R. O. SKOOG
file

ALASKA DEPARTMENT OF FISH AND GAME

JUNEAU, ALASKA

STATE OF ALASKA
William A. Egan, Governor

DEPARTMENT OF FISH AND GAME
Walter Kirkness, Commissioner

DIVISION OF GAME
James W. Brooks, Director
Don H. Strode, P-R Coordinator

GAME BIRD INVESTIGATIONS

by

Peter E. K. Shepherd
Robert B. Weeden

Volume III
Annual Project Segment Report
Federal Aid in Wildlife Restoration Act
Project W-6-R-3, Work Plan I

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

(Printed May 1963)

TABLE OF CONTENTS

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

Project: W-6-R-3 Name: Alaska Wildlife Investigations

Work Plan: I Title: Game Bird Investigations

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

PERIOD COVERED: July 1, 1961 to June 30, 1962

ABSTRACT

Replies to the annual game bird questionnaire indicated that game bird numbers improved slightly throughout the State over 1960, although populations were still at low to moderate levels. Ruffed and sharp-tailed grouse received the lowest ratings, and willow and white-tailed ptarmigan the highest. There was little variation in the assessment of grouse populations in the three arbitrary regions established for this analysis. Ptarmigan seemed to be more abundant in northwestern and western Alaska (Bristol Bay to Kotzebue Sound) than elsewhere. An experimental census of sharp-tailed grouse was made early in May along several roads in the vicinity of Tok, eastcentral Alaska. In total, 104 miles of road were covered and 39 grouse were recorded (0.37 grouse per mile). The count will be made again in 1962 to improve the methods used and to get a check on population levels of the species.

RECOMMENDATIONS

The game-bird questionnaire, sharp-tailed grouse census and specimen-collection programs should be continued in 1962-1963. Distribution records should be compiled as received, and more intensive efforts should be made to get more records of the occurrence of some species (particularly of blue grouse north of the Wrangell Mountains and in certain parts of Southeastern Alaska, and of ruffed grouse south of the Alaska Range).

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

Project: W-6-R-3 Name: Alaska Wildlife Investigations

Work Plan: I Title: Game Bird Investigations

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

PERIOD COVERED: July 1, 1961 to June 30, 1962

OBJECTIVES

To determine the distribution of grouse and ptarmigan in Alaska; to describe the general types of vegetation and terrain used by each species; to determine the relative abundance of each species in various parts of its range in Alaska; and to record annual changes in abundance of upland game birds.

TECHNIQUES

There were no basic changes in the techniques used this year to get information on the distribution and abundance of grouse and ptarmigan. The card-questionnaire on abundance was mailed late in November 1961, and a reminder was sent to people who had not replied by January 15. Index values were calculated as explained in the report for 1960-1961 (W-6-R-2, P.R. I-1). The replies were analyzed by regions set up in the report cited.

A census of sharp-tailed grouse was conducted in the vicinity of Tok, Alaska, in May 1961. As some sharp-tails in that area habitually use roadsides for courting, it was believed that a standardized count along the roads would indicate annual changes in populations. Five routes were

established, and each was censused three times between April 30 and May 14, 1961. The routes counted were: 1) Taylor Highway milepost 46-56; 2) Taylor Highway, milepost 16-20; 3) Alaska Highway, milepost 1313-1303.5; 4) Alaska Highway, milepost 1315.5-1325; 5) Slana-Tok Highway, milepost 117-123.5. The counts were started each morning before sunrise. The observer drove to the starting point (attempting to have the sun at his back while driving), got out of the car and recorded all sharp-tailed grouse seen or heard in three minutes. Stops were made at half-mile intervals thereafter to the end of the line. The routes were censused on two consecutive mornings on the following dates: 1) April 30,May 1; 2) May 7, 8; 3) May 13, 14.

FINDINGS

Distribution

This phase of the project received less attention this year than last, partly because more work was done on the abundance of gallinaceous birds. A lengthy manuscript on the ecology and distribution of ptarmigan was re-written, submitted to a number of people for criticism, and sent to the Arctic Institute of North America for review and publication.

I have received persistent reports of blue grouse being seen in Alaska on the north slope of the Wrangell Mountains near the Canadian boundary. These reports, from professional guides, have not been substantiated by specimens. If the species does occur there, it will be the first record for Alaska north of the Glacier Bay area. A few blue grouse live in southwestern Yukon, west of Whitehorse and south of Kluane Lake, about 200 miles from the area where they have been reported.

A few records of white-tailed ptarmigan on the northern slopes of the Alaska Range were received from other biologists, substantiating the suspected occurrence of the species in that area.

Abundance

The game bird questionnaire was mailed late in November 1961 to 327 residents of Alaska, including all registered guides and most professional biologists. Replies were received from 156 people (48 per cent) up to January 15. On January 18 a reminder was sent to those who had not replied, and subsequently ten more replies were received. Some people sent in

more than one card because they reported on more than one area; the total number of cards returned was 190. In 1960 only 106 cards were available for analysis.

All data from this survey are tabulated for the State as a whole and by regions in Appendix I. Index values for replies in 1961 are shown in Figure 1, and a comparison of index values for 1960 and 1961 is shown in Table 1. Current regional ratings and regional comparisons between 1960 and 1961 are given in Figure 2 and Table 2.

The current assessment of game bird populations by hunters, guides and biologists can be summarized briefly. First, all species were thought to be at low to moderate levels of abundance in 1961. Lowest ratings were given to ruffed and sharp-tailed grouse, highest to willow and white-tailed ptarmigan. Second, nearly all grouse were said to be as abundant as in 1960, whereas ptarmigan were thought to have increased slightly. Third, there was little variation in alleged population levels of grouse from region to region. Ptarmigan, on the other hand, seemed to be more abundant in western and northern Alaska than in eastern, central or southeastern sections of the State. The greatest increases over 1960 were reported among ptarmigan in the Bristol Bay, Yukon-Kuskokwim Delta and Kotzebue Sound areas.

It is, perhaps, too early in the project to be sure just what the survey data mean, how intensive an analysis they will support, and how accurately the questionnaire measures populations. Certainly, replies to the first question asked (Are game birds at high, moderate or low levels of abundance?) give no information on absolute densities. Each respondent is merely indicating where grouse and ptarmigan are at the moment along a vaguely-defined curve or range of abundance that he has formed over the years from casual observations or from conversations with other people. Frequently, in fact, that curve of abundance was formed in the past when the person lived in some other part of Alaska or in some other state. As far as individual reports are concerned, therefore, perhaps all we can expect is that when game birds are extremely abundant or practically absent, "high" or "low" answers will be given on the card. At all other levels, the tendency probably would be to check the "moderate" column.

The usefulness of answers to the second question (Are there more, the same number, or fewer than last year?) is even more

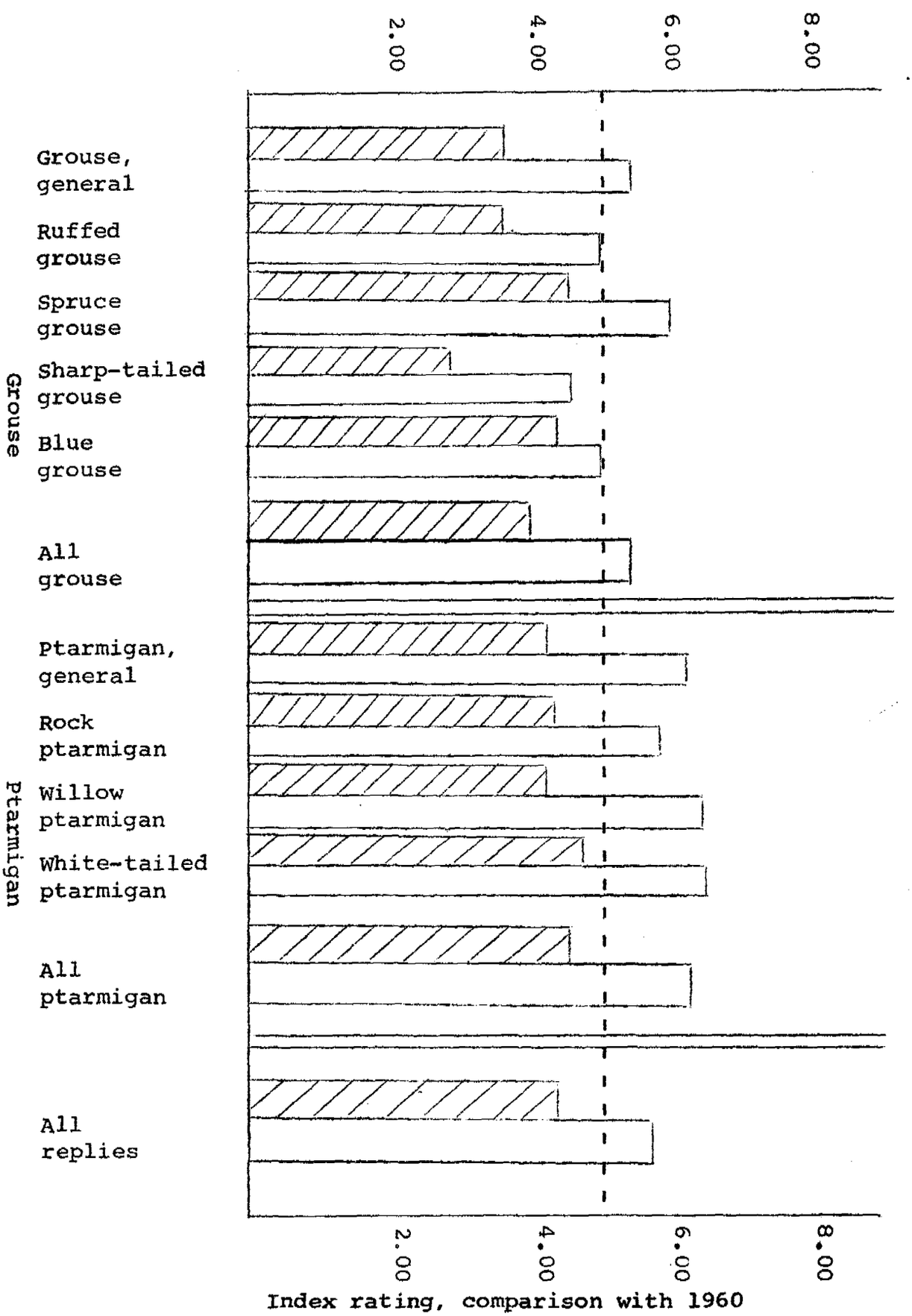


Figure 1. Index values of replies to questionnaire, all of Alaska, 1961.

Table 1. Comparison of statewide index values of game bird questionnaire, 1960 and 1961.

Species	Current Population Levels		Change in Index	Comparison With Previous Year		Change in Index
	1960	1961		1960	1961	
Grouse, general	3.2	3.7	+0.5	5.0	5.3	+0.3
Ruffed	3.5	3.6	+0.1	5.2	5.0	-0.2
Spruce	3.9	4.6	+0.7	5.6	6.1	+0.5
Sharp-tailed	2.3	2.8	+0.5	4.6	4.8	+0.2
Blue	3.9	4.2	+0.3	4.2	5.0	+0.8
All grouse	3.5	4.0	+0.5	5.2	5.5	+0.3
Ptarmigan, general	3.4	4.2	+0.8	5.4	6.3	+0.9
Rock	4.0	4.3	+0.3	4.8	5.8	+1.0
Willow	4.2	4.9	+0.7	6.3	6.5	+0.2
White-tailed	2.7	4.7	+2.0	4.2	6.4	+2.2
All ptarmigan	3.9	4.5	+0.6	5.6	6.2	+0.6
All replies	3.7	4.4	+0.7	5.4	5.8	+0.4

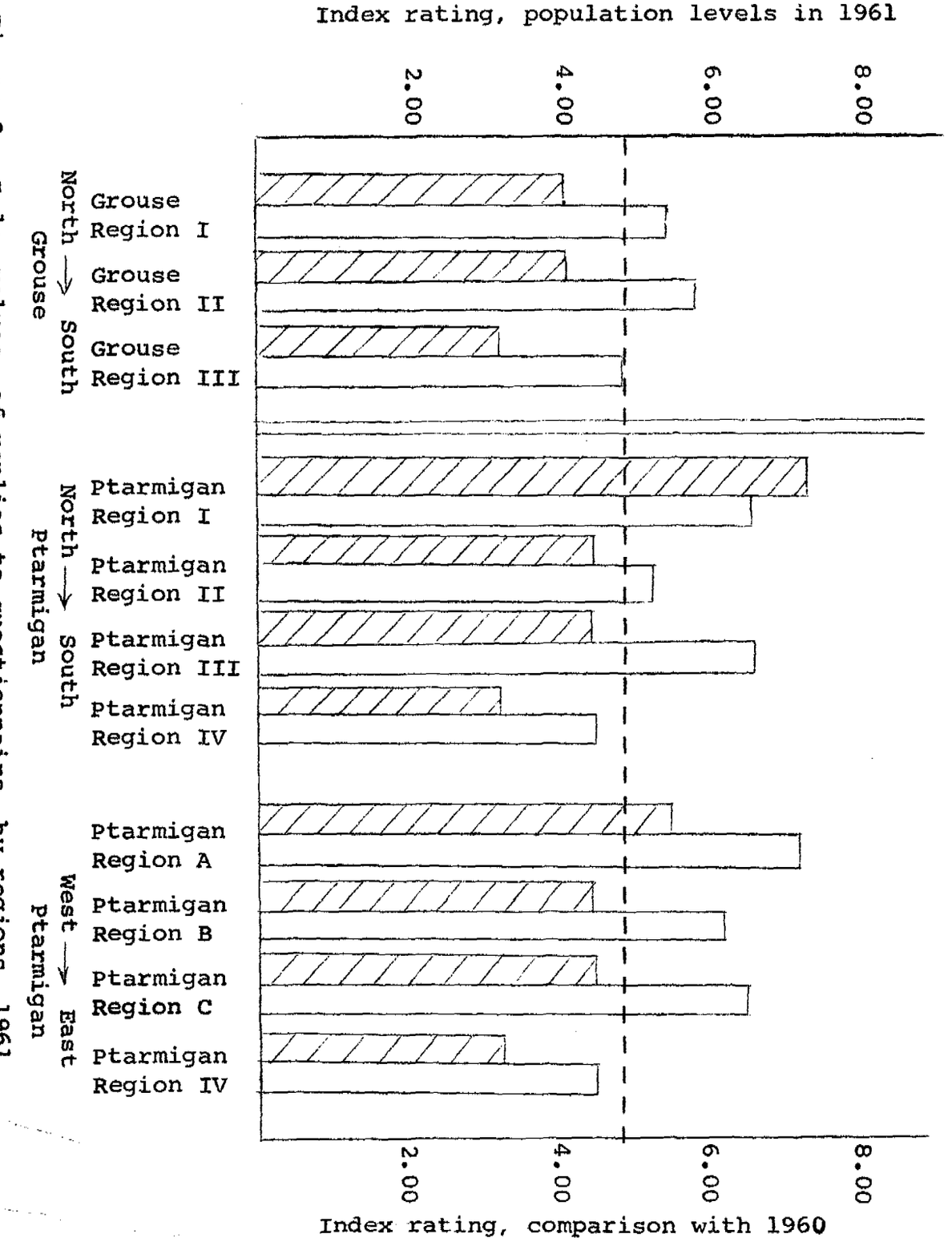


Figure 2. Index values of replies to questionnaire, by regions, 1961.

Table 2. Comparison of regional index values of game bird questionnaire, 1960 and 1961

Species and Area	Current Population Levels		Change in Index	Comparison with Previous Year		Change in Index
	1960	1961		1960	1961	
GROUSE						
Reg. I Northern	3.1	4.1	+1.0	4.9	5.5	+0.6
Reg. II Central	4.0	4.2	+0.2	6.2	5.8	-0.4
Reg. III Southeastern	3.3	3.2	-0.1	3.7	4.8	+1.1
PTARMIGAN						
Reg. I Northern	5.9	7.3	+1.4	6.8	6.8	-
Reg. II Central	4.6	4.5	-0.1	6.7	5.3	-0.6
Reg. III Southcentral	3.1	4.5	+1.4	5.0	6.7	+1.7
Reg. IV Southeastern	3.2	3.2	-	3.5	4.4	+0.9
Reg. A Western	3.3	5.5	+2.2	7.2	7.2	-
Reg. B. Central	4.2	4.5	+0.3	5.3	6.2	+0.9
Reg. C.Eastern	4.3	4.5	+0.2	6.1	6.5	+0.4
Reg. IV Southeastern	3.2	3.2	-	3.5	4.4	+0.9

limited. They refer to the past, and cannot be extrapolated to predict the future. They yield no information about the relative abundance of game birds, and index values for this question, plotted against an ideal sinecurve "cycle" of numbers (see Fig. 3), would not reveal the existence of the cycle. For the period of most rapid increase (A to B on Fig. 3), respondents would indicate more birds than in the previous year. Likewise, between C and D, "fewer" answers would prevail. When bird populations were not changing rapidly, near the highest or lowest points on the curve, respondents would indicate the same number of birds. The answers to this question may, however, serve as a check on the question of current population levels. For example, in Table 1, the index value for question No. 2 indicates that populations of willow ptarmigan were more abundant in 1961 than in 1960. Index value for current-year populations was 4.2 in 1960, 4.9 in 1961. The agreement of the two sets of answers therefore, gives additional confidence in their accuracy.

Counts of Sharp-tailed Grouse

The counts of sharp-tailed grouse made in the vicinity of Tok, Alaska,were done as an experiment in methods rather than as a serious attempt to obtain population data. I believe that there is an opportunity to develop a useful population index for the species - a technique that could be applied more widely in Alaska to provide data required by management should the need arise.

The method used in 1961 was outlined in this report in the section on techniques. I made the first counts on April 30 and May 1, and Joe Nava, game biologist of the Alaska Department of Fish and Game stationed at Tok, made subsequent runs on May 7-8, and May 13-14. The main objectives of the work this year were to find out when the most birds could be counted, and how many routes could be run in one counting period. As there is no information on the courtship season of sharp-tailed grouse in Alaska, it was necessary to spread out the counts as much as possible in an attempt to discover the season and hour of greatest activity. As Table 3 shows, some birds were courting at the end of April. About the same number were counted a week later, but a definite drop occurred on May 13-14. The weather was clear and cool (20^{o} - 30^{o} F) on each day of census, so weather conditions probably were not responsible for the decrease. As all other procedures were essentially the same (number of

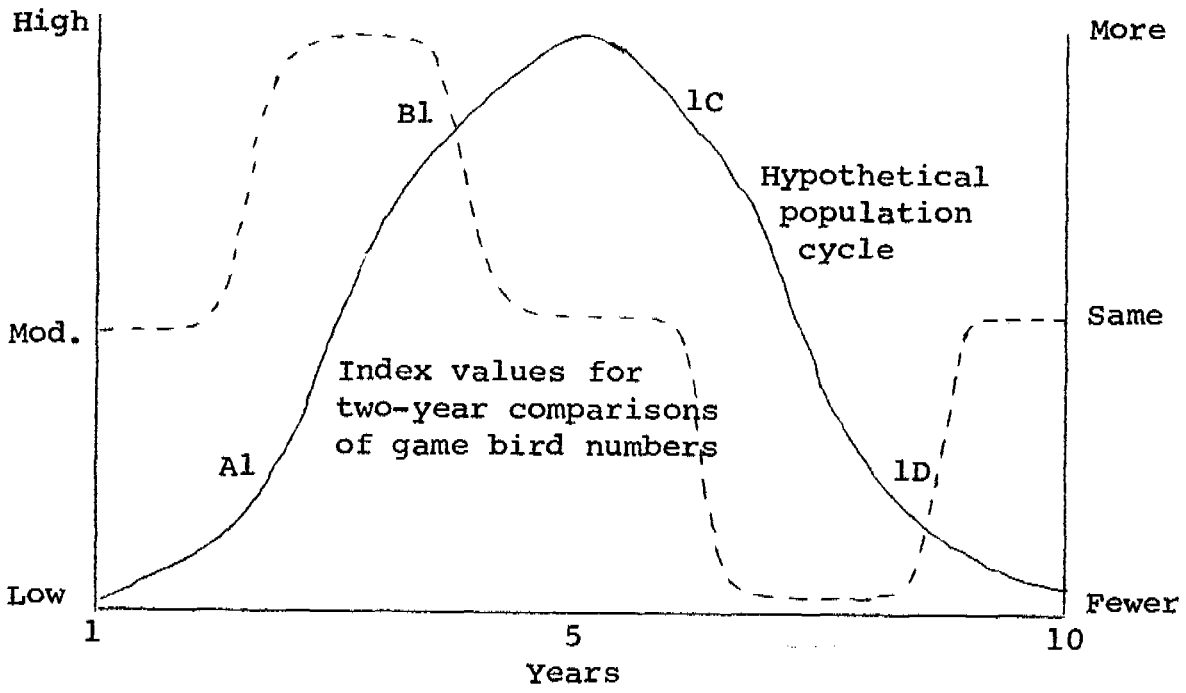


Figure 3. Probable trend of index values for current-previous year comparisons in game-bird numbers, plotted against a hypothetical sine curve cycle of abundance.

Table 3. Counts of sharp-tailed grouse in the vicinity of Tok, Alaska, in the spring of 1961.

AREA	April 30-May 1			May 7-May 8			May 13-May 14			Highest Count
	Time a.m.	No. Stops	Birds Counted	Time a.m.	No. Stops	Birds Counted	Time a.m.	No. Stops	Birds Counted	
Taylor 46-56	6:32 7:14	11[1]	0	1:51 3:32	21	7	3:50 5:04	21	5	7
Taylor 16-20	4:52 5:27	9	0	4:20 4:52	9	2	2:45 3:12	9	0	2
Tok east	2:40 4:05	19	8	2:25 3:31	20	7	4:31 5:45	20	3	8
Tok south (Slana)	3:17 4:16	14	6	3:35 4:15	13	0	3:23 4:07	13	1	6
Tok west	4:38 5:30	20	0	4:35 5:08	11[1]	0	2:30 3:11	11[1]	0	0
			14			16			9	23[2]

1. Line not completed.

2. Included 8 ♂♂, 2 ♀♀, 13 unknown sex.

stops, time of counts relative to sunrise, time spent looking and listening for birds, etc.), I believe that this decrease was due to a change in courtship activity.

On April 30 and May 1 I drove the same routes at dusk as at dawn. Only two grouse were seen or heard. On that basis, I assumed that counts early in the morning were more practical than in the evening. The counts on April 30 and May 1 were begun 45 minutes before sunrise (at about 2:40 a.m. local time) and ended 4 hours after sunrise. On May 7 and 8, the counts were begun earlier (an hour before sunrise) and ended earlier (3 hours and 15 minutes after sunrise). Many more grouse were recorded after sunrise than before, but this may be due to the amount of time spent and miles driven after and before sunrise. The amount of activity observed seemed to diminish when the sun was high, about three hours after sunrise.

The low-angled sun interfered greatly with visibility when lines were run in the wrong direction. The routes should be run as follows (see Appendix II for a description of the lines):

1) Taylor Highway, miles 46-56. Run south from mile 56 to 46.

2) Taylor Highway, miles 16-20. Run south from mile 20 to 16.

3) Tok east. Run from Alaska Highway milepost 1303 to 1313.

4) Tok south (Slana). Run from mile 123 to 117.

5) Tok west. This line should be dropped, as no grouse were seen on any of the counts in 1961.

