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# Montana-Idaho elk migration and key-use area study Salmon Beaverhead and Bitterroot National Forests

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MONTANA-IDAHO ELK MIGRATION AND KEY-USE AREA STUDY

SALMON, BEAVERHEAD, AND BITTERROOT

NATIONAL FORESTS

By

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The study area was in a 1,500 square mile (2,400 sq km) area of the Salmon National Forest in Idaho and adjacent portions of the Bitterroot and Beaverhead National Forests in Montana. Elk (Cervus elaphus) were trapped during winter 1973-74 and 1974-75, radio- or rope-collared, and ear-tagged. Movements were followed aerially and on the ground from February 1974 until December 1975. Migration routes from Idaho winter ranges to Montana summer ranges were located by biotelemetry.

Some radio-collared elk from the Hughes Creek trap migrated to Montana summer ranges, and others remained near the Idaho winter range or moved locally to higher elevations. Radio-collared elk from the Wagonhammer trap all migrated to Montana summer ranges. Spring migrations, triggered by snow-melt and green-up, commenced about the middle of May and were complete about mid-June. Fall migrations were triggered by fall snowstorms and were completed by the first week in December. Resting and feeding sites along migration routes and calving and rutting areas were established by clusters of radio transmitter locations. Radio-collared elk moved to roadless areas during hunting seasons. Radio- and rope-collared elk were shot in both states.

Grass winter ranges on the study area were used more extensively the first winter than during the second when snow depths were greater. Forage in and near tree cover was heavily utilized the second winter. Winter range boundaries varied due to snow depth, cover, slope, aspect, and human disturbance.

Habitat types were sampled in key-use areas and along migration routes. Use of clearcuts was not established, and some radio-collared elk-cattle competition was noted.

Data from 903 radio transmitter locations, sightings of radio- and rope-collared and unmarked elk, aided by recommendations from the Montana cooperative elk-logging studies provided information from which recommendations were submitted for management of elk and timber harvest on the study area.

# ACKNOWLEDGEMENTS

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I especially thank Dr. Bart W. O'Gara of the Cooperative Wildlife Research Unit, University of Montana, who directed and coordinated the study, and whose quiet understanding, suggestions, and advice were particularly important. The reviews and critiques of the committee members, Drs. Bart W. O'Gara, Robert R. Ream, and E. Earl Willard, are sincerely appreciated. I also thank other critiquing personnel: John L. Emerson, Hadley B. Roberts, Walter L. Bodie, John Firebaugh, John H. Ormiston, Joel G. Peterson, and Dwight R. Cook for their professional interest. The advice and assistance of Dr. C. Les Marcum was also thoroughly appreciated, since he had recently completed an elk study. I thank Walt Bodie and Dane Lyons of the Idaho Fish and Game Department, Salmon, Idaho, for elk trapping efforts. I also express my appreciation to Mrs. Helen Irons of the Idaho Fish and Game Department, Salmon, for transcribing tapes and study notes. Mrs. Ginger Schwarz, Miss Nancy Hill, and Miss Karen Konitz of the Cooperative Wildlife Research Unit, University of Montana, were extremely helpful in keeping track of expenditures, typing letters, rough and final study drafts, and providing other administrative assistance. I sincerely appreciate their efforts. Participation of all of the above made the study pleasant and rewarding.

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# CHAPTER I

## INTRODUCTION

Lewis and Clark sighted elk (Cervus elaphus nelsoni) near the present community of Northfork, Idaho, "Several miles below the confluence of the Lemhi with the Salmon River, a herd of elk was seen among the pines on the mountainside." (Hosmer 1902:430). This could have occurred near the juncture of Wagonhammer Creek and the Salmon River. A Lewis and Clark expedition marker is located there dated 25 August 1805, the date listed in Hosmer's excerpt from the journals. Elk numbers reached low levels in the Northfork-Gibbonsville area of Idaho during the early 1900's, according to local residents. Few elk were seen or hunted (F. Rose, pers. comm.). Elk are more plentiful in Idaho now than at the turn of the century (Humbird 1975).

In parts of western Montana, elk neared extinction at the turn of the century, surviving in areas around Yellowstone National Park, along the Continental Divide, and in a few isolated mountain areas (Rognrud and Janson 1971). Elk from Yellowstone National Park were transplanted near Divide, Montana, in 1912 (D. E. Jones, pers. comm.). In the early 1930's, five truckloads of elk from

Yellowstone Park were transplanted in the Panther Creek area, now Idaho Management Unit 28 (F. Rose, pers. comm.). Mr. Fred Rose was one of the truckers that hauled the elk to Panther Creek. Local and migrating animals in the study area may be descendents of those transplanted from Yellowstone Park.

An assumption that preceded this study was that elk winter in the Salmon National Forest of Idaho and summer in the Beaverhead and Bitterroot National Forests of Montana (Fig. 1). Elk concentrate on winter ranges near Northfork, Idaho. For many years, local residents reported that those elk summered in Montana. Personnel of the Idaho and Montana Fish and Game departments and U.S. Forest Service suspected those reports were correct. However, specific migration routes with associated calving, rutting, feeding, and resting areas were not completely documented (Anon. 1975b). Until recently, those portions of the Salmon, Bitterroot, and Beaverhead National Forests along the Idaho-Montana border were relatively undeveloped. Logging is now scheduled, and alterations of the existing environment seem inevitable (Anon. 1974a). While harvesting of timber may possibly benefit game, producing shrubby vegetation for food (Rognrud and Janson 1971), recent studies in Montana indicate that elk avoid areas of intense activity (Lyon 1974, Zahn 1974). Logging roads extend the activities which disturb elk. Lyon (1974:v-vi) stated that there was a fairly strong avoidance of sites within 0.25 mile (0.4 km) of roads.

Resource managers of the Salmon, Bitterroot, and Beaverhead National Forests and the Idaho and Montana Fish and Game departments decided that specific information on migratory routes and key-use areas was needed for planning purposes. Those managers felt that, unless properly planned, logging and roads would adversely affect the bi-state herd. During summer 1973, they met with representatives of the Montana Cooperative Wildlife Research Unit and planned this study. Specific objectives were to:

1) determine migration routes to and from traditional winter ranges;
2) locate preferred feeding and resting sites along the migration routes;
3) expand the present knowledge of key areas such as winter and summer ranges, and calving and rutting areas important to elk management; and
4) relate knowledge gained concerning migration routes and key areas to potential timber harvest and road construction using present Montana studies for comparison.

A system was needed for determining extensive migratory routes and associated key-use areas. Various marking systems were used in the past to determine movements of elk. Metal ear tags and hunter report cards were used in studies of the Gallatin herd in

Montana (Brazda 1953). However, this provided information on animals primarily during hunting seasons, and hunters did not always know exactly where they made kills. Information gained in this manner was also limited unless large numbers of marked animals were killed and the study continued over a long time span. Craighead et al. (1972) marked 1,507 elk with rope collars and were successful in determining migratory routes of elk in Yellowstone Park. Other recent studies also employed individually recognizable collars to follow elk movements (Simmons 1974, Zahn 1974). Long migrations are often made during short periods of time over rough terrain. Such movements are difficult or impossible to follow by visual systems but can be followed using aircraft and radio transmitters placed on animals. Portions of populations which remain in local areas or migrate can also be determined.

Radiotelemetry as well as visual markings were successfully used during recent Montana studies of elk-logging relationships (Ream et al. 1971, 1972, 1974). I used a similar system from January 1974 to December 1975, to investigate the migratory routes and associated key-use areas of elk to aid in better management.

# CHAPTER II

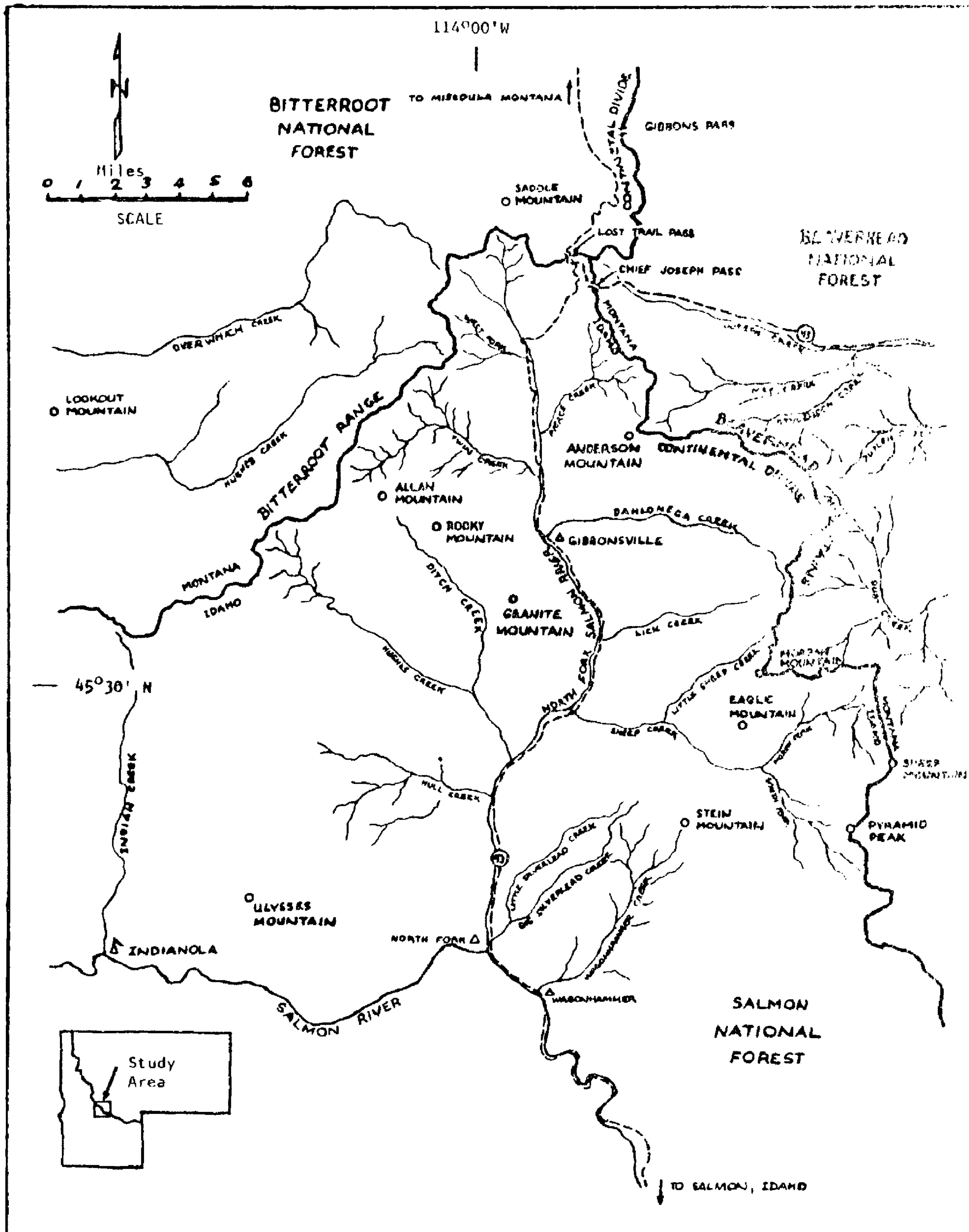
# DESCRIPTION OF THE STUDY AREA

## Location

The study area lies in the states of Idaho and Montana. U.S. Highway 93 approximately divides the area of 1,500 square miles (2,400 sq km) into east and west halves. Northfork, Idaho, is at the southern extremity. U.S. Highway 93 runs north from there, along the North Fork of the Salmon River to Lost Trail Pass, then down Camp Creek to Sula Ranger Station, approximately the northern extremity. The Bitterroot Mountains comprise the western portion, while the Continental Divide (Beaverhead Mountains) traverses the eastern portion (Fig. 1).

In the rough mountainous terrain, confusion in orientation can be avoided by determining the direction of water flow. All streams in the study area east of the Continental Divide flow into the Big Hole River and on to the Gulf of Mexico. All portions of the study area in Idaho drain into the Salmon River and thence west to the Pacific Ocean. Streams west of the Continental Divide in Montana flow into the Bitterroot system, thence north for many miles before turning west to the Pacific.

Fig. 1. Map of the study area.


114°00'W
N
Miles
0 1 2 3 4 5 6
SCALE
BITTERROOT NATIONAL FOREST
TO MISSOULA MONTANA
GIBBONS PASS
SADDLE MOUNTAIN
LOST TRAIL PASS
CHIEF JOSEPH PASS
NATIONAL FOREST
OVERWHICH CREEK
LOOKOUT MOUNTAIN
BITTERROOT RANGE
ANDERSON MOUNTAIN
CONTINENTAL DIVIDE
TWIN CREEK
ALLAN MOUNTAIN
ROCKY MOUNTAIN
GIBBONSVILLE
DAHLONEGA CREEK
MONTANA
IDAHO
DITCH CREEK
GRANITE MOUNTAIN
NORTH FORK SALMON RIVER
LICK CREEK
HUGHES CREEK
45°30' N
LITTLE SHEEP CREEK
EAGLE MOUNTAIN
SHEEP CREEK
HULL CREEK
STEIN MOUNTAIN
PYRAMID PEAK
INDIAN CREEK
ULYSSES MOUNTAIN
INDIANOLA
NORTH FORK
SALMON RIVER
WAGONHAMMER
SALMON NATIONAL FOREST
Study Area
TO SALMON, IDAHO

In Montana, the area west of Lost Trail Pass to Painted Rocks Lake and north is a portion of the Bitterroot National Forest. The adjoining area to the east is managed by the Beaverhead National Forest. That part of the study area to the south, in Idaho, lies in the Salmon National Forest.

## Land Use

Logging operations have been conducted since before the turn of the century in the more accessible portions of the study area. Current logging operations provide wood products for the world market and employment for local residents. Planning, under existing constraints, continues for future logging. At the present time, logging is the primary economic use of the three forests.

Outfitters and packers derive income from hunting during fall seasons and from summer boating on the Salmon River. Some recreational income is derived from tourists, campers, and back-packers who frequent the area mostly during the summer months. An undetermined income is derived each year from resident and non-resident hunters. This income probably provides an economic impact second only to the logging industry. Approximately 3,500 hunters are checked annually at the Carmen Creek Checking Station near Salmon, Idaho. Most of those hunters hunt in Units 21 and 21A which comprise a good portion of the Idaho side of the study area (Anon. 1973). The

Montana side of the study area accommodates approximately 1,500 hunters annually (J. Firebaugh, pers. comm.).

Mining is presently of little importance although there is continuing mineral exploration in the drainages of Wagonhammer and Ditch creeks. Intense placer mining operations occurred during the first quarter of the 20th century and earlier along the North Fork of the Salmon River near Gibbonsville, Idaho, and in both Hughes Creek and Sheep Creek. These mining operations played an important part in the economic history of the area. There is also ample evidence of additional early mineral explorations in the Montana portion of the study area.

Cattle grazing is of importance, especially in the Big Hole Valley of Montana. Portions of the elk winter range in Burns Basin on the Salmon National Forest is used for cattle grazing on a rest-rotation basis. Other portions of the study area are not extensively grazed by cattle due to rough terrain. Ranching efforts (mostly confined to areas along U.S. Highway 93) are conducted on a subsistence basis.

Comparisons of recreational income to income derived from the timber industry, or to grazing or other agricultural income have not been made. However, all are important management considerations in an area where approximately nine-tenths of the land is in federal ownership.

Geology

The Rocky Mountains were first uplifted during the Cretaceous Period about 100 million years ago in what is known as the Laramide Revolution. Some mountain building activity continues to the present. In the study area, most rocks are altered sandstones, shales, and a few limestones of the Beltian System deposited over 600 million years ago in a marine environment. A large mass of granitic intrusive rock, one of the segments of the Idaho Batholith and an event of the Laramide Revolution, is in contact with the sediments (Anderson 1959).

During Pleistocene times, the higher mountains were sculptured by glaciation. Cirques, tarns, and horns were formed, and the debris transported by the glaciers remains in the form of terminal and lateral moraines. These characteristics are especially pronounced in the Big Hole Valley, east of the Continental Divide in Montana; the cirques, moraines, etc., provide large catchment areas for snow. The steep scarp-like west side of the mountain range in Idaho is characterized by much smaller catchment areas. The glaciers west of the Continental Divide were smaller, and less material was transported than on the east side. The mountains are now undergoing stream erosion of bedrock, soil, and the remaining glacial debris (Anderson 1959).

Soils of the area have a narrow range in form and structure due to a youthful stage of development. These soils have weak profiles with homogeneous horizons differing only in depth, texture, and stoniness. Soils from granitic rocks of the Idaho Batholith are coarsely textured while those from volcanic and sedimentary rocks are medium to moderately fine. South and west slopes and steep slopes have soils that are more shallow than those facing northwest or soils on gentle slopes. There are no areas of highly productive soils.

Physiography

The study area is divided into quadrants for descriptive purposes on an approximate north-south axis by U. S. Highway 93, with the east-west axis on the Continental Divide and the Idaho-Montana border (Fig. 1). The Continental Divide from Chief Joseph Pass to the southeast (Idaho-Montana border), is rough and precipitous.

Sheep Mountain (9,858 ft; 3,005 m) and Pyramid Peak (9,616 ft; 2,931 m), through name, contour, and elevation, establish the character of the southeast quadrant. Other principal mountain peaks are: Anderson (8,039 ft; 2,450 m); Morgan (8,308 ft; 2,532 m); Eagle (8,025 ft; 2,446 m); and Stein (8,555 ft; 2, 977 m). Canyons and ridges are oriented to the southwest; creeks drain into the North Fork of the Salmon River or into the Salmon River proper. The little community of Northfork, Idaho (3,600 ft; 1,097 m), marks a southern edge of the study area. At this point, the Salmon River flows west into the Idaho Primitive Area. North slopes are timbered; at lower elevations, south and southwest slopes are open bunchgrass. These slopes (especially those near Big and Little Silverlead creeks, and Burns Basin with nearby ridges) provide winter range for elk.

Principal mountain peaks in the southwest quadrant are Allan (9,154 ft; 2,790 m) and Rocky Mountain (8,640 ft; 2,634 m). Allan Lake, of glacial origin, is present in this section. Most north slopes are heavily timbered, but some rocky, precipitous areas exist. Canyons and drainages are principally oriented to the southeast from the Idaho-Montana border. The North Fork of the Salmon River is the collecting stream for these waters. Granite Mountain and the nearby Ransack Meadows area, east, southeast, and south slopes of Hughes and Hull creeks, plus other lower elevational slopes in this quadrant provide elk winter range.

Lost Trail Pass (7,014 ft; 2,138 m) and Saddle Mountain (8,482 ft; 2,585 m) are elevational features of the northwest quadrant. Principal drainages are Overwhich and Hughes creeks (two Hughes creeks, see Fig. 1) which flow southwest to the West Fork of the Bitterroot River. North slopes are timbered with some south and southeast slopes of open bunchgrasses and other grasslike vegetation. Heads of these drainages, seeps, wet meadows, and cool north slopes provide summer range for elk.

In the northeast quadrant, the Continental Divide branches to the northeast and southeast from Chief Joseph Pass. The terrain is relatively gentle compared with other sections of the study area. May, Stevenson, Butler, and Ruby creeks are principal drainages. Thick stands of lodgepole pine (*Pinus contorta*) extend to the Big Hole Valley. Isaac Meadows, Yank Swamp (6,200 ft; 1,889 m), and the western edge of the Big Hole Valley establish an eastern boundary. Summer range for elk and few roads characterize this section.

Moraines, canyons, high mountain lakes, and heavily timbered areas are descriptive of the Montana side of the Continental Divide. Lodgepole pine and subalpine fir (*Abies lasiocarpa*) are dominant tree species. Elk summer range is an important feature of this portion.

## Access

Access has been developed over many years by trails, jeep trails, and roads that were initially used to service lookout towers or for logging and mining purposes. Some roads were developed later for recreational use.

*Western half of study area*. In the Granite Mountain area, a loop road provides access commencing at U.S. Highway 93, up the Hughes Creek drainage for approximately 4 miles, thence north to Granite Mountain Lookout, continuing east down the Votler Creek drainage to U.S. Highway 93. A logging road penetrates from the Hughes Creek access to the Humbug Ridge clearcuts. Numerous side logging accesses (many closed) are present in Humbug and Votler creek drainages, Ransack Meadows, and Vineyard, Johnson, and Friedorf gulches. Another loop road exists from the Twin Creek Recreation Area access from U.S. Highway 93 south on the western side of U.S. Highway 93 and terminating on this highway near Gibbonsville, Idaho.

The north portion of the western half is roadless at higher elevations, although a road to the now dismantled Saddle Mountain Lookout provides eastern access from Lost Trail Pass on U.S. Highway 93. In Montana, roads dead-end approximately halfway to the heads of Hughes and Overwhich creeks from the county road along the West Fork of the Bitterroot River near Painted Rocks Lake, providing a western approach. Logging roads are evident in the Saddle Mountain burn and the Camp Creek drainage.

Beginning near Lost Trail Pass Ski Resort on U.S. Highway 93, the Divide Trail follows an elevational contour from 8,000 to 9,000 ft (2,438 to 2,743 m) along the Idaho-Montana border for many miles to the southwest. Other U.S. Forest Service trails join the Divide Trail from Idaho via the Hughes and Twin creeks drainages. Many other trails are evident in the Montana portion starting near Saddle Mountain and traversing the headwaters region of Porcupine, Colter, Shields, Overwhich, and Hughes creeks, and the West Fork of Camp Creek.

Eastern half of study area. This portion is also characterized by many trails, jeep trails, logging roads, a state highway, and county road accesses.

In Idaho, an access road exists from U.S. Highway 93 east to the undeveloped campground along Sheep Creek. Stein Gulch access exists from this road on into the Big and Little Silverleads drainages where a new logging road was constructed in 1975. Many side logging accesses in the Stein Gulch area are now closed. A loop road leads up the Lick Creek drainage from U.S. Highway 93 over Morgan Mountain and joins the Big Hole Valley-Gibbonsville, Idaho, secondary road at Big Hole Pass (7,243 ft; 2,208 m). This secondary road becomes impassable to four-wheel-drive vehicles with the heavy snows of fall and winter. It remains closed until completion of snowmelt about the third week of June.

In the Montana portion of this half of the study area, logging roads are present in the area from Gibbons Pass to Chief Joseph Pass. Along the Continental Divide, the Anderson Mountain road provides access to the Anderson Mountain Lookout site from Montana Highway 43 at Chief Joseph Pass. Logging roads near the downstream portion of Butler Creek, in the Sawpit drainage, along Ruby, Little Moosehorn, and Big Moosehorn creeks exist from the Foothills Road access to Montana Highway 43.

In Montana, U.S. Forest Service trails up the Ruby and Butler creek drainages from the Big Hole Pass and Foothills Road accesses, respectively, join at the heads of these creeks and terminate at the mouth of May Creek on Montana Highway 43. Another trail follows the Continental Divide from Anderson Mountain to Big Hole Pass. In this vicinity of Idaho, U.S. Forest Service trails join the trail along the Continental Divide from the Gibbonsville, Idaho, Big Hole Pass access road along the Pierce Creek, Anderson Creek, Keystone Gulch, and West Fork of Nez Perce Creek drainages. U.S. Forest Service trails are also present along the North and South Forks of Sheep Creek, from Stein Mountain Lookout down the Wagonhammer and Big Silverlead creek drainages to U.S. Highway 93. Stein Mountain Lookout is still an active lookout tower and is serviced by a county and U.S. Forest Service road from U.S. Highway 93 up the Fourth of July and Black Tail creek drainages.

No effort was made to catalogue mileage of roads or trails in the study area. This data may be available through compilation from U.S. Forest Service, or other federal, state, and county sources.

## Climate

Temperatures, precipitation, snowfall, wind velocity, and direction vary in the study area due to differences in elevation, aspect, and topography. Diverse microclimates result. Most of the precipitation is supplied by eastward moving Pacific frontal systems which occur during the winter months and create deep snow packs. When frontal systems from the Pacific are blocked by high pressure, continental air flows into the area resulting in periods of clear weather and cold temperatures. In early spring, frontal systems occasionally move across the area depositing warm rain or snow. Proper combinations of temperature, rain, and snow can cause flooding in localized areas.

Warm, dry summers are critical in limiting vegetation and creating wildfire hazards. Lightning from dry thunderstorms is common. Occasionally, severe thunderstorms can cause erosion problems. This occurred in the study area during summer 1975.

Table 1 lists average monthly temperatures for calendar years 1973 and 1974 for four reporting stations representative of the study area. Table 2 indicates precipitation on the study area during 1973 and 1974. Snowfall during winter 1973-74 was comparatively light, and that of 1974-75 was heavy. Table 3 shows mean and extreme temperatures and precipitation by month for a 30-year period at Salmon, Idaho (U.S. Dept. of Commerce 1975). Similar data were not available for the other three stations. Mean annual precipitation, maximum monthly precipitation, and driest months are listed.

Table 1. Average temperatures by month and annually for calendar years 1973 and 1974. Taken from
U.S. Department of Commerce
National Oceanic and Atmospheric Administration
Environmental Data Service
Asheville, North Carolina

Climatological Data

| Station | Latitude | Longitude | Elevation |
|---|---|---|---|
| Salmon, Id. | 45° 11' N | 113° 45' W | 3970 ft. |
| Gibbonsville, Id. | 45° 33' N | 113° 57' W | 4480 ft. |
| Sula, Mt. | 45° 51' N | 113° 58' W | 4475 ft. |
| Wisdom, Mt. | 45° 37' N | 113° 27' W | 6060 ft. |

Average Temperatures
1973

| Station | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sept. | Oct. | Nov. | Dec. | Ann. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Salmon | 18.1 | 28.9 | 37.9 | 44.8 | 56.1 | 63.2 | 72.0 | 69.0 | 57.5 | 48.0 | 35.1 | 29.5 | 46.7 |
| Gibbonsville | 17.2 | 24.9 | 34.7 | 40.8 | 51.9 | 58.0 | 65.7 | 65.0 | 55.2 | 45.5 | M | M | M |
| Sula | 20.3 | 25.0 | 35.7 | 38.6 | 48.9 | 55.0 | 60.6 | 60.0 | 50.9 | 43.0 | 26.5 | 28.0 | 41.1 |
| Wisdom | 11.0 | 14.0 | 25.6 | 33.2 | 42.9 | 51.5 | 58.5 | 56.7 | 46.4 | 38.6 | 25.3 | 20.6 | 35.4 |

1974

| Station | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sept. | Oct. | Nov. | Dec. | Ann. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Salmon | 19.6 | 33.7 | 37.6 | 47.4 | 51.5 | 67.4 | 71.2 | 65.7 | 59.5 | 47.0 | 36.1 | 24.5 | 46.8 |
| Gibbonsville | 14.7 | 25.8 | 32.0 | 41.5 | 44.7 | M | M | M | M | 43.3 | 30.7 | 19.7 | M |
| Sula | 18.6 | 28.9 | 33.3 | 43.2 | M | 58.0 | 60.9 | 59.0 | 52.0 | 43.2 | 35.5 | 24.5 | M |
| Wisdom | 12.6 | 21.9 | 24.5 | 36.2 | 40.2 | 55.8 | 58.5 | 53.7 | 47.0 | 38.3 | 28.5 | 18.0 | 36.3 |

Temperatures in degrees Fahrenheit
M means missing data
Departures from normal listed for Salmon and Wisdom were plus 2.6 and 1.0° F (annually) for 1974 only

TABLE 2. Total precipitation in inches by month and annually for calendar years 1973 and 1974

Taken from U.S. Department of Commerce, National Oceanic and Atmospheric Administration Environmental Data Service, Asheville, North Carolina

| Station | Climatological Data | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1973 | | | | | | | | | | | | |
| | Jan. | Feb. | Mar. | Apr. | May | Jun. | Jul. | Aug. | Sept. | Oct. | Nov. | Dec. | Ann. |
| Salmon | .36 | .06 | .18 | .42 | .45 | 1.97 | .67 | .50 | .84 | .30 | 1.00 | 1.13 | 7.88 |
| Gibbonsville | 1.22 | .05 | .50 | .15 | 1.14 | 1.39 | .52 | .61 | .83 | .53 | 1.65 | 2.52 | 11.11 |
| Sula | .48 | .50 | .42 | .47 | 1.19 | 2.28 | .51 | .64 | 1.37 | 1.36 | 2.33 | 1.07 | 12.62 |
| Wisdom | .44 | .05 | .42 | .31 | .42 | 1.12 | .45 | .43 | .96 | .50 | 1.32 | 1.09 | 7.51 |
| | 1974 | | | | | | | | | | | | |
| Salmon | .86 | .23 | 1.14 | .10 | .66 | .29 | .33 | .91 | .02 | 1.02 | .45 | 1.07 | 7.35 |
| Gibbonsville | 1.50 | 1.00 | 1.44 | T | .40 | .10 | .69 | .58 | T | .40 | .15 | 1.74 | 8.00 |
| Sula | .92 | .75 | 1.85 | .49 | 1.02 | .45 | .91 | 1.87 | .42 | .56 | .62 | .28 | 10.14 |
| Wisdom | .39 | .26 | .90 | .27 | .60 | .20 | .60 | .88 | .13 | .40 | .44 | .53 | 5.60 |

Departures from normal listed for Salmon and Wisdom were minus 2.26 and 6.66 (annually) for 1974 only.

Table 3.

U.S. Department of Commerce, National Oceanic and Atmospheric Administration
Weather Service in Cooperation with
The Idaho Department of Commerce and Development
Climatography of the United States No. 20 - 10

Latitude 45° 11'
Longitude 113° 54'
Elev. (Ground) 3970 feet

Climatological Summary

Station SALMON IDAHO

Means and Extremes for Period 1940-1969

| | Temperature (°F) | | | | | | | * | Precipitation Totals (Inches) | | | | | | | | | Mean number of days | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Means | | | Extremes | | | | | | | | # Snow, Sleet | | | | | | | Temperatures | | | | |
| | | | | | | | | | | | | | | | | | | | Max | | Min | | |
| Month | Daily maximum | Daily minimum | Monthly | Record highest | Year | Record lowest | Year | Mean degree days | Mean | Greatest daily | Year | Mean | Maximum monthly | Year | Greatest daily | Year | Precip. .10 inch or more | 90° and above | 32° and below | 32° and below | 0° and below | Month |
| (a) | 30 | 30 | 30 | 30 | | 30 | | 30 | 30 | 30 | | 22 | 22 | | 22 | | 10 | 25 | 25 | 25 | 25 | |
| Jan. | 29.6 | 6.7 | 18.5 | 62 | 1953 | -36 | 1949 | 1460 | 0.61 | 0.76 | 1956 | 6.7 | 24.5 | 1930 | 6.0 | 1930 | 7 | 0 | 11 | 31 | 9 | Jan. |
| Feb. | 38.4 | 15.1 | 26.7 | 68 | 1950 | -35 | 1956 | 1128 | 0.54 | 0.63 | 1960 | 4.1 | 14.0 | 1930 | 6.0 | 1930 | 2 | 0 | 6 | 28 | 3 | Feb. |
| Mar. | 48.3 | 21.4 | 35.1 | 75 | 1966 | -20 | 1960 | 927 | 0.44 | 0.55 | 1957 | 1.3 | 6.0 | 1939 | 3.0 | 1939+ | 2 | 0 | [illegible] | [illegible] | 1 | Mar. |
| Apr. | 61.0 | 29.8 | 45.4 | 89 | 1946 | 10 | 1945 | 579 | 0.68 | 0.84 | 1967 | .3 | 4.0 | 1929 | 4.0 | 1929 | 7 | 0 | 0 | 20 | 0 | Apr. |
| May | 70.1 | 37.5 | 53.8 | 95 | 1954 | 19 | 1954 | 357 | 1.43 | 1.15 | 1948 | T | T | 1948+ | T | 1948+ | 5 | * | 0 | 6 | 0 | May |
| June | 76.5 | 43.7 | 60.2 | 99 | 1959 | 25 | 1954 | 186 | 1.59 | 1.10 | 1953 | 0 | 0 | | 0 | | 5 | 3 | 0 | 1 | 0 | June |
| July | 88.6 | 47.5 | 67.9 | 105 | 1960 | 26 | 1955 | 28 | 0.72 | 0.90 | 1945 | 0 | T | 1950 | T | 1950 | 2 | 16 | 0 | | 0 | July |
| Aug. | 86.0 | 44.9 | 65.7 | 103 | 1961+ | 28 | 1960 | 56 | 0.73 | 1.04 | 1943 | 0 | 0 | | 0 | | 2 | 12 | 0 | | 0 | Aug. |
| Sep. | 75.1 | 37.9 | 56.5 | 93 | 1950 | 18 | 1965 | 267 | 0.80 | 1.19 | 1966 | .1 | 1.5 | 1934 | 1.0 | 1934 | 3 | 2 | 0 | 6 | 0 | Sep. |
| Oct. | 62.4 | 29.0 | 45.7 | 86 | 1957 | 10 | 1960 | 595 | 0.60 | 0.73 | 1967 | .1 | 1.5 | 1935 | 1.0 | 1935 | 2 | 0 | 0 | 22 | 0 | Oct. |
| Nov. | 43.9 | 20.2 | 32.5 | 68 | 1959+ | -12 | 1952 | 996 | 0.57 | 0.81 | 1968 | 2.0 | 7.9 | 1931 | 5.5 | 1931 | 3 | 0 | 3 | 26 | | Nov. |
| Dec. | 32.5 | 12.1 | 22.7 | 57 | 1949+ | -28 | 1948 | 1318 | 0.68 | 0.95 | 1948 | 5.1 | 16.5 | 1942 | 9.0 | 1948 | 2 | 0 | 14 | 31 | 4 | Dec. |
| | | | | | July | | Jan. | | | | Sep | | | Jan | | Dec. | | | | | | |
| Year | 59.4 | 28.9 | 44.2 | 105 | 1960 | -36 | 1949 | 7897 | 9.39 | 1.19 | 1966 | 19.7 | 24.5 | 1930 | 9.0 | 1948 | 32 | 33 | 41 | 200 | 17 | Year |

(a) Average length of record, years

T Trace, an amount too small to measure

* Base 65° F (1931-1960)

\+ Also on earlier dates, months, or years

* Less than one half

\# 1929-1950

Snowfall and snow on the ground was listed for Gibbonsville only, and data were only partially complete. At the end of December 1973, 28 inches (71 cm) were on the ground; and at the end of December 1974, the amount was 22 inches (56 cm).

