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# The Breeding Biology of the Mountain Chickadee (Parus Gambeli)

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# THE BREEDING BIOLOGY OF THE MOUNTAIN CHICKADEE (PARUS GAMBELI)

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by

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**APPROVED FOR THE GRADUATE FACULTY**

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# Chapter 1

## INTRODUCTION

The Mountain Chickadee (Parus gambeli) breeds from northwestern British Columbia, south through eastern Washington and eastern Oregon to southern California. It is also found commonly on both slopes of the Rocky Mountains as far south as northern New Mexico and northern Arizona, and in parts of southern Nevada. Although it has occasionally been recorded in Mexico, there is no mention in the literature of its having bred there.

In central Washington, the breeding range of the Mountain Chickadee extends from lower limits of the Ponderosa Pine (Pinus ponderosa) transition to the heights of timberline on the eastern slope of the Cascade Mountains. Although it occurs and breeds throughout this area, it is found most commonly in the higher, semi-open coniferous habitat of the sub-alpine regions and in the dry, lower forests of the Cascade Mountains. The species is seldom recorded to the west of the Cascades where chickadee niches are occupied either by the Black-capped Chickadee (Parus atricapillus) and/or the Chestnut-backed Chickadee (Parus rufescens).

Bent (1946) provides a brief summary of the life history of the Mountain Chickadee, and Dixon (1964, 1965) discusses social organization, but detailed information on

the breeding biology is lacking. The purpose of the present study was to enlarge the available body of knowledge on the life history of this species. Special attention was given to nest aperture orientation not only as determined for the Mountain Chickadee but also for a number of additional cavity-nesting species.