If all lines had been completed each census, the counts would have covered 39 miles each count. However, several lines were shortened when no grouse were seen for long periods. In total, 104 miles of road were covered and 39 sharp-tailed grouse were counted (2.7 miles per grouse, or 0.37 grouse per mile). The highest counts were made on the second trial (May 7-8) when 16 grouse were recorded in 34.5 miles, or 0.46 grouse per mile. On May 13-14 only 0.26 grouse were noted per mile. Taking only the highest count for each line, 23 different

grouse were seen, or 0.66 per mile. As we have no other population estimates for sharp-tailed grouse, there is no way to assess the census results.

Specimen Collections

A collection of grouse and ptarmigan, preserved as skins in various plumages, would be a useful addition to all of the major offices of the Alaska Department of Fish and Game. The specimens would be especially valuable as demonstrations and exhibits at a variety of public gatherings where the Department's research and management programs are presented. During this year 18 study skins were prepared by a skilled biologist hired temporarily for the job. The specimens prepared were rock ptarmigan (4), willow ptarmigan (3), white-tailed ptarmigan (3), spruce grouse (3), ruffed grouse (2), and sharp-tailed grouse (3). I attempted to learn how to prepare study skins, and will be able to do most specimens required in the future.

SUBMITTED BY:

Robert B. Weeden
Game Biologist

APPROVED BY:

Don H. Strode
P-R Coordinator

James H. Brooks
Director, Division of Game

APPENDIX I.
Replies to Game Bird Questionnaire, 1961
Part I. Entire State

Table 1. All replies (190) for Alaska, 1961.

SPECIES	POPULATIONS, 1961				COMPARISON, 1960-61			
	HIGH	MOD	LOW	INDEX	MORE	SAME	FEWER	INDEX
Grouse, general	6	30	27	3.66	20	27	15	5.32
Ruffed	5	15	18	3.63	8	19	8	5.00
Spruce	19	62	30	4.60	45	41	17	6.08
Sharp-tailed	1	8	13	2.82	3	12	4	4.79
Blue	0	12	3	4.20	2	9	2	5.00
All grouse	31	135	92	4.05	82	111	50	5.53
Ptar., general	14	47	32	4.23	43	34	14	6.27
Rock	9	35	20	4.31	20	35	7	5.84
Willow	23	57	25	4.92	49	40	12	6.46
White-tailed	1	9	2	4.66	6	3	2	6.45
All ptarmigan	49	162	80	4.48	125	122	35	6.23
All replies	80	297	172	4.36	207	233	85	5.76

Part II. Regional Analysis

Table 2, Grouse, region I (north); 43 replies

SPECIES	POPULATIONS, 1961				COMPARISON, 1960-61			
	HIGH	MOD	LOW	INDEX	MORE	SAME	FEWER	INDEX
Grouse, general	0	16	7	3.79	7	9	7	5.00
Ruffed	5	10	13	3.84	8	11	6	5.32
Spruce	6	26	8	4.80	16	13	6	6.14
Sharp-tailed	1	7	9		3	7	4	
All replies	12	59	37	4.07	34	40	23	5.45

Appendix I. (Continued)

Table 3. Grouse, region II (Central); 86 replies.

SPECIES	POPULATIONS, 1961				COMPARISON, 1960-61			
	HIGH	MOD	LOW	INDEX	MORE	SAME	FEWER	INDEX
Grouse, general	6	13	13	4.12	12	14	5	5.90
Ruffed	0	3	6		1	7	2	
Spruce	14	35	20	4.65	28	25	11	6.06
Sharp-tailed	0	0	4		0	4	0	
Blue	0	0	1		0	0	1	
All replies	20	51	44	4.17	41	50	19	5.80

Table 4. Grouse, region III (southern); 21 replies

SPECIES	POPULATIONS, 1961				COMPARISON, 1960-61			
	HIGH	MOD	LOW	INDEX	MORE	SAME	FEWER	INDEX
Grouse, general	0	1	7		1	5	3	
Spruce	0	1	2		0	3	0	
Blue	0	11	2		2	9	1	
Ruffed	0	1	0		0	1	0	
All replies	0	14	11	3.24	3	18	4	4.84

Appendix I. (Continued)

Table 5. Ptarmigan, region I (north); 16 replies.

SPECIES	POPULATION, 1961				COMPARISON, 1960-61			
	HIGH	MOD.	LOW	INDEX	MORE	SAME	FEWER	INDEX
Ptarmigan, general	3	1	1		4	2	0	
Rock	3	1	0		3	2	1	
Willow	7	2	1		6	5	1	
All replies	13	4	2	7.32	13	9	2	6.85

Table 6. Ptarmigan, region II (Central); 36 replies

SPECIES	POPULATION, 1961				COMPARISON, 1960-61			
	HIGH	MOD.	LOW	INDEX	MORE	SAME	FEWER	INDEX
Ptarmigan, general	4	14	6	4.66	6	10	5	4.71
Rock	1	7	6	3.57	4	4	3	5.36
Willow	4	13	3	5.20	6	6	3	5.80
White-tailed	0	1	1		0	0	1	
All replies	9	35	16	4.53	16	20	12	5.33

Table 7. Ptarmigan, region III (Southcentral); 104 replies

SPECIES	POPULATION, 1961				COMPARISON, 1960-61			
	HIGH	MOD.	LOW	INDEX	MORE	SAME	FEWER	INDEX
Ptarmigan, general	7	30	17	4.26	32	16	5	7.15
Rock	5	25	12	4.33	14	25	3	6.05
Willow	12	43	17	4.72	39	23	8	6.77
White-tailed	0	8	1		6	3	1	
All replies	24	106	47	4.47	91	67	17	6.70

Appendix I. (Continued)

Table 8. Ptarmigan, region IV (Southeastern); 15 replies

SPECIES	POPULATION, 1961				COMPARISON, 1960-61			
	HIGH	MOD.	LOW	INDEX	MORE	SAME	FEWER	INDEX
Ptarmigan, general	0	3	8		1	5	4	
Rock	0	2	1		0	3	0	
Willow	2	2	3		1	4	1	
All replies	2	7	11	3.20	2	12	5	4.37

Table 9, Ptarmigan, region A (west); 36 replies

SPECIES	POPULATION, 1961				COMPARISON, 1960-61			
	HIGH	MOD.	LOW	INDEX	MORE	SAME	FEWER	INDEX
Ptarmigan, general	5	9	4	5.22	11	6	0	7.53
Rock	3	5	3	5.00	3	4	1	6.00
Willow	8	13	3	5.83	12	3	2	7.35
White-tailed	1	1	0		1	1	0	
All replies	17	28	10	5.51	27	14	3	7.19

Table 10. Ptarmigan, region B (Central); 80 replies.

SPECIES	POPULATION, 1961				COMPARISON, 1960-61			
	HIGH	MOD.	LOW	INDEX	MORE	SAME	FEWER	INDEX
Ptarmigan, general	4	24	15	6.00	21	13	8	6.24
Rock	3	19	10	4.13	9	22	4	5.57
Willow	11	34	10	5.07	26	23	7	6.36
White-tailed	0	6	0		5	1	0	
All replies	18	83	35	4.50	61	59	19	6.21

Appendix I. (Continued)

Table 11. Ptarmigan, region C (east); 40 replies

SPECIES	POPULATION, 1961				COMPARISON, 1960-61			
	HIGH	MOD.	LOW	INDEX	MORE	SAME	FEWER	INDEX
Ptarmigan, general	5	12	5	5.00	10	9	2	6.52
Rock	3	9	5	4.53	9	5	2	6.75
Willow	4	11	8	4.30	13	8	3	6.66
White-tailed	0	2	2		1	1	2	
All replies	12	34	20	4.52	33	23	9	6.47

APPENDIX II.

Sharp-tailed Grouse Census Routes, 1961

1. Taylor Highway, milepost 46 to 56. Twenty-one stops at half-mile intervals. Route should be run from north to south (mile 56 to 46) for best visibility on sunny days.

2. Taylor Highway, milepost 16 to 20. Nine stops at half-mile intervals. Route should be started at milepost 20 on sunny days.

3. Alaska Highway, milepost 1303.5 to 1313 (Tok east route). Twenty stops at half-mile intervals. Numbers of telephone poles at the stops are:

Alaska Highway Mile	Pole Number
1303.5	1317
1304	1334
1304.5	1351
1305	1368
1305.5	1385
1306	1402
1306.5	1419
1307	1436
1307.5	1453
1308	1470
1308.5	1487
1309	1504
1309.5	1522
1310	1539
1310.5	1557
1311	1575
1311.5	1592
1312	1608
1312.5	1625
1313	1643

On sunny days this route should be run from east to west (Miles 1303.5 to 1313). Poles No. 1317 and 1643 have a double ring of green paint. Other poles listed have a single ring.

4. Slana-Tok Road, mileposts 123-117 (Tok south route). Thirteen stops at half-mile intervals. Telephone pole numbers at stops are:

Slana-Tok Road Mile	Pole Number
123	56
122.5	73
122	90
121.5	107
121	124
120.5	141
120	159
119.5	176
119	193
118.5	210
118	226
117.5	243
117	260

The first stop on this route should be at mile 123 when the sun is visible. All poles listed above are marked with a ring of green paint. Poles No. 56 and 260 have a double ring.

5. Alaska Highway, milepost 1323 to 1328. Eleven stops at half-mile intervals. This route (Tok west route) was run in 1961, but will be dropped in subsequent counts due to lack of grouse.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

Project No: W-6-R-3 Name: Alaska Wildlife Investigations

Work Plan: I Title: Game Bird Investigations

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

PERIOD COVERED: July 1, 1961 to June 30, 1962

ABSTRACT

Ptarmigan populations, as assessed by recipients of the statewide game-bird questionnaire, were slightly higher than in 1960, especially in northern and western sections of the State. At Eagle Creek in Central Alaska, breeding populations of rock ptarmigan rose to 269 birds in 1961, an increase of 65 per cent over 1960. Although the average clutch contained one less egg than in 1960, survival of young was better in 1961; the total population in August was 813-894 birds, or about three times as many as in May. Investigators captured 258 rock ptarmigan on the study area, including 28 birds banded in 1960 and 118 chicks. Analysis of band returns and other data suggest that adult cocks, young males and young females take part in a dispersal from the study area some time between September and May. Most of the young females that lived until the spring of 1961 moved off the study area and bred elsewhere. The survival rate among adult hens was about 70 per cent, and nearly all surviving birds returned to breed a second time at Eagle Creek. The overall survival rate of males from August 1960 to May 1961 was 40 per cent; the survival of females in a comparable period was 57 per cent. Ptarmigan again appeared in low-altitude, non-breeding areas in October. Most of the birds (90 per cent of the willow and rock ptarmigan collected) taking part in this movement were females.

RECOMMENDATIONS

All phases of the current study should be continued next year (July 1, 1962 to June 30, 1963). Continuity in all major

aspects, including detailed studies at Eagle Creek, counts in other areas and the game bird questionnaire, is a necessity if the research is to be fruitful. Special emphasis should be placed on counts and other estimates of populations of rock ptarmigan at Eagle Creek, and banding work.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

Project No: W-6-R-3 Name: Alaska Wildlife Investigations

Work Plan: I Title: Game Bird Investigations

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

PERIOD COVERED: July 1, 1961 to June 30, 1962

TECHNIQUES

The methods used in 1960 to count breeding adults, to locate nests and broods and to capture ptarmigan (see Federal Aid Report W-6-R-2, Job I-2) were used again in 1961.

Two methods are being developed to determine age ratios among ptarmigan on the study area, where it is not desirable to collect large samples for autopsy. Plumage characters visible at close range with binoculars or spotting scopes indicate sex and age in autumn as follows:

1) Adult males - black eyestripe (including loral and superciliary elements, in front of and behind the eye) visible after mid-September; back and flank feathers of summer plumage dark and finely vermiculated.

2) Young males - have eyestripes;back, flank and breast feathers have yellowish bars and moderate width.

3) Adult females - only one out of four or five females have a black eyestripe, but even when present the eyestripe is found only in front of the eye; in summer plumage the breast and flank feathers are broadly barred with yellow.

4) Young females - eyestripe lacking or small; summer plumage like that of young males.

The adults are quite easy to distinguish as to sex and age at distances up to 150 feet in good light. The young are confusing, especially when females are seen with eyestripes. In the period September 10-25, however, when the plumage characteristics mentioned above make it possible to identify the birds, males of both age groups call frequently. Many a puzzle in identity is solved when the bird in question suddenly begins to call.

Apart from the difficulties sometimes encountered in identification, one other factor makes it hard to determine age ratios in the fall. The largest quantity of data can be obtained, of course, by counting birds in flocks. But in the early fall most flocks of rock ptarmigan are composed of brood units (adult hens and their young) plus a fraction of the adult males. Other adult males and some females that did not raise young are in separate, smaller flocks or are scattered in singles, two's and three's across the tundra. The only way of getting true age ratios seems to be to count a large number of birds, and to include all birds encountered, whether as lone birds or flocks, in the sample.

It is extremely important in this research program to be able to tell first-time breeders (birds 10-12 months old) from older birds in the spring. There is no way known to do this, except through banding-recapture operations, where the samples always will be small. It was hoped that the presence or absence of pigment on the ninth primary would serve to identify birds in their first-winter plumage (retained, on the wings, until July or August) from others. Among 267 known-age rock ptarmigan now available for study, the following proportions of pigmented and unpigmented primaries were found:

Sex and Age	Unpigmented	Pigmented	Percentage "error"
Adult Males	18	1	5
Young Males	6	79	7
Adult Females	29	19	40
Young Females	1	114	Less than 1

Although it is safe to say that a female with unpigmented ninth primaries is an adult, and that most young males and older males are distinguishable, more exact statements are

not possible at this time. For example, the errors among males would tend to cancel each other out when the age ratio was close to 1:1. For other ratios such as 2:1 or 3:1 in favor of young males, the observed ratio would differ from the true ratio by 10-30 per cent, the error depending on the ratio and the sample size. As a result of this and other difficulties, it is not possible to estimate age ratios directly from examining ninth primaries of ptarmigan. However, it may be possible to detect changes in age structure from year to year through changes in the proportion of "pigmented" birds found in the breeding population. A change among males from a pigmented:unpigmented ratio of 2:1 to 3:1, for example, might indicate a better survival of young males or a greater loss of adult males. In any case, I will continue to collect information on the condition of ninth primaries in the hope that it may be useful when more known-age specimens have been studied.

Game bird questionnaires were sent to 327 persons in November 1961. Most of the recipients were licensed guides, hunters or biologists. By mid-January, 190 cards had been returned by about 50 per cent of the cooperators. The replies were tabulated for the whole state and by regions, as described in Federal Aid Report W-6-R-2, Job I-1.

FINDINGS

EAGLE CREEK STUDY AREA

Detailed studies of rock ptarmigan in this project are being carried out at Eagle Creek, east-central Alaska. For a description of the area, see report for Federal Aid in Wildlife Restoration Investigations Project W-6-R-1, I-2.

Spring Census

The annual count of rock and willow ptarmigan at Eagle Creek was made from May 14-18.

The study area contains only a few hundred acres of riparian vegetation suitable for willow ptarmigan, so numbers of that species are low. In 1956 there were four or five pairs present, in 1960 there were six pairs, and in 1961 seven males and six females were counted in May.

Each year, the number of male rock ptarmigan counted in

May has been close to the total population as determined by countinued observations.

Table 1. Number of adult rock ptarmigan breeding at Eagle Creek, Alaska (1956, 1960, 1961).

Year	No. Seen in Census (May)		Total Adult Population		Per Cent Seen in Census		Adults per Square Mile	
	♂	♀	♂	♀	♂	♀	♂	♀
1956	27	15	29	24	93	62	2.0	1.7
1960	82	34	88	75	93	45	6.1	5.2
1961	132	74	134	135	100	55	9.2	9.3

The proportion of hens counted in the census is variable but smaller. The number of females seen varied according to the number laying or incubating eggs when the count was made, and also according to the time spent looking for them. The only basis for stating the total population actually present is careful listing of each hen seen with cocks, on nests or with broods throughout May-July. The figure for number of females present, therefore, is not as accurate as the one for males. I estimate that the true number of hens in within 5 per cent of the figure given in Table 2.

It should be noted that the concept of the breeding population being composed of pairs is not strictly true. In 1956 and 1960, for example, there were some "extra" males. Both in 1960 and 1961 a few males accompanied two females; in 1961 at least six such groupings were noted. Thus, although about 134 males and 135 females were on the study area, at least 10 cocks never were seen with hens whereas some cocks probably mated with 2 hens. However, as 90 per cent or so of the population was made up of pairs, it is convenient to discuss the population as though it contained as many pairs as the total number of females present.

The yearly increase in number of breeding rock ptarmigan at Eagle Creek between 1956 and 1960 can be expressed only as an average annual increase (33 per cent), as interim counts are lacking. From 1960 to 1961 the population increased about 65 per cent.

Changes in Breeding-Pair Distribution:

There are changes in places used by territorial males each year, resulting from population changes and actual shifts on the part of some birds present (Table 2). The upper section of the east branch of Miller Fork had fewer birds in 1961 (one pair and two cocks seen only in May) than in 1960 (four pairs), although the total number of pairs in that subdivision (Area II, Miller East) was the same both years. Five cocks occupying the slopes of Castle Brook Valley (Area IV, Castle) never were seen with hens during 1961. The males defended territories vigorously in May and early June. Perhaps this unusual situation indicates that the sexes arrive at Eagle Creek at different times in the spring, males probably first. For some reason no hens settled in this valley in 1961, but the unmated cocks continued their territory-display activities.

Table 2. Spring counts of male rock ptarmigan in various parts of the Eagle Creek study area (1956, 1960, 1961).

	Area	1956	1960	1961
I	Upper Bates	3	8	14
	Lower Bates	2	10	22
II	Miller West	1	3	8
	Miller East	2	8	8
	Lower Miller	5	11	11
III	Eagle Fork	1	7	10
IV	Mastodon Castle	0	6	11
	Castle	1	7	13
V	Cripple	3	10	12
	Camp	9	15	23

Last year and in 1956 there were no territorial cocks above the 3,600 foot contour. In the current season, seven males were found above that altitude. Three of the seven did not, as far as I know, have mates, but four were mated with hens that produced young.

Condition of P9 in Breeding Birds, 1960-61:

The presence or absence of pigment at the tip of the ninth primary was recorded for all birds captured in the summers of 1960 and 1961. The data are listed below for unbanded birds:

	Pigmented		Unpigmented		Ratio	
	1960	1961	1960	1961	1960	1961
Males	11	31	13	15	0.8:1	2.1:1
Females	30	52	13	13	2.3:1	4.0:1

For both sexes, there was an increase in the proportion of pigmented primaries from 1960 to 1961. The increase was greater in hens than cocks. Presumably, since the population as a whole increased, the change in ratios was due to a relatively better survival of young in 1960-61 than in 1959-60. This statement refers only to new (unbanded) birds handled in 1961, and will be modified in the discussion of age structure in a later section of this report.

Nests

Nest-hunting was relatively more rewarding in 1961 than last year, probably because of the additional experience in using clocker droppings to locate nests. Twenty-three nests were found, or about 17 per cent of those built on the area. One nest contained no eggs, one held a single egg and was deserted later, one had 2 cold eggs and 20 contained full clutches. Seventeen of the complete clutches hatched (85 per cent). An incubating hen was killed close to its nest, and the fate of two nests is unknown. In the successful nests, 116 of 124 eggs (94 per cent) hatched. Clutch size, hatching date and success of each nest are given in Appendix I. Table 3 shows the frequency of clutch sizes in nests found in 1956, 1960 and 1961.

Table 3. Number of eggs in nests of rock ptarmigan at Eagle Creek (1956, 1960, 1961).

	Clutch Size								Total	Average
Year	3	4	5	6	7	8	9	10	Nests	Clutch Size
1956			2	3	4				9	6.2
1960					2	7	2	1	12	8.2
1961	1	1	2	1	2	7	6		20	7.3
Total	1	1	4	4	8	14	8	1	41	7.3

In this study I have used 21 days as the incubation period for ptarmigan when calculating first-egg dates. Incubation period was determined this year for 2 nests located before the clutches were complete; in one the eggs hatched in 19 days whereas the other took 22 or 23 days, counting from the day the last egg was laid. I do not know whether this wide variation is typical of the species. However, until more information is available I will continue to use the 21-day average for calculations of breeding schedule.

Hatching occurred between June 17-22 in our sample of nests. Egg-laying probably began May 19-29. The age of chicks in 75 broods (estimated from relative feather development, see page 30), including some from nests being watched, revealed that 89 per cent of the broods hatched between June 15-22. Three broods (4 per cent) hatched before June 15, four (5 per cent) between June 23-26, and two (3 per cent) hatched between July 1-3. Last year 37 broods of known age hatched between June 13-25. The breeding activity both in 1960 and 1961, therefore, occurred in the same short period in May and June.

The occurrence of renesting among rock ptarmigan still is in doubt. Occasional observations of late broods (like the two seen in 1961 that hatched after July 1) may indicate renesting, but may be merely what would be expected from samples of an event (hatching) with a normal frequency-distribution. In my experience the proportion of late broods always has been small at Eagle Creek. No bimodal curves, such as might result from extensive renesting, have resulted from calculations of hatching dates of rock ptarmigan on that area.

Brood Studies

Repeated observations of individually-marked broods yielded information on movement, juvenile mortality, feather development in chicks and on total number of family groups on the study area.

Movements:

No new information resulted from observations of brood movements in 1961. The data (Appendix II, Tables 1 and 2) indicate the same behavior patterns and contain the same biases as those of last year. This phase of the study seems

to be yielding little information pertinent to the main research objectives, and I believe this work should be given less attention than previously. I will continue to gather the basic information, as this is easily done; subsequent reports, however, will give the data only in an appendix.

Feather Development:

I noted the general progress of feather growth of all chicks caught in 1961, and measured the primaries, longest tail feathers and total length of alula on a large number. Using this information, I synthesized a tentative schedule of plumage development which can be used to estimate the age of young rock ptarmigan. This schedule follows. Details of measurements of individual chicks are given in Appendix III.

It is convenient to recognize 2 age groups - chicks up to 16 days, and older chicks. Age determinations are accurate to within a day in the younger group, partly because a greater number of known-age chicks of this group have been handled, and partly because of the rapid changes that take place in that period. Some chicks shed their first juvenile primary at 15 or 16 days of age, and most chicks have 1 white primary of the first-winter plumage by 18-20 days. From then until the molt is complete nearly in September, the replacement of brown, juvenile primaries by white, first-winter primaries form the basis for age determinations.

The age of young rock ptarmigan up to 16 days old can be determined by the following plumage characteristics:

At hatching - Completely downy except for 3-5 mm. Sheathed primaries on some specimens.

1 day - Primary sheaths 8-12 mm. No vane.

2 days - Primary sheaths to 16 mm. Vane present on longest primaries in a few specimens.

3 days - Vane showing on several primaries.

4-5 days - Sheaths of secondaries and primary coverts appear. Alula present in many specimens. Longest primary 20-30 mm.

7 days - Humeral tract shows feather growth. Juvenile tail appears.

8-9 days - Tail, alula and humeral tract always present. Longest primary 37-45 mm., tail 5-17 mm., alula 19-24 mm.

10-11 days - Chicks fly weakly. Flank feathers start. Feathers of spinal tract (cervical area) often present. Longest primary 40-52 mm., tail 12-25 mm., alula 22-28 mm.

14-15 days - A few chicks drop P1 (innermost primary) at 15 days. Longest primary 55-60 mm., tail 25-28 mm., alula 30-32 mm.

