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14 Rock Ptarmigan

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Rock Ptarmigan

Lagopus mutus (Montin) 1776

OTHER VERNACULAR NAMES

*A*RTIC grouse, barren-ground bird, Chamberlain ptarmigan, Dixon ptarmigan, Nelson ptarmigan, Reinhardt ptarmigan, rocker (in Newfoundland), snow grouse, Townsend ptarmigan, white grouse.

RANGE

Circumpolar. In North America from northern Alaska, northwestern Mackenzie, Melville Island, northern Ellesmere Island, and northern Greenland south to the Aleutian Islands, Kodiak Island, southwestern and central British Columbia, southern Mackenzie, Keewatin, northern Quebec, southern Labrador, and Newfoundland (*A.O.U. Check-list*).

NORTH AMERICAN (excluding Greenland) SUBSPECIES (*ex A.O.U. Check-list*)

L. m. evermanni Elliot: Attu rock ptarmigan. Resident on Attu Island, Aleutian Islands.

L. m. townsendi Elliot: Kiska rock ptarmigan. Resident on Kiska and Little Kiska islands, Aleutian Islands.

L. m. gabrielsoni Murie: Amchitka rock ptarmigan. Resident on Amchitka, Little Sitkin, and Rat islands, Aleutian Islands.

L. m. sanfordi Bent: Tanaga rock ptarmigan. Breeds on Tanaga and Kanaga islands, Aleutian Islands.

L. m. chamberlaini Clark: Adak rock ptarmigan. Resident on Adak Island, Aleutian Islands.

L. m. atkensis Turner: Atka rock ptarmigan. Resident on Atka Island, Aleutian Islands.

L. m. yunaskensis Gabrielson and Lincoln: Yunaska rock ptarmigan. Resident on Yunaska Island, Aleutian Islands.

L. m. nelsoni Stejneger: Alaska rock ptarmigan. Resident in northern Alaska and northern Yukon south to the eastern Aleutians, the Alaska and Kenai peninsulas, and Kodiak Island and east to the western Yukon.

L. m. rupestris (Gmelin): Canada rock ptarmigan. Breeds from northern Mackenzie, Melville Island, northern Ellesmere Island, and southern Greenland south to central British Columbia, southern Mackenzie, southern Keewatin, Southampton Island, northern Quebec, and Labrador.

L. m. dixonii Grinnell: Coastal rock ptarmigan. Resident on the islands and coastal mainland of the Glacier Bay region of Alaska and on the mountains of extreme northwestern British Columbia south to Baranof and Admiralty islands.

L. m. welchi Brewster: Newfoundland rock ptarmigan. Resident in Newfoundland.

MEASUREMENTS

Folded wing: Adult males, 172–202 mm; adult females, 163–95 mm (males average 9 mm longer than females).

Tail: Adult males, 97–120 mm; adult females, 85–115 mm (males of all races average 104 mm or more, females usually average under 104 mm).

IDENTIFICATION

Adults, 12.8–15.5 inches long. Both sexes carry blackish tails throughout the year, and although the scarlet comb of males is most evident during the spring, it is also apparent to some extent through the summer. In the summer males are extensively but rather finely marked with brownish black and various shades of brown and lack the rich chestnut tone of male willow

ptarmigan. In summer females are more coarsely barred and are generally lighter overall but have somewhat finer markings than do female willow ptarmigan. Females have definite barring extending to the throat and breast, rather than having these areas finely barred or vermiculated as in males. In autumn males are generally pale above, with tones of ashy gray predominating (tawny brown predominating in some Aleutian races), and females at this time have relatively more brown and fewer black markings, plus a sprinkling of white winter feathers. Both sexes in winter are mostly white with blackish tails, and males (but not all females) have a black streak connecting the bill with the eye and extending somewhat behind the eye.

