29 Oct	7-16 Apr	161	22 Dec	4-6 Apr	104
5	3 Nov	30 Mar to 5 Apr	148	14 Nov	3-6 Apr	141
6	22 Nov	7-16 Apr	137	-	-	-
8	After 18 Nov	Prior to 16 Apr	140 to 150	22 Nov	10-19 Apr	140
9	5 Nov	-	-	-	-	-
10	5 Oct	22-25 Apr	200	14 Nov	-	-
11	20 Oct	2-4 Apr	165	-	-	-
12	3 Nov	7-16 Apr	156	-	-	-
13	5 Nov	16 Apr	163	-	-	-
15	8 Nov	Prior to 31 Jan	100	-	-	-
16	11 Nov	Prior to 16 Apr	149+	-	-	-
27	11 Nov	Prior to 16 Apr	149+	-	-	-

1/ Bear was known to have been in or at den on this date, although in some cases may have denned a day or so earlier.

Table 12. Habitat types and vegetation data for 10 grizzly bear den sites, 1976-77 winter (plus 6 dens from previous years)

Bear No.	Sex	Habitat type	Overstory: Major overstory sps	Overstory: Total cover class	Overstory: Density stems/A	Overstory: Avg DBH (in)	Overstory: Avg height (ft)	Understory: Major sps	Understory: Total cover class
4	F	ABLA-PIAL/Hts	ABLA-PIAL-PIEN	4	30	8	30	VASC-THOX	5
5	M	ABLA-PIAL/Hts	PIAL-PIEN	-	-	-	-	ERGR-PCMI-THAL	-
6	F	ABLA-PIAL/Hts	ABLA-PIAL	5	-	6	15	CARU-Arnica-VASC	6
10	F	ABLA-PIAL/Hts	ABLA-PIAL	7	-	8	20	Moss-VASC	2
11	M	ABLA-PIAL/Hts	ABLA-PIAL	5	-	8	35	CARU-VASC	3
12	F	ABLA-PIAL/Hts	PICO-ABLA-PIAL	4	140	-	30	VASC-CARU	6
13	F	PIEN/SEST	PSME-PIEN	7	150	7	50	Pyrola-CARU	3
15	M	ABLA/VASC/ CARU Phase	PIEN-ABLA-PICO	4	60	4	26	VASC-CARU-ARCO	2
16	F	ABLA/VASC	PICO-ABLA	4	60	6	50	VASC-PICO-CARU	5
JK2	Unk	ABLA-PIAL/Hts	ABLA-PIAL	3	30	10	25	CARU-Carex-BASA	6
			Old dens used prior to 1976-77 but located in 1977						
JK1	Unk	PIAL-ABLA/Hts	PIAL-ABLA	3	150	10	30	VASC-CARU-VAME	4
JK3	Unk	PIAL-ABLA/Hts	ABLA-PIAL	3	30	10	25	CARU-Carex-BASA	6
JK4	Unk	ABLA-PIAL/Hts	ABLA-PIAL	5	-	6	15	CARU-VASC-Arnica	6
B1-W	Unk	ABLA-PIAL/Hts	PIAL-ABLA	3	Alone	13	40	CAGE-LUAR-RIMO	5
B-E	Unk	ABLA/CAGE/ PSME Phase	PIEN-PSME-ABLA	4	35	11	65	RONU-THUE-SPBE	4
B-D	Unk	PIAL/VASC/ PICO Phase	PICO-JUCO	3	7	12	45	ARUR-VASC-Lupine	3

Table 13. Topographic data for 10 grizzly bear dens, 1976-77 winter (plus 6 dens from previous years)

Bear No.	Sex	Age	Den site topography	Aspect	Slope (°)	Elev (ft)	Soil type	Den construction and history
4	F	5	Side of gully	NW	25	8720	Clay loam (soft)	Dug under alpine fir partially caved in; new; female w/1 cub
5	M	9	Steep slope	NW	-	8500	Conglomerate rock	Natural cave used 2 years in a row
6	F	7	Bottom 1/3 steep slope	S	40	8440	Duff & small rock	In hollow WB pine base; appears to have been used many years as a den
10	F	6	Steep hillside	W	50	9520	Sandy loam w/gravel	Dug under large WBP; L-shaped, large and new
11	M	7	Ridge top on steep slope	N	35	9200	Loamy	Dug under large WBP; new
12	F	Ad	Broken slope	ESE	40	7960	Sandy loam	Dug under small WBP; new; F w/2 cubs
13	F	8	Steep slope	E	35	6640	Clay loam with a little rock	Dug into hill; new; F w/1 yr
15	M	6	On small ridge slope	NE	40	7680	Clay loam	Dug under deadfall; new
16	F	11	Midslope	N	45	7680	Sandy to clay	Dug into old caved-in den; new but caved in; F w/2 yearlings
JK2	Unk	-	Slope lower 1/3	WSW	30	8700	Rocky silt	Dug under root of WBP; used at least 2 yr
			Old dens used prior to 1976-77 but located in 1977					
JK1	Unk	-	In gully, steep midslope	SW	40	8800	Rocky silt	Dug under large WBP; 1 to 3 yrs old
JK3	Unk	-	Slope lower 1/3	S	35	8700	Rocky silt	Dug into slope; very old and collapsed
JK4	Unk	-	Steep slope	SW	40	8440	Rocky silt	Dug into slope; very old and collapsed
Bl-W	Unk	-	Upper slope, just below tree line	S	55	9600	Rocky silt	Dug under AF roots; 2+ yrs old; partially collapsed
BE	Unk	-	Slope just under ridge-line	N	75	7600	Gravelly loam	Dug under roots of deadfall; 2+ yrs old
BD	Unk	-	Slope just below crest	N	20	7400	Igneous sand	Dug in slope; old; may have been abandoned before completion

Table 14. Den measurements for 10 grizzly bears, winter 1976-77 (plus 6 from previous years)
(All measurements in cm)

Bear No.	Sex	Entrance Heighth	Entrance Width	Tunnel Heighth	Tunnel Width	Tunnel Length	Chamber Heighth	Chamber Width	Chamber Depth	Total length of den	Bed Width	Bed Breadth	Distance of bed from ceiling Front	Distance of bed from ceiling Back	Distance of bed from ceiling Center	Depth bed materials at center	Bed material	No. of bears used by
4	F	65	77	66	78	104	78	115	108	212	Roof partially collapsed		-	-	-	-	None	F & 1 cub
5	M	57	135	97+	-	433	124	157	567	1,000	Measured in 1976 Not meas. in 1977		-	-	-	-	-	1
6	F	42 Fr 30 Bk	33 Fr 30 Bk	42 Fr 50 Bk	33 Fr 30 Bk	35 Fr 56 Bk	305	90	140	175	70	178	-	-	-	31	Dried CARU and rotten wood	1
10	F	75	70	79	109	169	107	160	176	345	121	110	90	69	103	5	ABLA boughs and rotten wood	1 (+) ?
11	M	23	46	50	154	130	120	240	159	289	99	83	75	100	99	-	Very little PICO boughs	1
12	F	66	70	60	102	112	115	150	148	215	127	98	70	70	91	11	Dry VASC & CARU & PICO twigs	F & 2 cub
13	F	55	72	55	84	61	125	137	154	215	137	154	92	69	113	9	PIEN & PSME tailings and needles	F & 1 yr
15	M	56	73	66	95	123	72	155	220	370	96	117	-	-	-	4	ABLA - grass & Equisetum	1
16	F	-	66	-	119	109	-	155	145	294	Partially collapsed		-	-	-	-	-	F & 2 yr
UK2	Unk	63	65	60	99	55	132	196	132	187	140	107	84	99	122	6	Dry CARU w/some PIAL boughs	-
Average		56	64	60	97	100	107	155	154	256	113	121	-	-	-	-		
Old dens used prior to 1976-77 but located in 1977																		
UK1	Unk	66	66	Collapsed			-	-	-	130*	-	-	-	-	-	-	-	-
UK3	Unk	Collapsed		-	-	-	-	90*	-	120*	-	-	-	-	-	-	-	-
UK4	Unk	Collapsed		-	-	-	-	90*	-	100*	-	-	-	-	-	-	-	-
B1-W	Unk	67	75	65	160	88	46	145	180	188	Covered by roof sloughing					-	-	-
B-L	Unk	83	55	38	41	145	70	70	76	204	70	57	35	25	70	-	Bark, twigs, rotten wood	-
B-D	Unk	50	69	61	58	160	Collapsed			160	-	-	-	-	-	-	-	-

* Approximate measurements.

Time spent in the dens averaged about 140 days for 26 grizzly bears over the 3-year period, fall 1975 through spring 1978. Individual grizzly bears ranged from 81 to 200 days in the den.

Grizzly bear No. 4, an adult female, was in or at her den in upper Tepee Basin in Montana by 29 October 1976. There was a general lack of snow throughout the area in the 1976-77 winter. Her den did not snow shut until between 31 January and 7 February 1977. She was sighted out of her den on 22 December 1976 but was only a few feet from it. She was in the den on 28 December, and it did not appear that she had left the area.

She emerged from the den between 7-16 April 1977. She had one cub of the year with her. There were 3+ feet of snow remaining at the time. She stayed in the area and was in and out of the den for about 17 days after emergence. We do not know what, if anything, she was feeding on during this time. She left the den area about 9 May. Her radio failed in late summer, so no denning data for 1977-78 were obtained.

Grizzly bear No. 5, an adult male, was in his den on Plateau Creek in Yellowstone Park by 3 November 1976. Tracks in the snow indicated that he was in and out at least through 22 November. His den remained open into December but was snowed shut by 28 December. This den was in a natural cave in a conglomerate rock formation, and this was the second year in a row that we know he used it for his den.