Elk migrations from winter and summer ranges are affected by weather patterns and plant development. Tables 1, 2, and 3 provide gross climatological data from which references can be made. Microclimatic measurements were not taken.

Vegetation

A grassland habitat type, Wyoming big sagebrush/bluebunch wheatgrass (Artemesia tridentata var. wyomingensis/Agropyron spicatum), was present on the Burns Basin-Wagonhammer Creek winter range at elevations from 4,000 to 5,500 ft (1,200 to 1,650 m). This type occurred on all aspects but was more common on benches and south slopes (Schlatterer 1972). Idaho fescue (Festuca idahoensis) and junegrass (Koeleria cristata) were also present. Disclimax species such as cheatgrass (Bromus tectorum) and introduced grasses, crested wheatgrass (Agropyron cristatum), orchard grass (Dactylis glomerata), and intermediate wheatgrass (Agropyron intermedium) were evident. Forbs included arrowleaf balsamroot (Balsamorhiza sagittata). At least two subspecies of sagebrush, big sagebrush (Artemesia tridentata vaseyana) and Wyoming sagebrush (A. t.

wyomingensis) were present. Rabbitbrush (Chrysothamnus viscidiflorus) was noted. Mountain mahogany (Cercocarpus ledifolius) occurred on the rocky ridges near the 4,000 ft (1,200 m) level. Willow (Salix spp.) occurred in the creek bottoms.

Five timbered habitat-type series, listed in detail by Pfister et al. (1974) and Steele et al. (1974), are generally descriptive of the study area. These series include warm, dry habitat types of lower elevations and cool-moist associations of alpine areas.

Fig. 3 (Montana habitat-type field form) lists trees, shrubs, graminoids, and forbs growing in the study area. Appendix II provides the location and keyed-out habitat types of the 51 samples taken throughout the study area. The samples represent specific areas only and do not provide habitat typing of large acreages. The size of the study area would require many more samples or a different habitat typing technique to provide dependable habitat type maps.

A brief description of each of the five timbered series follows.

Ponderosa pine (Pinus ponderosa). Between 4,000 and 5,000 feet (1,200 and 1,500 m), ponderosa pine is the dominant tree species, but Douglas-fir (Pseudotsuga menziesii) may be present. This series is found mainly on warm, dry, south or west slopes. Bluebunch wheatgrass and forbs such as arrowleaf balsamroot and heartleaf arnica (Arnica cordifolia) are found in the understory. At higher elevations in this series, Idaho fescue may dominate. On moist sites, snowberry (Symphoricarpos albus) and white spirea (Spirea betufolia) are common.

Douglas-fir. Douglas-fir occurs at elevations between 4,000 and 7,000 ft (1,200 and 2,100 m). At lower elevations in this series, ponderosa pine may be a seral tree species; at higher elevations, lodgepole pine may be a seral dominant. At high elevations on cool north and east slopes, pinegrass (Calamagrostis rubescens) and elk sedge (Carex geyeri) dominate the understory, and beargrass (Xerophyllum tenax) is found in moist locations. Ninebark (Physocarpus malvaceus), snowberry and blue huckleberry (Vaccinium globulare) share the understory on moist north slopes.

Subalpine fir. The subalpine fir series occurs mostly above 6,000 ft (1,800 m). Understory species include beargrass, fool's huckleberry (Menziesia ferruginea), wood-rush (Luzula hitchcockii) and grouse whortleberry (Vaccinium scoparium). Stable communities of lodgepole pine usually dominate these sites. Seedlings of lodgepole pine are numerous. Subalpine fir regeneration is mostly vegetative and Engelmann spruce (Picea engelmannii) is present on moist sites and along creek bottoms. Pinegrass, beargrass, elk sedge, and heartleaf arnica are present in the understory vegetation depending on aspect and moisture availability.

Timberline habitat types. The transitional belt extending upward from contiguous forest to the upper limits of krummholz or shrublike trees supports the timberline habitat types. Subalpine fir, whitebark pine (*Pinus albicaulis*), lodgepole pine, and some spruce generally grow in clusters. The understory may consist of grouse whortleberry, wood-rush, elk sedge, pinegrass, beargrass, and Idaho fescue depending on exposure and moisture conditions.

Lodgepole pine community types. Pfister et al. (1974) discussed situations wherein lodgepole pine is a persistent seral species or possibly climax. In such situations, shade-tolerant species such as Douglas-fir, subalpine fir, and spruce have not made much of an inroad into the lodgepole pine stands. Many of these areas key out to a habitat type in the subalpine fir series if seedling frequency dictates (at least 10 per acre). Understory is often sparse, but understory species may consist of grouse whortleberry, beargrass, pinegrass, or elk sedge. This situation was noted in some parts of the study area in Montana, especially the West Big Hole.

# CHAPTER III

# MATERIALS AND METHODS

## Trapping

Between 19 and 23 November 1973, corral traps of portable pine panels with holding pens, restraining chutes, and gates rigged with trip-wire closing mechanisms were constructed by personnel of the Idaho Fish and Game Department, Salmon, in Wagonhammer and Hughes creek drainages. Traps were baited with salt blocks and second crop alfalfa hay. Hay bait trails were used. Trapping commenced in late December during the 1974-75 trapping season and in early January during the 1973-74 season. Traps were set for 2 to 3 days at varying intervals when snow conditions and elk activity indicated high probability of trapping success. Trapping was discontinued between 1 March and 15 May depending upon probability of success. With green-up, wet or moldy hay became less desirable; and trapping success declined. Mule deer (*Odocoileus hemionus*) were caught in the Hughes Creek trap as late as 12 May.

When elk were trapped, each was maneuvered through the holding pen into the restraining chute, collared with a radio or rope collar and ear-tagged with an ear flag and a numbered Idaho Fish and

Game Department aluminum tag. A trapped elk form, Fig. 2, was filled out, and the animal was released. Work was completed as rapidly as possible and care was taken to avoid stressing the animals. Ages were determined by the dentition method established by Quimby and Gaab (1957). Blood samples were taken from trapped animals at both Hughes Creek and Wagonhammer traps.

Spike bulls, cows, and calves were worked through the chutes. Branch-antlered bulls and one large spike were immobilized with Anectine (succinylcholine chloride) and processed in the main corral. Large antlered bulls would not fit the chutes. Drugged animals were closely observed and released when sufficiently recovered.

Radiotelemetry

Ten pulsing radio transmitters, operating in the 150 Mhz range, were used on the elk during the 1973-74 trapping season and six in 1974-75. One used the second year was a repackaged transmitter from a hunter-killed animal collared the previous year. That collar, complete with bullet hole, had been turned in to the Montana Fish and Game Department, Missoula, Montana. Another collar was retrieved from an animal that was a stress casualty and reused.

Denton (1973) described the method of assembling and waterproofing transmitter components. A departure from that system was

Fig. 2. Trapped elk form.

Elk No. ____________________

Trap Site ____________________

Arrival Time ________________

No. of Animals in Trap ________

Bull ____ Cow ____ Calf _______

Drug Used : Yes _____ No ______

Drug Type and Dose ___________

______________________________

Pregnancy ____________________

Approx. Age __________________

Tooth Pulled _________________

General Condition ____________

______________________________

Left Ear Tag No. _____________

Right Ear Tag No. ____________

Rope Collar I.D. _____________

Radio Collar Channel _________

Radio Collar No. _____________

Neck Measurement _____________

Release Time _________________

Date ____________

Departure Behavior ___________

______________________________

______________________________

______________________________

______________________________

Remarks ______________________

______________________________

______________________________

______________________________

______________________________

______________________________

______________________________

_______ (blood sample taken, drug reaction, external parasites, individual markings, etc., weather, temperature and general condition)

Observer (trap operator) _______

______________________________

that one large lithium battery, vice four small mercury batteries (pairs of two), was used as a power supply for transmitters prepared for the 1974-75 season. Lighter weight, greater efficiency, and longer life were advantages.

Forty-inch (102 cm) lengths of 2.5-inch (6.4 cm) diameter PVC irrigation pipe (ASC, 160 psi) were heated in an oven until pliable. A waterproofed transmitter package, with transmitting antenna, was inserted in each piece of pipe, placed in a mold, and pressed into a collar shape that fitted nicely around an elk's neck. Cooling was completed in the press. Cut ends of the pipe were waterproofed with a sealing compound. A bolt with a nylon-lined lock nut secured the collar around the elk's neck. The complete package was durable, waterproof, and weighed 2.5 lbs (1.34 kg).

Transmitters were manufactured by the AVM Instrument Company, Champaign, Illinois. Assembling of components, waterproofing, and construction of pipe collars were done at the University of Montana, School of Forestry.

A model LA-12 portable radiotelemetry receiver manufactured by the AVM Instrument Company, two 3-element Yagi receiving antennae, earphones, a right-left directional switch, and cables connecting the antennae mounted on struts of a Cessna-182 aircraft to the receiver in the cockpit comprised the receiving system for aerial locations. Ground radio transmitter locations were made with a hand-held Yagi antenna connected to the receiver. Denton (1973) described the electronic details of the transmitting and receiving systems, terrain effects and operating techniques. Aerial signal ranges were as great as 20 miles (32.2 km) in this study; ground ranges were much shorter due to line-of-sight signal characteristics.

Two radio transmitters (out of 16) ceased operating after approximately 16 months during the 2-year study. Six transmitters were still functioning on termination of the study. The transmitter in collar J2 was last located on 26 October 1975. Her position was undetermined. Remaining transmitters were on winter kills or animals that were shot.

One flight out of 77 (114.3 flight hours) was terminated early because of low battery output of the radio receiver. A broken headset lead and weakened cable and plug connections were other minor difficulties that caused early termination of another flight; thus the receiver was dependable.

Rope Collars

Craighead et al. (1969) perfected a rope collar marking technique for elk migration studies in Yellowstone Park. One-half inch (1.27 cm) braided polyethylene rope was cut into 38-inch (96 cm) lengths. Colored Saflag material (available from the Safety Flag

Company of America, Pawtucket, R.I.), cut into 3 x 9-inch (8 x 23 cm) strips and strung through the braids of the rope, was secured in place with hog rings. The collar was then placed around the elk's neck and clamped with six hog rings. Six flags were colored-coded to designate the year the animal was marked, trap site, and individual animal identification. A pendant with number completed individual identification. Rope collars on calves were adjusted for size by means of 0.25-inch (6 mm) bands cut from 0.5-inch (13 mm) diameter rubber surgical tubing. Rubber bands snugged the collar under the neck and prevented the collar from falling off. As the animal grew, the rubber bands rotted and fell off, allowing utilization of the full size of the collar. This system was used in marking 44 animals during two trapping seasons.

## Locating Radioed Elk

Aerial procedures for locating transmitters required practice and a thorough knowledge of the study area. Four phases of aerial search described by Denton (1973) were followed: 1) flying to known general area of radio transmitter location, receiving and identifying the transmitter signal; 2) homing in on signal source and making a pass over it to insure a receding signal strength; 3) returning to area of maximum signal strength using the right-left switch to equalize signal strengths by coaching the pilot in course changes of the aircraft; and 4) circling the area and reducing altitude to keep the signal source inside the diameter of the plane's circle. Many times, visual confirmations were made using this procedure. Flights were made in the early morning after first light, or in the evenings near or after sunset. At times, terrain, wind, and visibility prevented low altitude flying. Searching for a lost transmitter involved flying the Continental Divide, major drainages, or ridge lines until a signal was received.

Locating transmitter positions from the ground was time-consuming. Two or three cross-bearings with the hand-held Yagi antenna and receiver provided fairly reliable locations, if at least two of the bearings were 90 degrees apart. Pointing the antenna toward the signal source, locating signal null positions, and bisecting the angle between established a line-of-bearing. I attempted to visually determine if radioed cows had calves. Attempts resulted in frightening off the cows which had already hidden their calves.

Ground positions, when combined with aerial locations (visual and nonvisual), were sufficiently accurate to determine activity areas. Ground work was accomplished at any time visibility and weather permitted.

## Rope-Collar Observations

Locations of rope-collared animals were comparatively few.

Observations were easily made on winter ranges, but not on migratory routes or summer and fall ranges. Locations were obtained after spring migration was completed. Such observations helped reinforce locations of summer ranges and key-use areas. Reports on rope-collared elk seen during helicopter flights by U.S. Forest Service and Montana and Idaho Fish and Game Department personnel were used. Reports from non-agency personnel were helpful. Radiotracking flights were also used for visual observations of rope-collared animals. Trapping areas were easily determined by the color codes, but individual identifications were difficult. Hunter reports provided additional information (Appendix I).

Flight Procedures

Five different pilots participated during the 2 years. Three were classified as "bush" pilots and two were inexperienced in mountain flying. Older, experienced pilots did not mind low altitude work when unfavorable ("squirrely") wind conditions did not exist. Pilots new to mountain flying avoided low altitude work. This resulted in less exact radio transmitter positions.

Mountain thermals were evident during summer. At times, they occurred in the same positions and those areas were avoided. As a safety precaution, summer flights were terminated early in the day prior to severe thermal buildups. Winter flying was hampered by storms and low visibility.

In early morning, the study area was traversed from east to west to avoid flying into the rising sun. Ridges were crossed at a 45° angle, and safety precautions included flying up ridges and down canyons or draws. Flying over a ridge or saddle to block out a radio signal and returning to the area for further search, aided in locating exact transmitter positions. This procedure was followed by older pilots after pilot and tracker had worked together as a team and general search areas were known.

Some movements during migrations were not detected because of "no-go decisions" due to marginal weather, and gaps in some routes resulted. Following movements during two migration cycles eliminated some gaps.

During spring migrations, flights were sometimes made every other day. When radioed elk reached summer range, flights were reduced to weekly or 10-day intervals. During fall migrations, flights were again made at short intervals. Flights were made the day before hunting seasons opened and again the day after to determine dispersion due to hunting pressure. Frequent flights were scheduled during hunting seasons because they nearly coincided with fall migrations; however, weekend flights were avoided, after one Saturday flight, when a disgruntled hunter threatened to shoot down the search aircraft. While elk were on their winter ranges, most locations could be determined by ground telemetry. A few special flights were made to locate elk in remote areas of winter ranges or elk in areas where terrain prevented ground contact.

Techniques and Procedures

A small, hand-held tape recorder was used to record temperatures, weather conditions, and other pertinent data. Voice tapes were transcribed, proofread, and filed for later use. Data were recorded at the end of each day of flight or ground observations. Topographic maps (7.5- and 15-minute series) as well as larger scale regional forest maps were used in plotting elk locations and observations. Numbers of observations, locations, herd composition, time intervals, and seasons of observations were used in determining winter ranges, migration routes, feeding and resting sites along routes, and summer ranges. Key-use areas and calving and rutting sites were established in the same manner. When the number of observations indicated an activity center or key-use area, the site was visited and typed according to the system established by Pfister et al. (1974) and Steele et al. (1974). Montana Habitat Type Field Forms (Pfister 1974) were used to record the samples (Fig. 3). In this manner, samples of vegetation were taken and keyed out using the key contained in Preliminary Forest Habitat Types of the Challis, Salmon, and Sawtooth National Forests (Steele et al. 1974).

Fig. 3. Montana habitat-type field form.

(CODE DESCRIPTION)

| TOPOGRAPHY: | HORIZONTAL CONFIGURATION: | VEGETATION COVERAGE: CLASS (1%) | |
|---|---|---|---|
| 1-Ridge | | | |
| 2-Upper slope | 1-Convex (dry) | 0-None | 3-25 to 50 |
| 3-Mid slope | 2-Straight | T-Rare to 1% | 4-50 to 75 |
| 4-Lower slope | 3-Concave (wet) | 1-1 to 5 | 5-75 to 95 |
| 5-Bench or flat | 4-Undulating | 2-5 to 25 | 6-95 to 100 |
| 6-Streambottom | | | |

NOTE: Rate trees (> 4") and regen (0-4") separately (e.g., 4/2)

| | | |
|---|---|---|
| Plot No. | | |
| Location | | |
| T, R, S | | |
| Elevation | | |
| Aspect | | |
| Slope | % | % |
| Topography | | |
| Configuration | | |

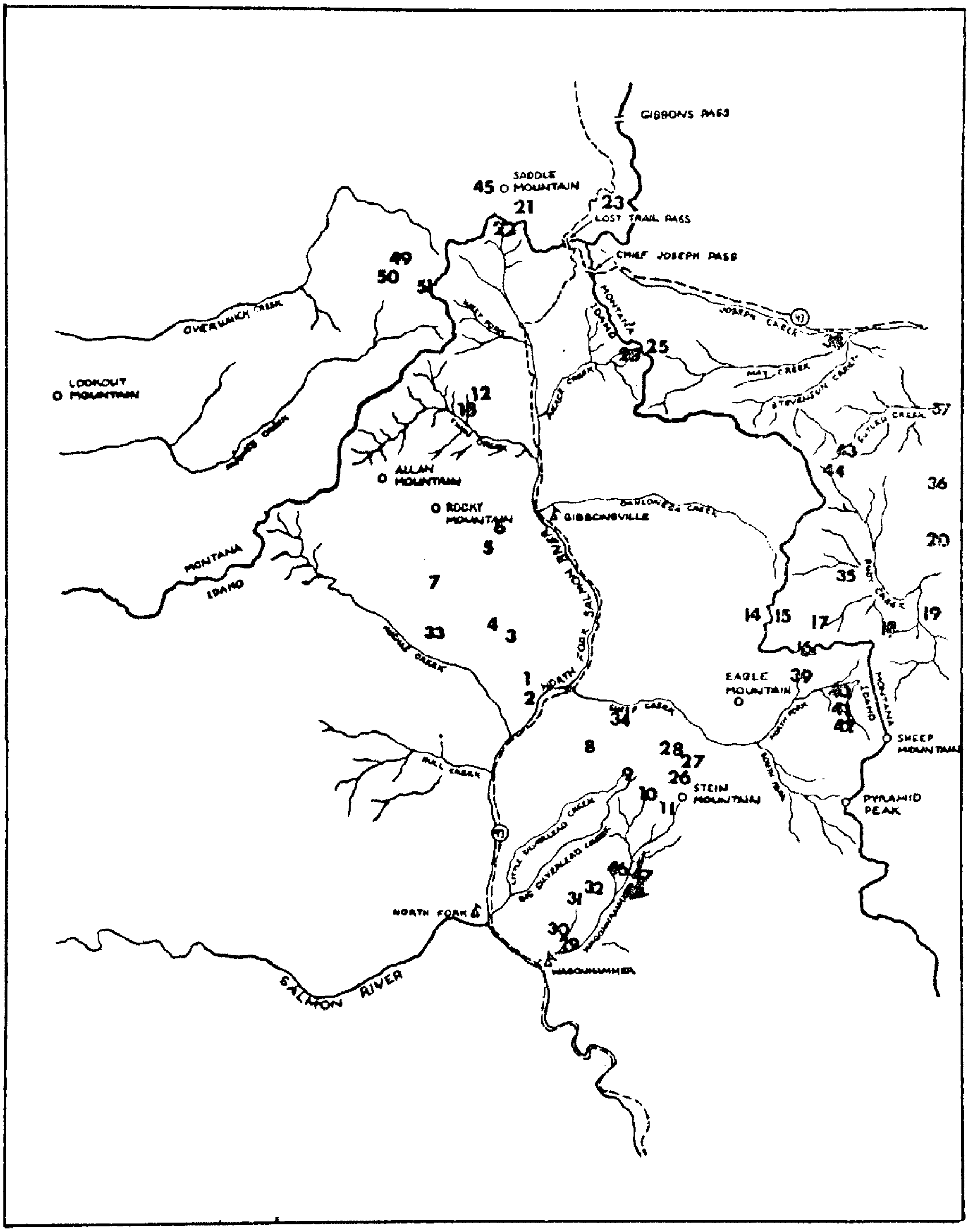
| Scientific Name | Abbrev | Common Name | | |
|---|---|---|---|---|
| **TREES** | | | | |
| 1. Abies grandis | GF | Grand fir | / | / |
| 2. Abies lasiocarpa | AF | Subalpine fir | / | / |
| 3. Larix lyallii | AL | Alpine larch | / | / |
| 4. Larix occidentalis | WL | Western larch | / | / |
| 5. Picea engelmannii | ES | Engelmann spruce | / | / |
| 6. Picea glauca | WS | White spruce | / | / |
| 7. Pinus albicaulis | WBP | Whitebark pine | / | / |
| 8. Pinus contorta | LPP | Lodgepole pine | / | / |
| 9. Pinus flexilis | PF | Limber pine | / | / |
| 10. Pinus monticola | WP | Western white pine | / | / |
| 11. Pinus ponderosa | PP | Ponderosa pine | / | / |
| 12. Pseudotsuga menziesii | DF | Douglas-fir | / | / |
| 13. Thuja plicata | WRC | Western red cedar | / | / |
| 14. Tsuga heterophylla | WH | Western hemlock | / | / |
| 15. Tsuga mertensiana | MH | Mountain hemlock | / | / |
| **SHRUBS** | | | | |
| 1. Alnus sinuata | Alsi | Mountain alder | | |
| 2. Arctostaphylos uva-ursi | Aruv | Kinnikinnick | | |
| 3. Berberis repens | Bere | Creeping Oregon grape | | |
| 4. Cornus canadensis | Coca | Bunchberry dogwood | | |
| 5. Holodiscus discolor | Hodi | Ocean spray | | |
| 6. Juniperus communis (+ horizontalis) | Juco | Common (+ creeping) juniper | | |
| 7. Ledum glandulosum | Legl | Laborador tea | | |
| 8. Linnaea borealis | Libo | Twin flower | | |
| 9. Menziesia ferruginea | Mafe | Menziesia | | |
| 10. Oplopanax horridum | Opho | Devil's club | | |
| 11. Physocarpus malvaceus | Phma | Ninebark | | |
| 12. Prunus virginiana | Prvi | Chokecherry | | |
| 13. Purshia tridentata | Putr | Bitterbrush | | |
| 14. Ribes montigenum | Rimo | Mountain gooseberry | | |
| 15. Shepherdia canadensis | Shca | Buffalo-berry | | |
| 16. Spiraea betulifolia | Apbe | White spirea | | |
| 17. Symphoricarpos albus | Syal | Snowberry | | |
| 18. Vaccinium caespitosum | Vaca | Dwarf huckleberry | | |
| 19. Vaccinium globulare (membranaceum) | Vagl | Blue huckleberry | | |
| 20. Vaccinium scoparium (+ myrtillus) | Vasc | Grouse whortelberry | | |
| **PERENNIAL GRAMINOIDS** | | | | |
| 1. Agropyron spicatum | Agsp | Bluebunch wheatgrass | | |
| 2. Andropogon spp. | ANDR | Bluestem | | |
| 3. Calamagrostis canadensis | Caca | Bluejoint | | |
| 4. Calamagrostis rubescens | Caru | Pinegrass | | |
| 5. Carex geyeri | Cage | Elk sedge | | |
| 6. Festuca idahoensis | Feid | Idaho fescue | | |
| 7. Festuca scabrella | Fesc | Rough fescue | | |
| 8. Luzula hitchcockii (glabrata) | Luhi | Wood-rush | | |
| **PERENNIAL FORBS** | | | | |
| 1. Actaea rubra | Acru | Baneberry | | |
| 2. Antenaria racemosa | Anra | Woods pussytoes | | |
| 3. Aralia nudicaulis | Arnu | Wild sarsaparilla | | |
| 4. Arnica cordifolia | Arco | Heartleaf arnica | | |
| 5. Athyrium filix-femina | Atfi | Lady fern | | |
| 6. Balsamorhiza sagittata | Basa | Arrowleaf balsamroot | | |
| 7. Clematis pseudoalpina (+ tenuiloba) | Clps | Virgin's bower | | |
| 8. Clintonia uniflora | Clun | Queen cup beadlily | | |
| 9. Equisetum arvense | Eqar | Common horsetail | | |
| 10. Equisetum spp. | EQUI | Horsetails & scouring rush | | |
| 11. Galium triflorum | Gatr | Sweetscented bedstraw | | |
| 12. Gymnocarpium dryopteris | Gydr | Oak fern | | |
| 13. Senecio streptanthifolius | Sest | Cleft leaf groundsel | | |
| 14. Senecio triangularis | Setr | Arrowleaf groundsel | | |
| 15. Smilacina stellata | Smst | Starry Solomon's seal | | |
| 16. Streptopus amplexifolius | Stam | Twisted stalk | | |
| 17. Thalictrum occidentale | Thoc | Western meadowrue | | |
| 18. Valeriana sitchensis | Vasi | Sitka valerian | | |
| 19. Viola orbiculata | Vior | Round-leaved violet | | |
| 20. Xerophyllum tenax | Xete | Beargrass | | |
| | | SERIES | | |
| | | HABITAT TYPE | | |
| | | PHASE | | |

Tree, shrub, forb, and grass identifications were made using vegetative characteristics according to Pfister et al. (1974) and Steele et al. (1974). Fig. 4 shows the locations of the samples taken in the study area. Appendix II matches sample plot numbers with locations and with habitat type classifications.

I sampled 51 vegetational plots throughout the study area on winter and summer ranges, migration routes, and key-use areas. Locations of sample plots were selected through radio transmitter cluster patterns aided by visual observations of unmarked elk. Plots were keyed out to climax habitat types using the system established by Pfister et al. (1974) for forest habitat types of Montana and Steele et al. (1974) for Idaho.

After information on winter and summer ranges, migration routes, and key-use areas was analyzed, this information was compared with the research findings in the progress reports of the Montana Cooperative Elk-Logging study (Anon. 1974b, 1975a). Recommendations regarding timber harvest and construction and closure of roads submitted in this study were the recommendations arrived at in Montana under similar conditions.

Fig. 4. Locations of samples of habitat types within the study area.


GIBBONS PASS
SADDLE MOUNTAIN
LOST TRAIL PASS
CHIEF JOSEPH PASS
JOSEPH CREEK
MAY CREEK
MONTANA
IDAHO
LOOKOUT MOUNTAIN
ALLAN MOUNTAIN
ROCKY MOUNTAIN
GIBBONSVILLE
NORTH FORK SALMON RIVER
SHEEP CREEK
EAGLE MOUNTAIN
STEIN MOUNTAIN
SHEEP MOUNTAIN
PYRAMID PEAK
NORTH FORK
SALMON RIVER
WAGONHAMMER

# CHAPTER IV

# RESULTS AND DISCUSSION

## Trapping and Marking

Appendix I provides a summary of trapping at the two selected trapping sites. Transmitter availability and trapping success controlled the final sample size and distribution of radio and rope collars between the two trapping areas.

Radio-collared animals retrapped after 1 year showed no galling on their necks. The 2.5 lb (1.34 kg) radio packages apparently did not hinder the animals. Four rope collars from hunter harvested animals were turned in at a checking station. Although ropes were faded and Saflag strips were worn and shredded, colors were still identifiable after 18 months of use. Calf, pendant number 62, shot 21 months after being collared, had sufficient space to allow three fingers to be placed between collar and neck (L. Buckingham, pers. comm.).

Blood samples (four from elk trapped at the Wagonhammer Creek trap and five from the Hughes Creek trap) were tested for brucellosis at the University of Montana. Results of the tests were negative.

Wagonhammer Creek trap. During 1973-74, five elk were radio collared. During 1974-75, the sample size was increased by 2 radio-collared and 19 rope-collared animals. Of the 26 animals, 19 were females and 7 were males. Age-group composition was as follows: 1) calves--5; 2) yearlings--9; 3) 2.5 years--0; and 4) 3.5 years and older--12.

During winter 1974-75, mining activity in Wagonhammer drainage, 0.5 mi (0.81 km) from the trap, caused poor trapping success. When this activity ceased on 22 January, trapping was successful.

Hughes Creek trap. Five elk were radio collared and 11 were rope collared during 1973-74. Four radio-collared and 14 rope-collared animals were added during 1974-75. Of these 34 animals, 24 were females and 10 were males. Age-group composition was as follows: 1) calves--11; 2) yearlings--8; 3) 2.5 years--0; and 4) 3.5 years and older--15. One bull calf, pendant number 67, was trapped five different times during 1973-74 and twice during 1974-75 as a spike. Table 4 is a combined breakdown into age-sex groups of elk trapped on the study area. The calf-cow ratio was 16/25 (64/100) excluding yearling cows.

