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GAME BIRD REPORT

by

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Volume V  
Annual Project Segment Report  
Federal Aid in Wildlife Restoration  
Project W-6-R-5,6, Work Plan I

The subject matter contained within these reports is often fragmentary in nature and the findings may not be conclusive; consequently, permission to publish the contents is withheld pending permission of the Department of Fish and Game.

(Printed March 1965)

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WORK PLAN SEGMENT REPORT  
FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO.: W-6-5,6 TITLE: Alaska Wildlife Investigations

WORK PLAN: I TITLE: Upland Game Bird Investigations

JOB NO.: 1, 2

PERIOD COVERED: January 1, 1964 to December 31, 1964

ABSTRACT

A survey by mail of 302 Alaskans with an interest in game birds suggested that population levels of grouse and ptarmigan were lower throughout the State than in 1963, although moderate to high numbers of ptarmigan were reported from the Alaska Peninsula and the western coastal areas. Grouse were particularly scarce in the Interior. Counts on small areas showed similar trends, with declining breeding populations of ptarmigan at Eagle Creek and Chilkat Pass, low numbers of broods on three Interior check areas, and record low counts of sharp-tailed grouse in the Tok area.

Breeding began at Eagle Creek at the latest date in the 5-year study, with the hatching peak 7 to 11 days later than previously. Clutch sizes were low (6.6 av.). Predators destroyed nearly half of the nests started. Summer gain (2.2 birds alive August 1 for every bird alive June 1) was relatively low. Most breeding birds in 1964 were 2 or 3 years old, indicating poor breeding success in 1963 and high winter losses of young in 1963-64. Hunters reported 22 bands in 1964, probably representing a kill of about 90 ptarmigan.

RECOMMENDATIONS

No recommendations relative to management are made at this time.

WORK PLAN SEGMENT REPORT  
FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO.: W-6-R-5, 6

TITLE: Alaska Wildlife Investigations

WORK PLAN: I

TITLE: Upland Game Bird Investigations

JOB NO.: 1, 2

PERIOD COVERED: January 1, 1964 to December 31, 1964

OBJECTIVES

To record changes in abundance of upland game birds throughout Alaska and on selected study areas.

To compile distribution records of Alaskan grouse and ptarmigan.

To discover characteristics of reproduction, mortality, movement and behavior in a selected population of rock and willow ptarmigan.

TECHNIQUES

Questionnaires were mailed in November to 302 cooperators to assess current opinion regarding the abundance of grouse and ptarmigan in Alaska. Replies were tabulated and analyzed on statewide and regional bases. The analysis of replies concerning ptarmigan was modified somewhat; new regions were established on the basis of physiographic features and climatic characteristics (Figure 1). Data from all questionnaires sent out since 1960 were examined on the basis of the revised regional breakdown.

Counts of grouse and ptarmigan were made on small study areas as follows:

- a) Rock and willow ptarmigan, Eagle Creek (central Alaska); complete count of territorial males in spring.
- b) Willow ptarmigan, Chilkat Pass (northern British Columbia); complete count of territorial cocks in June.

Figure 1. Regions used in analysis of game bird questionnaire.



1. Brooks
2. Western
3. Alaska Peninsula
4. Kodiak
5. Gulf
6. Interior
7. Southeastern

- c) Sharp-tailed grouse, Tok-Fortymile (eastern Alaska); roadside census of courting birds in May.
- d) Rock ptarmigan, Harrison Summit (central Alaska), mile 13 Denali Highway, and Mt. Fairplay (east-central Alaska); counts of broods in July.

Population characteristics of rock ptarmigan were studied intensively on a 15-square-mile area surrounding Eagle Creek, central Alaska. A dog was used to help locate nests and broods. Adults and chicks were caught in hand-held hoop nets, marked, banded, and released. Specimens were collected throughout the year for studies of molts, morphology, reproduction, food habits, and sex and age determination.

A method of age determination developed for willow ptarmigan by Bergerud, Peters, and McGrath (1963. Determining sex and age of willow ptarmigan in Newfoundland. J. Wildl. Mgmt., 27(4):700-711) was tested on ptarmigan whose age was known from banding records or internal examination for bursa of Fabricius. Results showed that the technique gives satisfactory determinations on both rock and willow ptarmigan:

| <u>Sex, Age</u> | <u>Number Seen</u> |               | <u>Per Cent Aged Correctly</u> |               |
|-----------------|--------------------|---------------|--------------------------------|---------------|
|                 | <u>Rock</u>        | <u>Willow</u> | <u>Rock</u>                    | <u>Willow</u> |
| First-year ♀    | 111                | 25            | 99                             | 100           |
| First-year ♂    | 99                 | 51            | 96                             | 88            |
| Old ♀           | 88                 | 42            | 99                             | 98            |
| Old ♂           | 52                 | 47            | 98                             | 100           |

The technique, involving examination of outer primaries, was used at Eagle Creek in 1963 and 1964.

## FINDINGS

### Current Abundance of Upland Game Birds

#### Statewide Mail Survey

Two hundred and forty completed cards were available for tabulation this reporting period. All replies are summarized in Table 1. Replies for ptarmigan by regions are in Table 2, which gives index values for all years since 1960. The concensus was that grouse were at very low levels of abundance throughout Alaska in 1964. While statewide compilation showed ptarmigan to be generally more scarce than in 1963, the regional summary showed that moderate to high populations existed in western Alaska and on the Alaska Peninsula.

#### Counts of Sharp-tailed Grouse

Fewer sharp-tailed grouse were counted on the standard census routes near Tok in 1964 than in any other year since counts began in 1961. Only 3 grouse were seen on the dates of highest counts (May 17, 18), or 0.10 birds per mile of census route. Snow cover persisted on all routes throughout the counting periods, and the weather was unusually cold. These conditions undoubtedly affected the number of birds courting, and therefore the number counted; breeding stock may also have been relatively scarce as well. In comparison, there were 0.66 birds per mile in 1961, 0.62 in 1962, and 1.24 in 1963.

#### Counts of Ptarmigan

Eagle Creek: The count of territorial cocks on this area was done from May 24 to May 31, 1964. One hundred and nine male rock ptarmigan and 78 females were seen, indicating a drop of about 30 males since the spring of 1963. Relatively more hens were seen than during most former spring counts, as the late thaw had delayed egg laying to the first week in June. Data gathered later in the summer indicated a total of 100 female rock ptarmigan in the breeding population.

One male willow ptarmigan was seen in the census. This is the lowest count of that species since 1960, when population work began.

