

BIRD - BANDING

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A STUDY OF THE CHICKADEE AND WHITE-BREASTED NUTHATCH BY MEANS OF MARKED INDIVIDUALS

Part II: The Chickadee (*Penthestes atricapillus*
atricapillus).

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Migration. Throughout almost its entire range in eastern North America, north of 40° latitude, the Black-capped Chickadee is recorded as a common permanent resident. There is, however, considerable evidence of migratory or wandering movements. It occurs slightly farther south in winter than in the breeding-season, it being a winter visitant only in southern New Jersey, Maryland, and the southern parts of Ohio, Indiana, Illinois, and Missouri.¹ In localities where it occurs throughout the year many observers report the Chickadee to be more abundant in fall and winter than during the breeding-season.² The most interesting record of a migration of the Chickadee is given by VanTyne, who reports that on May 20, 1928, in the daytime, he witnessed a flock of fifty Chickadees start out from Sand Point to cross Saginaw Bay, Lake Huron. The remarkable feature of this record is the lateness of the date, May 20th, since Chickadees appear to leave their winter quarters early in April.

In considering these evidences of a migratory movement, it should be remembered that even if birds appear to be more numerous during the winter, it is not proved that there really are more individuals present. Many birds are so much more conspicuous in winter than in summer that they may seem to be more abundant. The distributional records show that there

¹Shriner, "Birds of New Jersey"; Kirkwood, "Birds of Maryland"; Dawson and Jones, "Birds of Ohio"; Widman, "Preliminary Catalogue of the Birds of Missouri."

²Griscom, "Birds of New York City Region"; Douthitt, "Migration Records of Kansas Birds"; Taverner and Swales, "Birds of Point Pelee"; and many others.

is a movement of Chickadees, but it is not proved that there is a distinct north and south migration.

Bird-banding operations at some stations seem to indicate that there is an arrival of Chickadees in the fall and a departure in the spring, but the records have as yet given no proof of a distinct north-and-south migratory movement. Published records show only two Chickadee recoveries at points other than the place of banding. These two were recovered at distances of only three and twenty miles. The records do show, however, that there are many permanent resident individuals. The records at most stations do not show whether there are more individuals present in winter than in summer, since at most stations few Chickadees are trapped in the breeding-season. Individuals which are recorded only during the winter months may really be present throughout the year.

In the present investigation an effort was made to determine the number of Chickadees present in the winter and in the breeding season in the Louis Agassiz Fuertes Bird Sanctuary at Ithaca, New York. The Sanctuary is a typical bottomland woods with an area of about eighty acres. Four feeding and trapping stations, which I have called the North, East, South, and West Side Stations, were operated in the Sanctuary. In addition to these, sixteen others, referred to as the Lighthouse Road, Hillside, Glenside, and Golf Club stations, covering an area of a little more than a square mile of semi-wooded, suburban and residential territory, were operated. Efforts, however, were concentrated principally on a study of the birds in the Sanctuary. The location of these stations is shown on Map 1, and the number of Chickadees recorded at each are shown in the accompanying table, see page 3.

By applying colored bands to the birds trapped, and then watching for the marked birds, I was able to determine with a fair degree of accuracy the number of Chickadees present at any time in the Fuertes Sanctuary during the winter and spring. Between 60 and 65 Chickadees were seen there between December 10, 1928, and July 1, 1929. Of these 50 were banded. The date of banding and the approximate length of stay of these 50 birds is shown in the diagram.

Because of the difficulty of trapping the birds during the fall, the exact time of their appearance is not known. However, Chickadees were common in the Sanctuary during September, and since several birds banded at other stations in October were still present in January, it is thought that many of them arrived in September and October.

BAND NO.	FEB. 1928	NOV. 1928	DEC.	JAN. 1929	FEB.	MAR.	APRIL	MAY
A24081								
A24086								
A24101								
A24102								
B27298								
B27293								
B65273								
B65274								
B65276								
B65288								
B65290								
B65287								
B65285								
B65283								
B65284								
B65289								
24792								
24793								
24794								
24795								
24796								
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B77210								
B77202								
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B77224								
B77225								
B77263								
B77264								
B77265								
B77266								
B77269								
B65273								

DIAGRAM SHOWING DATE OF BANDING AND LENGTH OF STAY
OF CHICKADEES IN FUERTES SANCTUARY

Broken lines indicate that the birds left the Sanctuary but were recorded at other nearby stations.

By December 10th it appeared that practically all the Chickadees in the Sanctuary had been banded, and trapping was suspended for a time. The last week in December, however, a number of unbanded birds were seen. Trapping was recommenced, and eleven new birds were banded between December 29th and January 18th. The records for the Golf Club banding stations are similar. The weather had been very mild up to December 22d, when there were a few cold days. Cold weather started in earnest early in January. The records thus seem to indicate that the advent of cold weather brought in a number of new birds.

From January 18th till early in March no birds without bands were seen in the Sanctuary, except some members of a flock which occasionally entered the area from the west.

The vast majority of the birds stayed all through the winter, although some of them left the Sanctuary and were recorded from other near-by stations. These individuals are indicated by dotted lines in the diagram. The length of stay of individuals living in the vicinity of my other stations is not definitely known, since stations outside of the Sanctuary were not visited frequently enough to keep an accurate record in this respect. Of the birds in the Sanctuary, 2 disappeared in November, 4 in December, 5 in January, 2 in February, 11 in March, and 8 in April. It should be remembered that some of the birds recorded as having disappeared at a given time may have been present for a somewhat longer period, since it was by no means possible to find every bird that was present each day that observations were made. The disappearance of some of these birds was probably due to their death. If we assume the average length of life of the Chickadee to be three years (studies of the Purple Finch by Magee (1928) show that it is probably less than this for that species), and assume that the mortality rate is the same at all seasons of the year, there is a probability that three or four of the 50 birds would die during the winter. The records indicate, then, that there is little, if any, migration during the winter.

