Volume 1 Report No. I-1

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: I Game Bird Investigations

Job No: 1 Distribution and Abundance of Gallinaceous Birds in Alaska

Period Covered: July 20, 1959 to June 30, 1960

Abstract:

The main task during the first year of this project was to determine the procedures to be followed in reaching the objectives. An outline is presented which summarizes the approach decided upon. Sixty-four observations of grouse and ptarmigan were obtained by other members of the Alaska Department of Fish and Game and forwarded to the investigator; 70 records were obtained from local residents in interior Alaska by the investigator. No analysis of the data is feasible yet.

Objectives:

1. To determine the distribution of grouse and ptarmigan in Alaska.

2. To describe the general ecological niche of each species.

3. To determine the relative abundance of each species over various parts of its range in Alaska.

Findings:

The primary task in the initial year of this project was

to decide upon methods for obtaining the necessary information. Only a scant beginning was made on the work of collecting the actual data. An outline of the approach to the problem that was decided upon is given here:

I. Sources of Data

A. Written information - published and unpublished reports.

B. Correspondence and personal contact with residents.

C. Field observations carried out by the project investigator.

II. Determining Distribution and Abundance

A. Collecting the information.

1. Compile all pertinent records from published reports, as well as from unpublished information from the files of federal and state wildlife agencies.

2. Contact as many Alaskan residents as possible, obtaining specific information on places where grouse and ptarmigan have been seen.

3. Record all observations of Tetraonidae made by the project investigator while in the field.

B. Examining and analyzing the data.

1. Determine the reliability of the records, especially those obtained by conversations with residents.

2. Tabulate all reliable observations.

3. Prepare a map showing all places where grouse and ptarmigan observations have been made; on species where enough data are available, two maps will be prepared giving breeding and non-breeding occurrence.

III. Determining Ecological Niches

A. Collecting the information.

1. Read pertinent literature on ecological requirements of each species, particularly (but not exclusively) where studies have been made in Alaska.

2. Describe the places in which grouse and ptarmigan are seen during field work, especially in terms of the form of the vegetation and the physiography of the terrain.

3. Examine aerial photographs, where such are available, to determine vegetation and topography in places where birds have been reported by others.

B. Analyzing the data.

1. Prepare written synthesis in which information from all sources is combined into generalized descriptions of species habitats.

2. Using aerial photographs, physiographic maps and vegetation maps, outline areas that seem to be suitable (potentially) for each species.

3. Combine the maps showing the known records and possible distribution of each kind of grouse and ptarmigan.

Up to the present time, only a small amount of basic information has been collected. As an experiment, several members of the Alaska Department of Fish and Game (Ed Keough, Ronald Skoog, Arthur Sheets and Harry Merriam, Biologists; Sigurd Olson, Federal Aid Coordinator) were asked to solicit information from a few persons in their locality, and to record this information on maps and forms provided to them. A total of 64 observations of blue grouse and ptarmigan was obtained in this way, several of which were from areas where certain species had not been reported previously. Seventy observations of grouse and ptarmigan were recorded by the investigator during talks with Alaskans in the Fairbanks area. Many of these observations are of considerable interest,

although some must be substantiated by field work.

It is anticipated that the first attempt to tabulate and plot the observational information will be made during the winter and spring of 1961. By this time a sufficient volume of information should be available to make preliminary analyses meaningful.

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Volume 1 Report No. I-2

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: I Game Bird Investigations

Job No: 2 Title: Population Characteristics of Rock and Willow Ptarmigan

Period Covered: July 20, 1959 to June 30, 1960

Abstract:

The basic objectives of this study are to describe the rise and fall in numbers of ptarmigan within one year on a selected study area, to record any year-to-year changes in numbers and to determine from those data the harvestable portion of the fall population. Data obtained in 1959 show that the late summer and early fall proportion of immature birds to adult hens was about 7.5:1. An effort was made to discover a reliable indicator of age in rock ptarmigan after December, without success. Neither the "pointed primary" nor "speckled primary" methods, as described by others, appear satisfactory for the ptarmigan studied. Some information obtained in the study indicate that flock formation occurs early in September, and that extensive movements from one area to another may take place in September and October. The reproductive cycle probably begins in March, with testis enlargement and behavioral changes becoming evident early in April. Some data on weights of ptarmigan are given.