Table 1. Index Values, Game Bird Questionnaire, 1964 (Statewide).

|               | Population Levels, 1964 | Compared With 1963 |
|---------------|-------------------------|--------------------|
| Grouse        |                         |                    |
| General       | 1.93                    | 2.95               |
| Ruffed        | 1.40                    | 2.71               |
| Spruce        | 1.85                    | 2.92               |
| Sharp-tailed  | 1.22                    | 1.28               |
| Blue          | 3.28                    | 3.76               |
| All Grouse    | 1.78                    | 2.86               |
| Ptarmigan     |                         |                    |
| General       | 3.91                    | 3.77               |
| Rock          | 3.12                    | 3.80               |
| Willow        | 4.61                    | 4.37               |
| White-tailed  | 1.71                    | 3.13               |
| All Ptarmigan | 3.71                    | 4.00               |



Table 2. Index Values, Game Bird Questionnaire, 1960-64 (Ptarmigan, by Regions).

Part 1. Current Abundance

| <u>Year</u> | <u>Region</u> |                |                    |               |             |                 | <u>SE</u> |
|-------------|---------------|----------------|--------------------|---------------|-------------|-----------------|-----------|
|             | <u>Brooks</u> | <u>Western</u> | <u>Alaska Pen.</u> | <u>Kodiak</u> | <u>Gulf</u> | <u>Interior</u> |           |
| 1960        | 5.31          | 4.43           | 1.88               | 4.43          | 3.77        | 3.77            | 3.75      |
| 1961        | 6.33          | 5.00           | 4.11               | 3.57          | 4.60        | 5.27            | 2.74      |
| 1962        | 5.78          | 5.89           | 6.00               | 5.33          | 5.17        | 4.93            | 2.50      |
| 1963        | 5.67          | 4.56           | 6.47               | 5.00          | 4.81        | 4.69            | 3.91      |
| 1964        | 4.84          | 5.00           | 6.06               | 4.20          | 4.08        | 3.50            | 2.60      |

Part II. Comparison With Previous Year

| <u>Year</u> | <u>Region</u> |                |                    |               |             |                 | <u>SE</u> |
|-------------|---------------|----------------|--------------------|---------------|-------------|-----------------|-----------|
|             | <u>Brooks</u> | <u>Western</u> | <u>Alaska Pen.</u> | <u>Kodiak</u> | <u>Gulf</u> | <u>Interior</u> |           |
| 1960        | 7.77          | 7.57           | 7.00               | 5.00          | 5.00        | 6.13            | 3.46      |
| 1961        | 6.50          | 6.40           | 7.64               | 5.67          | 7.11        | 7.21            | 3.93      |
| 1962        | 5.36          | 6.60           | 7.15               | 7.50          | 6.00        | 5.81            | 4.47      |
| 1963        | 7.17          | 3.86           | 6.38               | 4.11          | 4.83        | 4.68            | 5.33      |
| 1964        | 4.64          | 7.67           | 5.00               | 4.00          | 4.33        | 3.93            | 3.67      |

Chilkat Pass: Only 43 male willow ptarmigan were found June 5 and June 6 on 0.75 square miles of good habitat at mile 75 Haines Road. Higher counts were obtained on this area in other censuses: 75 in 1960, 141 in 1961, 150 in 1962, 104 in 1963.

More ptarmigan were seen along the road about 5 miles north of the study area before and after the count. The study area had a nearly complete mantle of snow, ice, and water during the count, whereas the locality to the north, on hilly ground, was drier and partly free of snow. Local shifts, therefore, could have accounted in part for the low numbers seen on the study area.

Other Areas: Broods of rock ptarmigan were counted in July on three areas in the Tanana Hills and Alaska Range. The same areas were covered as in past years. Results are summarized below:

| <u>Area</u>         | <u>Date</u> | <u>Broods</u> | <u>Chicks Per Brood</u> |
|---------------------|-------------|---------------|-------------------------|
| Harrison Summit     | July 23     | 4             | 2, 2, 4, 6              |
| Mount Fairplay      | July 15     | 1             | no count                |
| Denali Road mile 13 | July 14     | 2             | 3, 7                    |

These data suggest continued low populations in all three check areas in 1964.

Population Characteristics of Rock Ptarmigan  
at Eagle Creek

Age of Breeding Birds

The age of adults caught in 1964 was determined from examination of outer wing feathers. Of 71 females, 12 were first-year birds; the yearling: older bird ratio was 0.2:1.0. Of 56 males, 23 were first-year birds, for a ratio of 0.7:1.0. This is the first year that the ratio has been less than 1:1 since studies began in 1960. Low chick production in 1963 and high losses of juveniles in the winter of 1963-64 were responsible for the scarcity of yearling breeders in 1964.

## Nesting

Egg deposition began in the last few days of May and reached a peak during the first week of June. Approximately 80 per cent of the study area was covered with snow on May 25, as a result of exceptionally cold and stormy weather in April and May. Hens acquired their brown summer plumage much later than usual; some females were still in flocks late in May, and obviously had not yet selected a nest site.

Sixteen nests were found in 1964 at Eagle Creek. The average clutch was 6.6 eggs. Clutches in 1963 averaged 6.5 eggs. Nests in both years contained significantly fewer eggs ( $P=0.01$ ) than clutches in 1960, when nests averaged 8.2 eggs. I do not know the cause of the decline in clutch size. The age of hens in the population did not seem to be involved, as 29 females known to be at least 2 years old in 1963 or 1964 laid 194 eggs (av. 6.7) and 13 yearling hens laid 82 eggs (av. 6.3). Whatever caused the lowered fertility seemed to act on all age groups.

Of the 16 known nests, 6 were destroyed by weasels and 1 was abandoned. Success of nests (56 per cent) in this sample, therefore, was the same as in the two previous years. Since all nests, whether found early in incubation or on the day of hatching, have been included in these computations, a bias is present that leads to an overestimation of nesting success. If nest losses occur more or less uniformly over the whole season, then nests found late have more chance of success than nests found early. When the success of the first 50 per cent of all nests found each year since 1960 was compared with that of the second 50 per cent, this bias showed clearly: 27 of 49 early nests (55 per cent) hatched, whereas 40 to 50 late nests (80 per cent) hatched.

The mid-point of hatching occurred July 1, 1964 (39 hatching dates available for computation). Seventy-five per cent of all nests hatched in a 6-day period, June 29 to July 4, and 90 per cent hatched in 8 days, June 28 to July 5. The hatching peak in 1964 was 7-11 days later than in 1960 through 1963.

## Losses of Chicks

An average of 6.6 eggs hatched in successful nests found at Eagle Creek in 1964. Brood counts in late July and early August showed 5.1 young per brood in 35 family groups. The loss of chicks from hatching to early August, therefore, was about 23 per cent.