Tracks indicated that he opened his den just a day or so prior to 30 March 1977, but was in it on 30 March. He left the den between then and 5 April. This is the same time he emerged from the den in the spring of 1976. He was still fairly lethargic when sighted 5 April 1977.

In the fall of 1977 he changed denning areas. Instead of returning to Plateau Creek, he moved into the Lost Creek drainage north of Cutoff Mountain and about 8 airline miles northeast of his previous den. He denned between 3-11 November 1977. This is essentially the same time period as the two previous falls. The area was snow covered and there were no tracks by 11 November.

He emerged a few days earlier in 1978 than previously, coming out between 28 and 31 March 1978.

Grizzly bear No. 6, an adult female, was in or at her den by 22 November 1976. She denned high in the head of Basin Creek, southwest of Heart Lake in Yellowstone Park. The den was in the hollow base of a large whitebark pine (Fig. 36). The heart of the tree had rotted out for more than 10 feet up. The tree was about 50 feet high and approximately 3.5 feet DBH. Some claw marks on the live roots were growing over, indicating that this tree had a long history as a bear den. Six other grizzly bear dens were located within a few hundred

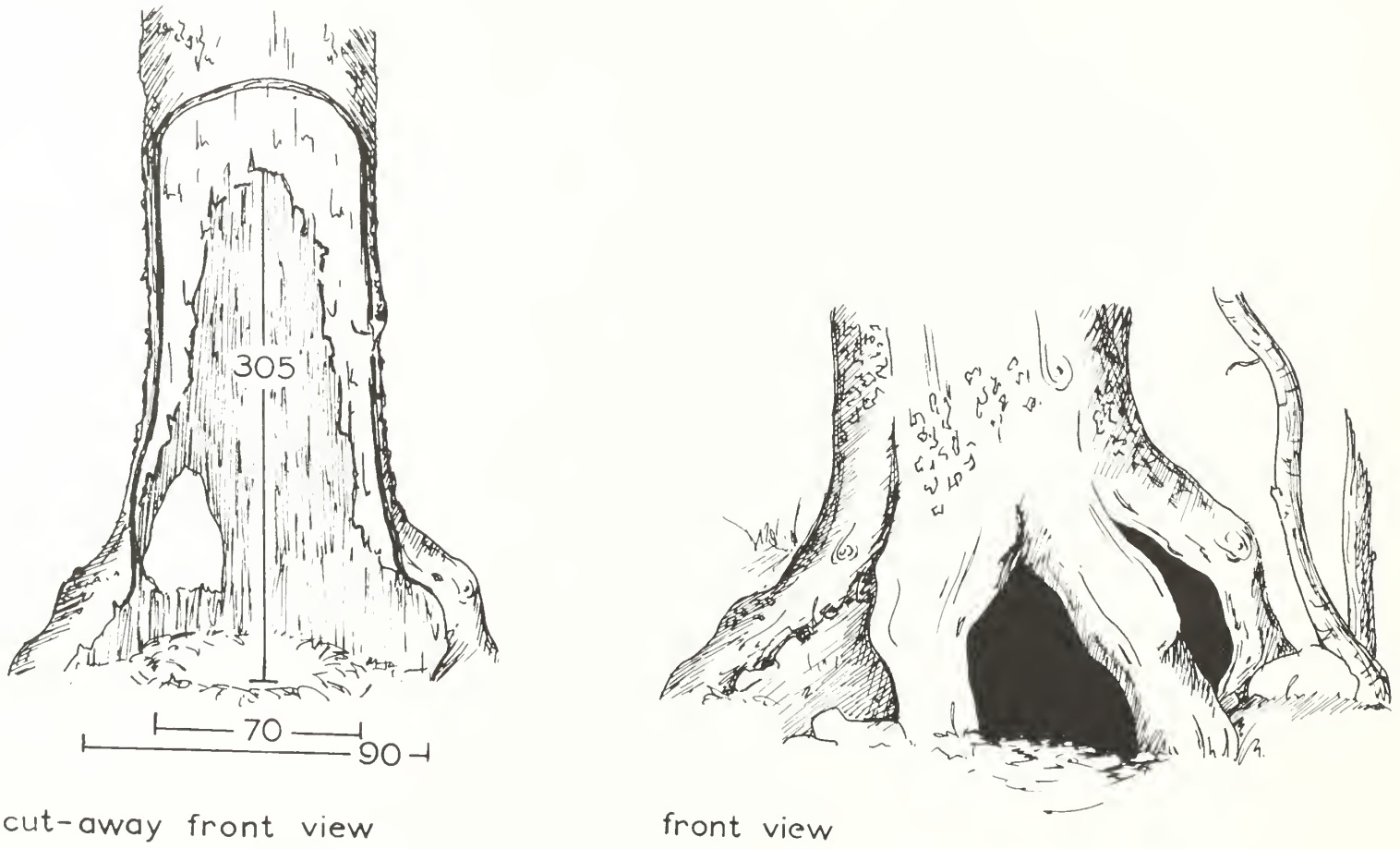

Fig. 36. Den diagram of grizzly bear No. 6, winter 1976-77.
(All measurements in cm)

yards of hers. One had been used by an unmarked grizzly bear in 1976-77 and was only about 50 yards upslope from No. 6's den. The other five were of varying ages prior to 1976.

She emerged from her den between 7-16 April 1977 and moved about 4.5 airline miles away during this time. In the fall of 1977 she left her summer range between 27 September and 3 October and moved to her den area in Basin Creek. She was denned by 11 October. Tracks in the snow in the vicinity of her den indicated that she came out again between 11-13 October. No tracks were seen after this date. Her 1977-78 den is a couple hundred yards south of her 1976-77 den.

She denned about 42 days earlier in 1977 than in 1976. We feel that this earlier denning indicates that she was pregnant. She emerged between 20-24 April 1978 and moved about 2.5 airline miles north. This is about 5 to 7 days later than when she emerged in 1977.

Grizzly bear No. 8, an adult female, probably denned after 18 November 1976. Problems with her transmitter precluded getting a more precise date. Fresh tracks of a female with cub were observed on 18 November in the area of her previous year's den. One radio signal in late January 1977 also indicated that she was at or near her 1975-76 den site.

She and her yearling emerged from the den prior to 16 April 1977. This is comparable to her 1976 emergence between 10-19 April. Her dens for these years were not examined.

She was reinstrumented in 1977; thus, we were able to track her to her 1977-78 den. Her 1977 den was on the west side of The Thunderer in Yellowstone Park. This is about 2 airline miles west and over the mountain from her den site for the previous 2 years. She was in or at the den by 11 November 1977, which is just slightly earlier than in 1975-76 and 1976-77.

She emerged from her den between 1-10 April 1978 which is within her usual emergence time frame. She remained in the area around the den at least through 20 April.

Grizzly bear No. 9, an adult male, was in or at his den on Calfee Creek in Yellowstone Park by 5 November 1976. His transmitter failed while he was in the den; thus his emergence date is unknown. His 1976 den was not examined.

He was reinstrumented in 1977 and was tracked to his den in the fall. The 1977 den was also on Calfee Creek and was within a few hundred yards of his 1976 den site. He was in or at the den on 21 October 1977 and had been in the area for about 17 days prior to this. He denned about 16 days earlier in 1977 than in 1976.

He emerged from his den between 3-16 March 1978. He remained in the general vicinity for awhile, then moved downstream to feed on elk, both as carrion and prey.

Grizzly bear No. 10, an adult female, denned between 30 September and 5 October 1976. This was about 40 days earlier than her 1975 denning date of 14 November. This was possibly due to her having bred in 1976. The 1976-77 den was located in the head of Republic Creek in Wyoming and about 4 miles south of Cooke City, Montana. It was dug under a whitebark pine tree and was large and L-shaped (Fig. 37).

She emerged from the den between 22-25 April 1977. Tracks in the snow indicated that she was accompanied by at least one cub of the year. She cast her transmitter near the den site and was not relocated.

Grizzly bear No. 11, an adult male, denned in 1976 high in the head of Temple Creek in Wyoming (Fig. 38). He was at or in the den by 20 October. He emerged from the den just a day or so prior to 5 April 1977. The area was heavily snow covered at the time, and he moved several miles from the den within the following 10 to 15 days.

Grizzly bear No. 12, an adult female, denned in a rather remote area south of Riddle Lake, Yellowstone Park. She was in or at the den by 3 November 1976. Due to a lack of snow cover, her den remained open through December. On 22 December we passed over the den in a helicopter. She emerged from the den and ran a short distance. She apparently returned to the den within a short time and was in it on 28 December.

She opened her den between 30 March and 5 April 1977 but did not leave it. She and one cub of the year were sighted in the den entrance on 5 April. She remained in the den at least through 7 April but had moved north away from it by 16 April accompanied by her two cubs.

She and her cubs denned in the same general area in the fall of 1977. Her 1977 den was about 3.5 airline miles north of the 1976 site and was on Solution Creek, about 1 mile south of the West Thumb of Yellowstone Lake. She was in or at the den by 16 November 1977, which was about 13 days later than in 1976.

She emerged from the den between 12-18 April 1978 and had moved about 2 miles north by 18 April. This is about the same time as she emerged in 1977.

Grizzly bear No. 13, an adult female, had a denning area in Broad Creek near the Grand Canyon of the Yellowstone River. She used this area in 1976-77 and again in 1977-78. She and her cub were in or at the den by 5 November 1976. They emerged from the den about 16 April 1977 and had moved about 1/4 mile from the den by 18 April. Two distinct beds were evident when the den was examined (Fig. 39).

