ALASKA DEPARTMENT OF FISH AND GAME
JUNEAU, ALASKA

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GAME BIRD REPORT

By

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Project Progress Report
Federal Aid in Wildlife Restoration
W-17-2, Jobs 10.1R & 10.4R (2nd half) and
W-17-3, Jobs 10.1R, 10.5R & 10.6R (1st half)

(Printed April, 1971)

JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperators: Jerry D. McGowan

Project No.: W-17-2 W-17-3 Project Title: Small Game Investigations

Job No: 10.1R Job Title: Population Characteristics of Rock Ptarmigan

Period Covered: January 1, 1970 to December 31, 1970

SUMMARY

Breeding density of male rock ptarmigan at Eagle Creek in 1970 (102) was slightly lower than in 1969 (113), and considerably lower than in 1968 (120). The Steese Highway was opened very early in 1970, and first flowering dates of alpine plants indicated an early spring. Males were on territories in mid May, and subsequent cool weather did not seem to alter breeding or nesting activities.

Based on a small sample of females, the juvenile to adult ratio was 1.2:1.0; the true age ratio was probably lower than indicated. Average clutch size of thirteen nests at Eagle Creek was 7.2, an increase over 1969. The average hatching date of June 21 was normal for most years, while nest predation (33 percent) was higher than 1969 (29 percent). Hatchability was 93 percent, an increase over 1969.

Average brood size in early August was 5.2, indicating at least 22 percent chick mortality between hatching and start of hunting season. Summer gain (2.4) was low, but showed a slight increase over 1969. Early completion of brood counts possibly resulted in a higher summer gain value than was actually the case. Little trapping was done in 1970 so overwinter mortality rates for age-sex groups could not be computed, but overwinter (1969-70) mortality for all age-sex groups was 56 percent. No checking station was operated; consequently very few band returns were received, and hunting pressure was not assessed. The parameters of clutch size, age ratio, and summer gain suggest that rock ptarmigan densities at Eagle Creek will continue to decrease in 1971.

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BACKGROUND

Rock ptarmigan are the most heavily hunted upland game bird in interior Alaska, and unlike other grouse they are easily taken during all seasons. Local populations are readily accessible, and we can see effects of current harvest levels. At present, large areas of inaccessible ptarmigan habitat serve to replenish more heavily hunted areas, but human populations are bound to increase in interior Alaska thus increasing hunting pressure on ptarmigan in the near future.

Early studies raised many questions concerning the biology and life history of rock ptarmigan (De Leonardis, 1952). In 1959 Robert Weeden initiated an intensive study of population characteristics of rock ptarmigan at Eagle Creek in interior Alaska. This study is a continuation of that project. The research is providing us with a sound basis for management; normal patterns of population change, normal parameters of production and survival, the effects of hunting, how to detect symptoms of excessive harvest, and how to reduce effects of hunting when needed.

OBJECTIVES

To record numerical changes of ptarmigan populations on selected study areas.

To determine mortality and reproductive rates among ptarmigan.

To evaluate roles of behavior, movements, and birth and death rates in determination of spring population levels.

PROCEDURES

A complete count of male rock ptarmigan in May was undertaken at Eagle Creek, and on two adjacent areas to determine how many breeding pairs were present. Number of females was estimated from direct counts in May and from subsequent observation work during nesting and brood rearing periods.

Nesting hens were trapped with long-handled nets, banded, and marked with colored dye on their wings. A trained dog helped to find nests; broods were located by imitating a peeping chick and listening for response of brood hens. The age of trapped ptarmigan was estimated by comparison of pigmentation on the ninth and tenth primaries, a technique described by Bergerud et al. (1963) and found to be accurate for Alaskan rock ptarmigan (Weeden and Watson, 1970).

FINDINGS

Spring Densities

Males were counted at Eagle Creek during the period May 14-17, 1970 and excellent weather prevailed allowing the count to be completed in a relatively short time. A total of 102 territorial males was tallied on the main study area, a slight decline from last year's total of 113 males, and a marked decline from the 120 recorded in 1968.

The Steese Highway was opened on April 4 in 1970, the earliest opening date since the start of the study in 1959. Upon opening of the highway, the Eagle Summit area was immediately closed to ptarmigan hunting; however, it is not known if illegal hunting occurred after the closure. There was no positive evidence that such hunting did occur.

Counts at Ptarmigan and Golddust Creeks are discussed in the report for Job 10.3.

Spring Phenology

Snowfall was very light during the winter of 1969-70 and by mid-May much of the snowpack had melted. Most of the common tundra plants bloomed approximately one week early (Table 1). Despite the early spring, unseasonably cool, snowy weather prevailed during the first two weeks of June which slowed up the normal progression of anthesis. Male ptarmigan had selected territories by May 13, and the cool, June weather did not cause any noticeable effect on breeding or nesting activities.

Table 1. Comparison of flowering dates of early-blooming plants at Eagle Creek in 1970 with six-year mean.*

Species	Flowering Date 1970	Previous Mean Anthesis
Douglasia gormanii	May 14	May 23
Anemone parviflora	May 22	May 30
Syntheris borealis	May 22	May 29
Petasites frigidus	June 1	June 1
Rhododendron lapponicum	June 1	June 7
Parrya nudicaulis	June 1	June 4
Lupinus arcticus	June 1	June 3
Louiseleuria procumbens	June 1	June 5
Cardamine purpurea	June 1	June 7
Sedum rosea	June 4	June 12
Dryas octopetala	June 4	June 6
Cassiope tetragona	June 5	June 7
Rubus chamaemorus	June 6	June 11
Andromeda polifolia	June 7	June 12
Polygonum bistorta	June 7	-
Ledum sp.	June 7	-
Androsace chamaejasme	June 13	June 15

* Six-year mean figures from Weeden 1968.

Age of Breeding Birds

No effort was made to trap males in 1970, but 24 females (nest and brood hens) were captured. Of the sample, 13 were yearlings and 11 adults, for a yearling to adult ratio of 1.2:1.0. The yearling to adult ratio of 100 females collected by Ronald Modafferi on a nearby area was 1.0:1.0. At Eagle creek age ratios among females have decreased yearly since 1966, reaching a low of 1.0:1.0 in 1969. Weeden (1969) noted that each year a high proportion of yearling females are captured early in the season (before June 20), but a higher proportion of adults are captured as the season progresses. He attributes this to the differential behavior between yearling and adult brood hens when approached by humans. Despite the small sample size in 1970 the same trend was present.

In 1970 only nest and brood hens were captured, where in other years attempts were made to capture all females encountered. This change in procedure, plus the smaller sample size, may bias age ratio data to some extent, but nevertheless the proportion of yearlings is low suggesting the population is on the decline.

Nesting

Nest hunting was done at Eagle Creek (by McGowan and Bendock) and at Porcupine Creek (by Modafferi). Twenty nests (13 on and 7 off the Eagle Creek area) were located that yielded clutch size information (Table 2). The pooled average clutch size was 7.5, but for the first time we noted a considerable difference between average clutch size at Eagle Creek compared with surrounding areas. The nests found off the Eagle Creek area were located as part of another research project which involved removal of 100 females during the springs of 1969 and 1970. No basic difference in range quality has been detected between Eagle Creek and surrounding areas. Possibly the noted difference in average clutch size between areas results from spring removals; however, the mechanism here is not understood.

In 1970 adult hens, on the average, had larger clutches than yearlings; this was true both on and off the study area. Adult hens also had larger clutches than yearlings in 1963 and 1965, but in other years the reverse was true. The biological significance of these variations is not understood; possibly it is a reflection of small sample size.