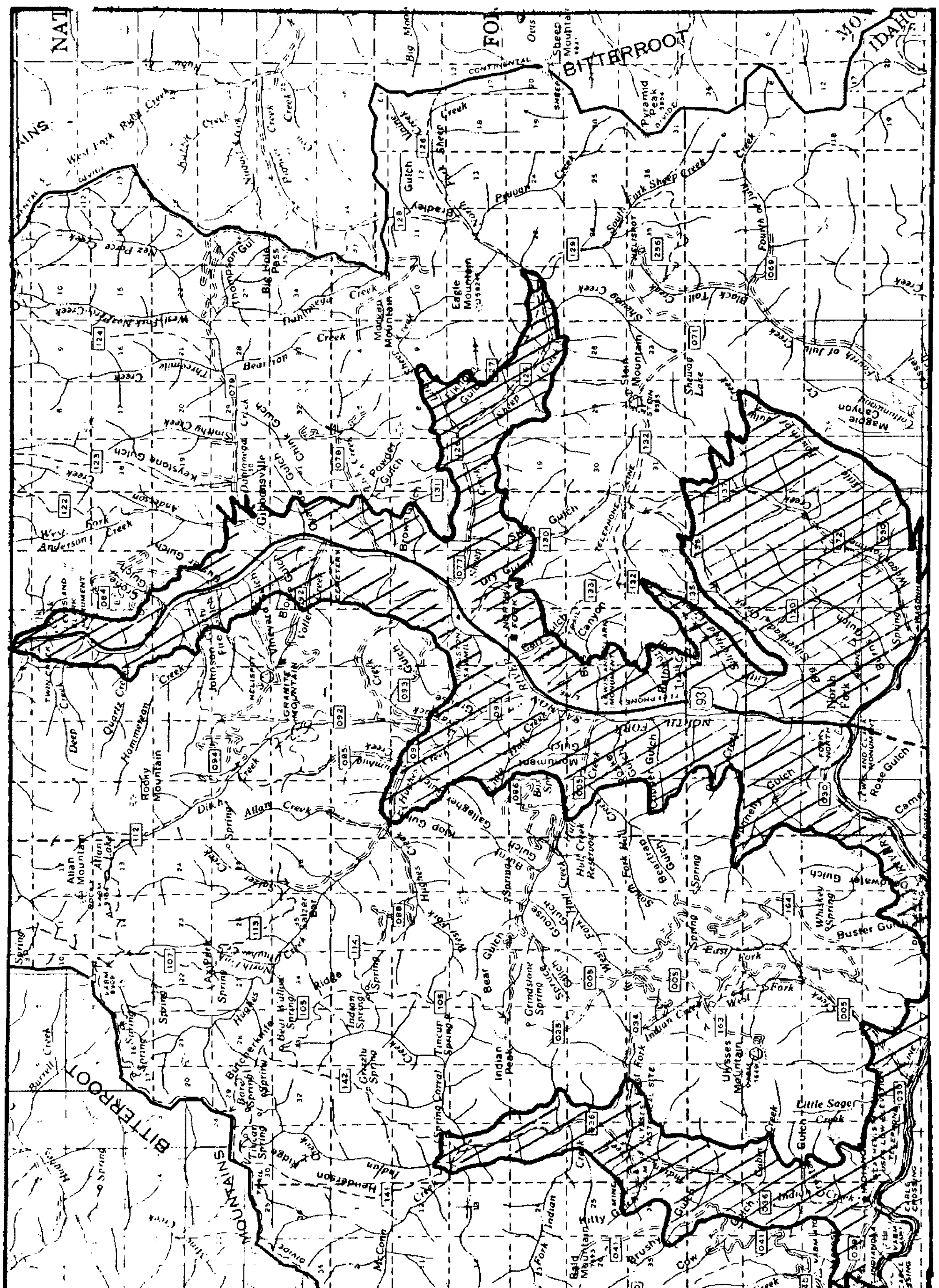
TABLE 4. Trapped elk by age and sex

| Age group | Trap site: Wagonhammer Creek ♂ | Wagonhammer Creek ♀ | Hughes Creek ♂ | Hughes Creek ♀ | Total ♂ | Total ♀ |
|---|---|---|---|---|---|---|
| 0.5 | 3 | 2 | 5 | 6 | 8 | 8 |
| 1.5 | 4 | 5 | 3 | 5 | 7 | 10 |
| 2.5 | | | | | | |
| 3-7 | | 11 | 2 | 11 | 2 | 22 |
| 8+ | | 1 | | 2 | | 3 |
| Total | 7 | 19 | 10 | 24 | 17 | 43 |
| | | | | | 60 | |

Winter Range

Elk use of traditional winter range in the Wagonhammer Creek-Burns Basin, Big and Little Silverleads creeks, and the Humbug Ridge-Ransack Meadows-Granite Mountain areas (Fig. 5) was generally known to management personnel. Locations of radio-collared elk and visual observations of rope-collared and unmarked animals indicated that boundaries of winter ranges varied with elevation (snow depth), slope, and aspect. Snow depth apparently was the primary reason for varying boundary lines; cover, forage availability, and human presence had a descending order of importance. Snowfall was greater during winter 1974-75 than during the previous "open" winter.

Fig. 5. Map of elk winter range on the study area in Idaho.


BITTERROOT
MOUNTAINS
IDAHO
CONTINENTAL
DIVIDE
Sheep Mountain
Pyramid Peak
Big Hole Pass
Thompson Gulch
Nez Perce Creek
Dahlonega Creek
Sheep Creek
South Fork Sheep Creek
Fourth of July Creek
Eagle Mountain
Mountain
Bear Trap Creek
Threemile Creek
Keystone Gulch
Anderson Creek
Gibbonsville
Powder Gulch
Shewag Lake
Dry Gulch
Telephone Line
Granite Mountain
Vineyard
Johnson Creek
Twin Creek
Deep Creek
Quartz Creek
Hammerean
Rocky Mountain
Allan Creek
Allan Mountain
Allan Lake
Hughes Creek
North Fork
Monument
Bear Gulch
Grindstone Spring
Indian Spring
Grizzly Spring
Tincup Spring
Indian Peak
Ulysses Mountain
Little Sager Creek
Buster Gulch
Rose Gulch
Whiskey Spring
Bald Mountain
Brushy Gulch
Indian Creek
Henderson
Ridge
Spring
93

Wagonhammer Creek. During a severe winter, Wagonhammer Creek-Burns Basin-Silverleads winter range lies at elevations from 4,000 feet (1,240 m) to approximately 6,000 feet (1,860 m) in open bluebunch wheatgrass areas in Burns Basin and on south and southwest slopes to Douglas-fir/ninebark habitat types on north slopes. Large Douglas-fir trees to the east of Burns Basin provide bedding sites and vantage points for wintering elk on the ridges. Elk used open bluebunch wheatgrass slopes and Burns Basin extensively during winter 1973-74. The following winter, elk seldom used those areas because of snow depth and crusted surfaces. Observations of animals, tracks, beds, and pellet groups showed extensive use of areas higher on the slopes under Douglas-fir trees. Tracks and animals were not observed in the open, snowy areas used the previous winter. Snow was intercepted by the tree canopy with reduced snow depths under cover. Elk browsed on conifer needles on ridge tops, ninebark on north slopes, and willow in high draws. Roberts (1975) wrote of this area, "One thing is certain, if this timber were not available for cover on this winter range, carrying capacity of this range would be reduced severely."

Knight (1970) observed that on winter range, under exceptionally severe circumstances, elk from the Sun River Elk Herd used the timber in preference to grassland. Beall (1974) found that elk have very strong associations with cover types and rather weak associations with food types during winter.

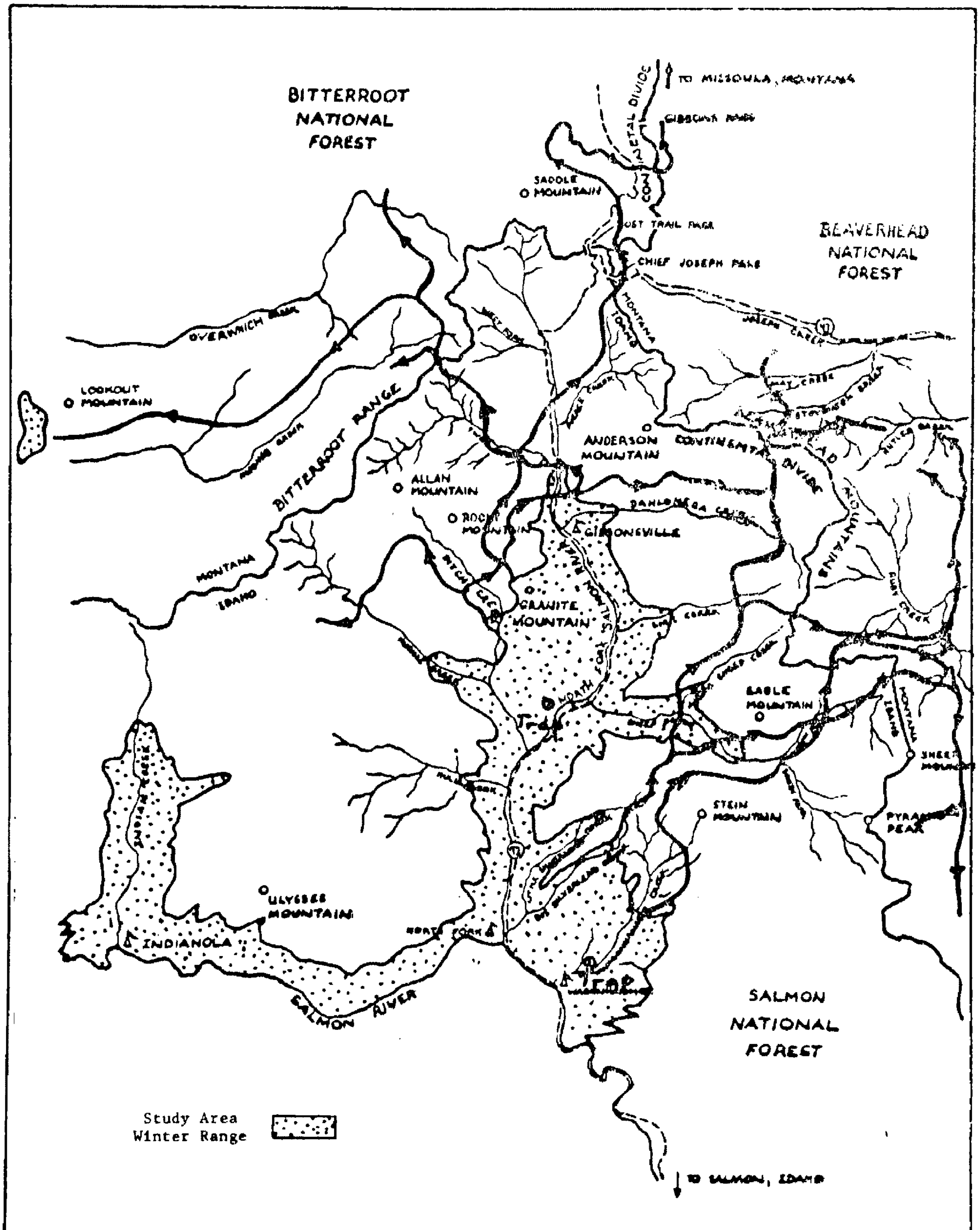
Hughes Creek. Snow depth, greater than 24 inches (61 cm), during winter 1974-75 caused dispersion of marked animals from the Granite Mountain-Ransack Meadows winter range, where they spent the winter of 1973-74, to ranges further south in the Hull Creek drainage, Copper and Donnelly gulches, and west along the south slopes on the north side of the Salmon River as far west as Indian Creek (Fig. 5 and Appendix III). Marked animals were not observed any further west. Winter range in this unit is also at elevations from approximately 4,000 feet (1,240 m) to 6,000 feet (1,860 m) during severe winters. Habitat types are similar to those on the Wagon-hammer winter range but with more east slopes. Winter ranges in both areas contain large amounts of open bluebunch wheatgrass slopes with Douglas-fir cover on nearby ridges. These ranges are predominantly grass with lesser amounts of browse.

Fig. 5 delineates winter range and Fig. 6 shows the general flow of marked elk from winter ranges in the study area.

## Migration Routes

A definition of terms must precede this section. "Local" or nonmigratory elk are defined as those that did not cross a state boundary. "Migratory" elk crossed a state boundary in moving from winter to summer ranges. Movements were followed for 2 years,

Fig. 6. Migration routes, winter to summer ranges.


BITTERROOT
NATIONAL
FOREST
BEAVERHEAD
NATIONAL
FOREST
SALMON
NATIONAL
FOREST
SADDLE MOUNTAIN
CHIEF JOSEPH PASS
OVERWHICH CREEK
LOOKOUT MOUNTAIN
BITTERROOT RANGE
ANDERSON MOUNTAIN
ALLAN MOUNTAIN
GIBBONSVILLE
MONTANA
IDAHO
GRANITE MOUNTAIN
SABLE MOUNTAIN
STEIN MOUNTAIN
ULYSSES MOUNTAIN
INDIANOLA
NORTH FORK
SALMON RIVER
TO SALMON, IDAHO
Study Area
Winter Range

disclosing different patterns of movement within the two trapping areas (Idaho Fish and Game Department Units 21 and 21A). Spring migrations of instrumented animals coincided with snow-melt and green-up and involved movements to higher elevations. Fig. 6 shows the general flow of marked elk from winter ranges in the study area.

During migration, elk sometimes traversed long distances in short periods of time. Flights were scheduled at short intervals to detect such movements. At other times, a series of locations made within a short distance of each other indicated resting and feeding sites or calving areas. Dates shown on individual elk migration routes in Appendix III are representative only. Many more (aerial, visual, and ground) locations were obtained on each elk.

In 1975, elk remained on Montana summer ranges until approximately the last week in October, when snowstorms triggered return movements. Hunting pressure in Montana could have been contributory. Fall snowstorms in 1974 were later than those of 1975, and migration to winter range began approximately 10 days later. The 1975 checking station data enforced this observation because of earlier hunter success in 1975. The 1974 migration to winter range was completed by 10 December, but the 1975 migration was completed approximately 3 weeks earlier.

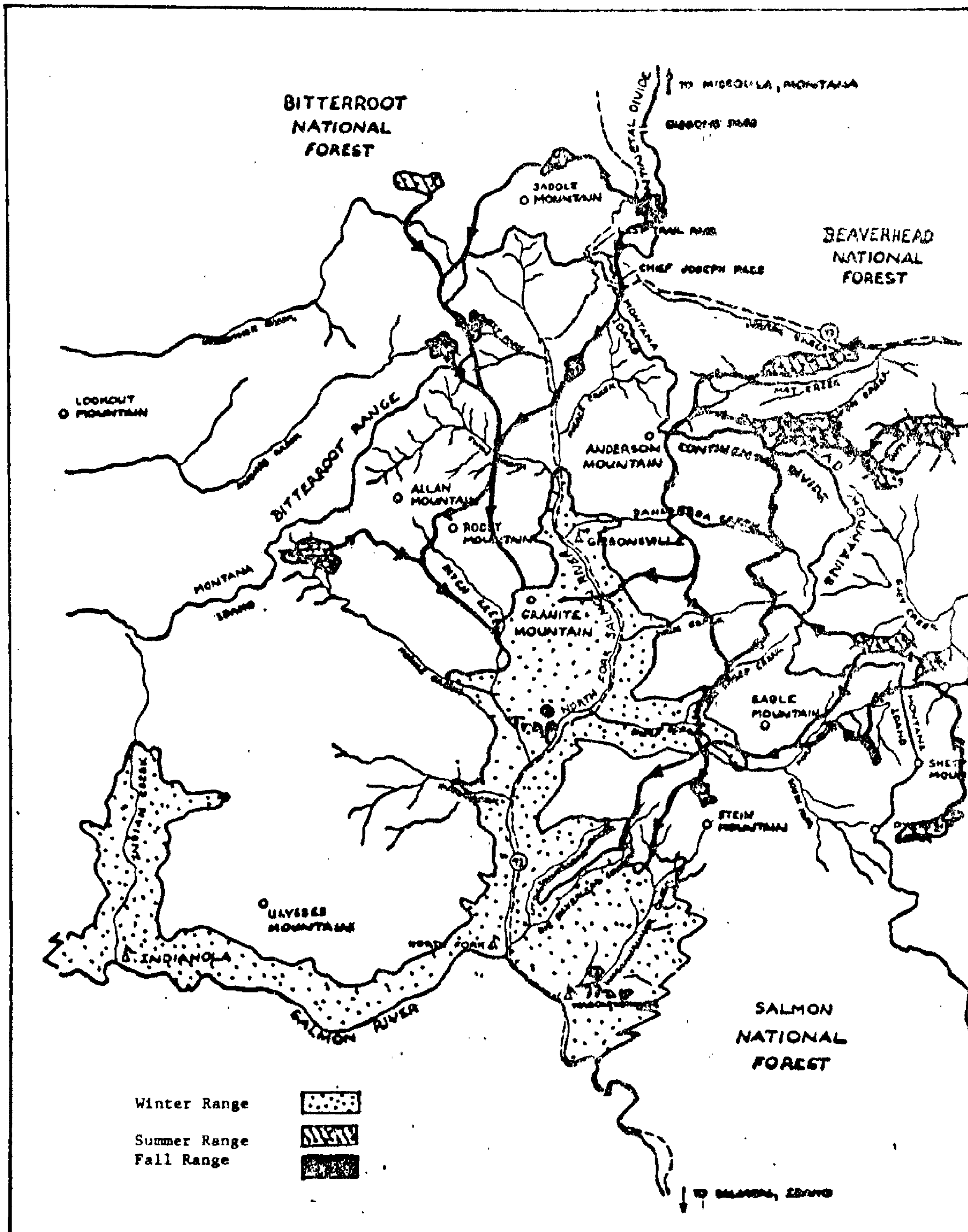
Movements of radio-collared animals B, D, E, F, G, H, and I (both trapping areas observed over 2 cycles) showed that local animal movements and migration routes were repetitive with fidelity for summer and winter ranges. Knight (1970), Craighead et al. (1972), Simmons (1974), Lemke (1975), and Biggins (1975) also observed fidelity to areas.

Elk C and 62, both young animals trapped in the Hughes Creek trap, were exceptions to the fidelity rule. Elk C moved from winter range in Idaho to summer range in Montana and wintered near Lookout Mountain and remained in that general vicinity. Elk 62 wandered to northern Idaho crossing many major drainages (Appendices I and III).

Elk G migrated from the Ransack Meadows-Granite Mountain winter range to Montana summer range in the Butler Creek drainage and returned to the Granite Mountain area. This indicated occasional mixing of elk from Idaho Management Units 21 and 21A.

Wagonhammer Creek. Radio-collared elk from the Wagonhammer trap (Idaho Unit 21A) all migrated to Montana summer ranges. Those that were not shot in Montana returned to Idaho winter ranges. Figs. 6 and 7 show general movement patterns and migration routes to and from summer ranges. Appendix III shows individual radio-collared elk movements from which the general pattern was drawn. Migration began between 7 and 28 May 1974 and was completed in Montana between 15 and 21 June 1974. Movement in 1975 started

Fig. 7. Return routes, summer to winter ranges.



BITTERROOT NATIONAL FOREST
BEAVERHEAD NATIONAL FOREST
SALMON NATIONAL FOREST
TO MISSOULA, MONTANA
SADDLE MOUNTAIN
CHIEF JOSEPH PASS
LOOKOUT MOUNTAIN
BITTERROOT RANGE
ANDERSON MOUNTAIN
ALLAN MOUNTAIN
ROBERT MOUNTAIN
GIBSONVILLE
GRANITE MOUNTAIN
MONTANA
IDAHO
NORTH FORK SALMON RIVER
EAGLE MOUNTAIN
STEIN MOUNTAIN
ULYSSES MOUNTAIN
INDIAN CREEK
INDIANOLA
NORTH FORK
SALMON RIVER
TO SALMON, IDAHO
Winter Range
Summer Range
Fall Range

later (21 to 28 May) with the same completion dates.

Mineral licks at the head of Big Silverleads Creek received heavy spring use during migration from the Wagonhammer winter range.

The junction of Little Sheep Creek with Sheep Creek is an important area during spring and fall migrations. During spring, migrating elk separate at that junction (Figs. 6 and 7) and rejoin there on return in the fall (Elk D, F, H, J1, J2, and M). Elk D, F (1974, 1975), and M (1975) spent from 2 to 10 days there prior to continuing up the North Fork of Sheep Creek and on to Montana. Elk F (1974), H (1974, 1975), J1 (1974), and J2 (1975) also spent time on nearby slopes feeding and resting prior to continuing north to Lick and Dahlonega creeks or to Morgan Mountain and Big Hole Pass (Appendix III).

The north face of Stein Mountain is also a feeding and resting site during spring and fall migrations. Elk J1 (1974) delayed there for 4 days on her way to Montana, and F (1974, 1975) remained there 7 days on her return from summer range. Sightings of numerous unmarked elk in this area were recorded for the same time periods.

The lower two-thirds of the south slopes and ridges of Eagle Mountain received much elk use during spring migration (D and F). Calving possibly occurred in secluded draws on these slopes. Although cow-calf groups were not sighted in that remote area, radio transmitter locations of cows D (1974), F (1975), and M (1975) and aerial observations of unmarked elk were made during the period 21 May to 10 June (Appendix IV). Calves were sighted 2 to 3 weeks later in Montana.

As migration continued, key crossing points over the state boundary and the Continental Divide were established. Return migration was by means of these same crossing points. From Management Unit 21A (Wagonhammer), crossing points to Montana Hunting District 321 were: 1) the head of the North Fork of Sheep Creek (Idaho) and Big Moosehorn Creek (Montana); 2) Bradley Gulch (Idaho) and Pioneer Creek (Montana); 3) the north side of Morgan Mountain and Big Hole Pass; and 4) heads of West Fork of Nez Perce (Idaho), West Fork of Stevenson (Montana), Anderson (Idaho), and May (Montana) creeks (Figs. 6 and 7).

Average migration distance of radio-collared elk to Montana summer ranges was 25.3 airline miles (40.5 km). Elk M moved the greatest distance of 31 miles (49.6 km).

Hughes Creek. Humbug Ridge-Granite Mountain-Ransack Meadows winter range (Idaho Management Unit 21) is located further north than the winter range in Idaho Management Unit 21A. Local westward movements to higher elevations followed snow-melt and green-up. Migration to Montana summer ranges began between 21 and 28 May during both years. Arrivals at summer ranges were complete at approximately the same time as those from the Wagon-hammer winter range (15 to 21 June). State boundary crossing points of elk from Idaho Management Unit 21 to Montana Hunting District 250 were: 1) Chief Joseph Pass (Elk E); 2) West Fork of Nez Perce Creek (Elk G); and 3) heads of Vine (Idaho) and Hughes creeks (Montana) (Elk K, L). A crossing point probably exists from the head of Hughes Creek (Idaho) into the Hughes Creek drainage in Montana (Fig. 1), but crossing there was not verified by biotelemetry. Observations of unmarked animals were extensive in that area. Locations of hunter harvested elk checked at the Carmen Creek Checking Station confirmed some of these crossing points.

The Montana migration segment of Hughes Creek radio-collared elk traveled an average distance of 25.4 airline miles (40.6 km) to summer ranges. The longest route of 32 miles (51.2 km) was traveled by Elk C. Local elk moved an average of 14.3 miles (22.9 km).

Movements of Elk A2, B, I, and 0 (Appendix III) were only elevational; they did not cross the state boundary. Therefore, those animals were classified as local, belonging to the Granite Mountain Elk Herd.

## Summer Ranges

Montana summer ranges in the study area are high, moist, cool, and seldom visited by humans. Creeks, seeps, bogs, willow flats, and high mountain meadows are common. Summer ranges occupied by the bi-state elk herds are larger than the winter ranges and do not receive heavy use by elk except in preferred areas (wallows, seeps, or other wet sites). Clearcuts ranging from 20 to 450 acres (8 to 180 ha) are evident (Anon. 1975c). Thick stands of lodgepole pine, subalpine fir, and whitebark pine are predominant at high elevations.

Wagonhammer elk. A large part of summer elk range in the West Big Hole section of the study area is characterized by remote, secure portions that are practically undisturbed by humans. In late June, cow-calf groups (including radio-collared elk) were sighted in the downstream portion of Butler Creek (Elk G), Ruby Creek willow flats (Elk H), the Cow Creek meadows, and Big Moosehorn Creek willow flats (Elk D).

Cattle grazed the downstream portion of Butler Creek, Ruby Creek willow flats, Isaac Meadows, the clearcuts in this area, the downstream portion of the West Fork of Ruby Creek to its junction with Pioneer, Cow and Ruby creeks, and the Cow Creek meadows and willow flats. Mid- and late summer cattle grazing in these lower portions of elk summer range influenced elk movements to higher, more remote sections of elk summer range.

Elk H, on two successive migrations to summer range, remained approximately 1 month on the Ruby Creek willow flats near the mouths of Sawpit and Butler creeks. During this period, moose (Alces alces) were sighted there. In late July (last location of Elk H there was 27 July), Elk H moved to higher elevation on the ridge between Sawpit and Butler creeks. She remained on the north slope of that area until migrating to winter range. Elk J1 exhibited nearly the same pattern as H by starting the summer on the Ruby Creek willow flats, and then moving to higher elevation at the head of Sawpit. Elk D reinforced this pattern by moving to the heads of Cow and Big Moosehorn creeks when cattle grazed the Cow Creek meadows in mid- and late summer. She had established herself during early summer in the downstream portions.

Elk J2 summered on the ridge between May Creek and Montana Highway 43 with no cattle grazing influence. She was last located on 26 October 1975 at the head of May Creek, near Anderson Mountain, on return migration. Possibly she was shot and the radio collar kept as a souvenir, or the radio transmitter failed.

During two successive summers, Elk F established herself in the Moose Creek drainage northwest of Pyramid Peak along the Continental Divide. Summer range of M was generally in this area but extended further south to Gravelly Park (T. 5 S., R. 15 W., S. 34). Cattle did not graze these areas and thus there were no cattle-elk interactions.

Summer range activity areas were not measured. An estimate of these range from less than a thousand acres to a pattern that would not lend itself to a valid area estimation.

A few elk summer in the Salmon National Forest, adjoining the Beaverhead National Forest along the Continental Divide, at the head of the North Fork of Sheep Creek (observation of unmarked elk), and from Big Hole Pass northwest to Lost Trail Pass at the heads of Nez Perce, Threemile, Smithy, and Anderson creeks.

Rope-collared elk from the Wagonhammer trap were sighted at the head of Nez Perce Creek, in Butler, Moose, and Hamby creek drainages, and near Wallace Creek (R. 18 W., T. 1 S., northwest corner section 36) while on summer range.

During 2 years of observations, instrumented elk were never located in the clearcuts adjacent to the Big Hole Valley or in those near Gibbons Pass. On one occasion, four unmarked elk were sighted in a clearcut within 20 yards (18.2 m) of the edge. On another occasion, nine were sighted running across a clearcut. Marcum (1975) studied summer and fall elk habitat selection and use in the Sapphire Mountains of western Montana. He found that, in the area of his study, elk selected against clearcuts. However, clearcuts in

Marcum's area were relatively young. He suggested that a complete examination of the interrelationships between elk and logging should take at least one generation of the species (approximately 15 to 20 years).

Hughes Creek elk. The heads of Hughes, Overwhich, Colter, and Shields creeks (Bitterroot National Forest) are roadless and provide summer elk range (C, K, and L). U.S. Forest Service land use planning objectives (Daniels 1974:58) for this area state that management will be toward preserving the roadless condition, and maintaining quality elk summer range.

Elk E, during 2 successive years, summered on the West Fork of Camp Creek and in an area east of U.S. Highway 93 south of Gibbons Pass (Appendix III).

Elk summer range in the Salmon National Forest portion of the study area adjoins that in the Bitterroot National Forest across the state boundary. The heads of Twin, Vine, and West Fork creeks comprised part of the summer range of Elk L. This high country is also roadless.

Local elk from the Hughes Creek trap summered on Butcherknife Ridge (0), at the heads of Hughes and Salzer creeks (A2), Ditch Creek, Humbug Ridge, and Votler and Hammerean creeks (B).

Rope-collared elk from the Hughes Creek trap were sighted on Porcupine Ridge (Sec. 2, T 1 S, R 20 W) (Montana) and State Creek (Idaho).

Overstory vegetation on these summer ranges is also characterized by lodgepole pine, subalpine fir, and whitebark pine at high elevations, with associated understory vegetation. Wet meadows, creek bottoms, and high, grassy meadows are also common.

Cattle were not grazed in this section.

Thiessen (1975) said, "Since 1960, intensive forest management practices including timber harvest and roadbuilding have been applied extensively in southern Idaho. Elk populations have declined significantly since 1964 in this area. In 1973, approximately 65 percent of all elk harvested in the Boise River area were taken from roadless and undisturbed areas. Roadless and undisturbed areas comprise about 25 percent of the timbered portions of this drainage."

The Idaho Fish and Game Department, Salmon, management biologist plotted hunter distances of elk kills from roads as reported during the 1975 hunting season in Idaho Management Units 21, 21A, and 28. Average kill distances were: Unit 21--1.3 miles (2.1 km), Unit 21A--1.1 miles (1.8 km), and Unit 28--2.2 miles (3.5 km). Of the three units, 28 is the largest, 21 next, and 21A the smallest. Roaded areas are located mainly in the eastern portion of Units 21 and 28. Unit 21A is the smallest unit with highest percentage of roaded area. The graphic plot showed that kill locations were concentrated in areas where there were the fewest roads within the three units (W. L. Bodie, pers. comm.). Bodie said, "The inference is that when other factors are discounted, and when harvest quota time limits are analyzed, the data will show that the quota limit would be reached quicker in the unit with the highest percentage of roaded areas."

Pengelly (1972) suggested that the amount of land permanently subtracted from production by roads, landings, and piles of logging debris represents an extreme challenge to the land manager. Marcum (1975) evaluated elk use in areas in or near open or closed road systems and found that elk used a greater percentage of that area available in a closed system compared to that available in an open road system.

## Key-Use Areas

Key-use areas (in addition to winter and summer ranges) were defined as calving and rutting sites, and terrain sought by elk during hunting seasons (secure areas).

In Idaho, habitat types associated with cow elk locations during the calving period were Douglas-fir/pinegrass or Douglas-fir/snowberry near 6,000 ft (1,860 m) elevation on ridges. A few small ravines (shallow longitudinal depressions about 100 yds [90 m] in length) led off the ridges. Wet areas with dense understory were nearby. The vegetational complex in Montana differed; lodgepole pine comprised the main overstory. However, many locations were in dense willow flats and sedge meadows along creeks (Ruby, Butler, Cow). Mountain big sagebrush was not a vegetative component as was noted in Roberts' (1974) study.

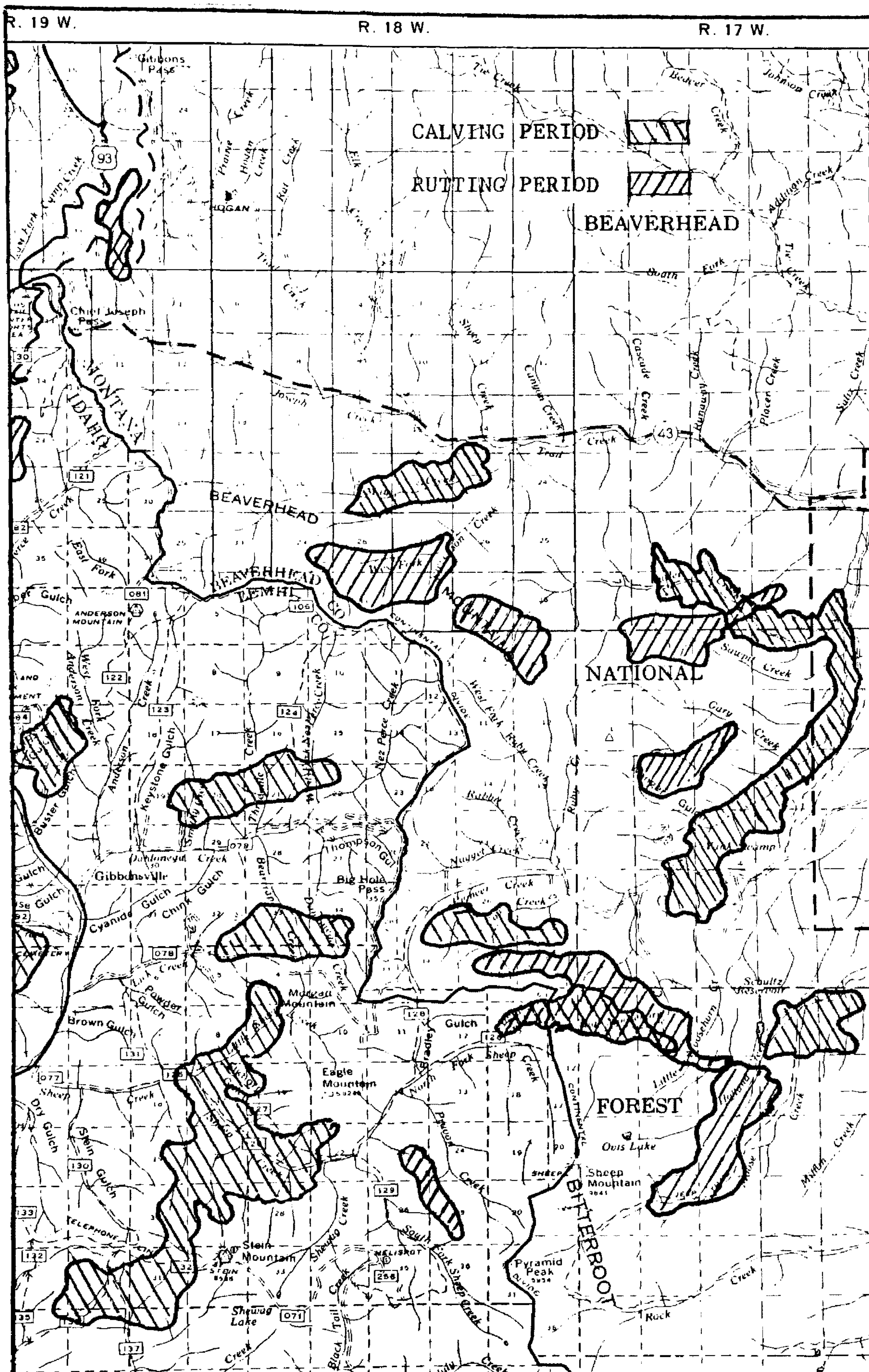
Locations of Wagonhammer elk during the calving period. During the calving period (21 May to 10 June), radio-collared cows from the Wagonhammer trap were located in the areas shown in Fig. 8. Appendix IV lists location dates and coordinates down to 40-acre (16 ha) tracts with drainage names or principal terrain features.