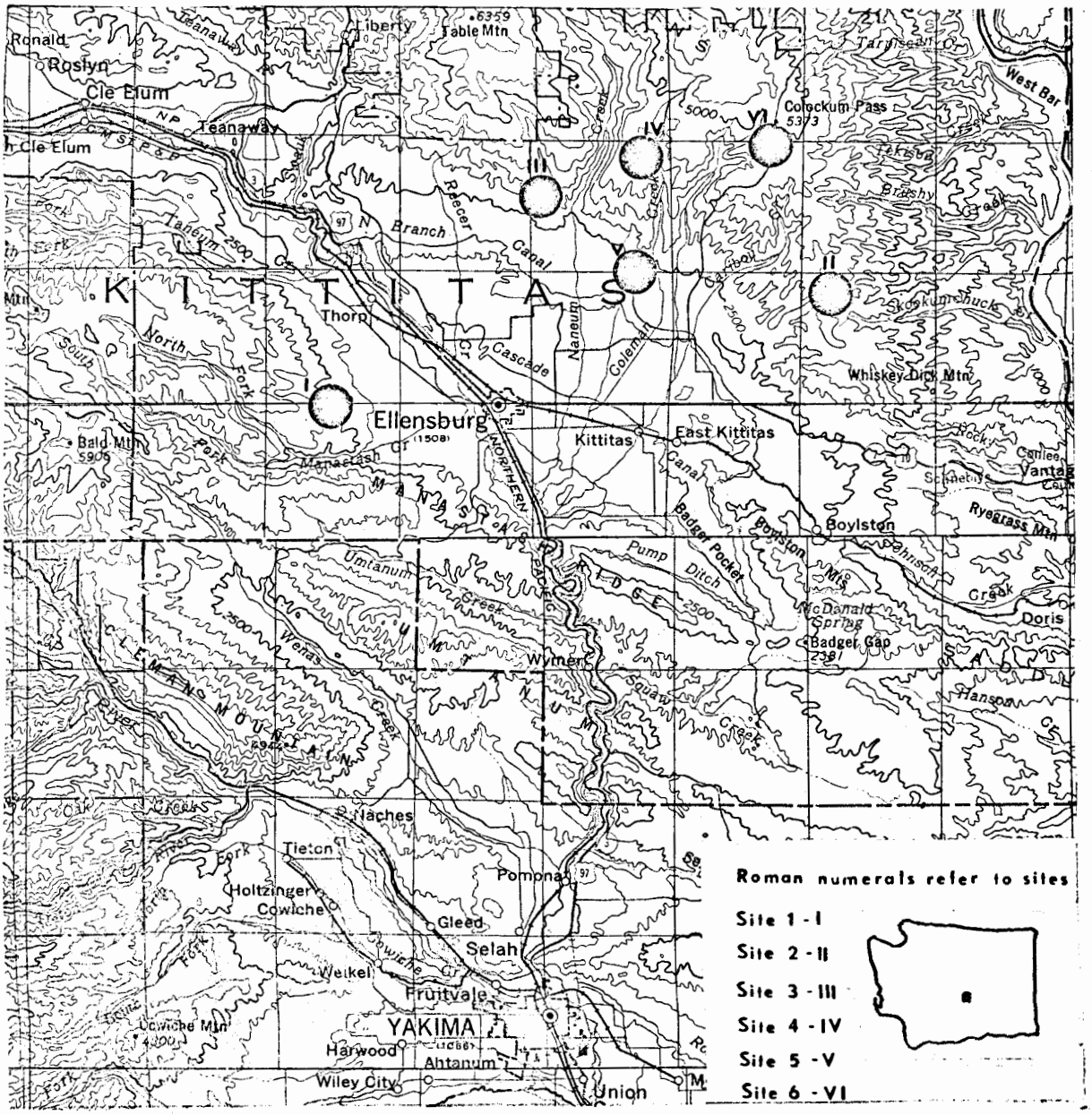
## Study Area

The study area was centered in the mountains of Kittitas County, Washington, principally in the Robinson Canyon, 13 miles west of Ellensburg, Washington (Site #1, Figure 1). Nests were sparsely distributed over a vast area making detailed mapping of the study area impractical. Additional data were obtained in Parke Canyon (Site #2, Figure 1), and Wilson Canyon (Site #3). Data on nest aperture orientation of several additional species were obtained at Sites #1, #2, and #3, as well as in Coleman Canyon (Site #4), Cooke Canyon (Site #5), and the Colockum Pass area (Site #6).

The Robinson Canyon site has previously been described (Erickson, 1969), and is characterized by forests of Ponderosa Pine, Douglas Fir (Pseudotsuga menzesii), and Quaking Aspen (Populus tremuloides) interspersed with open meadows. The other areas in which data were collected were of much the same vegetational type as the Robinson Canyon area, although some supported forests of Silver Fir (Abies amabilis), Subalpine Fir (Abies lasiocarpus), and Western Larch (Larix occidentalis).

# Figure 1

## Location of Various Study Sites in Kittitas County



## Chapter 2

## METHODS AND MATERIALS

Field studies were conducted during three breeding seasons (1968, 1969, 1970) with some observations of inter- and intra-flock behavior conducted during the winter and spring periods.

For the study of behavior around the nest during egg-laying, incubation and rearing, efforts were made to individually colorband as many of the paired adults as possible. During the nest-building period it was a fairly simple matter to capture adults with mist nets. At nest 1 and 2, both adults were banded, but at nest 3 banding attempts (and/or chipmunk predation) evidently caused the nest to be abandoned. At the other nest where most observations were made (nest 4) banding was foresaken and the adults and nestlings were simply observed periodically for additional data.

Most data on the breeding biology were taken from nests 1 and 2. At nest 1 nine nestlings were banded on their fourteenth day and at nest 2 four nestlings were banded on their twelfth day. The young in nest 2 were banded two days earlier as the young in nest 1 fledged at the time of banding.

To remove the nestlings for banding, a V-shaped groove was cut in the nest stump, downward from the nest aperture,

with a keyhole saw. This section was removed and the bottom of the nest cavity was then exposed. The piece of wood removed was glued back into place after the young were banded. This procedure did not appear to disturb the parents in any way.

Eggs and young in the darkened nest sites were observed with a dentist's mirror by reflecting sunlight from a small pocket mirror onto the dentist's mirror and then down into the nest cavity.

## Chapter 3

## RESULTS AND DISCUSSION

### Winter Flocks

During the early spring of 1969, about three trips per week were made to the Robinson Canyon site, and by 5 May, trips were being made daily and sometimes twice daily. Dixon (1964) says that "it appears probably that most and perhaps all adult Mountain Chickadees remain during the winter in the vicinity they occupied during their first breeding season and that altitudinal movements are performed largely, if not solely, by first year birds." In the fall of 1969 banded birds were seen only twice near their previous nest sites and no banded birds were seen in the early spring of 1970.

Intraflock encounters were fairly common and seemed to be mainly agonistic. Until just a few days before the advent of the breeding season, these encounters did not appear to be related in any way to mate selection or reproductive behavior. Fairly well-defined dominance-subordinance intraflock relationships were noted.

There was a noted rarity of song production during the two months prior to flock dispersal, with the chattering type of notes used during intraflock confrontations being the most prominent. Occasionally during encounters harsh, squeaking notes were produced. As the breeding season

approached and climatic conditions became milder and more stable, the birds greatly increased production of their characteristic, flute-like "chick-a-dee-dee" calls.

