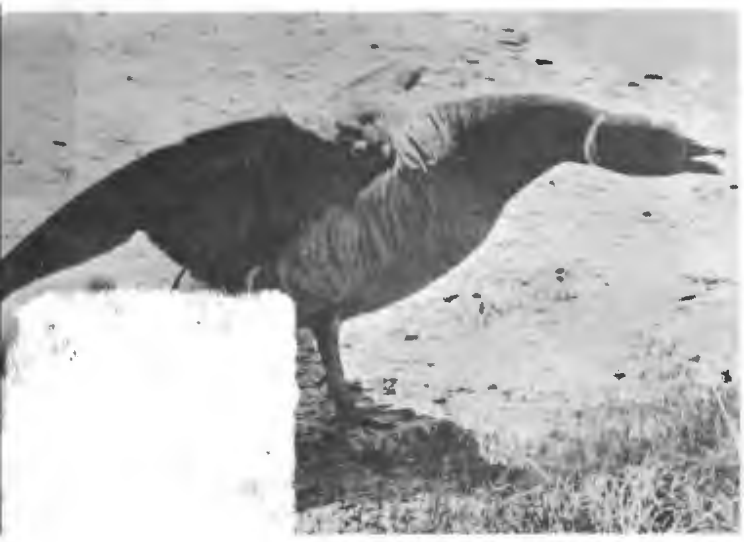
ALASKA DEPARTMENT OF FISH & GAME

1960-61 Pittman-Robertson Project Report

DIVISION OF GAME VOLUME II NO. 8

GAME BIRD INVESTIGATIONS

Work Plan I



Juneau, Alaska

The Yukon-Kuskokwim Delta situated in Western Alaska is the most important breeding grounds of black brant in North America. The coastal area of the region is composed of low, marshy tundra and grass flats producing ideal nesting and rearing sites for this maritime species. Banding studies conducted here and in other areas of Alaska yield information on patterns of migration, survival and hunter harvest of waterfowl essential for proper management of this resource. (Photo by Glen Sherwood)

Black brant adult displaying protective behavior (Yukon-Kuskokwim Delta). (Photo by Glen Sherwood)

Willow ptarmigan range in distribution from the Arctic slope to mountain meadows of the Panhandle and receive more hunting pressure than any other Alaskan upland game bird. (Photo by Dave Klein)

Volume II, Number 8 1960-1961

ANNUAL REPORT OF PROGRESS, 1960-1961

FEDERAL AID IN WILDLIFE RESTORATION PROJECT W-6-R-2

GAME INVESTIGATIONS OF ALASKA

STATE OF ALASKA

William A. Egan, Governor

Alaska Department of Fish and Game

Clarence L. Anderson, Commissioner

Division of Game

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Contents of Volume II

Reports of Investigations

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ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1960-1961 SEGMENT

State: Alaska

Project No: W-6-R-2 Name: Alaska Wildlife Investigations

Work Plan: I Game Bird Investigations

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

PERIOD COVERED: July 1, 1960 to June 30, 1961

ABSTRACT:

Over 400 useful distribution records for Alaskan grouse and ptarmigan were compiled from interviews with about 40 persons, from field notes of the investigator, from ptarmigan observation cards and from publications. The records were mapped and cross-indexed with punch-cards and original data sheets. The probable range of each species in Alaska is presented, using observations gleaned from all sources during this project. Comments are made on the habitat preferences of rock, willow and white-tailed ptarmigan. According to questionnaires sent to 160 persons in Alaska in January, 1961 (from which 106 replies were received), both grouse and ptarmigan were at moderately low levels in the State in 1960, but were as abundant or slightly more abundant than in 1959. On an experimental basis, the replies were tabulated according to regional subdivisions of the State. No strong geographic trends were detected, although the abundance of ptarmigan seemed to be greater in the north than in the southern areas.

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.

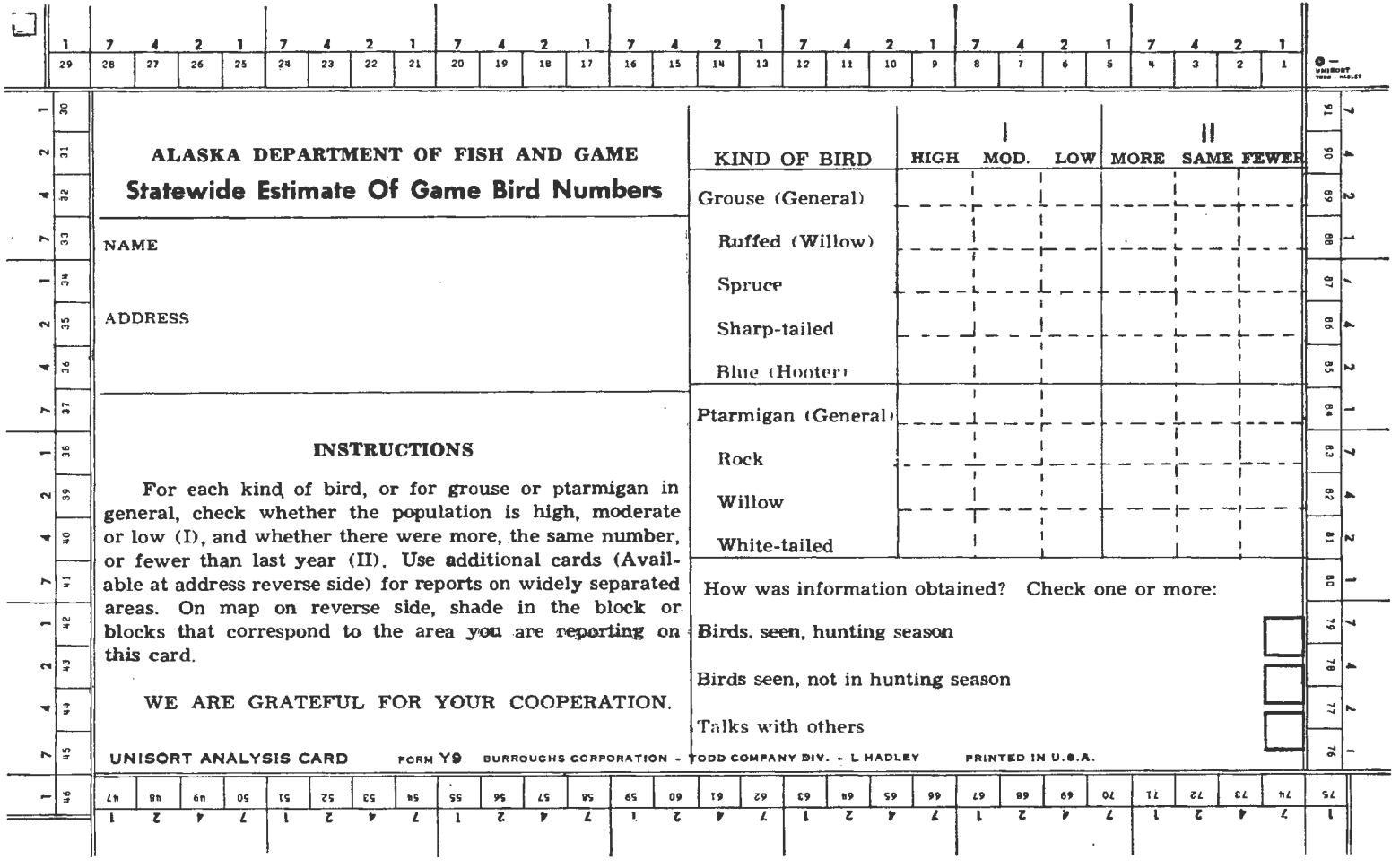
TECHNIQUES:

Distribution

Four sources were tapped for information on the distribution of upland game birds: 1) my own field notes, 2) talks with other people, 3) published reports and 4) ptarmigan observation cards. The latter are simple, pocket-sized forms sent in booklets to biologists throughout the State. Approximately 40 persons were interviewed and 28 publications reviewed. Each distributional record was plotted on a Geological Survey topographic map (scale 1:250,000). Each record was then listed on a punch-card, of which there is one for each of Alaska's 163 quadrangles. Reference numbers were given to each record so that it could be found in the original data sheets, punch-cards and topographic maps. Holes punched into each card indicated what species were known to be present in the area covered by a quadrangle, so that all maps containing references to a particular species could be sorted out quickly.

Abundance

A questionnaire concerning the abundance of game birds was designed, printed and mailed to 160 Alaskans in January, 1961. Recipients were asked to give their opinions on two questions: Were game birds at high, moderate or low levels of abundance in 1960? Were there more, the same number or fewer in 1960 than in 1959? Forms printed on 5 x 8-inch punch-cards (see Figure 1) were sent with explanatory letters and stamped, return envelopes to people known to be interested in wildlife from a professional or non-professional



ALASKA DEPARTMENT OF FISH AND GAME

Statewide Estimate Of Game Bird Numbers

NAME

ADDRESS

INSTRUCTIONS

For each kind of bird, or for grouse or ptarmigan in general, check whether the population is high, moderate or low (I), and whether there were more, the same number, or fewer than last year (II). Use additional cards (Available at address reverse side) for reports on widely separated areas. On map on reverse side, shade in the block or blocks that correspond to the area you are reporting on this card.

WE ARE GRATEFUL FOR YOUR COOPERATION.

KIND OF BIRD	I HIGH	I MOD.	I LOW	II MORE	II SAME	II FEWER
Grouse (General)						
Ruffed (Willow)						
Spruce						
Sharp-tailed						
Blue (Hooter)						
Ptarmigan (General)						
Rock						
Willow						
White-tailed						

How was information obtained? Check one or more:

Birds seen, hunting season ☐

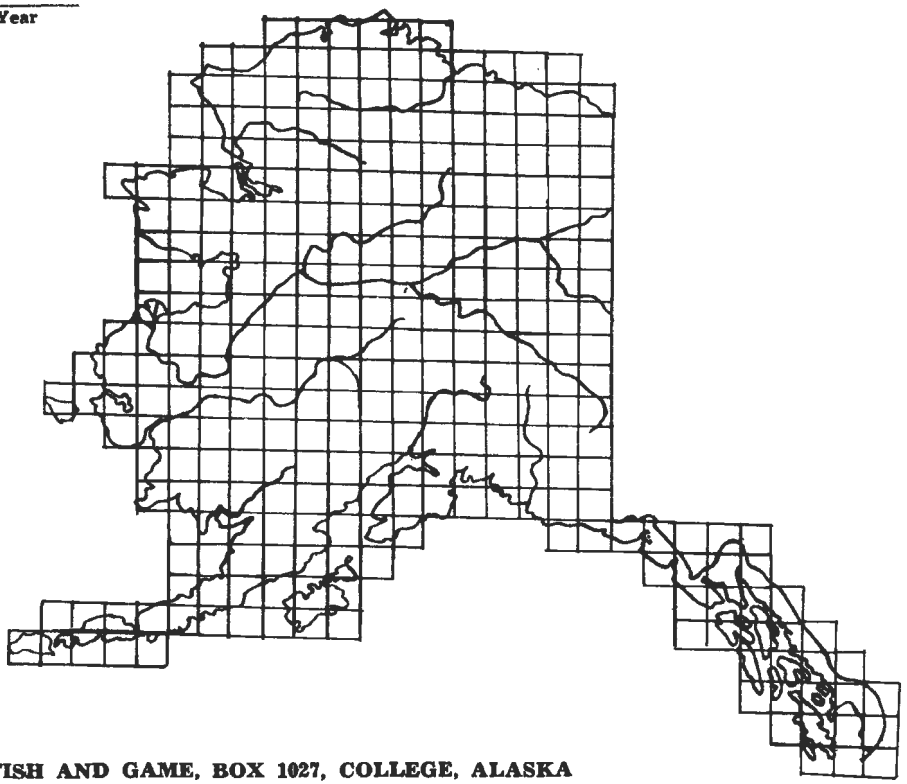
Birds seen, not in hunting season ☐

Talks with others ☐

UNISORT ANALYSIS CARD FORM Y9 BURROUGHS CORPORATION - TODD COMPANY DIV. - L HADLEY PRINTED IN U.S.A.

Fig. 1(a). Front of form used in statewide estimate of game bird numbers.

DATE_____
Day Month Year



RETURN BY JAN. 15 TO:
ALASKA DEPARTMENT OF FISH AND GAME, BOX 1027, COLLEGE, ALASKA

Fig. 1(b). Reverse side of form used in statewide estimate of game bird numbers.

standpoint. Replies were received from 60 per cent of those contacted, including 56 out of 85 professionals questioned and 40 of 75 non-professionals. No follow-up letters were sent. Ten people sent in one extra card each for additional areas.

The small number of replies does not warrant statistical analysis of results. However, it seemed advisable to devise a method for assigning an index value to each set of answers for each species, primarily for ease of comparison. The following method was used:

1. Arbitrary values of 9, 5 and 1 were given to each "high" (more), "moderate" (same) and "low" (fewer) answer, respectively.

2. The total value of the answers to each question for each species was divided by the number of answers.

3. Resultant index values range from 1.00 to 9.00, with a median of 5.00.

4. Example (from Table 1): ALL GROUSE, question on 1960 population levels:

   10 "high" x 9 = 90

   65 "moderate" x 5 = 325

   62 "low" x 1 = 62

   Total = 477

   477 ÷ (10 + 65 + 62) = 3.48

Although the number of replies this year was too small to allow conclusions about geographic trends, the records were tabulated by regions as an experiment. Three regions were used for grouse (Fig. 2): a northern one with three common species, a southern region where spruce grouse comprise the bulk of the grouse population, and a southeastern area where blue grouse and small numbers of spruce grouse and ruffed grouse are present. Two different subdivisions were used to test for west-east and north-south trends in

Table 1. Records of the distribution of grouse and ptarmigan from all sources as of April 18, 1961.

SPECIES	PERSONAL OBSERVATIONS (1)		TALKS WITH OTHERS (2)		PTARMIGAN OBS. CARDS (3)		PUBLICATIONS		TOTALS	
	All Year	(4) Summer	All Year	Summer	All Year	Summer	All Year	Summer	All Year	Summer
GROUSE:										
Ruffed	19	4	23	9			1	1	43	14
Spruce	24	3	26	5			17	13	67	21
Sharp-tailed	21	11	17	10			1	1	39	22
Blue	12	5							12	5
PTARMIGAN:										
Rock	21	17	11	6	22	13	38	34	92	70
Willow	19	14	35	29	34	16	45	41	133	100
White-tailed	8	7	11	5	2	1	4	2	25	15
TOTAL	124	61	123	64	58	30	106	92	411	247

(1) Includes 23 observations reported in letters or casual conversations.
(2) Omits 27 observations where species was uncertain.
(3) Omits a number of winter records where species and locality was uncertain.
(4) Records from May to August, inclusive.