Information on chicks of known age from 16-60 days old is scanty. The molt of the juvenile primaries seems to occur as follows:

P1 - 15-21 days	P6 - 30-35 days
P2 - 18-21 days	P7 - 38-42 days
P3 - about 24 days	P8 - 50-60 days
P4 - 23-26 days	P9 - appears (white) at 18-22 days
P5 - 25-32 days	P10- appears (white) at 19-24 days

The data in Appendix III show that there is a lot of variation among chicks allegedly of the same age. Some of the chicks caught in the same brood may not be siblings; some exchange of chicks may occur. Even siblings may grow at different rates, due to health or sex differences. More measurements of known-age birds will be made in the coming year to strengthen these data. When enough data are available, it may be possible to tell the age of a chick to within 1 day up to 16 days of age, within 2 days from 16-30 days, and within 4 days from 30-70 days. This degree of accuracy may be sufficient for most purposes.

Count of Chicks:

Eighty-eight complete counts of rock ptarmigan broods were obtained at Eagle Creek in 1961 (see Table 4). Only one investigator, without a dog, was on the area early in August,

so only a small number of counts were obtained in that period. Most broods were counted only once, but a few families were counted up to three times.

Broods on the study area in 1961 contained slightly fewer chicks than broods of comparable age in 1960. Forty-one counts up to July 20, 1960, averaged 6.6 chicks; 46 counts before July 16 in 1961 showed an average of 5.6 young. As nesting began at the same time in both years, the broods were of the same ages (less than one month old). The difference between the mean brood sizes is statistically significant ($t=2.789$, $P=0.01 - 0.005$). The mean clutch size varied in the same way; it was 8.2 (12 nests) in 1960 and 7.3 (20 nests) in 1961. Because of the small samples, the difference in mean size is not statistically significant ($t=1.608$, P=about .11). However, it is likely that most of the difference in mean brood size between the two years is due to the smaller number of eggs laid per hen in 1961. A smaller part may be due to greater mortality of chicks this year or to sampling errors.

I cannot explain the apparent gain of a chick per brood in July (Table 4). The statistical probability of getting a difference in brood sizes of that magnitude by chance alone is about .06 ($t=1.917$ for 61 d.f.). One possibility is that a few of the allegedly complete counts in the first half of the month were not complete. Other explanations might be that some broods combined, or gained one or more chicks lost by another hen. In the first case, however, one would expect to find two hens with the combined brood, or at least find more hens with no chicks if one female "captured" the entire brood of another. In addition, when two hens were found together with a brood, the aggregation was always counted as two families. We did not find more lone hens late in July than early in the period. The addition of a few chicks to a brood and the simultaneous loss of those chicks from another brood, should not affect mean brood size unless, for some reason, small broods were not found as easily as large broods.

Direct Evidence of Mortality

It is a common experience to find piles of white feathers on the tundra at Eagle Creek in spring, indicating the death of birds the previous winter. It is rare to find carcasses of birds that died in the summer. This must mean either that many more birds die in winter, or that evidence of summer mortality is harder to find. For adults, both alternatives may apply. Certainly, white feathers are easier to find on a brown background than brown feathers. But the main summer losses occur among chicks, a mortality rarely observed except through serial counts of broods.

Table 4. Numbers of chicks in rock ptarmigan broods, Eagle Creek, 1961.

Period	No. of Chicks 1	2	3	4	5	6	7	8	9	10	11	No. Counts	Av. No. Chicks
To June 30	1			3	3	4	5	3	2			21	6.1
July 1-15		1	3	3	8	4	3	3				25	5.2
July 16-31	1	3	2	2	3	10	9	5		2	1	38	6.1
August 1-15					2	1	1					4	5.8

Table 5. Carcasses of rock ptarmigan found at Eagle Creek, 1956, 1960 and 1961.

Summer of	Population Trend	Carcasses From Previous Fall	Carcasses From Previous Winter	Carcasses From May-September, Year of Study: Adult	Adult	Unsexed Adult	Young
1956	Down	12	66	2	3	3	2
1960	Up	5	7	4	4	1	4
1961	Up	4	61	2	2	1	1

A summary of carcasses of ptarmigan (omitting identifiable bodies of willow ptarmigan) found in the summers of 1956, 1960 and 1961 at Eagle Creek is given in Table 5. The season in which the deaths occurred was determined mostly from plumage condition. The study area was covered thoroughly each year, but the number of carcasses found is an unknown fraction of the number actually present. Carcasses were marked by sticking primary feathers upright into the ground. Some duplication probably occurs if portions of a carcass have been separated widely by the activities of predators and scavengers.

The most variable mortality is in the season when ptarmigan are fully white (from October 10 to May 1 for females, October 10 to June 1 for males). Two factors may influence the number of deaths occurring on the study area in this period: 1) Changes in the severity of mortality factors and 2) changes in the number of birds spending the winter there. The size of the wintering population may depend more on the pattern of fall movements and feeding conditions in winter than on the size of the summer population. The need for winter studies is becoming more urgent as questions of this sort arise.

Some of the animals preying on ptarmigan left sufficient evidence at their kill to identify them. Foxes (and possibly wolves and coyotes) usually sheared off the primaries, leaving a cleanly-cut end. The chalky, white excrement of hawks and owls, the disgorged pellets of owls and the characteristic droppings of foxes at the kill often identified the predator. In 1961 about 27 of the winter-killed ptarmigan were killed by canine predators, and 12 by hawks and owls. One adult was killed by a fox and two by birds in May 1961.

Estimate of Production

In this section three facets of production at Eagle Creek will be estimated: 1) The total number of chicks produced, 2) the number of chicks per adult female on August 1, and 3) the total population of rock ptarmigan on the area just before the hunting season.

Number of Chicks Produced:

This can be determined by multiplying the number of hens that reared young by the average number of chicks hatching per nest. I do not know precisely how many hens raised young.

Eighty-nine different broods were found on the study area (not counting some that obviously moved in from outside the area), but that figure is minimal because not all broods were found. As 17 (77 per cent) of 22 nests with eggs hatched, probably 89/.77 or 115 hens built nests to produce those 89 broods. However, there were about 135 hens on the area. It is likely that most of the 20 remaining hens attempted to nest. The number of females producing offspring, therefore, was between 89 and 109. For subsequent calculations I will use the midpoint in this range (99), plus-or-minus five broods, to determine production.

The average number of eggs hatching in 17 successful nests was 7.3. The total number of chicks hatching at Eagle Creek is estimated at between 7.3 x 94 and 7.3 x 104, or from 686-759 chicks.

Number of Young per Adult Hen on August 1:

Two deaths were known among the 135 female rock ptarmigan that began the breeding season on the area. Additional losses probably took place. I think that between 120-130 of the 135 original hens were alive on August 1, a guess based on the number of known broods, number of hens observed without broods in July, known and estimated adult mortality.

The mean brood size for the period July 16-31 was 6.1 (see Table 5). The number of young per brood on August 1 should have been smaller because of mortality in broods counted early in the period. However, counts of 14 broods between July 25-August 10 showed an average of 6.4 chicks, which is higher than I would expect. I will use the figure 6.1 chicks, recognizing its probable inaccuracy.

If 99 ($\pm$ 5) broods were produced at Eagle Creek, the number of chicks present on August 1 was between 573-634, or 4.2-4.7 per adult hen alive at the start of the breeding season and 4.4-5.2 per female alive on August 1.

Total Population, Early August 1961:

There is no evidence of greater or smaller losses among adult cocks in summer than among adult hens. The total number of old birds on the area early in August, therefore, was 240-260. Adding the estimated number of chicks at that date, I calculate that there were 813-894 rock ptarmigan present at

that time.

As the number of breeding ptarmigan on the study area increases, it becomes harder to keep track of individual pairs. There is a growing reliance on estimates and averages, with accuracy diminishing proportionately. However, the main uses of these data in present research are to provide estimates of the reproductive ability of ptarmigan, and to show whether changes in reproductive success are related to overall population fluctuations. The accuracy achieved seems sufficient for these purposes.

The population gains made in the summers of 1956, 1960 and 1961 are given in Table 6.

Banding

Banding operations were conducted from late May to early August in 1961 in the same manner as in the previous year. Adults were caught in a long-handled net; young rock ptarmigan were flushed, relocated with a dog, and netted. We caught the following unbanded ptarmigan at Eagle Creek in 1961:

	Rock Ptarmigan	Willow Ptarmigan
Adult Males	46	4
Adult Females	65	2
Young	118	0
	229	6

Eight adult hens and six young rock ptarmigan were banded at Harrison Summit, 10 miles east of Eagle Creek. A cock, hen and young willow ptarmigan were caught at mile 93.5 Steese Highway. A complete list of birds banded is at the administrative headquarters of the Alaska Department of Fish and Game, Subport, Juneau, Alaska.

Two adult male rock ptarmigan were killed accidentally while tangled in the net. One of these had been banded as a chick in 1960 (No. 109). One chick sustained a broken leg during banding (No. 246) but was released after the bone was reset, in the hope it would survive. No chicks were known to have been stepped on, but some mortality of that sort probably is inevitable.

In addition to the new birds listed above that were

Table 6. Summary of the extent of summer population gains, 1956 - 1961.

Year	No. of Birds In May ♂	♀	Av. Clutch	Av. Late Summer Brood Size	Total No. Birds in August	Factor of Summer Increase[1]
1956	29	24	6.2	4.0	130	2.55
1960	88	75	8.2	5.4	470	2.90
1961	134	135	7.3	6.1	813 - 894	3.02-3.33

[1] Per bird alive in May

handled in 1961, we caught a number of ptarmigan banded in 1960. These included two males and 18 females banded as adults, plus two females and six males banded as young. More complete information on these returns is given in Appendix IV, along with data on other returns of banded ptarmigan.

Apparently hunters take a disproportionate number of adult cocks. Of 18 bands returned by hunters in the fall of 1961, nine were from males banded as adults. Only three were females captured as adults; the rest were young-of-the-year. Using data from 1960 as well as 1961, the following proportion of band returns were obtained from rock ptarmigan:

Birds Banded	No. Banded	No. Returns
Adult males	70	11 (15.7 per cent)
Adult females	112	3 (2.7 per cent)
Young	185	9 (4.9 per cent)

I am sure there is no conscious selection of adult cocks by sportsmen, as very few could identify one if they saw it. The high hunting loss of cocks must be due to a difference in their behavior. In my opinion, two things are involved: 1) In August and September, when the most ptarmigan are shot, adult males tend to remain aloof from flocks; 2) generally speaking, large aggregations of ptarmigan are harder to approach than small groups or single birds. There may be a resurgence of territorial behavior in males in autumn, which would have a bearing on the first-mentioned statement. If hunters do shoot more birds as singles or in small groups, and if adult males comprise the bulk of such aggregates, then the result would be a disproportionate harvest of old cocks, as observed.

Immigration, Emigration and Mortality

Rock ptarmigan of the study area comprise an open system, giving and receiving individuals to and from other areas. Eagle Creek is a small part of a very large breeding area, and is apparently not different from any other arbitrarily-selected part of the higher Tanana Hills. I assume, therefore, that immigration and emigration are in balance for any sex or age group. Changes in overall age ratios should reflect mortality alone, whereas losses of banded birds result from emigration as well as death.

All of the population information now available that is pertinent to estimations of mortality and movement is presented graphically in Figure 1. Calculations leading to an estimate of new and repeat residents for each age and sex in 1961 are in Table 7.

By expanding the number of banded birds of each age and sex actually recaptured in 1961, to an estimate of the number of banded birds present in the whole population that year, we have a basis for determining the total number of rock ptarmigan that lived at Eagle Creek in 1960 and 1961. It is assumed that the return of unbanded birds is at the same rate as the return of banded birds. The figures for total number of "repeat" residents are indicated on the right-hand side of Figure 1.

Considering males first, we see that repeat residents, of which there were 80, made up 60 per cent of the total male breeding population in 1961. About 18 of these (22 per cent of the "repeat" males) were adults. The ratio of adults to yearlings in this segment of the 1961 population is 1:3.4, somewhat different from the adult:young ratio in August 1960, calculated as 1:2.6. Looking at Figure 1 again, we see that if the distance A'-C' (80 birds) is the number of repeat resident males, then the line C'-D' (54 birds) is the number of new residents. But, if the assumption of a balance between immigration and emigration is correct, then for every immigrant there was an emigrant. Thus line C'-D' is the number of males of both age groups that dispersed outward from Eagle Creek and survived to breed in 1961. Then line A'-D' is a measure of total survival of all males living in 1960 at Eagle Creek. To measure <u>rate</u> of survival we need a population estimate at some time before May 1961 as a base for calculations. Two such estimates, both of approximately the same accuracy, are available. The first, the estimate of total population of males after all chicks hatched in 1960, is composed of two separate estimates: 1) number of adult cocks still living in July, and 2) number of male chicks hatched, estimated as half of the total hatch. The survival rate, calculated from July 1, 1960, to May 20, 1961, is 134/330 or 40 per cent. Using the second set of available figures, derived for the period after most juvenile mortality has occurred, we can calculate a survival rate from mid-August 1960 to May 20, 1961, as 134/245 or 54 per cent. We can also say that of 245 males of all age classes alive in mid-August 1960, 80 (33 per cent) were breeding on the same area in May 1961, and 54 (22 per cent) were alive and breeding somewhere else. The yearling:adult ratio in the dispersing segment is not known for males.

Figure 1. Numerical changes of various sex and age classes of rock ptarmigan at Eagle Creek, May 1960-May 1961.

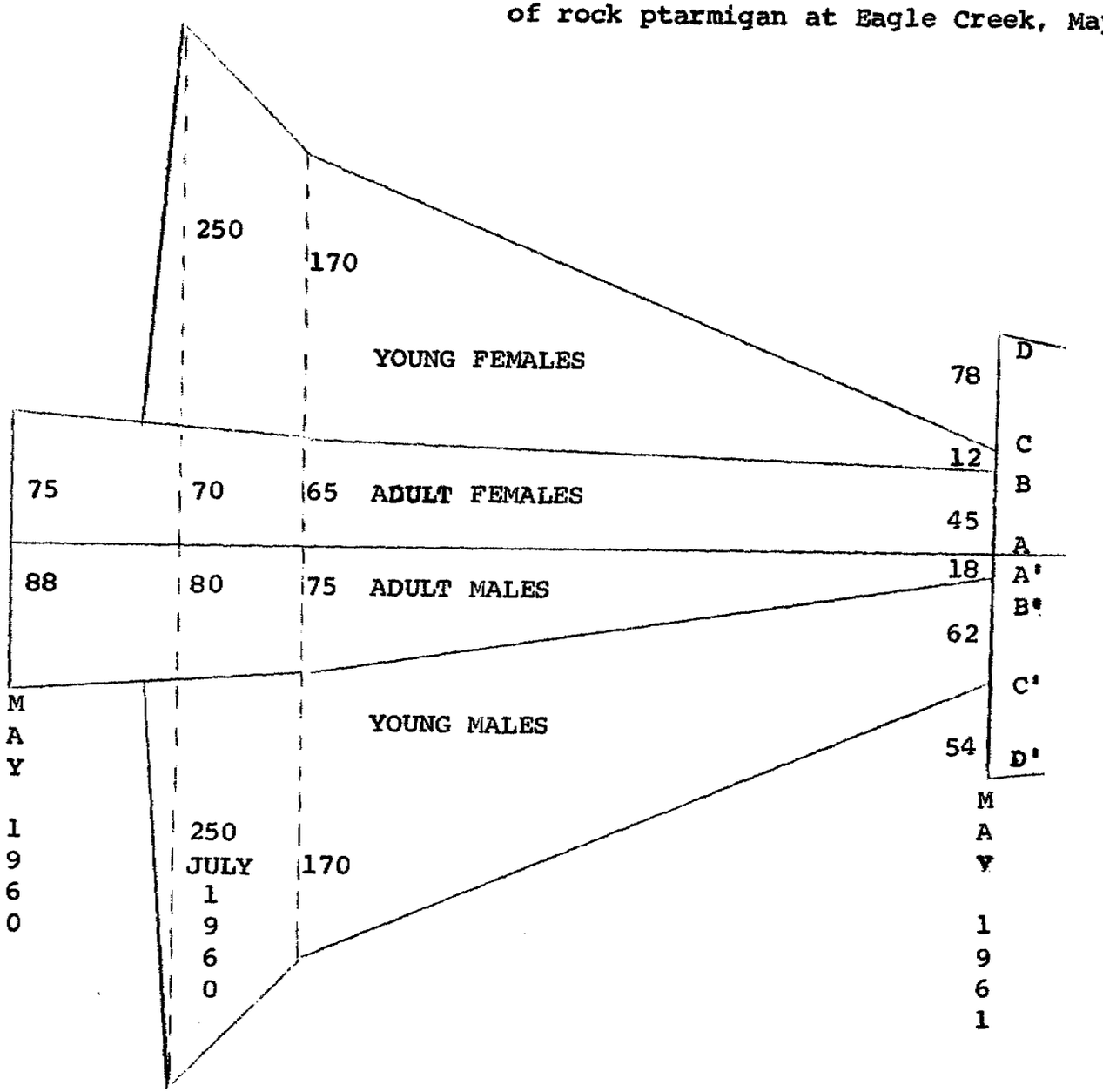


Table 7. Number of resident and immigrant rock ptarmigan breeding at Eagle Creek, 1961.

	ITEM	MALES	FEMALES
1.	No. present, spring 1960	88	75
2.	No. banded, 1960 and percentage of total 1960 population of each sex: adults	24 (27%)	48 (64%)
	young	39[1] (24%)	39 (24%)
3.	No. present, spring 1961	134	135
4.	No captured and percentage of total 1961 population of each sex:	54 (40%)	85 (63%)
5.	No. in 1961 with 1960 bands:		
	banded as adults	2	18
	banded as young	6	2
6.	Est. no. banded birds on area 1960 and 1961 (see line 4 above):		
	adults	5	29
	young	15	3
7.	Est. no. unbanded birds on area in 1960 and 1961 (see line 2 above):		
	adults	13	16
	young	47	9
8.	Total no. repeat residents:		
	adults	18	45
	young	62	12
9.	Total no. residents, and percentage of residents in total population of each sex:	80 (60%)	57 (42%)
10.	Total no. immigrants:	54 (40%)	78 (58%)

[1] 78 unsexed young were caught. Sex ratio is assumed to be 50:50.

The same calculations can be made for females. A far higher proportion of the 57 repeat residents of this sex (79 per cent) were adults in 1960. In fact, of 75 adult females on the area in May 1960, 45 (60 per cent) probably were on the area again in 1961. This suggests that the survival rate of adult females from 1960 to 1961 was 60 per cent. Further evidence of the same sort was discovered when I compared the pigmented:unpigmented P9 ratio in previously banded hens and unbanded hens handled in 1961. Among banded birds the ratio was 6:14 or 0.4:1; for new birds it was 52:13 or 4.0:1. As most adult hens have unpigmented primaries whereas nearly all young females have pigment on P9, the only explanation for the high ratio among new birds is that they were largely yearling birds. Thus, in Figure 1, line C-D (78 birds) is the number of immigrants and the number of emigrants, and is comprised primarily of young females. The survival rate of females of all ages was 135/320 or 42 per cent from July 1960 to May 1961, and 135/235 or 57 per cent from August 1960 to the following spring. Of 235 females alive in mid-August 1960, 78 (33 per cent) were alive but breeding elsewhere in 1961, and 57 (24 per cent) were breeding at Eagle Creek. If the most or all dispersing females were yearlings, then the survival of the emigrants together with that of the few yearlings that returned to Eagle Creek, must be an estimate of total survival of yearling females- in this case, 78 + 12/170 or 53 per cent.

In summary, the fate of rock ptarmigan breeding or hatching at Eagle Creek in 1960 seemed to be as follows:

1) Twenty per cent of the adult males returned to the study area; an unknown number survived until the following breeding season but bred elsewhere.

2) About 24 per cent of the male chicks hatching, and 36 per cent of those living until August 1960, returned to the study area to breed in 1961. An unknown number bred elsewhere.

3) The survival rate of all males from summer of 1960 to spring of 1961 was about 40 per cent. This includes mortality among young chicks.

4) Nearly all of the adult females that lived bred on the study area both years. About 60 per cent survived from May 1960 to May 1961.

5) Only 5 per cent of the female chicks hatched in 1960 returned to the study area to breed. About 53 per cent survived until May 1961, but almost all of them moved off the study area.

6) The survival rate of all females from August 1960 to May 1961 was 57 per cent.

Displays by Males in Autumn

Many birds undergo a resurgence of singing or display activity in autumn, the cause and function of which are not well known. Among North American Tetraonidae, at least the ruffed, blue and sharp-tailed grouse and the prairie chicken are known to show this behavior. I have seen and heard rock and willow ptarmigan males go through their flight and call routine many times in late August and September. These activities coincide with the joining together of the birds into flocks, and the social stimulation of other ptarmigan may be important in the initiation of autumn calling and display.

The question of what the fall songs and displays really are, and what they mean, may be an important one to answer. In one type of ptarmigan (Scotland's red grouse) the behavior is definitely a territorial display, as first old cocks and then young ones establish and defend pieces of ground in October and November. Whether or not this applies to rock ptarmigan, or our American subspecies of willow ptarmigan (which is conspecific with red grouse) is not known. Because of this uncertainty, I am including in this report one particularly detailed, though not atypical , series of observations I made on September 20, 1961, at Eagle Creek. It shows the type of display involved and is the basis for some general ideas and questions mentioned afterward. An excerpt from my field notes of that day follows (edited):

> 5:00 - 6:30 a.m. Sat at the head of Eagle Creek and watched a flock of 20 rock ptarmigan on the opposite hillside. The flock kept very quiet when I approached, every bird motionless in the new, thin coat of melting snow that covered the ground. After 10 minutes calling began among birds on another hillside, and the flock I watched came to life. Males called, then all birds stretched, lifted their wings, preened and began feeding. Calling continued at intervals during feeding. The intensity of activity quickly rose; the calling became more frequent, and the birds moved around rapidly,

plucking sedge seed-heads as they went.

> Suddenly a male stopped feeding and gave a peculiar display that I can only describe as a "squiggle". It spun and hopped and fluttered along the ground in rapid but erratic activity for three or four seconds, then stopped, called once, and began feeding again. Soon other males, both young and old, went through the same routine. Sometimes the display caused no reaction in the other birds feeding nearby, but usually the display ended with a rush toward another male. Once a young cock "squiggled"at an adult male, which stood its ground. The young one retreated. The old bird then ran, head lowered, at another male, which fluttered off. All three males called, then resumed feeding. No hens ever became involved that I could see.

Although the display is definitely sexual in connotation, as only males are directly involved, and although there are elements of threat and intimidation in it, my observations suggest that the display is an activity generated by social contact. No piece of ground is defended, unless the rushes towards other males can be interpreted as rudimentary territoriality. Young cocks with no previous experience with territoriality or courtship, as well as adult cocks, are involved; perhaps the former are stimulated by, and learn from, the latter. In the realm of pure speculation, the following could be elements in and consequences of the activity noted: 1) Adult cocks might be stimulated to call by a remembrance of spring courtship, when the cool weather, relatively short days, snow-covered ground and the presence of many other ptarmigan close by, were similar to the current autumnal conditions; 2) Young cocks learn or first begin to practice the long, snoring call that will be used in earnest the following spring; 3) The general pattern of calling, threat, tail-fanning and other displays may be valuable experience to the young males; 4) All males, but especially the older ones, might actually be familiarizing themselves with areas that they will hold as territories when spring comes; 5) This activity may be the basic cause for the sorting out of the sexes which has been noticed later in the winter during the present research.