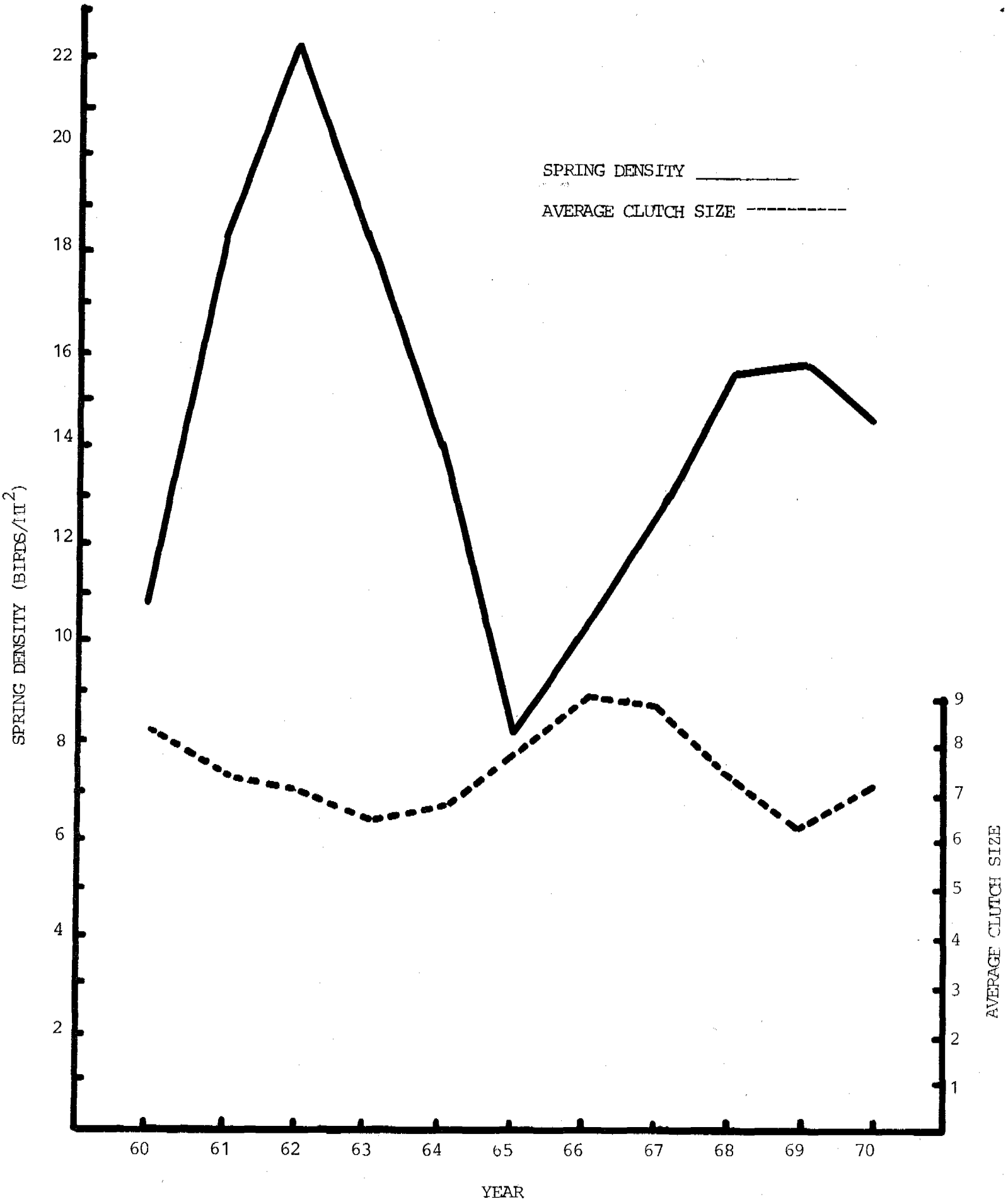
Clutches at Eagle Creek have been small during peak or declining periods, and have been higher during years of low or rising spring densities (Fig. 1). Clutch size-spring density trends for 1962-64 and 1968-70 follow the same general pattern. In 1971 I would expect breeding numbers to decline further and average clutch size to be higher than in 1970. It must be kept in mind, however, that we know little concerning the effects of weather on ptarmigan populations. The winter of 1969-70 was one of the mildest on record in interior Alaska; snowfall was very low. Because of this, ptarmigan probably entered the breeding season in unusually good condition, and the normal factors controlling number of eggs produced could have been overshadowed. As a result, clutches might have been larger than would have been the case following a typical winter.

Table 2. Clutch size in nests at or near Eagle Creek, 1970.

Age of Females	Nests at Eagle Creek Av. Clutch (No. Nests)	Nests Off Study Area* Av. Clutch (No. Nests)	All Nests Av. Clutch (No. Nests)
Yearling	6.5 (6)	7.6 (5)	7.0 (11)
2+ Years	6.8 (5)	9.0 (2)	7.4 (7)
Unknown	10.0 (2)	-	10.0 (2)
All Females	7.2 (13)	8.0 (7)	7.5 (20)

* A total of 7 nests located by Ronald Modafferi at Porcupine Creek northwest of Eagle Creek.

Figure 1. Clutch size at Eagle Creek in relation to spring densities.



Hatching dates were obtained on ten nests in 1970 (Table 3). Hatching occurred between June 19 and July 7; however, the latter is considered to be a re-nest and is excluded from average hatching data calculations. In most years there has been indication of re-nesting. This was the case in 1970; however, it is not as prevalent as in 1969 when an unusually severe spring storm destroyed many of the first nests. There was little difference between average hatching date for yearlings (June 21) and adults (June 20), and the pooled average of June 21 is normal for hatching peaks in most years (June 19-21).

Since 1959 nest predation at Eagle Creek has varied from near zero to 45 percent. Of 16 nests located in 1970, ten hatched, five were destroyed by weasels, and one was either deserted or the hen killed. Nest predation in 1970 (33 percent) was higher than in 1969 (29 percent), but essentially the same as that for 1968 (32 percent).

Hatchability in 1968 and 1969 was 86 and 85 percent respectively, but in all other years, with the exception of 1964, it was above 90 percent. Of 69 eggs in the ten successful nests in 1970, 64 hatched for a hatchability of 93 percent. Only two nests contained eggs that failed to hatch, and two of the unhatched eggs showed no development while the other three contained well-developed chicks.

Loss of Chicks

An average of 6.7 chicks hatched from successful nests at Eagle Creek in 1970. Thirty complete counts of broods conducted between July 20-27 averaged 5.17 chicks for a 22 percent loss of chicks after hatching. This is lower than chick loss in 1968 and 1969 (26 percent), and slightly less than the 10-year average loss. The lower loss in 1970 may reflect the relatively early completion of brood counts. In 1970 counts were completed on July 27 while in previous years this was not accomplished until the first week in August.

Summer Population Gains

The number of ptarmigan alive in August per bird alive in May is estimated below:

1.	Adults alive in May	204
2.	Estimated loss of adults in summer (10%)	20
3.	Adults alive in August	184
4.	Nests started	92
5.	Nests hatching	60
6.	Chicks per brood in August	5.2
7.	Total chicks alive in August	312
8.	Adults plus chicks in August	496
9.	Summer gains ($\frac{\#\ 8}{\#\ 1}$)	2.4

Table 3. Hatching dates of rock ptarmigan nests at Eagle Creek, 1970.

Date	Yearling Hens	Adult Hens	Unknown
June 17			
18			
19	11	1	
20		1	
21*		11	
22	1		
23			1
24			
25	1		
26			
27			
28			
29			
30			
July 1			
2			
3			
4			
5			
6			
7		1	
8			

* Average hatching date for all nests with exception of the one hatching July 7 which is considered a re-nest.

While in 1970 summer gain (2.4) was low when compared with other years of the study, it was higher than in 1969 (2.1) The increase in 1970 may be a result of relatively early brood counts which possibly resulted in overestimation of chicks present on the study area in August. Nevertheless, the low 1970 summer gain figure suggests that breeding stocks will decrease further in 1971.

Mortality, August 1969 to May 1970

Very little trapping was done in 1970 so mortality rates among various age-sex groups cannot be determined. However, comparison of 1969 fall population estimates for all age-sex groups and total spring (1970) census figures suggests an overwinter loss of 56 percent.

During the summers of 1959-69, live trapping provided age information on at least 100 ptarmigan each year. In years of increasing breeding density the proportion of yearlings increased, and in years of decreasing breeding population the converse was true (Table 4). Furthermore, the lack of highly disproportionate spring sex ratios has resulted in the belief that factors operating on the juveniles during winter is a key to population control. It should be pointed out that winter loss in any year is about the same for both juvenile males and juvenile females despite the fact that the sexes occupy different habitat types during this season. Based on these findings, I would expect the 1970 age ratio (yearling to adult) to be even lower than the 1.2:1.0 suggested by small sample of trapped females. Juvenile mortality was probably responsible for a major portion of the 56 percent overwinter mortality in 1969-70.