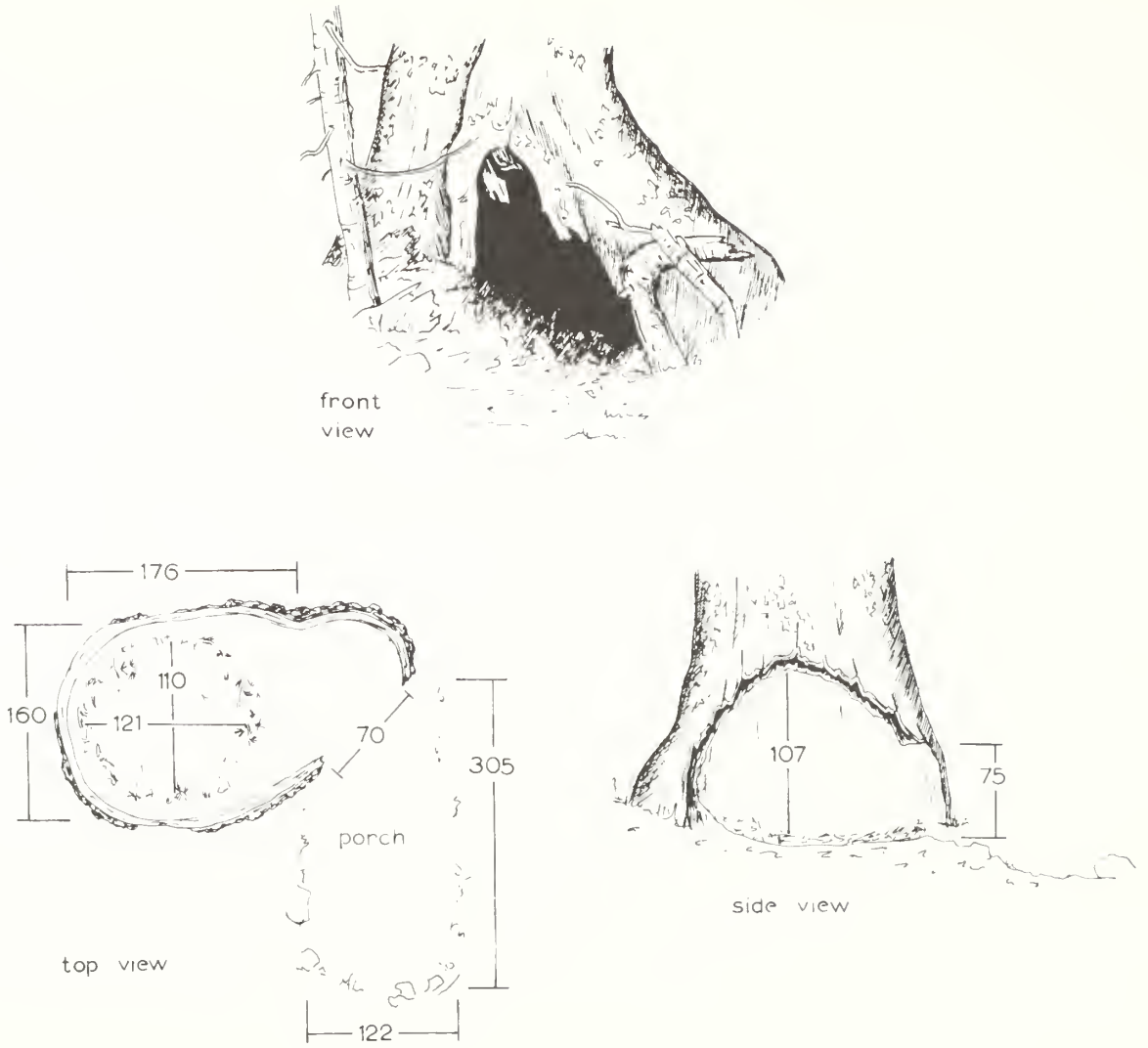

Fig. 37. Den diagram of grizzly bear No. 10, winter 1976-77.
(All measurements in cm)

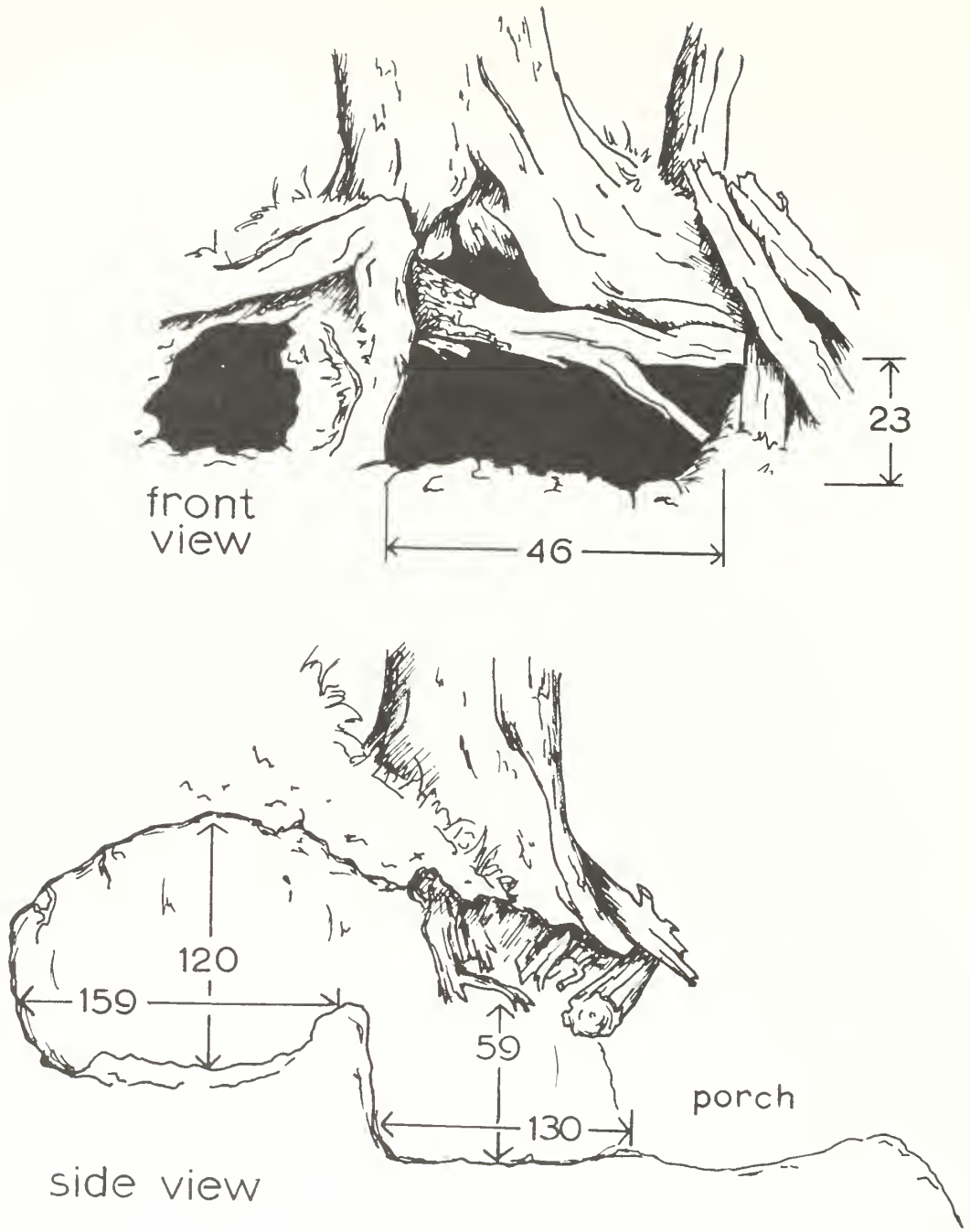

Fig. 38. Den diagram of grizzly bear No. 11, winter 1976-77. (All measurements in cm)

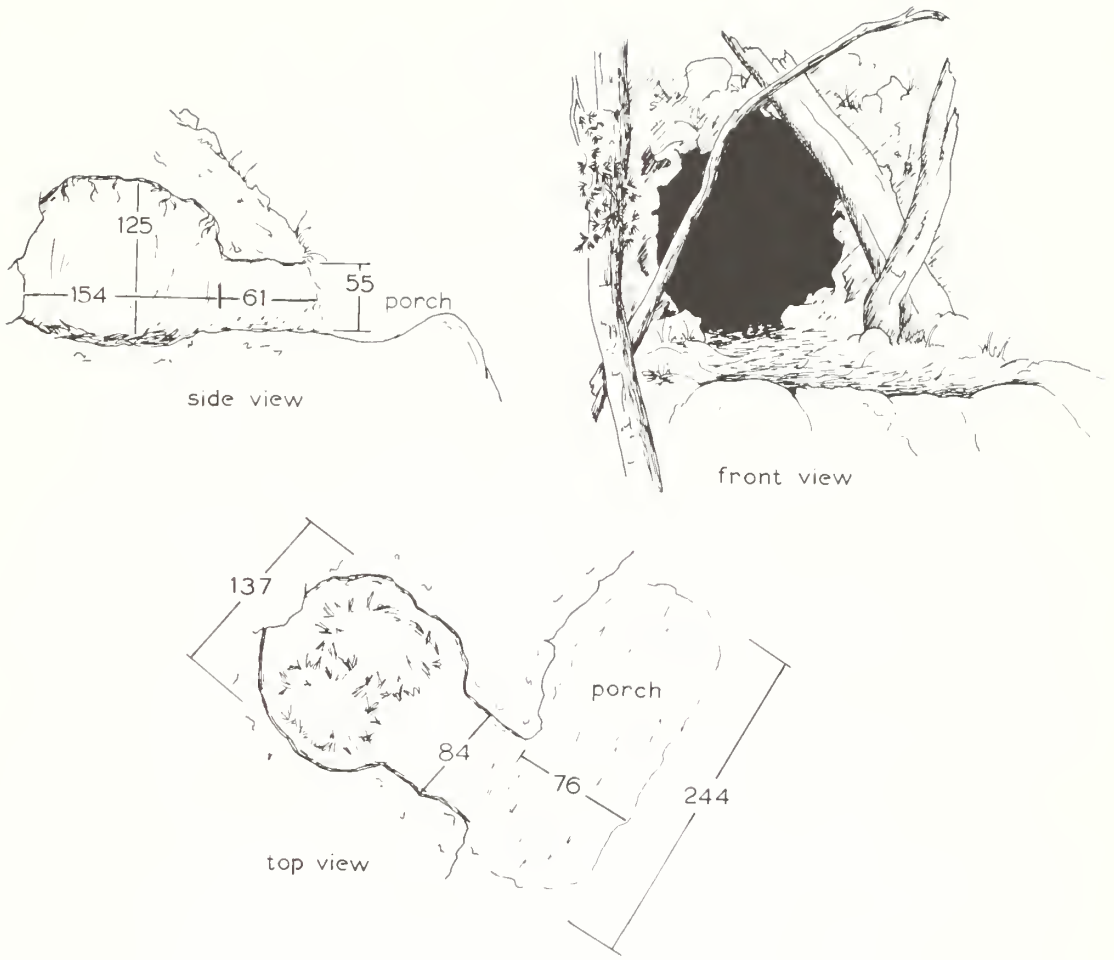

Fig. 39. Den diagram of grizzly bear No. 13, winter 1976-77. (All measurements in cm)