The records seem to indicate, also, that there are very few birds passing through Ithaca in the fall. Only four birds were recorded but once. It should be remembered, however, that transient visitants are much less likely to get caught than are the resident individuals. Accordingly, there may have been more individuals passing through than the records seem to indicate. All through the fall many unbanded birds, which may have been transients, were seen.

The evidence shows that there were but few, if any, arrivals from the South in the spring. Only one bird was banded in the Sanctuary in March, and only two or three other unbanded birds were seen. These, as we shall point out later in the discussion of local movements, were very likely birds which had spent the winter at no great distance from the Sanctuary. At Cascadilla about a mile distant (see map 1) a few new birds appeared in March. In the vicinity of the other stations very few unbanded birds were seen in the spring. As not quite all the winter individuals had been marked, possibly these unbanded birds had also spent the winter here.

It may be seen by referring to the diagram that most of the birds in the Sanctuary left in March or early April. They began to disappear after the first warm springlike days early in March at the time that the first Grackles and Red-winged Blackbirds appeared, and when Robins and Song Sparrows became plentiful. By the middle of April only the permanent resident individuals were left. Spring was rather early in 1929, however. In 1928 the birds remained for a somewhat longer period.

While the number of Chickadees seen in the Sanctuary during the winter and spring was between 60 and 65, only about half this number were present at any given time in the winter. The rest were birds which were recorded but once, or which spent only a part of their time in the Sanctuary. Placing the number of winter resident individuals at 30 and the area of the Sanctuary at 80 acres, this gives a density of population for the Chickadee during the winter of one bird for each two and two-thirds acres.

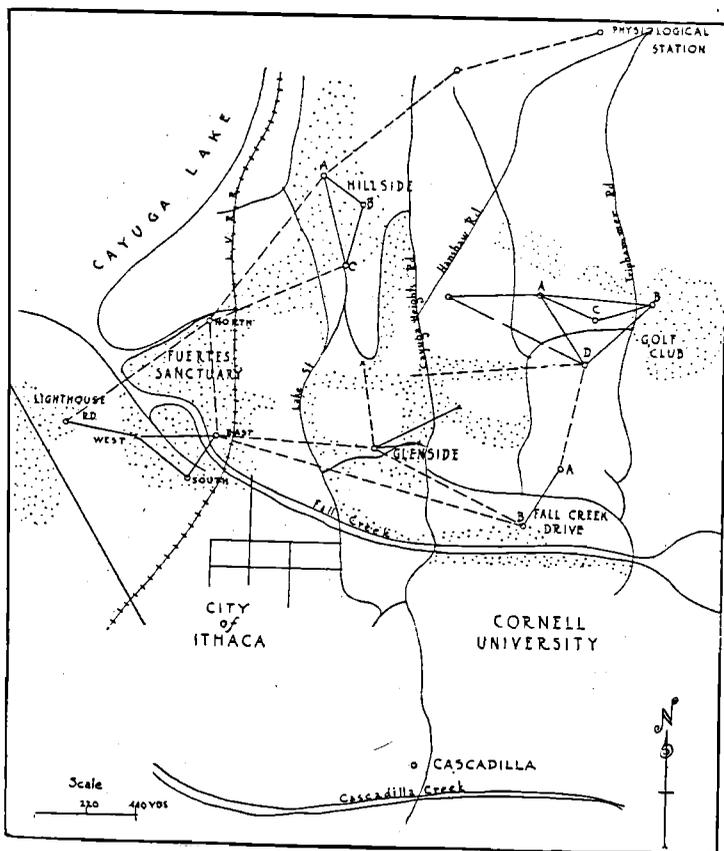
If we consider the whole area where the birds were studied as shown on map 1, we find that approximately 145 birds (148 banded, minus 21 banded but which apparently did not remain in the area, plus 18, estimated, unbanded) spent the winter in an area of a little more than a square mile. This gives one bird to about five acres, or 125 per square mile. In comparing these figures with the density of the Chickadee population in the Sanctuary, it should be remembered that the latter area is completely wooded, while the area as a whole has only scattered woods, shade trees, and shrubbery. It is noteworthy that these figures are considerably higher than estimates made on the abundance of the Chickadee in New Hampshire by Weed (1898) and in Michigan by Sanderson (1898). The former estimated that there were thirty-five per square mile, the latter only seven. The estimates were based on the number they observed while collecting them for food

studies. The number found at Ithaca is probably not an exceptional one. Other bird-banders have captured as many or more birds at one station than were reported from any one station in this investigation. Mrs. J. S. Chamberlain caught 48 Chickadees in one winter at Amherst, Mass. Whether the number of birds was increased by the presence of the feeding stations will be discussed later.

I was able to find only two pairs of Chickadees nesting in the Sanctuary in 1928. The number was the same in 1929. There may have been one or two other pairs present, since Chickadees are rather quiet during the nesting-season, and it is difficult to detect their presence in the dense tangle of vegetation growing in the Sanctuary. It is possible also that a few others nested in the neighborhood. A considerable amount of searching, however, indicated that there could scarcely be more than eight or ten of the thirty winter resident birds left in the vicinity in the breeding-season and probably only six or eight.

In the whole area where the birds were studied, 30 Chickadees were found during the breeding-season. No doubt all those present were not found, but from the figures it seems reasonable to estimate that there are four or five times as many Chickadees present in winter as in summer. The question then arises, whence do the winter resident individuals come? There are three possible theories regarding their origin. First, they may be young birds which have wandered from the locality of their birthplace, such as the bird which appeared in the vicinity of the Golf Club in the fall and which was one of the young from a nest at Glenside (see map 1). Undoubtedly a part of the increase in the number of birds in the fall may be accounted for in this way. However, reproduction alone could scarcely account for the increased number of new birds appearing. Furthermore, the winter resident birds do not appear until September and October, many of them not until December. If they were young birds, they would be present in July and August. This theory, also, would not account for the thinning-out of the birds in the spring.