The calving periods occurred during migrations, and calves were apparently born en route. Completion of migrations and the last days of the calving period (10-15 June) coincided. Cow-calf groups, including radioed cows, were sighted in the Pioneer and Cow creek drainages, and Big Moosehorn, Ruby, and Butler creek willow flats of Montana as early as 24 June.

Locations of Hughes Creek elk during the calving period. Locations of radio-collared elk from the Hughes Creek trap are shown on Fig. 9, and Appendix IV lists location dates and coordinates.

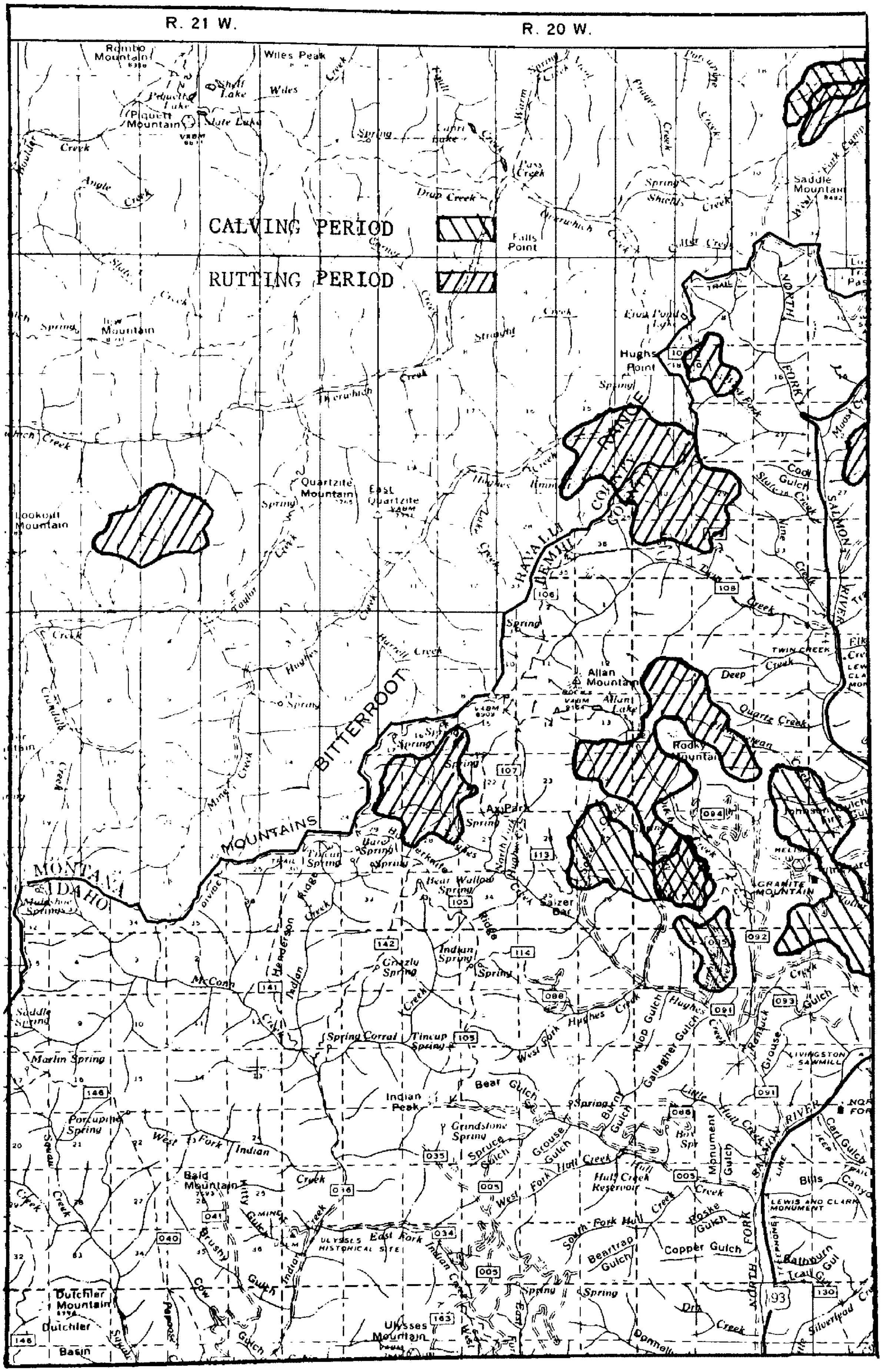
In Idaho Management Unit 21, cow-calf groups were sighted in the Salzer Creek drainage, on Humbug Ridge, at the head of Votler Creek, and on the Votler Creek ridge southeast of Granite Mountain

Fig. 8. Areas where elk were located during the calving period (5/21 - 6/10) and rutting period (9/16 - 10/14)--study area, east half.



R. 19 W.
R. 18 W.
R. 17 W.
CALVING PERIOD
RUTTING PERIOD
BEAVERHEAD
NATIONAL
FOREST
BITTERROOT
MONTANA
IDAHO
BEAVERHEAD
LEMHI
Gibbons Pass
Chief Joseph Pass
HOGAN
ANDERSON MOUNTAIN
Gibbonsville
Big Hole Pass
Morgan Mountain
Eagle Mountain
Stein Mountain
Sheep Mountain
Pyramid Peak
Shewag Lake
Ovis Lake

Fig. 9. Areas where elk were located during the calving period (5/21 - 6/10) and rutting period (9/16 - 10/14)--study area, west half.



R. 21 W.
R. 20 W.
CALVING PERIOD
RUTTING PERIOD
BITTERROOT
MOUNTAINS
MONTANA
IDAHO
RAVALLI COUNTY
LEMHI COUNTY
Quartzite Mountain
East Quartzite
Lookout Mountain
Allan Mountain
Rocky Mountain
Granite Mountain
Saddle Mountain
Hughs Point
Bald Mountain
Indian Peak
Ulysses Mountain
Dutchler Mountain
Dutchler
Basin
NORTH FORK
SALMON RIVER

Lookout. Elk I was sighted with a group of cows and calves on the Votler Creek ridge in an open meadow. A cow with calf was sighted in the Saddle Mountain burn on 30 May 1974 and was the first calf sighted during the calving period. The cow was not marked. Apparently she was migrating, as there was still a considerable amount of snow and no cover in the area. Sighting of cows and calves in the Salzer Creek drainage occurred on 24 June also.

Locations of elk during the rutting period. Figs. 8 and 9 include sites of radio-collared elk locations during the rutting period (16 September to 14 October). Since these locations were established by means of radio transmitters, and the sample size (number of radioed elk) was small, all rutting areas are probably not delineated. For example, the Continental Divide and adjacent remote areas in both the Beaverhead and Salmon National Forests have lots of habitat similar to that used for breeding in the drainages of the West Fork of Stevenson, Stevenson, and Butler creeks.

Bull A2 was sighted with 30 cows and calves in the Salzer Creek drainage on 15 August 1975 and was later located a number of times in small drainages at the head of Hughes Creek, northwest of Axe Park (Idaho). He was shot in that vicinity on 22 October 1975. When shot, he was accompanied by 11 other animals, one large bull plus cows and calves (C. E. Klinkenberg, pers. comm.). The location of bull O during the period was on the northside of Humbug Ridge near the Ditch Creek drainage.

The rutting area at the head of Hughes Creek in Montana is remote. Due to the remoteness, the hunting pressure is light (J. Firebaugh, pers. comm.).

Hughes Creek elk security areas. Bull O summered on Butcherknife Ridge. At the start of hunting season, he was located near the roaded portion of the Ditch Creek drainage (Appendix III). Three days later, he was on the north side of Rocky Mountain. Hunting pressure apparently caused the movement to the unroaded area. The areas between Allan and Rocky mountains, extending north to the head of Twin Creek, and the north side of Rocky Mountain provided security for elk during the hunting season (B, I, L, O). These are unroaded areas and cluster patterns of radio-transmitter locations showed this use during the hunting season.

A similar pattern was not noted for radioed elk returning to the Wagonhammer-Burns Basin winter range. The unroaded areas along the Continental Divide provided security due to remoteness.

## Habitat Types and Elk Use Observations

When keyed out by Pfister's (1974) method, sample plots reflect potential for climax vegetation and not necessarily what is growing there at the time. What was actually on the ground was recorded for the 51 sample plots in Fig. 4 and Appendix II.

Wagonhammer Creek winter range. As sampled, the timbered habitat types on the Burns Basin-Silverleads-Wagonhammer winter range were scree, Douglas-fir/pinegrass/snowberry, Douglas-fir/white spirea, Douglas-fir/Oregon grape, and Douglas-fir/ninebark (sample plots 29 through 32 and 46 through 48, Figs. 3 and 4 and Appendix II).

Douglas-fir trees provided cover and bedding sites. The big sagebrush/bluebunch wheatgrass habitat type in Burns Basin provided winter forage during the winter of 1973-74. Elk grazed the open areas, cropping closely with little or no range damage.

During winter 1975, snow depths in Burns Basin ranged from 2 to 3 ft (60 to 90 cm) with deeper snow at higher elevation on north slopes and along creeks. Elk use was not observed in the open areas, but cover higher up the slopes to the east provided by Douglas-fir trees was heavily used. Elk packed trails in the snow along main ridges, branch ridges, and saddles while using cover. Heavy concentrations of elk pellets around tree bases and along elk trails were noted.

Browse species near tree cover were utilized in lieu of open-area grasses during midwinter 1974-75 and included: willow, rose (Rosa spp.), chokecherry (Prunus virginiana), mountain big sagebrush, and Wyoming big sagebrush. Light foraging was noted on Douglas-fir, ponderosa pine, snowberry, and ninebark. During late winter and early spring, dry grasses and new-growth bluebunch wheatgrass were rapidly consumed on snow-free areas near ridge tops and on south slopes. Other species utilized were: penstemon (Penstemon spp.), quaking aspen (Populus tremuloides), elderberry (Sambucus racemosa), syringa (Philadelphus lewisii), mountain maple (Acer glabrum), mountain mahogany (Cercocarpus ledifolius), and serviceberry (Amelanchier alnifolia).

Elk use on each type varied with snow depth, temperature, and competition for forage (elk with cattle). In Burns Basin, the summer three-pasture program for cattle grazing caused extensive use of the Wagonhammer creek bottom during the two summers of the study. Thus, winter forage for elk was reduced. Cattle did not graze the steep slopes which were used exclusively by wintering elk and deer.

Hughes Creek winter range. The sampled timbered habitat types obtained in the Ransack Meadows-Granite Mountain section were Douglas-fir/Idaho fescue, ponderosa pine/bluebunch wheatgrass, ponderosa pine/snowberry, Douglas-fir/white spirea, Douglas-fir/white spirea/elk sedge, Douglas-fir/pinegrass, and Douglas-fir/beargrass (plots 1 through 7 and 33, Figs. 3 and 4 and Appendix II).

During a normal winter (1973-74), elk appeared to use forage sources in the proportion that they were available. Those sources were ponderosa pine/bluebunch wheatgrass, ponderosa pine/ snowberry, and the Douglas-fir/white spirea habitat types. By visual estimation, there appeared to be a relatively larger proportion of browse than grass present in this area.

During winter 1974-75, snow depths greater than 2 ft (60 cm) caused a dispersion of marked elk south to Copper and Donnelly gulches and further west. East and south slopes provided grass similar to that on the Wagonhammer-Burns Basin slopes. A similar pattern of tree cover use was noted at higher elevation. Browse was evident in or near cover on north slopes and in draws. During mid-winter, many elk, including marked animals, were observed foraging on the east and south grass slopes. Forage species were similar to those on the Wagonhammer winter range with the exception of light foraging on evergreen ceanothus (Ceanothus velutinus) and dry leaves of arrowleaf balsamroot wetted by snow.

With the advent of green-up, elk extensively cropped the new growth of intermediate and crested wheatgrasses and orchard grass on the closed logging roads in the Ransack Meadows-Humbug Ridge area. Roads had been seeded by the U.S. Forest Service. The flat surfaces, in contrast to nearby slopes, collected moisture which resulted in rapid growth of succulent forage. The effect of elk grazing on these closed roads was similar to that of a pasture cropped closely by domestic ungulates.

With continued snow-melt and green-up at higher elevations, elk foraged on new leaves and branches of white spirea, emerging seed heads and tender basal leaves of arrowleaf balsamroot, and some lupine (Lupinus spp.).

Plot 7 was at the 6,700 ft (2,010 m) level which explained the presence of beargrass. This part of the winter range was used by elk during late winter and early green-up.

Wagonhammer Creek migration route habitat types. Because migration routes crossed the Continental Divide and the state boundary at high elevations, plot samples reflected vegetational associations of high, cool, and moist environments. Observations of foraging elk were comparatively few compared with those on winter range because of elk dispersion from winter range concentrations. The sampled habitat types were Douglas-fir/pinegrass/pinegrass, Douglas-fir/beargrass, Douglas-fir/bluebunch wheatgrass, subalpine fir/fool's huckleberry, subalpine fir/blue huckleberry, subalpine fir/grouse whortleberry, subalpine fir/pinegrass, and Douglas-fir/ninebark.

Sample plots reflected transition from the Douglas-fir/pinegrass, Douglas-fir/beargrass habitat types into the subalpine fir/

whitebark pine habitat types and lodgepole pine associations. Grasses changed from wheatgrasses to pine grass and elk sedge with some Idaho fescue, and then the forb beargrass became common. Shrubs changed from snowberry and ninebark to fool's huckleberry and the huckleberry species. Elk sign on north slopes in subalpine fir/fool's huckleberry and subalpine fir/beargrass habitat types was noted. Elk were foraging on the new growth of fool's huckleberry. Considerable foraging on beargrass inflorescences was noted during summer.

Cover and travel routes were the primary uses of these habitat types.

Hughes Creek migration route habitat types. Sampled timbered habitat types taken along migration routes originating in the Hughes Creek drainage were subalpine fir/blue huckleberry, Douglas-fir/pinegrass, subalpine fir/beargrass, subalpine fir/pinegrass, and subalpine fir/grouse whortleberry (plots 12, 13 and 21 through 25, Figs. 3 and 4 and Appendix II). The same higher altitude species as noted in the preceding paragraph were prevalent along these routes. A relatively larger amount of Engelmann spruce occurred along routes north from Hughes Creek to Lost Trail Pass. All observations from the previous paragraph relative to species fed upon by elk apply here. Primary use of these habitat types was again for travel routes and cover.

Summer range habitat types. Summer range use at high elevations (6,000 to 8,000 ft; 1,800 to 2,400 m) was keyed to similar habitat types on all three National Forests. Sampled habitat types were subalpine fir/grouse whortleberry, subalpine fir/beargrass, subalpine fir/pinegrass, and whitebark pine/subalpine fir.

Lodgepole pine, subalpine fir, whitebark pine, and Engelmann spruce with some Douglas-fir were overstory species in all portions of elk summer range on the study area. Beargrass, pinegrass, and elk sedge with sparse stands of huckleberry occurred in the understory.

High wet meadows along the Continental Divide and along the state boundary contained many wet-site grasses, sedges, and shrubs. Elk use of these wet sites was noted especially during the latter part of the summer. Extensive elk sign in a boggy area at the head of Butler Creek was documented. Twelve wallows were counted in the wet area and 20 elk beds along the edge of the meadows next to the trees. Limited browsing on American false hellebore (Veratrum viride) in wet areas at the heads of high ravines along the Continental Divide was also noted. Elk nearby were observed in a lodgepole pine stand with down timber. Several elk beds in high grasses in a meadow were also documented near the mid-region of Butler Creek. Forage species were difficult to document, although forage use of beargrass seedheads was observed during late summer.

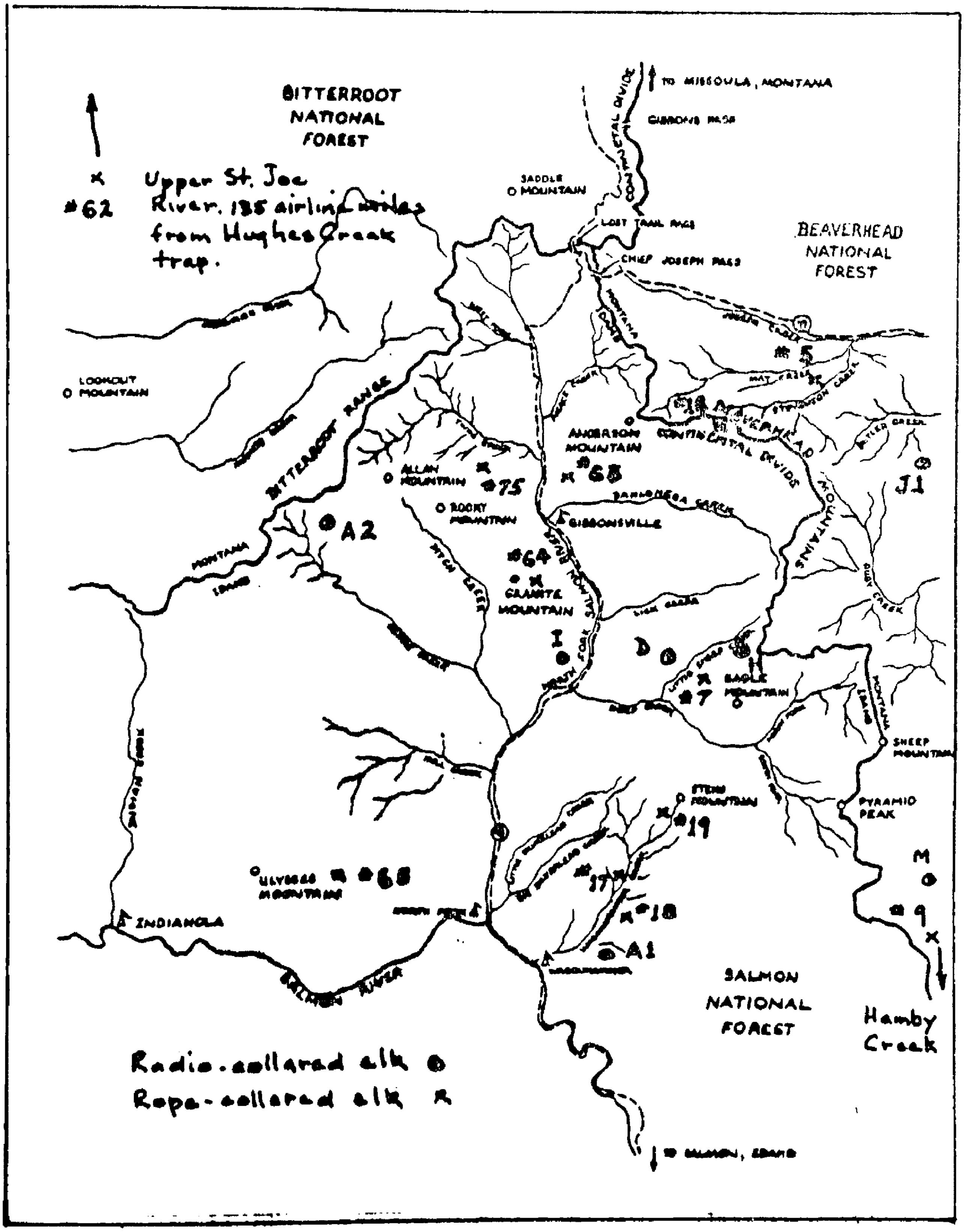
Biggins (1975) attempted to correlate five tree species with radioed elk locations during summer months. Engelmann spruce, a wet-site species, had a slightly greater relative abundance on radioed elk location sites during July and August, and Douglas-fir was least abundant. Marcum (1975) discussed elk preferences for wet-site habitats and the importance of these areas during summer and fall. My observations reinforce elk preference for wet sites. These data emphasize the importance of Montana summer ranges due to more water and more wet sites compared to the adjacent Idaho summer ranges along the Continental Divide. Thus, a larger number of elk summer in the Montana portions, especially in the West Big Hole area.

Mortality Suffered by Marked Animals

Twenty-one animals were trapped and marked the first trapping season. Three marked animals, one radio and two rope collars, were shot by hunters (14.3 percent mortality), and one was a trapping casualty. Thus, mortality the first year was 19 percent.

The number of marked elk increased to 60 the second year. Combined total shot for both years was 16 (5 radio and 11 rope collars, 26.7 percent mortality). The higher number killed the second year, 13, was probably due to early snowfall that started migration and made hunting easier. Total mortality of marked elk was 20 of 60 (33 percent). Fig. 10 gives the kill locations of marked

Fig. 10. Kill locations of marked elk.


BITTERROOT
NATIONAL
FOREST
#62
Upper St. Joe River. 135 airline miles from Hughes Creek trap.
TO MISSOULA, MONTANA
GIBBONS PASS
SADDLE MOUNTAIN
LOST TRAIL PASS
CHIEF JOSEPH PASS
BEAVERHEAD
NATIONAL
FOREST
LOOKOUT MOUNTAIN
BITTERROOT RANGE
ANDERSON MOUNTAIN
CONTINENTAL DIVIDE
ALLAN MOUNTAIN
#75
#65
J1
ROCKY MOUNTAIN
GIBBONSVILLE
A2
MONTANA
IDAHO
#64
GRANITE MOUNTAIN
I
D
EAGLE MOUNTAIN
#7
SHEEP MOUNTAIN
PYRAMID PEAK
#19
M
#9
ULYSSES MOUNTAIN
#68
#17
#18
A1
INDIANOLA
SALMON RIVER
SALMON
NATIONAL
FOREST
Hamby Creek
Radio-collared elk
Rope-collared elk
TO SALMON, IDAHO

animals.

Interpolations relating to population size, age-group composition, hunting success, winter-kill, etc., are of debatable value to management decisions due to the small sample size. Figures may relate to that population segment most susceptible to trapping (young and females). Hunting casualties may reflect the ease with which marked animals are seen over unmarked ones. The possibility also exists that hunters select for or against shooting a marked animal, if given a choice.

Bull calf 62, trapped on 2 February 1974, was killed as a "raghorn" bull on 20 October 1975 (21 months later) in the upper St. Joe River area 5 miles from the Red Ives Ranger Station, 135 airline miles from the Hughes Creek trap. When killed, the animal showed marks of fighting (L. Buckingham, pers. comm.). In this case, Mr. Buckingham stated he did not see the collar until the animal was down.

One cow died the first year in Little Fourth of July Creek drainage, apparently a stress casualty. The second year, an unmarked cow carrying twin fetuses, was gored and killed by bull O in the Hughes Creek trap. Elk number 17 was lame when trapped; she was found dead on 14 April 1975 on winter range. Examination of bone marrow indicated she had died of malnutrition. Elk I also died during the second winter within 3 miles of the Hughes Creek trap. Tooth wear and bone marrow indicated old age and malnutrition. Table 5 gives a summary of mortality.

TABLE 5. Mortality of marked elk on the study area

| Category | | Age group | | | | | Total |
|---|---|---|---|---|---|---|---|
| | | 0.5 | 1.5 | 2.5 | 3.5-7.5 | 8+ | |
| Hunter kills 1974 | no. | | 3 | | | | 3 |
| | % | | | | | | 14.3 |
| Hunter kills 1975 | no. | | 8 | | 5 | | 13 |
| | % | | | | | | 21.7 |
| Winter kills 1974 | no. | | | | | | 0 |
| | % | | | | | | 0 |
| Winter kills 1975 | no. | | | | 1 | 1 | 2 |
| | % | | | | | | 10 |
| Trap casualties 1974 | no. | | | | 1 | | 1 |
| | % | | | | | | 5 |
| Trap casualties 1975 | no. | | | | 1 | | 1 |
| | % | | | | | | 2.5 |
| Total | no. | 0 | 11 | 0 | 8 | 1 | 20 |
| | % | 0 | 55 | 0 | 40 | 5 | 100 |

Censusing

During a flight on 24 April 1975, 194 elk were counted in Idaho Management Unit 21A; six were marked. Total marked animals in that Unit was 24. Using a modified Lincoln-Peterson Index (Giles 1971), the population estimate derived for the Unit was 776.

The Lincoln-Peterson Index Method was applied to hunter harvest figures for Units 21 and 21A for Fall 1975 versus marked elk which were killed in those units (13/54 = 338/x). An adjusted estimate was derived by multiplying the elk harvest reported at the Carmen Creek Checking Station by a factor of 2.66. This factor was derived by tabulating the results obtained from a statewide questionnaire mailed to elk hunters and comparing those results to checking station harvest totals of elk (W. L. Bodie, pers. comm.).

TABLE 6. Idaho Management Unit elk population estimate, computed using the Lincoln-Peterson Index Method

1975 Hunting Season

| | Unit 21 | Unit 21A | Total |
|---|---|---|---|
| Marked elk | 30 | 24 | 54 |
| Marked elk harvested | 4 | 9 | 13 |
| Checking station elk harvest | 79 | 48 | 127 |
| Adjusted checking sta. harvest | 210 (79x2.66) | 128 (48x2.66) | 338 |
| Population estimate | | | 1,404 |

Obviously the variance in the population estimates is large. The hunter harvests in Montana Hunting Districts 250 and 321 were not included in the checking station data. Elk from the western half of Idaho Management Unit 21 were not marked. That terrain was not included in the study area. Small sample size and a short sampling period are variables that make the population estimates questionable.

Interpretation

I believe that the habitat currently is in good to excellent condition, resulting in a healthy elk population. This is based on observations of winter ranges that were not over-grazed, with elk shifting from open areas to those near cover during the second winter of the study when snow depths were considerably deeper.

In my opinion, elk herds are below carrying capacity. During the 1960's, winter-kill was higher and winter range conditions poorer; as a result, elk harvest quotas were increased (W. L. Bodie, pers. comm.). The winter range is adequate for the present population during most years, but availability fluctuates with snow conditions. Thus, winter range may become limiting in some years. Summer range is presently more than adequate, because more is available than is used.

Predation on elk was almost nonexistent, and winter-kill was negligible during my study. Thus, control of elk population is by hunter harvest quotas established by the Idaho and Montana Fish and Game Departments. Even though the sample size was small, hunter harvest of marked elk was high in 1975. Over 2 years, the average was a reasonable percentage. Quotas were reached quickly in 1975, but by the 1974 season closure, the harvest quota had not been attained. Although my sample size was small, the elk population appears to be young and vigorous. Idaho Fish and Game Department, Salmon, herd composition counts (1971-75) supports this (W. L. Bodie, pers. comm.).

Migration routes, calving and rutting areas, and other factors important to elk were defined in order to relate them to planned timber harvest. Cover on winter range seemed to be of most immediate concern as an elk habitat limiting factor based on increased use during a severe winter.

The recommendations in the following chapter are presented as the best information which I have accumulated for providing adequate habitat for the welfare of the elk population.

# CHAPTER V

## MANAGEMENT RECOMMENDATIONS

In view of the information gained during this study, it is recommended that:

1) Research be continued to relate past, current, and future timber harvest and access road construction to elk carrying capacity in the Humbug Ridge-Ransack Meadows-Granite Mountain and the Silverleads-Burns Basin-Wagonhammer winter ranges. Differential use of cover and forage by elk under varying winter conditions is cited as rationale.

2) Game management personnel in Montana and Idaho consider combined harvest quotas and coordinated hunting seasons for Idaho Management Units 21 and 21A, and Montana Hunting Districts 250 and 321. Elk that winter in Idaho and summer in Montana are hunted in both states, so joint control of harvest and carrying capacity should be maintained.

3) The mixing of local and migratory elk in Idaho Management Unit 21 should be considered in the timing of hunting

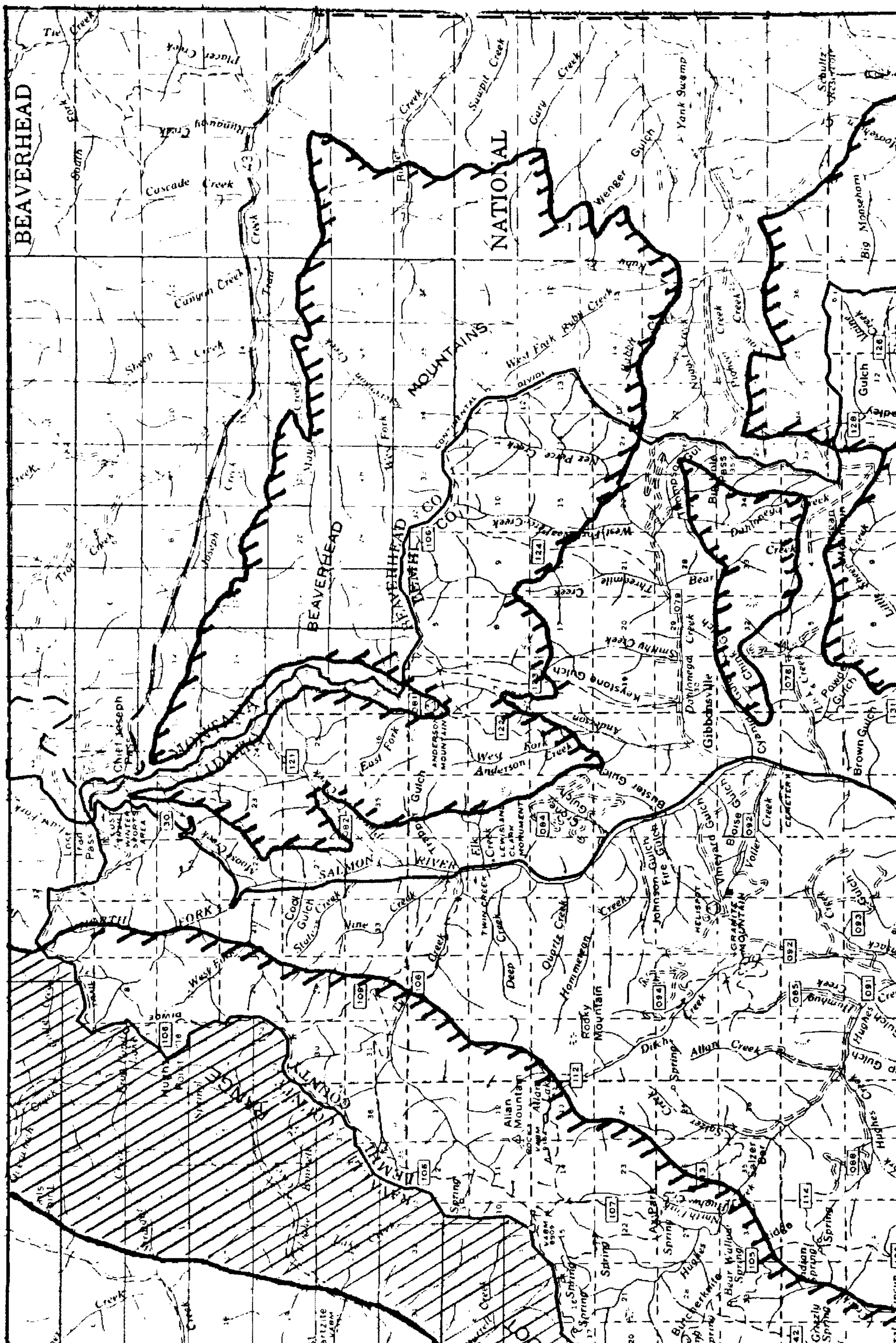
seasons, so one segment is not overharvested.