FIELD MARKS

The smaller, relatively weaker, and entirely black bill of the rock ptarmigan is sometimes detectable in the field and serves to separate this species from the willow ptarmigan in all seasons. In the winter, the presence of a black line through the eyes is also diagnostic, but its absence does not exclude this species. For plumage distinctions useful in separating the willow and rock ptarmigans, see the account of the preceding species. During the breeding season the rock ptarmigan is found in higher, rockier, and drier country than the willow ptarmigan, but they may occur together during winter and intermediate periods. In all seasons the dark tail distinguishes the rock ptarmigan from the white-tailed ptarmigan.

AGE AND SEX CRITERIA

Females lack the reddish "eyebrows" of adult males and in summer are more heavily barred with dark markings both above and below. In autumn the barring is reduced in the female, which is still somewhat more heavily marked than the grayish and finely vermiculated male. In winter the sexes are nearly identical, but females usually lack the black stripe through the eye that is present in males (Godfrey, 1966).

Immature females are browner and more narrowly barred with blackish brown above and on the breast than are adult females in autumn (Ridgway and Friedmann, 1946). The pointed condition of the outer primaries has been reported to be an unreliable indicator (Weeden, 1961). Instead, young rock ptarmigan may be distinguished by the fact that in adults the ninth primary (second from outside) has the same amount of pigment as the eighth, or less, whereas immature birds have more pigment on the ninth (Weeden and Watson, 1967).

Juveniles may readily be recognized by the presence of at least one brown

primary or secondary feather (the eighth primary is the last to be molted). These feathers are typically mottled with pale buff (Ridgway and Friedmann, 1946).

Downy young are illustrated in color plate 61. The downy young are usually paler throughout than those of willow ptarmigan, and the crown is lighter and more chestnut-colored than the blackish brown crown of the willow ptarmigan (Watson, Parr, and Lumsden, 1969). See willow ptarmigan account.

DISTRIBUTION AND HABITAT

The most arctic-adapted of all the grouse, the rock ptarmigan is more widely distributed in the high arctic than is the willow ptarmigan. It also extends south to Hudson Bay during the breeding season, and undertakes considerable southward movement during winter, sometimes occurring as far south as James Bay. Unlike the willow ptarmigan, the rock ptarmigan breeds as far north as Ellesmere Island and on adjacent Greenland to its northern limits at approximately 83 degrees north latitude. Also unlike the willow ptarmigan, this species can survive in the rocky desert-like habitat of the high arctic which may be a limiting factor in the northern distribution of the willow ptarmigan. Weeden (1965b) reports that typical breeding terrain of the rock ptarmigan consists of moderately sloping ground in hilly country, such as the middle slopes of mountains. Typically, the vegetation is fairly complete, but may be sparse on the highest and driest slopes. Shrubs are usually from one to four feet tall and are concentrated in ravines or other protected sites, while most plants are usually less than one foot tall. Many creeping or decumbent woody plants are typical, as well as rosette forms, while sedges and lichens are usually abundant. Breeding terrain rarely extends below the upper limits of timberline, and usually occurs from one hundred to one thousand feet above timberline in hilly country.

There have probably been few changes in the distribution of rock ptarmigan in historical times, since it is the species least likely to be affected by human activities. Considerable population fluctuations are known to occur, but those occurring in Greenland and Iceland have been interpreted as representing a ten-year cycle. Buckley (1954) concluded that ptarmigan populations in Alaska are also cyclic in nature, but adequate data to prove this view are not yet available (Weeden, 1963).

POPULATION DENSITY

Weeden (1963) has summarized population density figures for rock



FIGURE 27. Current North American distribution of the rock ptarmigan. Dashed line indicates normal southern wintering limits.

ptarmigan based on various studies in the Northwest Territories. These estimates range from as many as 8 adults per square mile to 4,000 adults on 12,500 square miles. Based on a five-year intensive study on a fifteen-square-mile study area in Alaska, Weeden (1965a, 1965b) reported yearly spring densities of males varying from 5.9 to 11.3 per square mile. Slightly lower estimates of female populations were obtained for the same period.