Another theory is that they are birds which have nested on near-by hills and have come into the valleys to winter. The fact that when the flocks break up in the spring the individuals start out in all directions (see map 1), lends support to this view. According to this theory, however, we must suppose that in the higher parts of their range the birds are practically absent, or at least scarce, in winter. While this is barely possible in the Northeastern States, it could scarcely be true



MAP 1 SHOWING MOVEMENTS OF CHICADEES FROM STATION TO
STATION IN WINTER.

Solid lines between stations indicate that the birds travelled freely
between the two points.

Broken lines indicate a few records from one point to the other.

Dotted areas indicate woods.

in the Middle West, where the Chickadee appears to be everywhere abundant in winter.

The third theory is that the birds are migrants and have come from the north. To test the validity of this theory let us examine the status of the Chickadee in Canada. In southern Canada its seasonal distribution is the same as in the United States. At Montreal, for example, it is recorded as a common winter visitant (September 17th, April 25th) and a rather scarce summer resident (Wintle, 1896; Terrill, 1911). About the city of Quebec it is said by Dionne (1906) to be most abundant in fall and spring, less common in winter, and nearly absent in summer. Somewhat farther north, in Gaspé County, at the mouth of the St. Lawrence River the Chickadee is also present throughout the year, but is said to be more common after March 15th than in the winter (DeMille, 1926). It is a common permanent resident in all the Maritime Provinces and in Newfoundland (Macoun, 1909). The Chickadee occurs in timbered regions in Labrador in summer, but whether it is present in winter is uncertain. But little has been published regarding the winter birds of northern regions. Townsend and Allen (1907) report that the Chickadee is a not uncommon summer resident in southern Labrador. Alexander Wilson (1808) says the Black-capped Chickadee is *most plentiful* during the *winter* in the region about Hudson Bay. Owing to the possibility of confusion with the Hudsonian Chickadee, little reliance should be placed on this record. Chickadees are reported as being present throughout the year at Lake Mistassini, half way between Hudson Bay and the Gulf of St. Lawrence, by Low (1891). Unfortunately the author does not state whether the birds observed were Hudsonian or Black-capped Chickadees.

Thompson (1922) reports that the Chickadee appears to be largely a transient visitant at North Bay, Ontario; common in late spring; not observed in summer, appearing in fall at the end of September; and occasionally seen in winter. North Bay is less than a hundred miles from Georgian Bay, Lake Huron, but it has a very cold climate. Chickadees were seen in the middle of March during winter conditions in intense cold at Inglehart, 138 miles north of North Bay (Eifrig, 1909). Unpublished records of Dr. H. F. Lewis state that two Chickadees were seen by him at North Bay, Ontario, on February 10, 1922. At Cochrane, Ontario, half way between the Great Lakes and James Bay, none was seen on a ten-mile walk through forested country on March 9, 1924.

In order to get more definite knowledge regarding the

Chickadee in winter in the northern part of its range, the names of some correspondents living in the region midway between the Great Lakes and James Bay were obtained from Dr. Lewis. One of these, Mr. C. Sequin, taxidermist and trapper at Mattagami Heights, Ontario, wrote that the Chickadees appear to be most numerous in November and are as common in winter as in summer in that locality. Mr. W. K. Scobbie, teacher of Zoölogy at Iroquois Falls, Ontario, also reported that the Chickadee is as common in winter as in summer. It is more frequently seen in winter, since in the breeding season it remains in the depths of the woods. Mr. Harry E. Ricker, science teacher at the Normal School, North Bay, Ontario, likewise wrote that the Chickadee is present throughout the year, although less frequently seen in winter, since the depth of the snow prevents the ordinary observer from roaming around as much at this season. These correspondents are evidently able to distinguish between the Hudsonian and Black-capped Chickadees, and we may conclude from these records that the Chickadee is present in winter at points as far north as we have any definite information, though, it is apparently not as numerous in winter as it is in southern Canada and the United States. Since some of the records in the North indicate a greater abundance of birds in fall and spring, it is possible that there is a migration of birds from the extreme northern part of their range, where we as yet have no records, and this may account for the increase in numbers of the Chickadee in the United States.

Local Movements. As is well known, Chickadees travel about during the fall and winter in small groups or flocks. The number of birds seen together may be anywhere from two to fifty or sixty. Single birds are also frequently seen. Usually however, a flock consists of about a dozen birds. It is difficult to determine the number in a flock, but when the birds are banded with colored bands, each individual can be identified and the total number in the group determined. These flocks behave as semi-permanent units. When smaller groups are seen in the winter, they are in most cases not complete flocks. Often a flock will temporarily partly break up. Thus small groups or single birds may become separated from the rest. When larger groups are seen, these are probably formed by the coming together of two regular flocks. Possibly, also, the birds sometimes migrate in larger units.

The association of Chickadees, Nuthatches, and Woodpeckers is only a temporary one. Often a pair of Nuthatches or a few Woodpeckers accompanied the flocks of Chickadees,

but more often the Chickadees were alone. When a flock composed of two or more species was followed, it was sometimes observed to break up, the Chickadees going one way, the other birds another. It is not always the same pair of Nuthatches which accompany a given flock of Chickadees. As we shall see later, each flock of Chickadees has a definite range, and each pair of Nuthatches a definite range. But the two ranges do not necessarily coincide. Therefore, when the Chickadees are in one part of their range, one pair of Nuthatches may be with them; when in another part of their range, another pair may be present. It is true, however, that one usually sees the same pair of Nuthatches with a given flock of Chickadees.