No interflock fighting was observed during the study, and the various flocks seemingly ignored or avoided one another if at all possible. However, Dixon (1965) found "interflock encounters were characterized by more pronounced hostility and more persistent challenging than were intra-flock contests." As previously stated, this behavior was not noted but probably does occur in central Washington Mountain Chickadee populations. Study of intra- and inter-flock behavior was not a primary objective of this study so little time was allotted.

Pairing of the Mountain Chickadee appeared to be a very gradual process. Although the flocks broke up quite rapidly (see Smith, 1967), conspicuous pair formation was not observed. Never were two chickadees seen fighting over a third, and often three or more were seen feeding and preening together in what could possibly be called a "communal feeding area." The birds continued to exhibit this behavior well into the egg-laying period.

## Territoriality

The only time that territorial defense of any kind was observed was at the nest stump. On one occasion a third chickadee flew to the nest stump of pair 2 and began to display while the female of nest 2 was incubating. The intruding bird barely finished its short song when male 2 flew in and chased it away. A wild chase ensued for

approximately 250 yards through the timber and across a meadow, after which male 2 returned to the nest stump.

Throughout the various periods of incubation and rearing, flocks of various sizes were seen foraging together with no confrontations resulting.

Several times intruding chickadees appeared close to an active nest of another pair, but only in the aforementioned case did any type of chase occur. Dixon (1965) indicates that breeding territories are exclusive but contiguous, and the pair may remain on the breeding territory well into the fall. Although the individuals observed in this study tended to stay in the general area of the nest site after fledging of the young, they by no means could be considered to have stayed on a "breeding territory." The author feels that in the Mountain Chickadee population reported here, only a nest territory was held, and during the nestling and fledgling periods even this territory seemed to disentegrate.

Stefanski (1957) says of Black-capped Chickadees, that "only in the nest-building stage were enough boundary disputes noted to determine a territory as a defended area. In some instances during this stage, no contacts were noted because there were no neighboring pairs." The author feels that this may well have been one of the main troubles in his failure to determine the boundaries of Mountain Chickadee territories; there were simply not enough pairs nesting in close enough proximity to show that a defined territory existed.

The individual family units continued to forage in the general nesting area well into the fall, being joined by various other individuals until there were three distinct

flocks formed in the Robinson Canyon study area, though the composition of these flocks often varied. These three flocks spent most of the winter foraging in the general area of the study site, until heavy snowfall apparently forced them to lower elevations. Ranges of these flocks seemed to have no definite boundaries, but different flocks were seldom seen to mingle. They often foraged in the same area on the same day but never at the same time.

## Nest Site Selection

During the three years in which observations in central Washington were made, little variation in the angle of orientation of nest apertures by the various cavity-nesting species of the area including the Mountain Chickadee was noted. Of 52 active nests of 14 species (Table 1), 38 occurred in the northwest quadrant, corrected for magnetic north (Figure 2). Included among these 38 nests were seven of eight active chickadee nests of 1968-70 (Figure 3).

No Mountain Chickadee nest was found in a live tree, all faced out over grassy open areas, and no nest stump had tall vegetation nearby. Stump size, type, and texture appeared to have no influence on site selection.

Nest aperture orientation. Data presented here clearly demonstrate a non-random orientation of nest cavity openings, with most apertures facing northwesterly. While this was true of the chickadees as well as the remaining 13 species studied, it cannot be presently argued that chickadees make an active discrimination of nest aperture orientations. This is true because the range of aperture

Table 1

Species, Number of Nests, and Angle of Orientation by Quadrant

| Species | No. of Nests | Quadrant NW | NE | SW | SE |
|---|---|---|---|---|---|
| Red-shafted Flicker (Colaptes cafer) | 4 | 3 | 1 | | |
| Lewis Woodpecker (Asyndesmus lewis) | 1 | | 1 | | |
| Hairy Woodpecker (Dendrocopus villosus) | 2 | 2 | | | |
| Downy Woodpecker (Dendrocopus pubescens) | 1 | 1 | | | |
| Tree Swallow (Iridoprocne bicolor) | 4 | 3 | 1 | | |
| Black-capped Chickadee (Parus atricapillus) | 2 | 2 | | | |
| Mountain Chickadee (Parus gambeli) | 8 | 7 | 1 | | |
| White-breasted Nuthatch (Sitta carolinensis) | 2 | 1 | 1 | | |
| Red-breasted Nuthatch (Sitta canadensis) | 18 | 14 | 3 | 1 | |
| Pygmy Nuthatch (Sitta pygmaea) | 1 | | 1 | | |
| House Wren (Troglodytes aedon) | 1 | 1 | | | |
| Western Bluebird (Sialia mexicana) | 4 | 2 | | 2 | |
| Mountain Bluebird (Sialia curricoides) | 2 | 1 | | 1 | |
| Starling (Sturnus vulgaris) | 2 | 1 | | | 1 |