She separated from her yearling during the summer of 1977. She returned to Broad Creek and was in or at the den by 13 October 1977. This den was just a few hundred yards west of the 1976 site. The denning date was 23 days earlier than in 1976, and we think that she was possibly pregnant. Her radio apparently failed after 28 March when she was still in the den; thus we do not have her 1978 emergence date.

Grizzly bear No. 14, an adult male, was tracked to his den in 1977 but not in 1976. He denned after 3 November 1977, and his den site on Juniper Creek was located on 16 November. There were no tracks in the snow around the den, and his transmitter equipped with a motion sensor was in the inactive mode. He emerged from the den between 17-21 March 1978. The den area was still heavily snow covered, and he moved about 8 airline miles west during this time to thermal areas along Rabbit Creek.

Grizzly bear No. 15, an adult male, denned outside Yellowstone Park in 1976 in the Gallatin National Forest, Montana. The den site was near Rathbone Lake, less than 1/4 mile from some large clearcuts. He was in or at the den by 8 November 1976. His transmitter was equipped with a motion sensor that caused the radio to change pulse rate if the transmitter was not moved for 5+ hours. Thus, we determined that he was becoming quite lethargic as early as 27 October 1976. He opened his den and came out prior to 31 January 1977. He was out of the den on this day but close by and quite lethargic, as indicated by the transmitter. He awoke or at least stirred when the plane went over, as the transmitter returned to the active mode. On 7 February he was in or very close to the den, but inactive. He was out and had moved about 7 airline miles from the den by 30 March 1977.

He denned in 1977 on Campanula Creek in Yellowstone Park. This area was about 6 airline miles east of his previous year's den. He was in or at the den by 16 November 1977 and had gone in between 11-16 November. This was essentially the same time period as in the previous year. His den was open on 2 March 1978 and he was sighted within about 20 yards of it. On 16 March he was located about 1-1/2 mi south of the den site feeding on a bull elk that had apparently winter-killed.

Grizzly bear No. 16, an adult female with two cubs of the year, was in or at her den by 11 November 1976. She was sighted on 5 November and appeared to be quite lethargic. However, neither of her cubs appeared lethargic as they were actively foraging. The den was located on the west side of the Firehole River in Yellowstone Park and just west of the Firehole loop drive. She and her cubs emerged from the den just prior to 16 April 1977.

In the fall of 1977 she and her remaining yearling, grizzly bear No. 27, denned on Sentinel Creek in Yellowstone Park about 4.5 miles

south of the 1976-77 den. They were in or at the den by 16 November 1977. They emerged from this den between 28-31 March 1978 and moved north away from the site. The entrance and emergence dates for both years were essentially within the same time period.

Five other bears were tracked to their dens in the fall of 1977. Data on these bears and den measurements for all dens from the 1977-78 winter will be reported at a later date following den examination in the spring of 1978.

HABITAT EVALUATION

Thirty-one forested habitat types following Pfister et al. (1977) and six nonforested habitat types following Mueggler and Handl (1974) have been identified on the study area. In addition, 16 nonforested community types, ecotones, or microsites that we believe to be important to bears were identified. A short description of each of these 16 follows:

The *Artemisia cana/Agropyron caninum* community type was restricted to moist meadows and swales where moisture conditions prohibited the invasion of other sage species. Aspect probably had little if any effect. Slope was primarily near 0 but occasionally up to 30°. Elevational distribution was from 6700 to 7800 feet. Tree cover was very low and without successful reproduction. *Artemisia cana* was consistently present with cover values from 2 to 50 percent.

Grass cover values ranged from 2 to 25 percent. *Agropyron caninum* was consistently present. *Festuca idahoensis* was present in most communities, and *Poa* sp., dryland *Carex* sp. and *Stipa occidentalis* were common. *Perideridia gairdneri, Achillea millefolium, Agoseris glauca, Fragaria virginiana, Taraxacum officinale,* and *Potentilla gracilis* were the most commonly occurring forbs, with cover values ranging up to 50 percent.

The *Artemisia tridentata/Agropyron caninum* community type could be a *FEID/AGCA* or an *ARTR/FEID* habitat type which, for some unknown reason, has had the *Festuca idahoensis* cover removed. It was found from 7400 to 8600 feet elevation, on all major aspects, and on slopes and benches from 10° to 45°. Tree species, if present, were sporadic and with low cover values. *Artemisia tridentata* was the dominant shrub, generally with cover greater than 2 percent and occasionally up to 75 percent. *Symphoricarpos oreophilus* was common in some stands with cover values from 2 to 25 percent.

Agropyron sp. dominated the grass layer. *Agropyron caninum* was present in most stands with cover values up to 25 percent. *Melica* sp. and *Bromus carinatus* were common in the type with cover values from 1 to 50 percent. Common forbs included *Perideridia gairdneri, Campanula*

rotundifolia, Geranium viscosissimum, Achillea millefolium, and *Potentilla gracilis*, with cover values ranging from near 0 to 50 percent.

One *Artemisia tridentata-Potentilla fruticosa/Festuca* community was sampled in the Porcupine drainage, Gallatin National Forest. This community was restricted to creek and river bottoms with deep soils, and it occurred sporadically throughout the study area. *Pinus contorta* was an occasional occupant with low cover value. *Artemisia tridentata* and *Potentilla fruticosa* were site dominants, both with cover around 15 percent. No other shrubby species were present.

Bromus spp., *Poa pratensis, Phleum pratense,* and *Festuca* sp. constituted the only significant grasses in this community, with cover ranging from 2 to 25 percent. Forb composition was variable with a wide variety of forb species present. *Eriogonum umbellatum, Geum triflorum, Taraxacum officinale* all had good cover values.

The *Agropyron caninum/Carex* spp. community type resembled Mueggler and Handl's *FEID/AGCA* habitat type, but *Festuca idahoensis* was absent. Three communities of this type were sampled: on south, west, and southeast aspects from 8400 to 8800 feet. Slope varied from 18° to 45°. No tree cover was found.

Bromus carinatus, Agropyron caninum, Poa spp., *Melica spectabilis, Phleum alpinum,* and *Carex* spp. were found in all three communities with cover values from 2 to 50 percent. *Erythronium grandiflorum, Potentilla gracilis, Geranium viscosissimum, Agoseris glauca,* and *Mertensia ciliata* were also present in all three, with cover values up to 50 percent. *Sambucus racemosa* was found in two communities and *Phlox multiflora* in one.

A *Salix/Carex* category was a grouping of similar communities. We found these from 6400 to 8650 feet. Aspect had little effect due to the nearly flat topography. Slope ranged from 0 to 10°. Occasionally *Picea engelmanii* and *Pinus contorta* were present, but their cover values seldom exceeded 1 percent. *Salix* spp. were consistently present with cover values from 1 to 95 percent. *Betula glandulosa* was an occasional site occupant.

Carex sp. were consistently present, usually with cover values from 2 to 95 percent. *Phleum alpinum, Poa* sp., and *Bromus* sp. were common grasses within this type. Commonly found forbs included *Potentilla gracilis, Achillea millefolium, Senecio triangularis, Aster* spp., *Epilobium angustifolium,* and *Mertensia ciliata.*

The *Agrostis* Grassland community type grouped those plant communities which did not fit into other accepted categories but which had at least one species of *Agrostis* present. This type was found from

7600 to 8560 feet on south, east, and west slopes of less than 30° and occasionally on slopes up to 65° under favorable moisture conditions. Generally this community occurred on valley bottoms and creek bottoms. Trees, when present, were few in number and not reproducing. If shrubs were present, they were wet-site species with low cover values.

The *Agrostis* present had cover values ranging from 2 to 75 percent. *Carex* sp. were common in highly variable amounts. Common forbs included *Achillea millefolium, Cirsium scariosum, Agoseris glauca, Fragaria virginiana,* and *Potentilla gracilis.*

Festuca Grasslands were encountered which may well belong to Mueggler and Handl's *Festuca idahoensis/Agropyron spicatum* habitat type, but one or more of the essential components for this classification were missing. These communities were found from 6600 to 9535 feet on upper slopes and ridges, primarily on southeast and southwest exposures. Trees, when present, were sparse and not reproducing successfully. Shrubby species had low cover values and low vigor.

Festuca species were present in all communities. Most communities had *Festuca idahoensis* as the primary grass species with cover values generally from 2 to 25 percent. Dryland *Carex* sp. were common. Forbs commonly present included *Sedum lanceolatum, Lomatium* sp., *Achillea millefolium, Lupinus argenteus, Claytonia lanceolata, Senecio integerrimus, Antennaria umbrinella, Erigeron eatonii,* and *Allium brandegei.* Cover values for these species were highly variable.

