

MIGRATIONAL MOVEMENTS AND HABITAT USAGE OF MIGRANT PASSERINES IN THE  
GREAT LAKES REGION: OTTAWA NATIONAL WILDLIFE REFUGE, OHIO

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INTRODUCTION

In 2016, Black Swamp Bird Observatory continued a long term passerine migration study on the Ottawa National Wildlife Refuge complex and various other sites in the southern Lake Erie region. Specific goals of the project are to monitor the population status of Neotropical migrants in the Great Lakes region and to better understand the relationship between en-route habitat and their breeding and winter ecology in order to inform conservation decisions that protect these species throughout the entire life cycle. Lake Erie represents a barrier to most passerine migrants. Passerines reluctance to navigate open water results in major concentrations along the southwestern shore of Lake Erie, unparalleled in the Midwest. With continuing habitat loss along both the Lake Erie coast and inland, this study will assist in monitoring the effects of habitat isolation and degradation on use by these species. There are only four small segments of beach ridge habitat remaining west of Port Clinton along Ohio's Lake Erie shoreline. The intensive bird use of these ridges in contrast to the adjacent condominium complexes and marinas signifies the importance of this habitat component in the Lake Erie marsh system. A wide range of migration corridor and stopover habitat occurs throughout the region (Ewert et al. 2006), but these sites do not contain bird concentrations as high as the beach ridges. The fall appears to paint a different picture with habitat further from the lake indicating much greater use. A complex of study sites are necessary to fully examine habitat use, migrational timing, and energetic condition of birds.

The importance of understanding avian migration and stopover habitat needs has greatly increased over the past two decades as tropical deforestation and temperate forest fragmentation have expanded and songbird populations have declined. Little information is known about the "problems" migrants contend with along their migratory routes (Morse 1980), not to mention the transition between spring migration and the breeding period. Recent studies have indicated upwards of 80% of annual mortality occur during migration for many landbirds (Sillett and Holmes 2002). To offset the energetic costs of migration, birds deposit substantial lipid reserves which may reach 50% body weight among long distance intercontinental migrants (Berthold 1975). As lipid stores are depleted during migration, birds are capable of replenishing reserves in a few days at rates approaching 10% body weight per day (e.g. Barlein 1985; Biebach *et al.* 1986; Moore & Kerlinger 1987). These lipid deposits are obviously critical for a successful migration, and they may also provide a selective advantage to the migrant

with energy reserves remaining (see Sinclair 1983; Ojanen 1984; Krapu *et al.* 1985; Kremetz & Ankney 1987). Adequate stopover habitat may play an important role in delivering migrating passerines to their breeding grounds with sufficient energy reserves to successfully nest.

In addition to the biological stressors confronting migratory birds, the changing landscape presents increasing risks of human-induced mortality and individual and population stressors. Only in the past year or two has there been a movement to recognize the air column as a vital habitat of birds. Much of their life cycle is spent in this habitat component. A variety of communication towers for radio, television, and cell phones dot the regional landscape. Huge kills have been documented at the battery of guy-wired towers south of Maumee Bay by farmers surveying field preparedness during spring migration. One such incident involved a bushel basket of male Rose-breasted Grosbeaks brought to the state wildlife office in Oak Harbor for identification by the farmer. This was a single night event under one tower and represented a large easy to see species, suggesting that many more cryptic, small birds went undetected. As the 21<sup>st</sup> century unfolds, a new threat has emerged in the form of increasing interest in wind power as an alternative power source. The cumulative negative effect on the avian resource in a highly important stopover area such as the western basin is of great concern to the future maintenance of avian populations through the eastern United States.

To this end, this project is an important part of a massive study being conducted along the western basin of Lake Erie. Multiple methodologies are being brought together to quantify their effectiveness of representing migration and risk to individuals, to identify nocturnal movements and their volume in this highly important stopover habitat, and to quantify ascent and descent trajectories of birds arriving and leaving the region. A study of this size - involving multiple radar units, comprehensive banding operations, and region-wide point counts - has not been conducted in the region to date.

There is no substitute for long-term monitoring to address many pressing questions regarding health of the environment in general and of birds specifically. Annual, site, species, and weather variation results in large uncontrollable parameters that cloud short-term studies. There are few long-term (greater than 20 years) programs for resource managers to utilize to inform decision making processes. These long-term datasets, such as the Navarre banding station, offer the greatest value in the interpretation of long-term ecological change.