Figure 2

Nest Aperture Orientation of 52 Nests
of 14 Species (1968-1970)

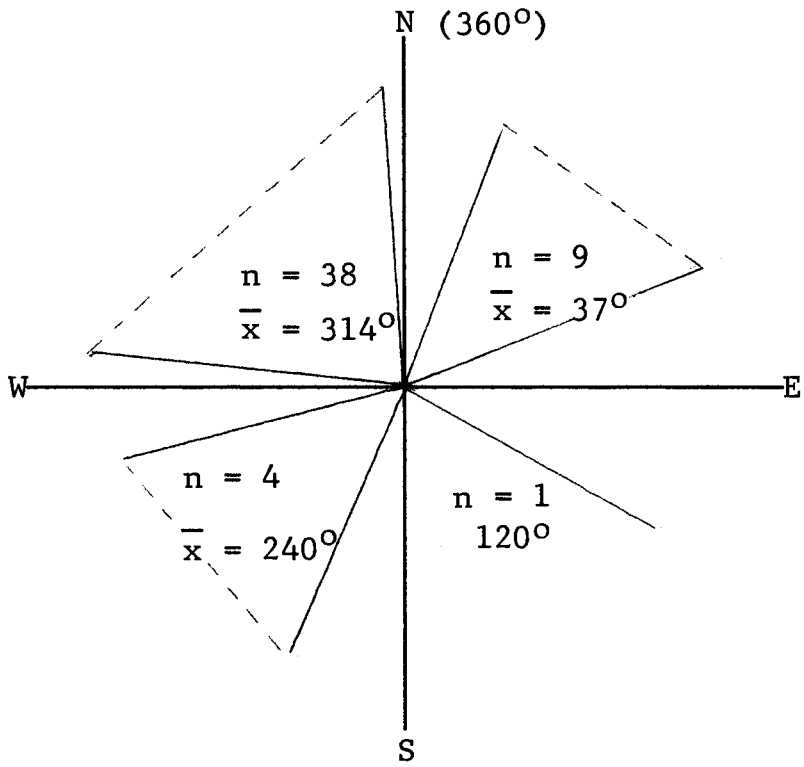
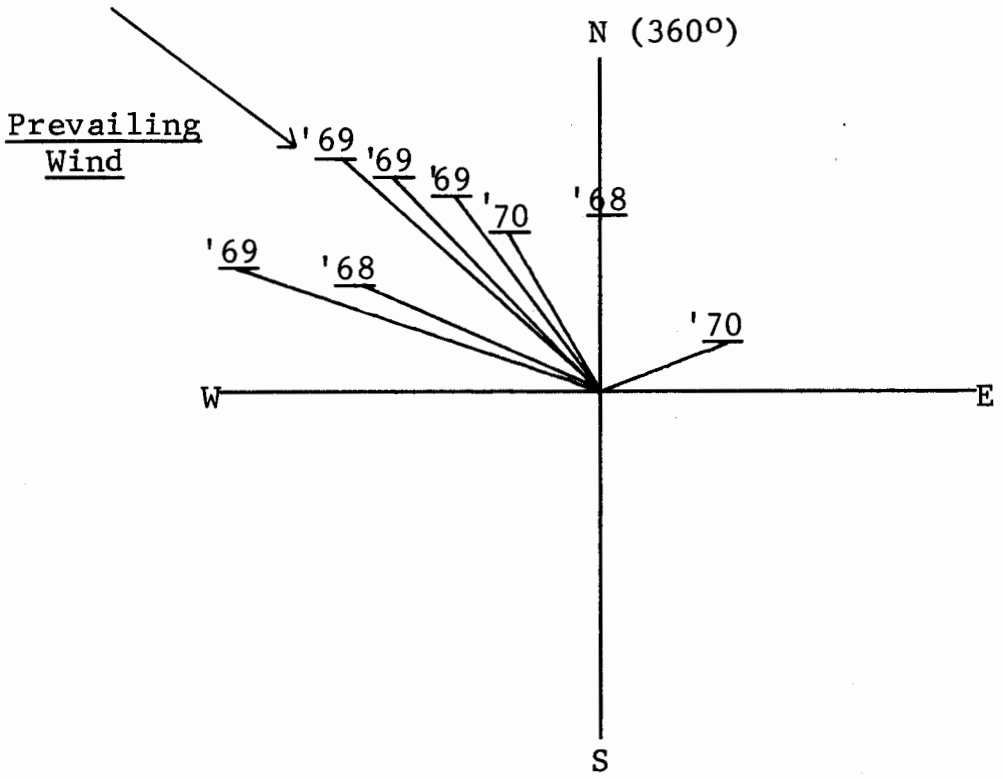