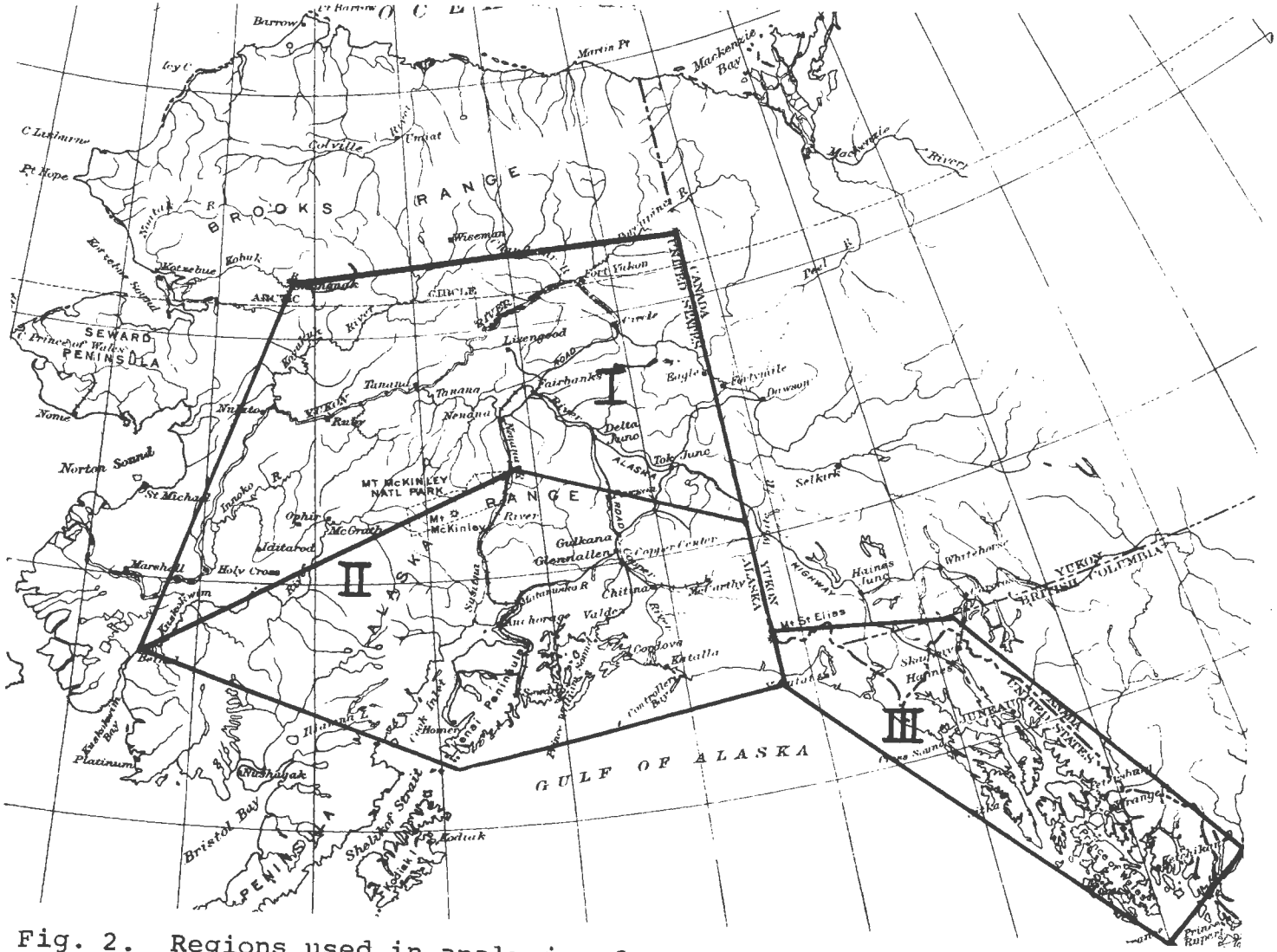


Fig. 2. Regions used in analysis of game questionnaires. Part I. Grouse.

the numbers of ptarmigan (Fig. 3). East-west differences were tested in regions A, B and C, and north-south trends in regions I - III. Region IV (Southeastern) and V (Aleutian Islands) could be used in such analyses also, but few reports are available from those areas.

FINDINGS:

Distribution

In Table 1, I have listed all distributional records tabulated so far, a total of 411. The accompanying maps (Figs. 4-8) show locations of known resident populations of each species, and the probable extent of the breeding range of each tetraonid in the State. The need for additional information is obvious, particularly for blue grouse and white-tailed ptarmigan. The scarcity of positive breeding records for grouse is noticeable, apparently reflecting the difficulty of finding nests and broods of this group. However, only part of the available literature has been read, and many more records could be obtained from this and other sources.

Habitat Preferences

Before joining the Alaska Department of Fish and Game in 1959, I studied the habitat preferences of ptarmigan. The results of this work are summarized briefly here. No original work has been done yet on the habitats used by grouse.

Willow Ptarmigan

Willow ptarmigan breed in tundra areas that contain tall shrubs (in excess of 2-1/2 - 3 feet) as well as low vegetation. Most subarctic populations are found close to timberline, often partly within the fringe of coniferous woodland, and most frequently along stream courses in riparian shrub communities. Along the Bering and Arctic shores the species is scarce except along watercourses where there is some development of shrubby vegetation. The terrain where the species breeds usually is level or gently rolling, rarely steep, and frequently is poorly drained. In interior Alaska, willow ptarmigan breed at altitudes of 2000-2800 feet. In coastal

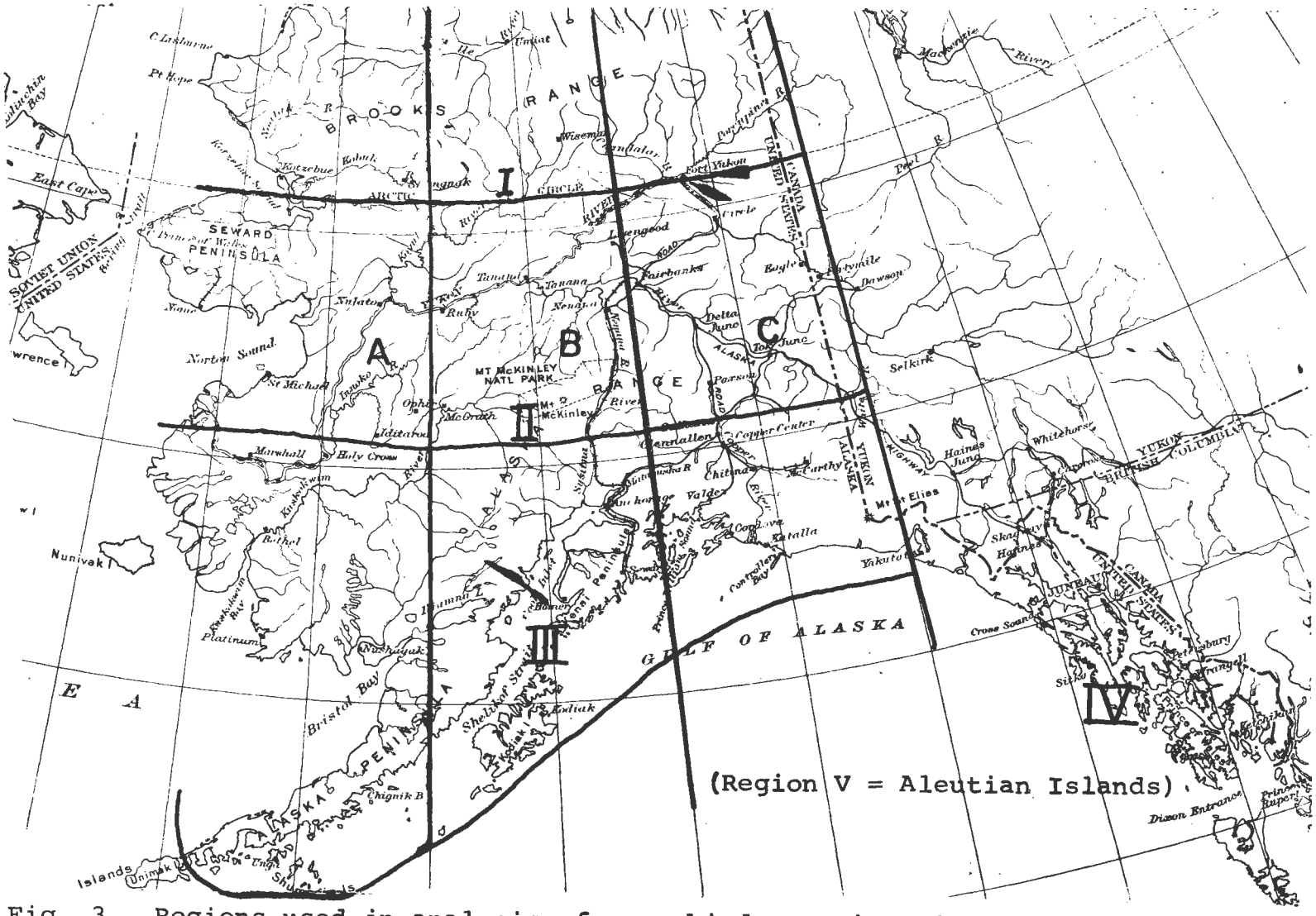


Fig. 3. Regions used in analysis of game bird questionnaires. Part II. Ptarmigan. (West-East Regions A, B, C; North-South Regions I-V).

Fig. 4. Approximate distribution of willow ptarmigan in Alaska.

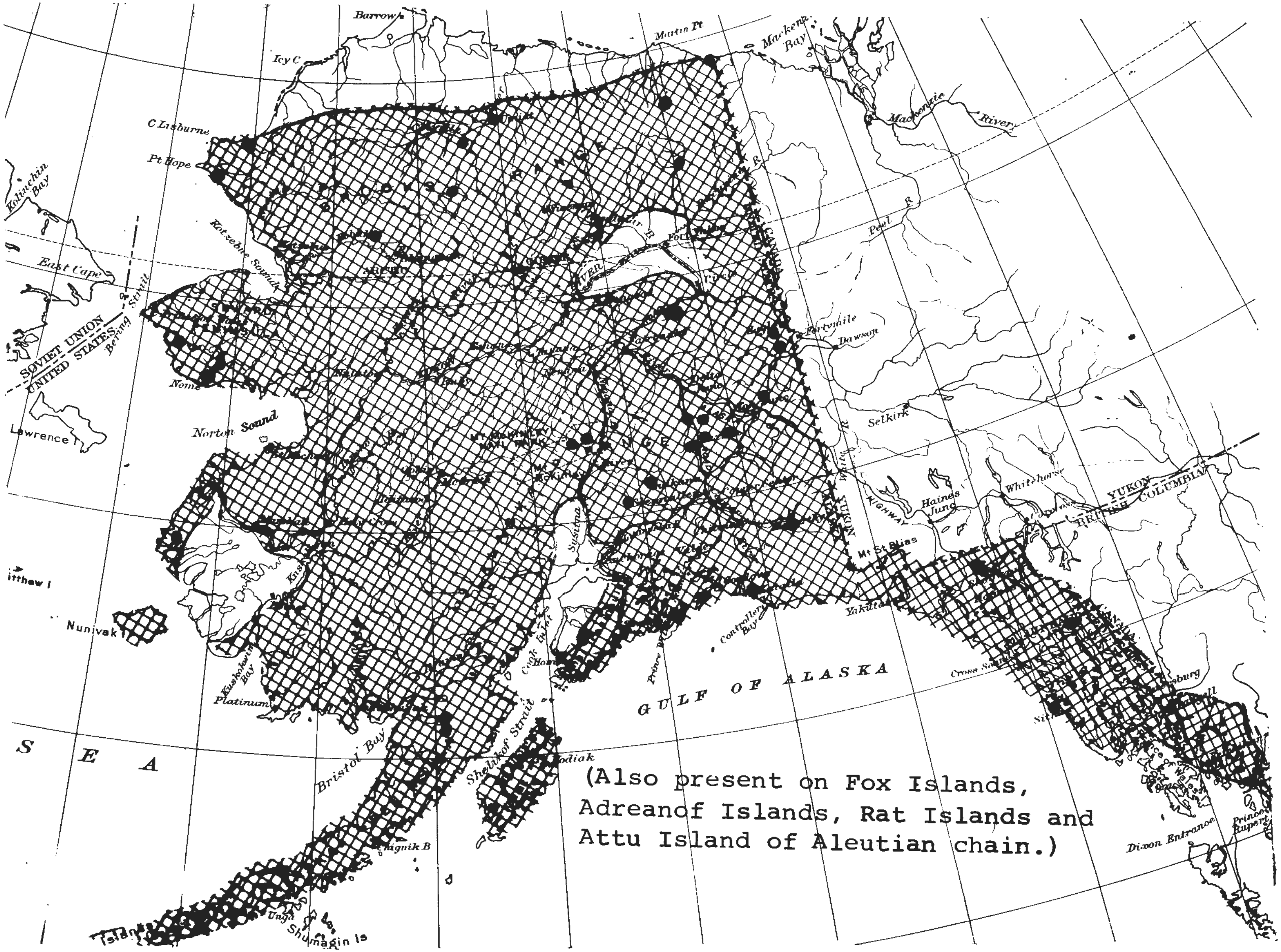


Fig. 5. Approximate distribution of rock ptarmigan in Alaska.

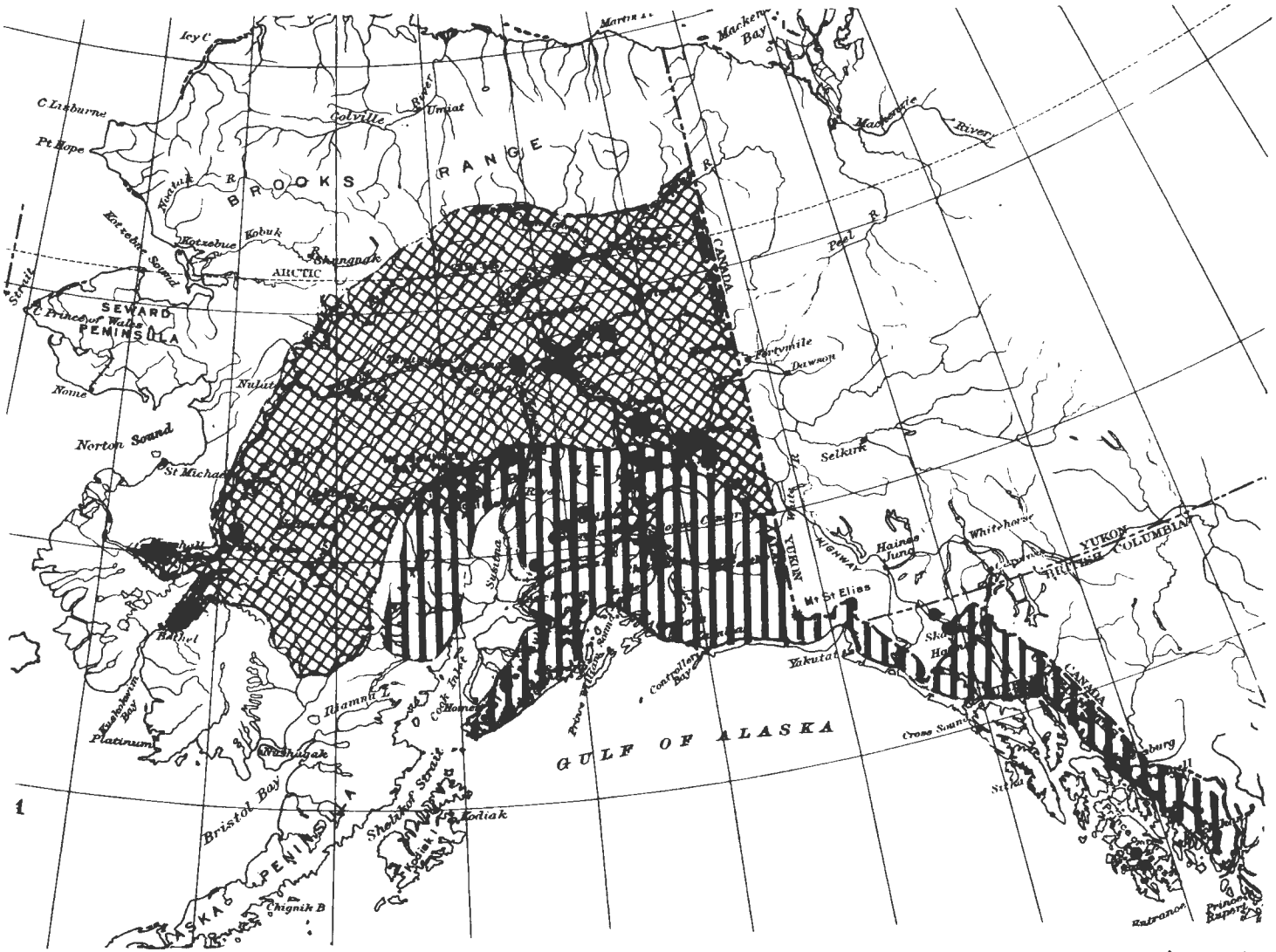


Fig. 6. Approximate distribution of ruffed grouse (cross-hatching) and white-tailed ptarmigan (single-line hatching) in Alaska.

