

# THE BLACK-CAPPED CHICKADEE IN THE SOUTHERN BLUE RIDGE MOUNTAIN PROVINCE: A REVIEW OF ITS ECOLOGY AND DISTRIBUTION

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The Black-capped Chickadee (*Parus atricapillus*) is a common resident through much of Canada and the northern United States. South of Pennsylvania, however, the species' breeding range becomes increasingly restricted to the Appalachian highlands; and the bird is replaced by the Carolina Chickadee (*Parus carolinensis*) in the coastal plain, piedmont, and lower mountains of the Southeast. Although the southern breeding limit of the Black-cap occurs in the Blue Ridge Mountain Province of eastern Tennessee and western North Carolina (A.O.U. 1957), the distribution and status of the bird are not well understood in the region (Pearson et al. 1959). In recent years, sight records of the Black-capped Chickadee have been reported with increasing frequency from areas where there is no valid evidence of their presence. In hope of clarifying the situation, this paper reviews the history and presently known status of the species in the mountains of western North Carolina.

## DATA SOURCES

The first published evidence that Black-capped Chickadees occurred in the Southern Appalachians came when Brewster (1886) observed and collected breeding specimens in the Black Mountains during the spring of 1885. Subsequent records have been reported by Batchelder (1886), Cairns (1887, 1889, 1891, 1894), Burleigh (1941), Oberholser (1937), Stupka (1963), and Alsop (1970). The most extensive study of the chickadee in the southern Blue Ridge was done by Tanner (1952), and his work remains the basic reference on the subject. Additional sources of information from areas outside the southern Blue Ridge include Hubbard and Hubbard (1973), Johnston (1971), Brewer (1963), Rising (1968), Ward (1966), and Odum (1942).

## IDENTIFICATION

The major source of confusion and controversy over the distribution of the Black-capped Chickadee in western North Carolina is the difficulty of positively separating the bird from the closely related Carolina Chickadee. Characteristics traditionally used to distinguish these two very similar species include differences in behavior, song, morphology, and, in the southern Appalachians, habitat and elevation.

**Behavior.** Tanner (1952) and Johnston (1971) state that the Black-capped Chickadee is more curious and less timid than the Carolina Chickadee. Unlike the Carolina, the Black-cap can often be induced to approach the observer at close range by "squeaking," imitating the song, or playing tape records of the call notes or song. During the non-breeding season, however, behavior differences do not seem to be pronounced; and individual birds do not always conform to the anticipated patterns even during the nesting season.

**Song.** Differences in song are widely considered to be a useful and reliable means of identification, and Tanner (1952) and Johnston (1971) regard this as the best technique for separating the two species in the field. Black-caps usually whistle a clear "fee-bee-ee" or "phe-bee," while the Carolina gives a thinner, higher pitched, more rapid "fee-bee, fee-bay" or "see-fee, see-fu." The call notes of both species consist of a series of "dee-dee-dee" syllables; but those of the Black-cap are delivered in a lower pitch, with richer tone, and more slowly than those of the Carolina.

Unfortunately, these differences in song are not invariable, particularly in areas where the species' ranges come into close contact, a situation that prevails in the southern

Appalachians. Noting "frequent variations" in song during his studies in the Great Smokies, Tanner (1952) reported as an example a chickadee that gave songs "typical" of both species. Although not proven by collecting, his impression was that such birds were often young Black-caps that wintered in mixed flocks at low elevations and thus learned the song of the Carolina. In Rockbridge County, Virginia, Hubbard and Hubbard (1973) noted that songs typical of both species were heard throughout the nesting period from late March to early September, despite the fact that their extensive trapping and banding studies indicated that only the Carolina Chickadee was present in the region during that time. The Hubbards suggested that Carolinas may learn the Black-cap song during the fall and winter, when the two species occur in mixed flocks in their study area. Based on these data, the Hubbards "suggest that summer Black-caps can not be reliably identified in the area (and perhaps in western Virginia) on the basis of song alone, at least in areas where Carolinas are known to occur."