Figure 3

Orientation of 8 Active Chickadee Nests of 1968-1970




The numbers '68, '69, and '70 refer to the year in which the particular nest occurred.

orientations available as nest sites was not determined. For example, it may be true that 75 percent or more of all cavities available to chickadees faced northwesterly, in which case the heavy proportion of northwesterly orientated chickadee nests could be no more than a product of available sites.

It is clear, however, that some species actively discriminate in favor of northwesterly orientation of nest cavities. If it is not the chickadees, then it must be the woodpeckers (Colaptes cafer, Dendrocopus sp.) and nuthatches (Sitta sp.) responsible for the excavation. It is the author's belief that all these species show a similar discrimination. One possible functional explanation for this has to do with the fact that prevailing wind direction in Kittitas County is from northwest to southeast (Figure 3).

If a nest opening faced downwind, there would be a slight vacuum or strong turbulence currents created in front of the nest opening by the wind flowing around the stump. As a result warm air would be drawn out and the eggs or young would cool more rapidly. Similarly, air flowing tangentially, or even approaching tangentially, across the opening would result in an aspirator effect to draw warmth from the nest. It therefore appears possible that selection has operated in favor of individuals selecting nest sites that face the prevailing wind, an adaptation to minimize heat loss from the nest.

Verner (1963) found that in the Long-billed Marsh Wren (Telmatodytes palustris) there was a definite orientation to the single aperture of the domed nest. He feels that there are several possible causative factors worth consideration, the main one being an adaptation against heat loss,

either by the effects of the sun's rays early in the morning (most nests faced northeasterly) or by protection from the wind. The writer feels that in any species that has a constant directional orientation of the nest aperture, a detailed study would reveal that some sort of temperature related phenomenon influences this orientation.

## Nest Building

Although it is reported that most parids excavate their own nesting cavity (Odum, 1941, and others) this behavior was not noted during the course of this study. Of the eight nests observed, one was in a crack of a stump, one was on the ground looking out over a steep hillside, and six were in cavities excavated by either woodpeckers or nuthatches. One nest found in 1970 was known to have been excavated and used as a nesting site by Pygmy Nuthatches (Sitta pygmaea) in 1969. With the abundance of nuthatches and woodpeckers nesting in the study area, the author feels that the Mountain Chickadee has foregone nest cavity excavation and simply chooses a ready-made site to its liking.

The principal nest material used was hair, of Mule Deer (Odocoileus hemionus) and Elk (Cervus canadensis), along with some fur of smaller mammals. Over 90 percent of the nesting material from three nests collected and weighed was Elk hair, and approximately 7 percent was deer hair. The study area serves as a wintering ground for both big game species and their hair is readily available.

Egg-laying

In 11 observed cases, eggs were laid in the morning before 0600 PST. All observations indicate that one egg was deposited each day until the clutch was completed. The first several eggs were covered with additional nest material brought by the female, so nest building continued even after egg-laying had begun. Similar behavior was reported for the Black-capped Chickadee (Odum, 1941). Throughout egg-laying and incubation the eggs were covered by females when they left the nest, although they quit bringing additional nest material shortly after the clutches were complete.

During the egg-laying period pairs remained closely associated, spending their time feeding, preening, and resting together. The pair rarely foraged near the nest stump. It was not uncommon to see the female begging food from the male, but he never fed her during this period unless she was in the nest cavity. During the incubation and early nesting periods, however, the food-begging of females increased sharply.

Mountain Chickadee eggs are thin-shelled, and require extreme care in handling. The eggs are either completely white or have a few indistinct reddish-brown markings on them. Clutch sizes were as follows: 5 eggs - 1 nest, 6 eggs - 1, 7 eggs - 3, 8 eggs - 1, 9 eggs - 2 (mean = 7.2).

Incubation and Hatching

Regular incubation began before the last three eggs were laid. Throughout the egg-laying period the female

spent her nights in the nest cavity, but presumably little incubation took place until the last three days.

Incubation time was determined accurately in only two cases. One period lasted 12 days, and the other lasted 13 days. All eggs hatched in one of the aforementioned nests within a four and a half hour period, between 0530 and 1000. In the second nest no eggs had hatched by 1900, on 7 June; the following morning two young were dry at 0630, and one was still wet. One of the remaining four eggs hatched by 0800 and the three remaining eggs in this clutch failed to hatch.