### Summer Population Gains

The factor of summer gain, defined as the number of birds alive in early August per bird alive in late May, was calculated from estimates of the breeding population, loss of adults in the summer, nesting success, and survival of chicks. The calculation is outlined below:

|   |           |
|---|-----------|
| 1. Ptarmigan alive late in May (adults)               | 209       |
| 2. Loss of adults in June and July (est. 10 per cent) | 21        |
| 3. Adults alive early in August                       | 188       |
| 4. Nests started                                      | 100       |
| 5. Nests hatching                                     | 56        |
| 6. Chicks per brood, early August                     | 5.1       |
| 7. Total chicks alive early August                    | 285+      |
| 8. Total adults plus chicks early August              | 473       |
|   | (445-490) |
| 9. Factor of summer gain                              | 2.1-2.3   |

### Banding Results

Banding efforts yielded 61 adult male, 75 adult female, and 56 young rock ptarmigan in 1964. Of these, all but 7 cocks and 4 hens were considered resident on the study area. A large number of the birds caught had been banded in previous years, including 2 females banded as adults in 1961, 10 females banded as adults in 1962, 1 female banded as a chick in 1963, 20 females banded as adults in 1963, 3 cocks banded as adults in 1962, 8 cocks banded as adults in 1963, and 1 male banded as a chick in 1963.

Band Returns from Hunters: The hunting season was unusually long at Eagle Creek in 1964, due to the continued accessibility of the area until mid-November. Although checking station personnel reported only 47 ptarmigan taken throughout September and until early October, many more birds must have been shot, according to

banding data. Hunters reported 22 bands:

| <u>Birds Banded As</u> | <u>In</u> | <u>Number Reported</u> |
|------------------------|-----------|------------------------|
| Chicks                 | 1962      | 2                      |
|                        | 1963      | 1                      |
|                        | 1964      | 6                      |
| Adult males            | 1961      | 1                      |
|                        | 1963      | 2                      |
|                        | 1964      | 7                      |
| Adult females          | 1962      | 1                      |
|                        | 1963      | 1                      |
|                        | 1964      | 1                      |

Hunters reporting 14 of the bands also said they shot 58 unbanded birds. Thus, 4.1 unbanded birds were taken for every banded bird. The 22 reported bands probably represent 90 ptarmigan killed. This figure is minimal, as it does not include cases in which hunters shot birds without taking any banded ones.

The reported kill of adult males in 1964 (7) was 14 per cent of the number (49) banded. The 6 chicks killed represent 11 per cent of those banded (56). The kill of adult females banded in 1964 was extremely low - 1 out of 42 banded, or 2 per cent.

Since 1960, 1164 ptarmigan have been banded at Eagle Creek, 93 of which (8 per cent) have been shot and reported by hunters. By sex and age classes, the returns are as follows: 41 returns from 263 adult cocks (16 per cent), 16 returns from 341 adult females (5 per cent), and 36 returns from 560 immatures (6 per cent). The kill of cocks obviously is higher than that of other groups, apparently because of behavioral features making them more vulnerable to hunters in August and September, and because resident males stay on the study area, where they are available to hunters, throughout the fall. Hens and female chicks migrate to other areas in October, thus being taken infrequently by hunters after the first week of that month.

### Live Weights

Rock ptarmigan caught during banding operations in 1964 were weighed with a spring scale graduated in 10-gram steps; weights were estimated to the nearest 5 grams. The data were obtained

a) to show the pattern of seasonal weight change in adult ptarmigan during June, July and August; and b) to determine whether annual changes in mean weight, possibly correlated with clutch size and chick survival, can be detected.

Males, of which 51 were weighed once and 7 were weighed twice, were lightest in June, gained rapidly in early July, and were heaviest in mid-to late July. The mean weights at lowest and highest levels were 405 grams (15 records, June 11-20) and 445 grams (5 records, July 11-20).

Females were lighter than males, and showed a different pattern of weight change. Weights were obtained from 68 hens, 11 of which were weighed twice. Only 2 hens were weighed the first week in June; these were heavier than any other hens handled in 1964, probably due to the presence of large ova. Mean weights declined to a low of 375 grams during July 1-10 (27 records), and rose slowly to the end of the study, July 31-August 9, when the mean weight of 6 hens was 390 grams.

The above data suggest that ptarmigan show weight changes in the breeding season similar to other gallinaceous birds. Cocks are lightest just after the period of intense courtship activity, and gain weight throughout the summer. Females lose weight throughout incubation, reach a low soon after the chicks hatch, and gain slowly thereafter.

#### Mortality, August to May

In August, 1963, there were approximately 240 adult and 310-380 young rock ptarmigan on the study area. The spring breeding population contained 147 old birds and 62 first-year birds in 1964. The loss from August 1963 to May 1964, therefore, was about 40 per cent for adults and 80-84 per cent for first-year birds. Examination of the data for each sex indicated a higher loss of old males (50 per cent) than of old females (30 per cent), and a higher loss of first-year females than males if the August 1963 sex ratio among chicks was 50:50. Total mortality for all sexes and ages was 53-57 per cent.

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WORK PLAN SEGMENT REPORT  
FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO.: W-6-R-5,6

TITLE: Alaska Wildlife Investigations

WORK PLAN: I

TITLE: Upland Game Bird Investigations

JOB NO.: 3

PERIOD COVERED: January 1, 1964 to December 31, 1964

ABSTRACT

The period April 20 to October 18 was spent near Aleknagik, 25 miles north of Dillingham, Alaska. Intensive observations were made on a 3.8-square-mile study area. Studies of territoriality in spring suggested a census of males could be accomplished in late May and early June. Five nests were located, and contained a mean clutch size of 8.0 eggs. An estimated 25 broods were on the study area in late August. The mean number of chicks in 15 broods counted during August was 3.8. A strip census was attempted in fall without success. A study of movements to roads from August 20 to October 18 indicated annual road counts might yield meaningful population indices. Adult males began appearing on roads earlier in fall than adult females or chicks. Data were obtained on habitat preferences by taking vegetation plots at winter roosts, nests, brood flushing sites, and adult flushing sites. Hand nets, mist nets, and clover-leaf traps were used in capturing 62 grouse.

Examination of 110 blood smears revealed five species of blood parasites. Two coccidiosis infections were detected among 65 fecal samples. Two species of trematoda and one species of cestodea occurred in 68 digestive tracts examined.

RECOMMENDATIONS

No recommendations relating to management can be made at this time.