The *Festuca/Agropyron* community type was fairly similar to the *Festuca* Grasslands community type except that it had a higher incidence and coverage of *Agropyron* spp. Forb composition and coverage in both community types were similar. However, there was little or no *Lomatium* sp., *Sedum* sp., or *Claytonia* sp. in this type. This type did have considerably more *Fragaria* sp. and *Trifolium* spp. than the *Festuca* Grasslands.

The *Carex* Meadow community type was a grouping of similar communities which occurred on low slopes, benches, and canyon bottoms with slopes from 0 to 15°. These types occurred in the study area from 6700 to 9360 feet on all aspects. Tree cover was negligible. Shrub distribution was sporadic and with generally low cover.

One or more species of *Carex* were consistently present with cover values from 2 percent up to nearly total coverage in one instance. *Poa* was common with cover values from 2 to 50 percent. *Melica spectabilis, Agropyron caninum,* and *Phleum alpinum* were common with cover values from near 0 to 25 percent. A variety of moist, open-site forbs occurred, with covers that averaged lower than on similar types, probably due to the high graminoid cover. Species cover values generally varied from near 0 to about 25 percent, with occasional values around 50 to

75 percent. *Potentilla diversifolia, Taraxacum officinale, Achillea millefolium, Mertensia ciliata, Cirsium scariosum, Agoseris glauca, Perideridia gairdneri, Claytonia lanceolata,* and *Fragaria virginiana* were common components of this community type.

The Subalpine Meadow community type was marked by a predominance of graminoids and forbs and an almost complete absence of woody species. It was found on slopes up to 70 percent, from ridgelines to canyon bottoms, and from 7200 to 9380 feet. What woody cover did occur was sporadic and inconsistent in its composition.

Graminoid cover was generally high. *Bromus carinatus* was common throughout this type with cover values ranging up to 50 percent. *Poa* sp., *Agropyron caninum, Melica* sp., and *Phleum alpinum* were also common. *Trisetum wolfii* was particularly abundant on some of the moister sites. Dryland *Carex* sp. was common in some communities. A wide variety of open, moist-site forbs was present and total cover was generally high. *Erythronium grandiflorum, Geranium viscosissimum,* and *Potentilla gracilis* were prevalent with cover values up to 75 percent. *Achillea millefolium, Ligusticum filicinum, Helianthella uniflora,* and *Agoseris glauca* were also very common; cover values for these species tended to be lower than for the former group.

One Forb Meadow community was sampled. The majority of the canopy cover was composed of moist-site forbs. *Abies lasiocarpa* was present, but with cover less than 3 percent. Shrub and grass covers were insignificant.

The Mountain Shrub community type grouped similar communities which had no significant tree cover, and a wide variety of shrubby species which usually occurred on relatively moist montane slopes. These communities were found from 7200 to 9700 feet on slopes and benches with south, east, and west aspects. Slopes ranged from 3° to 15°. *Elymus glauca, Poa* sp., and *Agropyron caninum* were common grasses in this type. *Carex geyeri* was common, usually with high covers. Forb covers were generally high, and species composition was highly variable.

Pond Edge was a restricted type associated with small ponds and potholes. Elevational distribution was 6900 to 8400 feet. Several species of *Carex* and *Juncus* were present in shallow water and along pond edges. *Potamogeton nodosus* was present along the shallow edges and out into deeper water in at least some ponds. *Potamogeton* was the major food sought in this type. *Nuphar polysepalum* was generally present in the deeper water.

Small Micro-Communities were frequently present within the study area and the broad community types. These microsites frequently were considerably moister and differed dramatically from the surrounding community. These sites generally had high covers of grasses and forbs

and offered a wide variety of food plants for grizzlies. Much of the study area was covered with relatively barren lodgepole pine communities, and without these microsites, the potential carrying capacity would be significantly reduced.

Ecotonal Areas were frequently associated with feeding and bedding activity. Species diversity within the ecotones frequently was very high and these offered a wide variety of food items.

An Unspecified Category was used for sampled communities which did not fit any of the other categories used. There were timbered and untimbered, dry and wet communities in this group. Most of these communities probably could have been forced into their related habitat types, but one or more indicator species were missing.

Tables 15, 16 and 17 list known grizzly bear plant foods and percentages of feeding sites in forested habitat types, nonforested habitat types and nonforested community types, respectively. Almost all types appear to have an abundance of food plants eaten by bears, although many of the listed foods are eaten infrequently.

There is very little correlation between the number of food items in a habitat or community type and the number of feeding sites examined in them. Although the nonforested habitat types had the highest average number of foods, only 12 percent of the feeding sites occurred there. This may be because nonforested habitat types cover much less of the study area than forested types. On the other hand, nonforested communities which covered the least area and had the least average number of food items per type accounted for 42 percent of the feeding site examinations. Most of the community types are small sites that retain moisture and lush vegetation longer than the more extensive habitat types.

Bear use of a habitat type or community type apparently depends upon season of use, phenological development and individual bear preferences more than variety of food. The *ABLA/CAGE* habitat type accounted for the most feeding sites at 9 percent and contained 31 different commonly used food plants, yet these food plants were not used by bears. All feeding sites examined where bear activity could be determined indicated that ants and other insects in rotten logs were the chief attraction. Ants and other insects were also the most commonly taken item in the *ABLA/CARU, PIEN/EQAR, PSME/CARU* habitat types and in the Forb Meadow community type although grazing of *Equisetum arvense*, along with forbs and grasses, may also occur in these types. Some feeding on insects was found in 11 other habitat types and community types.

Pond Edge, a community type, accounted for the second-most feeding sites at 6 percent. In contrast to the *ABLA/CAGE* habitat type, it only had three commonly recognized bear food plants; one of these, *Potamogeton nodosus*, accounted for the bulk of the food eaten.

Table 15. Frequency of occurrence of grizzly bear food items in forested habitat types and community types

	SCREE - 19 1/	ABLA/MEFE - 1	ABLA/ARMO2 - 8	ABLA-PIAL/VASC-51	ABLA/CAGE - 26	ABLA-PIAL/ - 37	ABLA/CARU - 26	ABLA/LIBO2 - 11	ABLA/VAGL - 19	ABLA/ARCO3 - 18	ABLA/VASC - 95	ABLA/CACA - 16	PIAL - 4	PICO/VASC c.t. - 4	PICO/CARU c.t. - 2	PICO/PUTR - 8	PSME/VAGL - 1	PSME/SPBE - 2	PSME/LIBO2 - 4	PSME/ARCO3 - 2	PSME/SYOR - 6	PSME/ACGL - 1	PSME/PEID - 5	PSME/SYAL - 25	PSME/JUCO3 - 10	PSME/CARU - 24	PIPU/JUCO3 - 1	PICEA/MATRE - 2	PICEA/LIBO2 - 21	PICEA/CAST - 28	PICEA/EVAR - 4	Freq of food item in forested types
Pinus albicaulis	21		63	100		95	12	27	21	17	18		100					50						8	10	4			4		48
Pinus flexilis	21	100	13		23	5	27	27	21	39	42			25	50		100	50	25			100	20	16	20	25	100		29	18		74
Populus trichocarpa	11			2		8	15	9		6											17		20	16		29			11		35
Arctostaphylos uva-ursi					4		8	9	11			13			50	50			75						8	30	21		14	11		42
Lonicera			25	14	46	11	31	82	32	28	36	6					100		25					38		21		100	24	14	50	58
Purshia tridentata																100																3
Ribes	11		13	5	12	14	8	36	26	28	12				50				50		33		40	4		17			33	4	50	61
Ribes montigenum	47		100	24		3			5		2																		5			23
Ribes setosum					4			9			1	6												4				50		18		23
Rosa			25	4		3	27	55	11	6	6	6			100			100	75	50	50	100	60	52		50		100	81	18	75	71
Rubus	37			4	4	3	4	9	5		3									50					20			50	14	7	25	45
Oxyria digyna			38	4	4	8	23	27	37	17	20				50		100		75	50				28	10	13			57	7		58
Vaccinium globulare		100		16	8	3	4	45	100	6	13	13	25				100											50	5		50	48
Vaccinium scoparium	42	100	50	90	19	11	15	64	74	22	100	6	50	100			100			50	50			4		25			43	7		68
Xerophyllum	16		38	2	19	16		18	11	11	5	6			50			50	75	50	100	100	100	96	30			100	76	64	25	74
Juniperus communis	37			16	12	16	50	36	21	22	28	25	50	25	100		100	50		100			40	56	100			50	57	54	25	74
Agropyron spicatum			13	2	4						5					75		50		50	33	100	80	24	10	13			7	50	48
Bromus	5		13	10	38	14	54	55	32	28	27	13			50	25		50	50	50	50		40	36	30	33		50	33	50	50	80
Melica	5				8	3	4			6		19									17		20	16	10				11		35
Poa	8		88	73	35	62	23	27	11	28	13	19	75		50	38		100	25		50	100	60	52	70	38			46		77
Carex	84		25	49	100	24	38	27	53	28	49	56	50	50	50	50					17		60	24	70	25		50	19	39	50	77
Agoseris	26		25	16	42	30		9	5	11	3	50	50			25					33			4		17			11		32
Allium	5										2	6									17	100	20	20	30	8		29	46	75	39
Angelica																														25	3
Cirsium	32				4						2				50				50		17		20		30	4			11		32
Cirsium arvense			13																						10						6
Cirsium scariosum	32			4		5	4				1	38				13									50	4			4		32
Claytonia lanceolata	11			10	4	11				6	3	6											20	4							29
Epilobium					4	3							25			13					17			4		4			5	4		29
Epilobium angustifolium	11	100	88	45	42	43	69	27	47	67	69	44	25	25	100	25	100	50	75	50	17		40	36		58		100	62	82	75	90
Equisetum												19													20					25	10
Equisetum arvense					4		4			11	1	19																50		14	75	26
Fragaria																					33					4						6
Fragaria vesca					12		8	45	21		8	6						50						28	80	4		50	19	7	25	45
Fragaria virginiana	21		50	12	7	22	69	36	32	39	27	50		25					100	50	33		100	68	10	88		50	90	79	50	74
Heracleum lanatum				2	19	3		9	16	17	2	38													10				5	21	75	39
Lomatium										6										50												6
Lomatium nudum	11				4																											6
Lomatium triternatum	5					3																		8								10
Mertensia ciliata						14				11	6	2	56																5		25	23
Peridendia pairdneri			13			3	4				6	1	6								33		40	28		4				11		35
Polygonum																																0
Polygonum bistortoides	5			4		5				11		31	25													4						23
Paramoegeton natans																																0
Smilacina			13		4	3		18	11		2	31							25	50		100	20	12		8		50	19	32	50	55
Stellaria				2	8						2				50	13														4		19
Streptopus amplexifolius								27	11		1																	100	14			16
Taraxacum											1																			14		6
Taraxacum officinale	5		13	4	4	11	35	18		22	7	31		25		25			25		33	100	80	56	30	38		50	24	57		71
Thalictrum	16		50	33	62	46	69	63	79	89	60	25	25	25	50			50	75	100	17			64		58		100	81	68	50	7.
Trifolium					8		8			6	3	19													10	8				21		26
Trifolium repens																									10							3
# Foods/type	25	4	21	26	31	31	25	25	25	28	36	29	11	8	14	12	7	12	15	13	19	8	19	29	23	28	1	17	26	35	21	20
% Feed sites	0	0	0	2	9	.7	2	2	.7	0	5	5	0	.7	0	5	0	0	0	0	2	0	0	.7	4	4	0	0	.7	2	.7	(Avg