At one nest the female was disturbed from her nest while the eggs were hatching. As soon as the author left the immediate nest site, the female returned to her nest, and remained in the cavity until hatching was completed. At the second nest the female was not in the nest cavity at the time of hatching, and although she returned during hatching and entered the cavity, she quickly emerged and remained outside until the process was completed.

The egg shells were only partially removed, as examination of nests after young had fledged revealed that bits of shell remained. Twice females were observed carrying shell parts to a point some distance from the nest, but it could not be determined whether the shells were eaten or simply discarded.

A total of 77 hours was spent observing three nests during the incubation period, and at no time were males seen to take part in the incubation procedure. Although males often came to the nest to feed females (Table 2), and often entered the nest cavity, the longest they ever stayed was

Table 2

Summary of Incubation Behavior

| Nest # | Total hrs. obs. | Attentive period Duration (min.) | | Inattentive period Duration (min.) | | Number of times ♀ left nest | | Number of times ♂ fed ♀ during a single attentive period | |
|---|---|---|---|---|---|---|---|---|---|
| | | Mean | Range | Mean | Range | when ♂ called | without ♂ calling | Mean | Range |
| 1 | 32 | 24.2 N = 78 | 19.5-27.0 | 6.8 N = 56 | 5.5-8.5 | 29 | 42 | 1.2 | 0-7 |
| 2 | 35 | 24.0 N = 80 | 22.5-25.5 | 7.7 N = 63 | 6.0-9.5 | 21 | 51 | 1.1 | 0-5 |
| 4 | 10 | 23.0 N = 24 | 18.5-25.0 | 7.3 N = 18 | 6.1-8.8 | 7 | 15 | 1.7 | 0-8 |
| Totals | 77 | 23.7 N = 182 | 18.5-27.0 | 7.3 N = 137 | 5.5-9.5 | 57 | 108 | 1.3 | 0.8 |

probably less than five seconds. Also, of 8 adult male chickadees examined during the breeding season, none had developed a brood patch whereas all females (7) examined had brood patches.

Table 2 summarizes 77 hours of timed observations of incubation behavior of three pairs of chickadees. These observations were made daily, at different times of the day, and lasted from one to four hours. The inattentive periods lasted from 5.5 to 9.5 minutes ($N = 137$, $\bar{X} = 7.3$) and the attentive periods lasted from 18.5 to 27.0 minutes ($N = 182$, $\bar{X} = 23.7$). The male frequently influenced the female's incubation behavior, as she terminated 141 of 182 attentive periods by leaving with the male when he came to feed her or when he called from a nearby tree. The main duration of those attentive periods was 24.0 minutes; that of the remaining 41 attentive periods was 22.8 minutes, there being no significant difference between these means

$$\left(t = \frac{M_1 - M_2}{\sigma \text{ diff}},\ t = 1.58 \quad P > .05,\ df = 180\right).$$

The longer mean attentive periods noted in the various species of Paridae (Steinfatt, 1938; Odum, 1941) compared to those of other passerines (Verner, 1965; Anderson and Anderson Part III, 1960; Nice, 1937; Kendeigh, 1941) is probably related to the high number of times the female is fed by the male while she is on the nest.

## Feeding of Young

The routine of movement to and from the nest shown by adults was much the same after hatching as it was before

hatching, up to about the eleventh day of development of the young. During the first week, the female behaved much like she did during incubation and the male did the greatest share of feeding the young, in addition to feeding the female several times an hour (see Table 3).

By the end of the first week there was no hesitancy shown by the male in approaching the nest. By the eighth or ninth day of development he completely eliminated all song upon approaching and appeared to concentrate completely on his feeding duties. By this time, the male paid almost no attention to the female's begging away from the nest, and when he did feed her at the nest, the author believes she usually fed his offering to her young.

During the last three days prior to fledging, both nests 1 and 2 were closely observed from before daylight. The females left their nests as soon as it was light enough to see; apparently daytime brooding had ceased sometime prior to the twelfth day of development. This corresponds with the data presented by Odum (1941) on the Black-capped Chickadee.

The adults spent their time away from the nest together. Nine times in the last three days of development the pairs were noted feeding and preening together; then, very abruptly, they would both resume the hectic process of caring for their young. Observations suggested that as the young increased in age, sychronization of the actions of the parents increased.

