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# Effectiveness of Wing Chord/Tail Length Measurements in Separating Black-capped Chickadee from Carolina Chickadee

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## ABSTRACT

Wing chord and tail length measurements used by Simon (1960) and Hubbard (1970) to separate Black-capped Chickadee (*Poecile atricapilla*) from Carolina Chickadee (*P. carolinensis*) were evaluated on 4422 Black-capped Chickadee captures near Schenectady, NY, and 40 Carolina Chickadee captures from Island Beach State Park, NJ. Using Simon, 3.17 % of the Black-caps fell in the Carolina measurement area, while 17.5% of the Carolinas fell in the Black-cap area due in part to the occurrence of hybrids in this area of New Jersey. Hubbard's method placed 0.43% of the Black-caps in the Carolina measurement range, and 5.74% in an intermediate unknown range; as well as 12.5% of the Carolinas in the Black-cap range, and 25.0% in the intermediate unknown range. Wing chord and tail length measurements increased 2.1 and 1.8%, respectively, in juvenile Black-capped Chickadees in the first two years after banding, but had no effect on the tail length/wing chord ratios which varied little in the range of 0.944 to 0.955, up to seven years following banding.

## INTRODUCTION

On 31 Oct 1998 and again on 8 Nov, I captured a puzzling chickadee in my yard at Schenectady, NY. The bird's plumage was characteristically that of a Black-capped Chickadee, but its diminutive size, immediately apparent in the net and in hand, was that of a Carolina Chickadee. Its wing chord, 60 mm, and tail length, 54 mm, placed it clearly in the Carolina range using Simon's (1960) as well as Hubbard's (1970) criteria. The bases of the primaries and rectrices lacked any sheathing, ruling out molt in progress as a possible factor in potentially altering the bird's measurements.

The Carolina Chickadee has never been substantiated in New York state (Bull 1974) and my Schenectady location is approximately 270 km (170 mi) north of the known northern range limit of the species' northern-most race, *P.c. extimus*, in mid-state New Jersey (Harrap and Quinn 1995). These circumstances prompted me to examine measurements from 4422 Black-capped Chickadee captures from the Schenectady area, 1970-2002, and 40 Carolina Chickadee captures from Island Beach State Park, NJ, 1965-2002, to assess the effectiveness of Simon's and Hubbard's criteria for separating the two species.

## METHODS

Black-capped Chickadees were captured year around at four locations within 15 km (10 mi) E, 28 km (17 mi) W, and 55 km (34 mi) N of Schenectady, NY, the vast majority of them at 55 km N in Adirondack Mountain habitat at 381 m (1250 ft) elevation at Jenny Lake near Corinth, NY, where the species is a breeding resident and irruptive winter resident. Measurements of the unflattened wing chord (WC) were taken to the nearest mm with a rule graduated to 1 mm, lacking an end stop. Tail length (TL) measurements were taken with the same rule by inserting it between the central pair of rectrices to the base of the tail (Pyle 1997). For analysis, I used measurements taken on birds when first captured for banding, and on any subsequent recapture following an intervening complete prebasic molt of primaries and rectrices. Birds captured while in molt were excluded to avoid encountering incompletely grown feathers which could artificially shorten the measurements.

Carolina Chickadees were similarly captured and measured (occasionally to the nearest half mm) at Island Beach State Park, NJ, a barrier beach along the Atlantic coast immediately south of South Seaside Park, NJ, where the species is a breeding resident. Captures were made during visits in May and October.