WORK PLAN SEGMENT REPORT  
FEDERAL AID IN WILDLIFE RESTORATION

STATE: Alaska

PROJECT NO.: W-6-R-5,6 TITLE: Alaska Wildlife Investigations

WORK PLAN: I TITLE: Upland Game Bird Investigations

JOB NO.: 3

PERIOD COVERED: January 1, 1964 to December 31, 1964

OBJECTIVES

To obtain life history data on the spruce grouse.

To develop census, trapping, sexing and aging techniques that can be applied to a population dynamics study of spruce grouse.

TECHNIQUES

A dog was an invaluable aid in locating grouse at all seasons, including the period in late spring when snow was still on and grouse were spending all their time in spruce trees. The dog probably accounted for two-thirds of all grouse contacts made off roads, and led me to 4 of 5 nests found.

Hand nets used in catching grouse had tubular aluminum hoops 2.5 feet in diameter. The handle of one net was an 8-foot piece of 3/4-inch tubular aluminum. The handle of another was a modified fiberglass fishing rod extendable to 24 feet. When extended, only the first four sections of the rod were rigid enough to support a hoop, giving a 16-foot handle that was collapsible to 4 feet. (Available from Actionrod, Inc., 912 West State St., Hastings, Michigan.) This handle was superior to the aluminum handle because of its longer reach, shorter collapsed length, and greater resiliency and durability.

Specifications of a Japanese mist net used for taking grouse were: length, 12 meters; height, 2.4 meters; shelves, 2; stretched mesh, 121 millimeters; and denier, 110. (Available from: E. A. Bergstrom, 37 Old Brook Road, West Hartford, Connecticut.) The net



was set up by stretching it between two of the fishing rods described above, allowing one to place the top edge of the net nearly 20 feet high.

A cloverleaf trap tested was similar to that used by Dorney (1956) for capturing ruffed grouse (Bonasa umbellus) and consisted of a central cage with two, 50-foot wire leads.

Grouse were leg-banded with serially numbered, butt-end, aluminum bands (inside diameter 8 mm.) obtained from National Band and Tag Co., Newport, Kentucky. Colored, anodized bands (red, blue, and yellow) placed on the tarsus could be distinguished under most field conditions with 7X binoculars.

A wing tag attached to the patagium by a "Jiffy" wing band (National Band and Tag Co.) was used to readily sight marked birds appearing on roads. Tags were a 1 1/4-inch square of plastic-coated nylon fabric (Saflag) available in a variety of colors from the Safety Flag Co. of America, Pawtucket, Rhode Island. Black symbols were painted on tags with a felt marking pen for individual identification.

Male and female study skins were presented to males in spring to study courtship displays.

A modified King grid census (Trippensee 1948) was tested on the 3.8-square-mile study area by walking, in 1 or 2 days, 26 miles of parallel lines randomly spaced at 200- to 300-yard intervals, the minimum spacing being determined by the maximum distance spruce grouse fly when flushed (rarely over 80 yards), and the maximum spacing being determined by the sampling intensity. Lines were randomly situated within these limits in anticipation of statistical analyses. Each line was established by compass and marked with surveying tape before August. Ruffed grouse are often censused in full by a strip census, wherein the effective strip width averages about twenty-two yards, and parallel strips are systematically spaced at 220-yard intervals, yielding approximately a ten per cent sample.

Beginning August 19, a series of standardized counts were made of grouse appearing in morning on an 11-mile section of the road into Dillingham. The route originated at the terminus of the Power Line Road and ended at Milepost 14 on the Lake Road. Counting was begun when it was light enough to see clearly without headlights. On some mornings I drove in the dark to Milepost 14 to begin the counts, to insure that I was the first to travel the route. Counts were not

considered valid if vehicular traffic preceded me and I could not contact the drivers. Traffic was known to affect the counts because fewer grouse were always seen on a return trip over the census route. If there had been no traffic, I suspect the counts could have been made as late as 2 hours after dawn, but the amount of traffic interfered with determining how late large numbers of birds could be seen on the road. The only weather factor known at this time to adversely affect the counts is rain. Meteorological data were obtained on cloud cover, temperature, and barometric pressure, but have not been analyzed.

Vegetation plots were taken at points occupied by grouse to obtain quantitative data for describing spruce grouse habitat. At each point, the number, estimated height, and estimated canopy coverage were recorded for tree species within a 15-foot radius of the plot center, and for shrubs taller than 3 feet within an 8-foot radius. Total canopy coverage was defined as the sum of the areas encompassed by a vertical projection of the peripheries of individual plants. Total canopy coverage could exceed 100 per cent on any one plot. Within a 2-foot radius of the plot center, the maximum height was measured, and the canopy cover was estimated, for shorter shrubs, herbs, and ferns. Canopy coverage was estimated by species, not by individual plants, but the total could exceed 100 per cent. At nest sites, 3-meter line transects were also laid out in the four cardinal directions at the edge of the 15-foot radius plot, and proportion of line intercepted was recorded for all species within 1 centimeter of the line.

## FINDINGS

### Study Area

The 3.8-square-mile study area was situated on the south shore of Lake Aleknagik, 25 miles inland from Nushagak Bay, southwestern Alaska. The area is accessible by a road between Lake Aleknagik and Dillingham, a fishing settlement on Nushagak Bay. North of the lake, mountainous terrain reaching altitudes of 3,000 feet predominates. White spruce (Picea glauca) and paper birch (Betula resinifera) grow to about the thousand-foot level, and a narrow band of dense alder (Alnus spp.) is often interposed between the taiga and the higher tundra. The land on the study area, and that south to Nushagak Bay, is nearly flat and is mantled with spruce-birch forests to within a few miles of the coast, where trees exist as scattered stands or individuals growing on tundra. Interior forests are of moderate density, being easily traversed and with about fifty per cent of the

forest floor receiving full sunlight. Most mature spruce trees are 6 to 10 inches in diameter, and 60 to 70 feet tall. Birch is present in about the same proportion as spruce but is shorter. Scattered aspens (Populus tremuloides) are found in dry sites supporting open spruce stands with lichen understories. Cottonwoods (P. tricarpa) are common in stream bottoms. Carpets of sphagnum mosses attaining thicknesses of a foot or more blanket about 70 per cent of the forest floor, and are a substrate for many small herbs and shrubs. characteristic understory plants are willow (Salix spp.), glandular birch (B. glandulosa), mountain cranberry (Vaccinium vitis-idaea) blueberry (V. uliginosum), and crowberry (Empetrum nigrum). About twenty-five lakes ranging in surface area from 1 to 75 acres dot the study area. Bogs in all stages of hydroseric succession encompass about three per cent of the land area.

