
Winter Site Fidelity of Six Sparrow Species in Maryland

Maren E. Gimpel¹
Daniel M. Small
James G. Gruber

Foreman's Branch Bird Observatory
Center for the Environment & Society
Washington College
101 S. Water Street
Chestertown, MD 21620

¹Corresponding Author:
email: MGimpel2@washcoll.edu

ABSTRACT

*Although many short-distance migrants are common in winter in the Mid-Atlantic States, there are no published studies on their site fidelity to the wintering grounds in this region. Foreman's Branch Bird Observatory near Chestertown, MD, has winter return records for many species obtained through banding data. Here we present records for six wintering sparrow species: Savannah Sparrow (*Passerculus sandwichensis*), Fox Sparrow (*Passerella iliaca iliaca*), Swamp Sparrow (*Melospiza georgiana georgiana*), White-throated Sparrow (*Zonotrichia albicollis*), Eastern White-crowned Sparrow (*Z. leucophrys leucophrys*) and Slate-colored Junco (*Junco hyemalis hyemalis*), that provide evidence of local site fidelity between winters. Also reported are North American longevity records for Eastern White-crowned Sparrow and Swamp Sparrow.*

INTRODUCTION

Many migratory passerines breeding in northern latitudes are known to exhibit site fidelity and defend territories on southern tropical wintering grounds (McNeil 1982). During the past 50 years there has been much interest in studying the winter ecology of Neotropical migrant birds, particularly in Central America and the Caribbean: Costa Rica (Warkentin and Hernandez 1996), Belize (Nickell 1968), Mexico (Monroy-Ojeda et al. 2013), Dominican Republic (Latta and Faaborg

2001), Jamaica (Diamond and Smith 1973) and Puerto Rico (Faaborg and Winters 1979). In the southeastern United States, site fidelity of wintering birds has been documented in Florida (Homann 1979, 2008, Somershoe et al. 2009), Louisiana (Brown et al. 2000) South Carolina (Odum and Hight 1957, Mowbray et al. 2001). However, we are unaware of any published accounts of winter site fidelity in the United States Mid-Atlantic region, a wintering area for many eastern Nearctic species.

Studies of the wintering ecology of birds can help elucidate aspects of longevity and demography, key factor analysis in survivorships and carryover effects to the breeding season (Sherry and Holmes 1996, Marra et al. 1998). However, many such studies (*loc. cit.*) have focused on warblers, such as Prairie Warbler, American Redstart, Black-throated Blue Warbler and Northern Waterthrush.

Here we add observations on six sparrow species: Savannah Sparrow (*Passerculus sandwichensis*), Fox Sparrow (*Passerella iliaca iliaca*), Swamp Sparrow (*Melospiza georgiana georgiana*), White-throated Sparrow (*Zonotrichia albicollis*), Eastern White-crowned Sparrow (*Z. leucophrys leucophrys*) and Slate-colored Junco (*Junco hyemalis hyemalis*), that provide evidence of local site fidelity between winters in Maryland and from neighboring states via data from the USGS Bird Banding Laboratory. Though we do not report here on details of winter ecology or behavior, our observations could be a starting point for such investigations in the future. Our results are an important contribution to the scant knowledge of winter site fidelity of sparrows of the eastern US.

While banders regularly tally new individuals banded and species richness recorded in a season and year, considerably less attention is paid to recaptured birds. Using recapture data from 15 winter seasons, we not only documented winter site

fidelity, but recorded two new North American longevity records. Datasets of previously banded birds are invaluable resources and we strongly encourage all banders to examine their own.

