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Site Fidelity, Residency, and Sex Ratios of Wintering Ruby-throated  
Hummingbirds (*Archilochus colubris*) on the southeastern U.S. Atlantic Coast

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## Site Fidelity, Residency, and Sex Ratios of Wintering Ruby-throated Hummingbirds (*Archilochus colubris*) on the southeastern U.S. Atlantic Coast

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**ABSTRACT.**—Ruby-throated Hummingbirds (*Archilochus colubris*) are common and widespread but little is known about their winter ecology anywhere within their nonbreeding range, and no studies have been conducted on the individuals that now overwinter along the southeastern Atlantic coast of the United States. From 2008–2012, I examined the winter survivability, site fidelity, residency, and age and sex ratios of Ruby-throated Hummingbirds at one location in coastal South Carolina. I investigated whether the wintering population there was migratory or sedentary. Winter site fidelity was 19.4% overall (14.6% for males and 31.6% for females), which is similar to or higher than return rates found in studies near the Gulf of Mexico coast, 300 km to the south. The rate of winter residency was 26.3%. Juvenile sex ratios were significantly male biased, suggesting possible latitudinal sexual segregation, although more study is needed. Only one bird banded during spring, summer, or fall was recaptured during the winter, indicating a probable turnover of birds between summer and winter. *Received 11 January 2014. Accepted 24 May 2014.*

**Key words:** *Archilochus colubris*, latitudinal segregation, site fidelity, sex ratios, winter residency.

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Ruby-throated Hummingbirds (*Archilochus colubris*) are widespread and common, and winter over an extensive area from central Mexico to Panama (Ridgely and Gwynne 1989, Howell and Webb 1995), as well as in central and south Florida (Robertson and Woolfenden 1992). This species has recently been identified as the second-most common wintering hummingbird in north Florida and southern Alabama (Bassett and Cubie 2009), and there has been a sharp increase in wintering Ruby-throated Hummingbirds along the

Louisiana coast during the last 15 years (Weidensaul et al. 2013). In the previous 25 years, Ruby-throated Hummingbirds have also been documented wintering along the southeastern Atlantic coast, including Georgia and South Carolina (Cole 1994, Sargent and Sargent 1999).

The reasons for this winter range expansion are not known, but one possibility is climate change. In the last 40 years, the nonbreeding ranges of many North American birds have shifted poleward in response to warming winter temperatures (La Sorte and Thompson 2007). Ruby-throated Hummingbirds are advancing their spring arrival dates on their breeding grounds between 11.4–18.2 days, perhaps because wintering ranges have expanded northward in response to changing climate (Courter et al. 2013).

Previous studies on Ruby-throated Hummingbirds overwintering in the southeastern United States have been conducted near the Gulf of Mexico coast. Weidensaul et al. (2013) reported on an unpublished study of wintering Ruby-throated Hummingbirds in southern Louisiana that looked at site fidelity over a 13-year period from 1999–2012. Long-term research of wintering hummingbirds also took place in north Florida and southern Alabama, when Bassett and Cubie (2009) investigated the winter site fidelity and age and sex ratios of 375 Ruby-throated Hummingbirds over a 10-year period from 1998–2008. However, Bassett and Cubie (2009) did not band during the breeding season and were unable to determine whether the wintering Ruby-throated Hummingbirds in their study area were migrants or year-round residents. Also, they did not look at

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winter residency, and residency rates during the nonbreeding season remain undocumented for this species.

For this study, I chose a location in coastal South Carolina, 300 km farther north than previous studies, where wintering Ruby-throated Hummingbirds have not been studied, and their site fidelity, sex ratios, and residency rates are unknown. My objectives were to 1) compare the survivability and philopatry of wintering Ruby-throated Hummingbirds along the southeastern U.S. coast with more southern locations; 2) investigate winter residency rates; 3) document age and sex ratios to explore the possibility of differential migration; and 4) determine whether the wintering population there is sedentary or migratory.

#### METHODS

This study was conducted at a private residence in the village of Rockville on Wadmalaw Island, South Carolina (32° 36' 8" N; 80° 11' 36" W) ~30 km south of the city of Charleston and 5 km from the Atlantic Ocean. The 0.6-ha property had an overstory of live oaks (*Quercus virginiana*) and southern magnolia (*Magnolia grandiflora*) and was adjacent to a salt marsh. Cultivated flowers, including wax mallow (*Malvaviscus arboreus* var. *drummondii*) and marvel of Peru (*Mirabilis jalapa*), were grown at the site during the warmer months because of their appeal to hummingbirds. Approximately 12 camellia bushes (*Camellia japonica* and *C. sasanqua*) were in bloom at various times during the fall and winter, providing a source of nectar and small insects. Sugar-water feeders have been maintained year round for more than a decade at this location.

From March 2008–May 2012, I conducted 42 banding sessions. A preliminary session took place in March 2008. Banding began monthly in August 2008 and continued until May 2012. No banding sessions were conducted in October 2008, July and August 2010, or June and July 2011. During the winter months (Nov–Mar), I trapped for 1.5 hrs per session. For the remainder of the year, sessions were 2 hrs in length. All banding was conducted in early morning or in late afternoon. No attempt was made to standardize the day or week of the month.

In the first 23 banding sessions, I captured hummingbirds using two round traps (see Bassett and Cubie 2009). In September 2010, I began using two additional traps at each banding session.

After capture and banding, each bird was aged and sexed based on plumage and feather characteristics (Baltosser 1987, Pyle 1997) as well as bill corrugations (Ortiz-Crespo 1972).