A total of 18 remains of dead ptarmigan killed in fall, winter and spring of 1969-70 were found in the summer of 1970. Of the 18, four were killed by mammals (probably foxes), and 14 were killed by avian predators. In 1969 we found remains of 49 ptarmigan, and 22 were located in 1968. The lower number of kills located in 1970 reflects the change in field routine, plus the fact that less time was spent at Eagle Creek during 1970 than in previous years.

Banding Results

We only attempted to catch nesting females and brood hens in 1970. Eleven nest hens (5 adults and 6 yearlings) and 13 brood hens (6 adults and 7 yearlings) were captured in 1970. Ronald Modafferi trapped 9 females (2 adults and 7 yearlings) and three yearling males at Porcupine Creek northwest of Eagle Creek.

Only two birds had been banded previously. Both were females, and #2512 was originally banded while attending a nest as a yearling in 1969. In 1970 she was recaptured on a nest approximately 200 yards from her nest site. This hen was two years old and nested successfully both

Table 4. Spring breeding densities and age ratios of rock ptarmigan at Eagle Creek, Alaska.

Year	Increase (+) or Decrease (-) in Breeding Density	Increase (+) or Decrease (-) in % Yearlings
1961	+	+
1962	+	+
1963	-	-
1964	-	-
1965	-	-
1966	+	+
1967	+	+
1968	+	+
1969	-	-

years. The other recapture, female #1962, was originally banded as an adult in 1968. She nested successfully in 1970 about 0.25 miles from where she was originally captured in 1968. This hen was 3+ years of age in 1970.

Band Returns and Hunting Pressure

No checking station was operated on the Steese Highway in 1969 or 1970, but 49 banded birds were returned voluntarily by hunters in 1969. Despite the fact that in 1970 signs were still present urging hunters to report the banded ptarmigan they shot, only two returns were received. Both were females 3+ years of age that were shot less than one mile from the previous observation. Without a check station or band return program we cannot assess hunting pressure.

ACKNOWLEDGMENTS

Robert Weeden assisted during the spring counts, and Terry Bendock assisted in all phases of the summer field work. Ronald Madafferi, working near Eagle Creek, contributed information on clutch size and age ratios.

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JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperators: David Roseneau

Project No.: W-17-2 Project Title: Small Game Investigations

Job No.: B.11 10.4 Job Title: Numbers and Productivity of Gyrfalcons on the Seward Peninsula

Period Covered: July 1, 1969 - June 30, 1970

SUMMARY

During the summers of 1968 and 1969, the Alaska Department of Fish and Game conducted a survey of the density and productivity of the gyrfalcon (Falco rusticolus) on the Seward Peninsula, Alaska. In the course of this research, food remains and pellets were collected from a number of occupied nesting sites. During 1970, this collection was analyzed. Prey species were identified and counted. The collection contained a minimum of 456 kills picked up in 1968 and 294 kills picked up in 1969, totaling a minimum of 750 kills. Uneaten portions of prey remains were counted, identified and compared to a respective collection of regurgitated pellets. Twenty-four bird species and 5 mammal species were identified. Ptarmigan species (Lagopus lagopus and Logopus mutus) and the Arctic ground squirrel (Spermophilus undulatus) were the most frequently occurring food items. Indigenous species (ptarmigan and mammals) composed approximately 75% of the food remains, while migratory species contributed approximately 25%. Shifts in prey species occurred between 1968 and 1969. These shifts appear to be a result of changing prey species' numbers and availability.

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OBJECTIVES

To determine the prey species utilized for food by nesting gyrfalcons on the Seward Peninsula, western Alaska.

To determine the approximate proportions of each prey species and various combinations of prey species utilized for food.

To determine what proportions of the food species were migrant species and what proportions were resident Alaskan species. It was assumed that migrant species would contribute greater amounts of pesticides to the gyrfalcon population.

BACKGROUND

In 1968, the Alaska Department of Fish and Game initiated a two-year survey of the numbers, distribution and reproductive success of the gyrfalcon (Falco rusticolus) on the Seward Peninsula, Alaska. During the course of this survey, a number of occupied nesting sites were visited and the uneaten portions of prey items along with regurgitated pellets were collected. This collection of food remains has been analyzed for the purpose of determining the prey species utilized for food by nesting gyrfalcons. A quantitative analysis was made for comparative purposes. Both qualitative and quantitative data were viewed with the assumption that a significant portion of the pesticide contamination of the population is dependent to a large degree on the amount of utilization of migratory species(as opposed to indigenous ptarmigan and small mammals).

PROCEDURES

Regurgitated pellets and uneaten portions of prey items were collected from 10 nesting sites in 1968 and from 13 nesting sites in 1969 (see Table 5). The uneaten portions of prey items normally consisted of bird and mammal skeletal material, feathers and pieces of mammal skin with fur attached.

On the first visit to a nest site, the active nest was located and climbed to (often descended to using rappelling techniques) where a "clean-up" was made. In turn, the rocks and slope below the nest were searched for

material that may have fallen from the nest in a similar fashion. The immediate outcrops, ridgetops and grassy hummocks were searched to determine the locations of favorite perching places. On this first visit, wherever prey remains and pellets were found, they were picked up. Obviously weathered pellets and remains were discarded, leaving the places of accumulation clean of food residues, so that on subsequent visits only those remains accumulated by the resident breeding pair would be assured of constituting the sample. Thereafter, whenever a visit could be made, these relatively fresh remains and pellets were collected. Throughout the summer, the nearby slopes were criss-crossed on foot and additional kills, usually in the form of a ring of plucked ptarmigan feathers, were noted. In almost all cases, the majority of the summer's sample came from the occupied nest and the slope directly beneath it. It was a common occurrence to always locate 2-3 primary perching places, where some additional fresh material could be located.

The tables included in this report were constructed using only the remains collected from the aforementioned locations, and in almost all cases, these remains consisted of actual skeletal material with flesh, fur or feathers adhering to it. Feather-rings on the nearby slopes were omitted, since it was impossible to determine if such a "ring" represented another kill, or if it belonged to the skeletal remains found in the nest (or at the other points checked). Almost all such "feather-rings" represented ptarmigan (Lagopus lagopus and Lagopus mutus) in winter plumage and were obviously from the previous winter and early spring.

Care was taken, when collecting pellets, to take only those pellets that were known to be fresh and obviously deposited by the resident pair of gyrfalcons. All suspicious pellets were removed from the area. Pellets found away from known perches or the nest were discarded since they could not usually be attributed to any one species (Weir, 1967).

When searching a nest for uneaten remains a careful search often revealed small tell-tale feathers or skeletal material. Effort was made to minimize the fact that the larger avian and mammal remains would be the most conspicuous and, therefore, most often recorded species (Errington, 1932). Fresh, uneaten portions of prey animals were sought with preference to pellets.

Collections made at each nest site were placed in labeled plastic bags. It was common to find two or three sets of portions (feet, feathers, etc.) from two or three separate kills of the same species at the perching and plucking places. Each set was placed in its individual plastic bag before being added to the total collection.

Carried from the field, the collection from any one eyrie on any one date was treated as follows: each labeled plastic bag was vented to allow drying and prevent mold and decomposition and placed in a labeled paper bag, with a liberal quantity of napha crystals. These bags were stored in a cool dry place whenever possible and, once remains were safely dry, the sealed paper bags were packed in cartons for shipment to the Fairbanks office of the Alaska Department of Fish and Game.

Identification of the skeletal material, feathers and other uneaten portions was carried out during 1970 at the bird and mammal collection of the University of Alaska. Bird and small mammal observations were made in the field during 1968 and 1969 and these, in addition to a check-list of the birds of the Seward Peninsula, (Dr. Brina Kessel, University of Alaska - unpublished) were valuable assets.