METHODS

Study Site. Foreman's Branch Bird Observatory (FBBO) is located on Chino Farms on the eastern shore of the Chesapeake Bay in Queen Anne's County, MD, about eight km east of Chestertown (39°15'N, 76°05'W) in the Atlantic Coastal Plain Physiographic Province and adjacent to the Chester River (a major tributary of the Chesapeake Bay). The regional landscape is mostly a rural mosaic of row-crop agricultural fields, upland and wetland woodlots. Chino Farms comprises over 891 ha of production farming and over 1336 ha of diverse wildlife habitat, including 92 ha restored native grasslands (Gill et al. 2006). The 23 ha FBBO grounds include fallow and successional fields, hedgerows, some well-established second growth woodlots and a man-made lake. The entire property was designated an Audubon Important Bird Area in Nov 2006.

Banding. FBBO has operated since 1998 and has served primarily as a migration monitoring station, but has intercepted many of the breeding and wintering birds in the area as well. The station operated 10-100 mist nets (6- and 12-m length, 2.6-m high, 4-shelf, 30-mm mesh, nylon Japanese mist nets) depending on conditions and available staff. Five four-cell Potter Traps were also used during most sessions. Protocol dictated that nets were open from sunrise until early afternoon, Mar through May and Aug through Nov. Winter banding was not standardized, though nets were occasionally opened Dec through Feb. All captured birds were banded with standard numbered aluminum bands from the USGS Bird Banding Laboratory (BBL) and sexed and aged to the extent possible using Pyle (1997). Standard biometric data were collected, including wing chord, fat and mass.

For this study on winter site fidelity, a bird was counted only as a return if it was recaptured in a subsequent non-breeding season. Because none of

the focal species breed in the area, there is no confusion in separating permanent residents from winter visitors.

RESULTS AND DISCUSSION

In the 15 years of operation covered in this study from spring 1998 through spring 2012, FBBO has banded over 172,000 birds of over 160 species plus over a dozen additional races, forms and hybrids. Return rates were determined by dividing the total number of birds banded by the number of individuals that returned. Ideally, such math would exclude migrant birds of the same species by restricting dates of inclusion to only the winter months. However, the bulk of our data was collected while fall migration was ongoing and it was impossible for us to discern which newly banded birds were through migrants on their way further south for the winter and which birds had reached the terminus of their migration and would spend the winter around the observatory. Dates of peak movements were not useful in separating through migrants from overwintering individuals, as some birds arriving quite early in the season stayed for the winter while some overwintering birds were never captured until late in the banding season.

A banded bird that returned in a subsequent non-breeding season was considered a return. In some cases, one could argue that a bird banded one fall and not seen again until the following fall was not showing winter site fidelity, but was merely recaptured on its annual migration southward. Though we have no definitive way to disprove this in most cases, it would be highly unlikely. Site fidelity of through migrants has rarely been documented in passerines (Winker et al. 1991) and thus it would be improbable to have hundreds of individuals representing six species showing such behavior. Because all newly banded birds were considered potential wintering birds, the rates of return listed are minimum rates and we suspect quite lower than actual rates of return. Excluding through migrants would surely make the rates of return much higher for most species. See Table 1 for a summary of the focal species and their rates of return.

Table 1. Return rates of six species of sparrow exhibiting site fidelity to Foreman's Branch Bird Observatory in Maryland.

| Species | Total Banded | Individuals Returned | Percent Return |
|---------|--------------|----------------------|----------------|
| SAVS | 1,773 | 46 | 2.59 |
| FOSP | 606 | 5 | 0.83 |
| SWSP | 3,164 | 11 | 0.35 |
| WTSP | 20,375 | 1,013 | 4.97 |
| EWCS | 1,277 | 81 | 6.34 |
| SCJU | 7,378 | 135 | 1.83 |

To supplement our data and the meager information available in print on many of the species, we acquired a list of recapture data from the BBL for these six sparrows banded in winter in the Atlantic Flyway and recaptured in the same 10-min block. In addition, during the course of reviewing our recapture records, North American longevity records were documented for two species: Swamp Sparrow and Eastern White-crowned Sparrow.