SUMMER STUDIES IN OTHER AREAS

Chilkat Pass

Each summer since 1957 I have been visiting Chilkat Pass at mile 75 on the Haines Road between Haines, Alaska, and Haines Junction, Yukon, to study willow ptarmigan there. The research prior to 1959 was done in connection with a thesis project for the Department of Zoology, University of British Columbia. In 1957 I conducted intensive, summer-long studies on a selected area of three-fourths of a square mile in the vicinity of the road maintenance camp at mile 75. Since then the work has been confined to brief trips each June to conduct a census of adult willow ptarmigan. Although Chilkat Pass is not typical of large areas of the range of willow ptarmigan, I believe the census data obtained there are important for two reasons. First, they show the remarkable densities attainable in willow ptarmigan populations. Second, they provide an example of population changes on one area that can be compared with other areas.

The counts at Chilkat Pass (Fig. 2) have revealed a rapid increase on that small area from populations that were high relative to any experienced so far at Eagle Creek among rock ptarmigan, to numbers that are phenomenal according to almost any standards of tetraonid abundance. A comparison with rock ptarmigan populations at Eagle Creek (Fig. 2) shows this: opposed to a peak of 9.2 males per square mile there in 1961, a calculated 176 male willow ptarmigan were present that year near mile 75 Haines Road. Of course, comparisons between species may have limited meaning; my only reason for mentioning it is to emphasize the difference in abundance. Note that the percentage increase has been less at Chilkat Pass (376 per cent since 1957) than at Eagle Creek (511 per cent since 1956).

Brood Counts, Interior Alaska

Brief trips were made to some other parts of interior Alaska to count broods. The individual counts and their means, including counts for 1960 for comparison, are in Table 8. The increase in brood size this year at Harrison Summit probably reflects the earlier date of the count, as less mortality would be expected to have occurred in younger broods. The low counts at Mount Fairplay may indicate a real difference in brood sizes in that area, even though the

Figure 2. Number of ptarmigan per square mile at the Chilkat Pass and Eagle Creek study areas, 1956-1961.

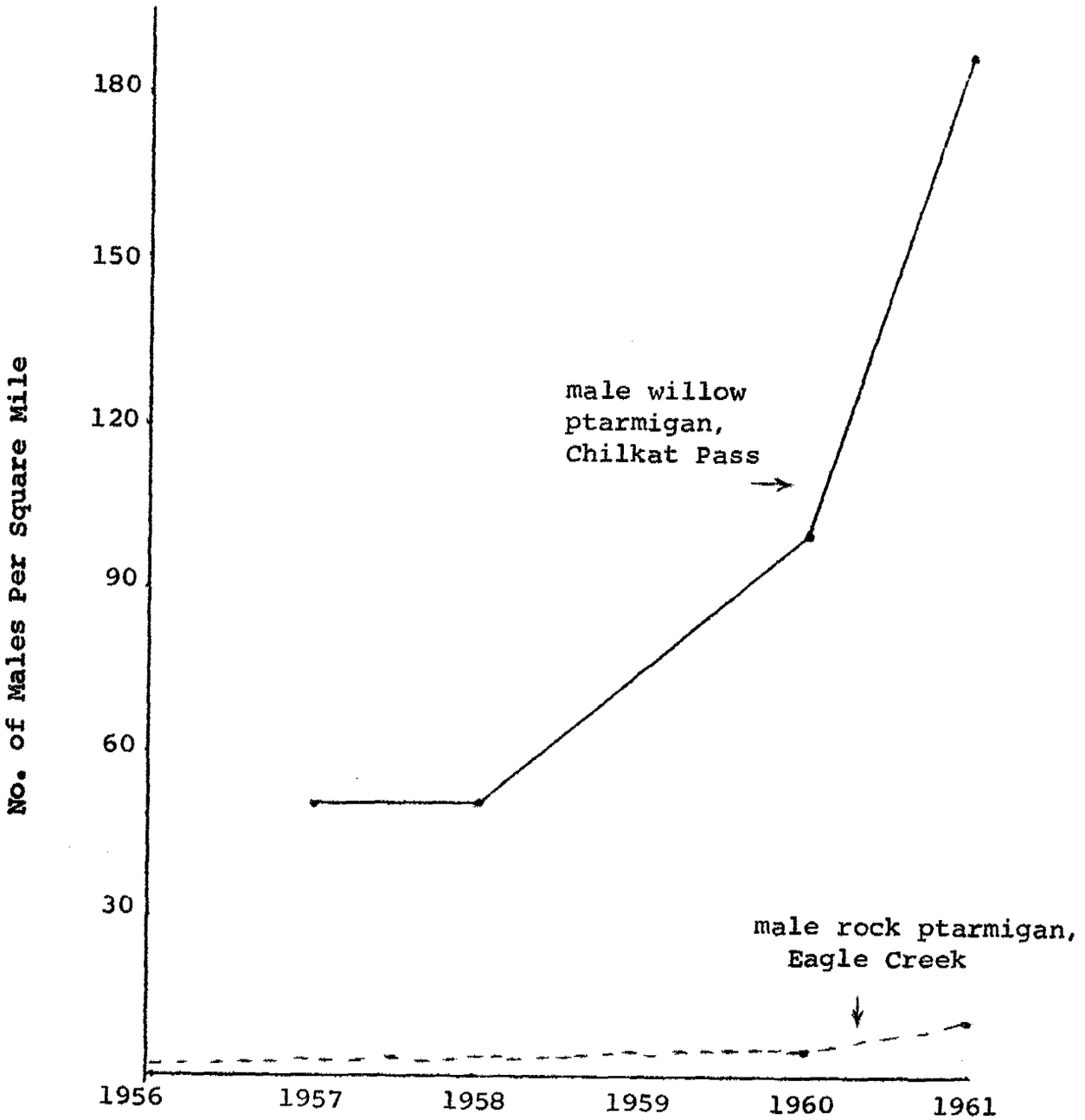


Table 8. Brood counts in three areas of Interior Alaska, 1960 and 1961.

AREA	DATE	BROOD SIZE 2	3	4	5	6	7	8	9	10	NO. OF COUNTS	NO. OF CHICKS
Harrison Summit												
1960	July 19			2	5	3	3	1			14	5.7
1961	July 4,5			4		2	4	6	2		18	6.8
Mount Fairplay (Taylor Highway)												
1960	July 22	1	1			1					3	3.7
1961	July 9	2	1	2		1					6	3.5
Mile 13 Denali Rd.												
1960	July 28	4	1			2	2	1			10	4.5
1961	July 10							1			1	---

sample is small. No counts were made at Yankee Creek (five miles north of Eagle Summit) in 1961 because poor road conditions made the area inaccessible. No broods were found on Twelve-mile Summit, mile 85 Steese Highway, in four hours of searching on July 6, 1961.

STUDIES IN WINTER

Questionnaire on Abundance of Ptarmigan

Card-questionnaires were sent in November 1961, to 327 hunters, guides and biologists in Alaska. Replies from returned questionnaires indicated that ptarmigan populations, though generally at low to moderate levels, were slightly higher than in 1960. A statewide rising tendency was noted by cooperators for the second year. An analysis of the replies by regions indicated that the highest, and most rapidly rising, populations were in northern and western Alaska. The most important reporting areas in those regions are Kotzebue Sound, the Yukon-Kuskokwim Deltas and Bristol Bay. The data supplying the general statements just mentioned will not be repeated in this report, as they are given in detail in Federal Aid Report W-6-R-3, Job I-1.

Ptarmigan in the Tanana Valley

Beginning in October during each year of this study, ptarmigan have appeared in non-breeding, forested areas in the Tanana Valley near Fairbanks and on surrounding hills. Willow ptarmigan usually are the more abundant species at lowest elevations, on the flat land adjacent to the Tanana River; however, some are found on ridges and hilltops close to bands of rock ptarmigan. Previous collections, which this season's work substantiates, showed that for both species, females are far more numerous than males in the areas mentioned. This year (winter of 1961-62) 18 out of 20 rock ptarmigan and 16 out of 17 willow ptarmigan shot in non-breeding habitats and examined by me were females.

In the fall of 1961 the first sightings of ptarmigan near Fairbanks occurred during the first week in October. Rock ptarmigan may have come before willow ptarmigan, as the first specimen (October 1, Ft. Wainwright) and first reported flocks (before October 6, Ester Dome) were of the former species. Specimens of willow ptarmigan were not obtained until November.

In 1959 and 1960 the first observations of ptarmigan in these wintering areas occurred about October 20.

After the initial flurry of observations, it became apparent that not as many ptarmigan were present in October, November or December of 1961 as in the two preceding years. Neither tracks nor birds were seen by me or reported to me as often this year, despite occasional trips made especially for that purpose. The only exception was Ester Dome, seven miles west of College, Alaska, where as many as 60-100 rock ptarmigan spent most of the time between early October and midwinter.

Without banded and marked birds, of course, we will never know where the ptarmigan come from that are seen in forested areas. Many ptarmigan are seen in places 10-15 miles from the nearest breeding grounds, and a number of willow ptarmigan taken at Clear Creek Butte, about 15 miles south of Fairbanks, were a minimum of 25 miles from a breeding area.

SUBMITTED BY:

Robert B. Weeden
Game Biologist

APPROVED BY:

Don H. Strode
P-R Coordinator

James W. Brooks
Director, Division of Game

Appendix I

Nests of rock ptarmigan found at Eagle Creek, 1961.

Nest No.	No. Eggs	Fate	Date Hatching	No. Eggs Hatching	Approximate Date[1] First Egg Laid
1	1	Deserted		0	May 22
2	8	Hatched	June 19	7	May 20[2]
3	8	Hatched	June 20	8	May 24[3]
4	8	Hatched		8	May 23[4]
5	9	Hatched	June 18	9	May 19
6	9	Hatched	June 18	8	May 19
7	9	Hatched	June 19	9	May 20
8	9	Hatched	June 21	9	May 22
9	3	Hatched	June 19-22	1	May 26-29
10	9	Hatched	June 19	9	May 20
11	9	Hatched	June 20	8	May 21
12	8	Hatched	June 19	8	May 21
13	8	Hatched	June 17-18	8	May 19-20
14	8	Unknown			
15	6	Hatched	June 19	6	May 23
16	4	Hatched	June 18	4	May 25
17	8	Hen killed		0	
18	2	Deserted		0	
19	7	Unknown			
20	5	Hatched	June 21	5	May 26
21	0	Unknown[5]			
22	5	Hatched		2	
23	7	Hatched[6]		7	

[1] Calculated from an assumed incubation period of 21 days and as assumed laying period equal to clutch size for nests with less than five eggs, clutch-size-plus-one in nests with five or more eggs.

[2] Nest had six eggs when found May 26

[3] Nest had four eggs when found on May 27

[4] Nest had seven eggs when found on May 31

[5] No eggs in nest when found on June 21

[6] Nest hatched before found on July 18

Appendix II

Movements of broods of rock ptarmigan at Eagle Creek, 1961.

Table 1. Short-term movements[1] of 25 broods of rock ptarmigan.

Brood No.	Approximate Distance Moved	Days Between First and Last Observation	Date of Last Observation
1	500 ft.	9	June 27
4	375 ft.	7	June 26
5	900 ft.	10	June 30
8	300 ft.	5	June 28
9	750 ft.	7	July 1
10	300 ft.	3	June 28
10	600 ft.	20	July 18
14	900 ft.	18	July 13
16	600 ft.	4	June 29
20	300 ft.	18	July 14
22	525 ft.	5	July 1
22	150 ft.	17	July 18
23	600 ft.	19	July 16
25	300 ft.	19	July 16
31	150 ft.	15	July 14
33	150 ft.	15	July 14
36	600 ft.	16	July 16
41	600 ft.	18	July 18
48	3000 ft.	19	July 20
50	200 ft.	17	July 18
52	1200 ft.	11	July 25
59	Same place	12	July 27
64	300 ft.	13	July 29
66	100 ft.	13	July 29
69	2600 ft.	7	July 26
75	900 ft.	11	July 30
76	750 ft.	11	July 30

[1] The distance between the first and last observation of a brood when the period covered is less than 21 and more than one day.

Appendix II

Table 2. Net seasonal movements[1] of 14 broods of rock ptarmigan.

Brood No.	Approximate Net Distance (Feet)	Days From First to Last Observation	Date of Last Observations
1	2700	46	August 3
3	300	25	July 14
5	375	39	July 29
6	450	24	July 14
9	1500	24	July 18
10	900	22	July 20
12	2700	45	August 19
26	2000	23	July 20
27	9000	22	July 19
32	1200	26	July 25
35	600	41	August 9
44	300	23	July 24
50	450	48	August 18
70	3500	22	August 9

[1] Net seasonal movements are defined as the distance between first and last observations of a brood, when the period between exceeds 20 days.

Appendix III

Feather Development in Rock Ptarmigan Chicks

Table 1. Measurements of chicks up to 16 days old, Eagle Creek, 1960 and 1961.

Brood and Chick No.	Age (Days)	Total Length (mm) of Primaries — Primary No. 1	2	3	4	5	6	7	8	Longest Primary (mm)	Lengths of All Prim.	Ave. Length of Prim.	Tail (mm)	Alula (mm)	Other Remarks
4(1)-61	<1	Primary Sheaths				3- 5mm				5					
2(1)-61	1	"				8-12				12					
1(1)-61	2	"				12-16				16					
1(1)-60	2	"				12-14				14					
1(2)-60	2	"				8-12				12					
10(1)-60	3	"				16-18				18					
9(1)-60	3	Sheaths 12-15mm, vanes to 6mm								21					Primary vane showing
9(2)-60	3	"				"				~21					
9(3)-60	3	"				"				~21					
9(4)-60	3	"				"				~21					
7(1)-61	4	Sheaths 12-16mm, vanes to 6mm								22					
9(1)-61	4									24					
12(1)-61	4-5									27					
15(1)-61	5									20					
15(2)-61	5									20					
15(3)-61	5									25				Pres.	
10(1)-61	5									25					
10(2)-61	5									~25					
10(3)-61	5									~25					
10(4)-61	5									~25					
10(5)-61	5									~25					

Appendix III

Table 1, continued

Brood and Chick No.	Age (Days)	Total Length (mm) of Primaries Primary No. 1	2	3	4	5	6	7	8	Longest Primary (mm)	Lengths of All Prim.	Ave. Length of Prim.	Tail (mm)	Alula (mm)	Other Remarks
10(6)-61	5									31					
10(7)-61	5									28					
4(1)-61	7									45			Pres.	Pres.	Humeral tract present
16(1)-61	7									38			"	"	"
13(1)-61	7									40			"	"	"
10(1)-61	8	29	34	36	38	36	36	31	19	38	259	32	11	19	
11(1)-61	8									45			Pres.	Pres.	
21(1)-61	8									40			"	"	
46(1)-61	8	34	39	43	44	45	43	40	26	45	314	39	15	22	
46(2)-61	8	38	41	44	45	45	43	38	25	45	319	40	17	24	
35(1)-61	8	28	33	34	36	37	33	29	19	37	249	31	10	19	
17(1)-61	8-9									45-50					
23(1)-61	9									35-40			6		Humeral tract present
27(1)-61	9-10	36	40	42	43	43	40	37	21	43	302	38	12	24	
27(2)-61	9-10	35	37	40	43	44	44	41	24	44	308	38	14	24	
25(1)-61	10	45	48	49	49	49	50	45	34	50	369	46	13		
25(2)-61	10	42	39	40	41	40	42	41	19	42	304	38			
25(3)-61	10	43	48	50	51	52	44	43	34	52	365	46	15	22	
22(1)-61	10									50			13		
40(1)-61	10	32	39	41	43	42	42	39	33	43	311	39	21	26	

Appendix III

Table 1, concluded

Brood and Chick No.	Age (Days)	Total Length (mm) of Primaries Primary No. 1	2	3	4	5	6	7	8	Longest Primary (mm)	Lengths of All Prim.	Ave. Length of Prim.	Tail (mm)	Alula (mm)	Other Remarks
14(1)-61	10									40			12-15	25	
45(1)-61	10-11	36	40	45	47	48	46	39	29	48	330	41	20	28	
37(1)-61	11	36	41	43	44	45	43	40	36	45	328	41	17	26	
37(2)-61	11	37	42	46	48	48	50	44	36	50	351	44	20	28	
28(1)-61	11	35	41	45	46	45	47	40	25	47	324	40	15	23	Flying
19(1)-61	11									40			13	25	Spinal tract (neck) starting
20(1)-61	11									40			16		Flying
9(1)-61	11	37	43	44	45	46	47	43	30	47	335	42	23	30	Flank feathers present
5(1)-61	11-12	38	43	43	44	43	45	41	27	45	324	40	21	26	
38(1)-61	11-12	32	37	40	43	48	47	42	31	48	320	40	22	27	
38(2)-61	11-12	33	40	40	45	48	45	40	40	48	331	41	21	27	
10(1)-60	12									55			15		
39(1)-61	14	35	42	47	50	56	52	49	35	56	366	46	26	33	
34(1)-61	15	M	44	50	50	53	57	51	43	57	(348)	50	28	32	
36(1)-61	16	M	46	54	57	62	61	57	46	62	(383)	55	25	37	Feathers on back and flanks

APPENDIX 3

Table 2. Measurements of chicks older than 16 days, Eagle Creek, 1960 and 1961.

Brood and Chick No.	Age (Days)	Length of Primaries (mm)[1] Primary No. 1	2	3	4	5	6	7	8	9	10	Tail (mm)	Alula (mm)
6(1)-61	23	44	30	18	57	65	77	73	76	35	18	45	47
6(2)-61	23	50	43	24	11	66	75	78	74	36	17	48	50
6(3)-61	23	47	30	20	M[2]	70	79	81	72	33	13	48	51
6(4)-61	23	56	41	6	66	68	72	75	71	28	M	45	52
1(1)-61	24	55	38	18	M	67	74	78	77	41	18	50	53
14(1)-61	27	70	52	37	26	6	70	85	92	53	25	57	57
14(2)-61	27	71	68	65	50	22	74	85	85	54	30	59	64
10(1)-61	27	64	59	44	27	M	74	85	84	58	35	54	60
10(2)-61	27	70	56	46	30	4	77	84	84	56	33	60	61
10(3)-61	27	66	59	47	27	2	75	85	85	53	30	53	62
9(1)-61	28	67	61	49	32	7	78	85	90	60	37	64	60
23(1)-61	28	61	48	30	13	73	78	85	86	53	26	55	59
50(1)-61	29	58	46	23	5	75	78	85	84	57	36	59	59
41(1)-61	29	68	67	52	31	7	80	88	92	65	32	64	62
25(1)-61	29	64	57	45	36	20	73	83	90	61	34	61	56
25(2)-61	29	63	55	39	29	15	72	80	90	63	35	65	57
25(3)-61	29	66	56	43	30	12	65	75	84	60	32	52	58
25(4)-61	29	60	54	39	29	12	78	84	89	64	38	54	56
25(5)-61	29	73	60	44	35	16	70	79	85	55	31	61	56
10(1)-61	29	66	60	44	28	9	80	86	92	65	35	61	61
10(2)-61	29	63	53	36	18	2	77	85	87	61	38	61	62
20(1)-61	29	64	56	43	23	4	75	81	88	58	25	54	58

[1] Underlined numbers mean that the feather is white.

[2] M stands for a molted feather, as yet not replaced.

Appendix III

Table 2, Concluded

Brood and Chick No.	Age (Days)	Length of Primaries (mm)[1] Primary No. 1	2	3	4	5	6	7	8	9	10	Tail (mm)	Alula (mm)
20(2)-61	29	57	45	25	12	63	70	75	76	48	18	48	52
20(3)-61	29	62	56	44	18	71	76	83	84	52	23	51	54
20(4)-61	29	69	57	37	14	72	79	84	86	52	18	57	61
20(5)-61	29	55	43	21	2	65	70	74	73	46	22	49	55
1(1)-60	30	85	80	50	33						18		
36(1)-60	32	63	55	31	21	M[2]	72	83	88	55	28	51	61
36(2)-60	32	65	50	29	M	68	75	79	81	47	20	53	55
5(1)-61	40	65	70	79	89	97	65	13	100	104	74	100	64
35(1)-61	49	86	89	91	100	116	106	83	111	132	100	118	69
44(1)-60	52				White				Brown	White			
44(2)-60	52				"				"	"			
44(3)-60	52				"				"	"			
44(4)-60	52				"				"	"			

[1] Underlined numbers mean that the feather is white.

[2] M stands for a molted feather, as yet not replaced.

Appendix IV

Returns of Banded Ptarmigan, 1961

Table 1. Ptarmigan recaptured and released, May-August 1961, Eagle Creek Area.

Original Banding Data							
Species	Band No.	When	Where	Age	Sex	Date of Recapture	Distance From Banding Place (yds)
Rock	136	5-25-60	South Hill	Adult	F		same place[1]
"	207	5-26-60	"	"	"		same place
"	141	5-27-60	"	"	"		same place
"	167	5-28-60	"	"	"		same place
"	217	6- 1-60	"	"	"		same place
"	10	6-14-60	"	"	"		3600
"	18	6-21-60	West-running Brook	"	"		same place
"	20	"	Miller Fork	"	"		300
"	24	6-22-60	Road Ridge	"	"		300
"	25	"	"	"	"		same place
"	26	6-23-60	Center Hill	"	"		1300
"	31	6-24-60	Mile 106 Steese	"	"		175
"	32	"	Bates Creek	"	"		same place
"	36	6-27-60	Cripple Creek	"	"	6- 7-61	200
"	41	7- 9-60	Mile 105.7 Steese	"	"	5-26-61	1700
"	49	7-15-60	South Hill	"	"	6-29-61	1900
"	51	7-16-60	Cripple Creek	"	"	7-14-61	same place
"	108	8- 4-60	Center Hill	"	"	6-27-61	same place
"	177	5-27-60	South Hill	"	M	5-31-61	same place

[1] "same place" means that the distance was 100 yards or less.

Appendix IV

Table 1, concluded

Original Banding Data						Date of Recapture	Distance From Banding Place (yds)
Species	Band No.	When	Where	Age	Sex		
Rock	14	6-16-60	Eagle Fork	Adult	M	6-16-61	same place[1]
"	1	7-24-60	Cripple Creek	Imm.	"	5-22-61	1750
"	53	7-16-60	"	"	"	5-23-61	400
"	59	7-17-60	Eagle Fork	"	"	5-25-61	3000
"	107	8- 4-60	Center Hill	"	"	5-29-61	same place
"	111	8- 6-60	South Hill	"	"	5-24-61	same place
"	84	7-20-60	Mile 106.1 Steese	"	F	6-25-61	4300
"	93	"	Miller Fork	"	"	5-25-61	2000
Willow	3	6-19-60	1 mi. west of camp	Adult	"	6-25-61	400
"	4	6-26-60	"	"	M	6-29-61	500
"	7	7-20-60	Mile 104.4 Steese	"	F	7-17-61	200

[1] "same place" means that the distance was 100 yards or less.

Appendix IV

Table 2. Banded ptarmigan killed or found dead, 1961.