Objectives:

1. To compare the annual numerical increase and decrease of ptarmigan on selected areas from one year to the next;

2. To discover the means by which variations in productivity and mortality are accomplished;

3. To describe general changes in populations of ptarmigan in various regions of Alaska;

4. To determine the harvestable portion of the fall population of ptarmigan.

Techniques:

The preliminary studies reported here were accomplished mainly by field observation. An estimate of the productivity of rock ptarmigan was obtained through counts of broods in July and August, and by determinations of age ratios of fall-collected specimens. More than 230 rock ptarmigan (Lagopus mutus) and 30 willow ptarmigan (L. lagopus) were collected to determine age, food, weights, parasite infestation, and other data. The carcasses of birds of known age were saved to test methods for age determination. The habits of ptarmigan were observed on many short field trips, including several to the study area at Eagle Creek. A punch-card system was established to record data pertinent to the study.

Study Area

One area has been chosen in which to carry out most of the intensive field work for this project. The area, consisting of about 25 square miles of arctic-alpine tundra 100 miles northeast of Fairbanks, was selected for the following reasons: 1) it is the site of three previous investigations of ptarmigan, beginning in 1951; 2) it is reached easily by car from Fairbanks from May to September; 3) it is part of a large mass of hilly tundra that probably is representative of ptarmigan habitat throughout interior Alaska. Because its boundaries outline the upper drainage system of Eagle Creek, the area is referred to as either "Eagle Creek" or "Eagle Summit" study area.

The Eagle Creek study area is near the northern and western end of a broad band of hills that extends for more than 300 miles from south of Dawson, Yukon Territory, to a point 100 miles northwest of Fairbanks, Alaska. Ancient uplifting of Precambrian rocks, the subsequent and continuing erosion of the exposed surfaces, and occasional intrusions of igneous materials have produced a range of hills whose summits

(usually rounded, rarely precipitous) rise from 2,000 to 5,000 feet above the valleys of the Tanana and Yukon Rivers.

Nearly all of the land above 2,700 feet is covered with tundra vegetation. Because of the great changes in site that occur over short distances in hilly country, diverse vegetational communities exist in any given locality. Perhaps the most widespread kinds of tundra occurring on the Tanana Hills are associations of dwarfed shrubs and sedge-dryas meadows. In mid-summer, the tundra appears as a vast, mosaic-patterned pasture - now dotted with low shrubs, or clothed in a dense mantle of bushes; now grassy, or even devoid of vegetation; sometimes soggy with accumulated melt-water of the thawing earth, occasionally as dry and rocky as a desert gravel pit.

Two species of ptarmigan breed in this region. One species, the willow ptarmigan, is relatively uncommon; its preferred breeding habitat is restricted to narrow strips along valley bottoms between 2,000 to 2,700 feet. Rock ptarmigan occupy much of the area above 2,700 feet, and usually nest between the 2,700 and 3,500 foot contour levels.

Findings:

Productivity of Rock Ptarmigan

No estimate can be made this year of the total number of young rock ptarmigan produced on the Eagle Creek area, as the number of hens successful in hatching chicks was not determined. From counts of broods in late July and early August (when most chicks were about one month old), and from ratios of young birds to adult females in mass collections made in September, however, it is possible to estimate the number of young per adult female.

Counts of Broods

Thirteen broods of rock ptarmigan were counted at Eagle Creek from July 26 to August 5. This may have represented roughly one-third of the number of broods actually present on the 25 square miles. The chicks were old enough to flush readily when alarmed, and only a few counts felt to be incomplete (and not included here) were obtained. The counts are listed in Table 1 and compared with those of 1951 and 1956 obtained in previous studies (DeLeonardis, 1952 and Weeden,

Table 1. Comparison of numbers of chicks in rock ptarmigan broods in 1951, 1956 and 1959.