DISCUSSION BY SPECIES

Savannah Sparrow (SAVS) Although well studied on their breeding grounds, there is less information available on overwintering Savannah Sparrows. There are studies which propose that winter territoriality is unlikely (Wheelwright and Rising 2008), describe winter home ranges within a season (Ginter and Desmond 2005) and document winter habitat use (Watts 1990). Norris (1960) reports on the densities and distribution of subspecies in South Carolina but did not address site fidelity. At the same location, over three winters in the mid 1950s, Odum and Hight (1957) documented return rates of 26-40% in adult sparrows claiming this verified the well-known tendency of winter fringillids to return to the same area on successive migrations. They also state that out of 100 birds wintering about 40 returned the next year and 26 of those survived to the third winter. This is the only published information on winter site fidelity of Savannah Sparrow known to us.

The BBL dataset contained 69 records of individuals recovered in a subsequent winter in the same block. These records included five in Massachusetts, one in New Jersey, 49 in South Carolina and 14 in Florida. The South Carolina birds are no doubt those studied by Odum and Hight (1957).

To these we add our Maryland records. FBBO recorded 46 individuals out of 1,773 banded for a minimum return rate of 2.59%. Forty individuals returned only one season, five came back two seasons and one bird returned three subsequent seasons. The individual returning three subsequent winters was four years and four months old at the time of its last capture and is the oldest known Savannah Sparrow at our site.

Fox Sparrow (FOSP) There is much written about the western races of Fox Sparrow, especially the permanent resident subspecies of northern California. Linsdale (1949) reported return rates of 14.29% outside Berkeley, California, with some birds recaptured five years after banding. Samuels et al. (2005) report recapture rates in subsequent winters between 2.8-11.5% in Marin County, California. Anecdotal reports of return Fox Sparrows are also given by Boyd et al. (2010) from Vancouver, B.C. Another study on the "sooty" race of the Fox Sparrow in Santa Clara County, California, reported one wintering individual that lived to be at least six years old (Sandercock and Jaramillo 2002).

There are few records to be found on the "red" fox sparrow of the east (*P.i. iliaca*). Mowbray et al. (2001) report recapturing two individual Fox Sparrows one year after the original banding near Sumter, SC. No totals of newly banded birds were given, so rates of return are unknown. No other published data from the east are known to us.

Additional banding records from the BBL show that only seven Fox Sparrows were banded in winter and recovered on the Atlantic Flyway in the same ten-minute block. These included two from New York, two from New Jersey, one from Maryland (from 1955, not the current study) and two from Virginia.

At FBBO, five individuals returned during a subsequent winter season. Four of these birds returned only once in the season immediately following the banding season. One bird banded in fall of 2007 came back the following winter of 2008-2009, was not captured in winter 2009-2010 or 2010-2011, but was captured once more in the winter of 2011-2012. That bird, the oldest known Fox Sparrow at our site, was five years and five months at its last capture. The total number of Fox Sparrows banded was 606 for a return rate of 0.83%.

Swamp Sparrow (SWSP) Several recent papers document winter site fidelity of Swamp Sparrows in the eastern US. Mowbray (1997) cites personal communication from Holberton, for 25.9% return rate for birds banded in Mississippi the previous winter.

Legare et al. (2000) documented four cases of winter site fidelity in Florida, though no numbers of the total banded were given so percentages cannot be determined. Their data search from the BBL turned up 20 additional cases from the southeast (though they do not list which states they included in the region). Additional cases in Florida were reported by Poole et al. (2003) (two individuals) and Somershoe et al. (2009) had five individuals return in a following season.

Additional data from the BBL included 16 records from the Atlantic Flyway, including three in Massachusetts one in Virginia, nine in Georgia and three in Florida. The large geographical gaps are interesting. There are no prior records from Maryland or nearby states, such as Delaware, New Jersey or New York. Coastal records south of Maryland may be the *M. g. nigrescens* subspecies.

