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DISPERSAL MOVEMENTS OF JUVENILE BLACK-CAPPED CHICKADEES

Dispersal, or movement of young away from their birthplaces, has been noted for many years in a wide variety of animals. The causes of these movements have been variously described as innate or as being the result of competition for food. The basic problem here is that in some species a specific dispersal mechanism has evolved, occurring at a precise stage in the life of the animal, while in others dispersal is rather haphazard, depending mainly on external factors. It is important to understand, for each species, how dispersal is accomplished.

The functions of dispersal are more easily agreed upon than its causes. Genetically, these movements are quite important in that they prevent inbreeding and aid in the redistribution of genes throughout the population. The movements aid a species in spreading its range rapidly as favorable habitats are created and allow it to have a discontinuous distribution. Dispersal is also essential in the reinvasion of areas that have been depopulated due to such things as fires, droughts, etc. (Howard, 1960).

Juvenile dispersal has been fairly well studied in European titmice (primarily the Great Tit, *Parus major*). Kluijver (1951), Perrins (1963) and Plattner and Sutter (1946, 1947) concur that the great majority of juvenile Great Tits move only a few hundreds of meters from their birthplaces, with only a few moving as far as 3 to 6.5 km or more. Most investigators found that the dispersal movements occurred so rapidly that it was impossible to follow the birds after it had begun.

In North America the extent and duration of the dispersal of juvenile titmice have been studied much less than in Europe, probably due largely to the greater difficulty of banding nestlings, as these titmice construct their own nest cavities and utilize nest boxes much less readily than do their European relatives. Odum (1941) and Kluijver (1961) banded a few nestling Black-capped Chickadees (*P. atricapillus*) and noted that the dispersal was very rapid, but were unable to determine distances traveled. Butts (1931) banded 13 nestling Black-capped Chickadees and found only two of them later — one at 1.3 km and the other at 2 km from their birthplaces.

To learn more about Chickadee dispersal this study was undertaken from the summer of 1970 through the summer of 1973, involving the color-banded population of Black-capped Chickadees at the UW—M Cedar-Sauk Field Station described by Weise (1971). The most intensively studied birds were located in about 26 hectares of upland beech-maple forest and about 30 hectares of the cedar-tamarack bog forest at and immediately surrounding the Field Station. The territories of the breeding pairs in these areas were mapped, and as many nests as possible were located. The development of the young in accessible nests was followed, and just before fledging, at an age of about 12 days, the nestlings were color-banded. This involved cutting into the nest cavity, removing the young and banding them, closing the nest cavity, and replacing the young.

After the young fledged, *i.e.* left the nest and learned to fly, the color-banded family groups were located several times a week and their behavior and movements were noted. This family behavior has been discussed by Van Male (1973). About 20 days after fledging the family groups dissolved. Intensive weekly or twice weekly efforts were made to locate the color-banded young and trace the rate and extent of their dispersal movements. During the late fall and winter of each year these searches were extended from the immediate Field Station area to all suitable habitats within about 2 km. The Cedarburg Bog was surveyed around its perimeter and along several transects through its interior. With the permission of private land-owners other nearby woods and swamps were investigated.

In order to gain further information concerning the movements of juvenile Chickadees, independent young were netted and banded during the July-October periods of 1970 through 1973. It proved almost impossible to net fledged dependent young or young just after family breakup. Such birds frequently stayed high in the forest canopy, and in any case they were not responsive to the tape-recorded calls and songs of Chickadees which were effective in luring adults. However, by late July juvenile birds did begin to respond to these stimulus tapes, in conjunction with a stuffed decoy Chickadee, and it was possible to lure them into portable Japanese mist net sets which could be carried through the woods and erected in any small forest opening. Using this method substantial numbers of Chickadees were trapped in the summer and fall, not only at the Field Station proper, but also in distant areas, especially in Cedarburg Bog. Many of these

birds were later retrapped at winter feeding tables at the Field Station, color-banded for individual recognition, and subsequently observed on their breeding territories.

The study during its initial stages in 1970 was largely a matter of learning techniques. A total of 11 nests were located that summer, but in only one of the nests were the young banded, that being a nest about 12 meters high in a sugar maple. In all other cases the nestlings fledged before they could be banded because too little was known about the development rate of young Chickadees. The three nestlings banded in 1970 were never seen again after fledging.