Fig. 7. Approximate distribution of spruce grouse in Alaska.

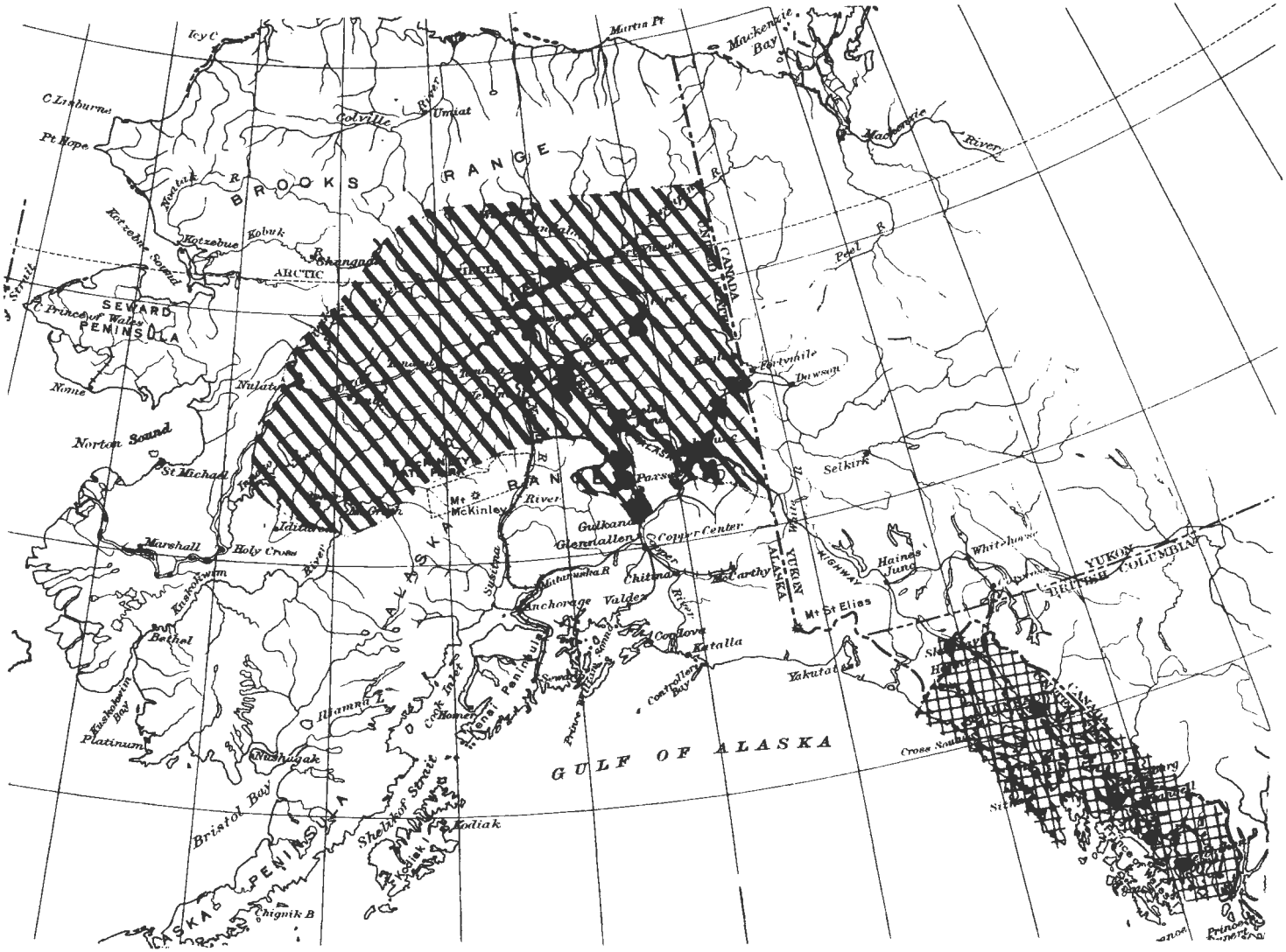


Fig. 8. Approximate distribution of sharp-tailed grouse (single-line hatching) and blue grouse (crosss-hatching) in Alaska.

areas of western and northern Alaska the species lives at altitudes from sea level to 1000 feet.

Rock Ptarmigan

This species lives on hilly terrain throughout Alaska, from 200-2000 feet above timberline. It prefers tundra without tall shrubs, and will breed in areas without upright woody vegetation. Typical summer habitat of rock ptarmigan looks like a vast, curving pasture, overgrown with dwarfed shrubs here and there and with occasional patches of rock showing. The soil is generally well-drained, but very dry places are little used.

White-tailed Ptarmigan

Most white-tailed ptarmigan in Alaska breed at altitudes of 3500-5000 feet. They occupy rugged terrain where vegetation forms a low, sparse cover interrupted by boulder fields, talus, ledges and glaciers. Rocks, in fact, are as important to white-tailed ptarmigan as tall shrubs are to willow ptarmigan, for they provide perches for courting males, shelter for nests and protection for chicks and adults. The species is found only in mountainous terrain in Alaska, as opposed to the more gently-sloping hills and flats frequented by rock and willow ptarmigan.

Abundance

The results of the statewide survey are listed in Table 2. In the opinion of most people contacted, Alaskan game birds were at levels slightly below "average," possibly with a very slight increase since 1959. The results were, on the whole, the same for grouse and ptarmigan. Spruce grouse and willow ptarmigan were given the highest ratings of the seven species (except for the localized blue grouse in the population-level category). The low abundance ratings for sharp-tailed grouse and white-tailed ptarmigan probably reflect the fact that few people see them, as both species are generally scarce and have restricted ranges in Alaska.

The index values in Part I of Table 3 suggest that grouse were at moderately low numbers in all three regions in 1960. The concensus was that there had been little change

Table 2. Statewide Results of Game Bird Questionnaire, 1960.

SPECIES	NO. OF ANSWERS HIGH	MOD.	LOW	INDEX	NO. OF ANSWERS MORE	SAME	FEWER	INDEX
				GROUSE				
General	2	16	18	3.22	7	17	7	5.00
Ruffed	2	8	9	3.53	7	4	6	5.23
Spruce	4	32	20	3.86	18	22	10	5.64
Sharp-tailed	1	3	11	2.33	3	5	4	4.58
Blue	1	6	4	3.91	1	6	3	4.20
ALL GROUSE	10	65	62	3.48	36	54	30	5.20
				PTARMIGAN				
General	5	24	23	3.43	17	19	12	5.42
Rock	3	15	7	3.96	4	13	5	4.82
Willow	7	24	16	4.23	22	13	8	6.30
White-tailed		3	4	2.71		4	1	4.20
ALL PTARMIGAN	15	66	50	3.93	43	49	26	5.58
ALL REPLIES	25	131	112	3.70	79	103	56	5.39

Table 3. Regional Analysis of Game Bird Questionnaires, 1960. Part I. Grouse.

SPECIES	HIGH	MOD.	LOW	INDEX(1)	MORE	SAME	FEWER	INDEX(1)	TOTAL
		Region I.			(Northern)		(30 cards)		
General		9	5	3.57	4	7	3	5.29	28
Ruffed		8	6	3.29	4	3	5	4.66	26
Spruce		10	11	2.90	3	12	5	4.60	41
Sharp-tailed	1	3	7	2.82	3	3	3	5.00	20
TOTAL	1	30	29	3.13	14	25	16	4.86	115
		Region II.			(Southern)		(35 cards)		
General	2	5	7	3.55	3	6	2	5.36	25
Ruffed	2		3	4.20	3	1	1	6.60	10
Spruce	4	19	8	4.48	15	9	3	6.77	58
Sharp-tailed			4	1.00		2	1	3.67	7
TOTAL	8	24	22	3.96	21	18	7	6.22	100
		Region III.			(Southeastern)		(18 cards)		
General		2	6	2.00		4	2	3.66	14
Spruce		3	1	4.00		1	2	3.33	7
Blue	1	6	4	3.91	1	6	3	4.20	21
TOTAL	1	11	11	3.26	1	11	7	3.73	42
ALL REGIONS	10	65	62	3.49	36	54	30	5.20	257

(1) See text page 5 for explanation.

in numbers since 1959. Only spruce grouse in the Southern Region (II) showed a distinct rising tendency.

The north-south divisions of ptarmigan data show a small, progressive decrease in numbers from north to south, although nowhere were ptarmigan assessed at better than moderate levels. A rising tendency was noticeable in northern and central areas, with stable or decreasing numbers elsewhere. No clear directional trends are indicated by the east-west tabulation. Ptarmigan seemed to be in greatest numbers in the eastern part of Alaska. The strongest increase was recorded in the west (Table 3 Parts II and III).

RECOMMENDATIONS:

This study should be continued along the same lines in the next fiscal year. Use of the same techniques should continue to increase the store of factual distribution and abundance data at a reasonable rate for two or three years. The investigator should contact more people in towns other than Fairbanks, and the number of recipients of the questionnaire on abundance should be increased as much as possible.

Two kinds of information of importance in this study are not being obtained with presently-used techniques. These are 1) breeding records of each species in uninhabited or sparsely-settled regions of the State; 2) information on the habitat preferences of grouse. In future years it may be desirable to spend more time on those phases of the study, although I do not recommend such intensified effort in the fiscal year 1961-62.

Table 3. Regional Analysis of Game Bird Questionnaires, 1960.
Part II. Ptarmigan, North-South.

SPECIES	HIGH	MOD.	LOW	INDEX	MORE	SAME	FEWER	INDEX	TOTAL
				Region I.	(Northern)		(11 cards)		
General	1	3			3	1			8
Rock		1				1			2
Willow	4	2	2		3	5			16
TOTAL	5	6	2	5.92	6	7		6.85	26
				Region II.	(Central)		(26 cards)		
General	2	11	3	4.75	8	6		7.29	30
Rock	1	7	2	4.60	3	4	2	5.44	19
Willow	2	10	3	4.73	10	2	2	7.29	29
White-tailed		2	1			2			5
TOTAL	5	30	9	4.64	21	14	4	6.74	83
				Region III.	(Southern)		(41 cards)		
General	2	6	13	2.90	6	7	7	4.80	41
Rock	1	6	5	3.66	1	7	3	4.27	23
Willow	1	10	10	3.28	9	4	5	7.00	39
White-tailed			2				1		3
TOTAL	4	22	30	3.14	16	18	16	5.00	106
				Region IV.	(Southeastern)		(15 cards)		
General		4	7			5	5		21
Rock	1	1				1			3
Willow		2	1			2	1		6
White-tailed		1	1			2			4
TOTAL	1	8	9	3.22		10	6	3.50	34
ALL REGIONS	15	66	50	3.93	43	49	26	5.58	249

Table 3. Regional Analysis of Game Bird Questionnaires, 1960.
Part III. Ptarmigan, East-West.

SPECIES	HIGH	MOD.	LOW	INDEX	MORE	SAME	FEWER	INDEX	TOTAL
			Region A.		(West)		(20 cards)		
General		4	6		6	3	1		20
Rock		3			1	2			6
Willow	1	5	5		8	2	1		22
White-tailed									
TOTAL	1	12	11	3.33	15	7	2	7.17	48
			Region B.		(Central)		(33 cards)		
General	3	7	6		6	4	5		31
Rock	1	8	4		2	7	4		26
Willow	4	12	7		10	7	4		44
White-tailed		1	2			1	1		5
TOTAL	8	28	19	4.20	18	19	14	5.31	106
			Region C.		(East)		(33 cards)		
General	2	9	1		4	6			22
Rock	1	4	6		2	4	3		20
Willow	2	6	3		4	2	2		19
White-tailed		1	1			1			3
TOTAL	5	20	11	4.33	10	13	5	6.08	64
ALL REGIONS	14	60	41	4.06	43	39	21	5.85	218

SUBMITTED BY:

Robert B. Weeden
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October 16, 1961

APPROVED BY:

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James W. Brooks, Director
Division of Game

Volume 2 Report No. I-2

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1960-1961 SEGMENT

State: Alaska

Project No: W-6-R-2 Name: Alaska Wildlife Investigations

Work Plan: I Game Bird Investigations

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

PERIOD COVERED: July 1, 1960 to June 30, 1961

ABSTRACT:

Ptarmigan were slightly more numerous in Alaska in 1960 than in 1959, as shown by replies to letters mailed to 160 people throughout the State. Most of the 105 respondents thought that ptarmigan populations were at moderate levels. On the Eagle Creek study area in central Alaska, 88 male and 75 female rock ptarmigan (Lagopus mutus) were present in May. Twelve nests containing 98 eggs were found. The 75 pairs of rock ptarmigan produced about 325 chicks that survived into August (5.4 chicks per brood). Marked broods traveled variable distances, but usually did not exceed one-half mile of net movement from June to August. Eleven willow ptarmigan (Lagopus lagopus) and 158 rock ptarmigan were banded, representing (of the latter species) about half of the adult females, 25-30 per cent of the cocks and 15-20 per cent of the young on the study area. Six band returns were obtained from the Eagle Summit area in August and September, 1960. In October, both species began to appear in non-breeding habitats in the Tanana Valley, remaining there in moderate numbers until early March.

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 productivity and mortality vary.

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:

An attempt was made in May 1960 to count all male rock ptarmigan (and as many females as possible) that had established residence on the Eagle Creek study area. The count was used as a basis for computing productivity. Clutch size was determined from 12 nests found on the area. Adult rock ptarmigan were captured with a hand-held hoop net, banded, color-marked and released for studies of brood movements and mortality. Hatching dates were obtained from 10 nests and from 37 broods whose age could be estimated closely by relative development of the chicks' primary feathers. The total number of chicks produced and the probable number of rock ptarmigan on the study area in August were calculated from information available on spring counts, productivity and mortality. Some brood counts were made in other areas of Alaska.

Throughout the fall and winter, observations and collections of rock and willow ptarmigan were made to study behavior, distribution and movements during those seasons. Some information was obtained on the relative abundance of ptarmigan in various parts of Alaska in 1960, by means of a questionnaire mailed to approximately 150 residents.

FINDINGS:

Eagle Creek Study Area

The study area at Eagle Creek, 105 miles northeast of Fairbanks on the Steese Highway, was described in general terms in the report for fiscal year 1960 (ADF&G, Federal Aid Report,

W-6-R-1, Job I-2). Due to a more accurate planimetering of the boundaries, a better estimate of the effect of slope and a slight change in the limits of the area, the extent of the study area is estimated to be 14.5 square miles instead of 25 square miles as reported previously.

Spring Census

Method: Two characteristics make it possible to get a complete count of male rock ptarmigan in May. First, the cocks are easily seen. They retain their white winter feathers even after the hills are predominantly brown; they also spend most of the day on conspicuous, elevated spots (rocks, trees, knolls) where they can see (and be seen) for considerable distances. Second, the males are spaced out, not in flocks, and do not shift about a great deal. As a result, confusion and duplication are minimal.

The census was completed by two men in seven days in 1960 (May 14 and May 20-25). After walking slowly along one slope of a valley, about half-way between the crest of the ridge and the valley bottom, stopping frequently to watch and listen for courting birds, the observers then crossed over to the opposite slope and returned to a point across from where the count was begun. Most counts were made between 2:00 a.m. and 10:00 a.m., as courtship activities generally are carried on more intensively then than later in the day, and the birds are easier to find.

Results: Eighty-two male and 34 female rock ptarmigan were seen in the count in May, 1960. By way of contrast, only 27 cocks and 15 hens were located on the same area in the spring of 1956, when the only previous census was made. The number of hens tallied reflects primarily the amount of time spent on the area, rather than actual numbers present, because they are much harder to see than the cocks, and because the females sometimes are on nests when the count is made. Rock ptarmigan are thought to be monogamous, and it is assumed that nearly all males represent pairs. Usually there are a few "surplus" males (cocks that later prove not to have females) that are included in the census. In 1956 there were five such cocks, or 17 per cent of the total count of males. In 1960, apparently 13 (15 per cent) of the males did not have hens. We do not know how constant this spring-time preponderance of males

is, or what causes the unbalanced sex ratio. Neither do we know the age of the "surplus" males.