**RESULTS**

The WC/TL data on 4422 Black-capped Chickadee captures are summarized in Fig. 1 using the presentation style of Simon (1960), but reversing the WC measurements to ascending order, bottom to top. The line of demarcation used by Simon

between the two species is represented by the WC/TL coordinates of 57/55 to 68/60 where the area left of this line is designated Carolina Chickadee and right of the line Black-capped Chickadee. In this sample, 140 Black-capped Chickadees (3.17%) fell in the Carolina area. Hubbard (1970) separated the species as follows: TL 60 mm or greater, or WC/TL occurring below the lower dashed line was Black-capped Chickadee; and TL 55 mm or less, or WC/TL above the upper dashed line was Carolina Chickadee. Birds with WC/TL measurements between the two dashed lines were intermediates of unknown species. These criteria place 19 Black-caps (0.43%) of this sample in the Carolina area, and 254 Black-caps (5.74%) in the unknown area.

Fig. 1. Numbers of Black-capped Chickadee captures near Schenectady, NY, having the indicated wing chord/tail length measurements shown on each axis. The solid line is the line of demarcation used by Simon (1960) to separate Carolina Chickadee to the left from Black-capped Chickadee to the right. The dashed lines represent Hubbard's (1970) boundaries within the wing chord range of 55.5-59.5 mm for separating Carolina Chickadee above the upper line and Black-capped Chickadee below the lower line, with birds between lines designated as unknown.