On several occasions during the breeding season, I have heard individual chickadees irregularly alternating the songs ascribed to both species. I have also noted atypical singing by birds that I thought were Black-capped Chickadees, although they gave songs not clearly referable to either species. These observations were made in spruce-fir and northern hardwood forests above 1370 m (4500 feet) in the Plott Balsam and southern Great Balsam Mountains of North Carolina and in the Mt. Rogers-Whitetop area of Virginia. Chickadees exhibiting these song patterns have been observed in the region of the two species' overlap in Illinois by Brewer (1971), and at Mountain Lake, Virginia, by Johnston (1971), who found evidence of hybridization in the specimens collected there.

Based on present data, therefore, song cannot be considered an invariably accurate means of distinguishing the two species, especially in those areas where the birds intermingle during any portion of the year.

**Morphology.** Morphological characteristics are the most consistent and reliable means for separating the Black-capped and Carolina Chickadees. Nevertheless, Tanner (1952), Brewer (1963), and Johnston (1971) have pointed out that size and plumage coloration are not always distinct and may show a broad range of overlap. The differences frequently are subtle, and distinguishing the two species in the field on purely morphological grounds is much more difficult than generally recognized and may often be impossible (Johnston 1971). Black-caps tend to be larger than Carolinas, but Tanner (1952) found considerable overlap in the size range of the two species collected in the southern Appalachians. Black-caps usually have white edging in the secondaries, greater coverts, and outer rectrices, while these areas are gray in Carolinas. Unfortunately, these white borders are most conspicuous when the birds have acquired their post-breeding plumage, and the edging is progressively worn down until it may be completely absent by the following spring. The flanks and sides of Black-caps may show a distinct brown color, while "typical" Carolinas are said to be uniformly gray below (Bent 1946). Even with a specimen in hand, however, size and plumage coloration may not be sufficiently distinct to permit identification. In fact, Oberholser's (1937) criteria for defining the Appalachian Chickadee (*Parus atricapillus practica*) were "... smaller, particularly the tail; upper parts darker, more greyish, less ochraceous ... wing coverts and rectrices with narrower white edgings." In other words, the Black-capped Chickadees of the Southern Appalachians are characterized by more closely resembling the Carolina Chickadee than do the northern populations.

After careful analysis, Tanner (1952), Brewer (1963), and Johnston (1971) found the only consistent feature distinguishing the two species to be the ratio of tail length to wing length. Johnston gave the tail:wing ratio as .91 to .97 in the Black-capped and .82 to .88 in the Carolina Chickadee. Using similar criteria, Tanner (1952) was able to establish the identity of specimens he examined from the southern Blue Ridge, despite the overlap in other characteristics, including size. Intermediacy in the tail:wing ratio has been used as evidence of hybridization by Tanner (1952) and Johnston (1971). Obviously this measurement can be obtained only by capturing or collecting the birds.

**Habitat and elevation.** Brewster (1886) and Cairns (1889, 1891, 1894) state that Black-capped Chickadees occurred in the Black Mountains during the breeding season above