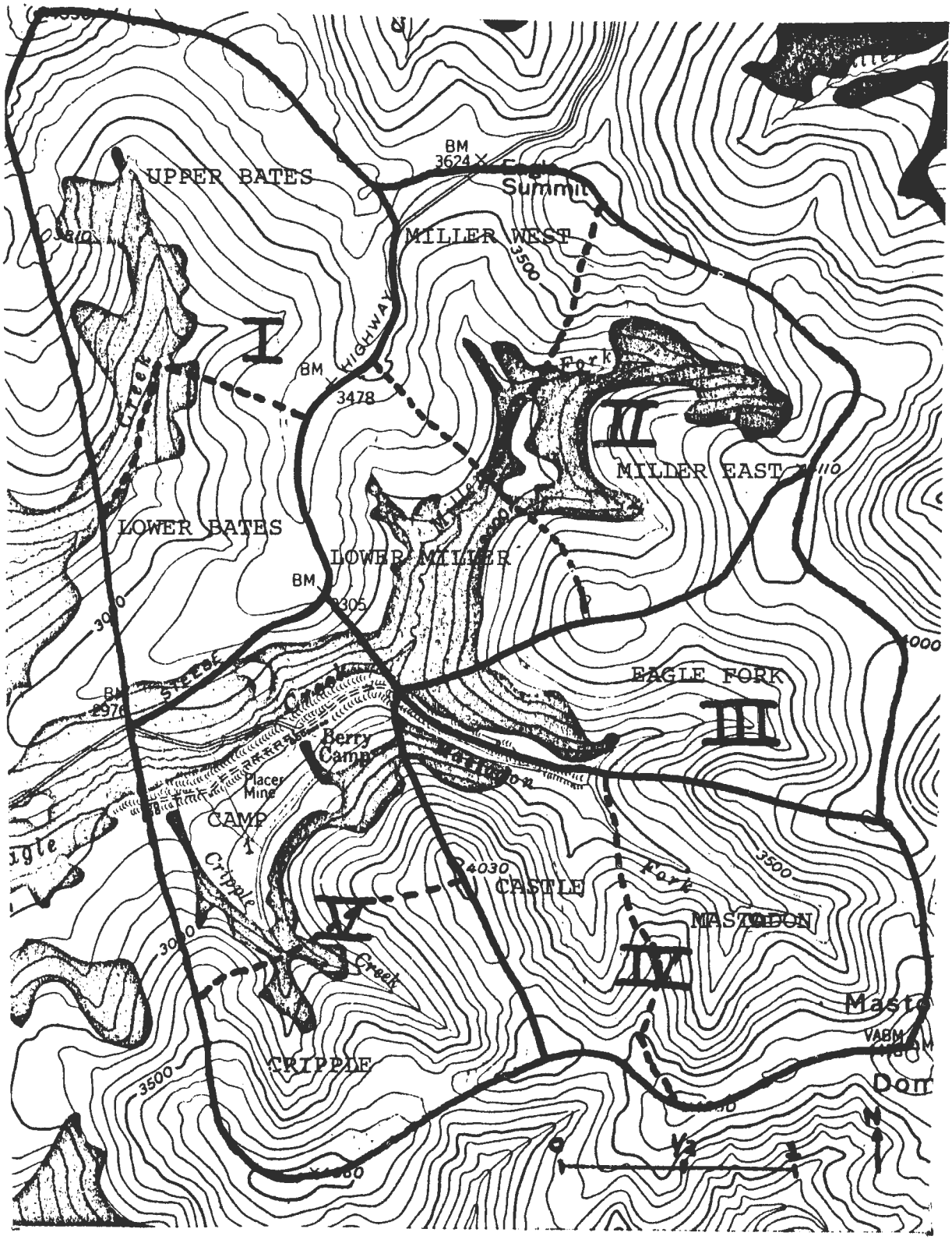
In 1956 and 1960, intensive studies after the census revealed a small number of new birds. A few of these may have moved in after the count, although most probably were present but not counted. The total population in 1956 was 29 cocks and 24 hens; in 1960 there were 88 cocks and 75 hens on the area. Thus, in both years between six and seven per cent of the males actually present in the summer were missed in the spring census.

Distribution of Males: About 3.8 square miles of the study area lies above 3600 ft., but no males were found on territories above that altitude either in 1956 or 1960. Therefore, the area actually used by males in May and June was about 9.7 square miles (all lying between 2600 and 3600 ft.), or one male for each 71 acres in 1960 and one cock in 212 acres in 1956. Broods, molting males and fall flocks used areas above 3600 ft. quite commonly.

To compare the local distribution of males in 1956 and 1960, two maps were made of the area, and the position of each cock was recorded on the maps. For convenience, each territory was represented by a single dot placed on the map in the spot used most often by each male. One map was divided into a grid with squares about 1/3 mile on a side. In 1956, the 27 known males occupied 26 such squares; the 85 males found in the spring of 1960 occupied 48 squares. The higher population in 1960 led to an increase in area used (22 more squares than in 1956, and 32 squares used that were not used in 1956) and an increase in the maximum number per square (six in 1960, two in 1956). However, 11 squares were occupied in 1956 that were not used in 1960, indicating a shift in locality of part of the breeding population.

A more versatile subdivision of the area, based on topography, was made on the second map (Figure 1). The Eagle Creek study area was divided into five main drainage units, and four of the units were subdivided once or twice. When territories (represented by a point) were plotted on the map, the distributional pattern of males in 1960 was seen to differ from that in 1956, as shown by the following listing:

Figure 1. Topographic map of Eagle Summit study area, showing major and secondary subdivisions.



	Area	Count in 1956	Count in 1960
I	Upper Bates	3	8
	Lower Bates	2	10
II	Miller West	1	3
	Miller East	2	8
	Lower Miller	5	11
III	Eagle Fork	1	7
IV	Mastodon	0	6
	Castle	1	7
V	Cripple	3	10
	Camp	9	15
		27	85

Although all 10 areas showed an increase in numbers of ptarmigan present in 1960, the greatest changes were in area III and adjacent area IV. Twenty males were counted there in 1960, in contrast to two seen in 1956. I do not believe that rock ptarmigan are so faithful in returning to specific breeding places that this ten-fold change was due to increased survival of birds reared on these areas. Rather, the marked change in numbers probably resulted from a general increase in ptarmigan populations and a "chance" increase in numbers of males that settled there and not somewhere else on the area.

Nesting Information

Nests of ptarmigan are hard to find. In 1960, two men and a Labrador retriever hunted an average of three hours a day for at least three weeks, and located 10 nests. Several things are responsible: dogs apparently cannot smell female ptarmigan on nests except at very short distances, and cannot scent preincubation clutches at all; the eggs and hens blend well with the surrounding vegetation; the hens will not flush until nearly stepped upon; there are relatively few nests per square mile in most places and in most years; ptarmigan nest in a variety of situations, so that almost every square foot of ground in a territory is a potential nesting place. The only reason for continuing to spend time looking for nests is that we do not know to what extent clutch size may vary

(although there is evidence that average clutch sizes vary annually) or what contribution a variable clutch size may make to changes in total population.

The clutch size and success of 12 nests of rock ptarmigan found on the study area in 1960 are summarized in Table 1. No nests were found before incubation had begun. The hatching dates of most nests were known (all successful ones hatched between June 15-24), so that approximate dates for the beginning of laying could be calculated. The assumed 21-day incubation period and the clutch-size-plus-one laying period were taken from published information on ptarmigan. It is obvious that many hens were completing their clutches when the spring counts were made, which is partly responsible for the low number of females seen.

Clutch Sizes: A summary of clutch sizes in nests found in 1956 and 1960 is given in Table 2.

Probably because of the small sample sizes, statistical tests did not demonstrate differences between the two years. Yet both the frequency distributions of clutch sizes and the average number of eggs per nest hint that some biologically meaningful differences did exist. Unfortunately, it will never be possible to get a satisfactory sample of nests. Nevertheless, it seems wise to continue looking for nests each year, as it may be useful to have some idea of clutch size when comparisons of brood sizes (of which adequate numbers can be obtained) are made between years.

Another indication that hens lay more eggs some years than others was found in 1959 during a check of brood sizes. No nests were found that year. However, 13 broods counted in late July and early August had an average of 7.5 young per brood. Studies in 1956 and 1960 indicated a loss by August of between 25 and 35 per cent of the chicks that hatch. Applying those rates of mortality to the 1959 data, we find that the clutch size that year may have averaged between 9.4 and 10.1 eggs. Of course, the actual loss of chicks in 1959 could have been less, or more, than 25-35 per cent.

Clocker Droppings: In 1960, it was discovered that hens deposited "clocker" droppings in fairly restricted places quite close to the nest. These droppings can be distinguished

Table 1. Summary of Information from 12 Nests of Rock Ptarmigan, 1960

Nest No.	No. of Eggs	Date Hatched	Approx. Date[1] Laying Began
1	8	(Destroyed)	
2	7	7 eggs June 22	May 24
3	9	8 eggs June 19	May 21
4	8	8 eggs June 17-20	May 19-21
5	9	9 eggs June 15-18	May 17-20
6	7	6 eggs June 17-21	May 19-23
7	8	8 eggs before June 19	before May 20
8	10	10 eggs June 24	May 24
9	8	8 eggs before June 21	before May 22
10	8	8 eggs June 22	May 23
11	8	(Hen killed)	
12	8	8 eggs June 19	May 22

Total: 98 (80 hatched, 2 left in successful nests, 8 deserted, 8 destroyed)
Average: 8.2
(1)Calculated from an assumed incubation period of 21 days, and an assumed laying period equal to clutch size-plus-one.

Table 2. Clutch Sizes in Rock Ptarmigan Nests, 1956 and 1960

Year	Clutch Size 5	6	7	8	9	10	Total	Average
1956	2	3	4				9	6.2
1960			2	7	2	1	12	8.2
Total							21	

easily from ordinary droppings by their large size, loose texture and different color. As hens sometimes adopt a fairly consistent schedule of daily incubation and feeding periods, and as they defecate only when off the nest, the deposition of the droppings likewise assumes some periodicity; hence the name. Clockers were found near seven of the 12 nests in 1960; in four cases no clocker droppings could be found, and in one instance no search was made. In those cases where clocker droppings were seen, from two to 20 droppings were found, mostly between five and 50 feet from the nest. Only a few were found less than three feet from the nest. Four droppings from one hen were 100 yards from the nest, in a place to which she flew to feed with the cock. All of the other droppings found in this case were within 20 feet of the nest. Perhaps nest hunting will be more fruitful in subsequent years if clocker droppings are used as clues to the location of the clutch.

Brood Studies

The studies of broods of ptarmigan were made possible by the capture and marking of adult hens on nests or with young. In most cases the hens were captured as they tried to distract my attention from their very young chicks. I used a hand-held hoop net, 36 inches in diameter and with a handle 9 feet long, constructed of aluminum tubing. The cries of captive chicks (or whistled imitations thereof) decoyed the more wary hens. Once caught, the adult was banded and colored on the wings with one or several colors, using Carter's Marks-a-Lot felt pen ink. The colors remained visible, with some fading, until the wing feathers were shed in August. Forty-seven adult females were marked in this way in 1960 at Eagle Creek.

Hatching Dates: By capturing chicks and estimating their age from the development of their primaries (see page 38), it was possible to get approximate hatching dates from 37 broods at Eagle Creek this year. All of these broods hatched between June 13-25. Twenty-six (70 per cent) hatched before June 21. The schedule of breeding activities was almost the same in 1956. All of the ptarmigan in the area apparently began nesting between May 14-26, as suggested by data on nests and broods.

Movements: Once individually-marked hens were available for study, we were able to get some idea of the general pattern of movement of rock ptarmigan broods. Three main difficulties, as yet unsolved, were met: 1) How much did human activity contribute to the movements observed? 2) When two observations of a brood were made at long intervals (a week to a month), where had the brood been in the meantime? 3) How many of the families moved out of the study area, beyond our surveillance? It seems likely that the effect of close study would be to increase the travels of the broods. Ptarmigan broods are so hard to find that they usually are disturbed by the time they are discovered. Also, it was necessary to make the birds fly to get a complete, accurate count of the chicks. As a result, the broods that provide the greatest quantity of data on movements are those that were disturbed most often. In regard to the second difficulty, it should be kept in mind that the only measurements of movement obtained were straight-line, point-to-point distances - and broods do not really move that way. Thus, the longer the interval between sightings, the less meaningful (in one sense) are the data. Finally, it is clear that a bias is present because some broods were seen only once; we know neither where they came from (usually) nor where they went. Frequently, these families are the ones that moved the farthest, and went out of the study area during their wanderings.

The information on distances moved by various broods was divided into two categories: "short-term movements," including observations spread over more than one, but less than 20 days (see Table 3), and "net seasonal movements," or the distance between observations made at 20-day intervals or longer (Table 4). The division between the two categories is purely arbitrary. Observations of the same brood made in less than 24 hours were discounted because of the factor of disturbance.

The variation in the performance of individual broods is so great that it is hard to pick out a general pattern. The greatest measured net movement was about 7800 feet, by brood number 1, over a period of 28 days. Brood number 17 moved the longest distance in the shortest time: approximately one-half mile in one day. The chicks of this brood could not fly at

Table 3. Short-term Movements[1] of 18 Broods of Rock Ptarmigan at Eagle Creek, 1960

Brood No.	Approximate Distance Moved (Feet)	Days Between First and Last Observation	Date of Last Observation
2	600	4	June 24
25	450	2	June 28
10	1800	10	July 2
11	1150	10	July 2
16	1700	9	July 2
22	900	8	July 2
18	1800	8	July 2
26	150	8	July 5
27	100	8	July 5
28	120	8	July 6
24	50	10	July 6
9	1450	15	July 7
22	150	11	July 13
11	2600	12	July 14
36	4150	5	July 14
44	650	9	July 15
22	1500	6	July 20
39	750	11	July 25
66	650	2	August 6
65	700	8	August 13
68	1650	4	August 22

(1) "Short-term movement" is the distance between the first and last observation of a brood when the period covered is less than 20 days and more than one day.

Table 4. Net Seasonal Movements of 11 Broods of Rock Ptarmigan at Eagle Creek, 1960

Brood Number	Approximate Net Distance (Feet) (1)	Days From First To Last Observation	Date of Last Observation
11	1700	22	July 14
1	7800	28	July 15
22	1300	26	July 20
6	1500	30	July 21
29	200	37	August 4
46	2750	20	August 4
7	200	45	August 5
44	4250	33	August 8
52	50	28	August 13
35	1100	39	August 14
8	1700	61	August 22

(1) "Net Distance" is defined as the distance between the first and last observation of an identifiable brood, when two or more sightings were made over a period exceeding 20 days.

that time. In contrast, several broods were seen in places less than 100 yards apart over periods of a month or longer.

From the information in Tables 3 and 4, and from other observations, it seems safe to make the following comments on the movements of rock ptarmigan broods:

1) The nest site does not attract families after hatching. In fact, hens may make an effort to lead the young away from the nest a few hours after they hatch.

2) The territory has little meaning to the hen and chicks. By hatching time there is almost no evidence of territorial behavior in cocks, and many have left the territory entirely.

3) If suitable food, good feeding conditions and concealing vegetation are present in the vicinity, the brood may stay close to the nesting site for weeks after hatching. Perhaps the hen's urge to stay in familiar areas is important here.

4) Some broods will wander considerable distances, passing quickly through areas that to all appearances would be suitable for them. Those same areas frequently harbor broods all summer, a further indication of their suitability.

5) The only over-all directional tendency noted at Eagle Creek was a shift of most (but not all) broods to places higher than the territory or nest from which they came. By late July, the most heavily-used areas were moist, sedgy saddles on ridges and between hills, usually above 3500 feet.

6) Most broods did not move more than one-half mile (net distance from late June to the first part of August).