We banded a total of 3,164 Swamp Sparrows in 15 years and documented 11 birds that returned, for a rate of 0.35%. Of the 11 birds showing site fidelity, eight returned only one following year, two returned two subsequent years and one bird came back each year for seven seasons. Swamp Sparrow #1831-29433 was banded in winter 2003-2004 and came back in each following winter through the winter of 2010-2011 (see Table 2), which is seven

subsequent seasons. When last handled on 12 Apr 2011, it was the North American age record holder at 7 yr 10 mo (Lutmerding and Love 2013).

Table 2. Recapture History of SWSP 1831-29433

| Winter Season | Dates Captured |
|---------------|-------------------------------|
| 2003-2004 | 17 Mar |
| 2004-2005 | 26 Oct, 7 Apr |
| 2005-2006 | 6 Nov, 9 Mar |
| 2006-2007 | 15 Nov, 1 Mar, 11 Mar, 10 Apr |
| 2007-2008 | 8 Nov, 2 Mar, 12 Mar |
| 2008-2009 | 2 Nov, 12 Nov |
| 2009-2010 | 28 Oct |
| 2010-2011 | 2 Mar, 30 Mar, 12 Apr |

White-throated Sparrow (WTSP). The White-throated Sparrow is a heavily studied species that often returns yearly to distinct home ranges that are maintained all winter (Falls and Kopachena 2010). In North Carolina, Piper and Wiley (1990a) showed that birds not only returned in subsequent seasons, but tended to maintain that area throughout the winter. In another paper, they report return rates varying from 30-50% (Piper and Wiley 1990b) and accordingly, they considered the species to be largely site-faithful. Nickel (1968), working in Thomasville, Georgia, does not give return rates, but records some individuals returning to the same trapping station. Further south, Homann (1979) in northern Florida recorded return rates varying between 2 and 19%.

Being such a widespread and abundant bird throughout their wintering range, we were not surprised to find quite a few additional records from the BBL dataset. Some of these data could be muddled by the presence of year-round individuals (no effort was made to separate the state-wide records based on geographic distribution; i.e., to disregard records from northwest New Jersey where there are breeding populations from the southern coast, where there would only be wintering birds). The records from the BBL included 364 from New Jersey, 414 from Pennsylvania, 100 in Delaware, eight in Washington, DC, 247 in Maryland, 130 in Virginia,

177 in North Carolina, 385 in South Carolina, 140 in Georgia and six in Florida. With so many records in the BBL database, we were surprised not to find more published documentation of winter returns.

Our data included 1,013 returning individuals out of 20,375 banded for a 15-year rate of return of 4.97%. Of the returning birds, 622 returned only one season, 204 returned twice, 85 returned three times, 38 returned four times, 17 returned five times, six returned six times and one bird returned seven times. The oldest known White-throated Sparrow at our site was eight yr and 10 mo old at the time of last capture.

Eastern White-crowned Sparrow (EWCS) Much like the Fox Sparrow, Eastern White-crowned Sparrows have been investigated much more thoroughly in the western US. In the west, it has been shown that individuals “imprint” on a winter home range and return to it in successive years (Ralph and Mewaldt 1975). In San Jose, California, 34% of banded birds were recaptured in a subsequent winter season, but the actual return rates may be as high as 61% (Mewaldt 1976). Also in California, Linsdale (1949) had return records up to seven years beyond the original banding date.

The Eastern White-crowned Sparrow (*Z. l. leucophrys*) is considered the most poorly studied subspecies (Chilton et al. 1995). The only records in the literature found for the eastern US were in Homan (1979), who documented return rates of 10% in one season in Tallahassee, Florida, but the species then vanished from his study site as the area was developed in following seasons.