Species	Original Banding Data					Date of Return	Distance From Banding Place (yds)
	Band No.	When	Where	Age	Sex		
Rock	69	7-19-60	Harrison Summit	Imm.	M	7- 5-61	5000
"	109	8- 4-60	Eagle Creek, Miller Fork	"	"	6- 7-61	2600
"	15 (tag)	6- 1-60	" South Hill	Adult	"	5-24-61	200
"	13 (tag)	5-31-60	" Tailings	"	"	9-30-61	3500
"	4	6- 9-60	" South Hill	"	"	5-15-61	400
"	86	7-20-60	" Mile 106.1 Steese	Imm.	"	5-26-61	3000
"	9	6-14-60	" South Hill	Adult	"	9- 4-61	1800
"	58	7-17-60	" Eagle Fork	Imm.	?	9-24-61	15 miles
"	59	"	" "	"	M	8-27-61	4500
"	36	6-27-60	" South Hill	Adult	F	9-14-61	same place[1]
"	139	5-22-61	" Tailings	"	M	9-10-61	300
"	150	5-25-61	" Mile 106.3 Steese	"	"	9-20-61	1800
"	154	5-26-61	" Tailings	"	"	9-14-61	1500
"	157	"	" Mile 104.6 Steese	"	"	8-26-61	same place
"	165	5-27-61	" Mile 108 Steese	"	"	9-20-61	1800
"	186	6- 7-61	" Mile 104.4 Steese	"	"	8-26-61	same place
"	292	7-16-61	Eagle Creek	Imm.	?	9-13-61	800
"	306	7-18-61	"	"	"	8-26-61	900
"	307	"	"	"	"	"	"
"	308	"	"	"	"	"	"
"	152	5-26-61	" Mastodon	Adult	F	6-18-61	same place

Appendix IV

Table 2, concluded

Species	Original Banding Data: Band No.	When	Where	Age	Sex	Date of Return	Distance From Banding Place (yds)
Willow	3	6-19-60	Eagle Creek	Adult	F	9- 1-61	1800
"	14	5-26-61	" , camp	"	"	9- 9-61	200
"	12	5-21-61	" , "	"	M	"	200

[1] "same place" means within 100 yards of place banded.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

Project No: W-6-R-3 Name: Alaska Wildlife Investigations

Work Plan: I Title: Game Bird Investigations

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

PERIOD COVERED: May 15, 1961 to March 31, 1962

ABSTRACT

Studies of the black brant on the Yukon-Kuskokwim Delta were begun in early June of 1961. Aerial sampling of brant breeding populations in the Hazen Bay and Hooper Bay areas were conducted, but were felt to be unreliable due to the proclivity of brant to flush far ahead of the survey aircraft. Experimental aerial brood counts suggested that accurate air estimates can be made of brood sizes. A distribution survey flown from Hazen Bay to Alakanuk indicated the main breeding populations of black brant occur from the south shore of Hazen Bay to Igiak Bay.

Ground studies included establishment of a 231 acre study area, a nesting success study, brood counts, selection of nest sampling plots, and banding. An increase in breeding brant was found in previously established check areas. Three hundred fifty-seven nests of all species (260 brant nests) were located on the study area. A selection of 127 nests from this sample was followed through to the end of nesting activity. In this sample 115 nests (90.6 per cent) successfully hatched. Hatching success of 423 eggs was 89.4 per cent. An average of 3.3 goslings hatched from a mean clutch size of 3.6 eggs. Brood survival at 6 weeks was 2.1 goslings representing 64 per cent survival. The reasons for the 36 per cent mortality are not known, but gull predation, a late spring, and inclement weather may have influenced gosling survival. The examination of 140 random one acre nest plots revealed a black brant nest density of 1.15± .20 (t.05) nests per acre over portions of Hazen Bay and Hooper Bay. Black brant trapped and banded totaled 132 locals and 910 adults.

RECOMMENDATIONS

All phases of the job should be continued for at least two years. Renewed emphasis should be placed on establishment of more check plots, the testing of sample plots, habitat analysis, and mortality of young brant. Continued banding appears justified since a sample of at least 1,000 local brant is needed for color marking and banding studies.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

Project No: W-6-R-3 Name: Alaska Wildlife Investigations

Work Plan: I Title: Game Bird Investigations

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

PERIOD COVERED: May 15, 1961 to March 31, 1962

OBJECTIVES

To determine the location and approximate size of breeding or summering populations of black brant in Alaska; to determine the pattern of natural mortality and mortality from hunting among juvenile and adult black brant; to determine annual fluctuations in numbers of brant nesting on permanent ground transects; and to determine the probable contribution of renesting to total brant production.

TECHNIQUES

Nesting studies and banding of black brant on the Yukon-Kuskokwim Delta in Alaska during the years 1949 to 1954 provided some information concerning the migration and mortality of this species. These studies and the conclusions reached from them are summarized in a publication by Hansen and Nelson (1957); therefore, I have not included a résumé of past work in this report.

The current study was designed to investigate the distribution, abundance, and production of black brant in Alaska. Special attention is being directed towards assessing the role of renesting, predation, and breeding ground mortality in relation to the little-understood population fluctuations of black brant. Banding and color marking studies of a limited nature will be conducted during the course of the study.

Field activities during June and July of 1961 were divided into four phases of work, these are as follows: (1) Aerial

surveys of breeding pairs, broods, and population distribution, (2) establishment of a nest and brood study area, (3) testing of nest sampling plots, and (4) banding studies. The aerial surveys and establishment of the nest sampling plots were accomplished by the writer. Glen A. Sherwood was responsible for following the progress of nesting in the study area and keeping records of broods. He was assisted in the initial nest search and reconnaissance of study area by J. J. Henzler and the writer. The banding crew consisted of Sherwood, Henzler, and Jack Paniyak.

Aerial Surveys:

Breeding Population Composition

Seventy-four lineal miles of transects were flown between Hooper Bay and the mouth of Baird Inlet on June 16, 1961. A 180 Cessna flying at 90 miles per hour and at a constant elevation of 100 feet was used to cover the survey area. Two observers recorded all waterfowl seen within 1/4 mile of each side of the aircraft. A portable stenorette dictation machine was used to tape all transects.

These surveys were flown during ebb tide and under weather conditions of high winds and overcast skies. I would estimate this coverage should have been flown about two weeks earlier.

Brood Counts

The aerial brood counts were flown in the same manner as the breeding population surveys except the transect width was reduced to 1/8 mile on each side of the aircraft. A special count was conducted over the Lower Kashunuk River study area in order to provide some comparative air-ground data. An effort was made to differentiate broods into age classes, but this was found difficult, if not impossible.

Distribution of the Black Brant

The area covered on the distribution surveys included that portion of the coast characterised by communities of sedge (Carex spp.) and beach rye (Elymus mollis). The entire coastline tidal area from Hazen Bay north to Alakanuk was covered on June 29. Visual estimates were made of black brant concentrations within these areas.

Nest and Brood Study Area

A 231 acre study area was selected about 25 river miles below Old Chevak on the Kashunuk River. This area was previously used as a nest sampling area by Olson (1951). It is a tidal flat rising 6 to 12 inches above the high tide levels, but within the area inundated by storm tides. The nesting habitat is well interspersed by small tidal pools and sloughs of a few inches to a foot or so in depth. The prevalent plant community of the area is a lush cover of sedge on the lower ground and beach rye in drier locations.

Marker poles were set up on the four corners of the study area to delimit its boundaries. In addition moveable marker poles were used as guides to prevent the nest searchers from wandering off transect lines. Each man was assigned a series and marker poles. The nest cards were printed on 5 x 8 inch pound cards imprinted with columns for future visits, descriptive remarks, etc. A sample of 127 nests was marked with aluminum rods 3/8 inch diameter and 4 feet long, painted with luminescent paint and numbered to correspond with each nest card. Marked nests were re-checked periodically from June 8 to July 4.

Ground Brood Surveys:

Brood surveys were conducted on foot and by boat over much of the Lower Kashunuk River area. Brant goslings were classified by the following age catagories: I (all down), II (first feathers), and III (feathered, but not flying). Bunching of broods into large flocks one week to ten days after the beginning of the hatch made brood counts difficult and unreliable.

Nesting Check Plots

A series of randomly placed one-acre plots were surveyed on the study area, Lower Kashunuk River, and Hazen Bay. Five one-acre plots were placed approximately 200 yards apart at right angles to a base line which was laid out parallel to river or slough shores. Each plot was two chains wide and ten chains in length; therefore, many plots, when placed as described above, would sample an area of comparatively heavy nest density to one of fewer nests. This was felt more desirable than laying each plot wholly within the high-density nesting habitat. All

plots were marked with numbered wooden stakes.

Nests within the boundaries of each plot were found by completely searching the enclosed space. A nest outside the plot was not included in the total count unless its edge touched the plot boundary. Unoccupied nests were examined for evidence of predation or successful hatching and to determine the species which utilized the nest. The usual nest records were kept for all active nests. These included state of incubation, number of eggs, etc.

Banding

Two methods of capturing brant were utilized during the banding operation. The first was the use of large chicken wire traps. These were constructed of two-inch mesh wire supported by aluminum and wooden stakes. Four-foot high wire was used on the pot, whereas three-foot wire was used for the wings. These traps were placed near the mouths of prominent sloughs. Brant were driven into the traps with the aid of a boat or by foot.

A smaller trap made of half-inch bar fish net, about 30 feet long, was used to trap small flocks of adults and young. This trap was quickly set up whenever a group of birds were located. The crew merely herded the brant into a circular enclosure which was constructed of the netting.

FINDINGS

Breeding Pair Surveys

Aerial breeding pair surveys do not seem practical as a means of assessing annual changes in nesting populations of black brant for the following reasons: 1) The proclivity of brant to flush far ahead of aircraft, and 2) prohibitive number of transects needed to adequately sample this population. Previous workers (Hansen, 1957; Spencer, 1951) have remarked on the flushing habit of brant when approached by aircraft. This year's experience was no exception and the same behavior was obvious to the observers flying the brant survey.

The 1961 aerial surveys as presented in Table 1 do provide some data regarding species composition. A comparison of relative species composition from these counts, nesting species on the study area, and in the one-acre check plots (Table 2) suggests that a composition change has occurred since early

Table 1. 1961 aerial breeding population surveys, Yukon-Kuskokwim Delta.

	No. Breeding Birds	Relative Percentage of Composition	No. in Flocks
Black Brant	552	70.7	2,276
Cackling Geese	146	18.8	107
Emperor Geese	16	2.0	59
White-fronted Geese	8	1.0	20
Pintail	28	3.6	
Whistling Swan	12	1.5	55
Spectacled Eider	18	2.3	
Common Eider	2	Trace	
Total	782	99.9	2,572

Table 2. Relative species composition of coastal nesting habitat, Yukon-Kuskokwim Delta 1951, and 1961

	Black Brant	Cackling Goose	Other*	Total
Aerial sample				
1951	44	41	15	100
1961	70	18	12	100
Study area				
1951	40	40	20	100
1961	74	12	14	100
Check plots				
1961	75	10	15	100

* Emperor Goose, Spectacled Eider, Common Eider, Steller's Eider, Old Squaw, Pintail, Greater Scaup, and Greenwinged Teal.

1950. This change seems related to an increase in the black brant population. Evidence of a limited nature supporting this supposition is the fact that while a 200 per cent increase in nesting brant was manifest on the study area the cackling goose segment remained nearly the same. These comparisons, provided the cackling goose segment of the population has remained numerically the same throughout the Delta, as in the study area, suggest that there has been a substantial increase in black brant numbers.

One item of interest that became evident during the aerial surveys was the ease with which brant nests could be seen from the air. The most obvious characteristic of these nests was the abundant down. This observation prompted some consideration toward attempting to sample nests by air as a method of breeding population estimation.

Brood Surveys

An average brood size of 3.0 goslings was calculated from 47 brant broods located by aerial surveys. Comparison of air-ground counts suggested that aerial counts accurately duplicate the brood size as observed on the ground. Simultaneous counts conducted over the Kashunuk study area on June 29 both indicated an average brood size of 2.6 goslings. The total ground and air count also indicated a similar brood size. The excellent air-ground count visibility is largely related to a scant ground cover which affords little concealment to brant and their broods.

Distribution

Few black brant were found north of the south shore of Hooper Bay except in Igiak Bay, Scammon Bay, and the mouth of the Black River. An estimated population of 2,000 to 3,000 brant was present on Igiak Bay. Many broods were also found in this area. A small population of nesting and non-breeding brant is located at the mouth of Scammon Bay. This concentration did not appear to exceed 1,000 brant. Close to the mouth of the Black River a flock of 100 non-breeding brant was located. No other brant were observed along the entire shoreline of the Yukon Delta north to Alakanuk. The main concentration of black brant as observed in 1961 is confined to that area between the south shore of Hazen Bay north to the Kashunuk River.

Nest and Brood Study Area

An intensive search of the Lower Kashunuk study area revealed a remarkable increase in nest densities over those of previous years. A comparison of the number of nests found in 1951 and 1961 on the main study area is presented in Table 3. In addition, a series of sampling plots on another previously-established area showed a proportional increase in nests.

The investigations on the 231-acre study area revealed black brant nesting densities of over 1 nest per acre. Within the study area, 127 brant nests were watched until the end of activity in them. The hatching success of this sample is presented in Table 4. The seemingly high egg and nest hatching success is possibly a result of two factors: 1) the nests were incubated one to two weeks before they were found, thereby early, and unaccountable egg losses are not known, and 2) the sample was selected from a closely nesting colony of birds instead of randomly throughout the population.

Brood Counts

An average brood of 3.3 brant goslings hatched from a mean clutch of 3.6 eggs in 115 nests under constant surveillance. Ground brood counts initiated June 18 revealed that the average brood size the first ten days of the hatching period was 3.2 goslings. A total count of all class I brant broods gave an average of 3.0 young (Table 5).

A month after the "peak of hatch" (Figure 1) computations of brood sizes, by relating the number of young caught per adult female in brood flocks, indicated the average brood at time time was 2.1 goslings. This represents a loss from the time of hatching of 36 per cent.

The reasons or factors responsible for this loss are not known; however, on June 30 a severe storm struck the Yukon-Kuskokwim Delta, causing extreme high tides and widespread inundation of the black brant nesting grounds. Little damage to nests by flooding was observed (Table 4) and since 98 per cent of the brant nests under constant check were hatched by June 27 (Figure 1), there is little reason to believe many nests were lost to the storm. Following this storm, the total number of broods counted per unit of area decreased, but the average brood size did not. The decrease in broods could be attributed to a general scattering of young during the storm,

Table 3. Nest composition of the Kashunuk study area.

	No. of Nests Found	
	1951	1961
Black Brant	74	260
Cackling Goose	49	49
Spectacled Eider	8	36
Steller's Eider	3	1
Common Eider	0	2
Pintail	2	7
Old Squaw	0	1
Green-winged Teal	0	1
Total	136	357

Table 4. Black brant nest and egg hatching success, Kashunuk study area.

Nests

Fate	Number	Percentage
Hatched	115	90.6
Destroyed (Avian)	6	4.7
Destroyed (Storm)	1	.8
Deserted	5	3.9
Total	127	

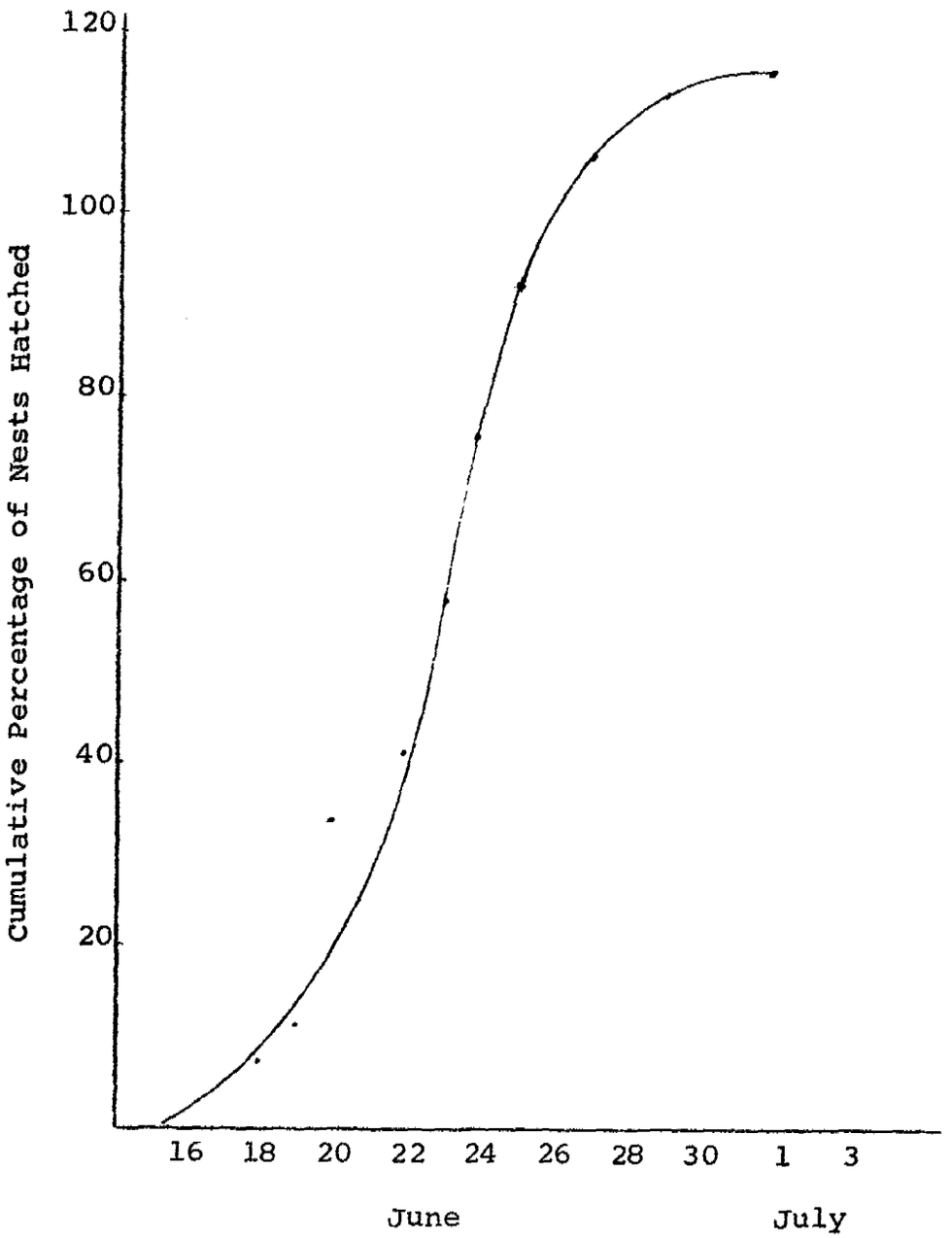
Eggs

Fate	Number	Percentage
Hatched	378	89.4
Sterile	18	4.3
Addled	17	4.0
Dead Embryo	7	1.6
Destroyed	3	.7
Total	423	

Table 5. Summary of brood counts.

	No. Broods	No. Young	Average
Black Brant	454	1,392	3.0
Cackling Goose	53	198	3.7
Emperor Goose	42	159	3.7
White-fronted Goose	5	15	3.0

Figure 1. Cumulative hatching curve for 115 black brant nests, Kashunuk study area, 1961.



a phenomenon which has been observed by previous workers; moreover, no dead goslings were found in the windrows of storm debris. It is unrealistic to believe that this storm did not cause some losses due to exposure of young brant, nest flooding, and indirectly through predation; however, no data are available to assess possible losses.

Considerable predation by glaucous gulls was observed all during the course of the study. This factor may become increasingly important as a population depressant during high populations of these gulls or at times of acute shortages of prey species, especially fish. Again, this is the general impression held by many biologists working in the same area.

Classification of brant broods into the various feather developmental catagories as described by Gollup and Marshall (1954) is difficult, if not impossible, in age classification of black brant. The logical approach to this problem was to eliminate the sub classes, i.e., a, b, and c and use only the brood class I (all down), class II (first feathers) and class III (feathered, but not flying) catagories.

Other difficulties encountered during this phase of the study were as follows: 1) the true brood size becomes masked by a tendancy to flock together in seven to ten days after the midpoint of the hatching period, and 2) brood sizes of newly hatched brant become smaller as the hatching season progresses. However, the smaller brood size as suggested by our brood counts is probably related to losses which occurred in the late hatching nests.

Nesting Check Plots

The difficulties encountered in the aerial breeding pair surveys and in air and ground enumeration of broods prompted the formulation of some other index to population and production trends. It was decided that the annual trends in nesting populations and production success could best be represented by establishing a random sample of permanent ground plots throughout the brant nesting habitat. Before this was attempted it seemed necessary to test some plots on an area of known nest concentration. To this end 45 one-acre plots were placed in the 231 acre study area. The observed brant nest density on the study area as computed from the complete search was 1.12 nests per acre. The sample plots revealed a density of 1.04 brant nests per acre, underestimating the true nest

density by 7 per cent with a sampling error of 23.7 per cent (Table 6). An error of this magnitude was felt acceptable and an additional 45 plots were laid out on the lower Kashunuk River area. Another 50 plots were placed at random over nesting areas located in Hazen Bay. In all, a total of 140 one-acre plots were surveyed in 1961 (Table 7).

When all the one-acre plots outside the study area were checked and a density figure derived for all plots, it was discovered that the average number of nests per acre (1.15) nearly equalled the study area figure (1.12 nests per acre). Seemingly we had accomplished one of the following points: 1) selected a study area that was fairly representative of the black brant nesting habitat, or 2) tended to choose similar nesting areas to sample, thus, ignoring areas of lesser importance. Figure 2 shows the distribution and location of the Kashunuk one-acre nest sample plots.

Banding

The wire stationary traps were found to be an excellent means for capturing flocks of adults and non-breeders. This technique could possibly be employed to capture brood flocks late in the brood season when they gather in greater numbers. The use of the small portable net trap is limited in that only a few broods can be captured on each drive. However, it appears to be an effective method and is useful under certain conditions. Black brant trapped and banded totaled 1,042 including 132 locals and 219 adult females with brood patches.

When banding downy brant the crew found it necessary to practice extensive control measures against glaucous gulls. A general scattering of goslings, as a result of disturbances created by banding activities, creates conditions conducive to predation. Gulls hesitate to attack young brant when the adults are present, but eagerly take goslings when separated from the brood unit.

The usual method used to control gull predation was to assign one member of the crew as a gunner with instructions to shoot all gulls taking or attempting to take young--this was particularly important when releasing banded young. A twelve gauge shotgun or 22 rifle is suitable for this type of control.

Table 6. Statistical summary of the 1961 nesting check plots[1].