4) Planning objectives for the Beaverhead and Salmon National Forests include retaining the roadless condition. Specific areas recommended are: a) that portion of the study area in the Beaverhead National Forest bounded by the junction of the Continental Divide on the south, Montana Highway 43 on the north, and the Big Hole Valley on the east; b) in the Salmon National Forest, adjoining areas at the heads of Pierce, Anderson, Smithy, Three-mile, Nez Perce, North and South Forks of Sheep Creek; and c) that area in the Salmon National Forest adjoining the Bitterroot National Forest, along the state boundary, including the heads of West Fork, State, Vine, Twin, and Hughes creeks (Fig. 11). If timber harvest is planned, it should be designed to assure retention of adequate cover and to close or restrict public access to the area. These areas presently provide secure elk summer range, breeding habitat, and afford escape cover during hunting seasons.

5) U.S. Forest Service resource managers give special consideration to the area around the junction of Little Sheep and Sheep creeks and nearby hillsides, and the north face of Stein Mountain. This area is a separation and

Fig. 11. Recommended roadless areas within study area (enclosed portions).

Note: Cross-hatched portion in Bitterroot National Forest has already been designated a roadless area in West Fork Ranger District environmental planning statement.


BEAVERHEAD
NATIONAL
MOUNTAINS
BEAVERHEAD
SALMON RIVER
NORTH FORK
Chief Joseph Pass
Lost Trail Pass
Anderson Mountain
Gibbonsville
Allan Mountain
Keystone Gulch
Dahlonega Creek
Threemile Creek
Big Moosehorn
Yank Swamp
Wenger Gulch
Cascade Creek
Canyon Creek
Sheep Creek
Trail Creek
West Fork
Johnson Gulch
Fire Gulch
Vineyard Gulch
Boise Gulch
Quartz Creek
Hammerean Creek
Rocky Mountain
Allan Creek
Brown Gulch
Hughes Creek
Salzer Bar
Twin Creek
Deep Creek
Nine Creek

joining point for elk migrating to and from summer ranges, is a resting, feeding, and concentration area during migration, and a probable calving area (Fig. 8).

6) U.S. Forest Service resource managers should assure retention of adequate cover areas on the north, east, and west sides of Rocky Mountain, Humbug Ridge, and the heads of Twin and Hughes creeks in developing any timber harvest plans. These areas are sought out by elk during the fall season and provide escape cover and breeding habitat (Fig. 9).

7) U.S. Forest Service resource managers should avoid removal of timber adjacent to grass winter ranges. Such timber is especially important as a source of food and shelter during severe winters.

8) The following recommendations from the Montana Cooperative Elk-Logging studies (if not already incorporated and as modified) be included in U.S. Forest Service timber harvest policies:

   a) clearcuts be kept as small as practicable (25-acre maximum);

   b) road access and straight stretches be minimized near or crossing elk migration routes;

   c) frequent dense cover areas be maintained adjacent to roads that are near or cross elk migration routes or are near elk winter ranges;

d) cuts, fills, and right-of-way clearings be minimized;

e) slash disposal, in clearcuts and along rights-of-way be extensive enough not to impede elk movements;

f) existing roads be evaluated to see if abandonment or closure would enhance elk management; and

g) proposed road systems be evaluated for impacts on elk on a case-by-case basis, and that elk requirements be considered in every system plan or road management decision.

# CHAPTER VI

## SUMMARY

Radio-collared and neck-banded elk were used to verify the assumption of migration patterns between winter ranges in Idaho and summer ranges in Montana. Repeat movements of radio- and rope-collared elk during two successive cycles between winter and summer ranges established that most elk of the bi-state herds had fidelity to certain areas; erratic movements of a few young animals provided exceptions. Traditional use of winter and summer ranges helped clarify their locations and reinforced their importance.

The elk herd in Idaho Management Unit 21 had mixed components. Some radio-collared elk moved to local summer ranges, and others migrated to summer ranges in Montana. Mixing of local and migratory animals and mixing between management units was established. Radio-collared elk from Idaho Management Unit 21A all migrated to Montana summer ranges during two successive cycles.

Return migrations from Montana summer ranges and concentration of elk on winter ranges were triggered by fall snowstorms and snow depths. Rope- and radio-collared elk were shot by both Montana and Idaho hunters.

Winter ranges in the study area contained a larger proportion of grass than browse. Elk use of open bluebunch wheatgrass slopes on the Silverleads-Burns Basin-Wagonhammer winter range was not as extensive the second winter of the study, as during the first winter, due to deep snow. Elk used the higher elevations under Douglas-fir trees and foraged near that cover. This pattern stressed the importance of cover near grass winter ranges.

Marked elk from Idaho Management Unit 21 (Humbug Ridge-Ransack Meadows-Granite Mountain winter range) moved south to Copper and Donnelly gulches and west along the north side of the Salmon River as far as Indian Creek during the second winter. This demonstrated flexibility of winter range boundaries and non-elevational movements of elk to avoid deep snow.

Movements of radio-collared elk during migrations established key-use areas. Migrating elk separated in the spring and rejoined in the fall at the junction of Little Sheep and Sheep creeks. Surrounding slopes and hillsides were extensively used during those periods.

Hunting pressure caused radio-collared elk in the Humbug Ridge-Granite Mountain area and on Butcherknife Ridge to move to unroaded areas between Allan and Rocky mountains and onto north and east slopes of Rocky Mountain for security.

Elk summer ranges were located in roadless areas at the heads of Hughes, Overwhich, Colter, and Shields creeks (Bitterroot National Forest). Adjacent elk summer range in Idaho was also identified.

Summer ranges in the Beaverhead National Forest were located along the Continental Divide and near the western and southern edges of the Big Hole River Valley. Some summer key-use areas such as seeps, wallows, willow flats, and high mountain meadows, used by cow-calf groups, were identified. Adjacent areas across the Continental Divide in Idaho also provided summer ranges. Elk use of large clearcuts in the area was not verified.

Calving and rutting areas were identified through pattern locations of radio-collared elk during the period 20 May-10 June and 16 September-14 October. Observation of unmarked elk and hunter reports plus elk sign supplemented data on those areas.

Key-use areas were visited and habitat typed. Elk use of each habitat type was documented whenever observed and related to elk requirements for food, cover, and water.

Management recommendations included further study of elk-logging relationships on winter ranges; combined hunting quotas for elk hunted in both states; timing of hunting seasons in Idaho Unit 21 to protect local elk; retaining the roadless condition, by nontimber harvest or road closures in certain areas; special consideration for key-use areas along migration routes and security areas during planning of logging sales; retaining timber adjacent to grass winter ranges; and establishing recommendations from the Montana Cooperative Elk-Logging studies as U.S. Forest Service timber harvest policies.

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Appendix I

Trapping Summary

## Wagonhammer Trap

Radio Collars

| Elk identification | Sex | Approx. age | Trapping date | No. of locations radio and visual | Local or migratory | Casualty and type | Blood sample | Remarks |
|---|---|---|---|---|---|---|---|---|
| A1 collar #123 | ♀ | 7.5 | 1/31/74 | 2 | - | Yes stress | No | radio retrieved 4/6/74 |
| D collar #98 | ♀ | 4.5 | 2/22/74 retrap 2/15/75 | 85 | migratory | Yes hunting 11/1/75 | No | new ear tag #182 |
| F collar #76 | ♀ | 2.5 | 2/22/74 | 83 | migratory | No | No | |
| H collar #81 | ♀ | 4.5 | 2/22/74 | 77 | migratory | Yes hunting 10/29/75 | No | |
| J1 collar #114 | ♀ | yrlng | 2/26/74 | 43 | migratory | Yes hunting 10/23/74 | No | collar turned in to Montana F & G Dept. Missoula 11/29/74 |
| J2 collar #114 | ♀ | 2.5 | 1/26/75 retrap 2/15/75 | 40 | migratory | ? | Yes | |
| M collar #124 | ♀ | 4.5 | 2/15/75 | 22 | migratory | Yes hunting 10/30/75 | No | radio retrieved F & G Dept. Missoula 11/17/75 |

## Wagonhammer Trap

Radio Collars

| Pendant No. | Sex | Approx. age | Trapping date | Casualty | Type | Blood sample | Date killed |
|---|---|---|---|---|---|---|---|
| 1 | ♀ | yrlng | 2/5/75 | No | - | No | - |
| 2 | ♀ | calf | 2/5/75 | No | - | No | - |
| 3 | ♀ | yrlng | 2/5/75 | No | - | Yes | - |
| 4 | ♂ | spike | 2/5/75 | No | - | No | - |
| 5 | ♂ | spike | 2/5/75 retrap 2/15/75 | Yes | - | No | 11/16/75 |
| 6 | [illegible] | calf | 2/5/75 retrap 2/25/75 | No | - | No | - |
| 7 | ♂ | calf | 2/5/75 | Yes | hunting | No | 10/27/75 |
| 8 | ♂ | spike | 2/5/75 | No | - | No | - |
| 9 | ♀ | 4.5 | 2/5/75 | Yes | hunting | Yes | 10/19/75 |
| 10 | ♀ | 2.5 | 2/5/75 | No | - | Yes | - |
| 11 | ♀ | 4.5 | 2/12/75 | No | - | No | - |
| 12 | ♀ | 5.5 | 2/15/75 | No | - | No | - |
| 13 | ♀ | 4.5 | 2/15/75 | No | - | No | - |
| 14 | ♂ | calf | 2/15/75 | No | - | No | - |
| 15 | ♀ | calf | 2/15/75 | No | - | No | - |
| 16 | ♀ | yrlng | 2/15/75 | Yes | hunting | No | 11/3/75 |
| 17 | ♀ | 4.5 | 2/15/75 retrap 3/2/75 | Yes | winter | No | 4/14/75 |
| | | | | Sighted 5 times on winter range | | | |
| 18 | ♀ | yrlng | 2/15/75 | Yes | hunting | No | 11/7/75 |
| 19 | ♂ | spike | 2/15/75 | Yes | hunting | No | 11/3/75 |

## Hughes Creek Trap

Radio Collars

| Elk identification | Sex | Approx. age | Trapping date | No. of locations radio and visual | Local or migratory | Casualty and type | Blood sample | Remarks |
|---|---|---|---|---|---|---|---|---|
| A2 collar #123 | ♂ | 3.5 | 2/5/75 | 36 | local | Yes hunting 10/22/75 | No | |
| B collar #89 | ♀ | 3.5 | 2/2/74 | 108 | local | No | No | |
| C collar #100 | ♀ | yrlng | 2/2/74 | 56 | migratory | No | No | This animal turned over to John Firebaugh 12/31/74. Radio failure summer '75. |
| E collar #45 | ♀ | 2.5 | 3/6/74 | 97 | migratory | No | Yes | |
| G collar #83 | ♀ | 2.5 | 2/10/74 | 65 | migratory | No | No | Radio failure 6/17/75. Two visual locations after radio failure. Last visual 7/11/75. |
| I collar #95 | ♀ | 10+ | 3/14/74 | 73 | local | Yes winter kill 4/75 | No | Radio retrieved 5/28/75 |
| K collar #65 | ♂ | spike | 1/4/75 | 40 | migratory | No | No | |
| L collar #120 | ♀ | 5.5 | 1/4/75 | 45 | migratory | No | Yes | |
| O collar #110 | ♂ | 3.5 | 3/1/75 | 39 | local | No | No | |

## Hughes Creek Trap

Rope Collars

| Pendant No. | Sex | Approx. age | Trapping date | Casualty | Type | Blood sample | Date killed |
|---|---|---|---|---|---|---|---|
| 61 | ♂ | calf | 2/2/74 | No | - | No | - |
| 62 | ♂ | calf | 2/2/74 | Yes | hunting | No | 10/20/75 |
| 63 | ♂ | spike | 2/2/74 | Yes | hunting | No | ? |
| 64 | ♀ | calf | 2/2/74 | Yes | hunting | No | ? |
| 65 | ♀ | calf | 2/2/74 | Yes | hunting | No | 10/19/75 |
| 66 | ♂ | calf | 2/2/74 | No | - | No | - |
| 67 | ♂ | calf | 2/9/74 Retrap 2/20, 2/21, 2/28, 3/19/74, 12/31/74, 2/25/75 | No | - | No | - |
| 68 | ♀ | calf | 2/28/74 | No | - | No | - |
| 69 | ♀ | 2.5 | 2/28/74 | No | - | No | |
| 70 | ♀ | 4.5 | 2/28/74 | No | - | No | - |
| 71 | ♀ | 5.5 | 2/28/74 | No | - | No | - |
| 72 | ♀ | 10+ | 12/28/74 retrap 1/17/75 | No | - | Yes | - |
| 73 | ♀ | yrlng | 12/28/74 | No | - | No | - |
| 74 | ♀ | yrlng | 12/28/74 | No | - | No | - |
| 75 | ♀ | yrlng | 12/31/74 | Yes | hunting | Yes | 10/19/75 |
| 76 | ♀ | 4.5 | 12/31/74 | No | - | No | - |
| 77 | ♀ | calf | 12/31/74 | No | - | No | - |
| 78 | ♀ | calf | 1/4/75 Retrap 1/17, 2/25, 3/1/75 | No | - | No | - |
| 79 | ♀ | 5.5 | 1/4/75 | No | - | No | - |
| 80 | ♂ | calf | 1/4/75 | No | - | No | - |
| 81 | ♀ | 5.5 | 1/17/75 | No | - | No | - |
| 82 | ♂ | calf | 1/17/75 retrap 2/25/75 | No | - | No | - |
| 83 | ♀ | 4.5 | 1/17/75 | No | - | Yes | - |
| 84 | ♀ | yrlng | 1/17/75 | No | - | No | - |
| 85 | ♂ | spike | 2/25/75 | No | - | No | - |
| Unmarked | ♀ | 4.5 | 3/1/75 | Yes | Gored by Bull O | No | 3/1/75 |

Appendix II

Study Area Habitat Types

| Sample | Location | Habitat Type |
|---|---|---|
| 1 | Hughes Creek Trap Area - Up slope from trap. (T. 25 N., R. 20 E., S. 10, center). | Douglas-fir - Idaho fescue (DF/Feid) |
| 2 | Hughes Creek Trap Area - Down slope from trap. (T. 25 N., R. 20 E., S. 10, center). | Ponderosa pine - bluebunch wheatgrass (PP/Agsp) |
| 3 | Ransack Meadows - East slope. (T. 25 N., R. 20 E., S. 4, center). | Ponderosa pine - snowberry (PP/Syal) |
| 4 | Ransack Meadows - West slope. (T. 25 N., R. 20 E., S. 4, center). | Douglas-fir - white spirea (DF/Spbe) |
| 5 | Granite Mtn L.O. - South side ridge. (T. 25 N., R. 20 E., S. 34, SW 1/4). | Douglas-fir - white spirea - elk sedge (DF/Spbe-Cage) |
| 6 | Granite Mtn L.O. - North side ridge. (T. 25 N., R. 20 E., S. 34, SW 1/4). | Douglas-fir - pinegrass-pinegrass (DF/Caru-Caru) |
| 7 | Humbug Ridge - East clearcuts, end of logging road. (T. 25 N., R. 20 E., S. 30, SW 1/4). | Douglas-fir - beargrass (DF/Xete) |
| 8 | End of Stein Gulch Road - ridge. (T. 24 N., R. 21 E., S. 25, SW 1/4). | Douglas-fir - pinegrass-pinegrass (DF/Caru-Caru) |
| 9 | Head of Big and Little Silver-leads creeks. (T. 24 N., R. 21 E., S. 36, NE 1/4). | Douglas-fir - beargrass (DF/Xete) |
| 10 | Stein Mtn Trail - South slope. (T. 24 N., R. 21 E., S. 31, NE 1/4). | Douglas-fir - bluebunch wheatgrass (DF/Agsp) |
| 11 | Stein Mtn Trail - North slope. (T. 24 N., R. 21 E., S. 32, NW 1/4). | Subalpine fir - menziesia (AF/Mefe) |

| Sample | Location | Habitat Type |
|---|---|---|
| 12 | Twin Creek - North slope. (T. 26 N., R. 20 E., S. 32, SW 1/4). | Subalpine fir - blue huckleberry (AF/Vagl) |
| 13 | Twin Creek - South slope. (T. 26 N., R. 20 E., S. 32, SW 1/4). | Douglas-fir - pinegrass (DF/Caru) |
| 14 | Continental Divide - North side Morgan Mtn - West slope. (T. 25 N., R. 22 E., S. 3, NE 1/4). | Subalpine fir - grouse whortleberry (AF/Vasc) |
| 15 | Continental Divide - North side Morgan Mtn - East slope. (T. 3 S., R. 18 W., S. 33, NW 1/4). | Subalpine fir - pinegrass (AF/Caru) |
| 16 | Saddle - Head of Bradley Gulch. (T. 3 S., R. 17 W., S. 34, SW 1/4). | Subalpine fir - grouse whortleberry (AF/Vasc) |
| 17 | Head of Pioneer Creek. (T. 3 S., R. 17 W., S. 34, SW 1/4). | Subalpine fir - grouse whortleberry (AF/Vasc) |
| 18 | Cow Creek. (T. 3 S., R. 17 W., S. 35, NW 1/4). | Subalpine fir - grouse whortleberry (AF/Vasc) |
| 19 | Big Moosehorn Creek - South of clearcut. (T. 3 S., R. 17 W., S. 32, SW 1/4). | Subalpine fir - grouse whortleberry (AF/Vasc) |
| 20 | Isaac Meadows - West side. (T. 3 S., R. 17 W., S. 21, NE 1/4). | Subalpine fir - grouse whortleberry (AF/Vasc) |
| 21 | Head West Fork Camp Creek. (T. 1 S., R. 19 W., S. 31, NE 1/4). | Subalpine fir - beargrass (AF/Xete) |
| 22 | Junction Divide Trail and Saddle Mtn Road. (T. 1 S., R. 19 W., S. 31, SW 1/4). | Subalpine fir - beargrass (AF/Xete) |
| 23 | Gibbons Pass Road - North slope. (T. 26 N., R. 23 E., S. 26, SW 1/4). | Subalpine fir - beargrass (AF/Xete) |

| Sample | Location | Habitat Type |
|---|---|---|
| 24 | Anderson Mtn Road - Head of Pierce Creek - West slope. (T. 2 S., R. 18 W., S. 30, NE 1/4). | Subalpine fir - pinegrass (AF/Caru) |
| 25 | Anderson Mtn Road - Head of Richardson Creek (Mt.) - East slope. (T. 2 S., R. 18 W., S. 24, NW 1/4). | Subalpine fir - grouse whortleberry (AF/Vasc) |
| 26 | North face Stein Mtn - 8,000 ft. elev. (T. 24 N., R. 21 E., S. 29, SW 1/4). | Subalpine fir - grouse whortleberry (AF/Vasc) |
| 27 | North face Stein Mtn - 7,500 ft. elev. (T. 24 N., R. 21 E., S. 29, SW 1/4). | Subalpine fir - grouse whortleberry (AF/Vasc) |
| 28 | North face Stein Mtn - 7,000 ft. elev. (T. 24 N., R. 21 E., S. 29, NW 1/4). | Douglas-fir - pinegrass (DF/Caru) |
| 29 | Wagonhammer Trap - South slope. (T. 24 N., R. 21 E., S. 13, NW 1/4). | Scree |
| 30 | Burns Basin. (T. 24 N., R. 21 E., S. 11, SE 1/4). | Wyoming big sagebrush/ bluebunch wheatgrass (Artr/Agsp) |
| 31 | Mud Springs - East side Burns Basin - North slope. (T. 24 N., R. 21 E., S. 12, NW 1/4). | Douglas-fir - pinegrass - mountain snowberry (DF/Caru-Syor) |
| 32 | Mud Springs - East side Burns Basin - South slope. (T. 24 N., R. 21 E., S. 12, NW 1/4). | Wyoming big sagebrush/ bluebunch wheatgrass (Artr/Agsp) |
| 33 | Junction Ditch and Hughes creeks. (T. 25 N., R. 20 E., S. 8, SW 1/4). | Ponderosa pine - snowberry (PP/Syal) |

| Sample | Location | Habitat Type |
| --- | --- | --- |
| 34 | Junction Sheep Creek and Stein Gulch - North slope. (T. 25 N., R. 21 E., S. 13, SW 1/4). | Douglas-fir - ninebark (DF/Phma) |
| 35 | West Fork Ruby Creek. (T. 2 S., R. 17 W., S. 11, NE 1/4). | Subalpine fir - grouse whortleberry - pinegrass (AF/Vasc-Caru) |
| 36 | Junction mouth of Gory Creek and Foothill Road. (T. 2 S., R. 16 W., S. 15, NE 1/4). | Subalpine fir - grouse whortleberry (AF/Vasc) |
| 37 | Junction mouth of Butler Creek and Foothill Road. (T. 2 S., R. 16 W., S. 35, SW 1/4). | Subalpine fir - pinegrass (AF/Caru) |
| 38 | Mouth of May Creek. (T. 1 S., R. 17 W., S. 13, SW 1/4). | Subalpine fir - dwarf huckleberry (AF/Vaca) |
| 39 | Bradley Gulch. (T. 25 N., R. 22 E., S. 11, SE 1/4). | Subalpine fir - blue huckleberry (AF/Vagl) |
| 40 | Mouth of Pruvan Creek. (T. 25 N., R. 22 E., S. 14, SE 1/4). | Subalpine fir - grouse whortleberry (AF/Vasc) |
| 41 | 2 miles up Pruvan Creek - East slope. (T. 24 N., R. 22 E., S. 24, SW 1/4). | Subalpine fir - pinegrass (AF/Caru) |
| 42 | Pruvan Creek - 2/3 way up drainage - East slope. (T. 24 N., R. 22 E., S. 25, SE 1/4). | Subalpine fir - blue huckleberry (AF/Vagl) |
| 43 | Butler Creek - 3/4 way up south branch. (T. 2 S., R. 17 W., S. 36, SW 1/4). | Subalpine fir - beargrass (AF/Xete) |
| 44 | Ridge - Junction Butler Creek, Ruby Creek and May Creek trails. (T. 2 S., R. 17 W., S. 2, NE 1/4). | Whitebark pine - subalpine fir (WBP/AF) |

| Sample | Location | Habitat Type |
|---|---|---|
| 45 | West side Saddle Mtn. (T. 1 S., R. 19 W., S. 30, NE 1/4). | Whitebark pine - subalpine fir (WBP/AF) |
| 46 | Junction Wagonhammer, Stein Mountain, Poison Meadow Trails, East slope. (T. 24 N., R. 21 E., S. 12, NE 1/4). | Douglas-fir - white spirea (DF/Spbe) |
| 47 | Junction Wagonhammer, Stein Mountain, Poison Meadow Trails, West slope. (T. 24 N., R. 21 E., S. 12, NE 1/4). | Douglas-fir - Oregon grape (DF/Bere) |
| 48 | Junction Wagonhammer, Stein Mountain, Poison Meadow Trails, South slope. (T. 24 N., R. 21 E., S. 12, NE 1/4). | Scree |
| 49 | Junction Shields Creek Ridge, Overwhich Falls Trails. (T. 1 S., R. 19 W., S. 34, SE 1/4). | Subalpine fir - beargrass (AF/Xete) |
| 50 | Hughes Point Trail - 1/2 way to Hughes Point - Ridge. (T. 1 S., R. 19 W., S. 2, NW 1/4). | Subalpine fir - grouse whortleberry (AF/Vasc) |
| 51 | Hughes Point. On top. (T. 2 S., R. 19 W., S. 11, NE 1/4). | Whitebark pine - subalpine fir (WBP/AF) |