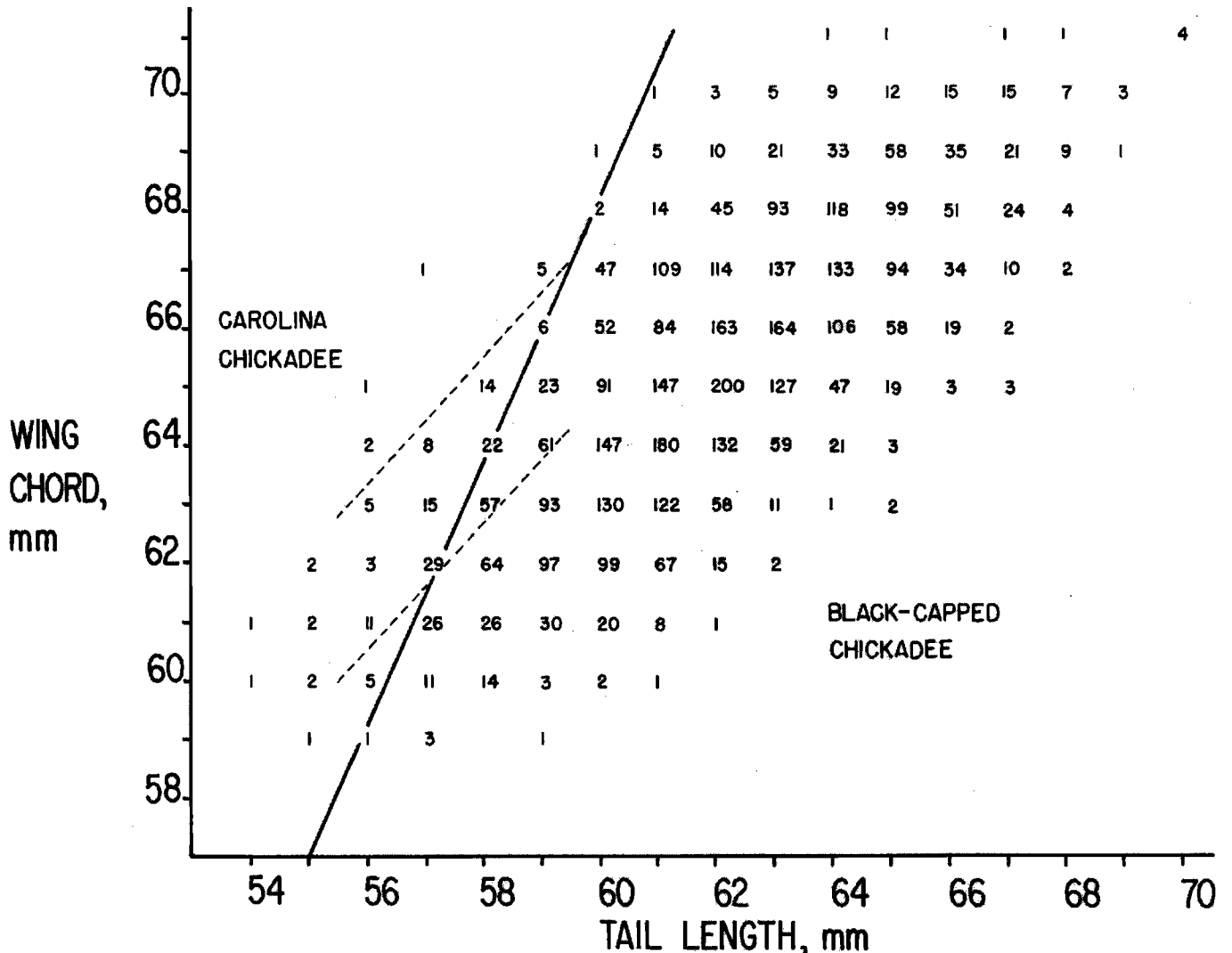
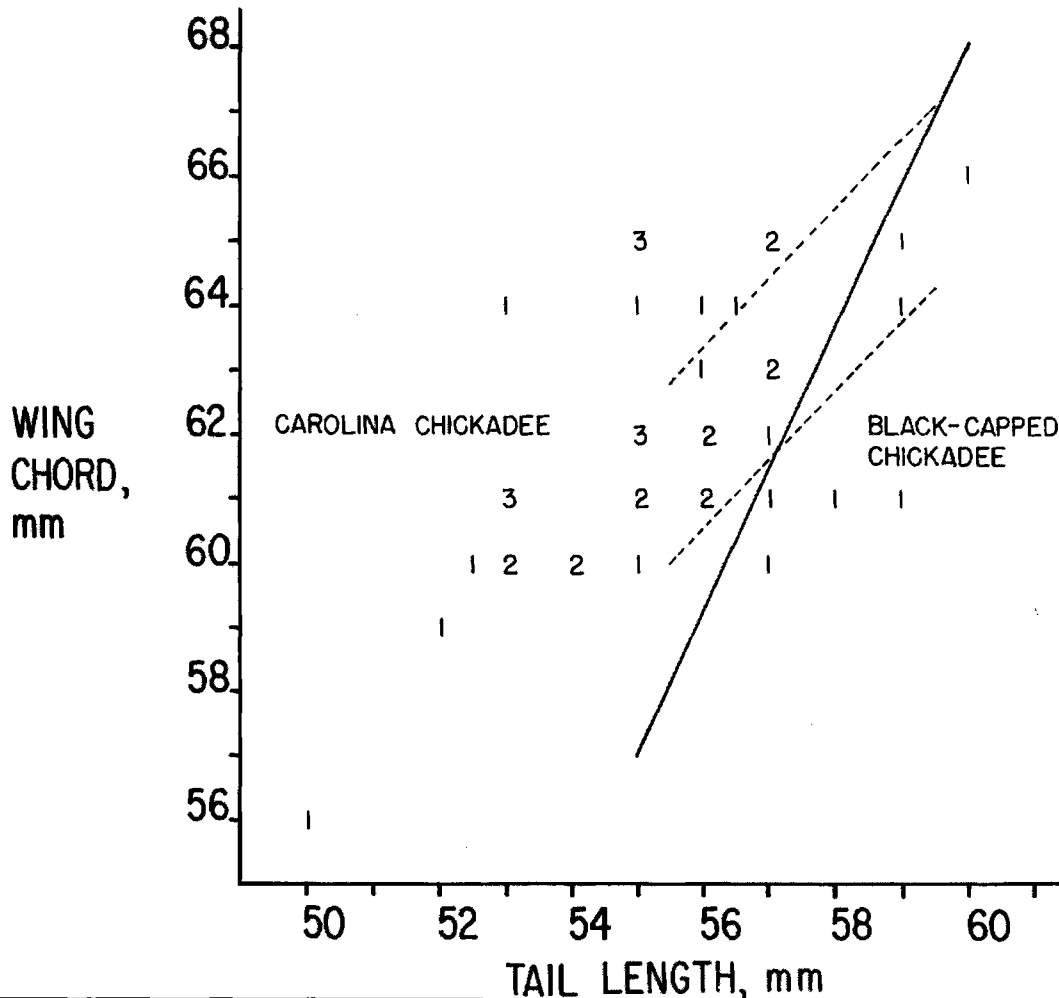