1/ Number of sites examined.

Table 16. Frequency of occurrence of grizzly bear food items in nonforested habitat types

	ARTR.FEID - 104 1/	*DECA/Carex* - 6	*FEID/DECA* - 8	*FEID/AGCA* - 69	*ARTR/AGSP* - 5	*FEID/AGSP* - 13	Freq of food item in nonforested types	
Pinus albicaulis	8			13		8	50	
Pinus flexilis	2			3			33	
Populus trichocarpa	8			6			33	
Arctostaphylos uva-ursi	2						16	
Lonicera	2				20		33	
Purshia tridentata							0	
Ribes	1			4		8	50	
Ribes montigenum							0	
Ribes setosum							0	
Rosa	22			4	20	8	66	
Rubus				1			16	
Shepherdia canadensis	1			1		8	50	
Vaccinium globulare							0	
Vaccinium scoparium							0	
Symphoricarpos	36		13	10	60	8	83	
Juniperus communis	10			6			33	
Agropyron spicatum	8			7	80	77	66	
Bromus	58	33	38	74	20	15	100	
Melica	41	50	38	66	20	31	100	
Poa	50	66	50	36	60	62	100	
Carex	45	100	38	55	20	23	100	
Agoseris	36	83	88	49	20	31	100	
Allium	13		13	6		31	66	
Angelica							0	
Cirsium	12			3	20	8	66	
Cirsium arvense							0	
Cirsium scariosum	15	50	38	25	20	8	100	
Claytonia lanceolata	11			12	20	46	66	
Epilobium	6	50					33	
Epilobium angustifolium	21		38	23			50	
Equisetum	1						16	
Equisetum arvense		33					16	
Fragaria							0	
Fragaria vesca	1			4			33	
Fragaria virginiana	33	33		39	40	23	83	
Heracleum lanatum	1			1			33	
Lomatium				3		8	33	
Lomatium cous	4		13	6	20	15	83	
Lomatium triternatum	6			7	40	15	66	
Mertensia ciliata		50	38	17			50	
Perideridia gairdneri	50	33	13	51	20	46	100	
Polygonum							0	
Polygonum bistortoides	12	17	88	22		23	83	
Potamogeton nodosus							0	
Smilacina	7						16	
Solidago			13	1			33	
Streptopus amplexifolius							0	
Taraxacum	2			4			33	
Taraxacum officinale	54	33		35	40	62	83	
Thalictrum	5		13	7			50	
Trifolium	19	50	25	29	20	15	100	
Trifolium repens							0	
# Foods/type	34	14	16	34	18	23	23	(Avg)
% Feed sites	4	2	0	4	2	0		

1/ Number of sites examined.

Table 17. Frequency of occurrence of grizzly bear food items in nonforested community types

	Pond Edge - 10 1/	*Salix/Carex* - 21	*ARTR/Agropy.* - 19	Unspecified - 33	Ecotones - 2	Forb Meadow - 1	*ARCAS/AGCA* - 7	Mtn Shrub - 9	*Fest/*Grass Mdw - 12	*Carex* meadow - 21	Subalpine Mdw - 46	*AGCA/Carex* - 3	*Agro* grasslands - 4	*Festuca/Agro* - 8	Microsites - 3	*ARTR-POFR3/Fes.* - 1	Freq of food in untyped communities
Pinus albicaulis			5					11	8		4						21
Pinus flexilis			5	2						5	2						21
Populus trichocarpa			16	66	50						2						21
Arctostaphylos uva-ursi		24		3													11
Lonicera				3	50	100		11									21
Purshia tridentata																	0
Ribes		10		9				56			2						26
Ribesmontigenum		5						33									11
Ribes setosum		5															5
Rosa			11	11	50												16
Rubus				3				56			2						21
Shepherdia canadensis			5	9				22			2						21
Vaccinium globulare																	0
Vaccinium scoparium				9				33		5							21
Symphoricarpos		5	42	26	50			33			4			13			37
Juniperus communis			5	26				33	8		7						32
Agropyron spicatum		5	11	6			14			10							26
Bromus		29	95	49	50	100	43	33	25	19	72	100	25	50	67	100	95
Melica		33	53	29			29	56	8	33	65	100	25	25			68
Poa	10	48	42	31	50		57	56	50	66	54	100	50	38		100	89
Carex	60	86	26	54	100		43	56	42	95	46	100	50	50	67	100	95
Agoseris		19	32	17			57	33	17	38	72	100	50	13			68
Allium		10	5	9			14		33	10	4				67		42
Angelica				6						5			25		33		21
Cirsium		33		11			14	11		10							32
Cirsium arvense				3			43										11
Cirsium scarioswm		19	16	17			29	44	8	29	7		50	50	33		74
Claytonia lanceolata				3					33	24	33						26
Epilobium			11	6					8	24	2		25	13	67		42
Epilobium angustifolium		38	21	29		100	14	44	8		26		50	38			58
Equisetum		5		6						5		50			67		26
Equisetum arvense		24		3						14	9						26
Fragaria				6													5
Fragaria vesca				9						5				38	67		21
Fragaria virginiana		62	32	43	50	100	43	11	17		22		50	38		100	74
Heracleum lanatum		14	26	14		100		33		10	11		25		67		53
Lomatium																	0
Lomatium cous			5						25		4						21
Lomatium triternatum		10	16	3				11	33		22						37
Mertensia ciliata		43	5	11			14	22	8	24	37	100	25	13			63
Perideridia gairdneri		14	74	34		100	86	11		33	26			38			58
Polygonum							29										11
Polygonum bistortoides		19		9					17	24	20			25			37
Potamogeton nodosus	90																5
Smilacina				6				11		5					33	100	26
Solidago		24	5			100											16
Streptopus amplexifolius																	0
Taraxacum				6					8								11
Taraxacum officinale		48		54	50	100	43	22	17	29	30	50	25	63	67	100	89
Thalictrum		29	11	20	50			22		5	13		25	38			53
Trifolium		33	5	23						19	20			63		100	47
Trifolium repens					50												11
# Foods/type	3	27	26	41	11	8	16	25	19	25	29	8	14	17	11	7	17 (Avg)
% Feed sites	6	4	5	5	2	.7	5	0	3	2	.7	0	2	5	2	0	

1/ Number of sites examined.

No other habitat types accounted for more than 5 percent of the feeding site examinations. Foods eaten varied considerably within each type and often did not reflect vegetative composition of the type. Animal foods like ants, rodents, or ungulates are not reflected in habitat analysis but are used in almost all habitat types. It does not appear a single or selected group of habitats can be singled out as critical for the bear. The bear makes use of all habitats available and probably requires the options that a variety of habitats provides.

It appears that no one food plant is of critical importance in the grizzly bear diet. Table 18 compares frequency of occurrence of some common foods in vegetative analyses and in scats in an intensive study west of Yellowstone Park. Most comparisons listed indicate that a bear does not have to do much searching for plant foods. Biscuit root *(Lomatium* spp.*)* was an exception, occurring in scats over three times as frequently as it did in vegetative samples. Several others, bitterbrush, horsetail, and bearberry, also occurred more frequently in scats than in vegetative samples, but the difference was not as great as with biscuit root. Many of the plants are used seasonally and are probably searched out more than indicated by this type of comparison; but overall, there does not appear to be a food shortage for bears.

DISTRIBUTION

The distribution of grizzly bears is reflected by observations of bears, of their sign, and by signal locations of radioed bears.

Locations of 138 reported sightings in 1977 involving 243 grizzlies are shown in Fig. 40. Included are only those observations that have been verified or that are judged to have a high probability of being valid. Reports were received of an additional 234 sightings that included 347 bears, but the validity of these reports could not be established.

Locations of 190 observed grizzly bear sign (scats, tracks, diggings, carrion caches) are shown in Fig. 41. These include 121 feeding sites examined for habitat evaluation studies.

No significant changes in overall distribution of the grizzly are evident from comparisons of 1977 observations with those of the 4 years from 1973 through 1976. A separate report on 5 years (1973-77) of distribution records is now in preparation.