Appendix III

Maps of Individual Animal Movements and
Rope Collar Sightings

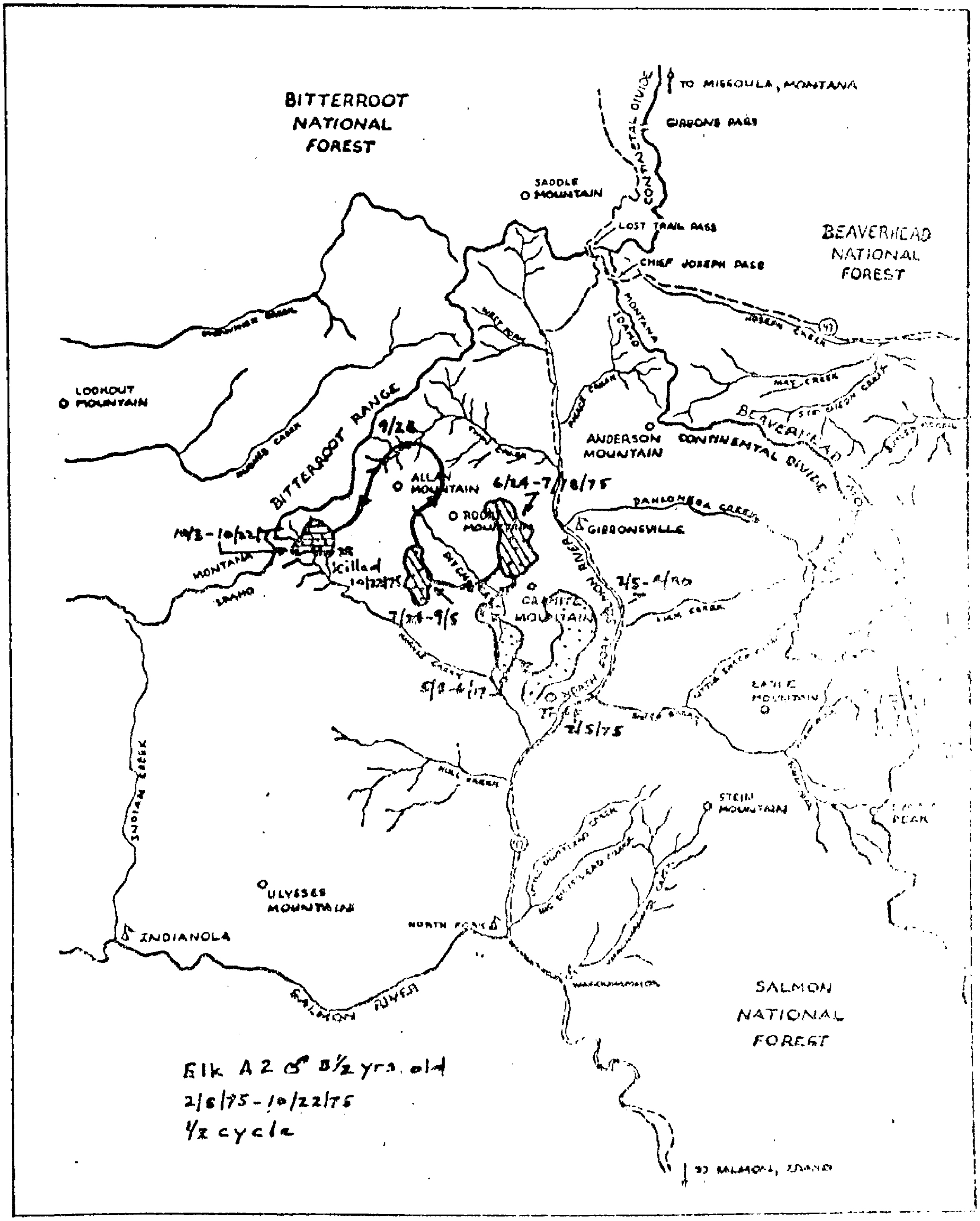
Winter Range

Summer Range

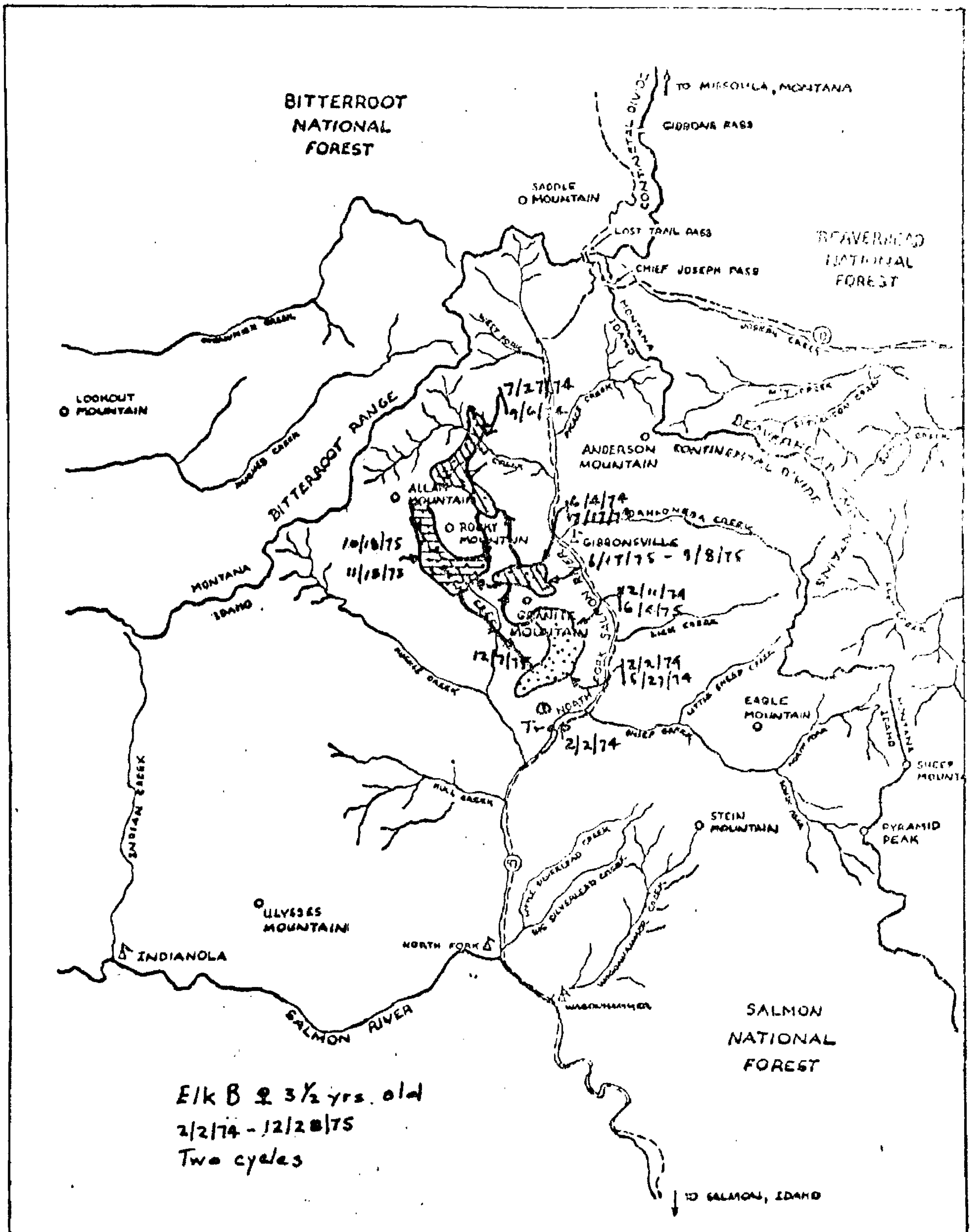
Fall Range

Rope Collar Sightings X X

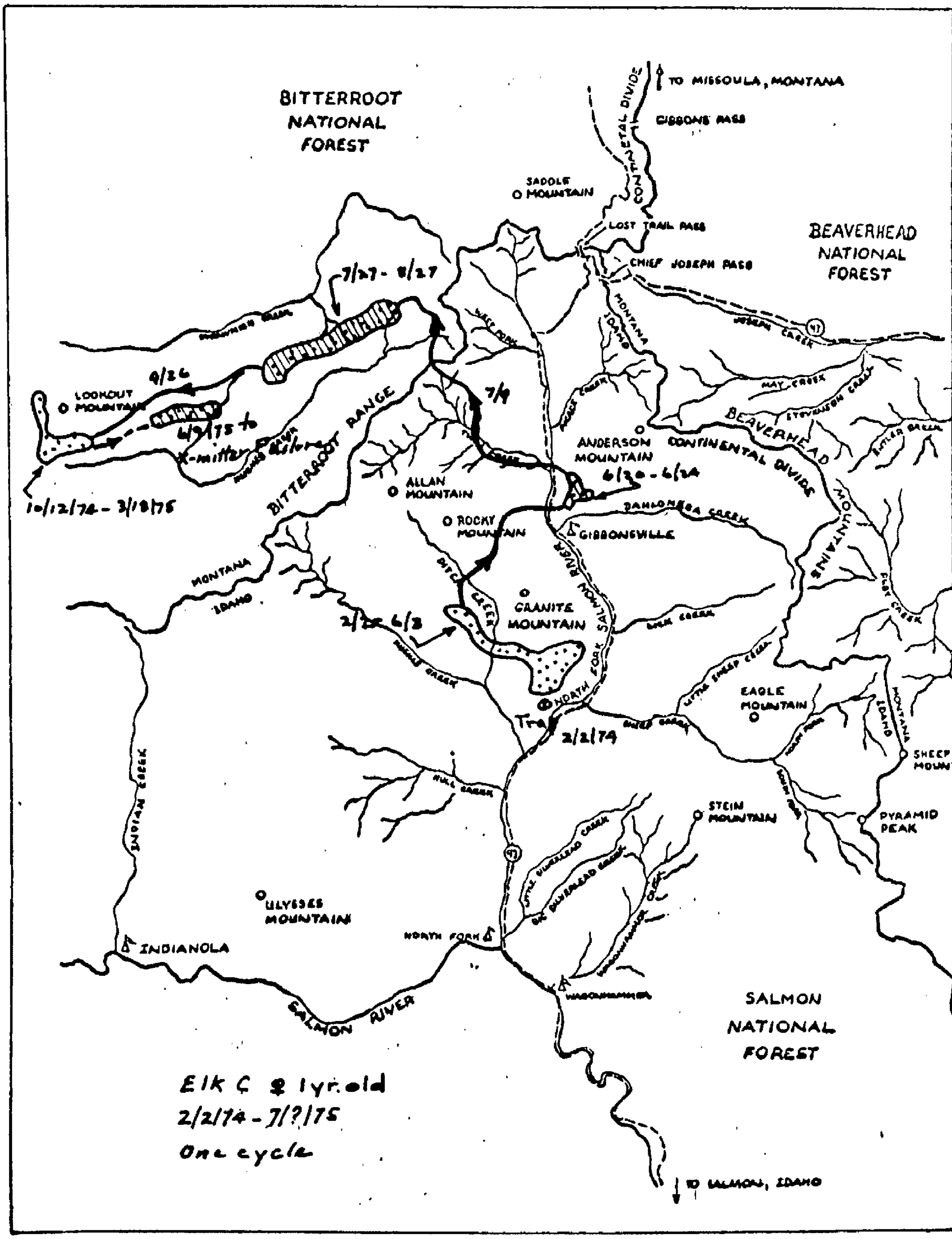
January 1974 to December 1975

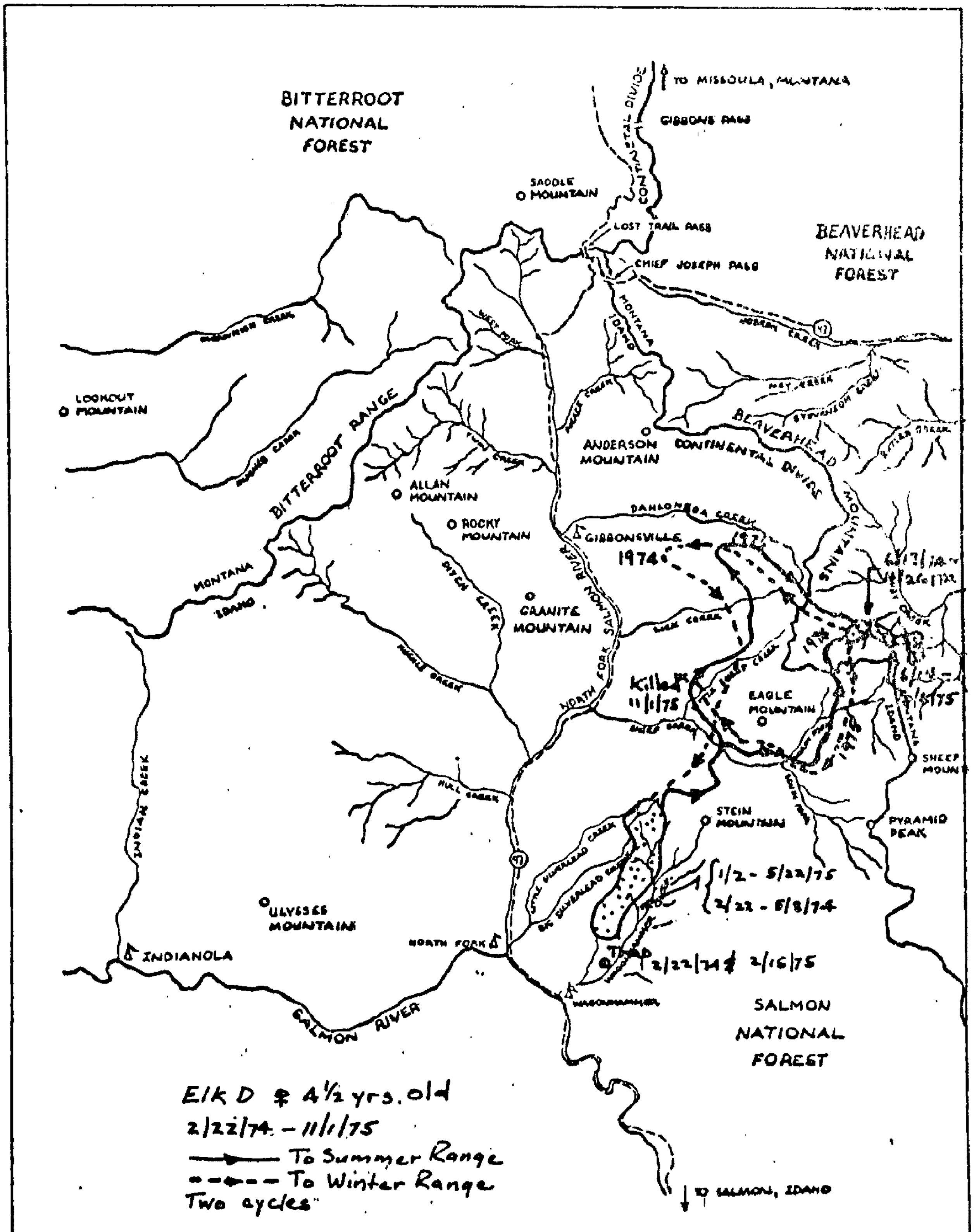


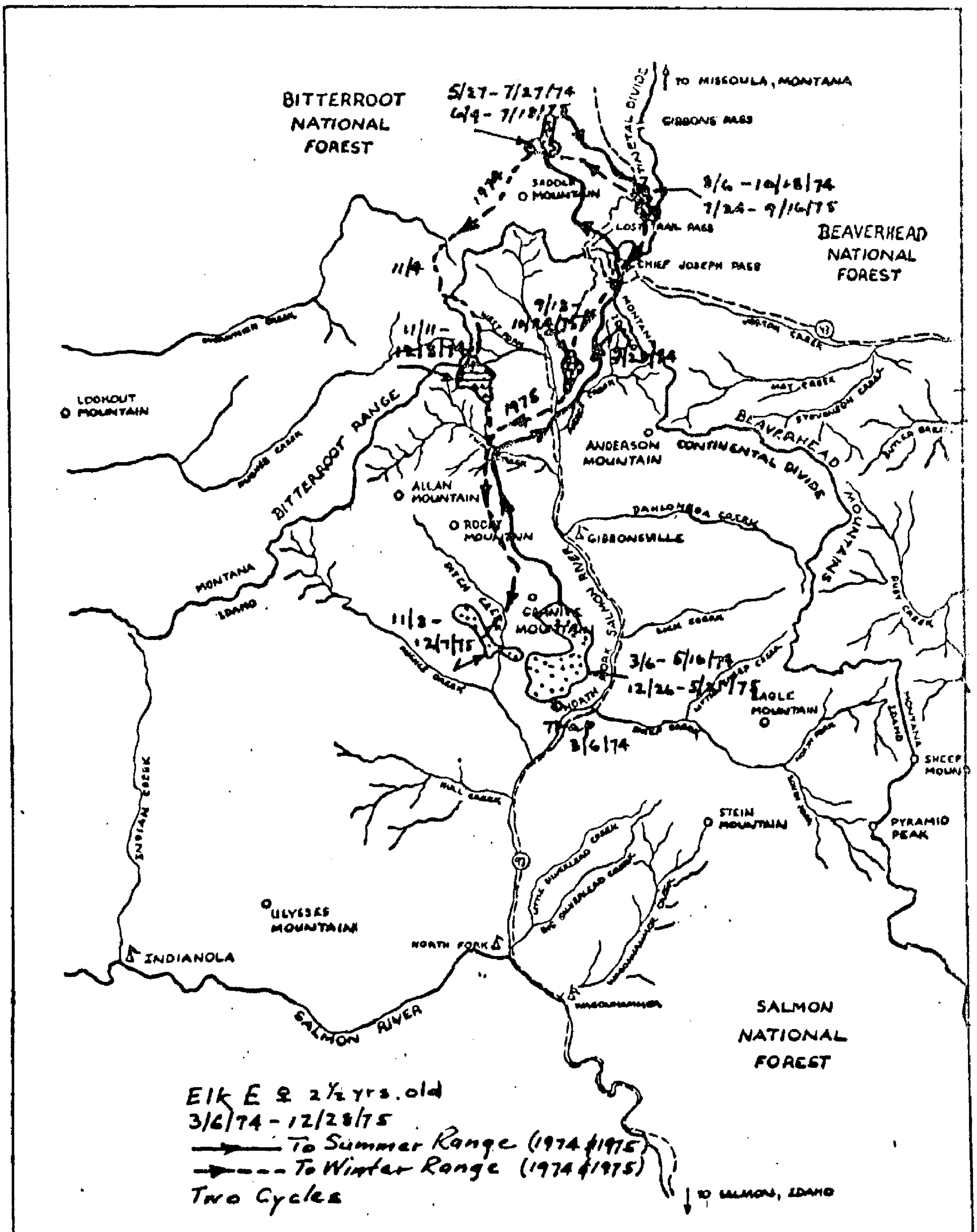
BITTERROOT
NATIONAL
FOREST
TO MISSOULA, MONTANA
GIBBONS PASS
CONTINENTAL DIVIDE
SADDLE MOUNTAIN
LOST TRAIL PASS
CHIEF JOSEPH PASS
BEAVERHEAD
NATIONAL
FOREST
MONTANA
IDAHO
LOOKOUT MOUNTAIN
BITTERROOT RANGE
9/28
ALLAN MOUNTAIN
6/24-7/18/75
ROOT MOUNTAIN
ANDERSON MOUNTAIN
CONTINENTAL DIVIDE
GIBBONSVILLE
10/3-10/22/75
MONTANA
IDAHO
killed
10/22/75
7/24-9/5
CARMEN MOUNTAIN
2/5-4/30
5/1-6/17
2/5/75
EAGLE MOUNTAIN
STEIN MOUNTAIN
ULYSSES MOUNTAIN
INDIANOLA
NORTH FORK
SALMON RIVER
SALMON
NATIONAL
FOREST
Elk A2 ♂ 3½ yrs. old
2/5/75-10/22/75
½ cycle
TO SALMON, IDAHO



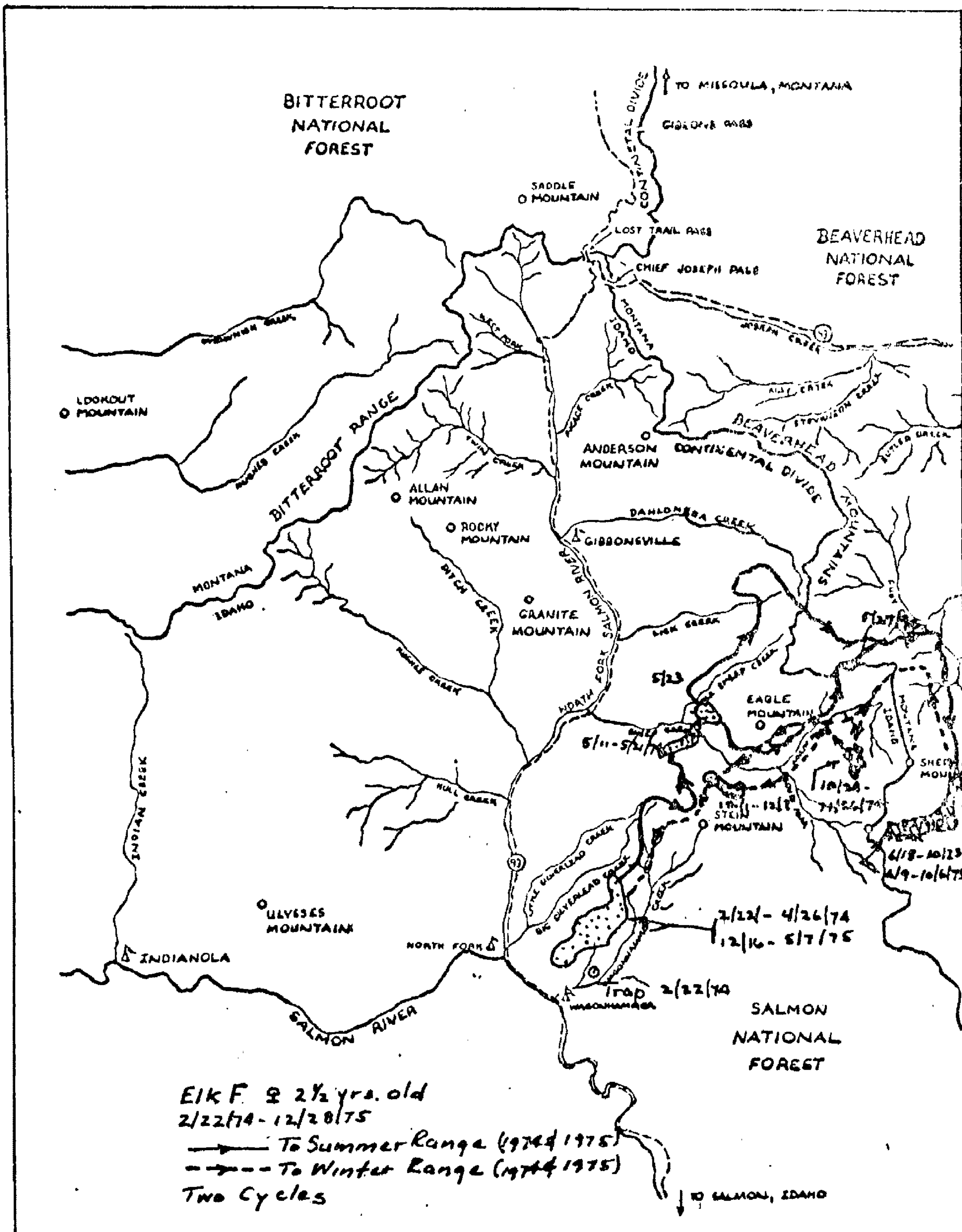
BITTERROOT NATIONAL FOREST
TO MISSOULA, MONTANA
GIBBONS PASS
CONTINENTAL DIVIDE
SADDLE MOUNTAIN
LOST TRAIL PASS
CHIEF JOSEPH PASS
BEAVERHEAD NATIONAL FOREST
LOOKOUT MOUNTAIN
BITTERROOT RANGE
ANDERSON MOUNTAIN
CONTINENTAL DIVIDE
ALLAN MOUNTAIN
ROCKY MOUNTAIN
GIBBONSVILLE
GRANITE MOUNTAIN
MONTANA
IDAHO
NORTH FORK SALMON RIVER
EAGLE MOUNTAIN
STEIN MOUNTAIN
PYRAMID PEAK
ULYSSES MOUNTAIN
INDIANOLA
NORTH FORK
SALMON RIVER
SALMON NATIONAL FOREST
TO SALMON, IDAHO
7/27/74
9/6/74
6/4/74
7/17/74
10/18/75
11/18/75
6/17/75 - 9/8/75
2/11/74
6/6/75
12/7/75
12/2/74
5/27/74
2/2/74
Elk B ♀ 3½ yrs. old
2/2/74 - 12/28/75
Two cycles

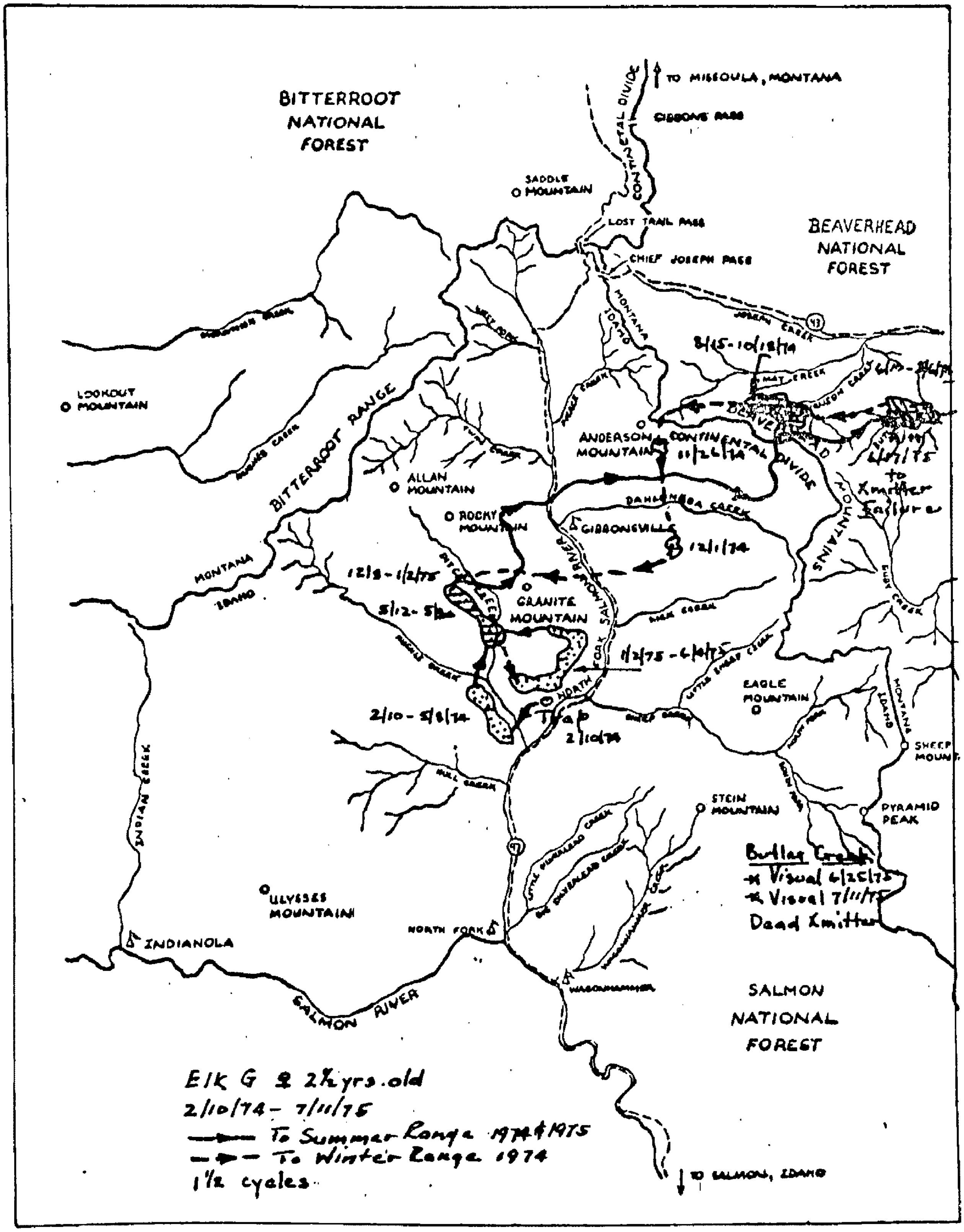

BITTERROOT NATIONAL FOREST
BEAVERHEAD NATIONAL FOREST
SALMON NATIONAL FOREST
TO MISSOULA, MONTANA
GIBBONS PASS
CONTINENTAL DIVIDE
SADDLE MOUNTAIN
LOST TRAIL PASS
CHIEF JOSEPH PASS
LOOKOUT MOUNTAIN
ANDERSON MOUNTAIN
ALLAN MOUNTAIN
ROCKY MOUNTAIN
GRANITE MOUNTAIN
EAGLE MOUNTAIN
STEIN MOUNTAIN
ULYSSES MOUNTAIN
SHEEP MOUNT
PYRAMID PEAK
BITTERROOT RANGE
BEAVERHEAD MOUNTAINS
MONTANA
IDAHO
GIBBONSVILLE
INDIANOLA
NORTH FORK
SALMON RIVER
NORTH FORK SALMON RIVER
DAHLONEGA CREEK
MAY CREEK
INDIAN CREEK
HULL CREEK
TO SALMON, IDAHO
7/27 - 8/27
9/26
7/9
6/20 - 6/24
10/12/74 - 3/18/75
2/22 - 6/3
2/2/74
Elk C ♀ 1yr. old
2/2/74 - 7/?/75
One cycle


BITTERROOT NATIONAL FOREST
TO MISSOULA, MONTANA
GIBBONS PASS
CONTINENTAL DIVIDE
SADDLE MOUNTAIN
LOST TRAIL PASS
CHIEF JOSEPH PASS
BEAVERHEAD NATIONAL FOREST
LOOKOUT MOUNTAIN
BITTERROOT RANGE
ANDERSON MOUNTAIN
CONTINENTAL DIVIDE
BEAVERHEAD MOUNTAINS
ALLAN MOUNTAIN
ROCKY MOUNTAIN
GIBBONSVILLE
1974
DITCH CREEK
GRANITE MOUNTAIN
MONTANA
IDAHO
NORTH FORK SALMON RIVER
Killed 11/1/75
EAGLE MOUNTAIN
HULL CREEK
STEIN MOUNTAIN
PYRAMID PEAK
1/2 - 5/22/75
2/22 - 5/8/74
Trap 2/22/74 & 2/16/75
INDIAN CREEK
ULYSSES MOUNTAIN
INDIANOLA
NORTH FORK
SALMON RIVER
SALMON NATIONAL FOREST
Elk D ♀ 4½ yrs. old
2/22/74 - 11/1/75
To Summer Range
To Winter Range
Two cycles
TO SALMON, IDAHO

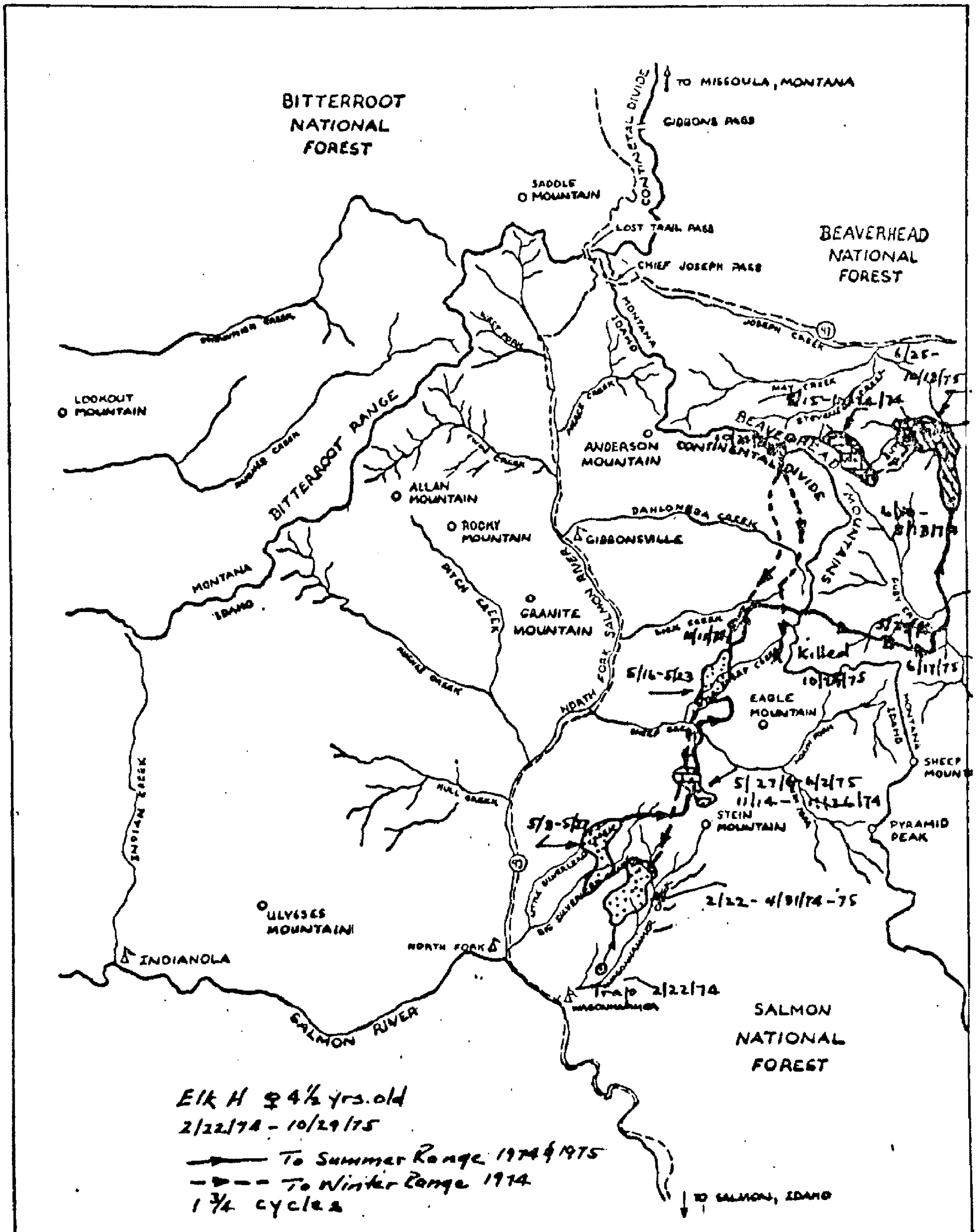


BITTERROOT NATIONAL FOREST
5/27-7/27/74
6/4-7/18/75
TO MISSOULA, MONTANA
GIBBONS PASS
SADDLE MOUNTAIN
8/6-10/18/74
7/24-9/16/75
LOST TRAIL PASS
BEAVERHEAD NATIONAL FOREST
CHIEF JOSEPH PASS
11/4
11/11-12/8/74
1975
LOOKOUT MOUNTAIN
BITTERROOT RANGE
ANDERSON MOUNTAIN
CONTINENTAL DIVIDE
BEAVERHEAD MOUNTAINS
ALLAN MOUNTAIN
ROCKY MOUNTAIN
GIBBONSVILLE
MONTANA
IDAHO
11/8-12/7/75
GRANITE MOUNTAIN
3/6-6/16/74
EAGLE MOUNTAIN
3/6/74
STEIN MOUNTAIN
PYRAMID PEAK
INDIAN CREEK
ULYSSES MOUNTAIN
NORTH FORK
INDIANOLA
SALMON RIVER
SALMON NATIONAL FOREST
Elk E ♀ 2½ yrs. old
3/6/74 - 12/28/75
To Summer Range (1974 & 1975)
To Winter Range (1974 & 1975)
Two Cycles
TO SALMON, IDAHO

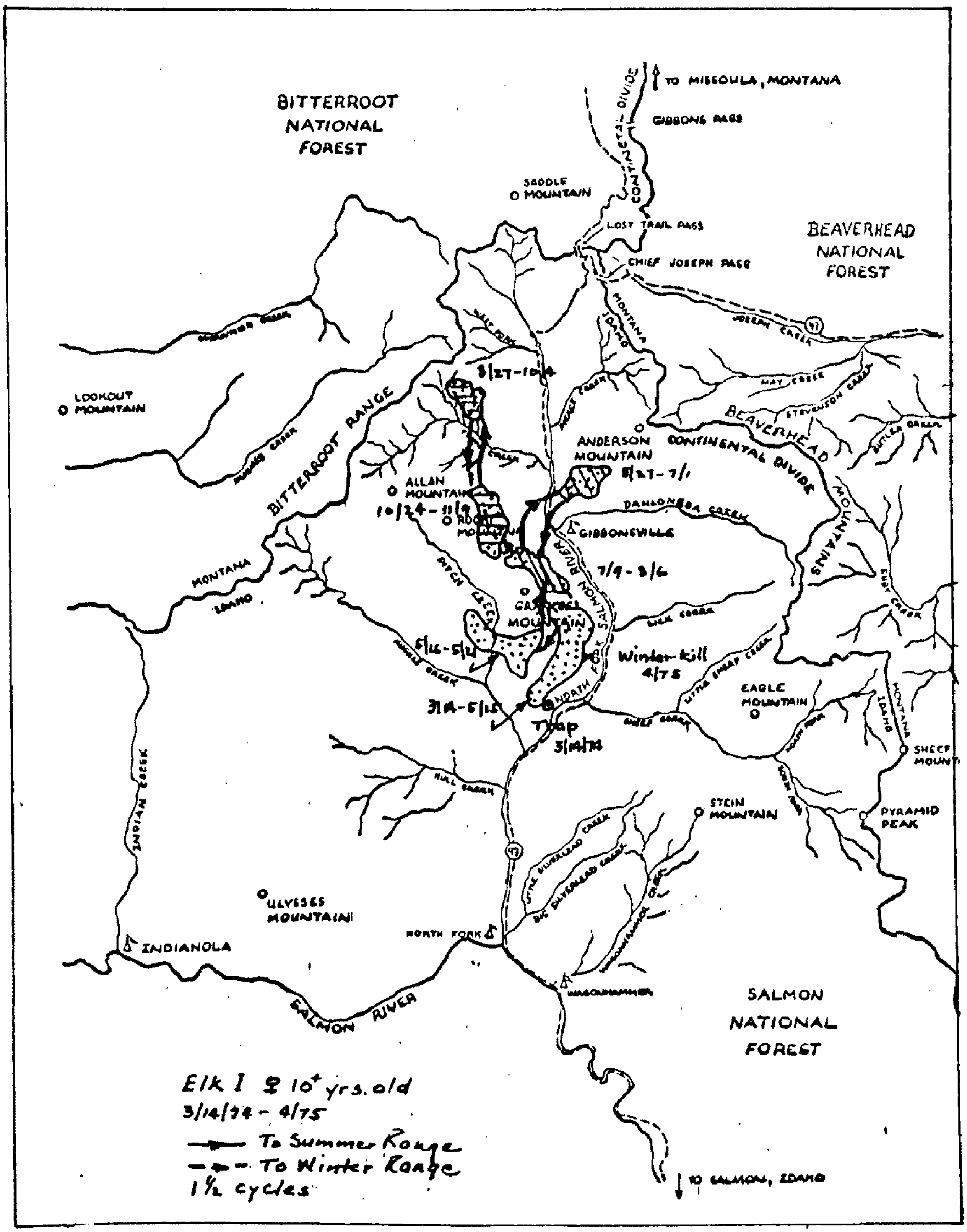

BITTERROOT NATIONAL FOREST
BEAVERHEAD NATIONAL FOREST
SALMON NATIONAL FOREST
TO MISSOULA, MONTANA
CONTINENTAL DIVIDE
SADDLE MOUNTAIN
LOST TRAIL PASS
CHIEF JOSEPH PASS
LOOKOUT MOUNTAIN
BITTERROOT RANGE
ANDERSON MOUNTAIN
CONTINENTAL DIVIDE
BEAVERHEAD MOUNTAINS
ALLAN MOUNTAIN
ROCKY MOUNTAIN
GIBBONSVILLE
DAHLONEGA CREEK
MONTANA
IDAHO
GRANITE MOUNTAIN
NORTH FORK SALMON RIVER
EAGLE MOUNTAIN
STEIN MOUNTAIN
INDIAN CREEK
ULYSSES MOUNTAIN
INDIANOLA
NORTH FORK
SALMON RIVER
5/23
5/11-5/21
2/22- 4/26/74
12/16- 5/7/75
Trap 2/22/74
TO SALMON, IDAHO
Elk F ♀ 2½ yrs. old
2/22/74 - 12/28/75
To Summer Range (1974 & 1975)
To Winter Range (1974 & 1975)
Two Cycles