In a study of Scottish ptarmigan, Watson (1965) estimated spring populations to be as high as one pair per 2 to 3 hectares (approximately 5 to 7.5 acres) in peak years on the best habitats. However, unlike the fairly uniform heather (*Calluna*) habitats favored by red grouse, the arctic-alpine breeding vegetation is typically more varied, and an area of 100 or more acres rarely contains no unfavorable habitat. Thus, extrapolations of local density figures to large areas is unprofitable; this also helps explain the wide differences in densities reported on small, favorable areas and those estimates based on large regional surveys. Watson (1965) estimated that in peak years, spring numbers on his study area of 1,220 acres were as high as fifteen to eighteen birds per 100 hectares (247 acres), and as low as five in one year.

HABITAT REQUIREMENTS

Wintering Requirements

In Alaska, rock ptarmigan winter in such locations as shrubby slopes at timberline, in large forest openings where shrubs, especially birch, project above snow level, and, rarely, in riparian willow thickets (Weeden, 1965b). Watson (1965) noted that in Scotland the birds moved down from their arctic-alpine breeding grounds into a moorland zone of heather that was used by red grouse during the breeding season. Ptarmigan can scratch through a few inches of soft snow to reach plants, but Watson did not find them burrowing under the snow to forage. Local variations in topography caused areas to be blown fairly free of snow periodically, exposing food plants, and the birds will move from one such area to another in search of food. Little if any competition for food between ptarmigan and red grouse was noted by Watson, since the two species remained almost completely separated during winter. As mentioned in the willow ptarmigan account, considerable separation of the sexes occurs in North American willow and rock ptarmigans during winter, with males remaining in more alpine-like habitats, while the females tend to move into relatively protected situations.

Spring Habitat Requirements

Territorial requirements for the rock ptarmigan consist of a larger proportion of relatively open vegetation than is the case for willow ptarmigan (Weeden, 1965b). Some territories contain no shrubs at all, and males utilize rocks, knolls, or similar elevations for territorial display and for resting. Watson (1965) reported that ptarmigan were most common where large boulders or outcrops occurred on stunted heath or a mixture of stunted heath and grassy vegetation. The birds rarely took territories on pure grassland, tall heaths, bogs, or stone fields without healthy vegetation. Favorite areas for territorial establishment were usually on varied heaths or a mixture of varied heaths and grasses. The highest territorial densities occurred on areas of nearly continuous heath broken up by large boulders, slightly lower densities were found on scattered patches of heath, and much lower densities occurred on areas of continuous heath with only a few boulders present. Territorial densities were lowest on bare, gravelly places with only scattered vegetation and boulders.

Nesting and Brooding Requirements

Nest sites for the rock ptarmigan may have less overhead concealment than those of willow ptarmigan, but some overhead protection is usually present (Watson, 1965). Parmalee, Stephens, and Schmidt (1967) indicated that the nesting habitat is usually dry and rocky and sometimes is barren and high but may consist of wet tundra sites with heavy vegetation where willow ptarmigan also breed.

Brooding habitat is similar to nesting habitat, but broods tend to gather in swales on ridges and upper slopes (Weeden, 1965b). They avoid dense shrubs and after beginning to fly at ten or eleven days of age escape by flying out of sight over knoll ridges.

FOOD AND FORAGING BEHAVIOR

The best source of information on rock ptarmigan food habits in North America is that of Weeden (1965b), based on 482 crop samples from interior Alaska. Winter foods there consist primarily of dwarf birch buds (*Betula*) and catkins, followed by willow buds and twigs (*Salix*). Dried leaves of shrubs extending above the snow are also taken in limited quantities.

Spring foods, based on relatively few samples, appear to consist of a variety of plant materials, including the new growth of shrubs, horsetail

tips (*Equisetum*), and a small amount of birch and willow materials. Summer foods include an even greater array of plant foods, which consist largely of leaves and flowers in early summer and berries and seeds later on. Blueberries (*Vaccinium*), crowberries (*Empetrum*), and mountain avens (*Geum*) provide important food sources during this time. During fall, blueberries and heads of sedges (*Carex*) are important, and dwarf birch begins to assume the great importance that will continue throughout winter.