Since the literature is so sparse, data from the BBL was of great interest. There are 34 records of White-crowned Sparrows recaptured in the same block at least one season later. Twenty-seven records are from Virginia and seven are from Maryland. Amazingly, there were no other records from the Atlantic Flyway. As in the case of the Swamp Sparrow, the geographical gap is curious. That there are no records from New Jersey or New York, where there have been active banders for decades is puzzling.

Our record of 81 individuals, out of 1,277 banded is a return rate of 6.34%. Of the returning birds, 50
Apr. - Jun 2014

returned only once, 18 returned twice, eight returned three times, and two returned for four subsequent seasons. Eastern White-crowned Sparrow #1271-39802 was banded as a hatching-year bird of unknown sex and recaptured numerous times through 12 Dec 2005 (see Table 3), at which point it was six years and six months old, representing the North American longevity record for the subspecies (Lutmerding and Love 2013).

Table 3. Recapture History of EWCS 1271-39802

| Winter Season | Dates Captured |
|---------------|----------------------|
| 1999-2000 | 7 Apr |
| 2000-2001 | 28 Oct, 5 Apr |
| 2001-2002 | 29 Oct, 26 Mar |
| 2002-2003 | 25 Feb |
| 2003-2004 | 22 Mar |
| 2004-2005 | 1 Mar, 24 Mar, 3 May |
| 2005-2006 | 12 Dec |

Slate-colored Junco (SCJU) Another intensively studied species, the Slate-colored Junco (*J. hyemalis hyemalis*) has been documented to be winter-site faithful in much of its range. Many details of junco migration have been investigated including that birds wintering farther south in the range returned at higher rates than those wintering farther north and that females migrate farther southward into the winter range than males and adults farther southward than young of the year (Ketterson and Nolan 1982).

In Indiana, estimates of fidelity were 20% across all years, but after individuals exhibited site faithfulness once, they were 50% likely to return the following year (Ketterson and Nolan 1982). Ketterson and Nolan (1982) also report return rates of 6.3% in Michigan. In the east, rates of 9.38% were documented in South Carolina, while rates in Alabama were only 0.65% (Ketterson and Nolan 1982 from BBL data). Keiser et al. (2005) report site fidelity in Giles County, Virginia, and Rabenold and Rabenold (1985) report site fidelity in the Great Smokey Mountain National Park in North Carolina.

Additional records from the Atlantic Flyway from the BBL include 653 individuals from New Jersey, 592 in Maryland, 74 in Delaware, 56 in DC, 317 in Virginia (some may be year-round birds), six in West Virginia, 51 in North Carolina, 13 in South Carolina and 42 in Georgia.

Some of these records could be the *J. hyemalis carolinensis* subspecies, a breeder in eastern mountains that moves to lower elevations during winter (Nolan et al. 2002). No effort was made to check, for example, whether Virginia records were from the mountains and thus potential *J. h. carolinensis* birds or from the coast where they most surely would be *J. h. hyemalis*.

Our data show 135 returning individuals out of 7,378 banded for a rate of 1.83%. Ninety-one individuals returned only one year, 28 returned for two years, seven birds returned three times, seven birds returned four winters and two birds returned for five winters after they were banded. The oldest known Slate-colored Junco at our study site is five yr and nine mo old.

GENERAL CONCLUSIONS

Though many banders may know they have wintering site-faithful birds at their stations, it is important that this information is published, making the data available to others. We encourage researchers to use their recapture databases to find and publish such records. These data could be the foundation for in-depth studies on the winter biology of many species, not just sparrows, as well as provide life-history information, such as longevity records.

ACKNOWLEDGMENTS

We greatly appreciate our regular long-term volunteers at FBBO: Victoria Cadby, Anne O'Connor, Brennan O'Connor, Hanson Robbins and Bill Snyder. We thank the staff of Chino and Bluestem Farms, especially Henry Davis as well as Harry Sears, without whose support none of our work could happen. Danny Bystrak, BBL, was very helpful in providing, explaining and discussing encounter data. Comments and suggestions by Doug Gill and the editor greatly improved the

manuscript.