POPULATION PARAMETERS

A summary of grizzly bear observations from routine fixed-wing flights for 1973 through 1977 is given in Table 19. Numbers of black bears observed/hour were similar to 1976 and lower than previous years. Numbers of grizzly bears observed/hour were lower than during 1976 but higher than during 197..

Table 18. Comparison of foods available as evidenced by frequency in 353 vegetative sites examined in Cabin Creek area compared to frequency in 120 bear scats collected in the same area

Food item	Percent in veg. sites	Percent occurrence in scats
Pinenuts	46	9
Pinus albicaulis	28	
Pinus flexilis	18	
Populus trichocarpa	6	.8
Cambium		.8
Arctostaphylos uva-ursi	2	3
Purshia tridentata	1	3
Ribes	20	4
Shepherdia canadensis	9	4
Symphoricarpos	19	8
Vaccinium	35	10
Agropyron spicatum	4	.8
Carex	50	2
Melica	24	5
Poa	58	3
Unidentified Grass & Grasslikes	100	30
Achillea millefolium	48	3
Cirsium	15	8
Claytonia lanceolata	7	.8
Compositae	48	4
Epilobium	44	3
Equisetum	10	13
Fragaria	29	4
Geranium	45	3
Lomatium	6	19
Perideridia gairdneri	14	6
Polygonum	10	3
Streptopus amplexifolius	0	.8
Taraxacum	25	3
Thalictrum	41	.8
Trifolium	13	6
Umbelliferae	6	3
Cervid		9
Ants		62
Other insects		2
Small mammal		11

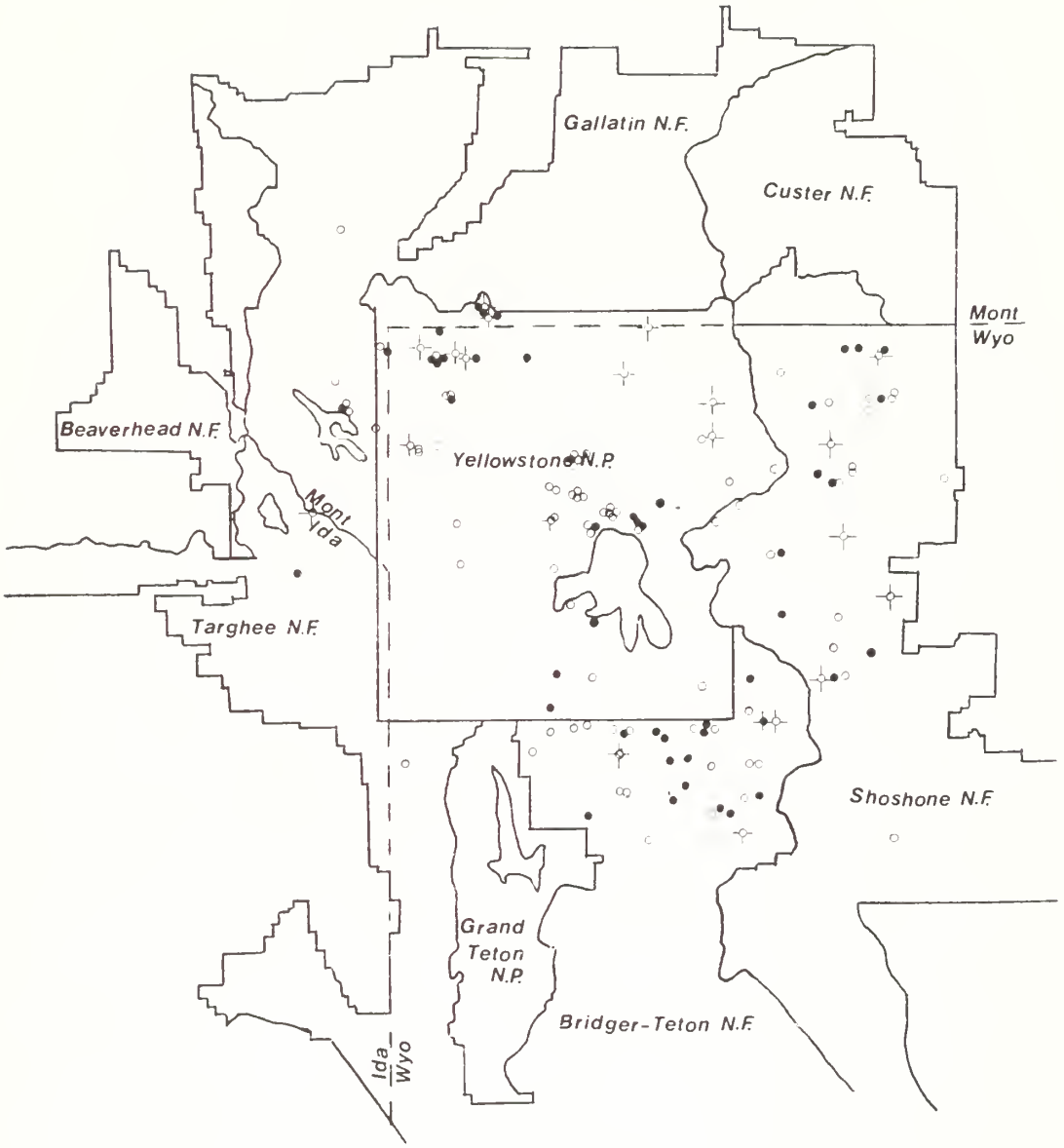

Fig. 40. Distribution of observed grizzly bears in 1977. Open circles denote lone bears, darkened circles sows with young, and ✛ two or more bears but not sow with young.

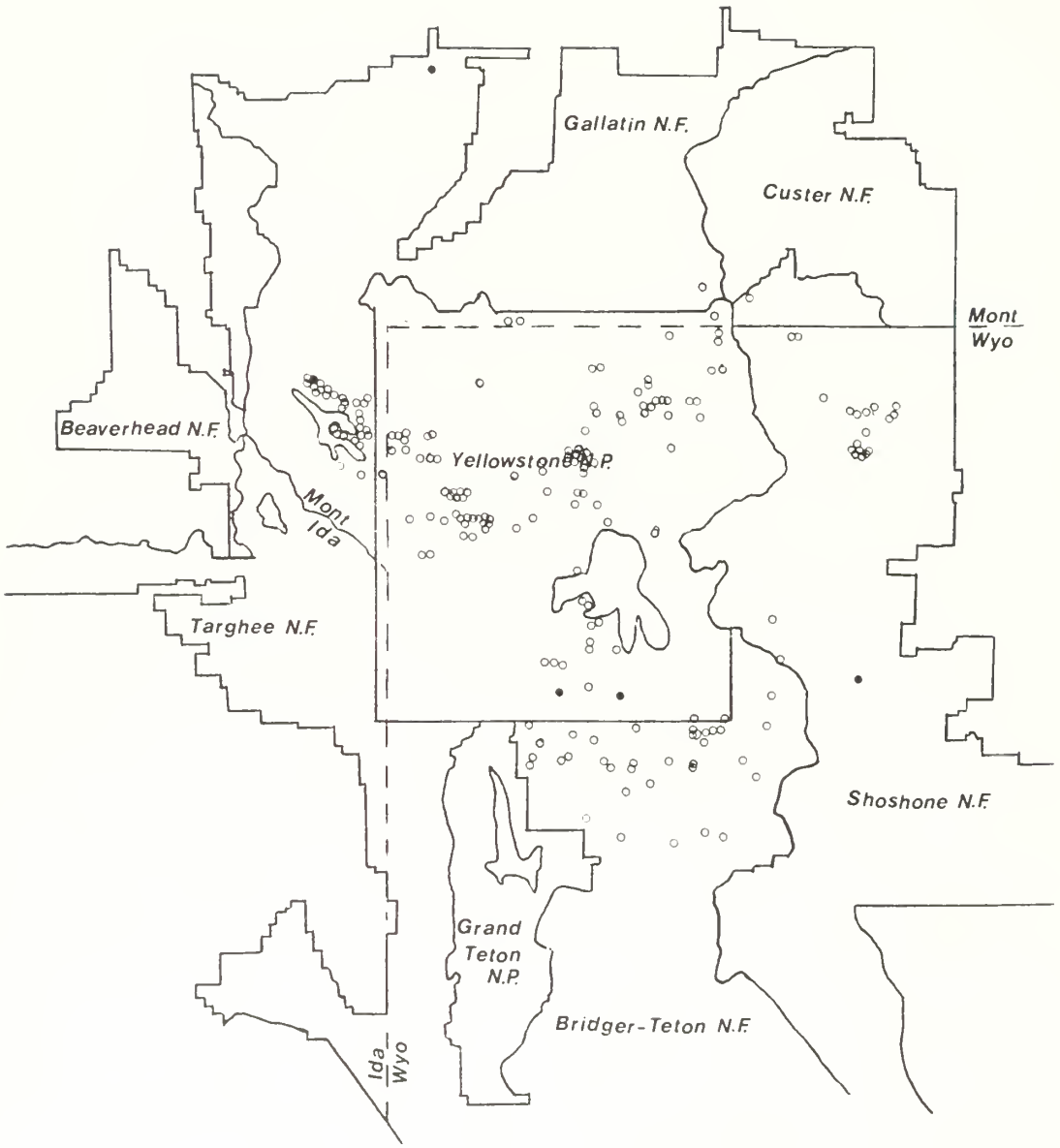

Fig. 41. Distribution of reported grizzly bear sign in 1977.