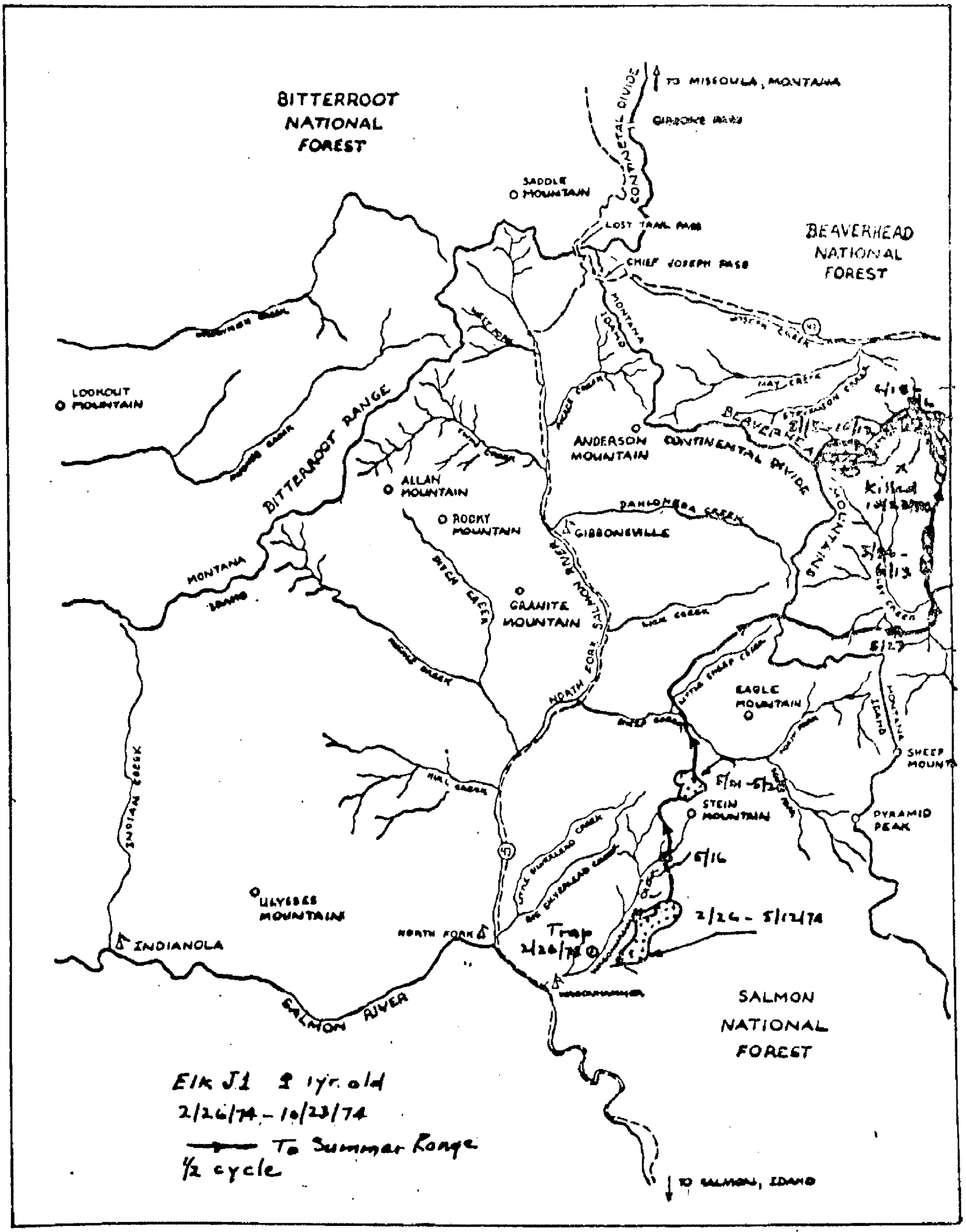
BITTERROOT NATIONAL FOREST
TO MISSOULA, MONTANA
CONTINENTAL DIVIDE
GIBBONS PASS
SADDLE MOUNTAIN
LOST TRAIL PASS
CHIEF JOSEPH PASS
BEAVERHEAD NATIONAL FOREST
LOOKOUT MOUNTAIN
BITTERROOT RANGE
ANDERSON MOUNTAIN
ALLAN MOUNTAIN
ROCKY MOUNTAIN
GIBBONSVILLE
GRANITE MOUNTAIN
MONTANA
IDAHO
EAGLE MOUNTAIN
SHEEP MOUNT.
STEIN MOUNTAIN
PYRAMID PEAK
INDIAN CREEK
ULYSSES MOUNTAIN
INDIANOLA
NORTH FORK
SALMON RIVER
SALMON NATIONAL FOREST
TO SALMON, IDAHO
8/15-10/18/74
11/26/74
12/1/74
12/3-1/2/75
5/12-5/
1/2/75-6/10/75
2/10-5/8/74
Trap
2/10/74
Dead Xmitter
Elk G ♀ 2½ yrs. old
2/10/74 - 7/11/75
To Summer Range 1974 + 1975
To Winter Range 1974
1½ cycles

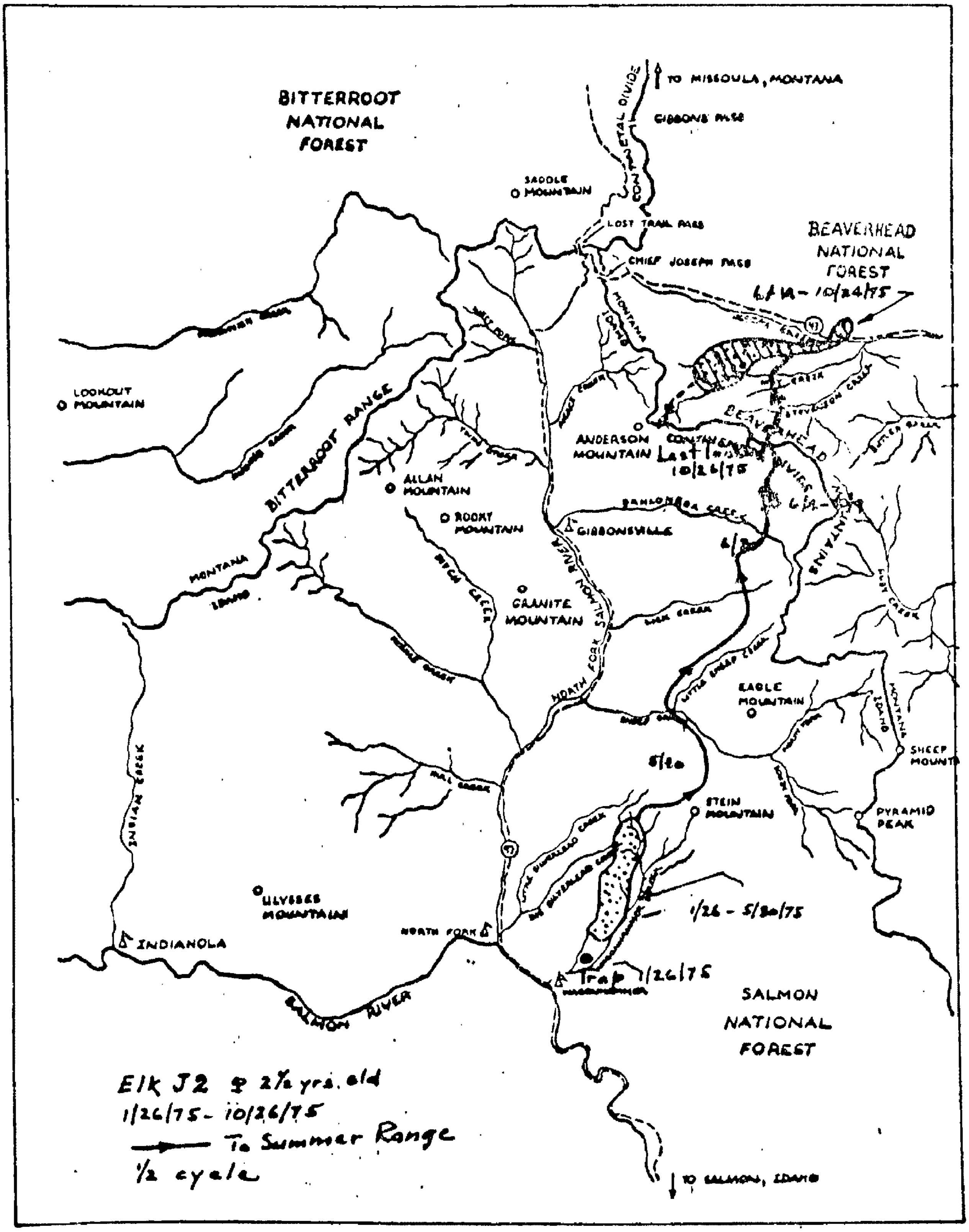


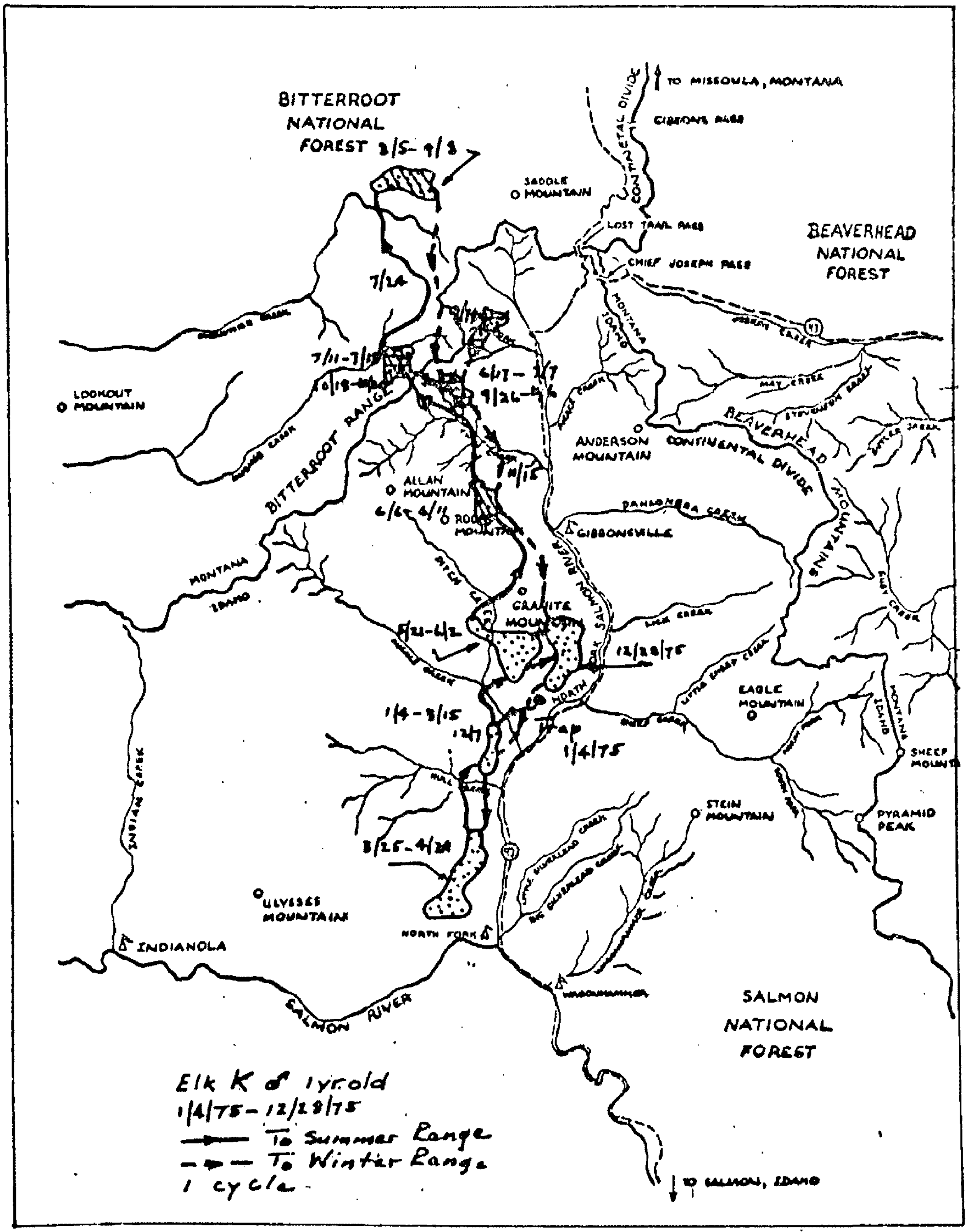
BITTERROOT NATIONAL FOREST
TO MISSOULA, MONTANA
GIBBONS PASS
CONTINENTAL DIVIDE
SADDLE MOUNTAIN
LOST TRAIL PASS
CHIEF JOSEPH PASS
BEAVERHEAD NATIONAL FOREST
LOOKOUT MOUNTAIN
BITTERROOT RANGE
ANDERSON MOUNTAIN
CONTINENTAL DIVIDE
BEAVERHEAD MOUNTAINS
ALLAN MOUNTAIN
ROCKY MOUNTAIN
GIBBONSVILLE
MONTANA
IDAHO
GRANITE MOUNTAIN
NORTH FORK SALMON RIVER
Killed
10/29/75
6/17/75
5/16-5/23
EAGLE MOUNTAIN
SHEEP MOUN
5/27-6/2/75
11/14-11/26/74
STEIN MOUNTAIN
PYRAMID PEAK
5/3-5/12
INDIAN CREEK
ULYSSES MOUNTAIN
2/22-4/31/74-75
INDIANOLA
NORTH FORK
Trap 2/22/74
SALMON RIVER
SALMON NATIONAL FOREST
TO SALMON, IDAHO
Elk H ♀ 4½ yrs. old
2/22/74 - 10/29/75
To Summer Range 1974 & 1975
To Winter Range 1974
1 3/4 cycles



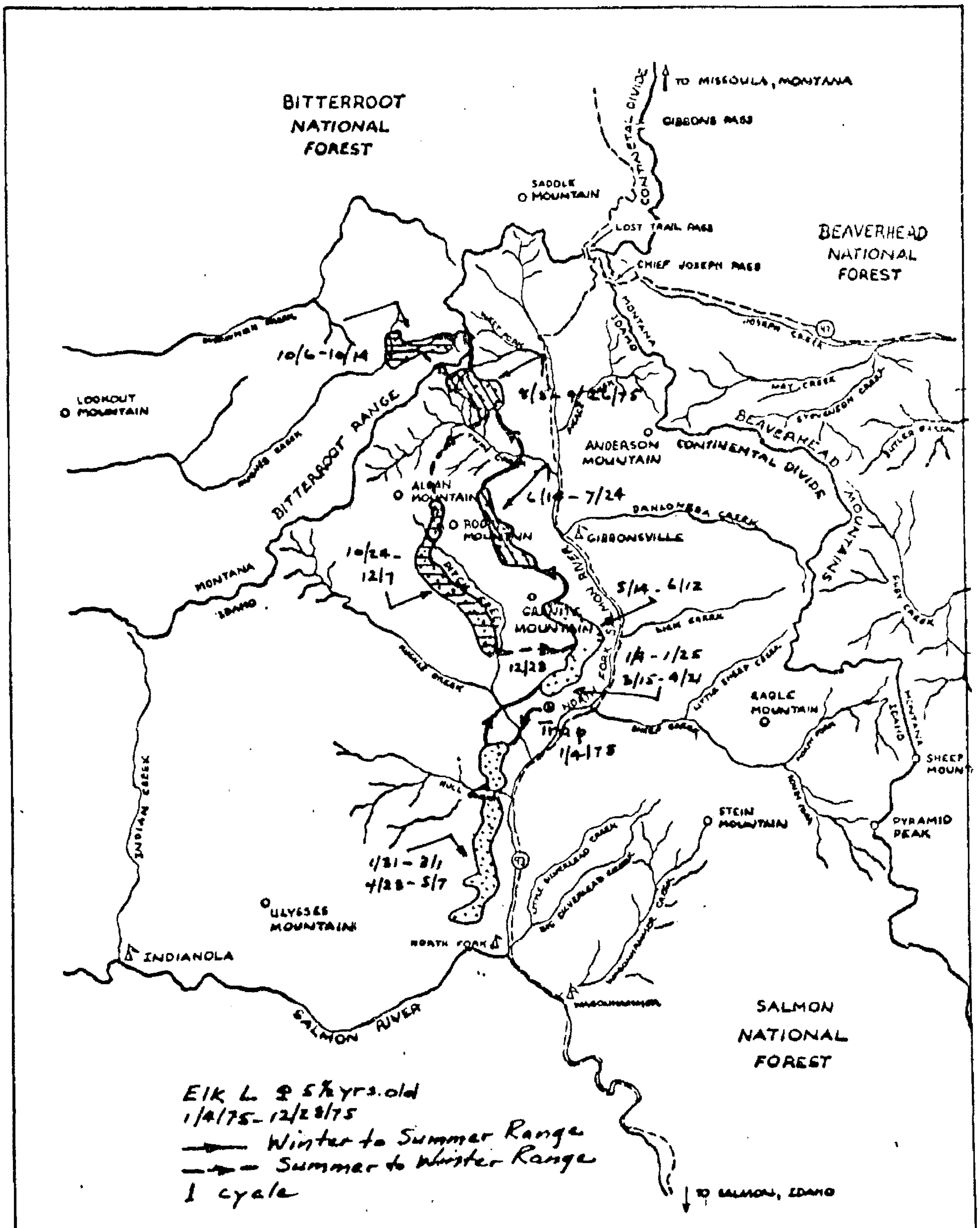
BITTERROOT NATIONAL FOREST
TO MISSOULA, MONTANA
GIBBONS PASS
CONTINENTAL DIVIDE
SADDLE MOUNTAIN
LOST TRAIL PASS
CHIEF JOSEPH PASS
BEAVERHEAD NATIONAL FOREST
JOSEPH CREEK
MAY CREEK
STEVENSON CREEK
BEAVERHEAD CONTINENTAL DIVIDE
LOOKOUT MOUNTAIN
BITTERROOT RANGE
ANDERSON MOUNTAIN
DAHLONEGA CREEK
GIBBONSVILLE
ALLAN MOUNTAIN
MONTANA
IDAHO
DITCH CREEK
NORTH FORK SALMON RIVER
Winter-kill 4/75
EAGLE MOUNTAIN
Trap 3/14/74
HULL CREEK
STEIN MOUNTAIN
PYRAMID PEAK
INDIAN CREEK
ULYSSES MOUNTAIN
NORTH FORK
INDIANOLA
SALMON RIVER
SALMON NATIONAL FOREST
TO SALMON, IDAHO
8/27-10/4
8/27-7/1
10/24-11/9
7/9-8/6
5/16-5/21
3/14-5/16
Elk I ♀ 10+ yrs. old
3/14/74 - 4/75
To Summer Range
To Winter Range
1½ cycles

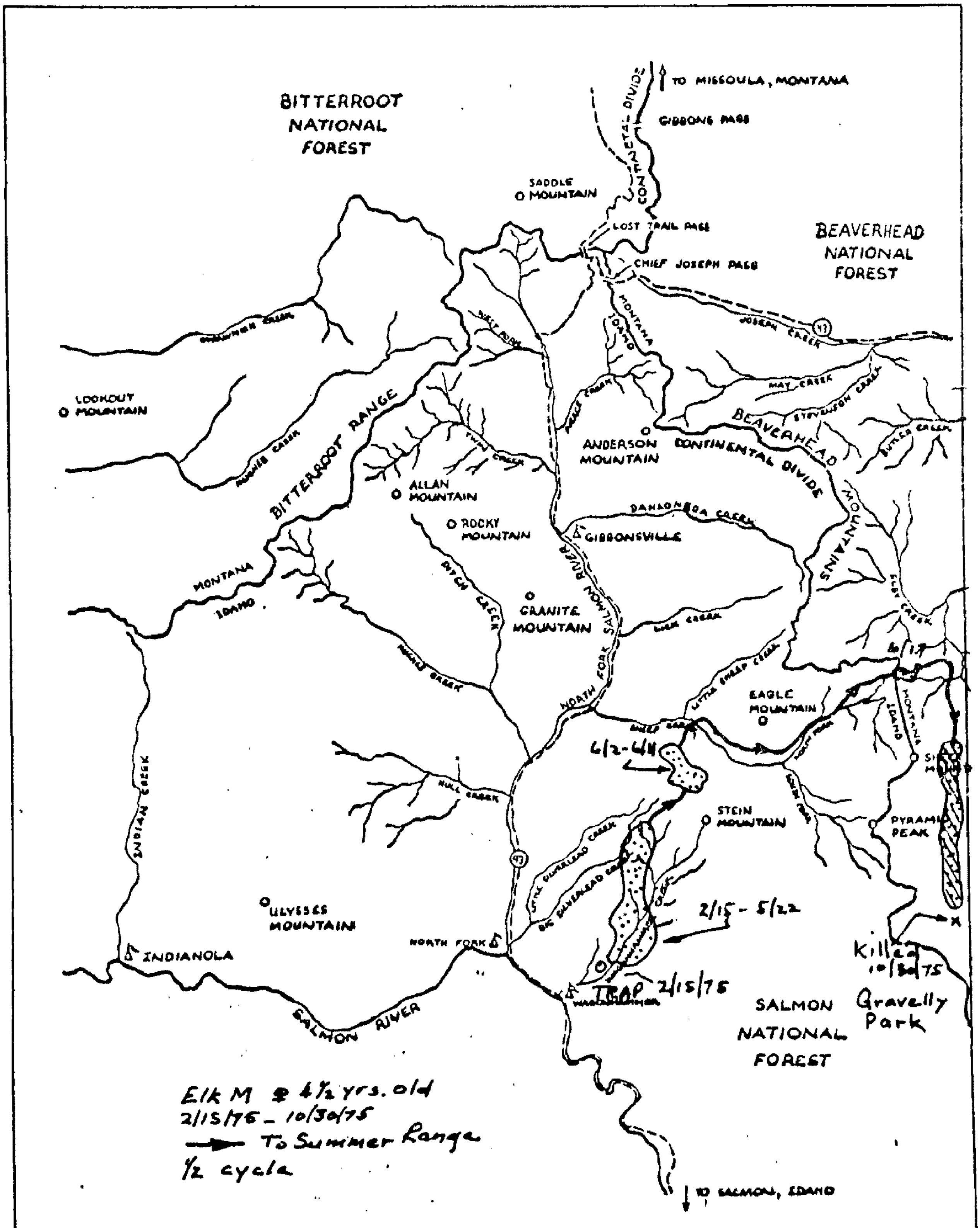

BITTERROOT NATIONAL FOREST
TO MISSOULA, MONTANA
CONTINENTAL DIVIDE
SADDLE MOUNTAIN
LOST TRAIL PASS
CHIEF JOSEPH PASS
BEAVERHEAD NATIONAL FOREST
MONTANA
IDAHO
LOOKOUT MOUNTAIN
BITTERROOT RANGE
ANDERSON MOUNTAIN
CONTINENTAL DIVIDE
BEAVERHEAD MOUNTAINS
Killed
ALLAN MOUNTAIN
ROCKY MOUNTAIN
GIBBONSVILLE
GRANITE MOUNTAIN
NORTH FORK SALMON RIVER
EAGLE MOUNTAIN
SHEEP MOUNTAIN
STEIN MOUNTAIN
PYRAMID PEAK
5/16
2/26 - 5/12/74
Trap 2/26/74
INDIAN CREEK
ULYSSES MOUNTAIN
INDIANOLA
NORTH FORK
SALMON RIVER
SALMON NATIONAL FOREST
Elk J1 ♀ 1 yr. old
2/26/74 - 10/23/74
To Summer Range
1/2 cycle
TO SALMON, IDAHO

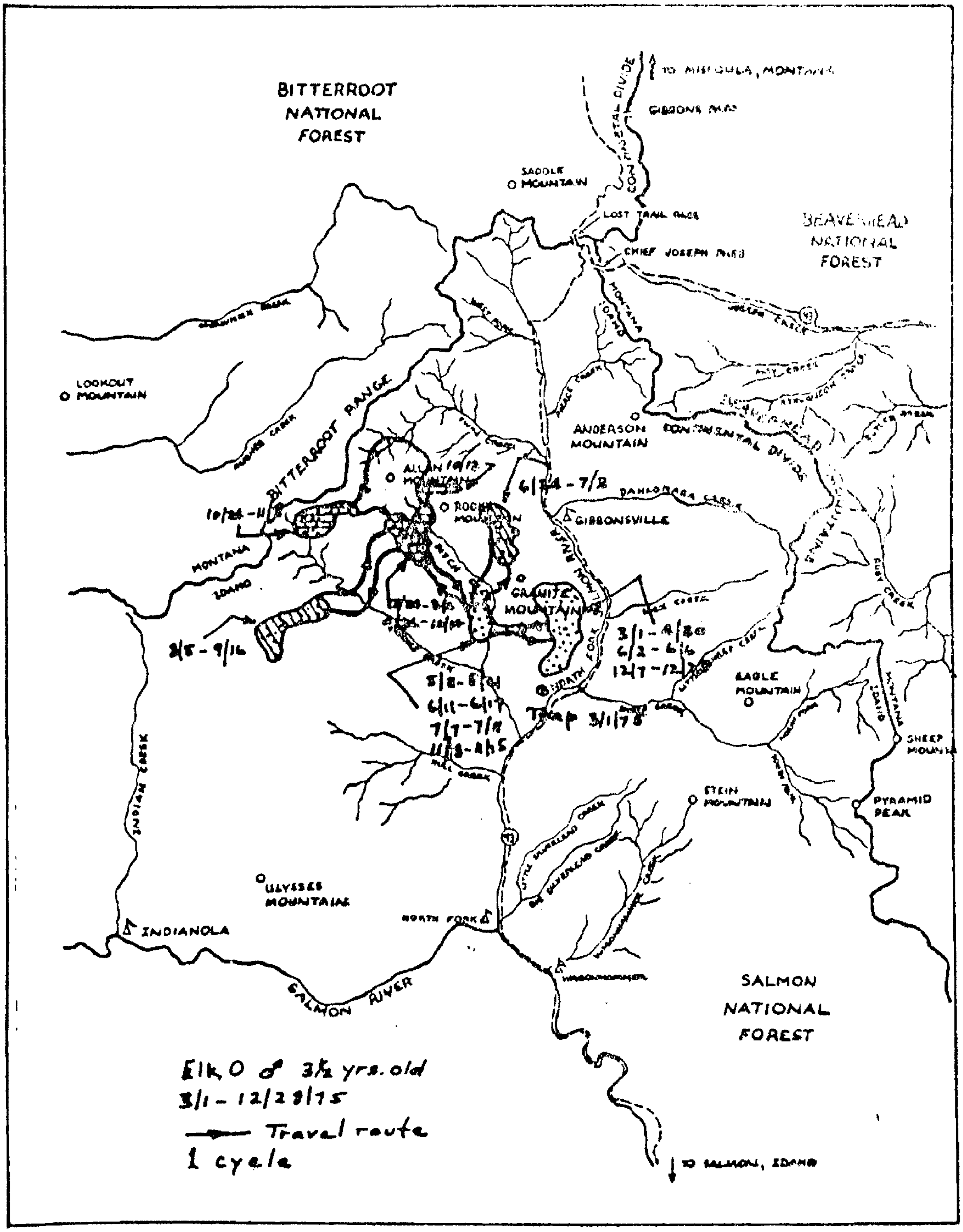

BITTERROOT NATIONAL FOREST
TO MISSOULA, MONTANA
CONTINENTAL DIVIDE
GIBBONS PASS
SADDLE MOUNTAIN
LOST TRAIL PASS
CHIEF JOSEPH PASS
BEAVERHEAD NATIONAL FOREST
LOOKOUT MOUNTAIN
BITTERROOT RANGE
ANDERSON MOUNTAIN
ALLAN MOUNTAIN
ROOKY MOUNTAIN
GIBBONSVILLE
MONTANA
IDAHO
GRANITE MOUNTAIN
NORTH FORK SALMON RIVER
EAGLE MOUNTAIN
STEIN MOUNTAIN
SHEEP MOUNTAIN
PYRAMID PEAK
INDIAN CREEK
ULYSSES MOUNTAIN
INDIANOLA
NORTH FORK
SALMON RIVER
SALMON NATIONAL FOREST
TO SALMON, IDAHO
Trap 1/26/75
1/26 - 5/20/75
5/20
Last loc. 10/26/75
Elk J2 ♀ 2½ yrs. old
1/26/75 - 10/26/75
To Summer Range
½ cycle

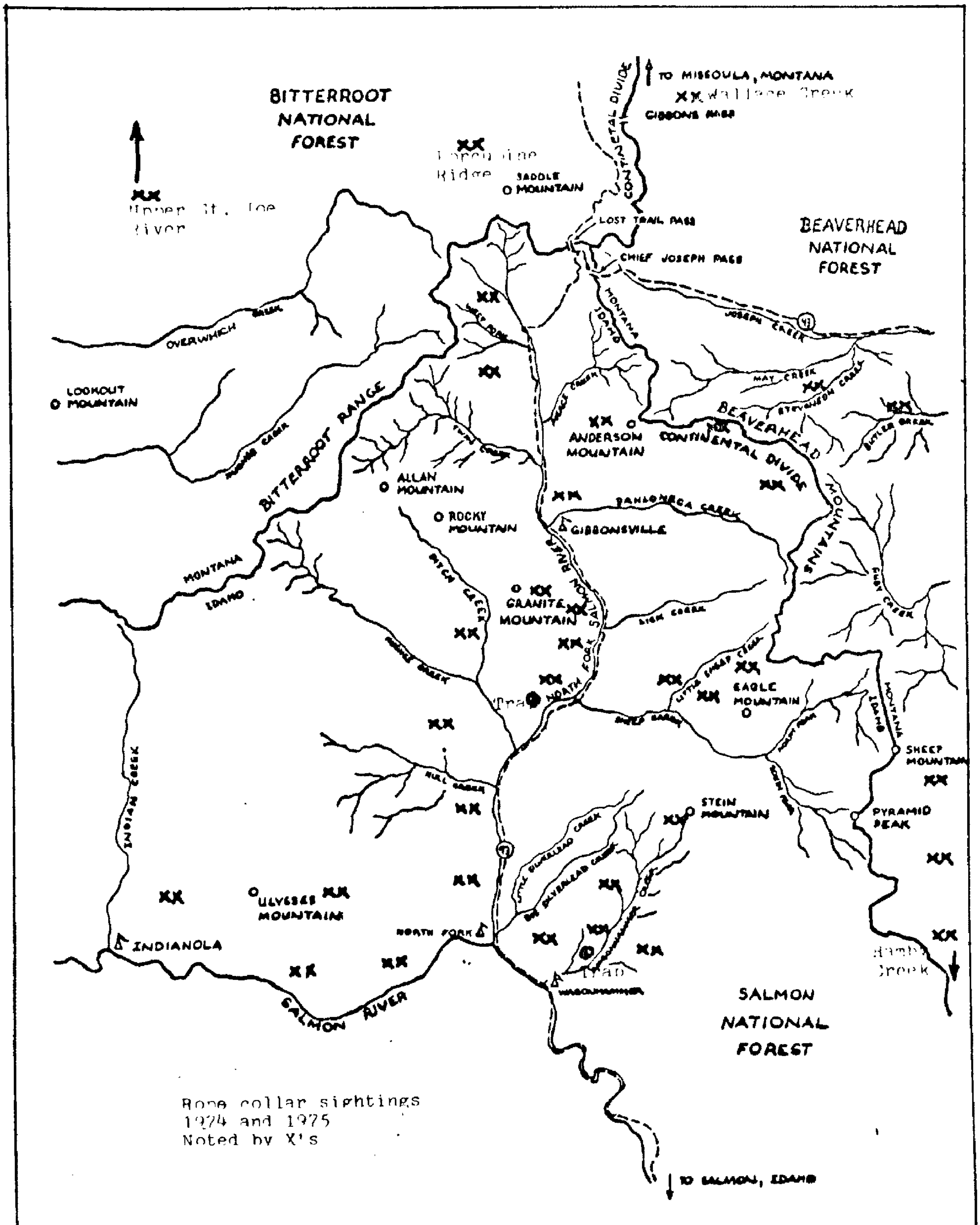


BITTERROOT NATIONAL FOREST
TO MISSOULA, MONTANA
SADDLE MOUNTAIN
LOST TRAIL PASS
CHIEF JOSEPH PASS
BEAVERHEAD NATIONAL FOREST
LOOKOUT MOUNTAIN
BITTERROOT RANGE
ANDERSON MOUNTAIN
CONTINENTAL DIVIDE
ALLAN MOUNTAIN
GIBBONSVILLE
MONTANA
IDAHO
GRANITE MOUNTAIN
EAGLE MOUNTAIN
SHEEP MOUNTAIN
STEIN MOUNTAIN
PYRAMID PEAK
ULYSSES MOUNTAIN
INDIANOLA
NORTH FORK
SALMON RIVER
SALMON NATIONAL FOREST
TO SALMON, IDAHO
Elk K ♂ 1yr.old
1/4/75 - 12/28/75
To Summer Range
To Winter Range
1 cycle