Whole pellets were broken apart and examined for content. The qualitative information from these examinations was used as a check against the species composition of each collection's prey remains counterpart. In the majority of cases, the pellets were composed of mammal hair, small bones and feathers from the heads, necks and breasts of birds (Bond, 1936). Pellets resulting from a meal of ptarmigan commonly contained the antebrachium and/or the manus and often the humerus of a wing, or the tibio-tarsus, tarso-metatarsus, phalanges and often the femur of a leg. Rarely did the examination of a pellet reveal signs of a species not already present among the uneaten prey remains. In almost all cases, pellet contents corresponded in proportions to that of the corresponding uneaten portions of the prey remains. It should be noted, however, that the presence of microtines was often discovered during these examinations, particularly the bones (often the skull) of the indigenous vole species. This indicates that vole species are taken to a greater degree than is apparent from the analysis of the uneaten prey remains.

Pellet examination reveals qualitative, but not quantitative, information (Errington, 1930, 1932). Therefore, only the relatively fresh uneaten portions of prey items collected over the course of each summer was used to begin developing a quantitative picture of gyrfalcon diet in northwestern Alaska (represented by Tables 1-15).

The University of Alaska's IBM 360/40 computer was utilized to tally kills and handle the computations. Kills were grouped in various categories, some of them presented here. Others will be more meaningful when 1970 and 1971 data are compiled. A preliminary attempt to sort kills by trophic level was made without significant results. More data are required. Only generalizations can be made when comparing 1968 and 1969 data. Well defined trends may become apparent when more data points are plotted.

Table 1. Total 1968-1969 gyrfalcon food remains.

Category	Total Kills	% of Total	% of Bird Kills	% of Mammal Kills
Ptarmigan species (*L. lagopus* & *L. mutus*)	437	58.27	70.37	-
Long-tailed jaeger (*Stercorarius longicaudus*)	58	7.73	9.34	-
Jaeger species	2	0.27	0.32	
Total	497	66.27%	80.03%	-
American Golden Plover (*Pluvialis dominica*)	15	2.00	2.41	-
Unidentified Passerine species	13	1.73	2.09	-
Short-eared owl (*Asio flammeus*)	10	1.33	1.61	-
Robin (*Turdus migratorius*)	9	1.20	1.45	-
Unidentified shorebird species	8	1.07	1.29	-
Common Snipe (*Capella gallinago*)	7	0.93	1.13	-
Tufted Puffin (*Lunda cirrhata*)	7	0.93	1.13	-
Unidentified bird species	7	0.93	1.13	-
Pintail (*Anas acuta*)	6	0.80	0.97	-
Whimbrel (*Numenius phaeopus*)	6	0.80	0.97	-
Oldsquaw (*Clangula hyemalis*)	4	0.53	0.64	-
Unidentified waterfowl	4	0.53	0.64	-
Pigeon Guillemot (*Cepphus columba*)	4	0.53	0.64	-
Bar-tailed Godwit (*Limosa lapponica*)	3	0.40	0.48	-
Black-legged Kittiwake (*Rissa tridactyla*)	3	0.40	0.48	-
Unidentified Alcid species	3	0.40	0.48	-
Gray-cheeked Thrush (*Hylocichla minima*)	3	0.40	0.48	-
Lapland Longspur (*Calcarius lapponicus*)	3	0.40	0.48	-
Redpoll species (*Acanthis flammea*/*Acanthis hornemanni*)	2	0.27	0.32	-
Green-winged Teal (*Anas carolinensis*)	1	0.13	0.16	-

Table 1 (Cont'd.)

Category	Total Kills	% of Total	% of Bird Kills	% of Mammal Kills
Semi-palmated Plover (Charadrius semipalmatus)	1	0.13	0.16	-
Ruddy Turnstone (Arenaria interpres)	1	0.13	0.16	-
Wandering Tattler (Heteroscelus incanum)	1	0.13	0.16	-
Unidentified Sandpiper species	1	0.13	0.16	-
Unidentified Auklet species	1	0.13	0.16	-
Tree Sparrow (Spizella arborea)	1	0.13	0.16	-
Total Birds	621	82.80%	100 %	-
Arctic Ground Squirrel (Spermophilus undulatus)	106	14.13	-	82.17
Collared Lemming (Dicrostonyx groenlandicus)	14	1.87	-	10.17
Brown Lemming (Lemmus trimucronatus)	5	0.67	-	3.88
Unidentified Microtine	2	0.27	-	1.56
Unidentified Vole species	1	0.13	-	0.77
Mink (Mustela vison)	1	0.13	-	0.77
Total Mammals	129	100 %		100 %
Total Kills	750			
Total Categories	37			
Total Minimum species	29 (24 bird, 5 mammal)			

Table 2. 1968 - 1969 Food gyrfalcon remains computed on a yearly basis.

Category	1968 Total Kills	% of Total	% Bird - Mammal	1969 Total Kills	% of Total	% Bird - Mammal
1. Ptarmigan species (L. lagopus & L. mutus)	294	64.47	74.81	143	48.64	62.72
2. Long-tailed jaeger (Stercorarius longicaudus)	42	9.21	10.69	16	5.44	7.02
3. Jaeger species	2	0.44	0.51	-	-	-
Sub Total	338	74.12	86.01	160	54.08	69.74
4. American Golden Plover (Pluvialis dominica)	4	0.88	1.02	11	3.74	4.83
5. Unidentified Passerine species	5	1.10	1.27	8	2.72	3.51
6. Short-eared owl (Asio flammeus)	8	1.75	2.04	2	0.68	0.88
7. Robin (Turdus migratorius)	1	0.22	0.25	8	2.72	3.51
8. Unidentified shore-bird species	3	0.66	0.76	5	1.70	2.19
9. Common snipe (Capella gallinago)	7	1.54	1.78	-	-	-
10. Tufted Puffin (Lunda cirrhata)	-	-	-	7	2.38	3.07
11. Unidentified bird species	5	1.10	1.27	2	0.68	0.88
12. Pintail (Anas acuta)	3	0.66	0.76	3	1.02	1.32
13. Whimbrel (Numenius phaeopus)	4	0.88	1.02	2	0.68	0.88
14. Oldsquaw (Clangula hyemalis)	-	-	-	4	1.36	1.75

Table 2. (Cont'd.)

Category	1968 Total Kills	% of Total	% Bird - Mammal	1969 Total Kills	% of Total	% Bird - Mammal
15. Unidentified waterfowl	1	0.22	0.25	3	1.02	1.32
16. Pigeon Guillemot (Cepphus columba)	-	-	-	4	1.36	1.75
17. Bar-tailed Godwit (Limosa lapponica)	3	0.66	0.76	-	-	-
18. Black-legged Kittiwake (Rissa tridactyla)	3	0.66	0.76	-	-	-
19. Unidentified Alcid species	3	0.66	0.76	-	-	-
20. Gray-cheeked Thrush (Hylocichla minima)	-	-	-	3	1.02	1.32
21. Lapland Longspur (Calcarius lapponicus)	1	0.22	0.25	2	0.68	0.88
22. Redpoll species (Acanthis flammea/A. hornemanni)	-	-	-	2	0.68	0.88
23. Green-winged Teal (Anas carolinensis)	1	0.22	0.25	-	-	-
24. Semi-palmated Plover (Charadrius semipalmatus)	-	-	-	1	0.34	0.44
25. Ruddy Turnstone (Arenaria interpres)	1	0.22	0.25	-	-	-
26. Wandering Tattler (Heteroscelus incanum)	1	0.22	0.25	-	-	-
27. Unidentified Sandpiper species	1	0.22	0.25	-	-	-
28. Unidentified Auklet species	-	-	-	1	0.34	0.44
29. Tree Sparrow (Spizella arborea)	-	-	-	1	0.34	0.44
Total Birds	393	86.18%	100% (bird)	228	77.55%	100% (bird)

Table 2. (Cont'd.)

Category	1968 Total Kills	% of Total	% Bird - Mammal	1969 Total Kills	% of Total	% Bird - Mammal
30. Arctic Ground Squirrel (*Spermophilus undulatus*)	43	9.43	68.25	63	21.43	95.45
31. Collared Lemming (*Dicrostonyx groenlandicus*)	11	2.41	17.46	3	1.02	4.55
32. Brown Lemming (*Lemmus trimucronatus*)	5	1.10	7.94	-	-	-
33. Unidentified Microtine	2	0.44	3.17	-	-	-
34. Unidentified Vole species	1	0.22	1.58	-	-	-
35. Mink (*Mustela vison*)	1	0.22	1.58	-	-	-
Total Mammals	63	13.82%	100 % (mammal)	66	22.45%	100 % (mammal)
Total Kills	456			294		

Table 3. 1968 - 1969 Gyrfalcon food remains comparison by grouping.