Mortality: We tried to get three basic facts whenever we found a brood: 1) identity of the family, 2) number of young, and 3) age of the chicks. By this method, we hoped to show the actual loss of chicks in specific broods and the overall loss among many broods at given intervals of time after

hatching. The estimates of mortality begin when the chicks are about two weeks old, as it is very hard to find all of the chicks in younger broods. A trained Labrador retriever was used to locate and flush the chicks. Only counts felt to be complete are discussed here. The term "loss" is used synonymously with "mortality," as very little loss was discovered that did not result from or lead to the death of the chicks.

More young rock ptarmigan seem to be lost in the first two weeks of life (Table 5) than at any other time up to the hunting season (August 20). At Eagle Creek, where 12 nests averaged 8.2 eggs, about 1.5 chicks died per brood up to July 10. During the following month only one chick disappeared, on the average, from each family. I cannot explain the differences among the three areas from which data were obtained. All areas are within eight miles of each other, with similar topography and vegetation. The low counts at Eagle Creek in late July probably are due to the small sample and the fact that several broods were flushed without the aid of a dog.

There are several known or possible causes of the loss of chicks. Four juvenile rock ptarmigan were killed by predators and later found by us. Six young were stepped on while we searched for the members of very young broods; a few more might have died this way. Two were killed by an overanxious retriever. The accidental separation of chicks from broods, weasel predation, weather and other factors might have caused mortality unknown to us. It seems to be a general characteristic of mortality among young birds that deaths rarely occur in a way spectacular enough to be noticed; all we see is the end result of a sporadic, unnoticed attrition that lowers the average size of the broods.

The data for Eagle Creek after July 31 (listed in Table 5) include a number of counts of broods that originated off the area. If only counts of indigenous families are included (nine broods are known), the average number of chicks is 5.4 instead of 5.9. This may result from the smaller sample size of immigrant broods, or it may indicate that our intensive activities caused a noticable loss of chicks. Whatever the reason, it may be best to use the conservative figure

Table 5. Counts of Broods of Rock Ptarmigan at Eagle Creek, Yankee Creek and Harrison Summit, 1960.

Area, Date, and Age of Young	Number of Chicks Per Brood										Number of Counts	Average Number of Chicks
	2	3	4	5	6	7	8	9	10	11		
Eagle Creek, before July 10												
Chicks 2-3 weeks old				3	5	3	2		2		15	6.8
Eagle Creek, July 11-20												
Chicks 3-4 weeks old			2	5	6	6	5	1	1		26	6.5
Yankee Creek, July 12												
Chicks less than one month old				1		3	3	3	1		11	7.8
Harrison Summit, July 19												
Chicks less than one month old			2	5	3	3	1				14	5.7
Eagle Creek, July 21-31*												
Chicks 4-6 weeks old	1	1		4	2	1		1			10	5.3
Eagle Creek, after July 31												
Chicks more than 5 weeks old	1	1		4	7	2	1	2		1	19	5.9

*Investigators not on area during most of this period. Counts made mostly without aid of dog.

(5.4) for calculating productivity.

Development of Primaries: The age of young ptarmigan can be determined quite accurately (± one day) up to one month or so by means of the relative development of primaries. The method has been worked out for willow ptarmigan [Westerskov, K. 1956. Age determination and dating nesting events in the willow ptarmigan. J. Wildl. Mgt. 20 (3): 274-279.] but not, in North America, for rock ptarmigan. Our data on feather development are not complete, because we were reluctant to collect chicks at Eagle Creek, and because it was impossible to get chicks of known age elsewhere. The general pattern of primary molt and development are known well enough to be sketched here, however.

Young rock ptarmigan have only a slight external trace of primaries at hatching. Subsequent growth is rapid. The first primaries to appear are P1-P8, counting distally. I do not know the order of their growth, as they all seem to appear simutaneously. The longest primary in the first (juvenile) set is P7, with P8 considerably shorter. This gives the wing a shape much like that of adults, where P8 and P9 are long, and P10 short. Chicks can fly (weakly) when their primaries are only two inches long, at an age of about 10 days. The primaries of this first set, which are all brown, continue to grow throughout the first three weeks of life, until the longest are three inches or more in length. At about 18-20 days, P1 of the initial, brown set is dropped, and a white one begins to grow in its place. P2 and P3 are dropped in a few days. At this time, P9 and P10 begin to show for the first time: they are both white. The rest of the primaries are replaced by white ones in sequence, from P4-P8. The last brown primary, P8, is dropped when the bird is about seven or eight weeks old. The completed set of white primaries is kept by the bird until July or August of the following year.

The tail coverts of juvenile rock ptarmigan begin to grow about the 10th or 11th day after hatching, and serve - rather inefficiently - as a tail for the first two months of life. At about the time that P6 (juvenile) is dropped and replaced by P6 of the first white set (35± days?), the true rectrices begin to grow. The rectrices probably do not take

over their full function in flight until the bird is two months old or so.

The Form of P9: Various people have proposed that the ninth primary can be used to separate ptarmigan more than one from those less than one year old. Most young ptarmigan have a pointed P9, with speckles or blotches of brown on the vane; adults allegedly have rounded, clear-white ninth primaries. Preliminary studies last year showed that 158 of 164 known immature rock ptarmigan examined (96 per cent) possessed the juvenile color characteristic, but that 11 of 33 adults also had colored ninth primaries supposedly typical of young. All of the young ptarmigan handled in 1960 were studied to test the character further. Of 86 young birds seen, 71 (82 per cent) had colored and pointed P9. Twelve more had dark areas on P9, but the feathers either were definitely rounded or of intermediate shape. Considering only color, 83 (96 per cent) had dark areas on P9. Only six adults were examined that had completed their post-nuptial molt; four males had light P9, two hens had dark P9. All adults had rounded ninth primaries except for one male. Thus, the general conclusion reached last year - that the color and shape of ninth primaries are not reliable indicators of age - was borne out this year.

Two facts, as yet only of academic interest, seem to bear on the problem of the color of P9. First, males of any age tend to have less dark coloration on the ninth primaries than females. This injects a bias in samples with uneven sex ratios. Second, some evidence is accumulating that siblings tend to have similar patterns of color on P9. One of the possible "types" is the lack of color on the first white P9 of juveniles. When samples are taken, therefore, a bias results equally when members of such "non-conformist" broods are included or omitted from the sample.

Adult Mortality

Four adult cocks, four adult hens and one adult of undetermined sex were found dead and freshly killed on the study area in the spring and summer of 1960. About 88 males and 75 females were present in May and June; the nine known deaths represent only 5.5 per cent of the known adult population.

Other deaths doubtlessly went undetected. All of the known mortality occurred in May or very early June, when the males were defending territories and the hens were laying or incubating eggs. It is easier to find dead adults at that time of year than later, because at least some of the body feathers are white, and show up against the brown, undeveloped vegetation.

The remains of nine rock ptarmigan killed in the late fall of 1959 or winter of 1959-60 were found on the study area. In contrast, 69 remains were found in the same area in 1956, apparently from fall and winter kills in 1955-56. 1955 was known locally as the year in which a tremendous drop in numbers of rock ptarmigan occurred. The numbers of the species were increasing in 1959-60. It will be of interest to see whether a relationship exists in future years between population changes and apparent winter mortality.

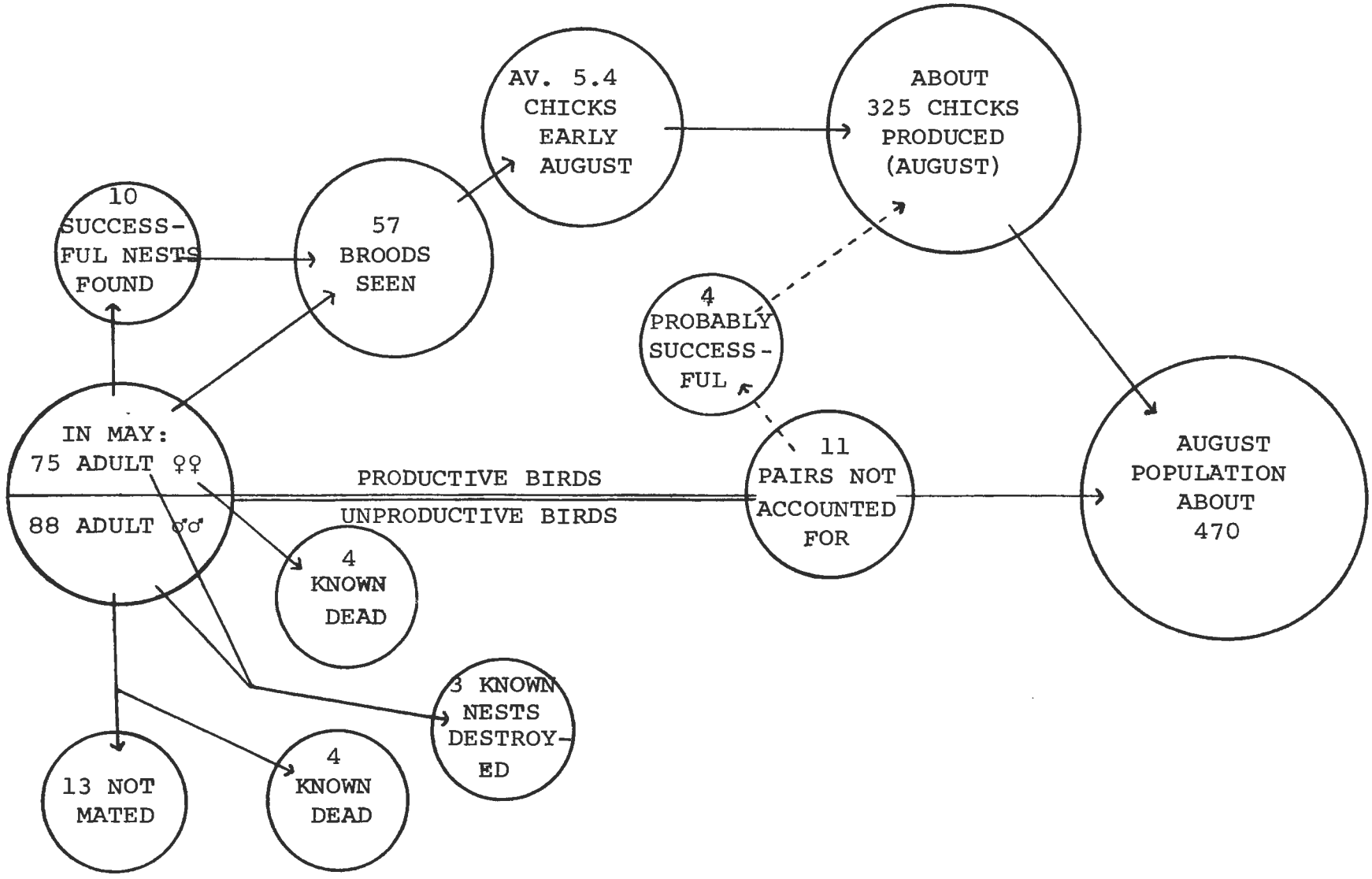
Breeding Success

The information needed to estimate productivity has been given in this report. I have summarized the information in Figure 2. The initial spring population of 163 birds contained about 13 unpaired males. The population density, therefore, was about 11 adults per square mile, or about 5 pairs per square mile. By August, with a gain of about 325 chicks and a loss of nearly 20 adults, the density had risen to 33 birds per square mile. In 1956 there were only 53 adults on the area in spring (four per square mile) and about 130 individuals (nine per square mile) in August.

Banding Studies

In July of 1953, three members of the Alaska Cooperative Wildlife Research Unit banded 301 young and 12 adult rock ptarmigan near Eagle Summit, Steese Highway. This was the first attempt to band ptarmigan in numbers in Alaska, and it still stands as the most successful single banding operation with this genus in western North America. Only 17 birds of this group were reported later: 10 immatures were shot in August and September, 1953 (most within a mile or two of the place where they were banded), and two birds banded as adults and five banded as young were shot in 1954 (also close to the

Figure 2. Summary of Productivity of Rock Ptarmigan at Eagle Creek in 1960.



banding place). Unfortunately, the studies were not continued. In 1956, five adult female rock ptarmigan, one adult hen and one adult cock willow ptarmigan were banded at Eagel Creek. Both willow ptarmigan were shot locally in September and October that year. None of the rock ptarmigan have ever been reported.

To my knowledge only one other serious effort was made prior to the present study to band ptarmigan in western North America. In the summer of 1957, I caught, banded and released 47 adult and 23 young willow ptarmigan in Chilkat Pass, British Columbia. Most were from a 3/4 square mile study area. In June and early July of 1958, six of the adults and one of the young were recaptured on the study area a maximum of 300 yards from the point of banding.

It is clear that many new things could be learned about the lives of ptarmigan from banding studies carried out at the same place over a period of years. For example, ptarmigan are thought to be monogamous, but there is no information on the length of time the pair bond lasts. We do not know whether any rock ptarmigan habitually return to the same breeding area after the wanderings of the fall and winter, nor do we know whether one sex or age group tends to be more philopatric than others. There is no information on how far ptarmigan travel from September to May. Most important to the present study, we know nothing about mortality rates, population turnover or longevity. We hope that the banding studies begun in 1960 will yield some information on all of those subjects.

Methods: It seems of first importance to band ptarmigan about which the most is known: adults residing on the study area in summer, and their progeny. The birds are scattered widely in summer, so mass-trapping techniques can not be used effectively. Fortunately, ptarmigan are sufficiently unwary in summer to be caught in hand-held or hand-thrown nets at distances up to 30 feet. We used a long-handled, aluminum-tubing net, as described on page 31. The netting was a double thickness of 1-1/2 inch gill net (unstretched measure). Usually it was possible to place the net very slowly over a sitting or standing ptarmigan and capture it without a struggle. The net did not seem to alarm most birds until

they had some experience with it, but a bird missed on the first attempt frequently could not be caught at all.

Young rock ptarmigan from 15-20 days old were tagged with numbered aluminum wing tags similar to those used on domestic chickens. When the legs of the chicks were large enough to hold a band, they were banded with No. 5 red aluminum leg bands obtained from the National Band and Tag Company, Newport, Kentucky. Willow ptarmigan were banded with silver aluminum bands.

Results: Eleven willow ptarmigan (seven of them immature birds) and 158 rock ptarmigan were banded in June, July and August 1960. Banding schedules giving information on each bird are filed at the Alaska Dept. of Fish & Game headquarters, Subport Building, Juneau. One of the immature rock ptarmigan was banded at Yankee Creek, about five air miles northwest of the study area; four young were captured at 12-mile Summit, mile 86 Steese Highway (about 15-18 air miles from Eagle Creek); 11 young and one adult were banded on Harrison Summit, six air miles from the study area; three other young were captured less than a mile from the study area. The adult cocks banded (24) represent about 25-30 per cent of those residing on the area. Because some of the adult hens (47 banded) and chicks (67 banded) caught on the study area came from outside of the boundaries, it is hard to give a comparable figure for those classes. However, at least half of the adult females that had nested on the area, and from 15-20 per cent of the young they raised, probably were banded.

The Steese Highway closed officially on October 14 in 1960, so that the effective season for ptarmigan hunting at Eagle Creek was only two months (from August 20) in spite of the general open season until April 15. In that two month period, hunters reported six bands. The returns are listed below (all dates in 1960):

1) Willow ptarmigan, band #5. Banded July 15, shot 300 yards away on September 23.

2) Rock ptarmigan:

   a) Immature, wing tag #24; banded July 6, shot on

study area August 27.

b) Adult male, band #3; banded on June 8, shot 300-500 yards away on September 25.

c) Adult male, band #8; banded June 14, shot 1/2 mile away on September 24.

d) Immature, band #82; banded July 20, shot at same location on August 27.

e) Immature, band #117; banded August 8, shot about 200 yards away on September 19.

As about 30 per cent of the resident rock ptarmigan and their progeny were banded on the study area (calculated from a total population in early August of 65 hens, 80 males and 325 young), a rough computation indicates that about 17 of the 470 birds supposedly on the area were shot by hunters. Actually, one group of hunters shot 19 in one day; bag-check data show that from 75-100 ptarmigan actually were shot on or near the area. Some of the things responsible for the low band return may be 1) a pre-season loss of banded birds through mortality or movement away from the road; 2) a dilution of the proportion of banded birds by the ingress of new, unbanded ones; 3) a disproportionately large harvest of young, of which only 67 were banded; 4) unreported bands. Whatever is responsible, it seems clear that it will be difficult to gauge hunting pressure from band returns in this area.

