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# Morphometrics Incorrectly Show the Presence of Black-capped Chickadees in Southwestern Ohio

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## ABSTRACT

*The purpose of this study was to test the validity of using tail and wing measurements to determine Black-capped Chickadee (*Poecile atricapillus*) identity in a geographic location suspected to contain only Carolina Chickadee (*Poecile carolinensis*). Standard measurements of wing chord and tail length were collected from 358 chickadees in southwestern Ohio and compared to the published criteria of tail length and tail/wing ratio. Analyses of the data indicate that 12% of the population fell within published criteria for Black-capped Chickadee. These data suggest that morphometric measurements alone will not be sufficient to accurately identify chickadees in southwestern Ohio. Factors including an incomplete understanding of morphometric boundaries between Black-capped and Carolina chickadees, hybridization between Carolina and Black-capped chickadees, and potential interbander measurement variability potentially impact our ability to categorize individuals accurately.*

## INTRODUCTION

The ranges of Black-capped (*Poecile atricapillus*) and Carolina (*Poecile carolinensis*) chickadees overlap across much of eastern North America. Formerly, their ranges nearly cut the state of Ohio in half. However, over the past several decades, Carolina Chickadees have steadily expanded northward and Black-capped Chickadee populations are now largely confined to the northern counties of the state (Bronson et al. 2005). Preliminary findings

from the 2011 Ohio Breeding Bird Atlas show a small island of potential Black-capped Chickadee distribution about 75 km north of Interstate 70, around Grand Lake St. Mary, but the southern Black-capped Chickadee boundary runs roughly along U.S. Highway 30, 100 km north of Interstate 70, and about 200 km north of Cincinnati (Ohio Breeding Bird Atlas-II 2011). As the apparent Black-capped Chickadee range continues to shift northward, the Cincinnati region of Ohio becomes less and less likely to have regularly occurring Black-capped Chickadees in winter and an even slimmer chance during the breeding season. Yet, when using the published morphometric criteria used in bird banding to determine different chickadee species, the data indicate the presence of Black-capped Chickadees in these far southern counties during all seasons.

A relatively narrow, yet discrete hybridization zone between Black-capped and Carolina chickadees occurs within Ohio. In the 1930s, the zone was thought to run along Interstate 70, bisecting the state, north and south (Trautman 1940). Today, the hybridization zone is roughly 20 to 30 km wide and runs along US Highway 30, about 100 km north of Interstate 70 (Peterjohn 2001, Sattler and Braun 2000). In this zone, male hybrids appear to have a selective disadvantage (Bronson et al. 2005). The hybrid zone widens to nearly 50 km in southeastern Pennsylvania and continues to expand as Carolina Chickadee populations shift northward, while Carolina Chickadees appear to enjoy a selective advantage during hybridization events (Reudink et al. 2007).

From a bander's perspective, morphometrics are considered to be the most robust method for separating Black-capped and Carolina chickadees. According to Pyle (1997), the relationship between the tail to wing is considered the most useful character for separating the two species. A tail-to-

wing ratio greater than 0.9 mm is diagnostic for Black-capped Chickadee (range 0.886 - 1.032, n = 551) and less than 0.9 mm indicates Carolina Chickadee (range 0.819-0.922, n = 538; Pyle 1997). However, there is a range of overlap where other characteristics such as the presence and amount of white on the greater coverts, the amount of white on the tertials and edges of the secondaries, olive-gray verses brown-gray back coloration and the presence of distinct white cheeks versus white fading into gray in cheek/nape become useful in determining correct identification.

Confounding the issue of correctly identifying chickadees by morphometric measurements in Ohio are data indicating that Carolina Chickadees show weak geographic variation among four described subspecies (Pyle, 1997). *P. c. extima* occurs roughly north of a line drawn through central North Carolina to western Tennessee and *P. c. carolinensis* occurs to the south of this area. Thus, the expected Carolina Chickadee subspecies in southwestern Ohio is *extima* with the nearest *carolinensis* occurring about 250 km to the south. Pyle (1997) mentions subtle differences between these two Carolina Chickadee subspecies such as *extima* being “medium in size; upperparts medium gray with an olive tinge”; while *carolinensis* is “small, upperparts dark gray with an olive tinge”; and *extima* has “greater coverts indistinctly edged buffy gray” whereas *carolinensis* has “greater coverts edged gray”. Distinguishing the two subspecies in the field is nearly impossible; however, birds in the hand at a banding station can be scrutinized more closely. Wing and tail measurements appear to be somewhat useful in determining subspecies (Table 1).