### STUDY AREAS

Black Swamp Bird Observatory (BSBO) banding sites are centered along the western basin of Lake Erie in Ohio with additional coverage along the central basin of Lake Erie east of Cleveland. The primary site is located at the Navarre Unit of Ottawa National Wildlife Refuge and is located on the largest remaining beach ridge along the western basin of Lake Erie which holds the most complete native beach ridge vegetative complex. Habitat at the site is dominated by Carolinian forest with multiple bands of wetland associations. Hackberry and Kentucky Coffeetree along with Eastern Cottonwood and White Ash make up the majority of overstory. The understory is primarily several species of Dogwood, Buttonbush, and Bush Honeysuckle. Herbaceous layers include a wide variety of herbs, sedges, and grasses. There is a diverse wildflower component but considerable damage from

invasive Garlic Mustard and overgrazing by White-tailed Deer are stressors to this layer.

Additional sites operated by BSBO include the Shaker Lakes site near Cleveland and Creek Bend site in Sandusky County, Ohio. Shaker Lakes is approximately five miles from Lake Erie and lies on a major riparian corridor to the lake. Habitats include a brook, marsh, scrub-shrub, and the border of a woods. The Creek Bend site is located approximately 15 miles due south of Lake Erie and is also past the perceived lake effect zone. This site provides a comparison to Navarre for lake effect and spring and fall comparisons for different species groups. Habitat is dominated by dogwood, old field, and a riparian corridor. The variety of habitat types and distances from the lake surveyed allows us to document variation in migrational timing, habitat selection, and movement.

## METHODS AND MATERIALS

In 2016, migrating and resident passerines were sampled on the Navarre Unit of the Ottawa National Wildlife Refuge and two other sites in the Great Lakes region: Creek Bend and Shaker Lakes (Figure 1). Sites operated near Cleveland and Lindsey, Ohio provide comparisons to the refuge site that is located at a major passerine migration staging area. Banding and point count efforts covered a minimum of 75% of the migration period for the study site. Every attempt was made to equalize any un-sampled parts of the migration period at the beginning and ending time frame. The migration period covers both short distance and long distance (Neotropical) migrants. Spring migration operation in 2016 began mid-April and continued through early-June. Fall migration banding was July 1 to early November.

Placement of mist nets is designed to represent the habitat at the site and to bisect primary bird movement direction and corridors. Mist nets are considered a random method of capture with the premise being they are undetectable by foraging and traveling birds. This is a broad assumption with many caveats that must be considered in data analysis. In reality not all birds have equal chance of capture. Bird size affects the chances of being captured and held in the net, species behavior can be a factor across species, height of activity is a factor, and weather effects can occur on any given day.

Mist netting was conducted from one-half hour before sunrise to at least 11:00 AM on each day of operation, weather permitting. Birds were captured utilizing 2.6 x 12 meter mist nets of 30mm mesh size. All birds were removed from the net, with the band and net recorded if previously banded, and placed in a mesh holding bag until processing. During processing, each bird was banded with a standard U.S. Fish & Wildlife Service leg band, measured by closed wing chord, body mass recorded, visually inspected for subcutaneous fat deposits using a 7-point ordinal scale (Helms & Drury 1960), and time stamped to net round. Birds were sexed and aged by the use of plumage characteristics (Pyle 1997) and guidelines of the Bird Banding Manual and Woods Manual (Woods 1969). Weather data were compiled from hourly readings of Toledo Edison's Davis Besse Nuclear Power Station.

Point counts were spaced evenly throughout the banding station defined by the area covered by nets. Points are located a minimum of 100 meters apart to reduce the potential of double counting individuals. This assumption may not always be fulfilled as the migration period is characteristic of

the definition of an open population as individuals may be actively migrating all day long. The Navarre route follows the primary direction of bird movement.

Point counts were conducted during both spring and fall migration to complement mist-netting operations and document species such as larger birds that are not typically captured by mist-nets. Counts were conducted for five minutes in which all birds seen or heard were recorded. Counts were run after net set up each morning permitted by weather and avian abundance. Point counts were canceled on extremely high wind or high bird activity days.

A daily list of species was compiled to document presence/absence for each site. This method complements the banding and point counts by acknowledging all species seen on a given day. This assists in rare species documentation and provides more complete information on arrival and departure dates for all species, particularly those that are unlikely to be banded in numbers reflecting their true abundance.

## RESULTS

### SPRING

Spring migration was monitored, weather permitting, daily in the Navarre Unit and when personnel were available at the Shaker Lakes and Creek Bend sites in 2016. Spring 2016 was relatively normal for weather patterns in Northwest Ohio though with some wide temperature swings (Figure 2). This pattern appeared to affect migration timing for short-distance migrants, but not long-distance Neotropical migrants. Low pressure cells had a tendency to track up into the Great Lakes. Good diversity and below average volume, was recorded at the Navarre station.