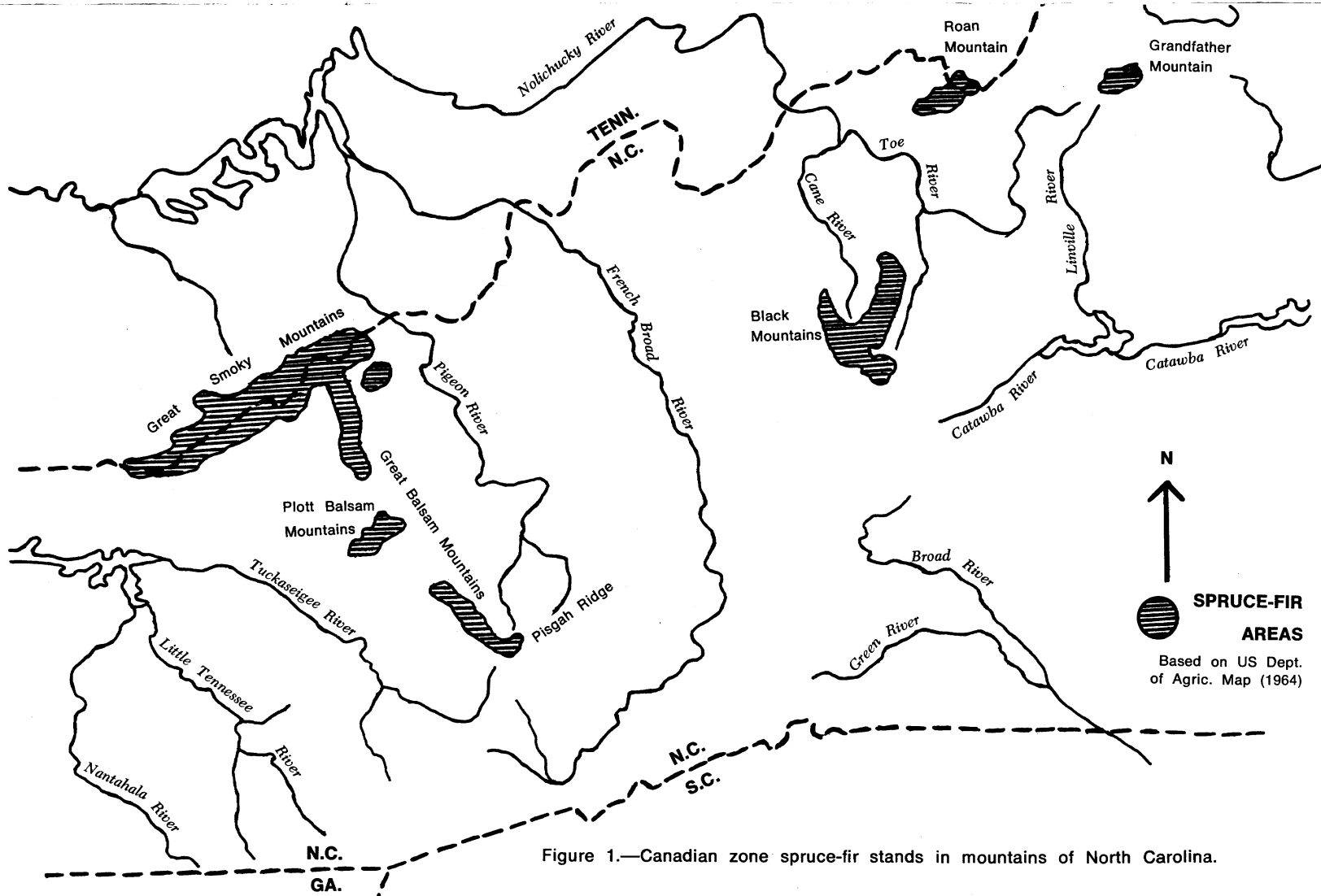


Figure 1.—Canadian zone spruce-fir stands in mountains of North Carolina.

1370 m (4500 feet) in forests of Fraser fir (*Abies fraseri*) and red spruce (*Picea rubens*), while Carolina Chickadees nested in deciduous forests below that elevation. Pearson et al. (1959) mention that Black-caps are found on some of the higher mountains, but they give no details. Unfortunately, these statements have been widely misinterpreted as meaning that elevation and habitat are reliable criteria for separating the two species throughout the southern Blue Ridge Mountains. Thus it has been assumed that a chickadee seen above 1370 m, especially if it is in Canadian zone spruce-fir forests (Fig. 1), is probably a Black-cap, while chickadees found in deciduous woods below this elevation are Carolinas. Ample evidence exists to refute this concept.

In ranges where the Black-capped Chickadee is absent, the Carolina Chickadee may occur above 1830 m (6000 feet) and often uses spruce-fir forests during the nesting season. In the Great Craggy Mountains, where Black-caps have never been reported, Cairns (1891) and Tanner (pers. com.) found that Carolina Chickadees regularly inhabit the deciduous forests up to 1830 m. Furthermore, Carolinas occur in the lower portions of the spruce-fir forests of the Black Mountains (Brewster 1886, Tanner 1952), Roan Mountain (Behrend pers. com.; Tanner, pers. com.), and Grandfather Mountain (Alexander 1973). In the Great Smokies, where the largest southern Appalachian population of Black-capped Chickadees presently occurs, Tanner (1952) observed a zone of approximately 245 m (800 feet) where neither species is found during the breeding season; and the Black-capped breeds down to 975 m (3200 feet) in both northern and southern deciduous forests.