The number of Chickadees which fed regularly during January at the North Side station, Fuertes Sanctuary, was fourteen. The number at the East and South Side stations was sixteen. The same birds visited both the East and South Side stations, which are 220 yards apart. On any one day, however, it was unusual to record all the birds which commonly visited the station, partly because some birds which did come were missed on account of difficulties in observation, and partly because some individuals really belonging to the flock had temporarily become separated from it and did not visit the feeding station while the observations were being made. The actual number observed in a flock in January at the Sanctuary feeding stations varied from nine to fifteen. The number of birds feeding at the other stations was not accurately determined, but it appeared to be about the same.

While the average number of birds feeding regularly at each station in the Sanctuary during the winter was fifteen, other birds occasionally came to the food and as many as twenty were seen at a station at one time. Thus, on December 8th five birds (Nos. A24096, B77205-06-07-08) were taken at the North Side station. Subsequent study of these birds showed that they regularly inhabited the region about the Hillside stations. Similarly, on January 21st a flock of about eight Chickadees which usually stayed in the vicinity of the Lighthouse Road station to the west, came to the North Side station. Here they fed for a few minutes. The regular North Side flock was also present at this time, and the two groups became mixed. Presently the Lighthouse Road Chickadees left. It is noteworthy that none of the North Side birds followed the Lighthouse Road birds, nor did any of the Lighthouse Road ones remain. The two flocks were segregated completely. The Lighthouse Road birds did not seem to be driven

away, as there was no more fighting than is usual at a feeding station. However, they did not stay long. Probably some of the birds did not obtain any of the food at all. We will give presently further data showing mixing and segregation of flocks.

While the different flocks thus seemed to behave as permanent units, if one followed a flock and kept a record of the birds seen as he went along, it would appear as if the personnel of the flock were changing. At one time certain birds would be in evidence. A short time later some of these would have disappeared and other individuals would have taken their places. This change was caused by some individuals getting left behind, straying from the main part of the flock, or staying in the tree-tops where they were not observed. As the flock progressed through the woods, new birds, which had previously become separated, would be picked up. A slight change in personnel was also brought about in another way. A few individuals (Nos. 65284, 65289, 24793, 24799, 77211) left the South Side flock and later appeared at Glenside. Two of these (Nos. 65284 and 24799) later returned to the Sanctuary. The others become permanent members of the Glenside flock and were seen in the neighborhood of Glenside regularly. While the shifting of the range of some birds during the winter caused some variation in the individuals visiting a certain station, nevertheless in the main the same flock visited the station at the end of the winter as at the beginning. We can conclude from these data that the flocks are semi-permanent units.

As mentioned in the discussion of migration, the flocks began to break up during the warm weather of the latter part of March. Small groups, however, were seen early in April. After the middle of April the birds were seen only in pairs. In the previous season's study (1927-28) two small flocks were seen about July first. Two of the birds in one of them were individuals which a short time before had had their nest broken up. The origin of the other birds is not known. They were evidently not immature birds. A number of unbanded adults were also seen in the summer at Glenside, which seems to indicate a wandering movement during the summer.

It has long been supposed that small flocks seen in fall and winter are family groups consisting of a mated pair with the young of the preceding nesting-season. This was shown not to be the case. Two families were banded in June, 1928, at Glenside. In a flock of about a dozen Chickadees living near this station the following winter, three of the parents were

found. One of the young birds appeared at the Golf Club stations (three-quarters of a mile east) in October and spent the winter there. Another one was seen in April a mile and a quarter southeast of the nesting-site.

As we have already intimated, each flock did not wander about from place to place but had a rather definite, restricted, feeding-area. The Chickadees in the Sanctuary were divided into two groups which I have called the North Side and the South Side flocks; the North Side birds feeding in the vicinity of the North Side station, and the South Side birds feeding at the East, West, and South Side stations. The first week in December there were a few records of birds going from the North to the East Side station (550 yards apart) or *vice versa*, but between December 10th and January 25th no North Side birds, so far as known, visited the East Side station, nor did any South Side birds visit the North Side station. On a number of occasions the North Side birds were followed for several hours in order to determine how much territory they covered. Several times they went to within fifty yards of the East Side station but they always turned westward before reaching it. The territory of the North Side flock was about forty acres; that of the South Side flock was probably a little more than this.

The small size of the area covered by the flocks was surprising. One wondered whether their movements were influenced by the presence of the feeding stations. Under natural conditions would the birds wander more widely? Would they find sufficient food in such a small area? Bird-banding operations have shown that many species of birds stay in the vicinity of one feeding station during the winter and do not appear at other near-by stations, but they do not show whether this is a natural condition or one brought about by the presence of the food. With the usual banding procedure it is necessary to put out food in order to trap and identify the birds, but since in the present study the birds could be identified without trapping, the food could be removed. Accordingly on January 24th, the North Side feeding station was discontinued. The next day no observations were made, but on the second day eight of the North Side birds were seen at the East Side station in company with the South Side birds which regularly fed there. It was thus seen that when the feeding station was removed the birds immediately increased their feeding-range. On February 3rd all feeding stations in the Sanctuary except the South Side station were discontinued. On February 4th several North Side birds were seen at the

South Side station in company with the South Side flock. Eventually eleven out of the fourteen North Side birds appeared at the South Side. Two of the three missing birds were never seen again. The other was observed at the North Side station again on March 25th after feeding had been resumed at this point.

Would the birds now leave the Sanctuary and appear at other stations if only natural food were available for them? To determine this point, the one remaining feeding station in the Sanctuary was discontinued on February 10th. The birds were then watched for at Lighthouse Road, Hillside, and Glenside stations. However, they did not leave the Sanctuary. All the birds which were regular visitors at the feeding stations up to the time that the food was taken down, were seen in the Sanctuary for at least a week afterward. All but two were known to be present until warm weather began in March.

During the time that no food was put out for the birds they ranged over a large part of the Sanctuary. Over how much of it could not be determined accurately since the birds were now more difficult to find. However, they were located and followed on a number of occasions. Once they left the Sanctuary, going a distance of one fourth of a mile east, and then returning.