The number of feedings per young per hour increased with growth of the young. Table 3 summarizes the feeding behavior during development at nests 1 and 2. By the third

Table 3

Feeding of Nestlings

| Nest 1 | | | | | | Nest 2 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Day of Devel. | ♀ feed yng./ hr. | ♂ feed yng./ hr. | ♂ feed ♀/ hr. | Total trips/ hr. | Total trips yng./ hr. | Day of Devel. | ♀ feed yng./ hr. | ♂ feed yng./ hr. | ♂ feed ♀/ hr. | Total trips/ hr. | Total trips yng./ hr. |
| 1 | 4.4 | 8.8 | 2.5 | 15.7 | 1.7 | 2 | 3.0 | 7.0 | 3.5 | 13.5 | 3.3 |
| 3 | 5.0 | 11.3 | 3.0 | 19.3 | 2.1 | 3 | 3.5 | 6.5 | 3.5 | 13.5 | 3.3 |
| 7 | 7.0 | 11.0 | 2.0 | 20.0 | 2.2 | 5 | 5.3 | 7.7 | 3.0 | 16.0 | 4.0 |
| 10 | 11.7 | 12.7 | 2.0 | 26.4 | 2.9 | 7 | 6.3 | 12.8 | 3.0 | 22.1 | 5.5 |
| 12 | 13.0 | 14.3 | 1.5 | 28.8 | 3.2 | 8 | 7.0 | 10.7 | 2.5 | 20.2 | 5.0 |
| 14 | 15.3 | 15.5 | 1.0 | 31.8 | 3.5 | 10 | 10.7 | 13.0 | 2.0 | 25.7 | 6.4 |
| | | | | | | 12 | 13.0 | 15.0 | 1.0 | 29.0 | 7.2 |
| | | | | | | 14 | 16.5 | 16.5 | 1.5 | 35.0 | 8.7 |
| | | | | | | 15 | 15.7 | 18.7 | 0.7 | 35.1 | 8.7 |

day after hatching at nest 1, the male was feeding twice as often as the female as well as feeding her more than three times an hour. By the eighth day, the male was feeding about one and one-half times as frequently as the female, and by the fourteenth day the female was feeding young slightly more often than the male. By the time the female equalled the male in number of feedings per hour, she had ceased daytime brooding altogether, although she still spent the night in the nest cavity.

## Development of Nestlings

Nestlings were taken from the nest only once for banding but were easily observed with mirrors for developmental changes. Young were hatched blind, nearly naked, and helpless. They apparently bore small patches of light gray down on most feather tracts. By the third day there were definite tufts developing--one tuft on each side of the capital tract, one on each of the humeral tracts, and one on the dorsal tract. By the third day contour feathers appeared as small dark spots near the surface of the skin, and by the fifth day the down described was more extensive. By the seventh day the young appeared dark all over, and the contour feathers were almost completely sheathed. The eyes were open on the seventh day at nest 2 although the young failed to fixate objects inserted into the nest cavity. The tail feathers were one-fourth to one-half inch long, and the feathers in the wings were slightly longer. On the tenth day the body was completely covered, with some of the contour feathers being unsheathed. The head was all black

with very little of the distinctive white eyestripe visible, and the young were much more active than had previously been noted. By the twelfth day they resembled the adults and by the fifteenth day, except for slightly shorter wing and tail feathers and the somewhat indistinct eyestripe they could scarcely be distinguished from adults. Also, as in most altricial species, there was a distinct yellow color at the corners of the mouth.

Until the eighth day, the fledglings reacted to sound only by opening their mouths in a feeding response and by making a few low squeaking noises which gradually developed with age to a noisy chatter. Any actions that might be called "fear behavior" were not noted until the twelfth day, and the "hissing" noises described by Bent (1946) did not occur until the thirteenth day.

Although the young at nest 1 fledged on the fourteenth day, the writer believes this was premature and resulted from disturbances caused by banding. At other nests, banding was done earlier, and the young in both nests 2 and 4 fledged on their sixteenth day.

## Breeding Frequency

It appears, at least during three observed breeding seasons in central Washington, that Mountain Chickadees raise only one brood a year. Probably at least three factors contribute to this: (1) late timing of breeding in response to severe climatic conditions of the area, (2) evolution of large clutch size, and (3) the subsequent physiological depreciation of the adults caused by the rigors of raising

such a large brood. The author feels that the physical limitations on adults of raising two large broods has made it a selective advantage not to do so.