In 1971, 20 nests were located and young were color-banded in 6 of these, a total of 37 nestlings. In 1972, 19 Chickadee nests were located and 48 nestlings were color-banded from 11 of the nests. The high number of nests reached in 1972 was due, primarily, to better techniques for getting at the higher nests. In 1971 and 1972 enough data were available to calculate the number of young fledged from each successful nest. This showed a great deal of variation with habitat as well as with breeding density. In 1971, in the upland forest where the breeding density was 10.7 pairs/100 acres, six young were produced per successful nest. In 1972 when the density was 12.1 pairs/100 acres, the production was 5.8 per nest.

On the other hand, in the bog forest in 1971, with a density of 18.4 pairs/100 acres, the average nest produced 6.5 young, while in 1972 with a density of 22.4 only 3.5 young per nest were produced. Clutch size, and the number of young fledged per nest, have previously been shown to be inversely related to breeding density by Kluijver (1951), Krebs (1971), and others. It should be noted that the breeding density of Chickadees in the bog forest in 1972 was almost twice that of the upland forest for the same year. The data also indicate that the older, more experienced Chickadees produce more young per pair than younger birds. A similar conclusion was reached by Kluijver (1951) in the Great Tit.

Breeding density also appears to have a slight effect on the height of the nests, with the Chickadee nests being slightly lower, on the average, in the low density year 1971. Data, however, are too few to make any definite conclusions on this matter. Nests in the upland forest averaged much higher, on the whole, than nests in the bog forest, due, more than likely, to the much higher canopy available in the upland forest. Nest locations ranged in height from 0.3m to 19m.

Notice was also taken of the types of trees used by the Chickadees for their nests. Chickadees were found to nest in sugar maple (*Acer saccharum*), beech (*Fagus grandiflora*), white and yellow birches (*Betula papyrifera* and *B. lutea*), tamarack (*Larix laricina*), ironwood (*Ostrya virginiana*), swamp white oak (*Quercus bicolor*), black cherry (*Prunus serotina*), black willow (*Salix nigra*), elm (*Ulmus sp.*), white cedar (*Thuja occidentalis*), black ash (*Fraxinus nigra*), and even poison sumac (*Toxicodendron vernix*). Of the ten species of trees utilized

as nest sites in the upland forest, nearly 50% of the nests were in sugar maple. In the bog forest six species were used, but 50% of the nests were in white birch. The sugar maple is the predominant species in the upland forest; however, white birch is far less abundant in the bog forest than tamarack and white cedar, which were relatively infrequently used by Chickadees.

Shortly after the young fledge a breakdown of the territorial boundaries occurs, and the Chickadee families begin to forage somewhat more widely. This has been noted in Great Tits by Kluijver (1951) and in Black-capped Chickadees by Odum (1941) and Stefanski (1967). It was also found that during this time aggressive tendencies are especially low, with actual conflict arising only when families come into almost immediate contact.

The young gain gradual independence from their parents (see Van Male, 1973), and eventually break away from them, beginning their dispersal. This study confirmed the extreme rapidity of the dispersal process. Of the 88 birds banded as nestlings, only one was found within 0.25 km of its birthplace by late July, or shortly after gaining independence from the parents. Thus, within only one to two weeks after leaving their parents, almost all the young had moved a considerable distance from their birthplaces. Only three birds banded as nestlings remained in the immediate vicinity of the Field Station through August. These birds spent at least part of the following winter there.

Analysis of the data from the banding of independent juveniles showed that birds banded in late July and August, only a few weeks after becoming independent, tended to breed the next summer 200 meters or less from the place of banding. This would strongly indicate that young Chickadees develop a "site attachment" within only a few weeks after they break away from their families, but after dispersal has occurred. Thus, the dispersal tendency in these birds must be a very short-lived occurrence. Juvenile birds banded in September and October showed less of a tendency to breed close to their initial capture point. Perhaps these birds were moving toward their winter feeding areas when first caught or were simply expanding their daily ranges of movement as the autumn progressed into winter and the food supply decreased. For many of the birds the winter feeding areas were quite far from their breeding territories — some moved as far as 1.0 to 1.5 km to visit the feeding tables at the Field Station in the winter.