BITTERROOT NATIONAL FOREST
TO MISSOULA, MONTANA
CONTINENTAL DIVIDE
GIBBONS PASS
SADDLE MOUNTAIN
LOST TRAIL PASS
CHIEF JOSEPH PASS
BEAVERHEAD NATIONAL FOREST
MONTANA
IDAHO
JOSEPH CREEK
10/6-10/14
LOOKOUT MOUNTAIN
BITTERROOT RANGE
8/24-9/22/75
ANDERSON MOUNTAIN
CONTINENTAL DIVIDE
BEAVERHEAD MOUNTAINS
6/14-7/24
ALBAN MOUNTAIN
GIBBONSVILLE
DAHLONEGA CREEK
10/24-12/7
MONTANA
IDAHO
5/14-6/12
NORTH FORK
1/4-1/25
3/15-4/21
12/28
EAGLE MOUNTAIN
1/4/75
SHEEP MOUNT
STEIN MOUNTAIN
PYRAMID PEAK
INDIAN CREEK
1/31-3/1
4/28-5/7
ULYSSES MOUNTAIN
INDIANOLA
NORTH FORK
SALMON RIVER
SALMON NATIONAL FOREST
Elk L ♀ 5½ yrs. old
1/4/75-12/28/75
Winter to Summer Range
Summer to Winter Range
1 cycle
TO SALMON, IDAHO


BITTERROOT NATIONAL FOREST
TO MISSOULA, MONTANA
CONTINENTAL DIVIDE
GIBBONS PASS
SADDLE MOUNTAIN
LOST TRAIL PASS
CHIEF JOSEPH PASS
BEAVERHEAD NATIONAL FOREST
MONTANA
IDAHO
JOSEPH CREEK
43
MAY CREEK
STEVENSON CREEK
LOOKOUT MOUNTAIN
BITTERROOT RANGE
ANDERSON MOUNTAIN
CONTINENTAL DIVIDE
BEAVERHEAD MOUNTAINS
ALLAN MOUNTAIN
ROCKY MOUNTAIN
GIBBONSVILLE
DAHLONEGA CREEK
DITCH CREEK
GRANITE MOUNTAIN
NORTH FORK SALMON RIVER
LITTLE SHEEP CREEK
EAGLE MOUNTAIN
SHEEP CREEK
6/2-6/11
6/17
STEIN MOUNTAIN
PYRAMID PEAK
HULL CREEK
INDIAN CREEK
LITTLE DIVERSHEAD CREEK
BIG DIVERSHEAD CREEK
2/15 - 5/22
ULYSSES MOUNTAIN
NORTH FORK
INDIANOLA
SALMON RIVER
TRAP 2/15/75
Killed 10/30/75
Gravelly Park
SALMON NATIONAL FOREST
Elk M ♀ 4½ yrs. old
2/15/75 _ 10/30/75
To Summer Range
½ cycle
TO SALMON, IDAHO


BITTERROOT NATIONAL FOREST
BEAVERHEAD NATIONAL FOREST
SALMON NATIONAL FOREST
SADDLE MOUNTAIN
LOST TRAIL PASS
CHIEF JOSEPH PASS
GIBBONS PASS
CONTINENTAL DIVIDE
LOOKOUT MOUNTAIN
BITTERROOT RANGE
ANDERSON MOUNTAIN
ALLAN MOUNTAIN
ROCKY MOUNTAIN
GIBBONSVILLE
GRANITE MOUNTAIN
MONTANA
IDAHO
EAGLE MOUNTAIN
SHEEP MOUNTAIN
PYRAMID PEAK
STEIN MOUNTAIN
ULYSSES MOUNTAIN
INDIANOLA
NORTH FORK
SALMON RIVER
INDIAN CREEK
TO SALMON, IDAHO
Trap 3/1/75
3/1 - 4/20
6/2 - 6/6
5/8 - 5/31
6/11 - 6/17
7/7 - 7/11
6/24 - 7/2
8/5 - 9/16
Elk, O ♂ 3½ yrs. old
3/1 - 12/29/75
Travel route
1 cycle




Rope collar sightings
1974 and 1975
Noted by X's

Appendix IV

Locations of Radioed Cow Elk During Calving Periods 1974 and 1975 (21 May-10 June)

Radioed Elk from Wagonhammer Trap

| Elk | Date | Location |
|---|---|---|
| D | 5/21/74 | T. 24 N., R. 22 E., 22, NE 1/4, NW 1/4, Sheep Creek. |
| | 5/23/74 | T. 24 N., R. 21 E., 21, SE 1/4, NE 1/4, Sheep Creek. |
| | 5/27/74 | T. 25 N., R. 21 E., 9, NE 1/4, NW 1/4, Little Sheep Creek. |
| | 5/30/74 | T. 24 N., R. 21 E., 17, NW 1/4, NW 1/4, Sheep Creek. |
| | 6/3/74 | T. 24 N., R. 21 E., 17, SE 1/4, SE 1/4, Sheep Creek. |
| | 6/10/74 | T. 24 N., R. 22 E., 22, SE 1/4, NW 1/4, Sheep Creek. |
| | 5/22/75 | T. 24 N., R. 21 E., 12, SW 1/4, NW 1/4, Wagon-hammer Creek. |
| | 5/27/75 | T. 24 N., R. 21 E., 12, SW 1/4, NW 1/4, Wagon-hammer Creek. |
| | 6/2/75 | T. 24 N., R. 21 E., 36, NW 1/4, NE 1/4, Big Silverleads Creek. |
| | 6/4/75 | T. 25 N., R. 21 E., 9, SW 1/4, NE 1/4, Little Sheep Creek. |
| | 6/6/75 | T. 25 N., R. 22 E., 34, SE 1/4, NW 1/4, Dahlonega Creek. |
| | 6/9/75 | T. 25 N., R. 22 E., 34, SW 1/4, NW 1/4, Dahlonega Creek. |
| | 6/14/75 | T. 3 S., R. 17 W., 26, SE 1/4, SE 1/4, Cow Creek. |
| F | 5/21/74 | T. 24 N., R. 21 E., 17, NE 1/4, SW 1/4, Sheep Creek. |
| | 5/23/74 | T. 24 N., R. 21 E., 17, SE 1/4, NW 1/4, Sheep Creek. |
| | 5/27/74 | T. 3 S., R. 17 W., 19, SW 1/4, SW 1/4, Ruby Creek. |
| | 5/30/74 | T. 3 S., R. 17 W., 21, SE 1/4, NW 1/4, Isaac Meadows. |
| | 6/3/74 | T. 2 S., R. 16 W., 15, NE 1/4, SW 1/4, Ruby Creek. |
| | 6/10/74 | T. 3 S., R. 16 W., 22, NE 1/4, SW 1/4, Isaac Meadows. |

| Elk | Date | Location |
| --- | --- | --- |
| | 5/27/75 | T. 3 S., R. 16 W., 2, NE 1/4, SE 1/4, Moose Creek. |
| | 6/9/75 | T. 3 S., R. 16 W., 2, SW 1/4, SE 1/4, Moose Creek. |
| | 6/17/75 | T. 3 S., R. 17 W., 3, SW 1/4, NE 1/4, Moose Creek. |
| H | 5/21/74 | T. 25 N., R. 21 E., 8, NW 1/4, SE 1/4, Little Sheep Creek. |
| | 5/23/74 | T. 25 N., R. 21 E., 5, NW 1/4, SE 1/4, Lick Creek. |
| | 5/27/74 | T. 3 S., R. 17 W., 28, NW 1/4, SW 1/4, Little Moosehorn Creek. |
| | 5/30/74 | T. 3 S., R. 17 W., 21, NW 1/4, SE 1/4, Isaac Meadows. |
| | 6/3/74 | T. 3 S., R. 17 W., 21, NW 1/4, SE 1/4, Isaac Meadows. |
| | 6/10/74 | T. 3 S., R. 17 W., 16, SE 1/4, SE 1/4, Nickel Bar Gulch. |
| | 6/13/74 | T. 3 S., R. 17 W., 14, SE 1/4, NW 1/4, Ruby Creek. |
| | 5/27/75 | T. 24 N., R. 21 E., 19, SE 1/4, SE 1/4, Stein Gulch. |
| | 5/30/75 | T. 24 N., R. 21 E., 29, NW 1/4, NW 1/4, Stein Mountain. |
| | 6/2/75 | T. 24 N., R. 21 E., 29, NW 1/4, SW 1/4, Stein Mountain. |
| | 6/4/75 | T. 25 N., R. 21 E., 8, NW 1/4, SE 1/4, Little Sheep Creek. |
| | 6/6/75 | T. 25 N., R. 21 E., 4, NW 1/4, SW 1/4, Lick Creek. |
| | 6/9/75 | T. 25 N., R. 21 E., 8, SE 1/4, NE 1/4, Little Sheep Creek. |
| | 6/14/75 | T. 25 N., R. 21 E., 33, SW 1/4, SW 1/4, Beartrap Creek. |
| J1 | 5/21/74 | T. 24 N., R. 21 E., 29, NW 1/4, NE 1/4, Stein Mountain. |
| | 5/23/74 | T. 24 N., R. 21 E., 20, NW 1/4, SE 1/4, Stein Mountain. |
| | 5/27/74 | T. 3 S., R. 16 W., 33, NW 1/4, NE 1/4, Little Moosehorn Creek. |

| Elk | Date | Location |
|---|---|---|
| | 5/30/74 | T. 3 S., R. 16 W., 22, NW 1/4, SE 1/4, Isaac Meadows. |
| | 6/3/74 | T. 2 S., R. 16 W., 15, NE 1/4, SW 1/4, Ruby Creek. |
| | 6/10/74 | T. 2 S., R. 16 W., 15, NE 1/4, SE 1/4, Ruby Creek. |
| | 6/13/74 | T. 2 S., R. 16 W., 3, NE 1/4, SW 1/4, Sawpit Creek. |
| J2 | 5/22/75 | T. 24 N., R. 21 E., 1, NE 1/4, SW 1/4, Big Silverleads Creek. |
| | 5/30/75 | T. 24 N., R. 21 E., 30, NE 1/4, SW 1/4, Stein Gulch. |
| | 6/2/75 | T. 25 N., R. 21 E., 32, SE 1/4, NW 1/4, Chink Gulch. |
| | 6/4/75 | T. 25 N., R. 21 E., 20, NW 1/4, SE 1/4, Three-mile Creek. |
| | 6/6/75 | T. 25 N., R. 21 E., 21, SE 1/4, NW 1/4, Three-mile Creek. |
| | 6/9/75 | T. 25 N., R. 22 E., 22, NW 1/4, SW 1/4, West Fork Nez Perce Creek. |
| | 6/14/75 | T. 2 S., R. 17 W., 22, SE 1/4, NW 1/4, May Creek. |
| M | 5/22/75 | T. 24 N., R. 21 E., 36, SW 1/4, NE 1/4, Big Silverleads Creek. |
| | 6/2/75 | T. 24 N., R. 21 E., 30, NW 1/4, SE 1/4, Stein Gulch. |
| | 6/4/75 | T. 24 N., R. 21 E., 30, SW 1/4, NE 1/4, Stein Gulch. |
| | 6/6/75 | T. 24 N., R. 21 E., 29, NE 1/4, SW 1/4, Stein Mountain. |
| | 6/9/75 | T. 24 N., R. 21 E., 30, NE 1/4, SE 1/4, Stein Mountain. |
| | 6/11/75 | T. 24 N., R. 21 E., 30, NE 1/4, SE 1/4, Stein Mountain. |
| | 6/17/75 | T. 3 S., R. 17 W., 1, NE 1/4, SE 1/4, Big Moosehorn Creek. |

Radioed Elk from Hughes Creek Trap

| Elk | Date | Location |
|---|---|---|
| B | 5/21/74 | T. 25 N., R. 21 E., 34, NW 1/4, SE 1/4, Votler Creek. |
| | 5/22/74 | T. 25 N., R. 21 E., 34, NW 1/4, SE 1/4, Votler Creek. |
| | 5/23/74 | T. 25 N., R. 21 E., 34, SE 1/4, SE 1/4, Votler Creek. |
| | 5/27/74 | T. 25 N., R. 21 E., 34, NE 1/4, NE 1/4, Votler Creek. |
| | 5/30/74 | T. 25 N., R. 21 E., 34, NE 1/4, NE 1/4, Votler Creek. |
| | 6/3/74 | T. 25 N., R. 21 E., 27, NW 1/4, SE 1/4, Vineyard Gulch. |
| | 6/6/74 | T. 25 N., R. 21 E., 27, NW 1/4, SE 1/4, Vineyard Gulch. |
| | 6/10/74 | T. 25 N., R. 21 E., 27, NW 1/4, SE 1/4, Vineyard Gulch. |
| | 6/11/74 (Ground Visual) | T. 25 N., R. 21 E., 27, SE 1/4, SE 1/4, Fire Gulch. |
| | 6/13/74 | T. 25 N., R. 21 E., 27, NW 1/4, SW 1/4, Fire Gulch. |
| | 5/23/75 | T. 25 N., R. 21 E., 27, NW 1/4, NW 1/4, Fire Gulch. |
| | 5/27/75 | T. 25 N., R. 21 E., 27, NW 1/4, SE 1/4, Vineyard Gulch. |
| | 5/30/75 | T. 25 N., R. 21 E., 33, SE 1/4, SE 1/4, Ransack Meadows. |
| | 6/2/75 | T. 25 N., R. 21 E., 3, NE 1/4, NE 1/4, Ransack Loop. |
| | 6/4/75 | T. 25 N., R. 21 E., 3, NE 1/4, NE 1/4, Ransack Loop. |
| | 6/6/75 | T. 25 N., R. 21 E., 21, NW 1/4, NW 1/4, Johnson Gulch. |
| | 6/11/75 | T. 25 N., R. 21 E., 34, SW 1/4, NE 1/4, Votler Creek. |
| C | 5/22/74 | T. 25 N., R. 20 E., 32, SE 1/4, SE 1/4, Humbug Creek. |
| | 5/23/74 | T. 25 N., R. 20 E., 32, NW 1/4, SE 1/4, Humbug Creek. |

| Elk | Date | Location |
|---|---|---|
| | 5/27/74 | T. 25 N., R. 21 E., 27, SW 1/4, NE 1/4, Vineyard Gulch. |
| | 5/30/74 | T. 25 N., R. 20 E., 20, SW 1/4, NE 1/4, Johnson Gulch. |
| | 6/3/74 | T. 25 N., R. 20 E., 25, NW 1/4, SE 1/4, Salzer Creek. |
| | 6/10/74 (Air Visual) | T. 25 N., R. 20 E., 33, NW 1/4, SE 1/4, Ransack Meadows. |
| | 5/27/75 (Ground Visual) | T. 2 S., R. 22 W., 23, NW 1/4, SW 1/4, Cow Creek. |
| | 6/2/75 | T. 2 S., R. 22 W., 23, center, Cow Creek. |
| | 6/5/75 | T. 2 S., R. 22 W., 23, NW 1/4, NE 1/4, Cow Creek. |
| | 6/9/75 | T. 2 S., R. 21 W., 20, NW 1/4, NW 1/4, Overwhich Creek. |
| | 6/13/75 | T. 2 S., R. 21 W., 19, NE 1/4, NE 1/4, Overwhich Creek. |
| E | 5/16/74 | T. 25 N., R. 20 E., 5, NW 1/4, SE 1/4, Humbug Creek. |
| | 5/21/74 | T. 25 N., R. 20 E., 32, SE 1/4, NW 1/4, Humbug Ridge. |
| | 5/23/74 | T. 26 N., R. 21 E., 26, SE 1/4, NW 1/4, Pierce Creek. |
| | 5/27/74 | T. 1 S., R. 19 W., 20, SE 1/4, NW 1/4, West Fork Camp Creek. |
| | 5/30/74 | T. 1 S., R. 19 W., 17, NW 1/4, SE 1/4, West Fork Camp Creek. |
| | 6/3/74 | T. 1 S., R. 19 W., 17, SE 1/4, SW 1/4, West Fork Camp Creek. |
| | 6/10/74 | T. 1 S., R. 19 W., 17, SW 1/4, SW 1/4, West Fork Camp Creek. |
| | 5/21/75 | T. 25 N., R. 20 E., 4, NW 1/4, NE 1/4, Ransack Meadows. |
| | 5/28/75 | T. 26 N., R. 20 E., 17, NW 1/4, NE 1/4, Quartz Creek. |
| | 5/30/75 | T. 1 S., R. 18 W., 36, SW 1/4, SW 1/4, Wallace Creek. |

| Elk | Date | Location |
| --- | --- | --- |
| | 6/9/75 | T. 1 S., R. 19 W., 17, SE 1/4, NW 1/4, West Fork Camp Creek. |
| | 6/14/75 | T. 1 S., R. 19 W., 17, NW 1/4, SE 1/4, West Fork Camp Creek. |
| G | 5/21/74 | T. 25 N., R. 20 E., 31, SE 1/4, NW 1/4, Allan Creek. |
| | 5/23/74 | T. 25 N., R. 20 E., 25, NW 1/4, SE 1/4, Salzer Creek. |
| | 5/24/74 | T. 25 N., R. 20 E., 30, SE 1/4, NW 1/4, Allan Creek. |
| | 5/27/74 | T. 25 N., R. 20 E., 30, SE 1/4, SE 1/4, Allan Creek. |
| | 5/30/74 | T. 25 N., R. 20 E., 21, SE 1/4, NW 1/4, Johnson Gulch. |
| | 6/10/74 | T. 17 W., R. 2 S., 33, NW 1/4, NW 1/4, Butler Creek. |
| | 5/21/75 | T. 25 N., R. 20 E., 31, SW 1/4, NE 1/4, Ditch Creek. |
| | 5/28/75 | T. 25 N., R. 20 E., 30, NW 1/4, SE 1/4, Ditch Creek. |
| | 6/2/75 | T. 25 N., R. 20 E., 33, NW 1/4, SE 1/4, Ransack Meadows. |
| | 6/4/75 | T. 25 N., R. 20 E., 33, NW 1/4, SE 1/4, Ransack Meadows. |
| | 6/6/75 | T. 25 N., R. 20 E., 31, NE 1/4, NE 1/4, Humbug Creek. |
| | 6/11/75 | T. 25 N., R. 20 E., 3, NE 1/4, SE 1/4, Grouse Gulch. |
| I | 5/21/74 | T. 25 N., R. 20 E., 5, SW 1/4, NE 1/4, Humbug Ridge. |
| | 5/23/74 | T. 25 N., R. 20 E., 32, NW 1/4, SE 1/4, Humbug Ridge. |
| | 5/27/74 | T. 25 N., R. 21 E., 23, NE 1/4, NE 1/4, Buster Gulch. |
| | 5/30/74 | T. 25 N., R. 21 E., 23, NE 1/4, NE 1/4, Buster Gulch. |
| | 6/3/74 | T. 25 N., R. 21 E., 13, SW 1/4, SE 1/4, Crone Gulch. |
| | 6/10/74 | T. 25 N., R. 21 E., 13, NE 1/4, SW 1/4, Crone Gulch. |

| Elk | Date | Location |
|---|---|---|
| L | 5/21/75 | T. 25 N., R. 21 E., 34, NW 1/4, SE 1/4, Votler Creek. |
| | 5/28/75 | T. 25 N., R. 21 E., 32, NE 1/4, SW 1/4, Humbug Creek. |
| | 6/2/75 | T. 25 N., R. 21 E., 3, SW 1/4, NE 1/4, Ransack Meadows. |
| | 6/4/75 (Ground Visual) | T. 25 N., R. 21 E., 34, NW 1/4, SE 1/4, Votler Creek. |
| | 6/6/75 | T. 25 N., R. 21 E., 34, NW 1/4, SE 1/4, Votler Creek. |
| | 6/11/75 | T. 25 N., R. 21 E., 3, NW 1/4, SE 1/4, Votler Creek Ridge. |
| | 6/12/75 | T. 25 N., R. 21 E., 3, NW 1/4, SE 1/4, Votler Creek Ridge. |

Locations are established by Township, Range, Section, Quarter-quarter section coordinates and drainage (or key elevational feature).

Appendix V

Locations of Radioed Elk During Rutting Periods 1974 and 1975 (16 Sept.-14 Oct.)

Radioed Elk from Wagonhammer Trap

| Elk | Date | Location |
|---|---|---|
| D | 9/16/74 | T. 3 S., R. 17 W., 26, NW 1/4, SE 1/4, Pioneer Creek. |
| | 9/26/74 | T. 3 S., R. 17 W., 5, SE 1/4, NW 1/4, Big Moosehorn Creek. |
| | 10/4/74 | T. 3 S., R. 17 W., 32, SE 1/4, NW 1/4, Big Moosehorn Creek. |
| | 10/12/74 | T. 3 S., R. 17 W., 6, SE 1/4, NW 1/4, Big Moosehorn Creek. |
| | 9/16/75 | T. 3 S., R. 17 W., 6, NE 1/4, SW 1/4, Big Moosehorn Creek. |
| | 9/26/75 | T. 3 S., R. 17 W., 36, NW 1/4, SE 1/4, Cow Creek. |
| | 10/6/75 | T. 3 S., R. 17 W., 6, SW 1/4, NE 1/4, Big Moosehorn Creek. |
| | 10/14/75 | T. 25 N., R. 22 E., 18, SW 1/4, NE 1/4, North Fork Sheep Creek. |
| F | 9/16/74 | T. 4 S., R. 17 W., 20, NE 1/4, SW 1/4, Moose Creek. |
| | 9/26/74 | T. 3 S., R. 17 W., 8, NW 1/4, SW 1/4, Little Moosehorn Creek. |
| | 10/4/74 | T. 3 S., R. 17 W., 9, SE 1/4, NW 1/4, Holland Creek. |
| | 10/12/74 | T. 3 S., R. 17 W., 9, SW 1/4, NE 1/4, Holland Creek. |
| | 9/16/75 | T. 3 S., R. 17 W., 16, SE 1/4, SE 1/4, Moose Creek. |
| | 9/26/75 | T. 3 S., R. 17 W., 16, SE 1/4, NW 1/4, Holland Creek. |
| | 10/6/75 | T. 3 S., R. 17 W., 16, SE 1/4, NW 1/4, Holland Creek. |
| | 10/14/75 | T. 3 S., R. 17 W., 6, NE 1/4, SW 1/4, Big Moosehorn Creek. |
| H | 9/16/74 | T. 2 S., R. 17 W., 17, SE 1/4, NW 1/4, Nickel Bar Gulch. |
| | 9/26/74 | T. 2 S., R. 17 W., 16, NW 1/4, NW 1/4, Nickel Bar Gulch. |

| Elk | Date | Location |
|---|---|---|
| | 10/4/74 | T. 2 S., R. 17 W., 34, SE 1/4, NW 1/4, Butler Creek. |
| | 10/12/74 | T. 2 S., R. 17 W., 33, NE 1/4, NW 1/4, Butler Creek. |
| | 9/16/75 | T. 2 S., R. 17 W., 32, NW 1/4, SW 1/4, Butler Creek. |
| | 9/26/75 | T. 2 S., R. 17 W., 33, SW 1/4, SW 1/4, Butler Creek. |
| | 10/6/75 | T. 2 S., R. 17 W., 33, SW 1/4, SW 1/4, Butler Creek. |
| | 10/14/75 | T. 2 S., R. 17 W., 33, SW 1/4, SW 1/4, Butler Creek. |
| J1 | 9/16/74 | T. 2 S., R. 17 W., 31, SE 1/4, SE 1/4, Butler Creek. |
| | 9/26/74 | T. 2 S., R. 16 W., 34, SE 1/4, NW 1/4, Butler Creek. |
| | 10/4/74 | T. 2 S., R. 16 W., 28, NE 1/4, SW 1/4, Butler Creek. |
| | 10/12/74 | T. 2 S., R. 16 W., 28, NE 1/4, SW 1/4, Butler Creek. |
| J2 | 9/16/75 | T. 1 S., R. 18 W., 17, NE 1/4, SW 1/4, May Creek. |
| | 9/26/75 | T. 2 S., R. 18 W., 20, SE 1/4, SW 1/4, May Creek. |
| | 10/6/75 | T. 1 S., R. 18 W., 9, NE 1/4, SW 1/4, Trail Creek. |
| | 10/14/75 | T. 1 S., R. 18 W., 21, NW 1/4, SE 1/4, Elk Creek. |

Radioed Elk from Hughes Creek Trap

| Elk | Date | Location |
|---|---|---|
| A2 | 9/21/75 | T. 26 N., R. 20 E., 18, NW 1/4, SE 1/4, Rocky Mountain. |
| | 9/26/75 | T. 26 N., R. 20 E., 2, SE 1/4, SE 1/4, Twin Creek. |
| | 10/3/75 | T. 25 N., R. 19 E., 21, NE 1/4, NE 1/4, Hughes Creek. |
| | 10/6/75 | T. 25 N., R. 19 E., 21, NW 1/4, NE 1/4, Hughes Creek. |
| | 10/10/75 | T. 25 N., R. 20 E., 22, SE 1/4, NW 1/4, Axe Park Way. |
| | 10/14/75 | T. 25 N., R. 20 E., 22, SE 1/4, NW 1/4, Axe Park Way. |
| B | 9/16/74 | T. 25 N., R. 20 E., 30, SE 1/4, NW 1/4, Ditch Creek. |
| | 9/26/74 | T. 25 N., R. 20 E., 20, SE 1/4, NW 1/4, Rocky Mountain. |
| | 10/4/74 | T. 26 N., R. 20 E., 18, SW 1/4, NE 1/4, Rocky Mountain. |
| | 10/5/74 | T. 26 N., R 20 E., 18, SW 1/4, NE 1/4, Rocky Mountain. |
| | 10/12/74 | T. 26 N., R. 20 E., 18, SW 1/4, NE 1/4, Rocky Mountain. |
| | 9/16/75 | T. 25 N., R. 21 E., 34, NW 1/4, SE 1/4, Southeast Granite Mountain L.O. |
| | 9/26/75 | T. 25 N., R. 21 E., 20, SW 1/4, NE 1/4, Rocky Mountain. |
| | 10/6/75 | T. 26 N., R. 21 E., 17, SE 1/4, NW 1/4, Quartz Creek. |
| | 10/14/75 | T. 26 N., R. 21 E., 8, SW 1/4, SW 1/4, Deep Creek. |
| C | 9/16/74 | T. 2 S., R. 20 W., 21, SW 1/4, SE 1/4, Overwhich Creek. |
| | 9/26/74 | T. 2 S., R. 20 W., 28, NW 1/4, NE 1/4, Overwhich Creek. |
| | 10/4/74 | T. 2 S., R. 20 W., 28, NW 1/4, NE 1/4, Overwhich Creek. |
| | 10/12/74 | T. 2 S., R. 20 W., 27, SE 1/4, NW 1/4, Overwhich Creek. |

| Elk | Date | Location |
|---|---|---|
| E | 9/16/74 | T. 1 S., R. 19 W., 35, NW 1/4, NW 1/4, Gibbons Pass Road and Continental Divide. |
| | 9/26/74 | T. 1 S., R. 19 W., 2, NE 1/4, NW 1/4, Joseph Creek. |
| | 10/2/74 | T. 1 S., R. 19 W., 35, NW 1/4, NW 1/4, Gibbons Pass Road and Continental Divide. |
| | 10/12/74 | T. 1 S., R. 19 W., 20, SE 1/4, NW 1/4, West Fork Camp Creek. |
| | 9/16/75 | T. 26 N., R. 21 E., 23, SE 1/4, NW 1/4, Pierce Creek. |
| | 9/18/75 | T. 26 N., R. 21 E., 23, SE 1/4, NW 1/4, Pierce Creek. |
| | 9/26/75 | T. 26 N., R. 21 E., 26, SE 1/4, NW 1/4, Pierce Creek. |
| | 10/6/75 | T. 26 N., R. 21 E., 22, NW 1/4, SE 1/4, Pierce Creek. |
| | 10/14/75 | T. 26 N., R. 21 E., 22, NW 1/4, SE 1/4, Pierce Creek. |
| G | 9/16/74 | T. 2 S., R. 17 W., 27, SE 1/4, NW 1/4, West Fork Stevenson Creek. |
| | 9/26/74 | T. 2 S., R. 18 W., 33, SW 1/4, SE 1/4, West Fork Stevenson Creek. |
| | 10/4/74 | T. 2 S., R. 18 W., 29, NW 1/4, SE 1/4, West Fork Stevenson Creek. |
| | 10/12/74 | T. 2 S., R. 17 W., 27, SE 1/4, NW 1/4, West Fork Stevenson Creek. |
| I | 9/16/74 | T. 26 N., R. 20 E., 32, NE 1/4, SW 1/4, Twin Creek. |
| | 9/26/74 | T. 26 N., R. 20 E., 33, SW 1/4, NW 1/4, Vine Creek. |
| | 10/2/74 | T. 26 N., R. 20 E., 33, SE 1/4, NE 1/4, Vine Creek. |
| | 10/4/74 | T. 26 N., R. 20 E., 29, NW 1/4, SE 1/4, Vine Creek. |
| | 10/5/74 | T. 26 N., R. 20 E., 29, NW 1/4, SE 1/4, Vine Creek. |
| | 10/12/74 | T. 26 N., R. 20 E., 29, SE 1/4, NW 1/4, Vine Creek. |

| Elk | Date | Location |
|---|---|---|
| K | 9/16/75 | T. 1 S., R. 19 W., 27, NW 1/4, SE 1/4, Shields Creek. |
| | 9/26/75 | T. 26 N., R. 20 E., 17, NE 1/4, SW 1/4, West Fork Creek. |
| | 10/6/75 | T. 26 N., R. 20 E., 18, SE 1/4, SE 1/4, West Fork Creek. |
| | 10/14/75 | T. 26 N., R. 20 E., 18, SE 1/4, SE 1/4, West Fork Creek. |
| L | 9/16/75 | T. 26 N., R. 20 E., 32, NW 1/4, SE 1/4, Vine Creek. |
| | 9/26/75 | T. 26 N., R. 20 E., 20, NW 1/4, SW 1/4, State Creek. |
| | 10/6/75 | T. 1 S., R. 19 W., 14, NW 1/4, SE 1/4, Hughes Creek. |
| | 10/14/75 | T. 1 S., R. 19 W., 14, NW 1/4, SE 1/4, Hughes Creek. |
| O | 9/16/75 | T. 25 N., R. 20 E., 34, SE 1/4, NW 1/4, Butcherknife Ridge. |
| | 9/26/75 | T. 25 N., R. 20 E., 30, SW 1/4, NE 1/4, Ditch Creek. |
| | 10/6/75 | T. 25 N., R. 20 E., 29, SW 1/4, SW 1/4, Ditch Creek. |
| | 10/14/75 | T. 25 N., R. 20 E., 30, NW 1/4, NE 1/4, Ditch Creek. |

Locations are identified by Township, Range, Section, Quarter-quarter section coordinates and drainage (or key elevational feature).