In Illinois, where the ranges of the Carolina and Black-capped Chickadees meet and occasionally overlap, Brewer (1963) found that both species were identical in their habitat requirements. It seems probable that the occurrence of Black-caps in mountain ranges where spruce-fir forests are found is, at least in part, coincidental, being the result of their requirement for the higher elevations at this latitude. At any rate, it is clear that Black-capped Chickadees cannot be identified simply on the basis of habitat and elevation in the southern Blue Ridge.

#### CRITERIA FOR IDENTIFICATION

Although song, behavior, and plumage are said to be helpful in distinguishing between Black-capped and Carolina Chickadees, the only consistent and reliable feature separating the two species appears to be the ratio of tail length to wing length. Because this requires direct examination of the bird, authenticated records must be based on measurements of collected or trapped specimens. Since most of the higher mountains are protected by Federal and State regulations, this is often impractical or impossible. Field observers who suspect the presence of Black-caps should, therefore, provide thorough details of the features on which they base the identification. Although description of habitat, elevations, plumage, song, and behavior should be noted, it must be recognized that conclusive proof of the species' presence should ultimately rest on direct measurement of individual birds.

#### VERIFIED DISTRIBUTION

Based on the tail:wing ratio of captured or collected birds, authenticated records of Black-capped Chickadees have been obtained in the Great Smoky Mountains, Plott Balsam Mountains, and Black Mountains.

*Great Smoky Mountains* (Sevier, Cocke and Blount Counties, Tenn.; Swain and Haywood Counties, N.C.). Tanner (1952) and Stupka (1963) indicate that the largest population of Black-capped Chickadees in the southern Blue Ridge is presently located in the Great Smokies and immediately contiguous northern Great Balsam Mountains. In addition to Tanner's extensive work, some 20 Black-caps were collected from the Smokies between June 1930 and April 1932 by T.D. Burleigh and are now at the U.S. National Museum in Washington. During the breeding season, Black-caps occur throughout the spruce-fir forest and range down as low as 975 m (3200 feet) in forests of northern and southern hardwoods (Tanner 1952). During fall and winter, many of the Black-caps move to lower elevations where they associate in mixed flocks with Carolina Chick-

adees. Stupka (1963) regards the bird as a "fairly common permanent resident" in the Park, while Alsop's (1970) study on Mt. Guyot found a breeding density of six pairs per 100 acres of virgin spruce-fir forest. Tanner found four nests, all located in yellow birch trees (*Betula alleghaniensis*), but he informs me (pers. com.) that all were in the Tennessee portion of the Park. To my knowledge, there are no authenticated nesting records of the Black-cap in any of the North Carolina portions of its range.

*Plott Balsam Mountains* (Jackson and Haywood Counties, N.C.). Black-caps were first reported from this lofty transverse range by Charles Batchelder (1886), who collected a series of 13 specimens from Jones Knob in December 1885 and January 1886. This collection is presently at the Museum of Comparative Zoology at Harvard University. Subsequently, Tanner (1952), Richard H. Peake (pers. com.), and Simpson (present study) reported sight records of the bird from the spruce-fir and northern hardwood forest that cover much of the higher elevations. Although no specimens have been examined from this area in recent years, there is no evidence that the Black-caps have been extirpated or replaced by Carolina Chickadees.

*Black Mountains* (Buncombe and Yancey Counties, N.C.). The earliest evidence that Black-capped Chickadees occurred in the southern Appalachians came when Brewster (1886) reported the species to be a fairly common summer resident of the spruce-fir forests around Mt. Mitchell during his visit to the range in June 1885. Specimens collected there by Brewster are presently at the Museum of Comparative Zoology at Harvard University. Subsequently, Cairns (1887, 1889, 1891, 1894) regarded the Black-cap as a local breeder in the spruce-fir community of the range. S.C. Bruner and A.L. Field collected a specimen in July 1911 on Potato Knob and gave the skin to the North Carolina State Museum in Raleigh. By the 1930s, however, the species had been extirpated from the Black Mountains following the extensive logging and fires of previous years. Burleigh (1941) considered the bird "of accidental occurrence only" during his studies from 1930 to 1934, when the only Black-caps that he saw were two individuals collected on Mt. Mitchell on 8 May 1930 and now preserved at the U.S. National Museum. Burleigh's record is the last authenticated report of the species from the Black Mountains, and Tanner (1952) and Simpson (1972) found no evidence of its presence in the area during subsequent years.