Reporting on birds taken on Baffin Island, Sutton and Parmelee (1956) noted that in the crops of eight adults taken in May about 60 percent of the total food materials consisted of buds and twigs of willow, 32 percent was the leaves and twigs of dryas (*Dryas*), and the remainder consisted of *Saxifraga*, *Draba*, and the galls of willows. A newly hatched chick had eaten leaves of crowberry (*Empetrum*).

Moss (1968) has made an interesting nutritional comparison of rock ptarmigan foods taken by birds of the Icelandic and Scottish populations. In Iceland, the birds have a diet predominantly of twigs of willow, leaves of dryas, the leaves and bulbils of *Polygonum*, which are relatively high in nitrogen and phosphorus, and berries of *Empetrum*, which are high in soluble carbohydrates. By comparison, the Scottish ptarmigan subsist on a relatively nutrition-poor diet of heather (*Calluna*), *Vaccinium*, and *Empetrum*. Correlated with this is the fact that in Iceland the ptarmigan have an average clutch size of about 11 eggs, whereas in Scotland the clutch is usually 6 to 7 eggs, averaging 6.6. The average clutch size in Alaska, based on studies made by Weeden (1965a), is essentially the same as in Scotland. Significant annual differences in clutch sizes do occur in Alaska and apparently also in Scotland, but they have not yet been adequately correlated with population density or food quality. Lack (1966) has suggested such a possible correlation between clutch size and heather conditions. Watson (1965) believed that annual differences in clutch sizes were unimportant compared with variations in chick survival. At least in the red grouse, chick survival may be related to the physical condition of the hens as determined by food supplies.

A possibly significant point related to food supplies and reproductive success is the fact that although the rock ptarmigan is the most northerly breeding of the ptarmigans, it is considerably smaller than the willow ptarmigan. Likewise, the alpine-breeding white-tailed ptarmigan is much smaller than either the rock or the willow ptarmigan, in contrast to what might be expected with arctic-breeding birds (Bergmann's principle). The possibility exists, therefore, that smaller body size in the rock and white-tailed ptarmigans is an adaptation to reduced food supplies and has evolved relatively independently of selective pressures related to environmental

temperatures. Yet Irving (1960) reported that willow ptarmigan collected in arctic localities of Alaska averaged ninety grams heavier than those from subarctic points some six hundred miles south. Further, winter birds tended to be heavier than summer birds, and males, which averaged ten to forty grams heavier than females, wintered in more hostile environments.

Whereas Irving (1960) found that the willow ptarmigan at Anaktuvuk Pass are migratory, the rock ptarmigan there are not, and in winter they feed on high, rounded slopes where low vegetation is exposed. Also, although willow ptarmigan often retreat with their crops filled with from fifty to one hundred grams of food to burrows some one and a half to two feet under the snow, this behavior is apparently not typical of rock ptarmigan. Manniche (cited in Bent, 1932) does indicate that in Greenland the birds may spend the night in holes about twenty centimeters deep on the lee side of rocks or in narrow snow-filled ravines in the rocks. MacDonald (1970) noted that the birds would dig roosting forms deep enough that only their heads remained above the snow, or would use the depressions caused by humans walking across the snow.