The fact that the band returns were obtained less than a half-mile from the point of banding, means little in terms of movement of the birds. Because most of the banding and most of the hunting was done less than a mile from the road, any birds that moved further than that probably had little chance of being shot.

Flocking and Fall Movements

At some time in June, the former need of breeding ptarmigan for semi-isolation (expressed as territorial and pairing behavior) begins to wane. By the time the chicks are a few weeks old, broods can be found in close

association; at the same time, cocks may congregate in small groups during the post-nuptial molt. These actions suggest that the social tendency of ptarmigan begins to assert itself to a slight degree in mid-summer. However, even though the birds might be ready to accept group life, some external stimulus is needed before flocks will form. I do not know what the stimulus is, but it seems to act at various times throughout August. The largest flocks at this time occur immediately after early snow storms. The first flocks (groups of birds not belonging to the same family and not clearly composed of two separate broods) were seen in 1960 as follows: August 5 (12), August 17 (14,12,11), August 19 (10), August 22 (13+), August 23 (68+), August 24 (22), August 25 (50, 17). By early September, with snow covering the ground lightly, almost all resident birds were in flocks. There were large flocks on the study area from mid-September until I left on September 28; 100 or more were seen together on September 20, 70 or more on September 22, 150 on September 23, and groups of 50-60 and 200+ on September 24. By September 28 the scene was quite wintery at Eagle Creek. Snow covered all of the higher country to a depth of eight inches, with many deep drifts, and little bare ground was present anywhere. Daytime temperatures ranged from 20-35°F.

Closely related to the increasing sociability among rock ptarmigan is a behavioral change to increased mobility. Some wandering takes place in July, but the distances moved are not great. Almost all of the movement is done on foot. As flocks begin to form, the birds become more willing to fly. By mid-September, ptarmigan need very little stimulus to take flight - the appearance of a hawk or car or person or raven, or even the "arguments" among members of the flock all might send the group sailing away - and when they fly, they frequently cover distances of more than one mile. From the size of the flocks alone, one can infer that some of its members, at least, must have traveled more than a mile, considering the size of the area required to produce that many ptarmigan.

One result of the behavioral changes just discussed (increased sociability and mobility) is that ptarmigan begin to appear in areas where they do not breed. Rock ptarmigan were seen in mid-October, 1960, on several hills (Ester Dome,

Cleary Summit) near Fairbanks, at least eight miles from the closest known breeding areas. In the fall of 1959, the same phenomenon occurred, with the first record of ptarmigan in non-breeding areas being on October 19. Rock ptarmigan were most abundant in both years (outside of their breeding places) on hilltops that approach timberline, where the country is open, with only occasional patches of shrubs or scrubby spruce visible above the snow. Scattered occurrences of the species were recorded in late October and early November in 1959 and 1960 on tailing piles in places mined extensively by dredges about 10-30 years ago; the winter aspect of the environment in such places is similar in many ways to the tundra, even though 2000 feet of elevation separate the two habitats.

Many more ptarmigan appeared in November 1960 than in the previous fall in the Tanana Valley. Almost every day, one or more persons would mention seeing ptarmigan or ptarmigan tracks in the greater Fairbanks area. The majority of the ptarmigan apparently were willow ptarmigan (although most people reported them simply as "ptarmigan"), but a few rock ptarmigan were seen as well. In general, rock ptarmigan were the more common species on the higher ridges, and willow ptarmigan more abundant in lower areas. Throughout the fall, the ptarmigan were in small aggregations of two to 15 individuals, and they seemed quite nomadic. Flocks would appear along a roadside in the afternoon gloom, like small, white figments of the imagination; in the morning only their tracks and frozen droppings would give proof of their passage. Perhaps through constant disturbance, the birds seemed more wary in October and November than earlier in the year.

As rock ptarmigan were present in the Eagle Creek area in November 1959, and late March 1960, it seems certain that not all ptarmigan move out of tundra breeding areas in the winter. We do not know what portion of the population takes part in this movement, nor what accounts for the difference in numbers seen in the wooded valleys and hills in different years.

Apparently there is some tendency for male and female willow ptarmigan of central Alaska to spend the winter in separate areas. On two trips to Murphy Dome and one to Cleary Summit (both are hills within 20 miles of Fairbanks)

in December, 1960, we collected and autopsied 22 willow ptarmigan. One was an immature male, but the rest were females (both adult and young-of-the-year). No flocks of males were located, and it is possible that cocks remain in winter at higher altitudes than females, and perhaps near the breeding grounds. If so, the harvest of hens might be greater than of cocks, as most ptarmigan hunting from November to April in interior Alaska is done at low elevations, in places where ptarmigan come close to roads.

Statewide Population Trends

Early in 1961, 160 game bird questionnaires were mailed to sportsmen, guides, professional biologists and others throughout Alaska. No attempt was made to sample specific groups of people or regions on a statistical basis; cards were sent to anyone known to us who might be able to give a reasonable estimate of numbers of game birds in a given area. Two basic questions were asked: 1) Were ptarmigan (and grouse) populations at high, moderate or low levels? 2) Were there more, the same number or fewer than in 1959? Up to April 4, 1961, 105 replies had been received. The answers are given in Table 6.

Apparently, the State as a whole had moderate to low populations of ptarmigan, considering all species together. Rock ptarmigan may be at slightly higher levels (relatively) than other species, according to the replies to the questionnaire, but the difference may not be statistically significant. As to trends in numbers, most people thought rock ptarmigan were the same as in 1959, but that willow ptarmigan were increasing.

As this is the first year of the survey, we cannot use the data to the fullest extent. The results of next year's questionnaire, when compared with this year's, should be more meaningful. It is hoped that enough people can be questioned to yield at least 200 replies in 1961, which should be enough to begin a more detailed comparison by regions of the State.

RECOMMENDATIONS:

This study of ptarmigan populations should be continued,

Table 6. Response to game bird questionnaire, section on ptarmigan, 1960.

	POPULATION IN 1960			COMPARED TO 1959		
SPECIES	HIGH	MOD.	LOW	MORE	SAME	FEWER
Ptarmigan (General) (1)	5	25	23	18	19	11
Rock	3	17	7	4	14	5
Willow	7	25	16	21	13	7
White-tailed		4	4		5	
TOTAL	15	71	50	43	51	23

(1) This column used when observer could not identify or separate each species.

with essentially the same techniques, through fiscal year 1961. It is only by gathering census data, banding returns and other information for a number of consecutive years that we can achieve the objectives of the program. I recommend maintaining Eagle Creek as the area of most intensive study, with complementary field work being done at Mount Fairplay, Denali Road, Harrison Summit, Yankee Creek and Twelve-mile Summit. Banding of resident rock ptarmigan at Eagle Summit should have high priority.

Because of the possible effect of fall hunting on locally-reared ptarmigan, more frequent checks should be made in 1961 of hunters in the vicinity of Eagle Creek. Adequate publicity should be given to the banding program to ensure that hunters look for bands on ptarmigan they kill.

If possible, winter field studies shouldbe intensified, especially in the Eagle Creek area. The benefits to be gained from additional banding opportunities, from observations of important behavior patterns, and from records of mortality, far outweigh the logistic difficulties of winter work in isolated areas.

It is recommended that the mailed-questionnaire survey be extended in coverage to include larger numbers of recipients, especially in regions that are not visited often by Department of Fish and Game personnel.

SUBMITTED BY:

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September 19, 1961

APPROVED BY:

David R. Klein
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James W. Brooks, Director
Division of Game

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1960-1961 SEGMENT

State: Alaska

Project No: W-6-R-2 Name: Alaska Wildlife Investigations

Work Plan: I Game Bird Investigations

Job No: 3-a Title: Mortality Studies of Western Canada Geese - Copper River Delta

PERIOD COVERED: July 1, 1960 to August 10, 1960

ABSTRACT:

The 1960 western Canada goose mortality studies were confined to banding a predetermined sample of at least 400 geese. This was accomplished by hand netting and use of a wire trap. In 10 days, 619 geese were captured. A comparison of methods shows that trapping is the more efficient method. Because complete banding records are not yet available to the investigator, no attempt is made to calculate the mean annual mortality rates of this population.

OBJECTIVES:

To determine the mean annual mortality rate of western Canada geese breeding on the Delta of the Copper River.

TECHNIQUES USED:

Preliminary Studies

Pilot studies begun on the Copper River Delta by the

United States Fish and Wildlife Service in 1949 pointed out the need for a better understanding of the relatively unknown population of geese breeding in this area. As a result of these studies, intensive banding of western Canada geese has been conducted every year since 1952. The value of this program became apparent when direct band recoveries of western Canada geese banded on the Copper River Delta in 1952, 1953, and 1954 gave recovery rates of 23, 19, and 18 per cent. At the end of four years, 37 per cent of the sample banded in 1952 had been returned.

It was determined from these returns that the annual hunting mortality was too great for the population to maintain itself. It also became apparent from the band returns that most of these geese were taken in a few counties situated in the Willamette Valley of Oregon. These facts prompted Fish and Wildlife Service biologists to formulate a management program designed to curb the excessive kill. Biologists knew that the western Canada goose population breeding on the Copper River Delta possessed the following characteristics: (1) nearly the entire population (young and adults) was stationary on the breeding grounds for at least part of the year, (2) the majority of these geese migrated over the Pacific Flyway to a known, restricted wintering area, and (3) most of the geese wintered and were harvested on this wintering area. These facts suggested that the Copper River Delta goose population was ideally suited to management through the use of banding samples obtained on the breeding grounds.

The Banding Area

The Copper River Delta is a flat expanse of glacial and alluvial deposits formed by the Copper River and numerous, adjacent glacial streams which discharge into the Gulf of Alaska. This flat area lies immediately east of Prince William Sound from Point Whiteshed eastward along the shores of the Gulf of Alaska for approximately 50 miles to Cape Martin. Fronting the entire shoreline of the Delta at a distance of four to seven miles offshore is a single line of sandy islands. Between these islands and the mainland shore there is an extensive, shallow bay which becomes nearly dry at low water. Beginning on the mainland shore of this intertidal bay the flats rise imperceptably from sea level and extend inland seven to ten miles to the Chugach Mountain Range.

At least five different plant communities are recognizable on the flats. However, only two of these communities, the Carex-forb and Alnus-Salix, are of any great importance ecologically to the western Canada goose. The Carex-forb community occurs as a narrow band barely jutting above the high tide level on the shoreward portion of the flats and extending inland three to four miles. This section of the flats is much dissected by winding sloughs, which drain into the estuarial tidelands. Nearly all the geese nest and gather for the summer molt within this area and along the natural dikes formed beside the many sloughs. Comparatively few geese nest in the Alnus-Salix community, but many flocks molt in these areas. Banding operations over the intra-tidal area of the flats were conducted in both vegetative types.

The Banding Operation

The goal of the 1960 operations was to capture at least 400 western Canada geese. A crew of three men equipped with an outboard-powered skiff, dip nets, and trap materials accomplished this goal. In 10 days the banding crew was able to capture 619 geese by using the following methods: (1) pursuit on foot with dip nets, and (2) a wire trap. A shortage of bands restricted the total geese banded to 500 birds of which 75 adults and 425 were locals.

The task of patrolling the vast tidal areas of the Copper River Delta with an outboard-powered skiff and pursuing flocks of geese by foot is an unrewarding chore. Moreover, the small return in terms of birds banded per man-hour suggested that a more efficient method of capture was needed. This prompted the construction of an experimental trap at the mouth and on the east bank of Walhalla Slough.

The trap was placed on a narrow neck of land separating the bay from a large tidal lake. This area was known as a natural goose portage and probably was a good location for a stationary trap. The holding pen or pot was built approximately 150 yards from the beach with 200-yard wings leading at a 60° angle towards the high water mark of a gently sloping beach. Three- and four-foot wide rolls of 1-1/2 inch poultry wire were used to make the wings and pot. Dry, two- or three-inch poles of spruce and hemlock were driven into the ground

to secure the wire in an upright position and also to strengthen the pot.

The entrance to the pot was formed by a four-foot extension of the wings converging into the heart-shaped pot until they were one-foot apart. This entrance was possibly too small, since the geese were noted to have some difficulty entering the trap and visibly queued up at the throat of the wings. A 24-inch opening probably would be more desirable in a trap of this type.

Just before high water a small flock of geese was driven from the landward side of the trap towards the open bay. A skiff was then used to drive the geese onto the beach and into the funnel formed by the trap wings. This was accomplished easily by presenting the port side of the skiff obliquely to the geese in order to turn the flock to the left or the starboard quarter to turn them to the right. In their escape behavior the geese seemed to anticipate the directional movement of the boat and tended to move in an opposite direction. While driving geese with the boat it was best to proceed at trolling speed close enough to the geese to force them to keep moving, but not so close as to alarm them unduly. If the geese were pursued too closely they often began to dive and scatter, forcing the pursuer to draw back to allow the geese to regroup. When the geese reached the shore the remainder of the drive was completed on foot. After all the geese entered the pot the trap entrance was blocked and the geese were removed with dip nets. One drive, on July 25, netted 206 geese.

FINDINGS:

The 1960 Population

A substantial increase over populations of the past three years was obvious during the July, 1960, banding activities. An estimated 1000 to 1500 geese were noted in Glacier and Tiedeman Sloughs where in previous years I have observed much smaller flocks. On July 24, 1960, during the course of one tide (approximately 6 hours), eight different flocks of from 200 to 500 geese were observed in the Castle Slough, Grass, and Story Island areas. Previous sight recordings of geese in those areas have never exceeded four

flocks over a comparative period of time. An estimate of the numbers of flightless western Canada geese seen during a 10-day period in 1960 is presented in Table 1. In all, western Canada goose production on the Copper River Delta appeared good with a noticeable increase over the 1957, 1958, and 1959 populations. As a result of this increase and improved trapping methods, nearly twice as many geese were captured in some places in 1960 as in any previous year.

Comparison of Capture Methods

A total of 15 man-hours was required to construct the trap and an additional 10 man-hours were needed to drive and band the geese. This represents an average of 8.0 geese trapped per man-hour in comparison to 3.7 geese per man-hour by hand capture, as presented in Table 1. The time element is an important consideration where work periods are restricted to times of high tide. Therefore, it is reasonable to adopt a method utilizing these tides to the best advantage. It is possible for a crew to construct a trap on low tide and drive geese on the flood tide. A crew using the hand method of capture must wait for high water and is limited to an average work period of four hours.

These data suggest a trap is more effective; moreover, the permanent construction of two of these traps would enable a crew of three men to band an adequate sample of geese in a few tides. The cost of wire replacement from year to year would be minor in comparison to the money saved in salaries, gas, and maintenance of equipment involved in a hand banding operation.

Calculation of the Mean Annual Mortality Rate

No attempt was made to calculate the annual mortality rate of the Copper River Delta goose population because the returns from the 1960 banding sample were still incomplete. When these returns become available the mortality rate for the 1960 sample will be calculated. Computation of the mean annual mortality rate of a given population requires band returns from a number of cohorts banded over a period of years. At this time it is possible to calculate a mortality rate for each age class and to figure an average mortality rate for the population.

Table 1.