Common predaceous birds and mammals include: Goshawk (Accipiter gentilis), Golden Eagle (Aquila chrysaetos), Marsh Hawk (Circus cyaneus), Hawk Owl (Surnia ulula), weasel (Mustela sp.), wolverine (Gulo luscus), red fox (Vulpes fulva), and lynx (Lynx canadensis).

Lake Aleknagik lies in the extreme southwestern portion of the Alaskan range of the spruce grouse, a transcontinental species that occurs north to the 69th parallel in Alaska and south to the 43rd parallel in Idaho.

### Life History Data

#### Courtship Displays and Territoriality

The courtship displays of male spruce grouse were described by Lumsden (1961) under the following headings: strutting, tail flick, flutter jump, head jerk, and head and tail down. I observed all five types of display by presenting male and female study skins to males. The head and tail down display was elicited only by a male skin, and a male skin elicited no other displays. Males were displaying at Lake Aleknagik between May 9 and June 10. Strutting and tail flicking of low intensity were also noted in September and early October. The behavior patterns in all displays were essentially the same as those detailed by Lumsden. Flutter jump displays, presumably a form of territory advertisement, were observed during the last 2 weeks of May.

#### Nest Data

Five completed clutches were found within the study area. Mean

clutch size was 8.0 eggs; the range was 5 to 9 eggs. One clutch did not hatch because the hen was killed late in incubation by an avian predator. The remaining 4 nests hatched between July 3 and 5.

Among the 4 successful nests, 27 of 31 eggs (87%) hatched. Peak of hatching probably occurs 2 weeks earlier in most years, but the spring of 1964 was unusually late.

### Brood Data

In August, the number of chicks in 15 broods was counted, giving a mean brood size of 3.8, with a range of 1 to 10. Prior to August it was difficult to procure total brood counts because the chicks scattered and hid at the approach of an intruder. During August, chicks became more obvious, but even then some chicks probably went unobserved. By September, broods were dispersing or integrating.

It was estimated that 25 broods were on the study area at the end of August. The number was derived by plotting the locations of brood sightings. The marking of ten hens with broods aided in eliminating some duplicate observations. Between August 15 and 31, 15 adult hens were encountered, 5 of which had no brood.

### Habitat Studies

Data collected on circular plots taken at roosts, nests, and brood and flushing sites are summarized in Table 1. Height data are omitted for brevity. Line transect data obtained near nests are presented in Table 2.

Winter Roost Plots: Data were recorded from April 10 to May 10 on tree and shrub cover at 48 winter roost trees. Snow depth varied from 6 to 3 feet during the time plots were taken. No canopy coverage was recorded for Betula resinifera because these trees did not leaf out until June. However, canopy coverage was recorded for shrubs, though they had no leaves.

Of nearly two hundred roost trees examined, all were spruce trees except one, which was a birch. Roost trees occurred not only in dense spruce stands, but also in very open spruce. Clipped needles in most trees indicated grouse had fed on them. Feeding has usually occurred on the southern exposures, halfway up the tree, or at an average height of 16 feet above the ground. There appeared to be some selection for younger needles, but needless 3 to 5 years old

Table 1. Characteristics of vegetation at 48 roosts, 8 nests, 15 brood sites, and 21 flushing sites.

| Tree Species on<br>15-ft-Radius Plot                    | Percentage Frequency Occurrence |      |       |       | Mean Percentage Canopy Coverage |      |       |       |
|---|---------------------------------|------|-------|-------|---------------------------------|------|-------|-------|
|   | Roost                           | Nest | Brood | Flush | Roost                           | Nest | Brood | Flush |
| <u>Picea glauca</u>                                     | 100                             | 100  | 100   | 100   | 21                              | 23   | 21    | 20    |
| <u>Betula resinifera</u>                                | 77                              | 62   | 93    | 95    | --                              | 26   | 38    | 18    |
| <u>Sorbus scopulina</u>                                 | 4                               | ---  | 7     | ---   | T                               | --   | 1     | --    |
| <u>Populus tricocarpa</u>                               | ---                             | ---  | 7     | ---   | --                              | --   | T     | --    |
| Shrub stems taller than<br>3 ft. on 8-ft-radius plot    |                                 |      |       |       |                                 |      |       |       |
| <u>Betula glandulosa</u>                                | 19                              | 25   | 13    | 52    | T                               | 2    | T     | 5     |
| <u>Salix</u> spp.                                       | 10                              | 37   | 20    | 48    | T                               | T    | T     | 4     |
| <u>Betula nana</u>                                      | --                              | 12   | --    | --    | --                              | --   | --    | --    |
| <u>Alnus fruticosa</u>                                  | --                              | --   | 7     | --    | --                              | --   | T     | --    |
| <u>Viburnum edule</u>                                   | 2                               | --   | 7     | --    | T                               | --   | T     | --    |
| <u>Spiraea beauverdiana</u>                             | --                              | --   | --    | 5     | --                              | --   | --    | T     |
| Shorter shrubs, herbs, and<br>ferns on 2-ft-radius plot |                                 |      |       |       |                                 |      |       |       |
| <u>Empetrum nigrum</u>                                  | --                              | 100  | 87    | 100   | --                              | 28   | 13    | 12    |
| <u>Vaccinium vitis-idaea</u>                            | --                              | 100  | 87    | 100   | --                              | 22   | 8     | 16    |
| <u>Vaccinium uliginosum</u>                             | --                              | 75   | 60    | 76    | --                              | 14   | 28    | 15    |

Table 1. (Continued)