Year	Area	Period	NUMBER OF CHICKS PER BROOD										
			2	3	4	5	6	7	8	9	10	11	AV.
			NUMBER OF BROODS										
1951*	Steese Highway	Up to July 20				1	3	3	4	2			7.3
	Fortymile Highway	Up to July 20			2	2		1	1				5.5
1956**	Steese Highway	Up to July 20	1	2	1	1	2	1					4.5
		After July 20		2	2		2						4.3
1959	Steese Highway	After July 20				2	4	1	1	2	2	1	7.5

* Approximate numbers of broods in each brood size, calculated from DeLeonardis' (1952) data on total number of chicks, and mean size.

** Data from studies by Weeden (1959).

1959). There is considerable variation in brood sizes between years, especially when data for 1956 are compared with those of 1951 and 1959. The 1956 and 1959 data are for young of about the same age; no information is available for 1951 broods. The variation probably reflects changing clutch sizes and changes in juvenile mortality, and may prove to be important mechanisms resulting in fluctuations in ptarmigan numbers. However, too few data are available now to discuss the matter fully.

Age Ratios in Fall-collected Birds

In order to substantiate the data from counts of broods, a mass collection of rock ptarmigan was carried out on September 29 and 30, at Eagle Creek. A total of 150 birds was shot from two flocks numbering between 100-200 individuals in each. As far as females and young are concerned, this collection probably resembles closely the actual population structure at the time. There are indications from samples of ptarmigan shot by hunters, that juveniles are more easily shot than adults in the fall. This bias may not be important in the collection made for the study, as such a high percentage of each flock was collected. The chance of getting a disproportionately large number of young would seem much less than when many hunters shoot a few birds from a number of different flocks.

The age of each bird was determined by the presence (in young) or absence (in adults) of the bursa of Fabricius. The state of plumage and condition of the ovaries were supplementary characteristics used occasionally.

Of the 150 birds collected, 5 were adult males, 17 were adult hens, 55 were immature males, 72 were immature females. The sex of one young rock ptarmigan could not be determined. On the basis of this proportion of sex and age groups, the following classes of ptarmigan probably comprised the original flocks: 1) A few adult cocks who either remained with the brood all summer (an uncommon occurrence in this species) or who returned after the summer molt; 2) old females, the great majority of which had raised chicks; 3) young birds.

The proportion of young to each adult female (128:17, or 7.5:1) was the same in the collection as the average brood counts made two months before. Although the samples are small, it can be inferred that the young suffered no disproportionate mortality, as compared with adult hens, in this period.

One segment of the population that cannot be accounted for at present is that including unproductive hens. In late July and early August, all hens had broods, and all broods were attended by hens - at least all that were observed in this study. It is very unlikely that all females bred successfully - the question is, did the unproductive hens join the flocks in the fall (and "dilute" the young:hen ratio), or did they remain aloof from the large aggregations from which the birds were collected?

Determination of Age in Rock Ptarmigan

The possibility that changes in population structure can be followed throughout the year rests on the ability to distinguish young-of-the-year from birds more than one year old. After the young have attained the first winter plumage (late in September), the best way of determining age is by looking for the bursa of Fabricius (an outpocketing of the large intestine at the cloaca, visible internally), which is present in young galliformes and absent in most adults. This structure begins to regress in young birds in the fall, and has been found unreliable after December; at that time, a few young have lost all traces of the structure, or it has become so small as to be indistinguishable from a bursal remnant which may persist in a few adults. From January onward, the usefulness of the bursa as an indicator of age diminishes rapidly. At present, no studies have been made tracing the growth and regression of the bursa in ptarmigan. In this investigation, it has been assumed that the bursa is useful at least until October and November.

From December until July, therefore, the problem of distinguishing adults and young is difficult. Petrides (1942) suggested two characteristics useful for age determination, based on the fact that young Tetraonidae retain primaries 9 and 10 (counting distally) through the first winter, spring and early summer. Adults undergo a complete molt of primaries in July and August. Petrides found that in the ptarmigan he examined, primaries 9 and 10 were speckled with brown in juveniles, pure white in adults. Also, the outer primaries of young ptarmigan tended to be more pointed than those of adults. Because the number of specimens available to Petrides was small, both criteria were tested on wings of ptarmigan of known age collected in 1959.