Group	Total Kills - 750			Total Kills - 456			Total Kills - 294		
	No.	% of Total	% Bird - Mammal	No.	% 1968	% Bird - Mammal	No.	% 1969	% Bird - Mammal
Passerines	31	4.13	4.99	7	1.54	1.78	24	8.16	10.53
Seed-eating birds	6	0.80	0.97	1	0.22	0.25	5	1.70	2.19
Insect-eating birds	12	1.60	1.93	1	0.22	0.25	11	3.74	4.83
Waterfowl	15	2.00	2.41	5	1.10	1.27	10	3.40	4.39
Raptors	10	1.33	1.61	8	1.75	2.04	2	0.68	0.88
Shorebirds	43	5.73	6.92	23	5.04	5.85	19	6.46	8.33
Sea-birds (including jaegers)	78	10.40	12.56	50	10.97	12.72	28	9.52	12.28
Sea-birds (excluding jaegers)	18	2.40	2.90	6	1.32	1.53	12	4.08	5.26
Non-migratory winter resident birds (ptarmigan)	437	58.27	70.37	294	64.47	74.81	143	48.64	62.72
Migratory birds (all other bird species)	184	24.53	29.63	99	21.71	25.19	85	28.91	37.28
Ptarmigan & mammals	566	75.47	-	357	78.29	-	209	71.09	-
Microtines	22	2.93	17.05	19	4.17	30.16	3	1.02	4.55
Non-microtines	107	14.27	82.95	44	9.65	69.84	63	21.43	95.45
Unidentified kills	9	1.20	-	7	1.54	-	2	0.44	-

Table 4. The 3 primary gyrfalcon food items.

Name	1968			1969			1968-1969		
	No.	% of Total	% Bird - Mammal	No.	% of Total	% Bird - Mammal	No.	% of Total	% Bird - Mammal
Ptarmigan	294	64.47	74.81	144	48.98	63.16	437	58.27	70.37
Ground Squirrels	43	9.43	68.25	63	21.43	95.45	106	14.15	82.17
Jaegers	44	9.65	11.20	16	5.44	7.02	60	8.00	9.66
Total	381	83.55%	-	223	75.85%	-	603	80.42%	-

Note: Willow Ptarmigan (Lagopus lagopus) and Rock Ptarmigan (Lagopus mutus) were considered as one category. No attempt was made to separate these species. Fifty-eight jaeger kills were identified as Long-tailed Jaegers (Stercorarius longicaudus). Two additional jaeger kills could not be identified to species, but were probably Stercorarius longicaudus, therefore "Jaeger" was considered to be a category.

Table 5. Gyrfalcon food remains collection location and dates.

Eyrie	Year	Dates of Food Remains Collection
J-68-1	1968	June 9, 14, 23; July 6
J-68-3	1968	May 31; July 9
J-68-4	1968	June 4, 9, 14, 25; July 5, 23
J-68-5	1968	June 16; July 6; August 23
J-68-6	1968	June 6; July 11
J-68-7	1968	June 13; July 12
J-68-8	1968	June 21
J-68-9	1968	June 22; August 16
J-68-30	1968	July 19
J-68-31	1968	July 21 (& June 13, 1969)
J-68-2	1969	May 27
J-68-4	1969	June 16
J-68-5	1969	May 29; June 16, 23, 27; July 7, 11, 17
J-68-6	1969	June 19; July 3, 13; August 12
J-68-31 (unoccupied)	1969	June 13 (1968 food remains gathered from nest)
J-69-37	1969	August 11
J-69-38	1969	July 5, 13
J-69-40	1969	June 13
J-69-41	1969	June 13
J-69-49	1969	July 20
RL-68-10 (Gyr-1969)	1969	June 21, 26; July 8, 12; August 5
RL-68-17 (Gyr-1969)	1969	July 16
GE-68-11 (Gyr-1969)	1969	July 20
Vern-69-1*	1969	July (date unknown)

* This eyrie was located by Mr. Vern Seifert who collected what remains he could find for donation to the project.

FINDINGS

1968

During 1968, 10 gyrfalcon eyries were visited a total of 24 times throughout the summer to collect prey remains. A minimum of 456 kills were identified. Respectively, avian and mammal species comprised 86.2% (393 kills) and 13.8% (63 kills) of this total (refer to Table 2).

Ptarmigan species (Lagopus lagopus and Lagopus mutus) occurred the most frequently, comprising 64.5% (294 kills) of the total prey remains and 74.8% of the avian remains. Long-tailed jaegers (Stercorarius longicaudus) comprised the second most frequently occurring (42 kills) avian prey species (9.2% of the total) and jaegers as a whole constituted 9.7% of the total remains (11.2% of the avian remains). Together, these two avian species constituted 74.1% (338 kills) of the 1968 prey remains and 86% of the 1968 avian prey.

The Arctic Ground Squirrel (Spermophilus undulatus) ranked equal with jaegers in occurance, comprising 9.4% (43 kills) of the prey remains. However, this species constituted 68.3% of the 1968 mammal remains. The second most frequently occurring mammal species was the Collared Lemming (Dicrostonyx groenlandicus), comprising 17.5% of the mammal remains. Lemmings, as a whole (Dicrostonyx groenlandicus and Lemmus trimucronatus, accounted for 25.4% of the mammal remains.

The occurance of one mink (Mustela vison) must be considered abnormal. This mammal is a rare species over the western portion of the Seward Peninsula and it is doubtful that gyrfalcons are often in a position to take them.

Of major interest, the indigenous species remains (ptarmigan and mammal) amounted to 78.3% (357 kills) of the 1968 total (refer to Table 3). Migratory species, assumed to be the major source of pesticide contamination to the population, comprised 21.7% (99 kills) of the prey remains. Shorebirds, as a group, contributed 23% of this figure. If we consider jaegers to be part of the general category of "seabirds," then this group pre-empts shorebirds as top "single" source. This category contributed 50.5% of the migratory species figure.

1969

During 1969, 12 gyrfalcon eyries were visited a total of 26 times to collect prey remains. In one instance, an unoccupied eyrie was visited and the remains gathered were assumed to have represented kills made during 1968, after the June 13, 1968 visit. Prey remains from an additional eyrie were donated to the project. A minimum of 294 kills were identified. Respectively, avian and mammal species comprised 77.5% (228 kills) and 22.5% (66 kills) of this total (refer to Table 2). It is noted that these figures represent a slight drop in avian species, but what may be a significant increase in mammals over the 1968 figure.

Ptarmigan species occurred the most frequently, comprising 48.6% (143 kills) of the total prey remains and 62.7% of the avian remains. These figures represent declines of approximately 25% and 17%, respectively, over those of 1968. As in 1968, long-tailed jaegers comprised the second most frequently occurring (16 kills) avian prey species. This species constituted 5.4% of the total remains and 7% of the avian remains. Together, these two avian species constituted 54.4% (160 kills) of the 1969 prey remains and 70.2% of the 1969 avian prey. It is probably significant that jaeger kills dropped from that of the 1968 jaeger kill.

The Arctic Ground Squirrel was the second most frequent prey species found during 1969. This species constituted 24.4% (63 kills) of the prey remains and 95.4% of the mammal remains. Ground squirrels, as a prey-remain, increased over the 1968 figure. This increase is probably significant.

During 1969, the indigenous species' remains constituted 71.1% (209) kills) of the total (refer to Table 3). Migratory species comprised 28.9% (85 kills) of the prey remains. This ratio does not appear to be significantly different from that of 1968. Passerines, as a group, contributed 28.2% of the migratory species figure. This differs from 1968, when shorebirds were the largest occurring group. As in 1968, if we consider jaegers to be part of the general category of seabirds, this group slightly surpasses the passerines in occurance totaling 32.9%.

In attempting to compare the 1968 and 1969 collections, consideration must be given to: 1) the consistency of search effort; 2) the number of eyries visited; 3) the consistency of the timing of these visits; and 4) changes in prey species numbers and their availability.