Fig. 2. The data for Carolina Chickadee captures at Island Beach, NJ, using the same criteria as described in Fig. 1.



Similarly, the Carolina Chickadee data are shown in Fig. 2 where, using Simon's criteria, seven Carolinas (17.5%) fell in the Black-cap area to the right of the line. Hubbard's criteria placed five Carolinas (12.5%) in the Black-cap area, and ten (25.0%) as unknown intermediates.

To determine what effect, if any, age might play on a Black-capped Chickadee's WC/TL measurements, I was able to separate from the Jenny Lake data a cohort of 279 chickadees for which I had WC/TL measurements starting with their original juvenile flight feathers followed by measurements of their successive basic plumages after intervening complete prebasic molts out to ten years after banding. This cohort supplied 757 WC and 753 TL measurements which were grouped by year after banding and averaged by year. They are presented in Fig. 3, along with annual TL/WC ratios based on

each year's average TL and WC values out to seven years after banding. Data points for years eight, nine, and ten were excluded because each was represented by only a single bird.

Given that these results showed these measurements to increase over the first few years after banding, I examined the data from all Black-caps at the four Schenectady locations to determine what effect older return birds might have on these measurements. I gathered data on all birds having a particular WC or TL value and for each value determined what percentage were returns. I plotted these in Fig. 4 over the WC range of 60 to 70 mm and TL range of 56 to 68 mm. The percentage of returns rose from 7.9 to 65.7% over the WC range, and 14.3 to 56.5% over the TL range showing that returns predominated among birds with the largest measurements.

Fig. 3. Wing chord, tail length, and tail length/wing chord ratio averages for Black-capped Chickadees banded while in juvenile flight feather plumage at Jenny Lake, NY, and re-measured upon recapture following intervening complete prebasic molts of these flight feathers.