The majority of chickadees measured at our banding stations in southwestern Ohio have wing and tail measurements within expected *extima* limits; however, there appears to be some overlap with *carolinensis* from the south, as some individuals measured less than the expected values for *extima*. Because of their small size, these individuals would be even less likely to be confused with Black-capped Chickadees, but it does add additional variation to

**Table 1. Established wing and tail measurements (in mm) for Black-capped and Carolina chickadees (from Pyle 1997).**

Species	Sex	Wing Chord	Tail Length
Black-capped Chickadee	M	60-69	59-66
	F	58-68	57-64
Carolina Chickadee			
<i>P.c. extima</i>	M	59-67	51-60
	F	56-65	49-58
<i>P.c. carolinensis</i>	M	55-65	48-54
	F	53-63	46-52

the scope of individuals present in southwestern Ohio.

## METHODS

We measured 358 chickadees between 2004 and 2010 at four banding stations in southwestern Ohio. Of these birds, 174 individuals were captured between 16 Mar and 15 Sep (spring/summer), the expected breeding season, and 184 individuals were captured from 16 Sep through 15 Mar (fall/winter), a potentially active movement period when Black-capped Chickadees would more typically be expected to move south into southwestern Ohio. The four stations included (1) the Hueston Woods Biological station in Hueston Woods State Park, straddling the Preble/Butler County line 55 km north of Cincinnati; (2) the Ecology Research Center just north of the campus of Miami University, Oxford, OH, about 48 km north of Cincinnati; (3) Pfeffer Park just south of the campus of Miami University; and (4) the Clifford Bird Observatory located at the Motherhouse of the Sisters of Charity of Cincinnati, adjacent to the College of Mt. St. Joseph, approximately 11 km east of Cincinnati along the Ohio River.

All individuals were captured by mist nets and processed at the banding station before release. Unflattened wing chord and tail lengths were measured to the nearest 1.0 mm, according to the best practices outlined in Pyle (1997). The following

criteria, recommended in Pyle, were tested for their ability to differentiate Black-capped Chickadees from Carolina Chickadees:

tail length of 57 - 66 mm (Black-capped Chickadee)  
vs 46 - 60 mm (Carolina Chickadee)

tail/wing ratio of greater than (Black-capped Chickadee), vs less than, 0.9mm (Carolina Chickadee)

tail/wing ratio range of 0.886 - 1.032 (Black-capped Chickadee) vs 0.819 - 0.922 (Carolina Chickadee)

Blood or tail feathers (R6) were also taken from some individuals for subsequent molecular analysis.

## RESULTS

Using the tail-length-only criterion for separating Black-capped Chickadees from Carolina Chickadees, we found only one individual to have tail length greater than the expected largest value (60 mm) for Carolina Chickadees. When using the criteria of wing/tail ratio greater than 0.9 mm to indicate Black-capped Chickadee, our data show that 42 individuals (12%) would best be categorized as Black-capped Chickadees. Of the 42 individuals, 18 occurred in spring/summer and 24 in fall/winter. Twenty individuals (6%) satisfied both criteria (tail > 56 mm and wing/tail > 0.9 mm).

Since the tail length distributions of Black-capped and Carolina chickadees overlap, it is reasonable to examine individuals with a tail length outside the overlapping range of 56 - 60 mm. Thus, when using a tail length of > 60 mm to indicate Black-capped Chickadee, our data indicated only one individual as Black-capped Chickadee (banded on 09 Sep 2008). Again, since the wing/tail ratios of Black-capped and Carolina chickadees also overlap, it is reasonable to examine individuals with a wing/tail ratio outside the overlapping range of (0.886 - 0.922). Therefore, when using a wing/tail ratio of > 0.922 to indicate Black-capped Chickadee, our data show that 18 individuals meet this criterion. Of the 18, eight individuals were banded in spring/summer and 10 in fall/winter.

These data indicate that even using the most restrictive morphometric criteria (tail/wing ratio > 0.922; tail length > 56 mm) to separate Black-capped and Carolina chickadees, about 3% of the chickadees in southwestern Ohio would appear to meet measurement criteria of Black-capped Chickadees. Our data also show nine individuals (3%) with tail lengths shorter than the published lengths for *extima* (Pyle, 1997) and which fall into the expected range for *P. c. carolinensis*, three individuals in spring/summer and six individuals in fall. Care was taken, particularly in fall, to ensure only birds who had not started molt or who had completed molt (so tails were complete) were included.

## DISCUSSION

It is surprising to find that nearly 12% of the chickadees banded 200 km south of the published hybridization zone in Ohio, express morphometric measurements indicative of Black-capped Chickadees. This is especially interesting, when the banded individuals typically flagged as not Carolina Chickadee by measurement are those with values in the lowest ranges expected for Black-capped Chickadees (i.e., wing cords in the mid 60 mm range and tails less than 59 mm). None of these individuals outwardly appeared to be Black-capped Chickadees. They did not show extensive white in the coverts, tertials or along the secondary margins and they did not appear "large-headed" or show contrastingly large white cheeks and back. Nothing outwardly alerted the banders to the potential complication in species identification.