MOBILITY AND MOVEMENTS

The relatively large heart size (Johnson and Lockner, 1968) of the rock ptarmigan suggests that it may be capable of considerable movements, but there is little detailed information on actual daily or seasonal movements in the species. Snyder (1957) stated that the bird is migratory to an appreciable degree in arctic Canada, and Weeden (1964, 1965b) reported that some low altitude wintering grounds of the species are at a minimum of ten, and probably fifteen to twenty, miles from the nearest alpine breeding areas. Weeden believed that, at least in the lower parts of the wintering range, rock ptarmigan move in an unpredictable fashion. By March and April, however, movements are quite limited and consist of visits to various feeding areas separated by distances of up to half a mile or more, the stay at each area lasting varying lengths of time. Irving (1960) reported that at Old Crow, Alaska, wintering birds might convene from a nesting area some thirty miles in diameter, but no actual evidence for a regular migratory pattern was indicated. Bent (1932) indicated that although the majority of the rock ptarmigan withdraw from the northern limits of their summer range, they do not usually retreat beyond the southern limits of their breeding range. Nelson (cited in Bent, 1932) reports a regular fall evening migratory movement across Norton Sound, via Stuart Island, and a comparable spring flight in April.

Weeden (1965b) noted that in Alaska the rock ptarmigan disappear from their wintering areas at low altitudes in March and April and that in 1962 the first migrants arrived at their Eagle Creek breeding ground study areas on March 29. This movement continued through April, and during April males begin establishing territories in advance of the arrival of most hens. In the study area, located northeast of Fairbanks, egg laying begins in the second to the fourth week of May. Farther north at Old Crow and Anaktuvuk Pass the males become territorial in late April and May. By comparison, the first flocks of rock ptarmigan which Parmalee, Stephens, and Schmidt (1967) saw on Victoria Island arrived in mid-May and were all males. The first territorial flights were noted on May 19, and the first female was seen May 23. Fresh eggs were noted from June 3 until late June, or nearly a month later than in central Alaska. Interestingly, the weights of spring males collected on Victoria Island averaged about one hundred grams more than Irving reported for Anaktuvuk Pass and Old Crow, and females averaged about ninety grams heavier.

REPRODUCTIVE BEHAVIOR

Territorial Establishment.

The period of breakup of winter flocks and establishment of territories probably varies greatly by locality and year. In Scotland, Watson (1965) noted that this behavioral transition occurs with the coming of spring thaws and sunny weather, which may be as early as the first part of January or as late as the end of April. In North America, where the birds usually move out of their breeding areas during the winter period, there is probably a fairly short lag between the arrival of the males on the breeding ground and the establishment of territories. The observations of Parmalee, Stephens and Schmidt (1967) indicate that this lag may be as short as a few days. Both yearling and adult male ptarmigan participate in territorial establishment; Weeden (1965a) found that the percentage of first-year ptarmigan in male breeding populations varied from 41 to 67 percent. Yearling females comprised from 17 to 75 percent of the breeding populations, and there was no evidence of any nonbreeding by females.

Agonistic and Sexual Behavior.

MacDonald's recent observations (1970) on Bathurst Island indicated that there individual males may defend surprisingly large areas of about one square mile, which include several lookout prominences adjacent to

moist hummocky tundra with heavy vegetation. From these points the male watches for other ptarmigan, attacking males and courting females. During the early stages of territoriality the male spends much of his time advertising his location with song flight displays. As his aggressiveness increases, the size and brilliance of his eye-combs also increase. Territorial males, on seeing a rival male, engage in aerial chases with tails spread, combs erected, and their bodies rocking from side to side while in flight. Aerial chases of females were not seen by MacDonald but have been reported by Weeden.