Based on the work of Yunick (1983) and Monroy-Ojeda et al. (2013), I defined recaptures as either repeats (a bird recaptured during the same winter) or returns (a bird banded during a previous winter with one or more intervening breeding seasons in between). I used chi-square tests to examine whether male-to-female sex ratios differed significantly from an expected ratio of 1:1 (Mulvihill et al. 1992). Significance was set at a level of  $P < 0.001$ .

For the purposes of this study, I delineated the seasons as follows: winter (1 Nov to 15 Mar); spring/summer (16 Mar to 31 Aug); autumn (1 Sept to 31 Oct). The range of winter dates was chosen because fall migrant Ruby-throated Hummingbirds have generally left South Carolina by late October, and spring migrants do not return until late March (DC, unpubl. data). These dates, however, are not precise. Occasional migrants may linger into November and a few may arrive before 15 March.

#### RESULTS

I banded 416 Ruby-throated Hummingbirds from March 2008 to May 2012. Of those birds, 71 were banded during winter: 19 after-hatching year (AHY) males, 13 AHY females, 32 hatching-year (HY) or second-year (SY) males, and 7 HY/SY females. One female banded on 21 March 2009 and recaptured on 7 November 2009, 23 January 2010, and 8 January 2011 was also counted as a wintering bird, for a total of 72. The remaining birds were banded either during spring/summer ( $n = 153$ ) or autumn ( $n = 191$ ).

Site fidelity for wintering birds was 19.4%. For males ( $n = 48$ ), the return rate was 14.6% and for females ( $n = 19$ ) the return rate was 31.6%. (Repeated captures of the same bird are not included in these percentages.) Seven birds (three males and four females) returned for two winters, five birds (four males and one female) returned for three winters, and one female returned for a fourth winter.

A total of 19 hummingbirds (four AHY males, four AHY females, 10 HY/SY males and one HY female) were re-encountered at least once during the same winter, a minimum of 3 weeks apart, for a residency rate of 26.3%. Three of these repeats

(one AHY male, one AHY female, and one HY male) also returned for more than one winter.

With the exception of one female banded on 29 August 2009 and recaptured on 14 February 2010, no other birds banded during spring/summer or autumn were re-encountered during winter. Three males and four females banded during winter were recaptured during early spring/summer, (four on 21 Mar, two on 24 Mar, and one on 19 Apr), likely before migration. One male banded in winter was recaptured 2 years later on 1 October.

Age ratios were 1.2 juveniles to one adult. The adult sex ratio of 1.4 males:1 female was not significantly biased toward males ( $X^2 = 0.76$ ,  $P > 0.001$ ). The juvenile sex ratio of 4.6 males:one female ( $X^2 = 16.02$ ;  $P < 0.001$ ) was significantly biased toward males.

#### DISCUSSION

Winter site fidelity of Ruby-throated Hummingbirds in this study (14.6% for males, 31.6% for females, and 19.4% overall), was similar to or higher than return rates near the Gulf of Mexico coast. In southern Louisiana, the average return rate ( $n = 744$ ) was 9% from 1999–2012 with a wide annual variation ranging from 1.6 to 21% (Weidensaul et al. 2013). In southern Alabama and north Florida (Bassett and Cubie 2009), the overall winter return rate ( $n = 327$ ) was 5.2% (3.6% for males and 7.4% for females).

No previous research has looked at site fidelity within winter periods, but my results (residency rate of 26.3%) suggest that a number of Ruby-throated Hummingbirds in South Carolina spend the winter at one location. Given the necessity of having to retrap hummingbirds to determine site fidelity and residency, these data likely underestimate the true number of repeats and returns because many birds become “trap shy” and can be difficult to recapture.

Only one bird banded during the spring/summer (on 29 Aug) was recaptured during winter, indicating a turnover of birds between the breeding season and winter. Birds banded during winter and recaptured in late March and early April were likely migrants that had not yet departed for their breeding grounds.

Chi-square tests showed the adult sex ratio of 1.4 males:one female was not significantly biased toward males, but the juvenile sex ratio of 4.6 males:one female was significantly biased toward males. In Alabama and Florida, Bassett and Cubie (2009) found juvenile sex ratios were male biased

( $n = 245$ , 2.4 males:one female) although adult sex ratios were female biased ( $n = 130$ , 2.2 females:one male). One possible explanation for this skewed juvenile sex ratio is that immature male Ruby-throated Hummingbirds may outnumber females. However, a 28-year study conducted at Powdermill Nature Reserve in Pennsylvania (Mulvihill et al. 1992) found a 1.1 female:one male sex ratio in juvenile Ruby-throated Hummingbirds in late summer and fall. Segregation by latitude during the nonbreeding season is another possibility, with juvenile males wintering farther north than females. In Mexico and Central America, Komar et al. (2005) used museum specimens and found female Ruby-throated Hummingbirds were more numerous in Mexico ( $n = 62$ , 1.8 females:one male), whereas the number of individuals of each sex were nearly equal ( $n = 21$ , 1.1 females:one male) in Central America. Komar et al. (2005) did not age their specimens. More investigation is needed to learn whether the sexes segregate by latitude.

More research is also needed to document how rapidly the population of wintering Ruby-throated Hummingbirds along the southeastern U.S. Atlantic coast is increasing. Pulido and Berthold (2010) suggested a warming environment is favoring birds that winter closer to their breeding grounds. Additional studies may demonstrate that this is happening with Ruby-throated Hummingbirds in the United States, and determine how far north the species can successfully overwinter.

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