It is conceivable that during the winter of 2005 irruption, when large numbers of Black-capped Chickadees were reported in southern Ohio (Ohio Ornithological Society 2005), some individuals may have been banded at these southwestern banding stations; however, the data do not support that hypothesis. Most individuals exhibiting Black-capped Chickadee morphometrics in this data set were collected during other years. There are also no corresponding records from local birders of Black-capped Chickadees being seen and heard around greater Cincinnati (Cincinnati Rare Bird Alert). It is

possible that hybrids from the intergrade zone trickle south each fall and some might stay and breed. The question then becomes: "What do we name individual chickadees that measure Black-capped Chickadee in data submitted to the banding lab, when over 12% of our individuals fall well within published values for Black-capped Chickadees?"

Additionally, we are within 200 km of the northernmost extent of Carolina Chickadee, well beyond the described distribution of smaller, more southern or western races of the Carolina Chickadee. Our banders have paid little attention to the subtle color and size variation seen between our typical chickadees and results from this project suggest that more attention should be given to the smaller, darker individuals. Nearly 3% of the individuals banded were smaller than the published threshold for *P. c. extima* and all these individuals had a tail/wing ratio of less than 0.83; whereas, more 'typical' *P. c. extima* appear to range between 0.85 and 0.90. There are currently no published genetic markers separating the four described Carolina Chickadee subspecies. Yet, there are two distinct Carolina Chickadee haplotypes, found clinally through southwest Alabama to southern Mississippi (Gill et al. 1999) with no recognizable morphological characteristics separating these two genetically distinct populations.

## CONCLUSION

The Black-capped-Carolina Chickadee hybridization zone, a narrow 20 - 30 km band, occurs over 150 km north of the banding stations in southwestern Ohio. Yet, 12% of the birds measured in southwestern Ohio fall within the published values determined for Black-capped Chickadee. To what species these individuals are assigned becomes problematic as they do not exhibit other diagnostic traits found in Black-capped Chickadees. Questions regarding (1) the expansion of the hybridization zone, (2) seasonal southward movements of pure or hybrid Black-capped Chickadees and, (3) the correct diagnostic measurements to use in southwestern Ohio in separating Black-capped from Carolina Chickadees, must be addressed. While apparently weak and clinal, evidence also suggests that

southwestern Ohio appears to show intergrades between the northern and southern races of the Carolina Chickadee.

Southwestern Ohio appears uniquely situated for looking at speciation from both an intra-and interspecific perspective. Our ability to capture and evaluate large numbers of chickadees through banding will allow for morphological and molecular comparisons in this potential zone of overlap. Efforts are currently underway to evaluate local chickadees using DNA extracted from blood, feathers, and buccal swabs. In addition to surveying for evidence of Black-capped Chickadees, and thus the reliability of published morphological differences, the determination of the genetic structure of Carolina Chickadees within southwestern Ohio will add to our understanding of the occurrence and distribution of Carolina Chickadee subpopulations.

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Black-capped Chickadee  
by George West

## News, Notes, Comments

### Retirement of Flo Soehnlein

Dear Bander,

After more than 39 years of service to the Federal government, Flo Soehnlein retired from the Bird Banding Laboratory on 1 June 2012.

Flo was hired as the Permit Officer for the BBL in 1982, moving to the lab from the Law Enforcement program the US Fish and Wildlife Service where she issued migratory bird permits. During her 30-year tenure as BBL Permit Officer, banding permits evolved from pieces of paper prepared on typewriters to the electronic system in use today. The workload has expanded greatly and the BBL permit office is currently responsible for conducting more than 7,000 permit actions annually, requiring a high level of organization and detailed electronic tracking to provide permits to the banding community in a timely manner. The successful transition to the electronic age was a result of Flo's hard work, willingness to adopt new technologies to meet the increased work load, and dedication to the BBL. Despite this unrelenting work load, Flo remained a helpful, cheerful voice on the phone as she answered questions and provided assistance to the banding community. She was also a very valuable source of information on the BBL permitting process for the various BBL chiefs during her tenure. Her knowledge and expertise will be greatly missed.

The BBL thanks Flo for her dedicated service over the years and wishes her a long, healthy and prosperous retirement. No doubt she will remain active as she enters the retirement phase of her life. Carrol LePore has been assisting Flo in the BBL permit office for the past 4+ years and will assume the responsibilities of that office.

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### BARRED OWL RAPID MOLT

The rapid molt of Barred Owl (*Strix varia*) rectrices was discussed previously by Acker and Garcia (2010). They determined that the number of days a Barred Owl takes to molts its' rectrices was unquantified but estimated to take over a month. Recently, Acker has quantified the time and growth of the rectrices from a pair of failed nesting Barred Owls that were observed nearly daily at his home on Bainbridge Island, WA, and captured six times over the molting period. The female was first observed, caught, and banded on 18 Jun 2011 with no tail. Her