While feeding was discontinued the North and South Side birds were often together in one flock. Twenty-two birds (ten North Side and twelve South Side) was the largest number seen together at one time. To a certain extent, however, the two flocks still behaved as separate units. Often they were segregated, either completely or almost so. For example, on February 16th a flock of nine birds on the South Side was composed of eight South Side birds and one North Side bird. On the same day a flock of nine birds observed near the center of the woods north of Fall Creek was composed entirely of North Side birds. At this time, the middle of February, there was a tendency for the North Side birds to occur more frequently in the northern part of the Sanctuary, while the South Side birds were never seen any distance north of the center of the woods. Accordingly it seems that the ranges of the two groups were not the same, although both groups were found ranging over a large part of the Sanctuary, which has an estimated area of eighty acres.

On February 26th food was again provided at the North and South Side stations. It was believed that the two flocks might be completely segregated again and behave as formerly, but soon after feeding was recommenced, the influence of

spring began to be felt, and the feeding stations were apparently not so much of an attraction to the birds. However, the birds did return to the South Side Station, twelve South Side and two North Side birds being recorded there in March. Only four of the North Side birds reappeared at the North Side station. We may conclude from this experiment that the presence of a feeding station does restrict the range of the Chickadee, but that even under natural conditions the flocks have rather definite feeding-territories and do not wander far.

The question might also be asked, do two flocks ever have the same territory? From the data obtained in the Sanctuary it would seem that two flocks may inhabit the same area. The two flocks at first had distinctly separate territories. The North Side flock invaded the territory of the South Side group and fed at the same stations as the latter birds only after it could no longer obtain food in the usual place. When inhabiting the same area, the two flocks tended to consolidate and form one. The data obtained at the other feeding stations show that in the main only one group of birds fed regularly at a station. Each flock had its feeding territory. These territories did not have definite boundaries, and often groups would be seen at points outside of their usual range. We have already mentioned, for example, the fact that Chickadees inhabiting the area about the Hillside stations occasionally visited the North Side station in the Sanctuary.

The greatest distance travelled by any flock from its regular feeding station was a half mile. One flock travelled nearly this distance in one direction, and nearly a quarter of a mile in the opposite direction, so that the flock was recorded at points a little less than three quarters of a mile apart. The extent which birds went from one station to another is shown on map 1.

Although no flock of Chickadees was recorded as having travelled as much as three fourths of a mile, individual birds did in some cases get farther away from the station where they were banded. This was because at first they were members of one flock, and later on they joined another flock with a different territory. In this way one or two birds banded in the Sanctuary in December, joined the flock with a territory about Glenside, and finally went with these birds as far as Fall Creek Drive, a distance fully three fourths of a mile from the place where they were banded.

Other bird-banders have also noted that Chickadees do not usually travel long distances when feeding in winter. It is reported by Horsey (1924) that Chickadees banded at Roches-

ter, N. Y., did not travel between two stations only 835 feet apart. According to the data of the present investigation, this is exceptional. It may have been due to the kind of environment between the two stations. Mrs. J. S. Chamberlain writes that in Amherst, Massachusetts, three banding stations are operated. These form a triangle, roughly half a mile on a side. At one station 48 Chickadees were taken in the winter of 1928-29. Only two of these came from the other stations. At each point only one or two birds were recorded as having come from another station.

It is believed by some that Chickadees in searching for food during the winter have definite routes over which they travel on schedule time. W. L. McAtee (1920) says: "Our feeding stations with practically inexhaustible supplies are periodically visited, and tempting as they are, usually do not localize the bird. Many observations by the writer, confirmed by comparing notes with others, indicate that various birds have more or less regular beats which they cover approximately on schedule." While Chickadees do have regular beats in the sense that they usually confine themselves to a certain area, no definite routes or regular paths over which they travelled were found during these investigations except those determined by the presence or absence of trees or shrubbery. Sometimes birds approached a station from one direction, sometimes from another. After leaving a station they sometimes went in one direction, sometimes in another. On some days they appeared at a certain station in the afternoon; on other days, this was not the case. Sometimes they remained for five minutes at a station; at other times they were about for an hour or more.

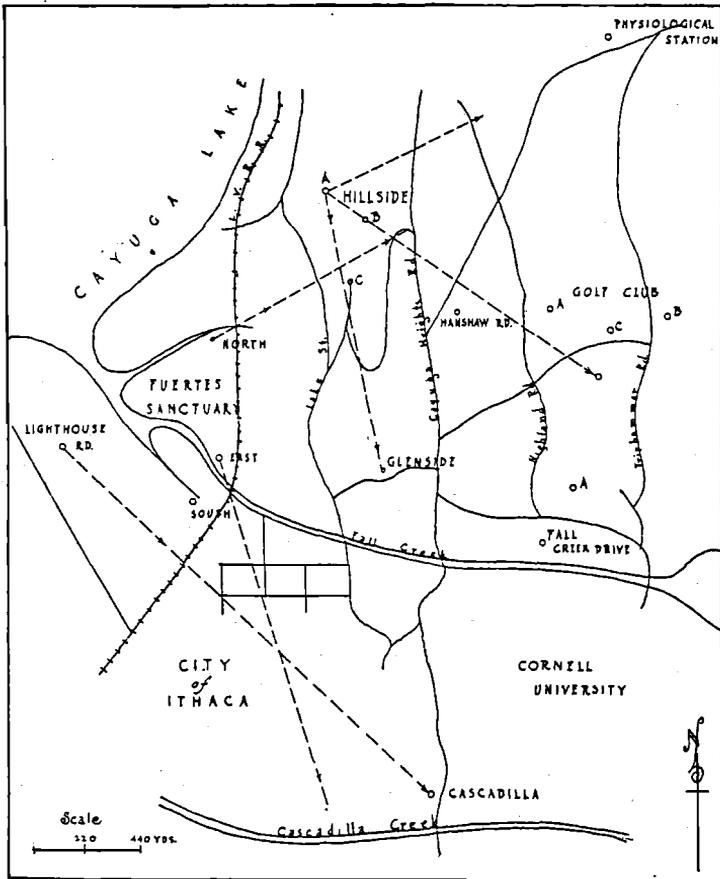
Some operators of feeding stations report that Chickadees come more frequently at certain times than at others. Thus it was reported at one station that the birds fed at breakfast time, at the lunch hour, and again later in the afternoon. My own observations at this and other stations showed that the birds were likely to be there at any time. When only one feeding station was within the range of the birds, they were seldom absent from it much more than three quarters of an hour. There was a tendency, however, for the birds to visit the feeding stations more frequently in the morning and on cold days. The general procedure of the birds was to stay at a station on the average for half an hour, although sometimes for a much longer period, and then be gone for half an hour or an hour. During their periods of absence they went a distance of two or three hundred yards and then returned,