	Study Area		Kashunuk & Hazen Bay Brant Plots	All Black Brant Nest Plots
	Black Brant	All Species[2]		
No. nests	47	69	114	161
No. plots	45	45	95	140
Mean no. nests per plot	1.04	1.53	1.20	1.15
Complete search mean	1.12	1.54		
Standard error (plots)	.126	.121	.109	.105
Sampling error	23.7%	15.4%	17.5%	17.2%
Confidence limits	1.04 ± .25	1.53 ± .24	1.20 ± .21	1.15 ± .20
	1.29 - .79	1.77 - 1.29	1.41 - .99	1.35 - .95

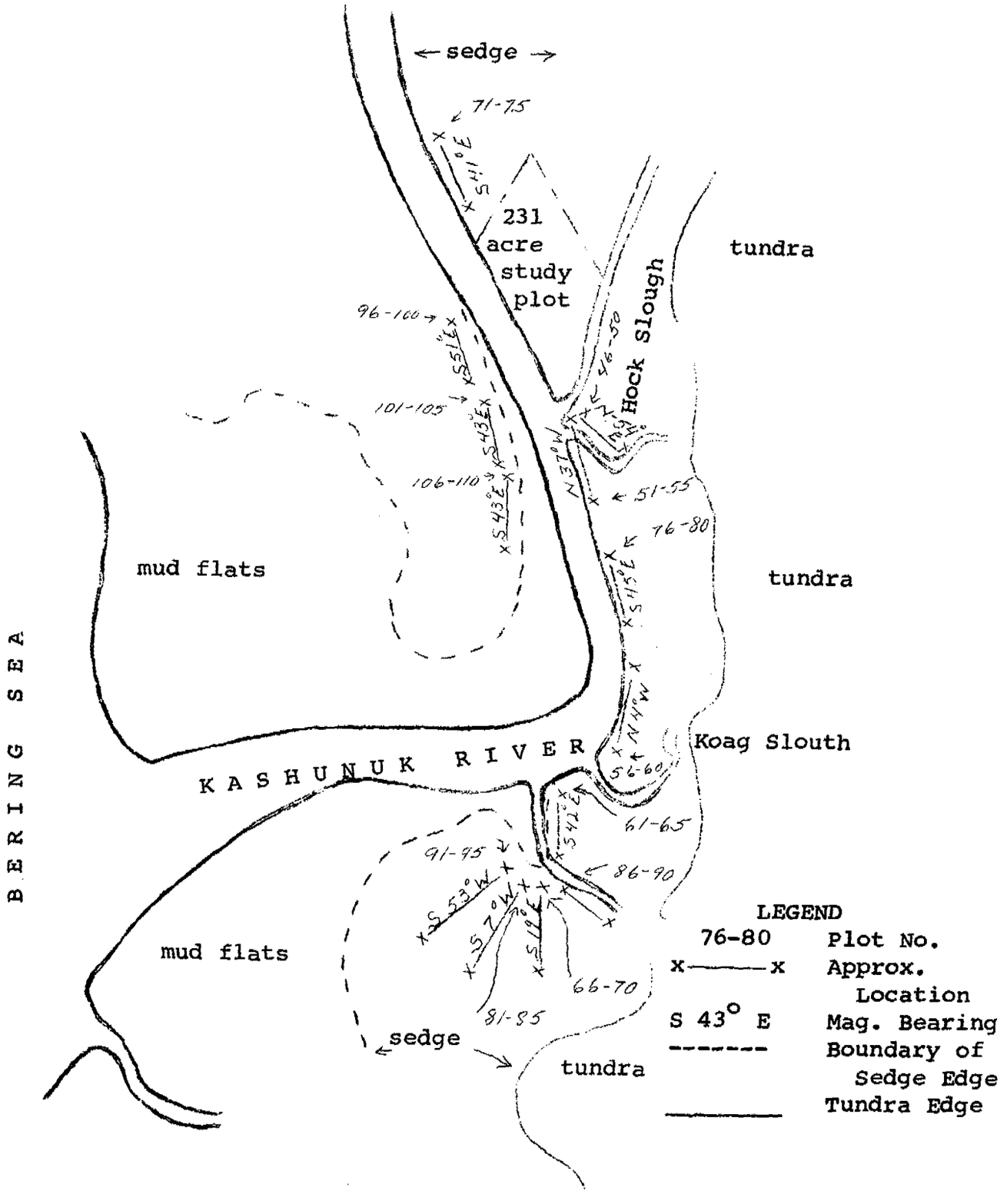
[1] Not listed are 25 plots where no nests were found.

[2] Includes 11 Cackling Goose, 9 Spectacled Eider, and 2 Old Squaw nests.

Table 7. Summary of the nesting check plots.

Species	Study Area	Lower Kashunuk River	Hazen Bay	Total
Black Brant	47	38	76	161
Cackling Goose	11	1	7	19
Spectacled Eider	9	1	1	11
Common Eider	0	3	3	6
Old Squaw	2	0	0	2
Total Nests	69	43	86	199
Total Plots	45	45	50	140
Av. Nest Density per Acre	1.53	.95	1.72	1.42

Figure 2. Location of nesting plots numbers 46 to 110, Lower Kashunuk River, Yukon-Kuskokwim Delta.



LITERATURE CITED

Gallop, J. B. and W. H. Marshall. A guide to aging duck broods in the field. Mississippi Flyway Council Technical Section Report, 1954.

Hanson, Henry A. and Urban C. Nelson. 1957. Brant of the Bering Sea - Migration and Mortality. Trans. 22nd N. A. Wildlife Conf. pp. 237-256.

Olson, Sigurd T. A study of goose and brant nesting on the Yukon-Kuskokwim Delta. Federal Aid to Wildlife Restoration Quarterly Report -- Project 3-R-6, Alaska, September 30, 1951.

Spencer, David L., J. C. Nelson and W. A. Elkins. 1951. America's greatest goose-brant area. Trans. 16th N. A. Wildlife Conf. pp. 290-295.

SUBMITTED BY:

Peter E. K. Shepherd
Game Biologist

APPROVED BY:

Don H. Strate
P-R Coordinator

James H. Brooks
Director, Division of Game

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

Project: W-6-R-3 Name: Alaska Wildlife Investigations

Work Plan: I Title: Game Bird Investigations

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

PERIOD COVERED: July 1, 1961 to March 1, 1962

ABSTRACT

A late spring delayed waterfowl nesting in the Interior one week to ten days. Net production was good to excellent despite rising water levels and a late season. Brood sizes were reduced nearly one duckling over the 1960 average.

There were 1,042 black brant and 500 ducks banded at the Yukon-Kuskokwim and Minto Lakes banding stations.

State and Federal personnel contacted 506 waterfowl hunters in 3 important gunning areas. These hunters bagged 1,883 ducks for an average take of 4.0 ducks per day. An open season on little brown cranes resulted in a light take. The three most prevalent waterfowl in hunter bags were pintail, mallards and American widgeon. An analysis of hunter identification of waterfowl revealed an average accuracy of 58 per cent. Statistics concerning crippling losses and hunting methods are presented.

RECOMMENDATIONS

Recording of migrant arrival, seasonal phenology, and factors affecting annual production should be continued in the major breeding areas. Observations of adult male and female ratios are needed to evaluate this possible index to production success. The significance of waterfowl age ratios in hunter bags as another production index warrents further study.

Expanded banding programs for black brant on the Yukon-Kuskokwim Delta and for local ducks at Minto Lake are suggested. Particular emphasis needs to be placed on the banding of a large sample of known age black brant.

Continued effort should be made to check waterfowl bags in the following areas: Minto Lakes and the Upper Tanana, the Susitna River Flats and the Copper River Delta, and the Stikine River Delta. The current method of bag check recording could become unwieldy with an increase in the number of hunters checked. An IBM card needs to be designed for rapid analysis of these data. An attempt should be made to carry on a mail survey of waterfowl hunters on a Statewide basis.

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT
FEDERAL AID IN WILDLIFE RESTORATION

State: Alaska

Project: W-6-R-3 Name: Alaska Wildlife Investigations

Work Plan: I Title: Game Bird Investigations

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

PERIOD COVERED: July 1, 1961 to March 1, 1962

OBJECTIVES

To determine nesting areas and migration routes for species where these facts are unknown; to determine the amount of production of waterfowl on selected nesting areas; and to determine the harvest of waterfowl by licensed hunters in Alaska.

TECHNIQUES

Production Surveys

Essentially the same methods were used to make brood counts at Minto Lakes as described in the 1960-1961 Annual Report. Brood counts on the Lower Kashunuk River, Yukon-Kuskokwim Delta were made by boat and on foot. The area covered extended from Old Chevak along the Kashunuk River and adjacent sloughs to the mouth of Rankin Slough.

Aerial counts of black brant and other species were conducted from a 180 Cessna on floats. Flight elevation was approximately 100 feet. Two observers made counts of waterfowl within a strip of 1/8 of a mile to each side of the aircraft. Brood observations were recorded while in flight with a stenorette dictation machine. The area covered by air was roughly from Igiak Bay along the coast to Baird Inlet.

Banding

This year rapidly rising water levels in July and August

precluded any extensive drive trapping at Minto Lakes and most of the waterfowl banded were captured in baited stationary traps.

On the Lower Kashunuk study area the banding of black brant was accomplished with use of two methods. One was the use of large, wire traps, similar to those used on Western Canada geese and described in the 1960-1961 Annual Report. Brant were driven along beaches or sloughs and into these traps. Adult brant were readily captured in this type of trap. Local brant were quickly captured in hastily constructed fish net traps, about ten feet in diameter.

Harvest Studies

The program for the 1961 Statewide waterfowl bag checks was stepped up considerably. Mimeographed forms were printed for distribution to duck camps and clubs at Minto Lakes, Healy Lake, the Anchorage area, and Cordova. These forms were accompanied by a letter explaining the Department's needs for hunter cooperation and gave instructions felt necessary for proper completion of the forms. Hunters were asked to record the number of hunters actively hunting each day, number of dogs used, number of cripples, and the numbers of ducks, geese and cranes taken. Response to this technique was not as good as anticipated; however, the major weakness in this system was thought to be the lack of a return self-addressed envelope. Periodic checks during the season revealed that sportsmen kept the forms up to date, but nearly all failed to return them at the close of the waterfowl season.

Another field form imprinted on a 5 x 8 inch Unisort punch card was designed and met with excellent success; however, it became apparent during the course of analysing these cards that this system was unwieldy, considering the number of variables encountered and the large number of cards handled. At present, an IBM card is being designed to take the place of the punch cards.

One field check station was established at mile 6 on the Copper River Highway; however, due to circumstances beyond our control, this station was closed the first day of operation. By and large most of the hunter contacts were obtained by interviewing sportsmen in the field or at hunting camps. Some data were obtained at State game checking stations and a report was submitted by one military hunting camp located in Cold Bay.

Occasionally waterfowl hunters volunteered information by phone or personal visit to me.

FINDINGS

Production Surveys - Breeding Ground Conditions

The Interior Alaska waterfowl breeding grounds were in good to very good condition during the spring and early summer of 1961. Larger lakes in the vicinity of Minto Lakes did not begin to open up until May 20 and some lakes were still ice-locked on May 25. A scant winter snowfall in the Interior was partially responsible for the persistent ice; that is, the lack of an insulative cover during the coldest part of the winter allowed considerable ice formation. This thick ice gave the impression of a late spring; however, dabbler flocks were generally on schedule and adequate nesting and feeding areas were available to early migrants. Conversely, diving ducks may have found conditions a little adverse, since few large bodies of water were available until late in May. Spring arrival dates and other phenological data for 1961 on the Minto Lakes study area are presented in Table 1.

The overall picture was that "breakup" was later than in 1960 and that a slow warming period and heavy rainfall throughout the summer appeared to retard the seasonal phenology. Nevertheless, net production seemed little affected by these factors, with as good or better production as in 1960.

High water levels at "freezeup," the fall of 1960, were augmented by a slight spring runoff and consequently the water levels during the early nesting period (May 10 to June 20) were excellent. As indicated in Table 2, the total rise to the early summer high was 5.2 feet.

Table 2. Comparative water levels, Minto Lakes, Alaska.

	1953[a]		1954		1955		1956		1961	
	Water Level	Date	Water Level	Date	Water Level	Date	Water Level	Date	Water Level	Date
First of Season	12.9	5/23	12.3	5/20	17.8		13.0	5/3	11.2	5/8
Early High	13.0	5/25	12.3	5/21	17.1	6/25	17.8	5/25	16.4	5/25

[a] Data for years previous to 1961 obtained for unpublished M.S. thesis by Ludwing J. Rowinski, 1958.

Table 1. Spring arrival dates and phenology at Minto Lakes 1961.

Date	Species	Remarks
April 24	Canada goose	
" 24	White-fronted goose	
" 24	Mallard	
" 24	Pintail	
" 27	Trumpeter swan	No snow remaining
May 1	Goldeneye	
" 2	Snow geese	Lakes all ice
" 5	Green-winged teal	Water beginning to flow into Minto Lakes
" 5	American widgeon	Ice out at Nenana
" 5	Bufflehead	
" 5	Canvasback	
" 5	Shoveler	
" 6	Scaup	Ice on lake edges largely in crystals
" 7		Anchor ice loosening
" 8		Able to paddle canoes
" 9		Anchor ice remains
" 10		Wind beginning to break ice
" 12		Skim ice in evening
" 13		Shore ice breaking loose
" 16	Surf scoter	Most of larger lakes free of ice
" 19	Old squaw	
" 19	White-winged scoter	Ice pack free on Big Minto
" 23		Water level reached spring high

During June the water levels receded, but heavy rains late in the month brought on a rapid rise. This excess water caused the inundation of some nesting areas as water levels approached the highest spring mark. Late nesting dabblers and divers may have suffered some nest losses with the first rapid rise of water. Continued inclement weather in July and August maintained constant high water levels the remainder of the summer in the Tanana Valley.

Brood Surveys

Brood surveys in mid-July revealed that the broods produced at Minto Lakes were slightly smaller than in 1960 and that the total number of broods produced was about the average for the past ten years (Table 3). Federal waterfowl biologists working in the Tetlin and Fort Yukon areas also observed a decrease in brood size and a better than average net production.

Table 3. Number of broods censused and average brood size, Minto Lakes.

	1951	1952	1953	1954	1956	1960	1961
Av. size	6.9	6.5	6.8	6.4	6.7	6.6	5.7
No. broods[a]	124	90	219	369	360	75	437

[a] Only the total counts from 1953, 1954, 1956, and 1961 are comparable.

The brood surveys at Minto Lakes were conducted between July 10 and 20 when only 40 per cent of the young were in Age Classes II and III. The average size of 437 broods was 5.7, or nearly 1 duckling less than in 1960 (Table 4). The average age Class II and III brood size was 6.0 young; whereas, the average Class I brood was 5.1 young. Possibly the small Class I brood size was related to a visibility factor resulting from high water and the flooded emergent cover, or to nest and brood losses from factors discussed previously. Considering that net production was excellent, although brood sizes were smaller, a very good, if not better than average fall flight was predicted to depart Interior Alaska.

Brood counts were also made on the Yukon-Kuskokwim Delta and although a paucity of comparative data made it difficult to

Table 4. Average brood sizes, 1960 and 1961.

	Minto		Kuskokwim-Yukon Delta
	1960	1961	1961
Cackling goose			53(3.7)
Black brant			454(3.0)
Emperor goose			42(3.7)
White-fronted goose			5(3.0)
Pintail	3(5.0)	78(5.2)	
Mallard		17(5.0)	
Green-winged teal	1(8.0)	42(5.9)	
American widgeon	19(6.2)	123(4.1)	
Shoveler	8(6.6)	81(6.0)	
Scaup	39(7.0)	73(7.0)	
Common goldeneye		4(6.2)	
Canvasback	3(5.3)	17(4.1)	
Redhead		1(5.0)	
White-winged scoter	2(6.5)	1(5.0)	
TOTAL	75[a](6.6)[b]	437(5.7)	554(3.2)

[a] No. broods observed
[b] Average brood size

interpret the results of these counts, the outlook for a good fall flight of brant and other geese was excellent (Table 4).

Age Ratios from Banding and Bag Checks

One of the indexes to annual production is the ratio of young to adults. Although there are many biases inherent in such data, a recent paper by Bellrose, et al., (1961) suggests that when properly handled these data can supply reliable information on productivity. Ratios from ducks taken in traps can provide a rough index to yearly changes in age ratios; however, in Interior Alaska more study of these ratios is suggested in order to adjust such counts to known differential migrations of adult males. Normally, both the numbers of adult males and females trapped are applied to the total number of young captured to arrive at an annual age ratio. This is not felt justified in the case of Interior waterfowl, since previous work at Minto Lakes has shown that the greater part of the adult male dabbler population is not present on the marsh after August 20. Occasionally dabbler drakes may not leave until early September; thus, comparable ratios of adult males to females are rarely found each year during the period when trapping of young waterfowl is conducted. While there are still other considerations involved in adjusting ratios of trap-caught ducks in the Interior, I feel that the ratio of adult females to young is perhaps the best means of standardizing these indices from year to year.

Age ratios obtained from bagged ducks and corrected for the greater vulnerability of juveniles offer the best means of determining the adult-juvenile composition of duck populations. Bag checks in the Interior verified that adult males are few in number during the hunting season. Under these conditions it seems logical to also use the adult female to young ratios in adjusting bag check information. The banding and bag check ratios are presented in Table 5.

Table 5. Age ratios of banded and bag checked waterfowl, Minto Lakes and Interior Alaska.

	Banding			Bag Checks		
	Adult[a]	Young	Ratio	Adult[a]	Young	Ratio
1960	111	164	1:1.4	18	116	1:6.4
1961	101	214	1:2.1	74	455	1:6.0

[a] Females

Of interest is that the 1961 age ratios of waterfowl shot in the Anchorage area and Cordova show figures of 1:3.2 and 1:2.6, respectively. These were based on adult male and female to young ratios. Assuming a 50:50 sex ratio for Interior waterfowl, the ratio given in Table 5 may be adjusted to equal 1 adult to 3 young or very close to the above figures. In order to obtain true age ratios, it is necessary to calculate the vulnerability quotients of juvenile birds; this cannot be accomplished without banding representative samples of waterfowl on the breeding marshes. So far, the sample at Minto Lakes has been too small to provide statistically reliable data; over the past 2 years from 300 to 500 ducks have been banded in the bait traps at Minto. Enlargement of this sample to 1,000 ducks would involve the establishment of a few more bait trap stations and require a little more effort than extended previously.

The data obtained through hunter bag checks suggest that net production in 1960 and 1961 was about the same. These production trends have been apparent in the annual winter inventory during January of 1961 and 1962. Moreover, hunter bag ratios of about 3.0 young per adult are suggestive of excellent production (Crissey, 1961). The value of these data will become apparent as more seasons pass and a greater body of comparative information is accumulated.

Banding Studies

Banding was conducted at two stations in 1961. These were 1) Minto Lakes and 2) the Lower Kashunuk River on the Yukon-Kuskokwim Delta. Only black brant were banded at the Lower Kashunuk River station; whereas, a variety of waterfowl were taken at Minto. Rapidly rising water levels in July and August precluded any extensive drive trapping at Minto Lakes and most of the waterfowl banded were captured in baited stationary traps. Results of the 1961 banding program are summarized in Table 6. A tabulation of direct recoveries from the 1960 banding is presented in Table 7.

This summer, for the first time in seven years, black brant were banded on the Yukon-Kuskokwim Delta. A total of 1,042 brant were marked, of which 135 were young of the year. Flocks of molting adults and sub-adults were readily captured in wire traps, somewhat similar to those used in the capture of western Canada geese (see 1960-1961 Report). The technique for capturing broods of young was slightly different and required the hasty setting of a small, circular net trap. A few broods were then

Table 6. Summary of banding, 1961.

Species	Male			Female			Unident.	
	Ad.	Im.	Loc.	Ad.	Im.	Loc.		Total
Black brant	365[a]	0	62	542[a]	0	73		1042
White-fronted goose	2	1	1	0	16	0		20
Mallard	16	7	1	10	11	2		47
Pintail	91	73	6	92	84	8	1	355
Green-winged teal	3	5	1	14	2	4	7	36
American widgeon	15	1	6	3	0	2		27
Shoveler	1	0	0	0	0	0		1
Canvasback	1	0	0	0	1	0		2
Greater scaup	0	1	0	0	6	0		7
Unidentified scaup	0	0	35	1	0	19		55
Lesser scaup	1	0	1	4	4	0		10
Common goldeneye	0	0	0	0	1	0		1
Bufflehead	0	0	0	3	0	0		3
Totals	495	88	113	669	125	108	8	1606

[a] Brant captured were identified as adults or locals; yearling non-breeders could not be distinguished from older birds.

Table 7. Direct band recovery rates, Alaska, 1960.

Species	BANDING AREA: Copper River Delta — No. Banded	Copper River Delta — No. Direct Recoveries	Copper River Delta — % Direct Recoveries	Minto Lakes — No. Banded	Minto Lakes — No. Direct Recoveries	Minto Lakes — % Direct Recoveries
Canada goose	500	95	19.0			
Pintail	5	0		263	16	6.1
Shoveler	4	2	50.0	51	4	7.8
American widgeon	1	1	100.0	181	14	7.7
Mallard	2	0		12	0	
Scaup				265	12	4.5
Bufflehead				66	0	
Canvasback				13	0	
Common goldeneye				3	0	
Green-winged teal				100	7	7.0
Blue-winged teal				7	0	

"rounded up" and driven into this trap. A crew of 3 men can band up to 200 young a day using these traps.

At Minto Lakes the stationary bait traps met with some success and nearly 500 ducks were captured. The steady rise in water levels during August required that the traps be moved nearly every day. This type of disturbance hinders efficient operation of the bait traps and a larger catch might have been made under different circumstances. Some trouble was encountered when a mink destroyed 17 ducks in the traps. This was the first instance of predation I have experienced in the Minto Lakes area.

A review of the returns from 1960 banding at Minto Lakes revealed that 16 states, 2 Canadian Provinces, and Mexico served as temporary homes for Alaska produced birds. These areas included: California, Oregon, Washington, Nevada, Texas, Utah, Montana, Louisiana, New York, Virginia, North Carolina, Kansas, Illinois, Minnesota, and Ohio; British Columbia and Alberta; and Mexico.

Harvest Surveys

One of the most important tasks facing waterfowl researchers in Alaska is to determine how extensively Alaskans are utilizing their waterfowl resource. A good start towards this goal was begun in 1961 with an intensive check of duck hunters at Minto Lakes, the Anchorage area, and at Cordova. Unfortunately, the Cordova check station was closed the first day of operation, although some harvest information was gathered through checks of hunters in the field. Instrumental in conducting bag checks in the Anchorage and Cordova areas were Game Management Agents of the U. S. Fish and Wildlife Service and the Southcentral Management Biologist. The State waterfowl biologist made bag checks in the Interior and was assisted on occasion by the U. S. Fish and Wildlife. In addition, one State biological aide was assigned to the Cordova station.

Waterfowl Movements and Seasonal Conditions

The usual fall movement of white-fronted geese began about August 10 in the Minto Lakes area. At this date flocks of 150 to 200 of these geese were commonly seen. A gradual build-up of white-fronted geese during August resulted in an early September concentration of 4,500 to 5,000 birds.

Lesser Canada geese began arriving at Minto in mid-August

and slowly moved through this area the remainder of the month. Few flocks elected to stay in the area for more than a day.

An early departure of American widgeon was recorded and is believed to be related to the fall high water which covered much of this species' preferred feeds. Coincident with this observation were remarks by biologists concerning early movements of American widgeon into the Susitna Flats area. Conversely, many other waterfowl appeared to be migrating later than in 1960. This retarded movement was possibly a response to the mild, early fall weather.

The first flocks of little brown crane arrived August 20 and flocks of 50 to 100 were seen commonly thereafter. Few cranes were observed at Minto after September 10.

The last of the migrant waterfowl departed Minto on October 5 when most of the open water had frozen. A trip to Minto on October 2 revealed that the only waterfowl remaining on the marsh at this date were mallards, goldeneye, and bufflehead. The last observation of migrant geese was made September 25.

Freezing conditions the week of October 7 to 12 forced many waterfowl to begin their southern migration somewhat earlier than usual in the Southcentral areas. Consequently, many waterfowl were departing or departed when I reached Cordova on October 12. A brief period of warm weather the next weekend held some birds in the area, but the main movement out of this area was apparently over.

A flock of 4,000 to 5,000 snow geese and other small flocks of 7 to 100 western Canada geese were seen on October 15 between Johnson and Tiedeman Sloughs on the Copper River Delta. These birds remained here for a few days and then continued on south. Cordova residents reported that the concentration of snow geese was the only group that had remained in the area this fall.

On October 14 and 15 numerous whistling swans (1,500 to 2,000) were noted moving southeast in small flocks of 10 to 50 birds. A few trumpeter swans were also observed in these flocks. The movement was apparently continuous and rapid since many whistling swans were observed traveling through the Juneau area October 16 and 17.

In the face of this early movement, the people in Southcentral Alaska found hunting slow and most hunters had difficulty

in obtaining full bags. The following week (October 16 to 22) hunters in the Stikine River Delta reported excellent snow goose, Canada goose, and mallard shooting.