Western Canada Goose Population Estimates and the Results of the 1960 Banding on the Copper River Delta

Date	Area	No. Flocks	Estimated Numbers	Man Hours	Method Hand Net[a]	Method Trap[b]	No. Geese Caught
July 14	Tiedeman Glacier	6	1200	13.5	X		76
July 15	Pete Dahl Gus Steven Walhalla	4	1000	18.0	X		60
July 16	Whiskey Pete to King Salmon	3	400	12.0	X		6
July 19	King Salmon Pete Dahl	3	250	15.0	X		40
July 20	Whiskey Pete	2	150	13.5	X		13
July 21	Big Copper	2	200	3.0	X		26
July 22	Big Glacier Little Glacier Tiedeman	8	1500	17.0	X		100

Table 1 (continued)

Date	Area	No. Flocks	Estimated Numbers	Man Hours	Method Hand Net[a]	Method Trap[b]	No. Geese Caught
July 23	Walhalla	0	0	15.0		X	0
July 24	Story Slough Grass Island	6	1500	18.0	X		92
July 25	Walhalla	1	200	10.0		X	206

a. $\frac{413 \text{ geese}}{110 \text{ man hours}} = 3.7$ geese/man hour

b. $\frac{206 \text{ geese}}{25 \text{ man hours}} = 8.0$ geese/man hour

RECOMMENDATIONS:

The Copper River Delta goose population is the only group of waterfowl in North America that is now being managed through the use of band recovery data. For this reason it seems advisable to continue banding a given sample of geese each year. Moreover, this task is much simplified from the experience of nearly ten years banding and can be accomplished in a minimum of time and with relatively little expense.

At present the lack of a sufficient number of personnel in the State Waterfowl Division and previous commitments precludes further field participation on this project. Therefore, it is suggested that another agency be contacted to conduct the annual goose banding project. Perhaps it would be possible for one of the states within the western Canada goose wintering area to supply the personnel for a two week banding operation each summer.

SUBMITTED BY:

Peter E. K. Shepherd
Game Biologist
October 10, 1961

APPROVED BY:

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ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1960-1961 SEGMENT

State: Alaska

Project No: W-6-R-2 Name: Alaska Wildlife Investigations

Work Plan: I Game Bird Investigations

Job No: 3-b Title: Distribution and Abundance of the Black Brant in Alaska

PERIOD COVERED: July 1, 1960 to June 30, 1961

ABSTRACT:

A reconnaissance of the brant populations from Cape Lisburne to the Colville River Delta was conducted in late June and early July of 1960. The only significant breeding populations of brant noted during this survey were found between Point Barrow and the Colville River Delta. Forty-four active nests were located on the Colville River Delta; an additional 30 nests were reported on Pitt Point. The average clutch size of 32 nests was 4.0 eggs. Seven broods averaging 3.0 goslings were counted.

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.

TECHNIQUES:

Aerial reconnaissance flights were made in Cessna 180

aircraft at altitudes ranging from 200 to 1,500 feet. These transects followed the coast and some were flown as far as 25 miles inland. The coastal habitat was covered extensively, while further inland the coverage was more random. It was discovered that flights over ten miles from the marine areas were unnecessary because few brant occurred that far inland.

A limited nest study was conducted on the Colville River Delta and consisted largely of a random search in the main nesting areas. Records were kept of each nest history and a general habitat description was given. Brood counts were made in conjunction with the nest studies.

FINDINGS:

Black brant are known to be summer residents along the Arctic Coast of Alaska east to the Perry River, District of Mackenzie and north to Prince Patrick Island, District of Franklin. Little is known concerning the breeding populations of these birds and of their importance to the west coast brant population. In order to estimate numbers and determine the distribution of these arctic brant, a reconnaissance of the brant populations from Cape Lisburne to the Colville River Delta was conducted in late June and early July of 1960. Aerial flights revealed that the only significant brant breeding populations within the limits of this area were situated between Point Barrow and the Colville River Delta. Nearly four hundred brant were located along the shoreline habitat and up to ten miles inland. A few scattered groups of brant were found as far as 25 miles inland.

Nesting studies on the Colville River Delta resulted in the discovery of 44 active nests. An additional 30 nests reported from Pitt Point brought the total of known nests to 74. Thirty-two of the Colville nests, on which data are available, held an average of 4.0 eggs per clutch. Few nests had hatched at the time of the survey and only seven broods (averaging 3.0 goslings) were counted.

RECOMMENDATIONS:

Work should be continued on this phase of the black brant project, especially south along the west coast of Alaska from Cape Lisburne to Bristol Bay.

SUBMITTED BY:

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November 14, 1961

APPROVED BY:

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Volume 2 Report No. I-3c

ANNUAL REPORT OF PROGRESS
INVESTIGATIONS PROJECT
COMPLETION OF 1960-1961 SEGMENT

State: Alaska

Project: W-6-R-2 Name: Alaska Wildlife Investigations

Work Plan: I Game Bird Investigations

Job No: 3-c Title: Production, Harvest, Distribution, and Migration of Waterfowl in Alaska

PERIOD COVERED: July 1, 1960 to June 30, 1961

ABSTRACT:

Minto Lakes nesting conditions appeared excellent in 1960; however, a scarcity of puddle ducks was apparent during mid-summer. American widgeon were the only exception to this decrease. It is suggested that the drop in puddler broods may be related to a reduced breeding population. Seventy-five Class II broods averaging 6.6 young were counted on a 25-square mile study area. Nine hundred and seventy-three ducks were banded, 652 in wire diver traps, and 321 in baited traps. Banding ratios and hunter bag checks at Minto Lakes revealed that the late summer resident and fall migrant flocks were composed of adult females and young. Hunter success was good at Minto Lakes. One hundred and ten hunters had an average bag of one goose and three ducks. A survey of established hunting camps and potential camp sites was made to evaluate the status and future potential of these facilities.

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.

3. To determine the harvest of waterfowl by licensed hunters in Alaska.

TECHNIQUES USED:

Brood Counts

Previous commitments and a late start limited waterfowl production studies in Alaska during the past summer. However, brood counts were made on the Copper River Delta, Minto Lakes, and other areas. All these counts, except those made at Minto Lakes, were incidental to other work.

A 25-square mile study area established by Hinman and Shepherd (1953) for production surveys provided a basis for comparing brood counts with previous years. An effort was made to count all broods within this area, but by the time our surveys were made most of the puddle ducks had begun to fly and many broods were no longer intact. The bulk of the counts were made from an outboard-powered skiff, others by "rat" canoe, and some while walking around the edges of lakes and ponds. Broods were observed with 7-power binoculars and a 20-power spotting scope. Duckling ages were determined by feather development as described by Gallop and Marshall (1954).

Banding

During the summer a special effort was made to perfect methods of trapping diving ducks, especially for those areas where portable equipment was needed. The banding crew was transported in a 12-foot aluminum skiff powered by a 10-horsepower outboard motor. Materials for construction of traps were placed in a 17-foot aluminum canoe which was towed behind the skiff. A 10-foot canvas "rat" canoe was carried in the skiff.

Trap materials consisted of 600 feet of 4-foot, 2-inch mesh chicken wire, 150 feet of 6-foot wire, twenty 10-foot

aluminum poles, and a number of spruce and willow poles. In general, traps were built near the shoreline along a shallow (1 to 3 feet), pondweed-free beach. A pot, 8 feet by 6 feet was erected within 20 to 60 feet of the shore. Spruce poles driven into the bottom at 2-foot intervals served to hold the pot wire upright and strengthen it at the same time. A heart-shaped pot with the tapered part pointing to the rear was found to be best. On each side of the pot wire wings were extended in a "V" shape, with the apex of the "V" leading into the pot. The wing leading to the shore was short, while the other, or offshore wing, often exceeded 300 feet in length. A slight hook in the outside wing helped to shunt birds back into the wing when they attempted to escape around the end. A drawing of the typical diver trap is presented in Figure 1.

Upon completion of a trap all personnel participated in the drive. This was accomplished by working behind the flocks of molters and then slowly motoring or paddling in their direction, thereby gradually forcing the ducks to retreat towards the trap. Near the trap the drive became more difficult, but with care the birds could be maneuvered back and forth until they were within the wings. At this time it was necessary to detail one person to the end of the outside wing while the others slowly drove the ducks into the vestibule at the apex of the wings. When all, or most of the ducks, had entered the pot it was blocked and we immediately began to remove the occupants with dip nets. If the ducks were left in the pot and only removed as needed, losses from shock and exposure became excessive; therefore, burlap sacks were used to hold the ducks prior to banding. The sex, age, species, and band number were recorded in waterproof field notebooks.

Later in the summer some experimental bait traps were constructed in order to evaluate their use for the capture of teal, mallards, and pintail. These traps are easily made and consisted of the following materials: Two 18-foot sections of 5-foot, galvanized, heavy 2-inch mesh chicken wire, a 12 by 8-foot section of light, 2-inch chicken wire, and four 6-foot wood stakes. Each end of the heavy wire sections was bent into a half circle with about eight feet of straight side. The two sections were placed together and staked securely at both ends of the straight sides. A

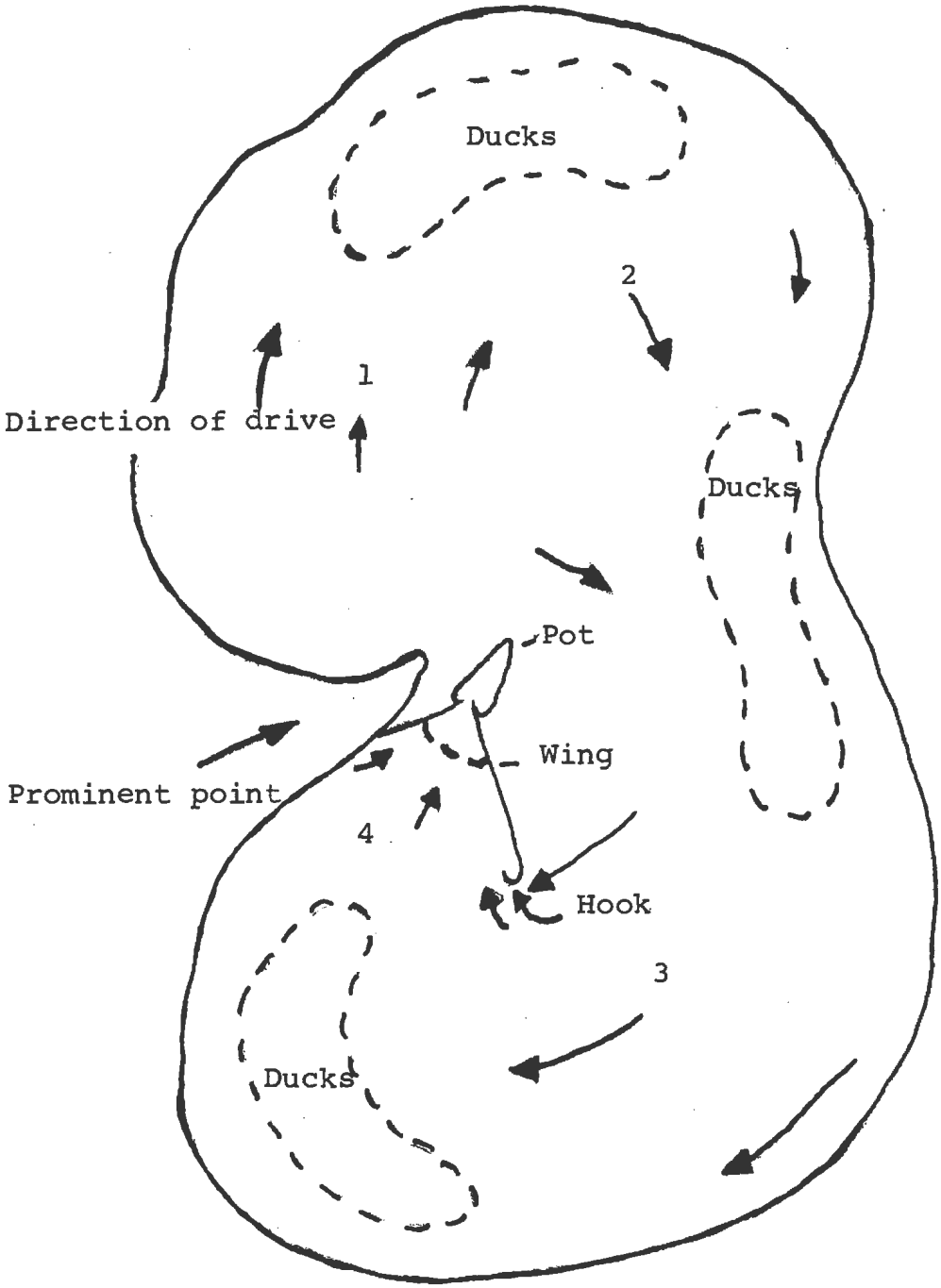


Figure 1. Drawing of Diver Trap and Typical Drive Pattern.

5-inch space was left at the waterline, where the half circles of each section touched; this served as an entrance. The 12 by 8-foot section of light wire was placed over the walls of the trap and tied securely with string. Figure 2 is a drawing of the complete trap.

Trap sites were chosen in shallow water (3 to 5 inches) over hard sand or mud bottom. This choice was important for two reasons: (1) the ducks must be able to see the grain, and (2) the grain must remain on the bottom to facilitate feeding. Twenty-five pounds of soaked feed wheat were placed in front and inside both entrances to the trap. This bait needed renewing each day.

The traps were visited twice daily and the birds removed by driving them into a portable holding pen placed at one entrance to the trap. The pen was made of 1/2-inch mesh hardware cloth 12 inches wide, 36 inches high and 48 inches long fastened with hog rings. Wire windows cut into one side of the pen gave access to the birds.

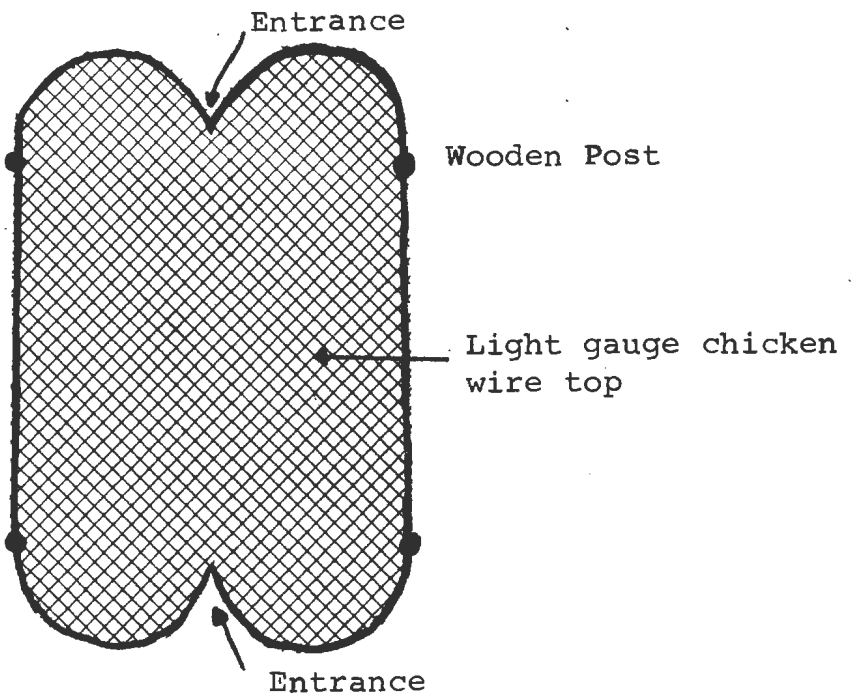
Bag Checks

Hunter bag checks were conducted at Minto Lakes beginning with the opening of the waterfowl season, September 1. Checks were made with the aid of an outboard-powered skiff after the morning flights and again in the evening at the various duck camps. Birds were examined to determine species, age, and sex. A record was also kept of the date, area, and number of hunters. No attempt was made to evaluate crippling loss, but hunters were asked if they used a dog. Some time was spent discussing harvest techniques with each hunter.