Search-effort during 1969 was consistant with that of 1968. However, in some instances the nest itself was not visited, with more effort expended in search below the nest and in search of perching places.

In 1968, ten eyries were reached. In 1969, twelve eyries were visited, representing an increase of 20%.

During 1968, visits to eyries were spread fairly evenly over the period May 31 to July 23. In 1969, the majority of visits occurred between June 15 and July 20. It is possible that some remains, accumulated prior to June 15, were scattered and thus unrecoverable.

Prey species' number changed markedly, in some instances, from 1968 to 1969. In 1968, considerable amounts of snow remained until late June. Many migratory species were concentrated along the road system and in other scattered areas free of snow until early June. Lemmings, particularly Dicrostonyx, were plentiful. Red-backed voles (Clethrionomys rutilus) were also quite common in grassy areas. Consequently, Long-tailed Jaegers and Short-eared Owls were found in large numbers. Both Rock and Willow Ptarmigan were found in large numbers throughout the Peninsula. Rock Ptarmigan were often located at low elevations in Willow Ptarmigan habitat and in many instances both species were found nesting in the same locations.

Ground squirrels appeared plentiful and were observed over a wide variety of habitat types. Waterfowl were generally abundant. Pintails (Anas acuta), in particular, were common nesters in valley bottoms and marshes, and were found nesting under willows at considerable distances from streams in several instances.

Light snowfalls during the following winter and high May temperatures resulted in a rapid 1969 snow-melt. Snow-melt was completed approximately 30 days ahead of the 1968 melt. Returning passerines and shorebirds were observed scattered across the tundra instead of concentrated along the cleared road system. During the 1969 summer, microtines were virtually non-existant. A total of 350 trap-nights in three good habitat areas produced one Red-backed Vole (Clethrionomys rutilus). Only nine Short-eared Owls were observed. Eight of these birds were in 2 family groups observed hunting along the Kuzitrin River during mid-August. Long-tailed Jaegers were thinly scattered across the Peninsula. The majority of those present were non-breeders ranging about in small groups and feeding on berries. Ptarmigan numbers were reduced and both Rock and Willow Ptarmigan were found more localized in only the better habitats. Ground squirrels were present in large numbers, but also appeared more restricted to particular locales. Waterfowl were considerably less common. U. S. Fish and Wildlife Service aerial counts confirmed this.

Shifts occurred in the utilization of prey species between 1968 and 1969, and from the data available, these shifts appear to be based on prey species' numbers and availability. It appears that ground squirrels were a relatively stable food source both years. This species was utilized to a greater extent in 1969 probably because of the decline in ptarmigan, jaegers and microtines. The "shifting" that occurred can be attributed in part to the decline of microtines, notably lemmings, which influenced other prey species' populations.

Combining 1968 and 1969 data (Table 1), ptarmigan appear as the preferred food species. Cade (1960) noted this preference "even in a year when they were scarce" from his Colville River data. Though data are still limited, it appears this observation is correct and the Seward Peninsula native name of "Kis-co-wik," translated as "ptarmigan hawk," is well founded. Cade's comment that "Gyrfalcons are much more specialized on a population-wide-basis in their food habits, depending primarily upon one or two resident species of prey" is substantiated by the fact that ptarmigan species and the Arctic Ground Squirrel accounted for 543 of the 750 identified kills. On a percentage-wise basis this represents 70.4% of the total food remains. This situation held true for both 1968 and 1969, when these resident species accounted for 73.9% and 70.4%, respectively, of the yearly kills. By body weight, these species account for over 85% of the consumed biomass. Cade found a comparable situation when he analyzed his Colville River data.

It appears that large lemming-microtine populations influence gyrfalcon utilization of some migratory species, notably Long-tailed Jaegers and Short-eared Owls, while acting as an additional food source themselves.

One hundred eighty-four kills of the total, or 24.5%, were migratory bird species. As a whole, this group contributed a relatively small amount of biomass by body weight. The utilization of migratory species is dependent, in part, on fluctuations in their numbers. Utilization of these species varies from eyrie to eyrie. A primary factor influencing this variability appears to be the eyrie location itself. Eyries located in and near habitats preferred by these species will reflect a higher utilization of these species in the food remains found at them.

There is some evidence to indicate prey preference by pairs of nesting gyrfalcons, beyond what might be termed a "population preference" for ptarmigan. Eyrie No. 2 (Table 7) was occupied by the same pair both years. In 1968, large numbers of ptarmigan were observed within the valley system that this nest site overlooks. Numbers of Long-tailed Jaegers were also present. In spite of the more numerous ptarmigan (that appeared easier to capture), 50.9% of the kills identified from prey remains were jaegers. In 1969, ptarmigan were scarcer, but considerably more apparent and available than the only occasional jaegers. Even so, six jaegers constituting 12% of the collected prey remains were killed. It appeared that the gyrfalcon pair utilized jaegers whenever possible.

Tables 6 through 14 represent 11 eyries where food remains were picked up in 1968 and 1969. The prey remains listed for each eyrie are generally representative of the prey species available in each of the habitat sitations.

Table 6. Eyrie No. 1 (J-68-9). Location: overlooking the sea above a narrow coastal plain.

Name	1968 No.	% of Kill
Ptarmigan species	18	34.62
Long-tailed Jaeger	15	28.85
Total	33	63.47%
Black-legged Kittiwakes	3	5.77
Unidentified Alcids	3	5.77
Unidentified Birds	3	5.77
Pintail	2	3.85
Green-winged Teal	1	1.92
American Golden Plover	1	1.92
Whimbrel	1	1.92
Bar-tailed Godwit	1	1.92
Short-eared Owl	1	1.92
Lapland Longspur	1	1.92
Total Birds	51	98.08%
Ground Squirrels	1	1.92
Total Mammals	1	1.92%
Total Kills	52	
Sea-birds*	21	40.39%
Sea-birds	6	11.54%
Migrant Birds	33	63.46%
Ptarmigan and Mammals	19	36.54%

* Including Jaegers

Table 7. Eyrie No. 2 (J-68-6). Location: inland river bluff in a narrow valley, 10 air miles from the coast.

Name	1968 No.	1968 % of Kill	1969 No.	1969 % of Kill
Ptarmigan species	24	43.64	37	74.00
Long-tailed Jaegers	27	49.09	6	12.00
Jaeger species	1	1.82	-	-
Total	52	94.55%	43	86.00%
Unidentified Passerines	-	-	2	4.00
American Golden Plover	-	-	1	2.00
Unidentified Shorebird	1	1.82	1	2.00
Unidentified Bird	-	-	1	2.00
Total Birds	53	96.37	48	96.00%
Ground Squirrels	1	1.82	2	4.00
Brown Lemmings	1	1.82	-	-
Total Mammals	2	3.64	2	4.00%
Total Kills	55		50	
Migrant Birds	29	52.73%	11	22.00%
Ptarmigan and Mammals	26	47.27%	39	78.00%

This eyrie was occupied by the same pair both years.

Table 8. Eyrie No. 3 (J-68-5). Location: lower slopes of a narrow river valley, 8 air miles from the coast.

Name	1968 No.	1968 % of Kill	1969 No.	1969 % of Kill
Ptarmigan species	10	32.26	16	23.81
Robins	-	-	3	7.14
Unidentified Passerines	3	9.68	2	4.76
Bar-tailed Godwits	2	6.45	-	-
American Golden Plover	-	-	2	4.76
Long-tailed Jaegers	-	-	2	4.76
Redpolls	-	-	2	4.76
Jaeger species	1	3.23	-	-
Whimbrel	-	-	1	2.38
Ruddy Turnstone	-	-	1	2.38
Tree Sparrow	-	-	1	2.38
Gray-cheeked Thrush	-	-	1	2.38
Unidentified Shorebird	-	-	1	2.38
Unidentified Bird	-	-	1	2.38
Total Birds	16	51.61%	33	78.57%
Ground Squirrels	15	48.39	9	21.43
Total Mammals	15	48.39%	9	21.43%
Total Kills	31		42	
Passerines	3	9.68%	6	14.29%
Shorebirds	2	6.45%	5	11.91%
Migrant Birds	6	19.35%	17	40.48%
Ptarmigan and Mammals	25	80.65%	25	59.52%

This eyrie was occupied by the same pair both years. One raven (Corvus corax) was apparently killed in aerial conflict with this pair in June, 1969, and brought to a ledge next to the nest, but was not utilized for food.