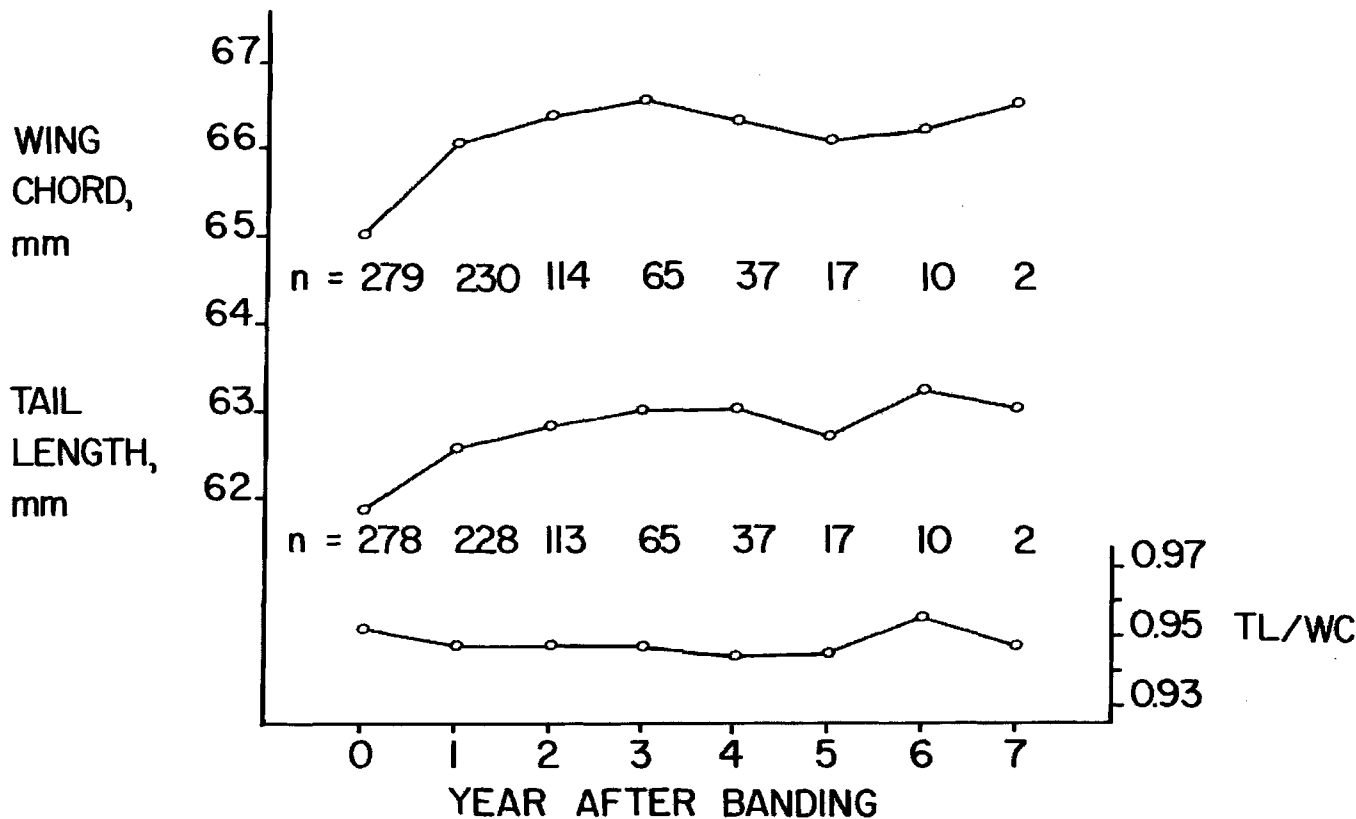
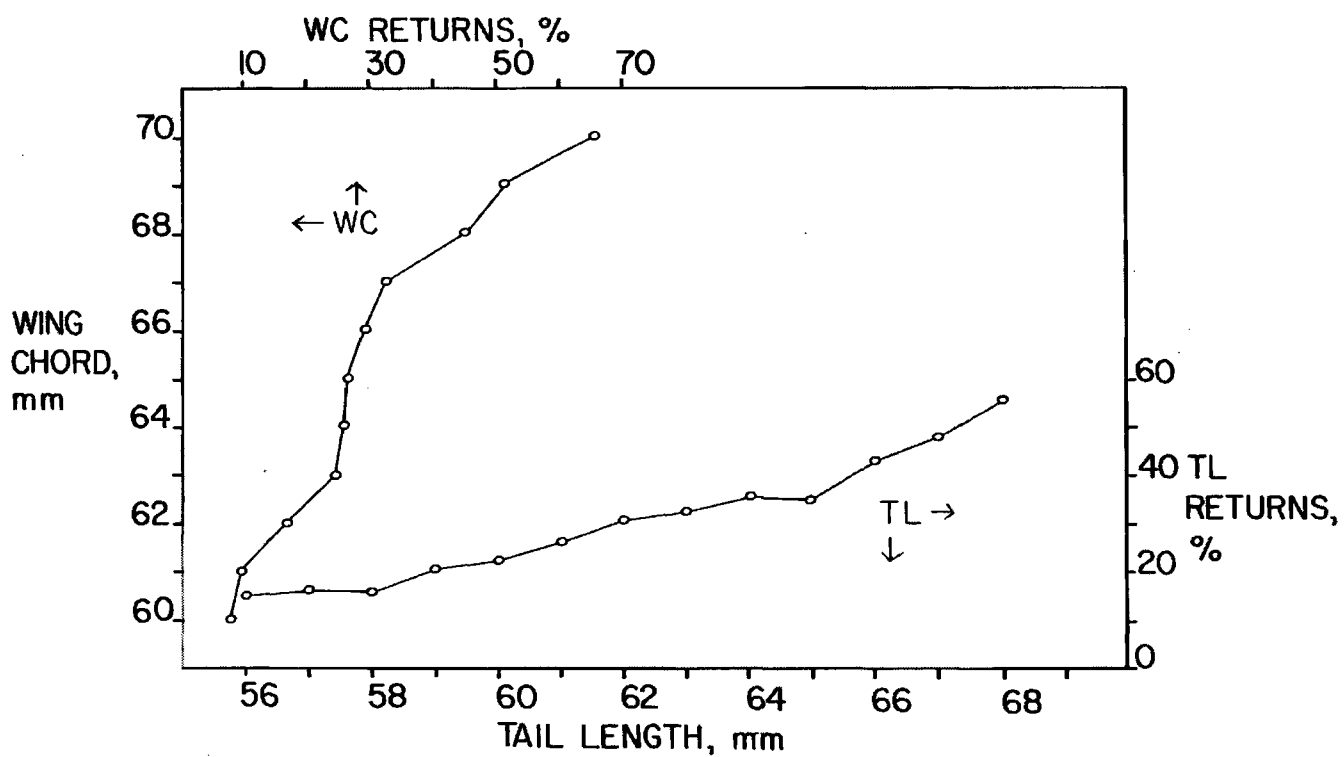