Test of the "Speckled Primary" Method

The basic color of the remiges of all North American ptarmigan is white. Rock ptarmigan, and many willow ptarmigan, have black shafts on all primaries. Various amounts of speckling or blotching with black or brown are present on the primaries of rock ptarmigan, especially on the outer three primaries of young birds. The age-specificity of this characteristic was tested. The results are shown in Tables 2 and 3.

It can be concluded that the presence or absence of dark areas on any of the outer three primaries, in any combination, cannot be relied on as an indicator of age. About 96 percent of the young had dark areas on P9, but so did 33 percent of the adults. The effect of the error resulting from use of this characteristic would vary with the proportion of young:adults in the population sampled. There may be a sexual difference in the tendency to have dark markings on the primaries (Table 3). Females seem to possess dark areas more often than males; as a result, errors in placing adult wings in the "young" class occur more frequently among females, while more of the young birds erroneously called "adults" are males.

Several of the color combinations of P8, P9, P10 suggest at least moderately accurate means of determining age. However, it must be remembered that the answer being sought - the ratio of young:adults - is also necessary to determine the probabilities that any unknown specimen with a certain characteristic of the outer primaries is either a young bird or an adult. To clarify this, the following example is given:

> Assuming (Table 2) that 96 percent of the young have P9 speckled, and that 4 percent do not; and assuming that 33 percent of the adults have P9 speckled, and 67 percent do not; what is the chance that a wing with P9 speckled belongs to a young bird?
>
> 1. A speckled P9 could belong to either an adult or a young bird. Therefore, the probability of choosing a young bird must be calculated.
>
> 2. If the ratio of young to adults were 1:1 in the population, the chance of choosing a young bird would be 1/2.

Table 2. Color characteristics of primaries 8, 9 and 10 of young and adult rock ptarmigan collected in Alaska, 1959.

CHARACTERISTIC	YOUNG		ADULTS	
	Number Positive	Percent Positive	Number Positive	Percent Positive
P8, P9, P10 with dark areas	2	1.2	4	12.1
P9, P10 dark*, P8 light*	17	10.4	0	
P10, P8 dark, P9 light	0		0	
P9, P8 dark, P10 light	13	7.9	6	18.2
P8 dark (not considering P9, P10)	15	9.1	16	48.4
P9 dark (not considering P8, P10)	158	96.3	11	33.3
P10 dark (not considering P8, P9)	19	11.6	4	12.1
P8 dark, P9, P10 light	0		6	18.2
P9 dark, P8, P10 light	126	76.8	1	3.0
P10 dark, P8, P9 light	0		0	
P8, P9, P10 light	6	3.6	16	48.4
	No. young examined 164		No. adults examined 33	

* Primaries which were speckled or marked in any way with dark color on the vane (the shafts were not considered) were termed "dark". Feathers without such markings were called "light".

Table 3. Color characteristics of primaries of male and female rock ptarmigan.

Characteristic	MALE				FEMALE			
	ADULTS		YOUNG		ADULTS		YOUNG	
	Number Positive	Percent Positive	Number Positive	Percent Positive	Number Positive	Percent Positive	Number Positive	Percent Positive
P9 with dark	1	11.1	65	92.3	10	41.7	93	98.9
P8, P9, P10 light	7	77.8	5	7.7	9	37.5	1	1.1
P8, P9, P10 dark	0		0		4	16.6	0	
P8 dark, P9, P10 light	1	11.1	0		5	20.8	0	
	9		70		24		94	

3. The chance of a young bird having P9 speckled is .96; thus, 1/2 x .96 = .48 is the probability of choosing a young bird with a speckled wing.

4. The chance of getting an adult would be 1/2 x .33 = .17.

5. The chance that a wing with P9 speckled belongs to a young ptarmigan, under those conditions, is .48/.17 times greater than that the wing is from an adult.