The basic territorial advertisement display of the rock ptarmigan is the song flight. MacDonald noted that the height of this display flight varies from as little as about 4 feet early in the season to an estimated 250 feet observed in a highly aggressive male. The display may be performed spontaneously or may be elicited by a disturbance of some kind within hearing or visual range of the male. The bird typically leaps into the air, uttering a loud, belching call, and swiftly flies forward and upward with alternate wing-flapping and sailing. At the end of the climbing flight, the male sets his wings, fans his tail, and begins an upward soaring glide until he finally reaches stalling speed. At this point he swells his neck and begins to utter a series of staccato, belching notes. As the bird begins his descent on bowed wings a second series of belching notes is uttered and he slowly parachutes downward toward the ground. Just before landing the male tilts his spread tail vertically downward, and as he alights he quickly cocks it back upward to a near-vertical position. The wings are held to the side of the body and are drooped toward the ground, as the male stands with an erect neck or runs forward a short distance while uttering a staccato call. Then the male's neck is deflated, the primaries are lowered so that they drag on the ground, and the tail is fully spread while being tilted at an angle of forty-five degrees. Next, the bird begins a short forward run, simultaneously extending his neck and making a single, slow bowing movement with his head. When a female is newly present on his territory, the male may run in an arc toward her, tilting his tail toward her and extending one wing away from her. The head is also tilted toward the female, exposing the enlarged eye-combs. After a female has become established on a male's territory, this ground display is omitted. Females evidently gradually associate themselves with a specific male and his territory, initially following the male in flight and later being followed by the male. MacDonald noted that at least one male mated with three females in one season, all of which nested in the male's territory.

When two territorial males meet, violent fights may ensue. Threats may be uttered as the birds sleek their plumage, inflate their necks, and close

their tails so that they are nearly hidden. The crown may be raised or lowered, and the combs erect or concealed. During attacks the birds attempt to grasp each other with their bills, while striking with the wings. Often feathers from the neck may be pulled out, and sometimes the eye-combs are torn.

Pair formation in rock ptarmigan is apparently a gradual process, judging from MacDonald's observations. He noted that while the resident male drives other males off his territory, the female becomes more submissive and dependent on him, relying increasingly on the male to warn her of danger. When near the female he continuously utters a contact call consisting of ticking notes, which change to a ratchet-like alarm call when alert to possible danger. When a female is thus alerted, she flushes and is immediately followed by the male, which may perform a song flight before landing. As the male returns to the female following the song flight he may perform the head-bowing and tail-tilting display described earlier. He typically circles the female at a distance of up to two feet, with his head held low, his wings dragging, and his tail tilted toward her. Apparently he attempts in this manner to direct the female into a tundra depression, seemingly trying to induce the female to crouch in it. In four observed instances of copulation, the female crouched in such a depression, partially extending her wings and exposing her white wrists. The male then stepped on her back and pecked at her nape but did not grasp her neck feathers. Rather, he remained with his body in a rather upright posture during copulation, finally bending forward and walking off her back over her shoulder. Then, with his head lowered and held forward, his tail spread and held vertically toward the female, and his wings dragging, he walked in a circular path around the female, with his combs greatly enlarged and his bill open. The female remained crouched for a time, then stood up, shook her plumage, and preened. In two cases the female ran from the male before he completed his postcopulatory display, while in one case the male circled around her twice while the female remained crouched.

MacDonald obtained some data indicating that males were more highly attracted to mounted specimens of females that had piebald brown and white plumage than to whiter females, which is of special interest since females molt into their brown nuptial plumage much earlier than males, which remain white and highly conspicuous throughout the pair-forming period.

Vocal Signals

MacDonald (1970) reported that although the territorial male has at least six different vocalizations, the sounds nearly defy description. In

all cases, they appear to be variations of pulsed clicking sounds that resemble the noise produced by drawing a stick over the slats of a picket fence. The predominant frequencies are low, which is of interest in view of the fact that MacDonald discovered a seemingly unique membranous, inflatable sac on the dorsal side of the trachea in males. During vocalizations, not only the esophagus but presumably also this tracheal air sac may be inflated, which would facilitate the amplification of low-frequency sounds. The value of low-frequency sounds to the rock ptarmigan would seem to be correlated with the apparently large territories that they hold and associated with their long-distance visual signals in the form of the black and white plumage pattern.

MacDonald also noted that female rock ptarmigan produce at least three different vocalizations, which he described as whining, clucking, and a high-pitched screech, the latter apparently being an alarm call. He also noted a hissing produced during nest defense.

Nesting and Brooding Behavior.