## Predation and Enemies

The main predator of most bird species in the study area was the Steller's Jay (Cyanocitta stelleri), but because chickadees are cavity nesters this type of predation was not a factor in this study. Although snakes (Coluber constrictor, Crotalus viridis, Thamnophis sp. Pituophis catenifer) were common in the study area and were often observed near nests, no snake predation was noted. Seventeen confrontations between chickadees and Yellow-pine Chipmunks (Eutamias amoenus) were noted and the chipmunks appeared to be increasingly curious about the nest cavity once incubation had begun. Three times in one day female chickadees were noted leaving the nest to drive intruding chipmunks away. Bent (1946) mentions that the presence of chipmunks undoubtedly affects the behavior and nesting activity of the Mountain Chickadee. The only actual predation noted in the present study, however, was that on another cavity nesting species, the Red-breasted Nuthatch (Sitta canadensis). A clutch of nuthatch eggs had been observed for several days, and one day a chipmunk was seen emerging from the nest cavity. After observing about 10 minutes, the author approached the nest, the chipmunk fled, and only two of eight eggs were left in the clutch. The chipmunk had been seen carrying at least two of the eggs away, but the author could not discover what had been done with them.

## Food Habits

Eleven adult Mountain Chickadees were collected at various times of the breeding season to check gonadal development and stomach contents. Four birds were collected in mid-May, four in mid-June, and three in early July. One hundred forty-five insects of 22 families and five orders were identified (Table 4), and there appeared to be no major differences related to changes in breeding development. The one obvious fact that did appear was the large number of lepidopteran larvae found during the time of development of the young; also, the adults at nests 1 and 2 were noted carrying large numbers of these larvae to feed their young. The data thus suggest that these larvae comprise an important part of the pre-flight diet.

Table 4

Identified Contents of 11
Chickadee Stomachs

| Insects | No. Specimens Adult | No. Specimens Larvae | No. Stomachs |
|---|---|---|---|
| Lepidoptera | | | |
| Tortricidae | - | 19 | 11 |
| Phaloniidae | 1 | 10 | 7 |
| Geometridae | 4 | 9 | 6 |
| Unidentified | - | 3 | |
| Diptera | | | |
| Mycetophilidae | 3 | - | 1 |
| Tipulidae | 6 | - | 3 |
| Tachinidae | 4 | - | 3 |
| Ephydridae | 1 | - | 1 |
| Anthomyiidae | 2 | - | 1 |
| Coleoptera | | | |
| Coccinellidae | 5 | 2 | 4 |
| Chrysomelidae | 5 | - | 2 |
| Staphylinidae | 2 | - | 2 |
| Hemiptera | | | |
| Heteroptera | | | |
| Miridae | 4 | 1 | 3 |
| Homoptera | | | |
| Membracidae | 3 | - | 2 |
| Cercopidae | 6 | 6 | 10 |
| Cicadellidae | 4 | - | 2 |
| Adelgidae | 4 | 2 | 3 |
| Aphidae | 1 | 2 | 2 |
| Unidentified | 1 | 1 | |
| Hymenoptera | | | |
| Formicidae | 10 | 11 | 11 |
| Pteromalidae | 2 | - | 1 |
| Ichneumonidae | 6 | - | 2 |
| Sphecidae | 1 | - | 1 |
| Unidentified | 4 | - | |

## Chapter 4

## SUMMARY

The breeding biology of the Mountain Chickadee (Parus gambeli) was studied in 1968, 1969, 1970 in the Robinson Canyon, 13 miles west of Ellensburg, Kittitas County, Washington.

The population is resident, with little altitudinal migration noted. Observations of the birds did not reveal any conspicuous pair formation activities, and flock dispersal in the spring was gradual. Male chickadees, as far as was determined in this study, held only a nest territory. It was common to see several adult chickadees, both male and female, foraging together throughout the breeding season.

Eight nests were located during this study. Nest building began in May and only one brood per year was raised. All nests were in decaying stumps except one which was on the ground. Nests were comprised mainly of deer and elk hair.

All cavity nesting species of the area, including the Mountain Chickadee, definitely revealed a non-random orientation of nest apertures. Of 52 nests found, 38 faced into the northwest, the direction from which the prevailing wind blows in Kittitas County. It is hypothesized that this non-random orientation acts as a heat-retention mechanism for these species.

Egg-laying occurred during early morning hours, and the mean of eight clutches was 7.2 (range 5-9).

Females were solely responsible for incubation, and the incubation period, determined accurately in only two cases, was twelve and thirteen days. Young fledged after about fifteen days and stayed in the vicinity of the nest for about one week.

Direct predation on Mountain Chickadees was not observed during the study although several confrontations between chickadees and Yellow-pine Chipmunks (Eutamias amoenus) were noted. Predation on Red-breasted Nuthatches (Sitta canadensis) by chipmunks was noted.

Food habits of chickadees remained fairly constant with the only preference shown being that for lepidopteran larvae during the nestling period.

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