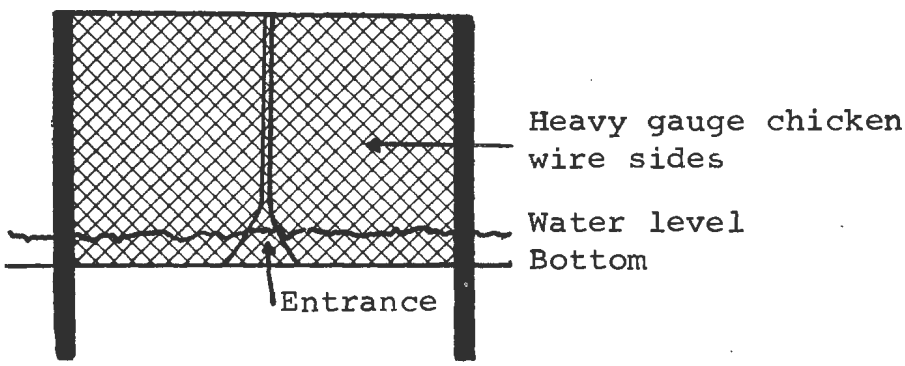
Camp Site Surveys

A survey of the permanent duck camps and their owners was made to detemine the number of recreational and commercial sites at Minto Lakes. An attempt was also made to estimate a total seasonal harvest by various camps. In addition, a brief reconnaissance of potential camp sites gave some insight to the future potential of facilities.

TOP VIEW



END VIEW



Scale: 1/4" = 1'

Figure 2. Drawing of a wire bait trap.

FINDINGS:

Production Surveys

The scarcity of certain puddle ducks, especially mallards, pintail, and above all, green-winged teal, was apparent during the brood census of Minto Lakes and other areas. Results of these counts are presented in Table 1. Shovelers were far less abundant on the Copper River Delta than they were in 1959. Widgeon were the only exception to the general puddler decrease. This species led all others in terms of relative abundance, and more broods were produced in the Minto Lakes area than previous census counts indicate. Divers, especially scaup, fared well and no change in numbers was noticed in the Minto area. Canvasback broods were seen frequently at Minto, and it appears that this species is increasing locally.

It is impossible to be certain of the reason or reasons for the apparent poor dabbler production. However, if a nesting failure occurred, it certainly was not evident in the comparison of average brood sizes for 1959 (see United States Fish and Wildlife report to the Pacific Flyway, November 1960). Furthermore, the conditions for nesting and brooding during the past season seemed excellent and gave little reason to suspect excessive nest or brood losses. A possible factor behind the low dabbler production might have been a reduced breeding population in 1960 that was not detected in the aerial breeding pair counts.

Western Canada goose production on the Copper River Delta appeared good with a noticeable increase over the 1957, 1958, and 1959 populations.

Banding

Encouraging results were obtained through the operation of the wire diver traps at Minto Lakes. Six hundred and fifty-two ducks were captured in less than one week of operation. Previous banding crews of five personnel, working 18-hour days, have never been able to capture over 400 birds in 10 days of trapping. Moreover, census figures during the more successful banding in former years indicate higher populations at these times. Based on this evidence

TABLE 1

Average Brood Size
1960

Species	Minto Lakes	Copper River Delta	Other
Mallard		2(8.5)	
Pintail	3(5.0)	5(5.4)	1(7.0)
Widgeon	19(6.2)	2(8.0)	
Shoveler	8(6.6)	5(4.6)	
Green-winged teal	1(8.0)	1(6.0)	1(4.0)
Blue-winged teal		1(5.0)	
Scaup	39(7.0)		2(6.0)
Canvasback	3(5.3)		
White-winged scoter	2(6.5)		1(5.0)
Goldeneye			2(4.0)
Oldsquaw			1(6.0)
Merganser			2(5.5)
TOTAL	75(6.6)	16(5.8)	10(5.3)

it would seem that the present trapping methods are more efficient. Just as important is the fact that wire traps may be set up and transported much more rapidly than a cumbersome net trap.

Banding studies in the past have shown that mallards, teal, and pintail are not easily caught by driving or hand banding; therefore, a concerted effort was made to develop better techniques for their capture. The portable wire traps, baited with feed wheat were found to be most efficient late in the summer. Testifying to this efficiency was a catch of 321 dabblers taken in a one-week period. These results were attained by one operator using three traps and 450 pounds of bait. (Table 2)

Examination of incomplete band returns indicated that most of the puddle ducks banded at Minto Lakes travel along the Pacific Coast, principally through British Columbia, Washington, Idaho, Oregon, and California. Many puddle ducks raised in the Minto Lakes are found during the winter as far south as Mexico and Central America. The scaup (lesser and greater) apparently prefer to spend the winter months along the Atlantic Coast, although some lesser scaup have been recovered on the Pacific Coast.

At present band returns from Minto Lakes suggest the local take of ducks is light. For example, only 7 banded ducks were recovered by hunters at Minto from the 1960 sample of over 900 marked birds. This represents about 1 per cent take; whereas, the average annual direct recovery of banded waterfowl is often 12 per cent or more of the total sample.

Of note are the age and sex ratios of the bait-trapped ducks presented in Table 3. I found only eight males in a sample of 303 ducks. While this observation supports a known fact, i.e., male waterfowl molt early and then depart in sex-seggregated flocks, it also has some bearing on the composition of the local and migrant waterfowl prior to the hunting season. Further discussion of this feature will follow in the section on bag checks.

Table 2. Summary of Banding, 1960.

Species	Male			Female			Not Sexed		
	Ad.	Im.	Loc.	Ad.	Im.	Loc.	Loc.	Unident.	Total
Mallard	1		3	1		7	2		14
Pintail	9	44		118	51	2	3	41	268
Widgeon	19		48	40		63	7	5	182
Green winged teal		24		49		22	2	3	100
Blue-winged teal		3		2	2				7
Shoveler			21	1		29	4		55
Canvasback			2	4		7			13
Scaup	29		103	27	1	99	4	2	265
Goldeneye				3					3
Bufflehead	23			43					66
TOTAL	81	71	177	288	54	229	22	51	973

TABLE 3

Sex and Age of Bait-trapped Ducks
August 20, 1960 to August 31, 1960
Minto Lakes, Alaska

	Adult		Immature		Local	
Species	♂	♀	♂	♀	♂	♀
Mallard	1	1	2	7		1
Pintail	7	79	41	56		
Shoveler			1			
American widgeon			1	1		
Green-winged teal		29	25	19		
Blue-winged teal		2	3	2		
Scaup				1	1	2
Canvasback						1
TOTAL	8	111	73	86	1	4

Bag Checks

A complete check of all waterfowl hunters at Minto Lakes is physically impossible for one or more of the following reasons: (1) airplane hunters can enter and leave the marsh anywhere and at any time, (2) some camps cannot be reached by boat, and (3) a number of check stations would be needed to check the returning hunters. Nevertheless, during the first three weeks of the duck season 110 hunters were checked. These hunters took a total of 105 geese and 350 ducks, or approximately one goose and three ducks per hunter. I estimate that about 50 per cent of the duck hunters were interviewed. An estimated kill of 700 ducks and 200 geese is calculated by applying this percentage of hunters to the total bag of all hunters checked.

American widgeon, pintail, and mallards composed over 75 per cent of the kill. These species were followed numerically in importance by shoveler, teal, scaup, and bufflehead. Hunters shot four Canada geese for every white-fronted goose downed. The low water levels which exposed many mud bars and an abundance of food were no doubt partly responsible for some excellent goose hunting at Minto. In addition, concentrated flights of widgeon commencing about September 9 bolstered bags measureably.

The take of waterfowl, especially geese, could have been much greater if hunters in this area were more proficient. Conversation with a number of hunters revealed that many were unaware of more efficient harvest methods. Little to no use is made of decoys and duck calls. Most hunters prefer to jump shoot or pass shoot waterfowl in this area. The results of these hunting techniques are reflected in the preponderance of dabblers in the hunter bag checks (Table 4). Divers, as the reader will note, are conspicuously absent from the harvest figures. This I believe is not really a reflection of abundance, but one of hunting techniques and reluctance to take "fish" ducks. Indeed, if hunters used decoys in combination with calls I would expect a measurable increase in the take of divers and geese.

It will be noted in Table 5 that not one adult male

Table 4. 1960 Minto Waterfowl Bag Check Data

September	No. Hunters	Can. Goose	W. F. Goose	Mallard	Pintail	A. Widgeon	G. W. Teal	Shoveler	Scaup	Bufflehead	Canvasback	W. W. Scoter	Goldeneye	Unident.	Total
1	19	8	6	6	17	13	8	12	1	0	0	0	0	0	71
2	10	12	7	10	4	5	4	3	2	0	1	0	0	4	52
3	6	8	2	2	1	0	0	3	0	0	0	0	0	7	23
4	3	5	6	6	6	0	0	0	0	0	0	0	0	0	23
5	3	7	0	3	2	0	0	3	0	0	0	0	0	0	15
6	2	0	0	0	2	2	0	0	0	0	0	0	0	0	4
7	2	0	0	0	0	1	0	0	0	0	0	0	0	0	1
9	10	1	0	0	6	14	0	11	1	0	0	0	0	0	33
10	7	2	0	0	3	18	2	1	1	0	0	0	0	0	27
11	23	37	0	4	1	12	1	0	0	1	0	0	0	60	116
12	1	0	0	0	1	4	0	0	0	0	0	0	0	0	5
13	1	1	0	0	0	1	0	0	0	0	0	0	0	0	2
14	1	3	0	0	1	0	0	0	0	0	0	0	0	0	4
15	5	0	0	1	0	3	0	2	0	7	0	0	1	0	14
16	6	0	0	7	3	8	1	0	1	1	3	1	1	0	26
17	4	0	0	0	0	11	3	3	0	0	0	0	0	0	17
18	2	0	0	0	0	4	0	0	0	0	0	0	0	0	4
19	5	0	0	3	2	2	1	1	3	0	0	0	0	8	20
T.	110	84	21	42	49	98	20	39	9	9	4	1	2	79	457

TABLE 5

Sex and Age, Minto Lakes Bag Checks

September 1, 1960 to September 19, 1960

Species	Adult		Immature	
	♂	♀	♂	♀
Mallard		4	5	8
Pintail		5	8	8
American widgeon		5	28	34
Shoveler		1	5	6
Green-winged teal		2	3	2
Greater scaup			3	2
Lesser scaup			1	
Bufflehead		1		
Canvasback			1	2
Goldeneye		1		
Canada goose	1	5	4	8

duck was checked out of 135 birds sexed and aged at Minto. These data suggest that most or all of the adult males had departed and flown south or had migrated over different flight lanes. It also appears from the banding data (page 69) that most of these males left the Minto area at least one week before the hunting season. Management-wise, these observations have wide-ranging implications, since recent studies have shown that local populations can be "burned out" by continued gunning of local and adult females. At present this is probably of small importance at Minto, but might become a problem with increased gunning pressure. Before any conclusions can be drawn it is necessary to answer the following questions: (1) was the phenomenon as observed in 1960 typical of every fall?, (2) what proportion of the females is composed of local ducks?, (3) was the trapping conducted over too limited an area?, and (4) is this flight typical of the fall composition of waterfowl departing the interior marshes?

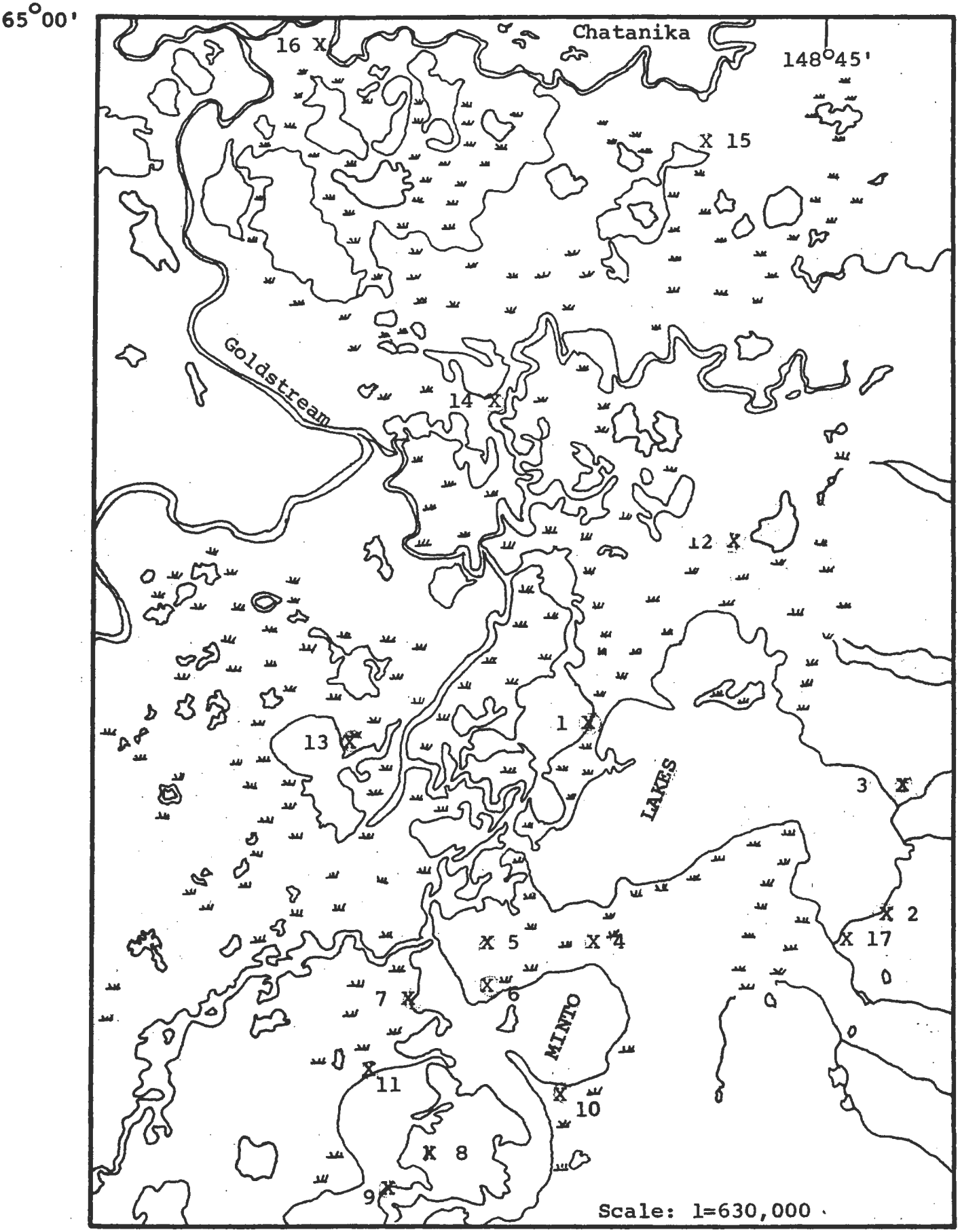
Camp Site Surveys

At present there are 14 frame or log type dwellings being used for recreational hunting and fishing in the Minto Lakes area (Figure 3). Titles are held on only seven of these lots, one of which is an 80-acre commercial withdrawal (Site 10). A number of tent sites are utilized each year, but only two (Sites 11 and 12) are on improved locations.

There are few timbered sites left within reasonable distance of the lake that are suitable for future construction. However, about two miles of grassy shoreline on the east side of Minto Lake could provide temporary camp sites. In addition, there are a number of sites (without timber) located along the outlet channel leading from Minto Lake to Goldstream.

Preliminary investigation of the waterfowl management, research, and public recreational values of Minto Lakes renewed the opinion of others that this area is well suited for these purposes. Moreover, there appears to be no reason to doubt that this area is not manageable on a multi-purpose basis. It is also apparent that some restrictions governing vehicular travel within the Minto area are

Figure 3. Map of Minto Lakes area showing location of recreational hunting and fishing camp sites.



warranted. There has already been considerable damage to vegetation by track vehicles, and at present the operation of airboats seems undesirable from a disturbance standpoint.

RECOMMENDATIONS:

Studies of the Minto Lakes ecology with emphasis on application of the findings to a marsh management program are needed. Perhaps some means, if compatible with the existing habitat, can be devised to promote a more stable waterfowl and fur production. This could include investigations into the feasibility of low dams to regulate water levels. Our knowledge concerning the importance of Minto Lakes as a resting and feeding habitat for migrant ducks and geese needs to be enlarged. Moreover, it is imperative that we know more about hunter harvest and the impact of this hunting on the local population. For these reasons, it is suggested a more comprehensive and long-range program be developed for the Minto Lakes area, possibly through coordination with the University of Alaska and the Alaska Cooperative Wildlife Research Unit.

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