Fig. 4. Frequency of return captures of Black-capped Chickadees near Schenectady, NY, in each wing chord/tail length sample. Wing chord data are plotted against the left and upper axes, while tail length data are plotted against the bottom and right axes.



## DISCUSSION

**Evaluation of Simon's and Hubbard's WC/TL Criteria** - Simon's (1960) WC/TL diagram has been cited repeatedly (Wood 1969, Pyle et al. 1987, and Pyle 1997) as a means for separating these two similar species in the hand. It creates the impression of a very clean separation lacking any overlap of these measurements between species. This might cause confusion for banders who handle only limited numbers of either or both of these species because, as the data presented here indicate, there is overlap. Simon's samples of 38 Black-caps and 66 Carolinas did not detect this overlap. However, Simon's method, as applied here, met the Bird Banding Laboratory's 95% reliability criterion in that it identified 96.83% of the Black-caps as such, while 3.17% fell in the Carolina size range.

If the line of demarcation in Fig. 1 is moved 1 mm to the left, the number of Black-caps in the Carolina area decreases from 3.17% to 0.66%, but that creates another problem relative to the number of Carolinas in the Black-cap area. As drawn in Fig. 2, the line shows 17.5% of the Carolinas in the Black-cap area, and moving the line 1 mm to the left raises that number to 30.0%, in neither case fulfilling the Bird Banding Laboratory's requirement of 95% reliability.

Hubbard's criteria lessen the number of these Black-cap measurements occurring in the Carolina area from 3.17% (using Simon) to 0.43%, but suffer from causing 5.74% of known Black-caps to be classified as unknown intermediates. His criteria lessen slightly from 17.5% to 12.5% the number of Carolinas in the Black-cap area, but classify 25.0% of the Carolina sample as unknown intermediates.

My Carolina Chickadee sample is small ( $n = 40$ ) and is taken from an area where hybrids with Black-capped Chickadees occur (Harrup and Quinn 1995). Thus using WC/TL measurements to separate these species requires additional study before effectiveness can be confirmed. I am convinced that at least two birds (5.0%) in the Island Beach "Carolina" Chickadee sample were hybrids. These birds in the hand looked and felt like Black-caps (and measured as such) but possessed the typical plumage of a Carolina with sooty gray rather

than white edges to the inner secondaries, inner greater coverts, tertials, and rectrices.