6. If the ratio of young to adults were 3:1, the chances are 3/4 x .96 = .72 for young, 1/4 x .33 = .08 for adults.

Test of the "Pointed Primary" Method

Primaries 9 and 10 tend to be more pointed in many Tetraonidae less than one year old than in those which have completed their post-nuptial molt. In some areas, this method has been satisfactory for determining the age of ptarmigan (Watson, in lit.). However, no one has verified, in quantitative terms, the extent of the alleged difference in shape. The test reported here was an attempt to do this. Table 4 gives the results of the analysis of data on about 31 adult and 150 rock ptarmigan. All specimens were collected in August, September or October, 1959, when age could be determined by the bursa of Fabricius. Measurements were made with vernier calipers.

The measurements did not demonstrate any reliable age-specific differences. It is possible that experienced observers could detect, by eye, differences not brought out here. The eye allows the assessment of all of the components of feather shape, only a few of which were measured in this study. However, in the region from which these specimens were taken, it seems probable that enough overlap in shape occurs to make it impossible to rely on this method alone.

Observations of the Habits of Ptarmigan, August-April

Field observations of ptarmigan were restricted in the period August, 1959 to April, 1960, by office duties and difficult travel conditions. The few trips that were made, and some information received from other qualified observers,

Table 4. Results of measurements of primaries of adult and young rock ptarmigan.

		NO. MEASURED		MEAN (mm.)		STANDARD DEVIATION** (mm.)	
		Adults	Young	Adults	Young	Adults	Young
(1) Width 2 mm. from tip	P9	31	144	4.4	3.6	.5	.4
	P10	27	150	4.1	3.4	.5	.4
(2) Length of barb 5 mm.	P9	31	149	4.6	4.5	.1	.4
from tip	P10	26	150	4.4	4.0	.4	.1
(3) Sum of (1)+(2)		25	142	17.5	15.5	1.4	1.0
(4) Width 2 cm. from tip	P9	29	145	11.4	11.2	.7	.8
	P10	24	150	8.9	8.8	.8	.8
(5) Ratio: (1)/(4)	P9	29		.39	.33	.05	.04
	P10	24		.46	.39	.05	.05

* Explanation of measurements:

(1) Width 2 mm. from tip: The total width of the feather, measured perpendicular to the shaft at a point 2 mm. from the tip. Primaries no. 9 and 10 measured, as in succeeding measurements.

(2) Length of barb 5 mm. from tip: The length of an individual barb on the wide (proximal) side of the feather, which originates at a point on the shaft 5 mm. from the tip.

Table 4. Results of measurements of primaries of adult and young rock ptarmigan (cont.).

(3) The sum of values of the previous two measurements.
(4) Width 2 cm. from tip: The total width of the feather, as in (1), at a point 2 cm. from the tip.
(5) A ratio of the value obtained in (1) to the value in (4).

** Calculated largely from data processed by IBM methods.

yielded some data on flock formation, flock behavior, dispersal, feeding, habitat preference and the onset of the reproductive cycle.

Flock Formation

A list of observations made pertinent to the formation of flocks of rock ptarmigan is given in Table 5.

Table 5. Observations of rock ptarmigan, July-October, 1959.

Date	Observation
July 26	Broods, with 11, 9, 7, 7, and 9 chicks plus F
August 2	Broods, F + 2 (incomplete), 5, 8, 10 young
August 3 (snowing)	Flock of 9 with at least 2 adult males; also 2 males singly close by; another group of 3
August 4	Broods, F + 6, 9, 6, 10, 6; 5;* flock of 5 adults*
August 22	Broods, F + 3, 6 young
August 25	Flock 4 adult males*
August 29	Flock of 20-25
August 30	Flock of 20-30; 20-25;* flock of 12*
September 5	2 birds; single F
September 6	Flock of 30, 7
September 7	Flocks of 35, 2, 5, 1, 1, 65-70
September 15	Flock of 35-45; 1, 1
September 17	Flocks of about 150, 200
September 21	Flock of 100*

Table 5. Observations of rock ptarmigan, July-October, 1959 (cont.).

Date	Observation
September 29	Flock of 150 or more
October 19	Flock of 8

* Reported by others.

These observations suggest that broods, consisting usually of a hen and her chicks, retain their identity as family units until late August. Until this time, adult males may be found in small groups, usually apart from the broods (although the August 3 observation indicates that they may join the broods, at least temporarily, on occasion). Quite abruptly, in late August, broods combine to form small flocks. The size of these flocks suggests that they are formed from only a few broods, which probably have not travelled far from their hatching place. Another abrupt change took place in mid-September, resulting in the formation of large flocks.