| Shorter shrubs, herbs, and<br>ferns on 2-ft-radius plot | Percentage Frequency Occurrence |      |       |       | Mean Percentage Canopy Coverage |      |       |       |
|---|---------------------------------|------|-------|-------|---------------------------------|------|-------|-------|
|   | Roost                           | Nest | Brood | Flush | Roost                           | Nest | Brood | Flush |
| <u>Vaccinium ovalifolium</u>                            | --                              | 12   | 7     | 30    | --                              | T    | 1     | 2     |
| <u>Betula glandulosa</u>                                | --                              | 12   | 13    | 9     | --                              | T    | 1     | 1     |
| <u>Betula nana</u>                                      | --                              | 50   | 13    | 33    | --                              | 16   | 3     | 5     |
| <u>Spiraea beauverdiana</u>                             | --                              | 50   | 87    | 81    | --                              | 3    | 6     | 5     |
| <u>Ledum decumbens</u>                                  | --                              | 12   | 13    | 5     | --                              | 1    | 4     | 1     |
| <u>Rubus chamaemorus</u>                                | --                              | 12   | 47    | 9     | --                              | T    | 1     | T     |
| <u>Rubus pedatus</u>                                    | --                              | 50   | 60    | 81    | --                              | T    | 8     | 1     |
| <u>Rubus</u> spp.                                       | --                              | 24   | --    | 5     | --                              | T    | --    | T     |
| Pyrolaceae  | --                              | 12   | 40    | 33    | --                              | T    | T     | T     |
| <u>Linnaea borealis</u>                                 | --                              | 50   | 60    | 76    | --                              | T    | 1     | 1     |
| <u>Trientalis europea</u>                               | --                              | 12   | 60    | 33    | --                              | T    | T     | T     |
| <u>Cornus canadensis</u>                                | --                              | 25   | 53    | 38    | --                              | T    | 2     | T     |
| <u>Epilobium angustifolium</u>                          | --                              | --   | 7     | --    | --                              | --   | T     | --    |
| <u>Oxycoccus microcarpus</u>                            | --                              | --   | 7     | --    | --                              | --   | T     | --    |
| Poaceae   | --                              | 62   | 73    | 57    | --                              | T    | 1     | 1     |
| <u>Equisetum</u> sp.                                    | --                              | --   | 7     | --    | --                              | --   | T     | --    |
| <u>Lycopodium annotinum</u>                             | --                              | 12   | 40    | 29    | --                              | T    | 5     | 1     |
| Bryophyta   | --                              | 100  | 100   | 100   | --                              | 86   | 87    | 85    |
| Filicales   | --                              | --   | 40    | 9     | --                              | --   | 6     | 2     |
| Basidiomycetes  | --                              | --   | 7     | --    | --                              | --   | T     | --    |
| Lichenes  | --                              | 75   | 66    | 71    | --                              | 1    | 1     | 2     |

Table 2. Characteristics of vegetation adjacent to eight nest sites. (Values are per nest site.)

| <u>Species</u>                 | <u>% of Occurrence</u> | <u>Mean %<br/>Canopy Coverage</u> |
|--------------------------------|------------------------|-----------------------------------|
| <u>Picea glauca</u>            | 100                    | 24                                |
| <u>Betula resinifera</u>       | 50                     | 13                                |
| <u>Betula glandulosa</u>       | 50                     | 5                                 |
| <u>Betula nana</u>             | 63                     | 7                                 |
| <u>Salix</u> spp.              | 50                     | 2                                 |
| <u>Empetrum nigrum</u>         | 100                    | 25                                |
| <u>Vaccinium vitis-idaea</u>   | 100                    | 15                                |
| <u>Vaccinium uliginosum</u>    | 100                    | 26                                |
| <u>Vaccinium ovalifolium</u>   | 63                     | 2                                 |
| <u>Spiraea beauverdiana</u>    | 87                     | 5                                 |
| <u>Ledum decumbens</u>         | 25                     | 1                                 |
| <u>Rubus chamaemorus</u>       | 25                     | T                                 |
| <u>Rubus pedatus</u>           | 100                    | 4                                 |
| <u>Rubus</u> spp.              | 25                     | T                                 |
| <u>Pvrolaceae</u>              | 63                     | T                                 |
| <u>Linnaea borealis</u>        | 75                     | 2                                 |
| <u>Trientalis europea</u>      | 100                    | T                                 |
| <u>Cornus canadensis</u>       | 50                     | T                                 |
| <u>Epilobium angustifolium</u> | 12                     | T                                 |
| <u>Poaceae</u>                 | 75                     | 1                                 |
| <u>Equisetum</u> sp.           | 25                     | T                                 |
| <u>Lycopodium annotinum</u>    | 25                     | T                                 |
| <u>Lycopodium complanatum</u>  | 12                     | T                                 |
| <u>Bryophyta</u>               | 100                    | 86                                |
| <u>Licenes</u>                 | 75                     | 7                                 |
| <u>Filicales</u>               | 25                     | 2                                 |

were taken regularly. Grouse had often roosted on the snow beneath the spreading limbs of the roost tree or nearby trees, and occasionally snow roosts were found in nearby open areas. Sometimes a complex of roost trees, ground roosts, and snow roosts suggested that a grouse had spent a week or more on an area of 1/2 to 1 acre.

**Nest Plots:** The eight nests were in spruce-birch stands of medium to open density and, with one exception, were in sites with little shrub cover. Six nests were at the base of spruce trees, one was beneath a prostrate, live spruce, and one was under a rotting birch tree lying on the ground.

**Brood Plots:** Broods were usually found in stands with a large proportion of birch and a dense ground cover of blueberry. The blueberry averaged 27 centimeters tall, and apparently was important as a concealing cover type for hiding the activities of the chicks.

**Flushing Plots:** Plots were grouped that were taken between June 13 and July 8 at locations where adult males and females without broods were flushed. The higher proportion of large shrubs indicated the tendency for molting adults, particularly males, to seek out glandular birch and willow thickets. As molting progressed in late July, males were seen more frequently in brushy areas.

### Parasites

**Blood Parasites:** Robert M. Stabler, Colorado College, examined blood smears of 110 grouse (80 adults, 30 chicks) collected at Lake Aleknagik. Chicks under 3 weeks of age (3) carried no blood parasites. Chicks over 6-8 weeks old exhibited infections similar to those of adults. The parasites and the number of smears they occurred in were: some parasitemia, 101; Haemoproteus, 82; Leucocytozoon, 84; Trypanosoma, 35; microfilaria, 24; and Hepatozoon, 1.

**Coccidia:** Kenneth Neiland, Alaska Department of Fish and Game, analyzed 65 fecal samples for oocysts, finding two infections of Eimeria bonasae, "or very similar coccidian". The infected birds were chicks; the sample included 28 chicks and 37 adults. Eimeria angusta has been reported in spruce grouse (Bump 1947).

**Intestinal Helminths and Cestodes:** The digestive tracts of 68 grouse collected between April 10 and October 15 were examined Macroscopically for parasites. Intestinal contents were washed to facilitate isolation of parasites, but the sticky consistency of cecal contents precluded washing. Brachylaima fuscata occurred in 17 (25%) of the intestines; Raillietina sp. (identification by Kenneth Neiland tentative) occurred in 1 (1.5%). Records of autopsies



performed by the Zoonotic Disease Section, Arctic Health Research Center, on 35 spruce grouse collected throughout Alaska indicated that Brachylaima sp. was found in 17 (49%), Hymenolepis sp. in 1 (3%), and Davainea sp. in 1 (3%).

The bursa of Fabricius, if present, and cloaca of 65 of the 68 birds were examined, and Leucochloridium variae was found in 47 (72%) birds. This fluke has also been reported in Michigan spruce grouse (McIntosh 1932).