Whether hybridization is occurring at Island Beach, or hybrid birds are coming from the mainland, is not known, but the latter is suspected. The sea-level, barrier-beach environment of Island Beach is very unlike the forested environment on the mainland where a Black-capped Chickadee might be found breeding. Banders at Island Beach banded 173 Carolina Chickadees (eight to 26 per year) and three Black-capped Chickadees between fall 1992 and fall 2002 (Glenn Mahler, pers. comm.) The Black-caps were banded on 30 Sep 1997, 8 May 1995, and 14 May 1996. I banded the 14 May bird and, while the date is late suggesting possible local breeding status, I believe this second-year bird was a late northward migrant based on the lack of brood patch or cloacal protuberance and the presence of fat deposits. Every one of the ten Carolina Chickadees I handled in May at Island Beach was in breeding condition, lacking fat deposits. The New Jersey breeding season for Carolina Chickadee is mid-Apr to mid-Jun (Harrup and Quinn 1995).

These observations and analyses led me to conclude that banders in the Northeast-Middle Atlantic region where both the northeast Black-cap race, *P. a. atricapilla*, and northerly Carolina race, *P. c. extimus*, occur should use caution in viewing Simon's graphic separation of these species. Contrary to the clean division portrayed, overlap placed 3.17% of the New York Black-capped Chickadees I handled in the smaller Carolina Chickadee measurement area. I concluded also that the puzzling chickadee I caught on 31 Oct 1998 was most likely nothing more than a small Black-capped Chickadee not unlike others I had captured. Given their number ( $n = 140$ ) and the distance from known Carolina Chickadee breeding territory, the possibility of any of these birds being a hybrid of Carolina size and Black-cap plumage is very remote.

Further, these WC and TL measurements were not sufficiently reliable at recognizing the Carolina Chickadee in New Jersey where the southern breeding limit of *P. a. atricapilla* abuts the northern range limit of *P. c. extimus*, where hybridization may occur. A combination of measurements, plumage

characteristics, and vocalization (when possible) should be employed, but even these at times may not be definitive as discussed by Harrap and Quinn (1995).

**Effect of Age on WC/TL Measurements** - The data in Fig. 3 illustrate that WC and TL measurements increase when juveniles molt into adult basic plumage at their second prebasic molt (one year after banding) and only slightly thereafter. The average juvenile WC increased from 65.0 mm to an asymptotic value of 66.4 mm, an increase of 2.1%; and TL from 61.9 mm to 63.0 mm, or 1.8%. Despite these increases, the average TL/WC ratios varied little within the range of 0.944 to 0.955. Pyle (1997) lists a range of 0.886-1.032, usually greater than 0.9, for Black-cap; and 0.819-0.922, usually less than 0.9, for Carolina. Referring to Fig. 1, I found a minimum Black-cap ratio of 0.851 at TL/WC = 57/67, and a maximum of 1.045 at 69/66. Referring to Fig. 2, the range was 0.828 (at 53/64) to 0.967 (at 59/61) for the Carolina Chickadee.

This observed WC increase of 2.1% compares to 2.8% found by Blake (1956) at Lincoln, MA (immatures, n=32; adults, n=21); while Stewart (1963) in the UK found Blue Tit (*Parus caeruleus*) wing chords increased 3.1% from first-winter birds (n=215) to adults (n=91). He cites Kluijver's (1939) study on Great Tits (*Parus major*) wherein wing chords increased 2.7% in males (n=148) and 1.4% in females (n=143) from first-winter to adult birds.

Fig. 4 presents an interesting finding. Older return birds make up an ever increasing percentage of the sample as TL and WC increase. However, WC and TL data on these same birds in Fig. 3 appear to show the increase to be asymptotic, thus not increasing significantly with age beyond the second or third year after banding. A possible explanation of the increasing return percentages in Fig. 4 is that larger size favors increased survivorship, causing proportionately more of these larger birds to live longer.

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