LITERATURE CITED

- Boyd, M., S. Franks, D. Hodkinson, P. Levesque, C. Rock and L. Rockwell. 2010. Iona Island Bird Observatory 2010 Year-End Report.
- Brown, D.R., P.C. Stouffer and C. M. Strong. 2000. Movements and territoriality of wintering Hermit Thrushes in southeastern Louisiana. *Wilson Bulletin* 112:347-353.
- Chilton, G., M.C. Baker, C.D. Barrentine, and M.A. Cunningham. 1995. White-crowned Sparrow (*Zonotrichia leucophrys*). In the birds of North America, No. 183 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA and The American Ornithologists' Union, Washington, DC.
- Diamond, A.W. and R.W. Smith. 1973. Returns and survival of banded warblers wintering in Jamaica. *Bird-Banding* 44:221-224.
- Faaborg, J. and J.E. Winters. 1979. Winter resident returns and longevity and weights of Puerto Rican birds. *Bird-Banding* 50:216-223.
- Falls, J.B. and J.G. Kopachena. 2010. White-throated Sparrow (*Zonotrichia albicollis*). The birds of North America online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: <http://bna.birds.cornell.edu/bna/species/128>
- Gill, D.E., P. Blank, J. Parks, J.B. Guerard, B. Lohr, E. Schwartzman, J.G. Gruber, G. Dodge, C.A. Rewa and H.F. Sears. 2006. Plants and breeding bird response on a managed conservation reserve program grassland in Maryland. *Wildlife Society Bulletin* 34:944-956.
- Ginter, D.L. and M.J. Desmond. 2005. Influence of foraging and roosting behavior on home-range size and movement patterns of Savannah Sparrows wintering in south Texas. *Wilson Bulletin* 117:63-71.
- Homann, P.H. 1979. Wintering bird returns in north Florida. *North American Bird Bander* 4:154-157.
- Homann, P.H. 2008. Wintering-site persistence and fidelity of eight passerine migrants at a location in northern Florida. *Florida Field Naturalist* 36:23-54.
- Keiser, J.T., C.W.S. Ziegenfuss and D.A. Cristol. 2005. Homing success of migrant versus nonmigrant Dark-eyed Juncos (*Junco hyemalis*). *Auk* 122:608-617.
- Ketterson, E.D. and V. Nolan Jr. 1982. The role of migration and winter mortality in the life history of a temperate-zone migrant, the Dark-eyed Junco, as determined from demographic analyses of winter populations. *Auk* 99:243-259.