Table 19. Summary of aircraft flight reports, 1973-77

Month	Hours Flown	No. Flts	Bears observed		Bears/flight		Bears/hour	
			Black	Grizzly	Black	Grizzly	Black	Grizzly
Apr								
1974	10	3	1	0	.33	-	.1	-
75	13	4	0	3	-	.75	-	.31
76	17	7	0	3	-	.42	-	.18
77	37	9	0	3	-	.33	-	.08
May								
1973	12	3	3	17	1.00	1.41	.25	1.40
74	21	7	19	14	2.71	2.00	.90	.67
75	25	9	9	5	1.00	.56	.36	.20
76	29	10	5	5	.5	.5	.17	.17
77	32	8	10	18	1.25	2.25	.31	.56
Jun								
1973	19	5	18	10	3.60	2.00	.95	.50
74	36	10	34	18	3.40	1.80	.94	.50
75	10	4	4	8	1.00	2.00	.40	.80
76	29	9	11	28	1.20	3.11	.38	.96
77	53	11	14	17	1.27	1.55	.26	.32
Jul								
1973	14	5	4	23	.80	4.60	.29	1.60
74	31	11	18	45	1.64	4.10	.58	1.44
75	38	12	37	17	3.08	1.40	.97	.45
76	36	11	6	6	.54	.55	.16	.17
77	48	10	14	24	1.40	2.40	.29	.50
Aug								
1973	9	3	0	0	-	-	-	-
74	20	7	5	39	.71	5.57	.25	1.97
75	36	10	1	2	.10	.20	.03	.06
76	42	12	6	23	.50	1.92	.14	.55
77	34	6	2	1	.33	.17	.06	.03
Sep								
1973	10	3	0	2	-	.66	-	.20
74	17	6	2	1	.33	.17	.12	.06
75	39	11	1	0	.09	-	.05	-
76	33	7	5	19	.71	2.71	.15	.58
77	67	13	3	10	.23	.77	.04	.15
Oct								
1973	12	4	0	8	-	2.00	-	.67
74	15	6	0	8	-	1.33	-	.54
75	19	7	0	1	-	.14	-	.05
76	27	6	0	3	-	.50	-	.11
77	67	18	1	10	.06	.15	.01	.15
Total								
1973	76	23	18	60	.78	2.60	.30	.79
74	150	50	79	125	1.58	2.50	.52	.83
75	180	57	52	36	.91	.63	.29	.20
76	213	62	33	87	.53	1.40	.15	.41
77	338	75	44	83	.59	1.11	.13	.25

Observability as indicated by radio locations was similar to 1976. Five percent of the radio locations were in areas where the bear could have been seen without the aid of the radio. The corresponding figure for 1976 was 4 percent.

Observability figures are not strictly comparable between years since 1974. Beginning in 1975 increasing amounts of flight time have been devoted to radio tracking, with corresponding less time to regular observation. During 1977, when up to 20 bears were being tracked over most of the 8,000 mi^2 study area, a large proportion of the flight time was spent in high altitude searching which was not compatible with observation.

Ratios of young:female for 1974 through 1977 are given in Table 20. Cub production as indicated by observation was lower than during 1976 but higher than 1975. The number of yearlings was higher than 1976 or 1975, possibly a reflection of the large number of cubs observed in 1976. Overall production for 1977 was good in comparison to other years of the study. However, mortality, as discussed below, altered this by the end of the season. Ratios of young:female with young have not changed significantly during the course of the study. Frequency of litter size (Table 21) was not appreciably different from other years of the study.

An unduplicated sample of 100 bears was identified from all sources of observation (aerial, ground, and trapped bears). This was similar to 1976 when 102 individual bears were identified, but the portion of the study area enclosing the sample (Fig. 42) was a little larger. These represent the minimum number of bears observed since many bears were observed which were probably different individuals but could not be separated with certainty. Also, it is probable that many bears were not observed at all.

Mortality. - There were 12 known grizzly bear mortalities in 1977 (Table 22). Direct man-caused mortalities were the largest category. One adult male died as the result of improperly administered drugs within Yellowstone Park. Another adult male was killed by the Fish and Wildlife Service on a cattle allotment north of Yellowstone Park. Three adult females with cubs were illegally shot. One cub of the year was also illegally shot. One sow with cubs was killed by a car, along with one of the cubs. The fate of six other cubs orphaned by these actions is uncertain, but it is not likely they all survived. The one natural mortality was one of three yearlings abandoned by their mother in the fall of 1976. When discovered, he was being consumed by one of the other siblings who was in a very weakened condition and probably did not survive the spring.

Three mortalities were of questionable cause. The surviving sibling of the two mentioned above was captured, radio-instrumented,

Table 20. - Summary of females with young observed, 1974-77

Year	Females w/cubs	Cubs	Ratio	Females w/yearlings	Yearlings	Ratio
1974						
Cumulative	21	36	1.7	35	52	1.5
Individual	15	26	1.7	18	31	1.7
1975						
Cumulative	5	8	1.6	4	9	2.2
Individual	4	6	1.5	3	6	2.0
1976						
Cumulative	36	69	1.9	10	18	1.8
Individual	17	35	2.0	7	12	1.7
1977						
Cumulative	24	43	1.8	19	32	1.7
Individual	13	25	1.9	9	16	1.8

Table 21. - Frequency of litter size among females with young, 1974-77

	Cubs				Yearlings			
	1974	1975	1976	1977	1974	1975	1976	1977
Females w/1	6	2	3	3	7	1	3	3
Females w/2	7	2	10	8	10	1	3	5
Females w/3	2	0	4	2	1	1	1	1

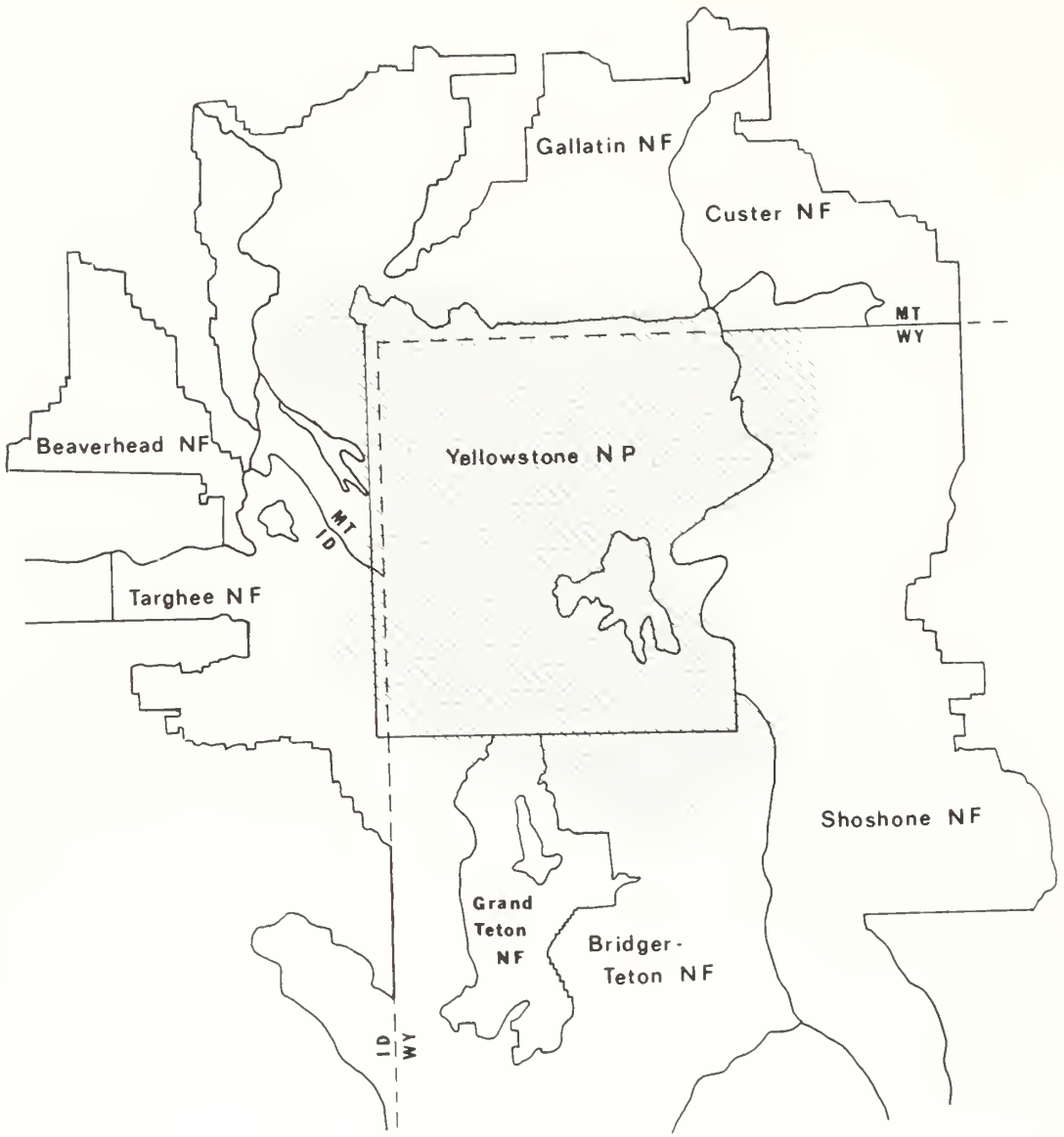

Fig. 42. Portion of study area enclosing unduplicated sample in 1977.

Table 22. - Known grizzly bear mortality, 1977

	Adults		Cubs and yearlings		
	Male	Female	Male	Female	Total
Natural	0	0	1	0	1
Man-caused	2	4	2	0	8
Questionable	0	1	2	0	3
Total	2	5	5		12

and monitored until October when part of his carcass was found buried and his radio transmitter was also found buried 125 yards away. One small yearling was in poor condition and had an abnormal growth on his jaw when trapped. He was sacrificed for autopsy but would probably not have survived. One instrumented female with two yearlings was found dead and had apparently been eaten by the yearlings. Cause of death was unknown; however, she was less than 4 miles from a cattle ranch that had complained of livestock depredations.

Although 12 bears are probably not a great proportion of the population, five of the mortalities were producing females and their deaths could have an adverse effect on the population.

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