#### UNVERIFIED SIGHT RECORDS

In the southern Great Balsam Mountains (Jackson, Haywood, and Transylvania Counties, N.C.), Harry LeGrand (pers. com.), Richard H. Peake (pers. com.), and Simpson (present study) have observed chickadees that exhibit behavior, song, and plumage characteristic of the Black-capped Chickadee. These have been comparatively large and tame chickadees, many of which gave the "fee-bee-ee" song typical of the Black-cap and showed conspicuous white edging in the wing and tail feathers. The birds have been observed during the breeding season and autumn in forests of spruce-fir and northern hardwoods at elevations above 1525 m (5000 feet). My records include a flock of 10 at Richland Balsam on 14 September 1969, 20 in small flocks near Buckeye Gap on 5 October 1969, 2 at Devil's Courthouse on 6 September 1968, a pair near the summit of Richland Balsam on 16 June 1963, and 1 at Devils Courthouse on 18 June 1964. No specimens have been examined from this area, however, and extensive trapping or mist netting studies are needed to determine the identity of the chickadees that inhabit the higher elevations of this range.

In the Mt. Rogers-Whitetop area of Virginia, F.R. Scott (pers. com.) and Simpson (present study) have observed chickadees whose behavior, song, and plumage suggest their identity as Black-caps. These include breeding season and late summer records of large tame chickadees giving the "fee-bee-ee" song and inhabiting spruce-fir and northern hardwood forests above 1310 m (4300 feet). No specimens have been examined for verification from this area.

Although spruce-fir and northern hardwood forests are found on Roan Mountain, Grandfather Mountain, and on other scattered high elevation peaks in the southern Blue Ridge, I am unaware of any evidence suggesting that Black-capped Chickadees occur

in these areas. These ranges probably do not contain enough high elevation terrain to support a disjunct population of Black-caps.

#### DISTRIBUTIONAL AND ECOLOGICAL HISTORY

A number of birds inhabiting the southern Appalachians have restricted breeding ranges, but their distribution usually is understandable on the basis of habitat selection and elevation. The Golden-crowned Kinglet (*Regulus satrapa*) and Red-breasted Nuthatch (*Sitta canadensis*) occur at elevations above 1100 m in forest with spruce, fir, hemlock (*Tsuga canadensis*), and rarely white pine (*Pinus strobus*). The Saw-whet Owl (*Aegolius acadicus*) apparently requires spruce-fir woods, while the Olive-sided Flycatcher (*Nuttallornis borealis*) has been observed in both spruce-fir and hemlock stands. In contrast, the complexity of the Black-cap's disjunct range in the southern Blue Ridge is best understood by tracing the probable history of the bird during the period following the last ice age.

During the Pleistocene glacial period, when the polar ice sheet extended as far south as Ohio, many northern plant and animal species were driven into the southeastern portion of the United States. During this time, the Black-capped Chickadee probably occurred through much of the area now occupied by the Carolina Chickadee (Brewer 1963). When the glaciers eventually began to retreat and the climate started to warm, the boreal flora and fauna moved northward, leaving many disjunct or isolated populations in the southern Appalachians, where ecological conditions were suitable for their survival into modern times. While the population center of the Black-capped Chickadee shifted to the northern portion of the United States, the isolated Black-caps of the southern Blue Ridge gradually retreated to higher elevations in the mountains. Eventually the valleys and lower slopes were invaded by Carolina Chickadees, while the Black-cap's range became restricted to medium and high elevations. As the warming trends continued, the Black-capped Chickadee declined further in numbers and distribution, steadily forced by climatic changes to retreat into the highest portions of the Blue Ridge Mountains. Because the birds are largely sedentary in this region, movement of individual Black-caps from one isolated mountain range to another was probably minimal, thus preventing the replenishment of the species in localities where natural disasters or competition with Carolina Chickadees had reduced its numbers. In mountain ranges where there was insufficient high elevation terrain to support a stable, reproductively isolated, and self-perpetuating population of Black-caps, the species eventually was reduced in numbers and swamped out through direct competition and possibly through hybridization with the Carolina Chickadee. The species survived into modern times only in those mountain ranges containing enough high elevation terrain to support a sufficiently large population to compete successfully. Thus the critical factor in its distribution may be the amount of suitable woodland habitat above perhaps 1220 m (4000 feet) in a particular mountain range.