In most of the North American studies of titmice in which nestlings were banded, none of the birds banded as nestlings were ever seen near their birthplaces once dispersal had occurred (Odum, 1941; Kluijver, 1961; and others). In this study, in 1971, three (8%) of the 37 banded nestlings were located at the Field Station feeding tables in the winter following their births. Likewise in 1972, two (4.3%) of the 48 banded nestlings were present at the winter feeding stations. Of the three birds in 1971, only one remained in the area to breed (unsuccessfully), another disappeared during the winter, and the third moved 1.5 km to the north to breed, perhaps to an area to which it had become site attached the previous summer before coming to the feeders. Of the two birds banded in

1972 that remained at the feeding tables through the winter, one was last seen in the bog forest the next spring, and the other spent the summer in the upland forest very near its birthplace, although it may not have nested.

Of the 88 birds banded as nestlings, 12 (13.6%) were located the following winter within 1.6 km (1 mile) of their birthplaces, while 2 (2.3%) were located farther away, at 6 and 11.2 km. Three (8.1%) of the birds banded as nestlings in 1971 were located on their breeding territories the following spring, at distances of 850, 900, and 1600 m from their birthplaces. Of the 1972 group, only two (4.2%) were found the next breeding season, at distances of 360 and 1200 m. (See Table 1.)

Year	Birthplace	Number Banded	% Later Observed	Directions and Distances from Birthplace of Observations during:	
				Fall & Winter	Breeding Season
1970	Upland forest	3	0.0	—	—
1971	Upland forest	13	53.8	East, 550 m	—
				NNW, 1.0 km	—
				SSW, 900 m	SSW, 900 m
				East, 700 m	NNE, 1.6 km
				ESE, 700 m	ESE, 850 m
1971	String bog	6	16.7	NNW, 11.2 km*	—
				WNW, 6.0 km	—
				SSE, 1.2 km	—
1971	Bog forest	18	16.7	East, 600 m	—
				SE, 2.4 km	—
				East, 550 m	—
1972	Upland forest	32	9.4	ENE, 700 m	NNW, 300 m
				NW, 1.1 km	—
				East, 700 m	ENE 1.2 km
1972	Bog forest	16	0.0	—	—

*Bird observed at same place January 1972 and 1973 – breeding territory probably nearby.

Table 1. Observations subsequent to family breakup of Black-capped Chickadees banded as nestlings, 1970-1972.

Kluijver (1951) found that most Great Tits settled down to breed within 2 km of their birthplaces with a large proportion in the 200 - 800 m zone. The present study suggests that Chickadees move, on the average, farther than Great Tits.

In this study significant movements of unbanded Chickadees into the Field Station area occurred during March and April. Similar occurrences have been noted by Butts (1931), Odum (1941), and Smith (1967) for Chickadees in other parts of the nation. The cause for these movements is not known for certain. However, they correspond to the one-to-two month period during which increasing numbers of pairs of Chickadees at the Field Station are setting up their

territories, beginning with the older, more dominant males. Smith (1967) also noted this similarity between the onsets of territoriality and spring movements of young birds. It might easily be supposed that these unbanded birds are yearlings, the presumably subordinate birds, being forced off their winter feeding areas by the adults setting up their territories. This movement would tend to be density-dependent, with more birds being forced to move, and probably to move farther, in years of higher density of adult birds. This conclusion was also reached by Kluijver and Tinbergen (1953). They believed, although without direct evidence, that spring movements adjust density in the more attractive habitats, and since mortality during the winter may leave vacancies, these will be filled by the immigrants into the areas.

Thus, the movements of juvenile Black-capped Chickadees appear to be as follows. During mid-summer the actual dispersal occurs — a very rapid, short-lived, and extensive movement of the juvenile birds. By late summer the birds settle down and develop an “attachment” for a particular site. This is followed in the autumn and early winter by daily movements of increasing extent in search of a winter feeding area. During mid-winter movements are restricted as the birds concentrate all their efforts on finding food. As spring arrives the adult birds begin to set up territories. The young Chickadees approaching their first breeding season also attempt to establish territories and we hypothesize that they attempt to do so on or near the site to which they had become “attached” the previous summer. However, being subordinate to the adults they are often not able to do so and thus begin to move about during March and April in search of vacant areas. By May this process has ended with most birds having established territories, while some small fraction (varying with population density) remains as non-territorial “floaters” during the breeding season.

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