Flock Behavior

On September 17, the investigator spent one morning observing the behavior of about 350 rock ptarmigan at Eagle Creek. Their behavior was similar to that of other flocks seen during the next two weeks. During the period from 6:00 to 8:00 a.m. the birds were restless as individuals, and very wary as a flock. The restlessness of the members of the group, as they fluttered or ran from one patch of food to another, occasionally triggered the movement of the whole flock; without apparent warning, they would fly across a small valley to the opposite slope. At this time of day, too, the presence of a human a few hundred yards away, or the sudden appearance of a hawk or eagle, would alarm the ptarmigan and send them sailing off to other places up to a mile away. As the feeding period waned, however, the wariness of the birds decreased enough so that they could be approached and shot at without causing more than a momentary disturbance.

Males (including young cocks) called frequently during the month of September, especially early in the morning and during snow flurries. It appeared that this calling activity often resulted in the movement of the flock from one place to another. If one or two cocks flew away from the flock for a short distance, and croaked as they landed, other males would follow shortly. Soon small groups of both sexes would fly to those birds, and finally the remainder of the flock would join them.

Flocks containing both rock and willow ptarmigan were seen in September. In one case, a large group of rock ptarmigan flew from a hillside at Eagle Creek to a nearby stream-bed, joining about 30 to 50 willow ptarmigan there. As this group was pursued up the creek, it was noted that the rock ptarmigan, when flushed, usually flew out of the valley bottom and onto the adjacent slopes. The willow ptarmigan remained near the stream, flying from one thicket of willow shrubs to the next.

Dispersal from Breeding Grounds

Two bits of evidence were obtained which suggest that rock ptarmigan become nomadic in September and October. First, the occurrence of very large flocks, and their restless behavior, indicates that the birds were being drawn together from a large area, and were travelling together. Second, small groups of rock ptarmigan began to appear in October in places somewhat distant from the nearest breeding habitat. Most of these birds were from four to eight miles from the nearest suitable tundra, in open vegetation types such as muskegs, burns and marshes.

More data will have to be obtained before the nature of this movement can be described, and before its effect is known. It seems possible that by this mechanism, rock ptarmigan prevent over-utilization of food supplies in winter on the breeding grounds, and may continually re-populate many marginal or unfilled habitats.

Feeding and Habitat Preference

The crops of all ptarmigan specimens collected in this study have been saved, and will be analysed later. A few observations were made in the field which indicate something of the feeding periodicity and food preferences of rock and

willow ptarmigan. These are not sufficient to warrant much discussion of the subject, however. Two tendencies are apparent, which will be tested with further data: 1) Willow ptarmigan tend to eat the buds of willows (Salix) more than any other item; rock ptarmigan, on the other hand, eat more buds of Betula (dwarfed birch). This may be due to availability and/or preference. 2) Two important feeding periods in the winter are early in the morning, just after dawn, and in mid to late afternoon.

Three trips, made on November 6, February 25 and April 7, yielded some information on the habitats used by rock and willow ptarmigan prior to the breeding season in interior Alaska. Again, only suggestions can be offered at present as to specific habitats preferred. Rock ptarmigan were found in two distinct areas: 1) At the upper limit of shrub growth, where shrubs (particularly dwarfed birch and willow) were not completely covered by snow; 2) On windswept, bare ridgetops, where dryas and sedges dominated the sparse vegetation. The former kind of place was used apparently from early November to early spring. Ptarmigan were seen on the bare ridgetops only during the April trip, although a search was made in similar habitat in early March. Willow ptarmigan were seen in three types of areas: 1) Extensive, shrub-grown openings in boreal forest, especially where logging or burning had occurred near timberline; 2) riparian willow thickets along the upper reaches of streams, but often within the forest zone; 3) extreme upper limit of spruce woodland, where willow shrubs occur abundantly, especially in hollows at the headwaters of creeks. Two kinds of vegetation, adjacent to utilized types, that apparently did not attract ptarmigan were: 1) Dense timber (deciduous, evergreen or both); 2) "muskegs" found on north-facing slopes at and below timberline, where only alder (Alnus sp.) and black spruce (Picea mariana) remained above the snow.