Other Parasites: Among the 68 grouse, threadlife worms were found in the fascia overlying the pectoral muscle of 8 birds collected in September and October. Similar parasites in 6 of 35 grouse examined by the Zoonotic Disease Section were termed *Filaria*.

Lice taken from spruce grouse collected near Fairbanks were identified as Goniodes corpulentis by K. C. Emerson, Arlington, Virginia.

### Trapping Results

Sixty-two grouse were captured , including 19 adult males, 18 adult females, and 25 chicks. Thirty-three birds were taken with a hand net, 28 with a mist net, and 1 with a cloverleaf trap. Two of the birds hand-netted sustained fractured wing bones upon striking the metal hoop.

The hand net was effective only when birds could be taken on the ground, and was especially useful in late May and early June, when a female study skin was used to induce males to strut on the ground. A trap for taking males can probably be designed by employing the female skin to attract males. Molting adults, particularly males, were easily hand-netted in late July and early August, when the rectrices were being molted and the birds were reluctant to fly. Hand-netting along roads in fall was not practical because most birds flushed wildly as a vehicle approached. This behavior was contrary to that of spruce grouse on the Kenai Peninsula in 1957 and 1958, when U. S. Fish and Wildlife Service personnel hand-netted 34 birds on roads. A greater number of birds on the Kenai roads may have made some difference.

The mist net was not tried until August, when it was utilized in taking birds which readily flushed into trees. The birds were captured by reflushing them into the vertical net. Most birds mist-netted were taken after mid-August, when adults were completing the molt of rectrices, and when chicks were reaching leg-banding

size. Chicks almost always flushed into trees as a dog or person approached, rendering hand-netting nearly impossible.

The cloverleaf trap was set four times in areas where broods had been observed, but was of little value. The trap would probably take the most birds in early fall when set parallel to a road at a point where birds were known to be coming out for grit.

### Census Techniques

**Spring Count of Males:** Although no spring count of males was tried, it appeared that a tabulation of territorial males would be feasible. During a 3-week period beginning about May 10, individual displaying males could be located daily in the same 10- to 20-acre area, presumably their territory. In the spring of 1965, and endeavor will be made to find all territorial males on a 2-square-mile area. Since displaying males do not perform conspicuous aerial displays or produce sounds audible for more than 100 yards, a dog will have to be relied on to locate most birds.

**Fall Strip Census:** Census lines were walked twice, on September 9, and on September 29 to October 1. Four different grouse were encountered on the first census, and six different grouse on the second. Mean flushing distances were 12.7 yards on the first census, 17.6 yards on the second, representing sampling intensities of 9.7 per cent and 13.7 per cent, respectively. The calculated number of grouse was 41 and 44. A subjective estimate of the number of grouse was 140, or 37 birds per square mile.

I think the discrepancy can be explained primarily by the small number of grouse present relative to the proportion of the study area covered. Hungerford (1951) has successfully applied a strip census to a ruffed grouse population with densities of 64 to 82 grouse per square mile. Another source of error may have been that spruce grouse do not flush as readily as ruffed grouse, but a dog was hunted along 6 miles of census lines without flushing any grouse within 20 yards of the line that would not have been flushed had the dog not been present. While the dog was ranging out from the line, I flushed two broods totaling eight grouse that were on the line. No broods were seen on either census, indicating the variability that can occur when sampling a population comprised partially of scattered flocks of birds.

The results of the two censuses suggested that about eighty miles of lines would have been required to flush ten per cent of the grouse estimated to be present. The Aleknagik population was of

moderate density, suggesting that an even greater distance would have to be walked to accurately census a population of low density. Thus the strip census would be impractical for population dynamics work, unless one could be assured of an eight- to ten-man crew each fall.

Road Counts: Grouse were on roads in greatest numbers in late September and early October (Fig. 1). I left the study area in mid-October, but reports by a reliable observer suggested there were large numbers of birds on roads during October 22 to 24. Grouse reportedly ceased coming out in the last days of October, as the first snows covered roads.

Adult males were the first to commence early-morning trips to roads. A chi-square test applied to the observed sex ratio (28:7), derived from dawn counts and checks of hunters' bags, for the period August 28 to September 18, gave a significant value (12.60) at the 1 per cent level. As females with broods began coming to roads in mid-September, the difference in the ratio of males to females began to narrow. There was some suggestion that fewer males than females were on roads between September 19 and October 18, but the chi-square value (3.10) for the ratio (67:89) was not significant at the 5 per cent level. For the entire period August 28 to October 18, the number of males and females was nearly equal (95 vs. 96).

Annual counts made at dawn between September 25 and October 25 on the same section of road under similar weather conditions would probably produce indices to population trends in the Lake Aleknagik area.

Movement Data: Sixty grouse were individually marked to obtain data on distances traveled by birds appearing on roads in early fall. Forty-five of the grouse marked between May 19 and October 7 were marked prior to September 1, the date birds began coming out to roads regularly. Five tagged grouse were seen on the road during the dawn counts (Fig. 2). An adult male traveled the greatest distance, 1.5 miles, and was seen along a half-mile section of road on 5 mornings between September 13 and October 7. The remaining four birds were seen only once. No tagged birds were shot by hunters, despite moderate hunting pressure from early September to late October.

#### Sexing and Aging by Plumage

Sex Determination: Tails from 95 grouse (54 males, 41 females)