This hypothesis accounts for many of the known facts of the species' distribution in the North Carolina mountains. Examination of topographic maps reveals that records of the Black-capped Chickadee are from those ranges which contain the greatest total mass of high elevation terrain. The largest population of Black-caps is found in the Great Smokies, which have the largest area of continuous high elevation terrain in the southern Appalachians. The Black Mountains, despite the superior altitude of the highest peaks, have only a fraction of the land mass found above 1370 m (4500 feet) in the Smokies. Thus Black-capped Chickadees in the Mt. Mitchell area would be expected to be at a competitive disadvantage compared to the population in the Smokies. Such appears to have been the case, since Brewster (1886) found the Carolina Chickadee in the lower fringes of the spruce-fir forest and, perhaps prophetically, noted a male Carolina and male Black-cap singing in the same spruce tree. By examining Brewster's specimens, Tanner (1952) found evidence suggesting hybridization, since the tail-wing ratios of birds from the Black Mountains more closely approximate that of the Carolina than do those collected in the Smokies. In contrast to the overlap in the Black Mountains, Tanner (1952) found the two species separated by a zone of 245 m (800 feet) elevation

during the breeding season in the Smokies, suggesting that the Black-cap population in the Smokies is sufficiently large to maintain its competitive advantage in the higher elevations of that range. With the extensive fires and logging in the Black Mountains, the nesting habitat of the Black-caps was reduced even further, apparently to the point that the population was unable to maintain itself in the region and was eventually extirpated.

These facts would account for the absence of the Black-cap in other ranges that contain high elevation peaks, often covered by spruce-fir forests, but which have only a small total area of terrain above 1370 m (4500 feet). The Great Craggy Mountains, Newfound Mountains, Pisgah Ridge, Roan Mountain, Grandfather Mountain, and the Nantahala Mountains all have summits above 1525 m (5000 feet), but the total area at these elevations is apparently inadequate to support Black-capped Chickadees in sufficient numbers to compete and reproduce successfully.

#### UNRESOLVED PROBLEMS

The southern Great Balsam Mountains and the Mt. Rogers-Whitetop area appear to be ecologically suitable for the Black-capped Chickadee, and the previously mentioned observations from these areas suggest that the species might inhabit the region. Trapping or mist netting studies should be undertaken in these areas to determine the identity of the chickadees occurring in the ranges.

The movements and distribution of the Black-cap during the non-breeding seasons have been studied only in the Smokies (Tanner 1952, Stupka 1963), where the birds move to the lower slopes and valleys during the winter, intermingling with Carolina Chickadees that inhabit the lower elevations throughout the year. The possibility of similar vertical migration has not been studied in the Plott Balsam Mountains, and the extent of winter dispersal movements through the southern highlands remains unknown.

An intriguing but not yet investigated possibility is the use of tape recording followed by spectrographic analysis or "voice printing" to determine whether the two species can be distinguished even when they appear to be vocalizing the song of the opposite species. If proven to be reliable, such a technique would greatly simplify future investigations of distribution and dispersal movements in the southern Appalachians.

Recent reports from Virginia suggest that the Black-capped Chickadee may be extending its breeding range into areas previously occupied by the Carolina. Johnston (1971) collected Black-caps at Mountain Lake, Giles County, in woodlands where only the Carolina Chickadee had been found in earlier years. Similar range expansion in the North Carolina mountains should be watched for and properly documented if it should occur.

#### SUMMARY

The Black-capped Chickadees of the southern Blue Ridge Mountain Province occur as relict disjunct populations isolated from the more northern forms by climatic and vegetative changes following the Pleistocene glacial period. Their survival into modern times occurred only in mountain ranges with a high elevation land mass of sufficient size to support a population capable of reproductive and competitive success. At present, the major population inhabits the Great Smoky Mountains with a smaller number found in the adjacent Plott Balsam Mountains. Black-caps occurred in the Black Mountains until extirpated by fires and logging. The difficulty of identifying the species in the field emphasizes the need for direct examination of individual specimens and measurement of the tail:wing ratio in establishing the presence of Black-capped Chickadees outside their presently known range. Observers should be alert for evidence of breeding, since there are no published nest reports from North Carolina.

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