- Latta, S.C. and J. Faaborg. 2001. Winter site fidelity of Prairie Warblers in the Dominican Republic. *Condor* 103:455-468.
- Legare, M.L., D.B. McNair, W.C. Conway and S.A. Legare. 2000. Swamp Sparrow winter site fidelity records in Florida. *Florida Field Naturalist* 28:73-74.
- Linsdale, J.M. 1949. Survival in birds banded at the Hastings Reservation. *Condor* 51:88-96.
- Lutmerding, J.A. and A.S. Love. 2013. Longevity records of North American birds. Version 2013.3. Patuxent Wildlife Research Center. Bird Banding Laboratory. Laurel MD.
- Marra, P.P., K.A. Hobson and R.T. Holmes. 1998. Linking winter and summer events in a migratory bird using stable carbon isotopes. *Science* 282:1884-1886.
- McNeil, R. 1982. Winter resident repeats and returns of austral and boreal migrant birds banded in Venezuela. *Journal of Field Ornithology* 53:125-132.
- Mewaldt, L.R. 1976. Winter philopatry in White-crowned Sparrows (*Zonotrichia leucophrys*). *North American Bird Bander* 1:14-20.
- Monroy-Ojeda, A., M. Grosselet, G. Ruiz and E. Del Valle. 2013. Winter site fidelity and winter residency of six migratory Neotropical species in Mexico. *Wilson Journal of Ornithology* 125:192-196.
- Mowbray, T.B. 1997. Swamp Sparrow (*Melospiza georgiana*). In the birds of North America, No. 279 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.
- Mowbray, T. B., A. Whitaker, L. Glover and N. Singh. 2001. A 20-year record of migratory bird movements in the Black River Swamp of South Carolina. *Chat* 65:123-136.
- Nickell, W.P. 1968. Return of northern migrants to tropical winter quarters and banded birds recovered in the United States. *Bird-Banding* 39:107-116.
- Nolan, V., Jr., E.D. Ketterson, D.A. Cristol, C.M. Rogers, E.D. Clotfelter, R.C. Titus, S.J. Schoech and E. Snajdr. 2002. Dark-eyed Junco (*Junco hyemalis*). In the birds of North America, No. 716 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- Norris, R.A. 1960. Density, racial composition, sociality, and selective predation in nonbreeding populations of Savannah Sparrows. *Bird-Banding* 31:173-216.
- Odum, E.P. and G.L. Hight 1957. Use of mist nets in population studies of winter fringillids on the AEC Savannah River area. *Bird-Banding* 28:203-213.
- Piper, W.H. and R.H. Wiley. 1990a. Correlates of range size in wintering White-throated Sparrows. *Animal Behaviour* 40:545-552.
- Piper, W.H. and R.H. Wiley. 1990b. The relationship between social dominance, subcutaneous fat, and annual survival in wintering White-throated Sparrows (*Zonotrichia albicollis*). *Behavioral Ecology and Sociobiology* 26:201-208.
- Poole, R., M. Wilson and C. Brown. 2003. Site fidelity and crown plumage in winter Swamp Sparrows in central Florida. *Florida Field Naturalist* 31:6-7.
- Pyle, P. 1997. Identification guide to North American birds, Part I. Columbidae to Ploceidae. Slate Creek Press, Bolinas, CA.
- Rabenold, K.N. and P.P. Rabenold. 1985. Variation in altitudinal migration, winter segregation, and site tenacity in two subspecies of Dark-eyed Juncos in the Southern Appalachians. *Auk* 102:805-819.
- Ralph, C.J. and L.R. Mewaldt. 1975. Timing of site fixation upon the wintering grounds in sparrows. *Auk* 92:698-705.
- Samuels, I.A., T. Gardali, D.L. Humple and G.R. Geupel. 2005. Winter site fidelity and body condition of three riparian songbird species following a fire. *Western North American Naturalist* 65: 45-52.
- Sandercock, B.K. and A. Jaramillo. 2002. Annual survival rates of wintering sparrows: assessing demographic consequences of migration. *Auk* 119:149-165.
- Sherry, T.W. and R.T. Holmes. 1996. Winter habitat quality, population limitation, and conservation of Neotropical-Nearctic migrant birds. *Ecology* 77:36-48.
- Somershoe, S.G., C.R.D. Brown and R.T. Poole. 2009. Winter site fidelity and over-winter site persistence of passerines in Florida. *Wilson Journal of Ornithology* 121:119-125.
- Warkentin, I.G. and D. Hernández. 1996. The conservation implications of site fidelity: a case study involving Nearctic-Neotropical migrant songbirds wintering in a Costa Rican mangrove. *Biological Conservation* 77:143-150.
- Watts, B.D. 1990. Cover use and predator-related mortality in Song and Savannah sparrows. *Auk* 107:775-778.
- Wheelwright, N.T. and J.D. Rising. 2008. Savannah Sparrow (*Passerculus sandwichensis*). The birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the birds of North America online: <http://bna.birds.cornell.edu/bna/species/045>
- Winker, K., D.W. Warner and A.R. Weisbrod. 1991. Unprecedented stopover site fidelity in a Tennessee Warbler. *Wilson Bulletin* 103:512-514.