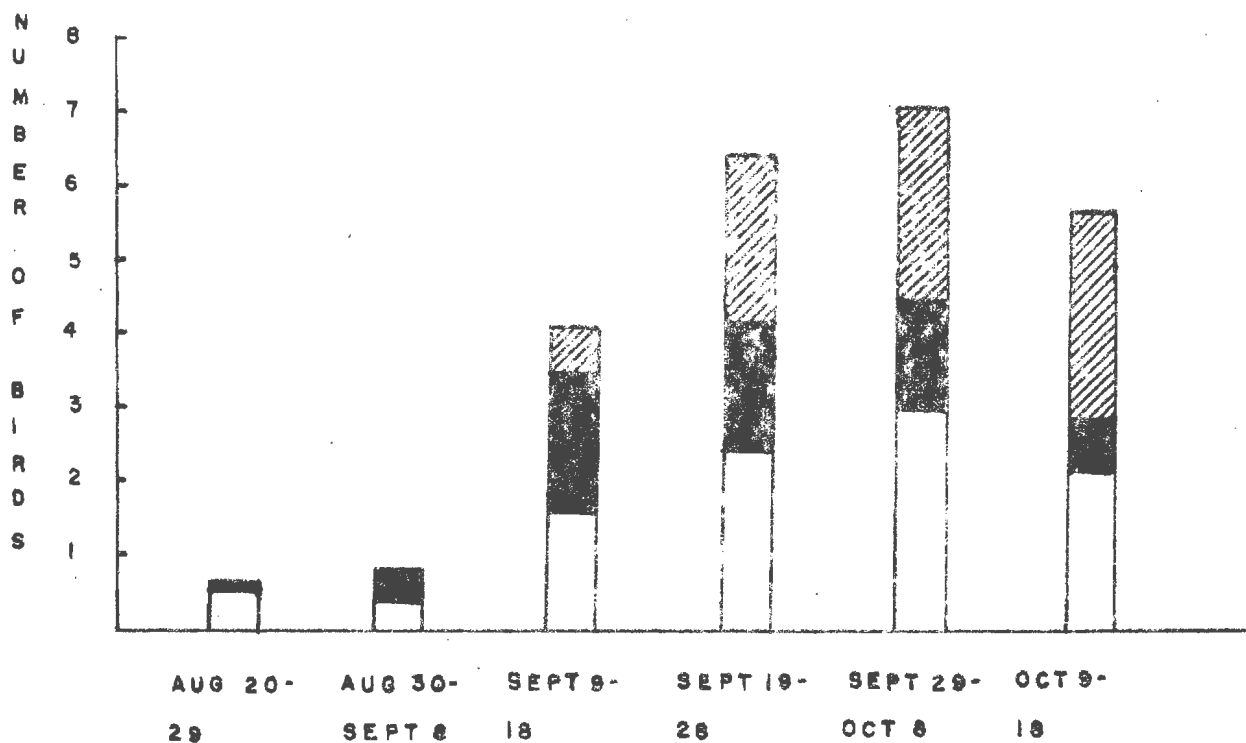
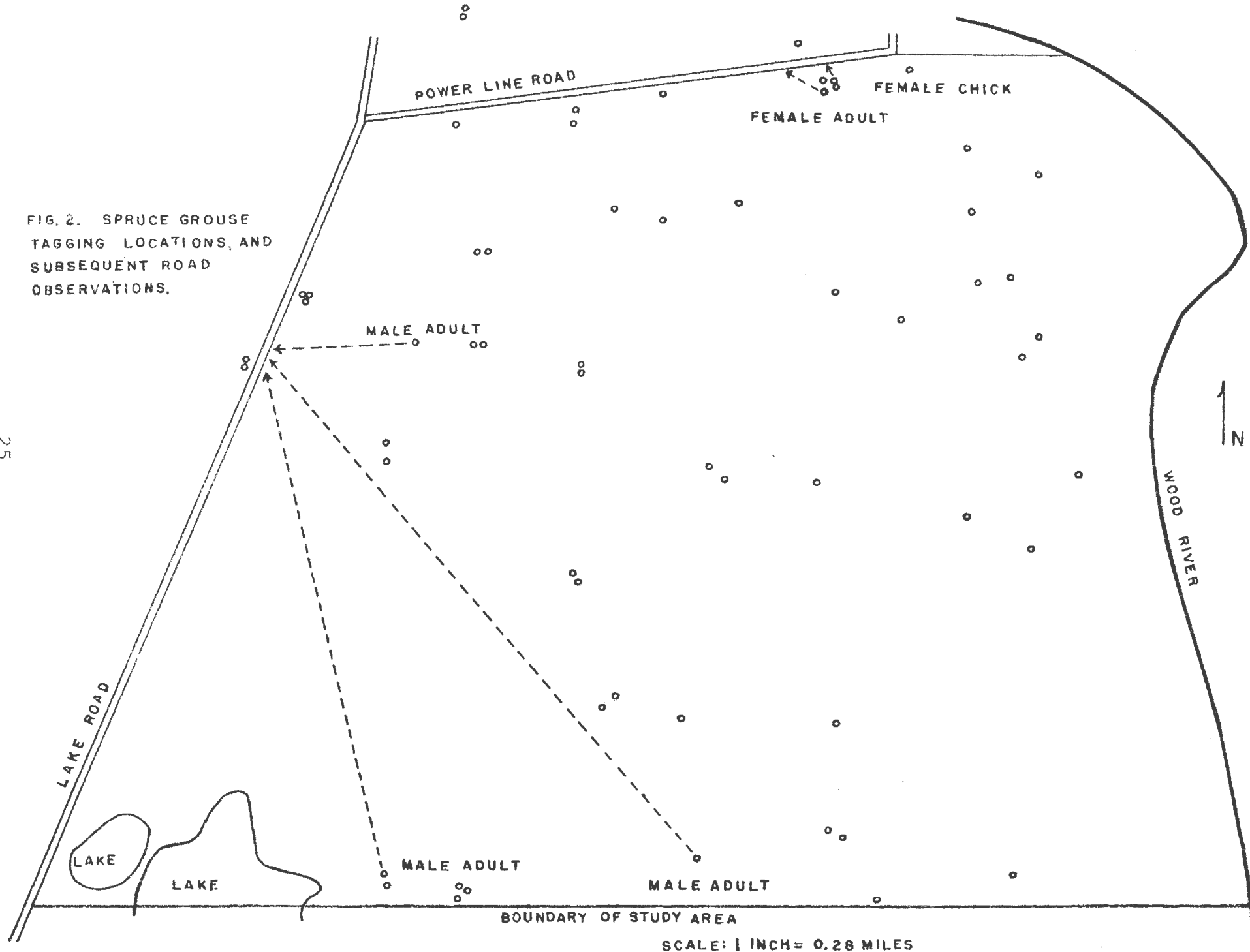


FIG. 1. MEAN NUMBER OF GROUSE OBSERVED ON ROAD AT DAWN, PER 10-DAY OBSERVATION PERIOD.

MALE
  FEMALE
  UNIDENTIFIED

FIG. 2. SPRUCE GROUSE  
TAGGING LOCATIONS, AND  
SUBSEQUENT ROAD  
OBSERVATIONS.



were classed as male or female by the amount of brown flecking in the rectrices. Among males, the brown is usually restricted to the margins of each rectrix, whereas among females the brown often occurs as transverse bars. Two tails (2.1%) were assigned the wrong sex. Sex determination by breast feathers would probably be more accurate, as the central breast feathers of all males in their adult plumage seem to lack the brown barring found in females, a dimorphism appearing at about eight weeks of age.

Age Determination: Among many gallinaceous birds, the two outermost primaries are not replaced during the post-juvenal molt, and tend to be more pointed than the outermost primaries of adult birds. Aging by this technique was tested on 94 wings of known-age spruce grouse by visually evaluating the shape of the primaries. Six wings (4.4%) were incorrectly aged, five of these representing females. The sample included 21 adult males, 20 adult females, 23 juvenal males, and 30 juvenal females.

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