Female ptarmigan locate their nests within the territorial boundaries of the male. In Scotland at least, the numbers of females associated with territorial males is rarely more than 50 percent (Watson, 1965), thus few if any males are normally likely to acquire more than one female. Weeden (1965b) reports that in Alaska two females may sometimes mate with a single cock, and presumably both hens nest within the territorial area of the male. To what extent the male defends the female and her nest is still not very clear for the rock ptarmigan. Höhn (1957) described how, when two female rock ptarmigan were shot, the male quickly approached and displayed to the corpses, but this kind of behavior clearly does not belong in the category of female defense. Weeden (1965b) noted that about one brood in twenty will have a male in attendance, but he never observed any actual brood defense by males. However, MacDonald (1970) reported several cases of brood defense by males, including both attack and distraction behavior.

Rock ptarmigan females build simple, shallow nests, the depressions often being little more than might be caused by the weight and movements of the brooding hen (Weeden, 1965b). Clutch sizes vary considerably by locality and by year. Weeden (1965a and unpublished *Game Bird Reports* vols. 7 to 10) noted clutch sizes varying annually between 1960 and 1969 from 6.4 to 9 eggs, and the average size of 195 clutches was 7.2 eggs. In the more arctic-like environment of Victoria Island, Parmelee, Stephens, and Schmidt (1967) found three nests, two containing eleven and one containing thirteen eggs, suggestive of somewhat larger clutch sizes at

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higher latitudes. Judging from Weeden's data (1965a), about two-thirds of the nests hatch during an average year. Renesting is apparently not common enough to affect over-all productivity. Weeden (1965a) provided data indicating an average brood size in August of 5.3 for 208 broods, with yearly averages ranging from 4.8 to 6.1 between 1960 and 1964. By comparison, Watson found that the average size of full-grown broods between 1945 and 1963 was from 1.2 to 6.2 young. Watson found that, on the average, 38 percent of the females went broodless each year, but in different years it varied from none to over 80 percent. Weeden (unpublished Alaska Fish and Game Department *Game Bird Report*, vol. 8, 1967) reported that between 1963 and 1966 60 percent of 130 year-old females were seen with young, while 77 percent of 185 older females were observed with young; thus, incubating or brooding efficiency evidently increases with age of the female.

The female is highly attentive to her young and when disturbed by humans utters a throaty *krrr* during distraction behavior (Sutton and Parmelee, 1956). When calling chicks toward her, she utters a clucking *kit* or *krit* call. Weeden (1965b) indicates that by imitating the distress peeping of a chick, he could elicit a low, crooning note that carried up to one hundred yards and helped locate broody hens.

Weeden (1965b) noted that one brood seen in 1960 moved about forty two hundred feet in five days, while another was found only about fifty feet from the point where it had been seen ten days before. In the case of two broods that were seen again after twenty-eight days, one had moved about fifty feet and the other family seventy-eight hundred feet. In general, the broods stayed within an area of about one-half square mile but did not appear to be attracted by the male's former territory. By late July, most broods had moved to areas higher than the nesting sites, congregating on moist and gentle slopes where sedges, grasses, forbs, and low shrubs predominated in the vegetation. Weeden also found several indications of transfer of individual chicks between broods. Hens which have lost their clutches or broods join the flocks of males that gather on high, rocky ridges or in streamside willow thickets. As the broods mature, they tend to combine, and these flocks in turn attract groups of males and nonproductive hens. In time, flocks of fifty to three hundred individuals may build up. However, at the same time, there is some calling and displaying among the males and an apparent resurgence of territoriality. The possible significance of this fall behavior is still unknown.

EVOLUTIONARY RELATIONSHIPS

Some general statements as to the evolutionary history of the ptarmigans

have been mentioned under the willow ptarmigan account. In addition it might be noted that the rock ptarmigan is not only the most northerly and most widely distributed of all the ptarmigans but also might perhaps be considered as most representative of an ancestral ptarmigan type adapted for high arctic breeding. From such a type the evolution of an alpine offshoot, as represented by the white-tailed ptarmigan, and a subarctic type, represented by the willow ptarmigan, might easily be imagined.