Table 9. Eyrie No. 4 (GE-68-11). Location: sea-cliff on perifery of a large sea-bird colony.

Name	1969 No.	% of Kill
Ptarmigan species	11	26.83
Tufted Puffins	7	17.07
Pigeon Guillemots	4	9.76
Unidentified Waterfowl	3	7.32
Unidentified Passerines	2	4.88
Unidentified Birds	2	4.88
Whimbrel	1	2.44
Unidentified Shorebirds	1	2.44
Long-tailed Jaegers	1	2.44
Robins	1	2.44
Total Birds	33	80.49%
Ground Squirrels	8	19.51
Total Mammals	8	19.51%
Total Kills	41	
Sea-birds*	12	29.27%
Sea-birds	11	26.83%
Migrant Birds	22	53.66%
Ptarmigan and Mammals	19	46.34%

* Including jaegers

Table 10. Eyrie No. 5 (J-68-4). Location: hillside in a narrow valley system 23 air miles from the coast.

Name	1968 No.	% of Kill
Ptarmigan species	8	21.05
Common Snipe	5	13.16
Total	13	34.21%
American Golden Plover	2	5.26
Short-eared Owl	1	2.63
Robin	1	2.63
Total Birds	17	44.73%
Ground Squirrels	8	21.05
Collared Lemmings	8	21.05
Brown Lemmings	4	10.53
Vole species	1	2.63
Total Mammals	21	55.26%
Total Kills	38	
Shorebirds	7	18.42%
Migrant Birds	9	23.68%
Ptarmigan and Mammals	29	76.32%
Lemmings	12	31.58%

Table 11. Eyrie No. 6 (RL-68-10). Location: hilltop in a wide river valley 11 air miles from the coast.

Name	1969 No.	% of Kill
Ptarmigan species	8	12.70
American Golden Plover	6	9.52
Robin	3	4.76
Gray-checked Thrush	2	3.18
Long-tailed Jaeger	1	1.59
Semi-palmated Plover	1	1.59
Unidentified Shorebird	1	1.59
Lapland Longspur	1	1.59
Unidentified Passerine	1	1.59
Total Birds	24	38.10%
Ground Squirrels	38	60.32
Collared Lemming	1	1.59
Total Mammals	39	61.91%
Total Kills	63	
Passerines	4	6.35%
Shorebirds	8	12.70%
Migrant Birds	16	25.40%
Ptarmigan and Mammals	47	74.60%

Table 12. Eyrie No. 7 (J-39-37). Location: inland river bluff in a broad, marshy valley 36 air miles from the nearest coast.

Name	1969 No.	% of Kill
Ptarmigan species	36	78.26
Unidentified Waterfowl	4	8.70
Pintails	3	6.52
Total Birds	43	93.48%
Ground Squirrels	3	6.52
Total Mammals	3	6.52%
Total Kills	46	
Waterfowl	7	15.22%
Migrant Birds	7	15.22%
Ptarmigan and Mammals	39	84.78%

Table 13. Eyrie No. 8 (J-68-31). Location: shoulder of a ridge in a high barren valley system along the continental divide, 32 air miles from the nearest coast.

Name	1968 No.	% of Kill
Ptarmigan species	54	84.38
Whimbrel	2	3.13
Short-eared Owl	2	3.13
Unidentified Passerine	1	1.56
Unidentified Bird	1	1.56
Total Birds	60	93.91%
Ground Squirrels	4	6.25
Total Mammals	4	6.25%
Total Kills	64	
Migrant Birds	6	9.38%
Ptarmigan and Mammals	58	90.63%

Table 14. Eyrie No. 9 (J-68-3). Location: hillside in a broad valley system, 16 air miles from the coast.

Name	1968 No.	% of Kill
Ptarmigan species	153	93.87
Short-eared Owl	3	1.84
Unidentified Shorebirds	2	1.23
Pintail	1	0.61
Total Birds	159	97.55%
Ground Squirrel	2	1.23
Unidentified Microtine	1	0.61
Mink	1	0.61
Total Mammals	4	2.45%
Total Kills	163	
Migrant Birds	6	3.68%
Ptarmigan and Mammals	157	96.32%

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JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperators: Jerry D. McGowan

Project No.: W-17-3 Project Title: Small Game Investigations

Job No.: 10.5R Job Title: Effects of Controlled Spring Hunting on Rock Ptarmigan

Period Covered: July 1, 1970 to December 31, 1970

OBJECTIVES

To determine the effects of repeated shooting of 40 percent of the spring population of rock ptarmigan on a specific area, and on subsequent fall and spring population levels.

No work accomplished during the reporting period.

JOB PROGRESS REPORT (RESEARCH)

State: Alaska

Cooperators: Jerry D. McGowan

Project No.: W-17-3 Project Title: Small Game Investigations

Job No: 10.6R Job Title: Density and Productivity of Goshawks in Interior Alaska

Period Covered: July 1, 1970 to December 31, 1970

SUMMARY

Ten stick nests (potential goshawk nests) were located from the air in approximately six hours of flying time near Fairbanks. Subsequent ground observations revealed two of these to be active in 1970. A third active nest was later located from the ground. Stick nests are easily observed from the air when snow is on the ground, and before the trees develop leaves. In early April, adults are agressive toward low-flying aircraft, which aids in locating active nesting areas. Once most traditional nest sites have been located, yearly density and productivity data can be collected fairly easily. Of the qree active nests, two contained three young, and one contained two young. Actual hatching and fledging dates were not determined, but observations in 1970 suggest hatching occurred in mid June, and the young fledged about July 7. A total of ten raptors (7 goshawks and 3 rough-legged hawks) were banded with both color and standard Fish and Wildlife Service bands in 1970. Four Swedish goshawk traps were operated during the fall, and six (4 males and 2 females) goshawks captured. Five of these were juveniles hatched in 1970, and the sixth was in transition plumage and assumed to have been hatched in 1969. Weights and various measurements were taken on ten goshawks; six of these had been live trapped, two were captive birds being used for falconry, and two had been accidentally caught in steel traps and were dead. Weights and measurements from this small sample suggest that sexual dimorphism is sufficient to allow accurate sexing of goshawks based on a combination of parameters. Comparing these data with those available from elsewhere in the United States indicates that the Alaskan birds are both heavier and larger than those found in more southern latitudes.

CONTENTS

BACKGROUND

The goshawk (Accipiter gentilis) is an important avian predator throughout the year in wooded regions of Alaska. Goshawks are known to prey heavily on upland game birds and snowshoe hares (Lepus americanus) in Alaska, and studies from Finland indicate that grouse are preferred for food by goshawks even when other birds are available (Sulkova, 1964). Presently there is serious concern for many raptors because of decreased productivity resulting from contamination by chlorinated hydrocarbons, and population declines of peregrine falcons (Falco peregrinus) have been discussed by Hickey (1969), Cade et. al. (1968), and others. Because goshawks, as well as gyrfalcons (Falco rusticolus), are permanent residents of Alaska, these contaminations are probably not reducing productivity of these species to the extent recorded for the migratory raptors. Goshawks have long been recognized as excellent birds for falconry, and the demand for raptors to be used for this purpose is increasing. In view of the recent decrease in productivity of peregrine falcons and other migratory birds of prey, goshawks and gyrfalcons may be the only species we are justified in using to satisfy this increasing demand. We have good general knowledge of gyrfalcon populations on the Seward Peninsula (Roseneau, 1968 and 1969); however, no data on Alaskan goshawks have been reported. A literature review revealed very few references to this species from elsewhere in North America, and no information concerning population densities or productivity was found. This is a report of studies initiated in 1970 designed to give us information essential for management of goshawks.

OBJECTIVES

To develop techniques for determining distribution and productivity of goshawks in interior Alaska.

PROCEDURES

Much of the work in 1970 was of an exploratory nature, and accessible habitat in the general vicinity of Fairbanks was surveyed from the air in April. Stick nests were easily observed from a Supercub flying at low altitudes in the spring when snow was on the ground, but before the trees developed leaves. Later in the summer all nests located from the air were visited on the ground to determine usage.