usually by a somewhat different route. Sometimes they merely roved about in the vicinity of the station. On leaving a station they travelled leisurely, going at the rate of not more than two miles an hour, feeding as they went, and occasionally stopping for as much as half an hour in one place, but the return to the feeding station was made much more rapidly. One could not keep up with them. It seemed as if they suddenly became hungry, remembered the feeding station, and returned to it by the shortest route. On their travels they kept largely to the woods, orchards, shade trees, hedgerows, and shrubbery. Open spaces they crossed at the narrowest point. The greatest distance they were observed to traverse in the open was one hundred seventy-five yards.

The data we have given thus far apply to the movements of the Chickadees during the winter only. The case is somewhat different when the flocks begin to break up on the approach of spring. After March 7th there were a number of records of birds being seen at considerable distances from the point of banding. These are shown on map 2. Apparently these birds were looking for mates or for suitable places for breeding. One pair started to clean out a hole in a cherry tree in the city. In spite of this wandering movement, however, all the Chickadees actually found nesting were within or near the area where they spent the winter.

An experiment was performed to see what would happen if a group of Chickadees were removed from their winter territory and liberated at another place. This is an important practical question, since it is desirable to know whether a species can be increased in numbers in one locality by bringing birds in from outside. Accordingly, on February 17th, eleven Chickadees were captured at the Poultry Farm and taken to the Lighthouse Road station, some two miles west. One bird died and three escaped without being banded. The remaining seven were provided with yellow and red bands and were painted blue to make identification easy. The next day all had disappeared from the vicinity where liberated. One went back to the Poultry Farm, and later nested there. Possibly others returned also, but several hours' search failed to reveal them. Perhaps a similar experiment in the fall before the newly arrived birds had formed an attachment for a feeding area, would have a different result.

Relation to Feeding Stations—There are a number of interesting questions regarding the operation of feeding stations which were brought out by the present study. How close together must feeding stations be placed in order to reach every



MAP 2 SHOWING MOVEMENTS OF CHICKADEES IN SPRING

Chickadee in a given area? Chickadees went freely between the East and South Side Stations of the Sanctuary, 220 yards apart. Therefore it is not necessary to have them as close together as this. The birds did not go freely between the North and East Side stations (550 yards apart) while both were in operation, but the North Side birds did find the food at the East Side station when the North Side station was discontinued. Evidently one feeding station in the center of the Sanctuary would have been found by all the birds residing within the area. The birds travelled frequently between the East and West Side stations also. Hence, if one of these stations had been the only one operated, it would have been found by all the birds. One station near the northern edge of the woods was not sufficient to reach all the birds in the Sanctuary. This is well shown by the trapping in 1927-28. In that season the North Side station was the only one operated until the latter part of February, when the East Side station was started. In February it was apparent that all the birds at the North Side station were banded. The number banded, 21, was practically the same as the number banded here the following season. When the East Side station was started, 14 new birds were banded in about a week. Evidently the North Side station had not been found by all the Chickadees living in the Sanctuary. These data show that the natural feeding-range of the Chickadee in that particular environment was less than the length of the Sanctuary (850 yards) from north to south but equal to, or greater than, the width (500 yards) from east to west.

If feeding stations are separated by a distance not greater than the natural feeding-range of the bird, they will be found by all the birds within the area, so we can say that stations some seven hundred yards apart are ample. One station will feed the Chickadee in seventy-five acres. Although the natural feeding-range of the Chickadee is three-eighths of a mile, occasionally flocks did travel over a half-mile. These longer distances, however, were not travelled regularly, and to reach all the birds the stations should not be farther apart than the distance traveled regularly. There is no doubt some variation in the area covered in different types of environment. The data collected at the other stations verify the figures given. In general when stations were less than three-eighths of a mile apart, birds went freely from one to another. When between three-eighths of a mile and half a mile apart, some birds were recorded at both stations, although in the main the birds feeding at one were different individuals

from those feeding at the other. When more than a half-mile apart, different flocks visited them.

How many times a day does a flock visit a feeding station? The frequency with which the flocks visited the feeding stations was quite variable. It depended upon the weather, the number of feeding stations within the range of the flock, and the kind of food provided. As a general rule the flocks were absent from the station somewhat less than an hour. The length of time they remained in the vicinity of the station depended on the kind of food available. If suet was provided, they usually had enough in fifteen or twenty minutes. Under these conditions they made seven or eight visits a day. If sunflower seed or peanuts were available, they often stayed over an hour. Indeed, occasionally the flock never went far from the feeding station, and some of the birds were feeding all day long, or as long as the food lasted. Often when the main part of the flock left, a few individuals remained, so that there were birds at the station nearly all day.