No information is available on the effects of weather on the habitat preferences of ptarmigan in winter, nor on the degree to which the area used by each species overlap.

Beginning of the Reproductive Cycle

The testes of two rock ptarmigan collected April 10, 1960 were larger than any seen previously in winter specimens. Three male willow ptarmigan also had enlarged testes on that date, and feathers of the spring plumage were visible under the

white winter feathers on the neck. Seven female willow ptarmigan had ovaries containing a few follicles that had begun to enlarge. Cocks of the latter species were heard calling at dawn during this field trip; the calls ceased shortly after dawn, and were not heard at all during the day or the following evening. There was no opportunity to check on whether male rock ptarmigan were calling early in the morning. Both species were still in flocks in early April. From this meagre information, it seems that the first visible evidence of sexual rejuvenation in ptarmigan appeared in late March or early April. Territorial behavior had not appeared as of April 10.

Weights of Rock Ptarmigan, September 29-30

Weights were obtained from 150 ptarmigan collected at Eagle Creek on September 29 and 30, 1959. The birds remained frozen from a few hours after being shot to the time they were weighed, a few days later. A triple-beam scale, accurate to tenths of grams, was used. The weights, as given in condensed form in Table 6, are those of the entire carcass, including crop contents. The weight of the crop and its contents was recorded for 25 specimens; the range was 2.0 (empty crop) to 19.1 grams, with the average 9.3 grams. Although the weights of the birds are not true body weights as a result of including the crop contents, it is believed that all sex and age classes are affected similarly, so that no bias exists. One specimen was omitted because its sex could not be determined with certainty. Another bird, an immature male, was omitted because its body weight (365.9 grams) was so much lower than any other young male. This bird may have been younger than other immatures, or may have been in poor physical condition.

The significance of the differences among the means was tested with Snedecor's (1940) formula:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{s_{\bar{x}}}$$

$$s_{\bar{x}} = \sqrt{s_1^2 + s_2^2 \left(\frac{n_1 + n_2}{n_1 n_2} \right)}$$

Table 6. Statistics concerning weights of ptarmigan collected at Eagle Creek, September 29-30, 1959.

STATISTIC	ADULT		IMMATURE	
	MALE	FEMALE	MALE	FEMALE
No. collected	5	17	54	72
Range high	525.1*	468.1	507.0	474.6
Range low	468.7	401.5	403.9	374.1
Range difference	56.4	66.6	103.1	100.5
fiducial limits	± 46.5	± 14.3	± 12.6	± 6.9
Mean ($\bar{x}$)	493.5	427.0	452.5	420.3
S^2	506.6	414.2	597.8	478.0
Standard deviation S	22.5	20.4	24.5	21.8
Standard error $S\bar{x}$	10.1	4.94	3.42	2.58

Formulae Used (Snedecor, 1940)

1) Standard Deviation (s) = $\sqrt{\frac{\Sigma (\bar{x} - n)^2}{n - 1}}$

2) Standard Error ($S\bar{x}$) = $\sqrt{\frac{S^2}{n}}$

3) Fiducial Limits = $\bar{x}$ ± (t at 1% level x $S\bar{x}$)

* All weights given in grams.

It was found that: 1) There is less than one chance in 100 that the difference between the means of young males and young females is due to chance alone; 2) there are less than two chances in 100 that the difference between the means of young males and old males, and adult males and adult females, is due to chance alone; 3) there are more than five chances in 100 that the difference between the means of adult and immature females is due to chance.

It appears that although young males grow faster than young females (in terms of weight gained per day from hatching until fall), young females reach the weight of adults more quickly. This is true because the weight of adult hens in autumn is less than that of adult cocks. The range in weights is greater for young than for old birds, primarily because of the relatively large difference in the ages of the young, and because the young were not quite full grown.

Probably the greatest value of these data will come when comparisons can be made with weights of birds of known sex and age at other times of the year, especially in spring.