Pole climbing irons were used to climb to active nests where chicks were weighed and banded. During the fall and early winter, Swedish goshawk traps, similar to those described by Beebe and Webster (1946, p. 301), were baited with feral and domestic pigeons (Columba livia) and used to trap goshawks.

Trapped hawks were weighed and banded with both color and 7A Fish and Wildlife Service bands. It is generally felt that male goshawks are about one-third smaller than females. Sex was judged by general body and foot size before weight and measurements were taken from live-trapped birds. The measurements taken are listed below.

Length - The distance from the tip of the bill to the end of the longest rectrix. The bird is placed on its back for this measurement.

Extent - The distance from tip to tip of the longest primaries of the outstretched wing. The bird is placed on its back, and the wings grasped at the wrist joints and fully extended.

Wing - The distance from the bend of the wing to the tip of the longest primary. The curvature of the primaries is not straightened.

Primaries - The total flattened length of the tenth (P10) and the seventh (P7) primary.

Deck Feathers - The total flattened length of tail feathers five (D5) and six (D6).

Bill - The distance from the tip of the upper mandible is a straight line to the anterior edge of the cere. Calipers necessary for this measurement.

Tarsus - The distance from the joint between the tibia and metatarsus to the joint at the base of the middle toe in front. Calipers necessary for this measurement.

After data were recorded the birds were promptly released in the general area where they were captured. Dead goshawks submitted to the Department were weighed and the same measurements taken as for live-trapped hawks.

FINDINGS

Nest Surveys

Ten stick nests were located in approximately six hours of aerial survey time. Later observation revealed that three of the nests were active in 1970, two were occupied by goshawks and one by rough-legged hawks (Buteo lagopus). Later in the summer, another active goshawk nest was located. On April 9, while flying in search of nests, a goshawk made an aggressive "pass" at the aircraft in an area where an active nest was found later. From this incident it appears that by early April territories have been established, and nest hunting should be started at this time.

In some locations up to five stick nests were present in an area of a few hundred yards. It is assumed that these are traditional nesting sites, and they will be key areas for providing long term productivity information. Because of the aggressive behavior demonstrated in the spring by territorial adults, potential nesting areas can be checked from the air in mid April and active sites determined. Once most of the traditional nesting sites have been located, a definite study area can be delineated, and yearly density and productivity information collected with a minimum of preliminary reconnaissance.

Nesting and Productivity

Three active goshawk nests were located in 1970, with an average of 2.7 young produced per nest. Other field obligations prevented close monitoring of nesting activities, consequently no specific data on clutch size, hatching success, or fledging success are available. In future years nests will be followed closely in order to assess various parameters of productivity. Observations made at each nest are presented below for later reference.

On June 30 an area near Fairbanks containing five stick nests was visited on the ground and an active nest located. The female came off the nest calling and diving aggressively when the nest tree was approached. She continued to call and dive as long as the observers were in the area; however, the male was never seen. The nest was about 25 feet above the ground in a birch (Betula papyrifera) approximately 10 inches in diameter. The nest was lined with terminal birch twigs, and contained two downy young. The difference in size between the two chicks was readily apparent. The larger of the two was assumed to be a female and weighed 1,100 gm. This chick was banded (see Table 1) and returned to the nest.

An active nest was located in the Birch Creek drainage on July 7. As the nest, which was about 35 feet off the ground in a cottonwood (Populus balsamifera) approximately 10 inches in diameter, was approached, the female circled and called but did not make the aggressive dives mentioned above. The male was not observed in the area. The nest contained three well developed young, that left the nest and perched nearby as we approached. Fledging had probably occurred recently because the chicks were able to fly awkwardly for short distances, but still had a strong affinity for the immediate nesting area.

An active nest was located from the air in the Chena drainage and found to contain three young in mid July. No further information is available from this nest.

While few nests were located in 1970, some useful information was obtained which will aid in scheduling and carrying out future work: 1) adults establish territories as early as April 7, 2) territorial goshawks are aggressive and will "attack" low flying aircraft, thus aiding in locating active nest sites, 3) hatching probably occurs in mid June, and 4) fledging takes place near the end of the first week of July. In Alaska hatching and subsequent fledging dates of gyrfalcons show considerable variation in any given year (Roseneau, 1968). This is probably also true of goshawks, and while the 1970 data presented here are useful, the possibility of variation should be considered when scheduling field activities.

TRAPPING AND BANDING

Four Swedish goshawk traps were in operation sporadically during November and December in three areas near Fairbanks. Unfortunately, it is not possible to calculate the effort in customary trap-night units. In the future, records will be kept to allow such computations. Six goshawks were captured, and 1970 banding information for all hawks (those banded as nestlings and those banded in November and December) appears in Table 1.

Sexual dimorphism in the goshawk has been discussed by Mueller and Berger (1968) and Storer (1966), and the authors agree that by using body weight plus a combination of measurements sex can be determined accurately in most cases. Weight alone was not sufficient for establishing sex due to overlap between juvenile males and females, but overlap in wing and tail measurements between juvenile male and females was noted only rarely. A summary of weight and measurement data from ten goshawks (4 males and 6 females) is presented in Table 2. Six of the birds (4 males and 2 females) were trapped between September and December near Fairbanks, two (1 male and 1 female) were captive hawks being used for falconry, and two (1 male and 1 female) were dead when examined, having been caught in steel traps. All were juvenile birds, hatched in 1970 with the exception of one male in transition plumage, assumed to be more than one but less than two years old. Data from this bird are included in compilations for juvenile males. It was possible to examine two birds internally to confirm sex, and in both cases sex determination based on weight and measurements proved to have been correct. Total length, extent, wing, tarsus, and tenth primary measurements for birds judged to be males showed no overlap with birds judged to be females, however, overlap did occur in other measurements. While sample size is small, I feel that a high degree

Table 1. 1970 Raptor banding data.

Species	Date	Location	Sex	Plumage	Color Band	Band Number
Goshawk	6-30	St. Patricks Creek	F	Downy Chick	Red Left	617-2-3499
Goshawk	9-20	Goldstream Creek	M	Juvenile	Green	617-2-3417
Goshawk	9-21	Pearl Creek	F	Juvenile	Blue	617-2-3418
Goshawk	10-4	Goldstream Creek	M	Juvenile-Adult Tr.	Green	617-2-3419
Goshawk	10-5	Goldstream Creek	M	Juvenile	Green	617-2-3420
Goshawk	11-8	Steele Cr.	F	Juvenile	Red Right	877-1-0001
Goshawk	11-12	Steele Cr.	M	Juvenile	Red Right	877-1-0002
Rough-legged Hawk	6-30	Little Chena River	?	Downy Chick	Red Right	877-0-2799
Rough-legged Hawk	6-30	Little Chena River	?	Downy Chick	Red Right	877-0-2699
Rough-legged Hawk	6-30	Little Chena River	?	Downy Chick	Red Right	877-0-2698

Table 2. Weight (gm) and measurement (cm) data taken from four female and six male goshawks in fall 1970.

	Females	Males
Weight Range	971.4 - 1,267.0	683.0 - 971.4
Mean	1,157.8	906.0
Sample Size	4	6
Length Range	59.7 - 64.2	52.6 - 57.7
Mean	61.6	55.3
Sample Size	3	5
Extent Range	112.3 - 114.6	100.0 - 105.0
Mean	113.5	102.5
Sample Size	2	2
Wing Range	35.2 - 36.1	31.4 - 31.5
Mean	35.5	31.4
Sample Size	3	2
D5 Range	25.4 - 28.6	23.1 - 25.9
Mean	27.3	24.5
Sample Size	4	5
P10 Range	16.4 - 17.1	13.7 - 16.5
Mean	16.7	15.0
Sample Size	4	6
P7 Range	25.6 - 28.0	24.5 - 25.9
Mean	26.6	25.3
Sample Size	4	5
Bill Range	2.2 - 2.6	2.1 - 2.2
Mean	2.4	2.1
Sample Size	5	3
Tarsus Range	7.1 - 8.1	6.3 - 6.9
Mean	7.8	6.5
Sample Size	3	3

of accuracy in sex determination can be expected by taking weight and various other measurements into consideration. Compared to other goshawks from other portions of the United States, the Alaskan birds appear to be both heavier and slightly larger.

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