How much food does a Chickadee eat at a feeding station in one day? At a single visit of a flock some Chickadees would take only a few sunflower seeds. At this rate no large amount would be eaten in a day. It was not unusual, however, for a bird to carry away a dozen or more seeds before leaving. Usually more food seemed to be taken in cold weather, but an extreme case was recorded on a bright warm day in March. At 10 A.M. no birds were present at the station. A quantity of sunflower seed was put out, and in a few minutes two Chickadees appeared. One wore a yellow band, and the other red and blue ones. Between 10:10 and 11:25 the yellow-banded bird took 70 seeds. This was at the rate of about one per minute. It was noted that the bird removed the shell of each seed and hid the kernel in a crack in the bark of some tree or shrub near by. A few of the seeds were eaten instead of being hidden, and once the bird ate some suet also. During this time the red-and-blue-banded bird was also storing seeds but at a much slower rate, only about half as many being taken. After an absence of a half-hour I returned at 12 o'clock and found the birds still taking seed after seed. At 2 o'clock the birds were still hard at work, although they had slowed down somewhat, 12 seeds being taken in twenty minutes. They had been joined in the meantime by two others. During the remainder of the time all four birds were collecting, though none of them as regularly as the yellow-banded bird. At 4 o'clock I made another visit to the station and found them still busily engaged, collecting at about the same rate.

Between 10:10 A.M. and 5 P.M. one bird must have taken between two hundred and fifty and three hundred seeds. Later study showed that the yellow-banded bird was a male and the red-and-blue-banded one a female. The pair nested near by, but the fact that they were storing food within what was later their nesting-territory is probably without significance, since it was found that at other stations many birds which did not nest in the vicinity also stored food.

Does the operation of a feeding station increase the number of Chickadees in the vicinity by attracting birds from outside areas? The evidence seems to indicate that such is not the case, that only the birds within whose natural range the feeding station is located find the food. Some of the feeding stations, such as the Sanctuary Stations and the Golf Club Stations, were started early in the season while others such as Physiology, Poultry Farm, Hillside, and Lighthouse Road stations were not begun until late in January. If the first two stations had attracted birds away from the surrounding regions, we should then expect a scarcity of birds at the stations started later. This was not the case, however (see tabulation).

Does the operation of a feeding station in the fall increase the number of Chickadees present in winter by inducing wandering or migrating birds to remain in the neighborhood? The fact that there were practically as many birds living in the vicinity of the Hillside and Lighthouse Road stations, where food was not provided until January, as there were at the Sanctuary Stations, which were started September 28th, is an indication that the number of individuals present in winter is not increased by fall feeding.

By operating for several seasons two or more stations placed far enough apart so that birds would not go from one to the other, it would be possible to determine this point accurately.

There are a number of other interesting questions regarding feeding stations which could be answered by marking the birds with colored bands. For example, does a Chickadee which learns to eat out of one's hand one year remember its experience and come readily to the hand again the second season? Do Chickadees remember from one season to the next the location of a feeding station? Does the operation of a feeding station for successive seasons increase the number of birds in the vicinity?

Sexual Differentiation. There is no noticeable difference in the plumage of the sexes of the Chickadee. In a few cases in the present study the sex was determined by the behavior

during the breeding-season. An individual which did the incubating was judged to be a female; one which fed its mate was judged to be a male. C. L. Whittle (1927) has shown, however, that one cannot always be certain of the sex when one bird is seen feeding another. On one day Chickadee number A6012 was seen feeding A26677. On the next A26677 was feeding A6012. Identification of the individuals was made possible by colored enamelled bands. With birds marked with colored bands, when the sex of an individual is once ascertained, it can be determined at any time by simply referring to the records.

Breeding Territories. The territories of Chickadees appear to be ill defined. Sometimes they nest quite close together. Forbush (1907) records two nests only two rods apart. In the present investigation two nests were found about one hundred yards apart. The feeding-range during the nesting-period is greater than this, but neither pair was ever observed to go near the other birds' nest, or even in that direction. Chickadees are apt to nest in the same territory or near it for successive years. There are certain areas where Chickadees nest nearly every year. At Glenside one nesting-box, or another near-by box, has been occupied by Chickadees for several years. For two years the same female nested in the same box. Likewise in the Sanctuary a certain female nested in the same part of the woods for two years.

Twelve Chickadee nests were found or approximately located in the two years of the present study. All except three of the breeding birds were banded. Since in the locality where the nests were found not quite all the birds present during the winter were banded, it is thought that all the breeding birds were permanent residents. All the others seen in the nesting season but whose nests were not found were banded birds. In every case the nest was located within or quite near the birds' winter feeding-territory. This is probably not a universal rule, however, since it is known that many of the birds wander in the spring. One individual was seen investigating a hole nearly a mile from the point where it was banded in the winter.

Birds were first observed going in pairs and appearing as if they had picked out a breeding-territory in March. The nest, however, was not always built at the place the birds first selected. For example, two birds were seen together near the North Side station five or six times between March 6th and March 12th. They were not seen at this point after March 15th, but on April 23rd they were found excavating a hole in a

stump near the center of the woods, about three hundred yards from the North Side station. This site also was given up, and they finally constructed a nest about fifty yards farther away.

Between the time the nest is started and the time incubation begins, the birds do not stay all the time near the nest, but appear to range almost or quite as widely as they do in winter. In one case it was noted that when the first nest was broken up, the second one was built by the same pair at a distance of one hundred seventy-five yards from the first site.

Feeding the Young. Both sexes share about equally in feeding the young. At one nest the male fed fourteen times in an hour and fifteen minutes, the female eighteen times. This is at the rate of once every two and one-third minutes for both birds. At this time the six or seven young were about two-thirds grown. They left the nest five days later. The young were not fed regularly, however. The general procedure was to feed a number of times at frequent intervals, six or eight feedings in as many minutes. Then one or both parents would be gone from the nest for some time, occasionally as long as fifteen or twenty minutes. During these periods of absence the parents were not engaged all the time in looking for food. They appeared to have no difficulty in finding food within a minute or two in nearby shrubbery and shade trees. Several times I observed their behavior when away from the nest. On one occasion the male, after searching about for insects for a few moments, settled down for a rest in a shrub some two hundred feet from the nest. He preened his feathers for a long time, hopped about a little, and then continued the preening process. It was fully ten minutes before the search for food was begun again. In a minute or two more, he had a beakful of insects, which were carried to the nest. On this occasion the bird went one hundred yards from the nest. This was about the limit of the parents' feeding-range. Most of the food was obtained within fifty yards. One male bird, however, was once seen two hundred twenty yards from the nest.