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Volume 1 Report No. I-3

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1959-1960 SEGMENT

State: ALASKA

Project No: W-6-R-1 Name: Game Investigations of Alaska

Work Plan: I Game Bird Investigations

Job No: 3 Title: Waterfowl Investigations

Period Covered: July 20, 1959 to June 30, 1960

Abstract:

No field work was accomplished during this initial year of waterfowl studies due to the late-summer arrival of the investigator. Several basic tenets regarding Alaska's place in the continental waterfowl program were suggested as guides to future planning, and three field projects were set up for the 1960-61 fiscal year. The State's first permanent, full-time waterfowl biologist has been hired, and will arrive in Alaska on July 1, 1960.

Objectives:

1. To determine the flyway distribution of migrant waterfowl from nesting areas not previously investigated.

2. To determine waterfowl production on selected nesting areas.

Findings:

No field work was done this year on the waterfowl project, as the investigator, after arriving in Alaska on July 26, was committed to other duties until September 1. The primary tasks relating to this project have been to decide on an overall approach on the part of the State to the problems of waterfowl research and management, to plan for the

1960 field season, and to hire the necessary personnel.

The Overall Approach.

It seems that the main factors to consider in establishing the waterfowl program in Alaska are these:

1. Alaska is an area where waterfowl are produced in large numbers, but where few live from October to May. There are almost no waterfowl that winter on any of the important breeding areas. The birds wintering on the coast from the Aleutians to Ketchikan are not an important source of recreation, and probably are not a major segment of the summer breeding population.

2. The harvest of Alaska-produced waterfowl is made by sportsmen in other states. Some species migrate and winter within the administrative boundaries of the Pacific Flyway. Significant numbers of many species of waterfowl migrate through Canada to each of the other three Flyways. Thus, it is of the utmost importance that the program of the State of Alaska be coordinated closely with the continental scheme, as well as with the program for Pacific Flyway states.

3. The current continental waterfowl situation suggests that the following problems will be of paramount importance in Alaska: a. Assuring that the major breeding areas in the State remain suitable for maximum production of waterfowl; b. Preventing the loss or undue disturbance of a few major resting areas used by migrating waterfowl; c. Developing more accurate and efficient methods for estimating annual production; d. Obtaining further information on migration routes, migration schedule and areas used in winter by waterfowl breeding in Alaska.

4. Within the State, the program should provide sportsmen and others a greater opportunity to utilize waterfowl, and, at the same time, should give the State management control of certain production and resting areas.

Of necessity, it will be several years before the long-term plans for waterfowl investigations will be formulated completely. Until then, the statements made above may serve as general guides to research activity.

Plans for 1960.

At various times throughout the winter of 1959-1960, the investigator conferred with Sigurd T. Olson, State Coordinator for P-R projects in Alaska; Leslie E. Whitesel, Federal Aid Coordinator for Alaska; James W. Brooks, Chief of the Game Division, Alaska Department of Fish and Game; and Henry Hansen, Waterfowl Biologist, Bureau of Sport Fisheries and Wildlife, Fish and Wildlife Service. The suggestions of these people were of tremendous value in helping the investigator to set up the projects to be carried out in 1960. The proposals for work in the 1960-61 fiscal year have been reported in detail in job descriptions submitted earlier; only the project titles and objectives will be repeated here.

Job 3a Mortality in western Canada geese

Objective: To determine the mean annual mortality rate among western Canada geese breeding on the delta of the Copper River.

Job 3b Distribution and abundance of black brant in Alaska

Objectives: 1) To determine the location and approximate size of breeding or summering populations of black brant in Alaska.

2) To determine the pattern of natural mortality, and mortality from hunting, among juvenile and adult black brant.

Job 3c Production, distribution and migration of waterfowl in Alaska

Objectives: 1) To determine nesting areas and migration routes for species where these facts are unknown.

2) To determine the amount of production of waterfowl on selected nesting areas.

Most of the field work on the above projects will be done by Research Biologist Peter E. K. Shepherd, with the assistance of Biological Aides. Shepherd and Weeden will report on the projects and do the preliminary planning for subsequent studies.

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