The end of waterfowl hunting activity was coincident with "freeze-up," which occurred a little earlier than usual. Some localities in Southeastern Alaska, Kodiak, and the Alaska Peninsula had waterfowl available until the close of the 1961 season on December 14.

Factors Affecting the 1961 Harvest

The 1961 open season on game ducks and geese in Alaska ran consecutively from September 1 to December 14. A daily bag limit on ducks was set at five with a possession limit of ten. There was no open season on canvasback and redheads. The limit on geese was 6 per day and 12 in possession, of which 3 daily or 6 in possession could be Canada geese or subspecies of Canada and white-fronted geese.

An open season on little brown crane presented eager waterfowl hunters with a choice new target; however, many hunters found cranes somewhat more of a challenge to their hunting skill. The open season on cranes was from September 1 to 30 with a daily bag limit of two and a possession limit of four birds. Few hunters were able to fill daily bags, let alone possession limits. Only nine cranes were checked at Minto Lakes, and not many more were shot in the Fairbanks area.

Nearly the entire month of September was spent making waterfowl bag checks in the Minto Lakes area. These checks revealed a decided difference in waterfowl composition and distribution in comparison to the 1960 season. I believe these differences are directly related to the abnormal water levels during the summer and fall. Three to four feet of water covered the succulent grasses, spike rushes, pondweeds, and smartweeds which are usually available to migrant waterfowl. Because these foods were lacking, and with the loss of satisfactory loafing areas, most migrants--especially geese--were reluctant to remain on the marsh. This reluctance to remain is reflected in a reduced take of the two important species of geese (Table 8).

The increased water area appeared to attract many flocks of diving ducks, at least many more than usual. Accordingly, the take of diving ducks was up slightly. This increase may also be related to a less selective type of hunting which

Table 8. Comparison of the 1960 and 1961 Minto Lakes waterfowl bag checks.

Species	1960		1961	
	No.	Per Cent	No.	Per Cent
Lesser Canada goose	84	22.2	10	1.6
White-fronted goose	21	5.6	11	1.7
Pintail	49	13.0	149	26.6
American widgeon	98	25.9	141	22.9
Mallard	42	11.1	109	17.7
Shoveler	39	10.3	55	8.4
Green-winged teal	20	5.3	51	8.2
Blue-winged teal	0	0.0	1	Trace
Greater scaup	9[a]	2.4	11	1.7
Lesser scaup	0	0.0	20	3.2
Canvasback	4	1.1	2[b]	Trace
Goldeneye	2	.5	4	.6
Bufflehead	9	2.4	27	4.3
Old Squaw	0	0.0	1	Trace
White-winged scoter	1	Trace	0	0.0
Little brown crane	0[b]	0.0	9	1.4

[a] Both lesser and greater

[b] No open season

resulted from a scarcity of preferred ducks.

A scarcity and dispersion of ducks forced hunters to get out and "beat the brush" for birds; however, those hunters who did were usually rewarded with a full bag. An apparent increase (numerically) in pintail and mallards suggests that many hunters rallied to the conditions--both species are most often encountered in the emergent grasses where one must jumpshoot. A slight decrease in the numbers of American widgeon is not surprising, as I found them far less abundant than in 1960.

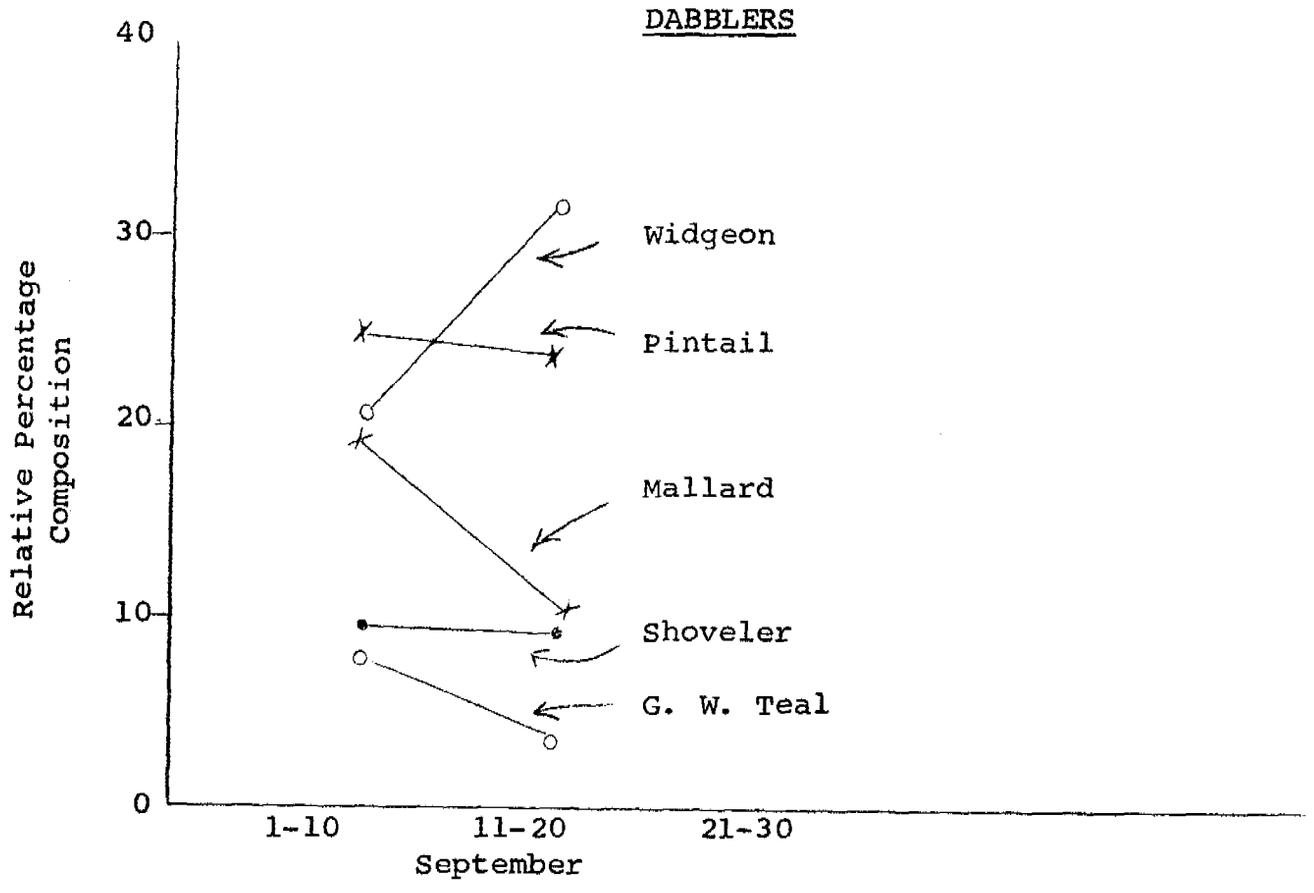
While no information on factors affecting the 1961 harvest are available for the other check areas, a comparison of weekly hunting efforts (Figures 1, 2 and 3) indicates that abundance and migrational movements are most influential in regard to composition and harvest.

Early in September mallards and pintails led in relative abundance, but as the season progressed, they gradually disappeared from hunter bags. The phenomenon is believed to be related to two factors (1) migration of these species, and (2) a tendency of hunters to be less selective as the season advances. The tendency to take other species of game ducks is well reflected in all three check areas as the season moved into the second week. Here it is apparent that widgeon and shoveler, as well as green-winged teal are more important in the relative composition. Again, this is related to abundance and a later migration.

Migrational movements of geese are aptly portrayed by the harvest statistics presented in Tables 3, 4 and 5. White-fronted geese are absent from bag checks after September 20. Lesser Canada geese quickly departed the Interior and reached a peak of abundance about October 10 in Southcentral Alaska. Cackling geese and snow geese also became most abundant during the same period.

Diving ducks are relatively unimportant to hunters until late in the season when other species are unavailable. A pronounced increase in the take of divers is evident throughout the season and reaches a peak the last days of open water.

Some data of interest concerning hunter success and effort are revealed in Figures 4, 5 and 6. The general trend after opening day in all areas except Cordova is a decrease in the average number of ducks per hunter, reflecting a lack of pressure



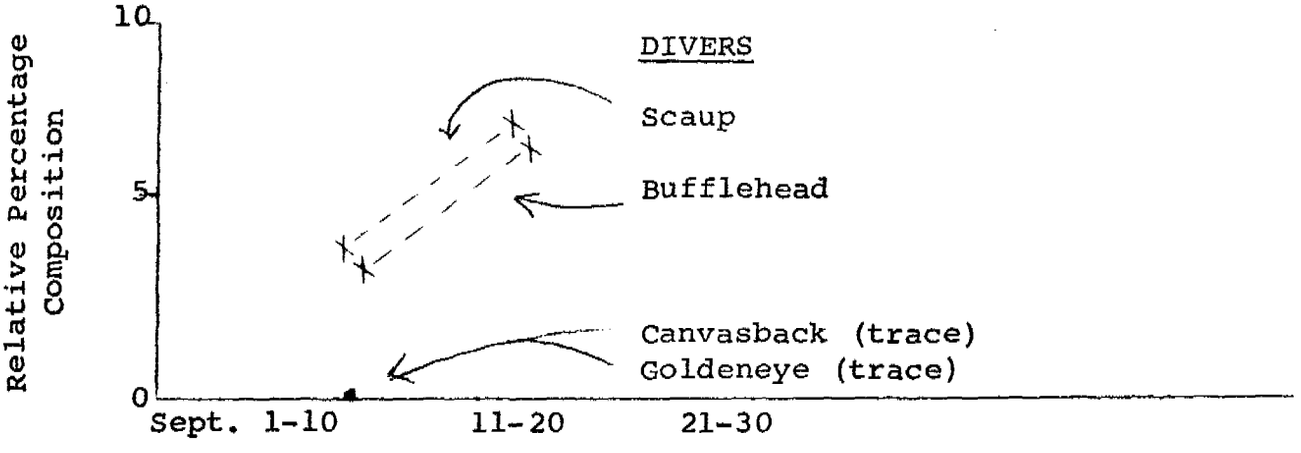


Figure 1. Weekly take of waterfowl by species, Interior, 1961.

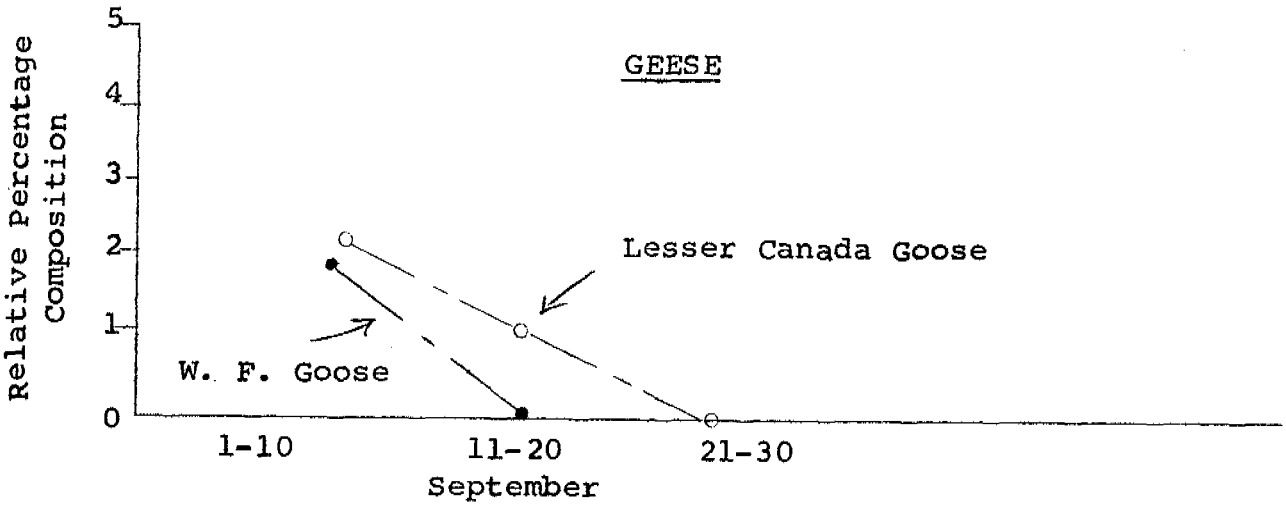


Figure 1 Continued. Weekly take of waterfowl by species, Interior, 1961.

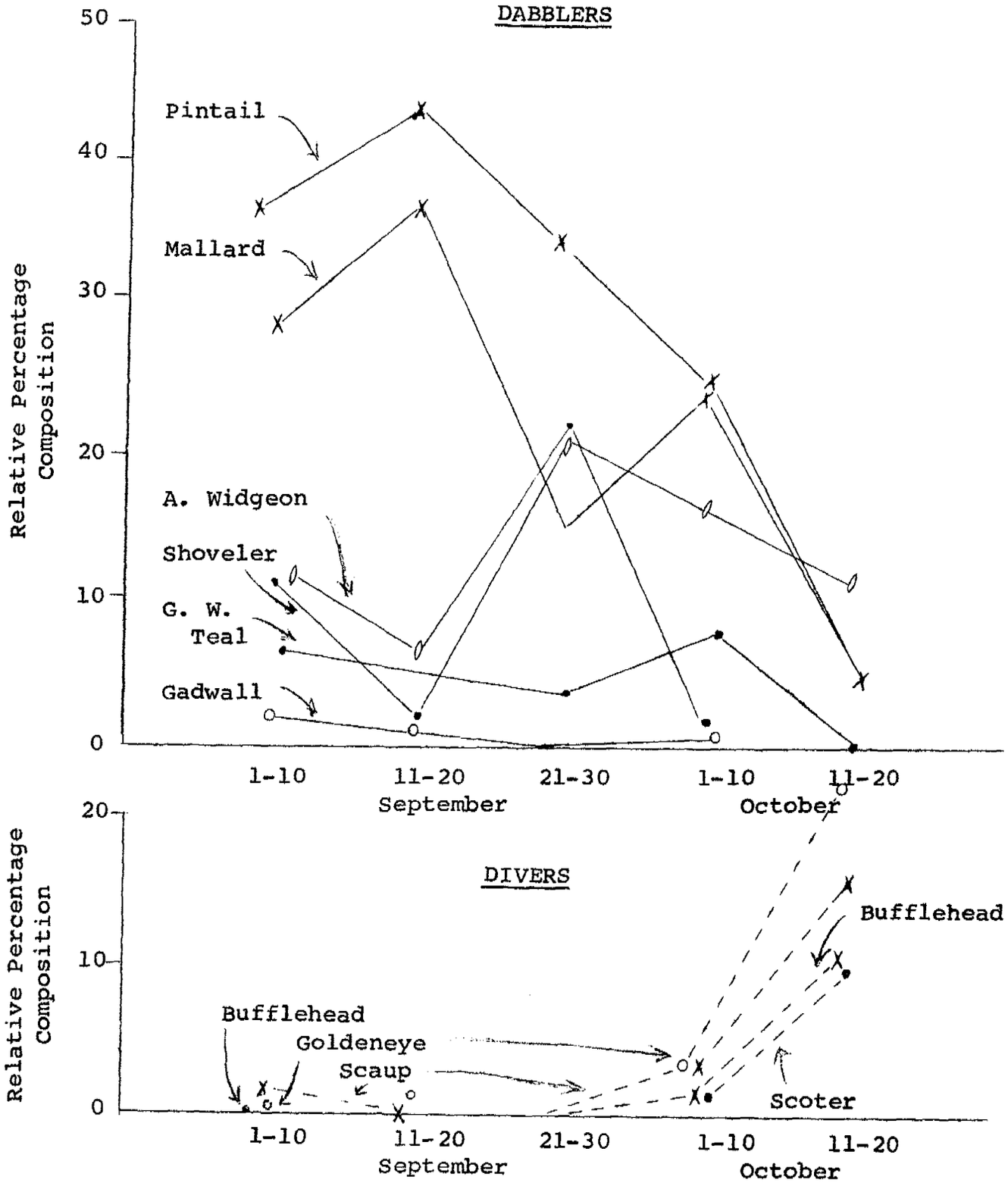


Figure 2. Weekly take of waterfowl by species, Southcentral, 1961.

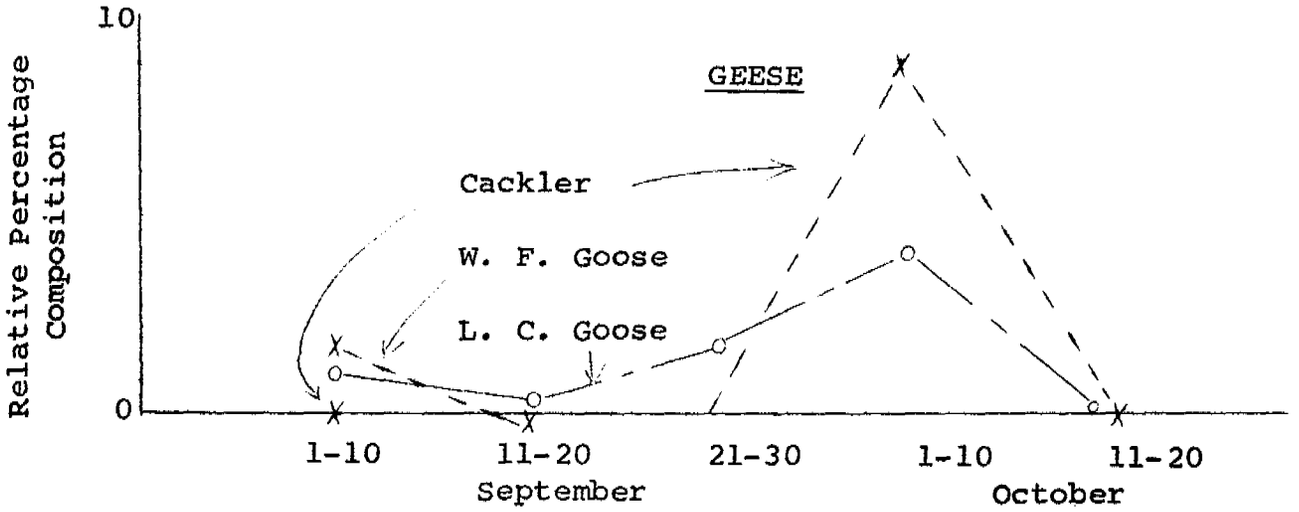


Figure 2 Continued. Weekly take of waterfowl by species, Southcentral, 1961.

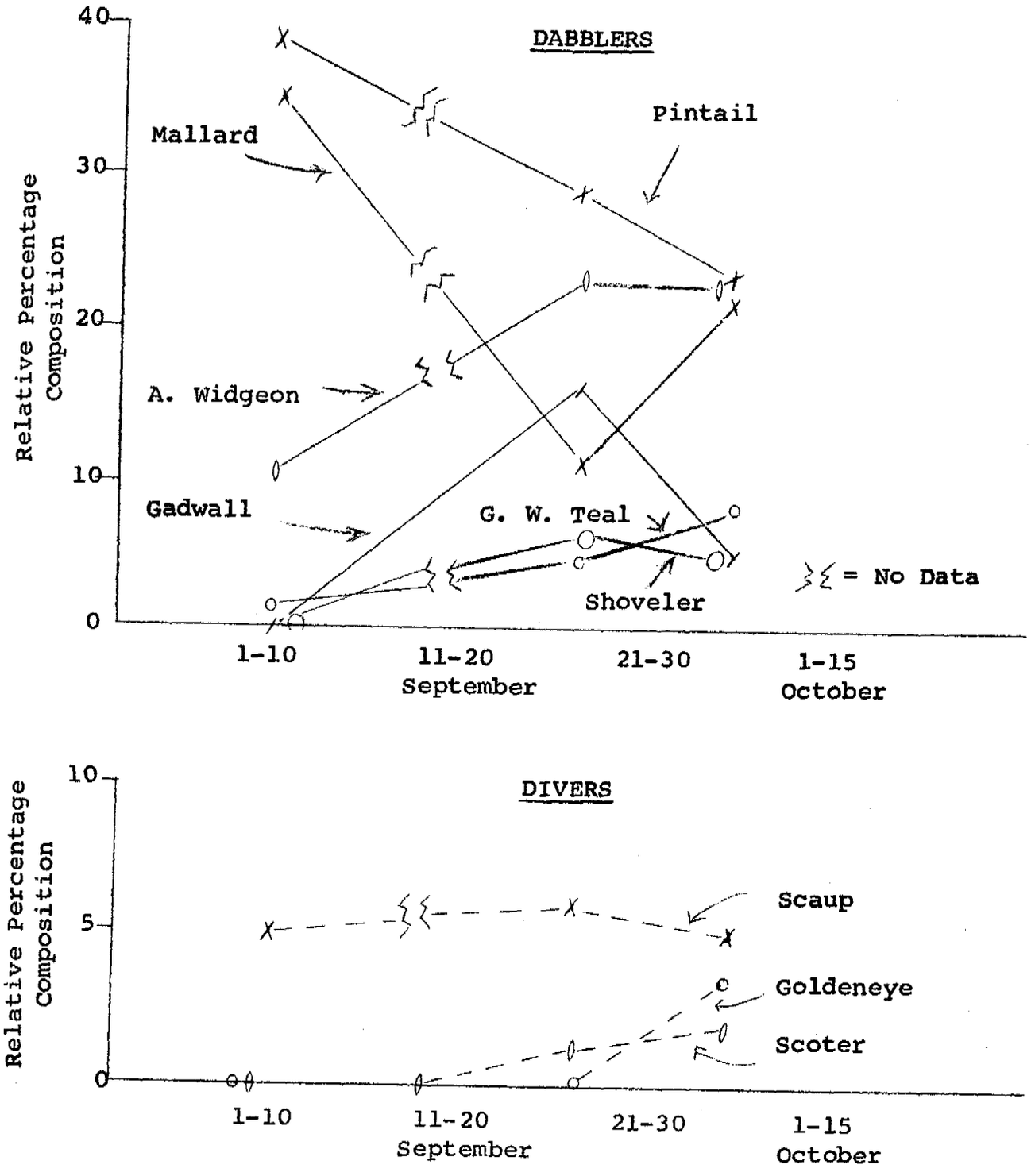


Figure 3. Weekly take of waterfowl by species, Cordova, 1961.