Dispersion of Young. Mr. A. G. Lawrence writes that one Chickadee banded as a nestling in June in Winnipeg, Manitoba, was taken the following October in another part of the city six miles from the place of banding. Another nestling banded at Dell Rapids, South Dakota, was recovered the following winter at Pipestone, Minnesota, about twenty miles northeast from the nest-site.

Of thirteen nestlings banded in 1928 in Glenside, one was recovered at the Golf Club stations in the fall; one was doubtfully recorded in the winter about one and a half miles east

of the point of banding; and one was seen one and a fourth miles southeast in April. These records indicate that the young scatter in all directions. C. L. Whittle (1927), however, cites the case of a young Chickadee, banded on July 19, 1925, and presumably raised near the banding station, which stayed in the vicinity. It probably nested near by in 1927.

Change of Mates. One gets many surprises when he watches birds provided with colored bands. On June 3d a pair of Chickadees were found nesting in a bird-house along Fall Creek. One bird wore an aluminum band, but no celluloid band. The other bird was unbanded. The seven young were about one-third grown. Three days later, when I made observations, there was only one bird feeding the young and it was a different individual from either of the previously observed parents as it wore a blue celluloid band. My observations on all three birds were checked by another person, and inquiry made it certain that the colored band had not been applied in the meantime. Doubtless one of the original parents had been killed, and the other parent had obtained a new mate (the blue-banded bird), and then had been killed in turn, leaving only the foster-parent to bring up the young. This he, or she, succeeded in doing. An interesting fact is that this single bird fed the seven adopted young just as frequently as the pair of birds whose feeding operations we have already described. Fifty-five feedings were recorded in two hours and ten minutes, or at the rate of one in two and one-third minutes, the same figure given for the other feeding-rate. This nest was on the edge of a narrow strip of woods. A large part of the food was obtained within a hundred feet of the nest. Sometimes the bird went as far as two hundred feet, but apparently never farther. The total area in the feeding territory was about two thousand square yards. This is much smaller than the feeding-area of the other pair, but this territory was all woods, while the other had only scattered shade trees and shrubbery to provide insect food.

Cases of the disappearance of breeding birds were quite common. Perhaps the most interesting is that of a female who raised two broods in two seasons and had four mates. This bird and her first mate were both banded March 6, 1928. They raised a brood of six. The following fall and winter both birds were still present in the same territory. The male was last seen on January 10th. On April 4 and 6, 1929, the female was seen in the company of another bird, number 65278, examining a nesting-box, the same one she had used the preceding year. Number 65278 had been banded November 13,

1928, and had been in the same flock with the female all winter. On April 13th she was building a nest in the same nesting-box with the assistance of another bird, number 65272, which had been banded November 9, 1928, and which was also a member of the same flock. On April 26th she was still with this bird and the nest was apparently finished. It is not certain whether any eggs were laid at this time. The bird (number 65278) with whom she had previously been seen, was observed in the vicinity on May 10th, apparently mated to another bird. On May 8th her second mate of 1929, number 65272, had disappeared and his place had been taken by another male, the fourth one in two years. This bird was unbanded and may or may not have been present in the winter.

Chickadees are not always successful in obtaining a new mate. One other bird whose mate disappeared raised a brood alone. When she was first discovered, the young had evidently just hatched, and the parent divided her time between brooding the young and searching for food. She was off the nest for 4 minutes, then on the nest 15 minutes, off 10 minutes, on 8 minutes, off 1, on 1, off 1, on 4, off 1, on 1, off 1, on 10, off 1. Two days later feeding was more frequent, although considerable time was still spent on the nest.

I have no records of Chickadees having the same mates for two seasons. This is owing to the disappearance of one of the pair. Of three pairs nesting in 1928, the male of each pair had disappeared by the breeding season of 1929. Since birds which become mates are usually birds that have been together in the same flock during the winter, there is no doubt that a bird may get the second mate the second season in some instances. In fact C. L. Whittle (1927) reports a case where two Chickadees were apparently mated for two years.

Length of Life. In two years' study not much data can be accumulated regarding the length of life of a species. However, the frequent disappearance of nesting birds indicates a high mortality rate. Of six breeding Chickadees in 1928 only three were left in 1929. Of twelve breeding birds in 1929 five disappeared before nesting was over. It is probable the average length of life is not much, if any, over two years. There are banding records, however, of one Chickadee having survived seven years (banded by M. S. Crosby), two birds living five years, and one four years. Most of the records, however, are less than three years.

NUMBER OF CHICKADEES BANDED

1927-28

Fuertes Sanctuary, North Side	21
Fuertes Sanctuary, East Side	14
Other stations	13
Nestlings.	13
Total	61

	No. of Banded Birds	No. of Unbanded Birds in Winter (estimated)	No. of Birds Seen (estimated)
1928-29			
Fuertes Sanctuary, North	23	0	31
Fuertes Sanctuary, East	13	0	35
Fuertes Sanctuary, South.	13	0	38
Lighthouse Road	14	6	..
Hillside (A, B, C)	12	6	27
Glenside.	10	2	22
Sunset Drive	5	0	
Hanshaw Road.	4	0	
Golf Club (A, B, C, and D)	37	0	
Fall Creek Drive (A and B)	17	4	
Physiological Station	6		
Poultry Farm	7		
Cascadilla	11		
Total banded Birds	172		
Total in Fuertes Sanctuary	49		60
Total in whole area where birds were studied (first 11 stations).	148	18	166
Returns from 1927-28			13
Returns from 1926			2
Nestlings banded			12

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To be Continued