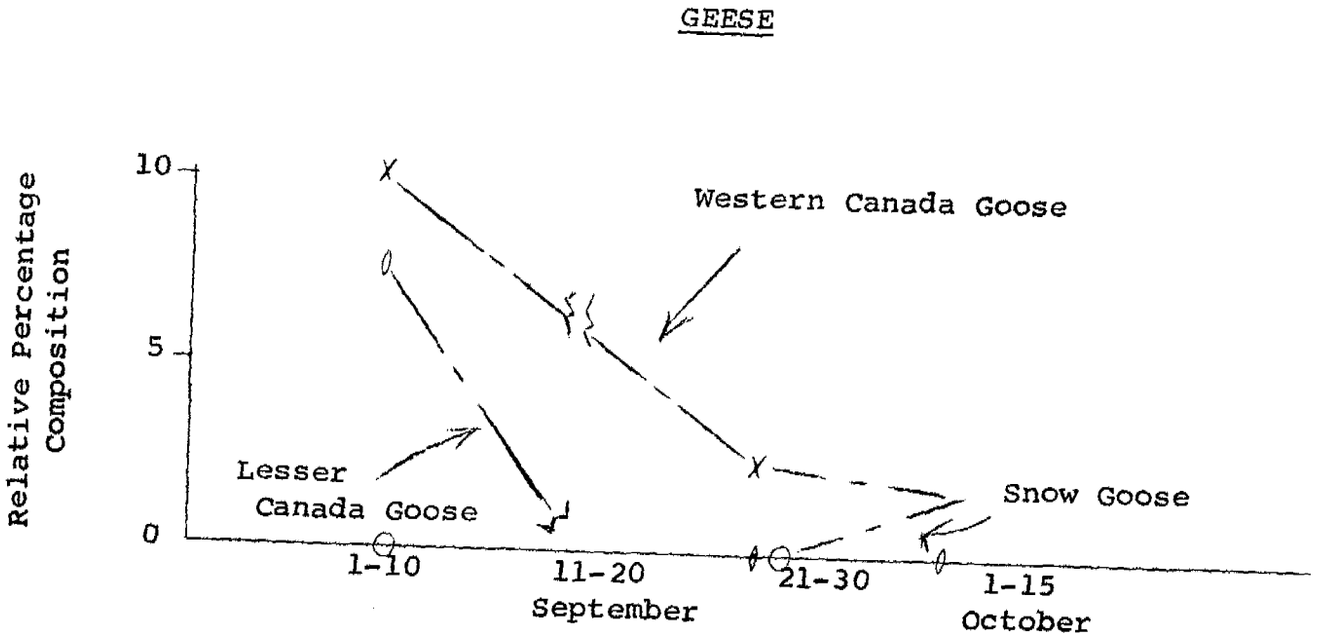


Figure 3 Continued. Weekly take of waterfowl by species, Cordova, 1961.

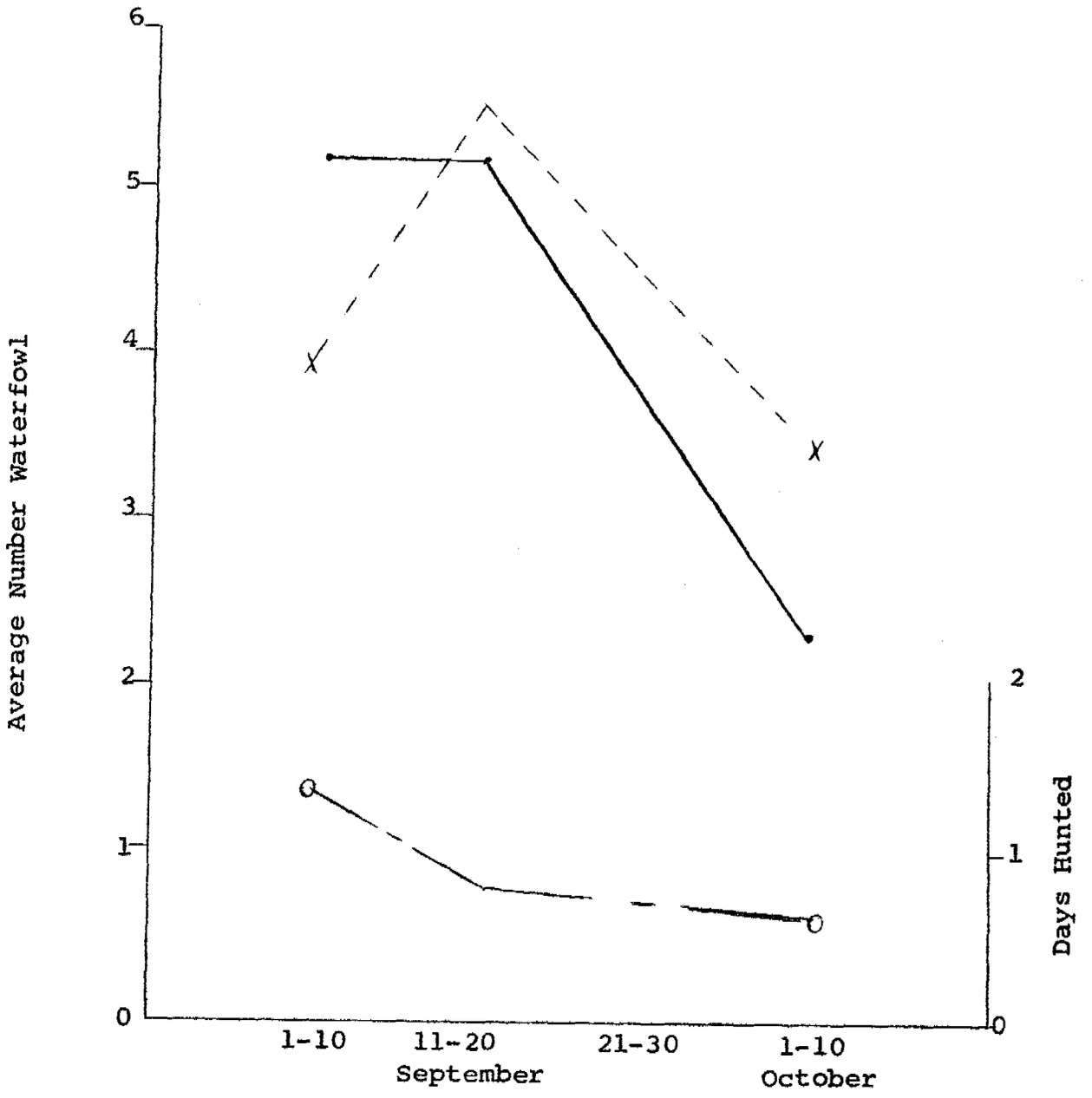


Figure 4. Hunter success and hunting effort, Interior, 1961.

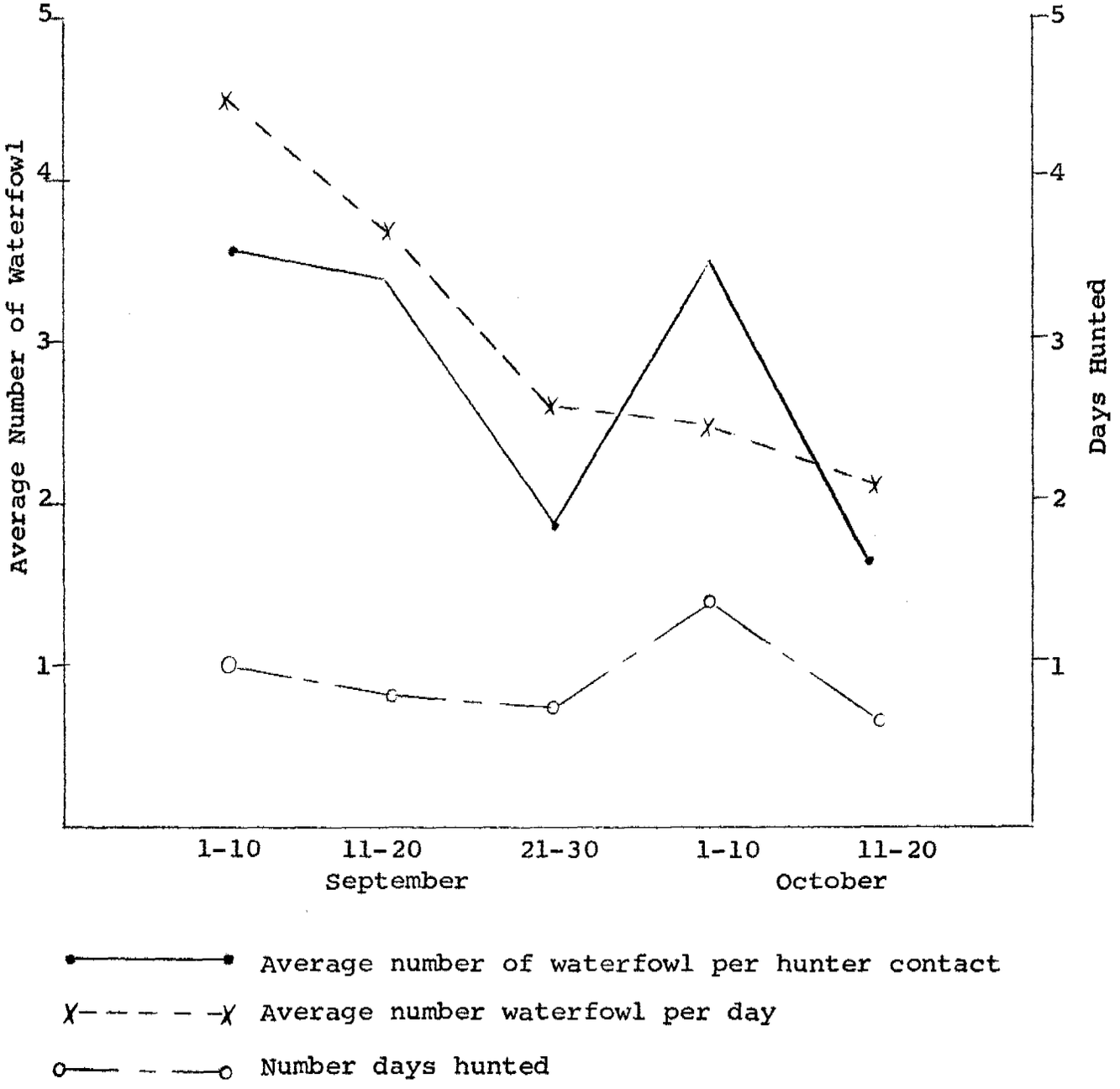
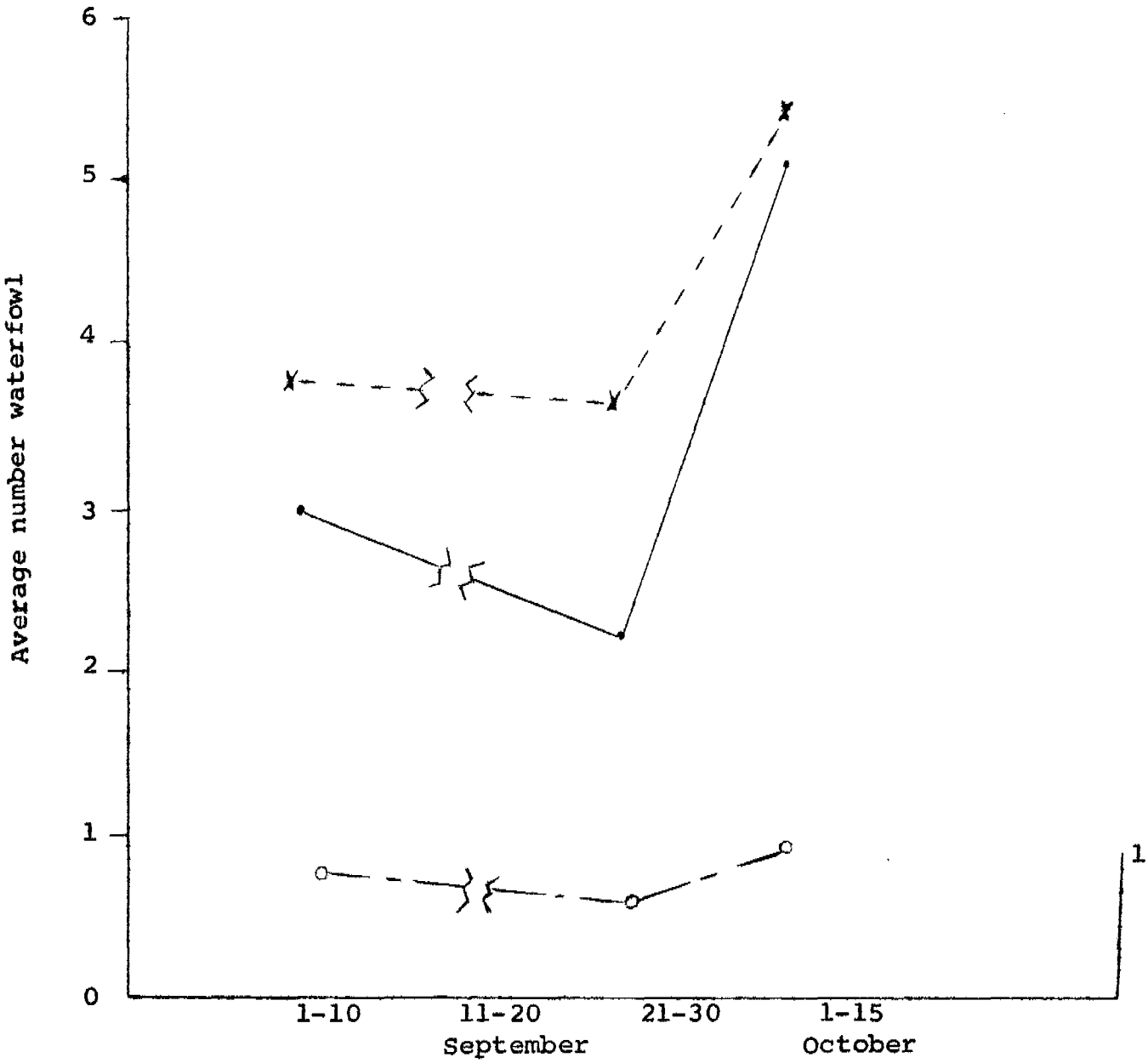


Figure 5. Hunter success and hunting effort, Southcentral, 1961.



Average number of waterfowl per hunter

Average number of waterfowl per day

Average number of days hunted

Figure 6. Hunter success and hunting effort, Cordova, 1961.

as well as a decrease in waterfowl abundance. In the case of the Cordova harvest data, it is known that hunters in this area prefer to shoot later in order to take advantage of excellent goose gunning in early October. The degree to which this late season goose shooting affects the hunting effort and take is shown by an increase in the number of days hunted, both in Cordova and the Anchorage area. This increase in the number of days hunted materially increases the number of waterfowl taken at this time.

Harvest Statistics

Compilation of the 1961 bag check cards revealed that 506 waterfowl hunter contacts were made by State and Federal personnel. The combined take of these hunters was 1,883 ducks and geese for a Statewide average daily bag of 4.0 birds. A summary of these statistics by the areas checked is presented in Table 9.

Table 9. Summary of the 1961 waterfowl bag checks.

Area	Total No. of Hunter Contacts	Total No. Days Hunted	Total Ducks and Geese Bagged
Interior	130	158	654
Southcentral	288	273	946
Cordova	88	66	283
Statewide Total	506	497	1,883

Hunting success was about the same in 1961 as in 1960 in the Interior. Fewer geese were taken at Minto Lakes because of poor hunting conditions and a lack of geese. This loss was compensated by an increase in the number of ducks bagged (Table 8). No comparative data are available for the Southcentral and Cordova areas; however, the 1961 statistics concerning hunter success and effort are presented in Table 10.

Table 10. Average bag per hunter, per day, and hunting effort per day.

Area	Average Bag Per Hunter Contact	Average Bag Per Day	Average Days Hunted Per Hunter Contact
Interior	5.0	4.1	1.2
Southcentral	3.3	3.5	.95
Cordova	3.2	4.3	.75
Statewide Av.	3.7	3.8	1.0

Estimates of the annual bags of Interior, Southcentral, and Cordova hunters were made from harvest statistics and questions asked during hunter interviews. These estimates suggest that Interior hunters are taking fewer ducks in comparison to other areas (Table 11). This feature is felt to be largely a reflection of the much shorter season and a consequent lack of waterfowl after the first two weeks of the open season. For all practical purposes, hunting ceases in the Interior about September 20 or earlier. Southcentral hunters have over six weeks of hunting and are a little closer to good, accessible areas, resulting in larger seasonal bags. The fortunate sportsman in the Cordova area has the advantage of an excellent hunting marsh which is easily reached by road or boat; consequently, the seasonal take per hunter is much higher than the other check areas. There is reason to believe that some bias to sampling highly successful hunters was encountered in the Cordova area and seasonal bags are thought to be much lower--perhaps in the magnitude of 30 to 40 ducks and geese per season.

Table 11. Estimated seasonal waterfowl bags, 1961.

Area	No. Days Hunted[a]	Av. Bag Per Day	Total Seasonal Bag
Interior	3.2	4.1	13.1
Southcentral	4.7	3.5	16.4
Cordova	18.9	4.3	81.2

[a] Hunters' estimate.

Bag Composition

The 3 most important species composing over 70 per cent of the waterfowl taken in 1961 were pintail, mallard and American widgeon (Table 12). Pintail and mallard replaced American widgeon in order of importance (American widgeon highest in 1960) apparently due to poor American widgeon production in 1961. The decrease in the number of geese in hunter bags at Minto Lakes has been mentioned previously.

Apparently, adult male ducks were a little later in departing Interior marshes because many more appeared in bag checks early in September than during the same time last year. The other check areas appeared to exhibit normal sex ratios in adult birds, although the Cordova data hinted that there is some selectivity toward adult males. Here, late in the season, full-

Table 12. Summary of relative species compostion, 1961 waterfowl bag checks.

Species	Interior		Southcentral		Cordova		Statewide	
	No.	Percentage	No.	Percentage	No.	Percentage	No.	Percentage
Pintail	171	25.1	327	34.6	84	29.7	582	30.5
Mallard	127	18.6	261	27.6	55	19.4	443	23.2
A. Widgeon	152	22.3	127	13.4	55	19.4	334	17.5
G.W. Teal	52	7.6	66	6.9	15	5.3	133	6.9
B.W. Teal	1	Trace*	1	Trace	0	0.0	2	Trace
Gadwall	0	0.0	13	1.4	20	7.1	33	1.7
Shoveler	64	9.4	54	5.7	12	4.2	130	6.8
Scaup	31	4.6	17	1.8	15	5.3	63	3.3
Bufflehead	33	4.8	5	.5	0	0.0	38	1.9
Goldeneye	2	Trace	18	1.9	4	1.4	24	1.3
Scoter	0	0.0	5	.5	3	1.1	8	Trace
Canvasback	2	Trace**	0	0.0	0	0.0	2	Trace
Merganser	0	0.0	4	Trace	0	0.0	4	Trace
L.C. Goose	14	2.1	15	1.6	6	2.1	35	1.8
W.C. Goose	0	0.0	0	0.0	12	4.2	12	.6
C. Goose	0	0.0	21	2.2	0	0.0	21	1.1
W.F. Goose	12	1.8	9	1.0	0	0.0	21	1.1
Snowgoose	0	0.0	0	0.0	2	.7	2	Trace
Brant	0	0.0	1	Trace	0	0.0	1	Trace
Crane	10	1.5	1	Trace	0	0.0	11	.5
Unident.	10	1.5	1	Trace	0	0.0	11	.5

* less than .5

** no open season

plumaged adults are available and preferred by some wildfowlers. Age ratios from all areas are fairly comparable and a discussion of these ratios appears in the section on production. Tables 13, 14 and 15 provide a breakdown of the species composition, age ratios, and sex composition of the birds taken in 1961.

Species Identification by Hunters

An analysis of hunter accuracy in identifying waterfowl is presented in Table 16. A surprising percentage of ducks and geese in hand were known by the hunters interviewed. These figures suggest that in at least some of the check areas the waterfowl hunting is more than just an incidental hobby; whereas, in the Anchorage area (Southcentral) there appear to be more novice hunters.

Table 16. Species identification by hunters.

Area	Identified	Total Bagged	Per Cent
Interior	551	666	82.0
Southcentral	410	960	42.0
Cordova	145	283	51.0
Statewide Total	1,106	1,909	58.0

Crippling Losses

Crippling losses varied from 16 to 25 per cent of the birds retrieved (Table 17). The Statewide average appears to be fairly comparable to statistics on crippling losses from other states. Some relationship between cover conditions and use of dogs are apparent in the Minto Lakes data. Those hunters using dogs lost nearly one half fewer birds than those without dogs. Losses as high as 60 per cent of the waterfowl bagged were recorded at Minto. These high crippling losses are attributable to the extensive flooding of emergent cover, which afforded little chance of retrieving birds.

Table 17. Summary of crippling losses.

Area	Birds Retrieved		Cripples	Percentage Cripples
Interior	w/o dog	452	116	25
	dog	214	29	13
Southcentral	w/o dog	283	54	19
Cordova	w/o dog	106	17	16
Statewide		1,055	216	20

Table 13. Waterfowl sex and age composition, Interior, 1961.

Species	Adult		Immature		Unident.	Total	
	No. ♂	No. ♀	No. ♂	No. ♀	No.	No.	per cent Comp.
Pintail	4	33	54	54	19	164	26.6
Mallard	12	12	42	33	10	109	17.7
A. widgeon	2	11	61	60	7	141	22.9
G. W. teal	1	6	22	21	1	51	8.2
B. W. teal	0	1	0	0	0	1	Trace
Shoveler	2	4	39	8	2	55	8.9
G. Scaup	0	0	3	7	1	11	1.7
L. scaup	0	0	9	9	2	20	3.2
Canvasback	0	0	1	0	0	1	Trace
Goldeneye	0	1	0	3	0	4	.6
Bufflehead	1	6	8	12	0	27	4.3
Old squaw	0	0	0	1	0	1	Trace
L. C. goose	3	4	0	1	2	10	1.6
W. F. goose	2	1	4	3	1	11	1.7
Crane	3	1	0	1	4	9	1.4
TOTALS	30	80	243	212	50	615	

Table 14. Waterfowl sex and age composition, Southcentral, 1961.

Species	Adult ♂	Adult ♀	Immature ♂	Immature ♀	Unident. No.	Total No.	Total per cent Comp.
Pintail	40	30	138	117	17	342	35.8
Mallard	39	39	92	80	13	263	27.6
Widgeon	14	8	49	49	5	125	13.1
G. W. teal	4	10	12	33	5	64	6.7
Shoveler	3	1	15	27	2	48	5.0
Gadwall	3	0	7	2	0	12	1.3
B. W. teal	0	0	1	0	0	1	Trace
G. Scaup	2	2	2	6	2	14	1.5
L. Scaup	0	0	0	0	3	3	Trace
Bufflehead	0	2	2	2	0	6	.6
Goldeneye	2	3	6	6	0	17	1.8
Scoter	0	0	2	0	2	4	Trace
Merganser	0	0	1	2	1	4	Trace
L. C. goose	2	3	6	2	1	14	1.5
C. goose	1	2	11	7	0	21	2.2
W. F. goose	2	1	0	1	5	9	.9
Brant	1	0	0	0	0	1	Trace
Crane	0	0	0	0	1	1	Trace
Snipe	0	0	0	0	5	5	.5
TOTALS	113	101	344	337	59	954	

Table 15. Waterfowl sex and age composition, Cordova, 1961.

Species	Adult		Immature		Unident.	Total	
	♂	♀	♂	♀	No.	No.	per cent Comp.
Pintail	10	5	35	28	3	81	29.7
Mallard	9	9	12	14	5	49	17.9
A. widgeon	14	2	16	19	4	55	20.1
G. W. teal	0	1	3	8	2	14	5.1
Shoveler	0	2	6	3	1	12	4.4
Gadwall	0	3	10	7	0	20	7.3
G. scaup	8	1	0	1	3	13	4.7
L. scaup	0	0	0	2	0	2	.7
Goldeneye	0	0	0	4	0	4	1.4
Scoter	0	1	1	1	0	3	1.1
L. C. goose	0	0	2	4	0	6	2.2
W. C. goose	3	1	1	0	7	12	4.4
Snow goose		2				2	.7
TOTALS	44	27	86	91	25	273	

Hunting Methods

Hunter success varied according to the method of hunting, with decoy hunting providing the best results. Most hunters, however, preferred to combine pass and jump shooting and nearly as many hunters were in favor of pass shooting alone. No attempt was made to determine differences in species composition in relation to the various methods, although some are apparent. These include jump shooting which favors the taking of dabblers and decoy shooting which provides more geese and diving ducks.

SUBMITTED BY:

Peter E. K. Shepherd
Game Biologist

APPROVED BY:

Don H. Steele
P-R Coordinator

James A. Brooks
Director, Division of Game