Through our research, we have found large numbers of Neotropical and short-distance migrants arrive in three “waves”. These waves are generated by weather patterns and migrational drivers of each individual species. Day length is the primary driver initiating migration in birds. This results in definable and predictable timing of migration annually. Weather patterns at the time of movement affects the fine-scale details of the movement. For the Lake Erie Marsh Region a low pressure cell centered in the Arkansas/Oklahoma region spins warm fronts that pick up warm tropical winds and pushes migrants up the Mississippi and Ohio River drainages. This front is depicted by a jump in temperature, southwest winds and stormy weather leading to major movements of passerines. These patterns generally occur approximately every 7 days. Each “wave” of migrants is dominated by certain species and sex classes of birds with a large number of associated species. Males tend to precede a week to ten days ahead of females in most species in migration. For the Lake Erie Marsh Region, the first wave occurs around 24 April and is dominated by male White-throated Sparrow, Hermit Thrush, male Yellow-rumped Warbler, and male Ruby-crowned Kinglet. In 2016, this wave had a good first pulse but had a fair second pulse, peaking 25-27 April. The second wave occurs 07-13 May and is represented by the greatest species diversity of the spring. It is dominated by female White-throated Sparrow, Swainson’s Thrush, female Yellow-rumped Warbler, female Ruby-crowned Kinglet, and male Magnolia Warbler. A second pulse of this wave comes five to

seven days later, and usually has the largest volume and contains the same dominant species. This second wave was excellent and occurred 07-11 May with a second pulse on 14-17 May which transitioned into third wave birds. The third wave normally occurs around Memorial Day weekend and is dominated by female Magnolia Warbler, American Redstart, Mourning Warbler, vireos, and flycatchers. In 2016, the third wave peaked 24-26 May. Predation from mink precluded identification of the second pulse of this wave as migration diminished in early June.

#### Navarre Banding Station, Ottawa County, Ohio (413-0830)

In spring 2016, the Navarre banding station was operated on 38 days for 5,322.2 net hours. Including hummingbirds, 6,578 new birds were banded and a total of 7,816 birds handled (Table 1). The capture rate was 123.6 birds/100 net hours. This compares to the long-term average (1992-2015) of 121.1 birds/100 net hours (+3% from average). The long-term average shows no change over time of the capture rate at Navarre. One hundred and eight species were banded in Navarre during spring 2016 (Table 2). The most unusual species and subspecies included Cerulean Warbler, Pine Warbler, Yellow Palm Warbler, Clay-colored Sparrow, Savannah Sparrow, and Kirtland's Warbler. The ten most abundant species banded were Yellow Warbler (490), White-throated Sparrow (477), Nashville Warbler (397), Gray Catbird (397), Magnolia Warbler (378), Yellow-rumped Warbler (295), Ruby-crowned Kinglet (284), Swainson's Thrush (251), Traill's (Alder/Willow) Flycatcher (247), and American Redstart (238).

Point counts were initiated in 1995 as a part of the data collection at the Navarre site. These counts provide the best data for larger birds not sampled by mist nets. Point counts were conducted on 34 days during spring 2016. One hundred and twenty-seven species and 12,126 individuals were recorded (Table 3). Northern Cardinal, Red-winged Blackbird, Common Grackle, and Tree Swallow were observed each count day. The most abundant species recorded was Red-winged Blackbird (1,907) followed by Blue Jay (1,820), Canada Goose (1,366), Tree Swallow (829), and Yellow Warbler (641).

#### Shaker Lakes Banding Station, Cuyahoga County, Ohio (412-0813)

This site is located east of Cleveland at the Nature Center of Shaker Lakes and 2016 was the 15<sup>th</sup> year of the banding operation. This site permits comparison to western Lake Erie sites as birds migrate along Lake Erie and disperse through the landscape. Banding operations were conducted Mondays, Wednesdays, and Fridays and was conducted on sixteen days, with 204 new birds banded in 566 net hours (36.0 birds/100 net hours). A total of 266 birds were handled (47.0 birds/100 net hours) during spring migration (Table 4). Fifty-nine species (Table 5) were banded with the ten most common banded being Gray Catbird (26), Ruby-crowned Kinglet (18), White-throated Sparrow (16), American Robin (15), Swainson's Thrush (8), Common Yellowthroat (7), Song Sparrow (6), Northern Cardinal (6), Canada Warbler (6), and Black-capped Chickadee (6). Orange-crowned Warbler and Hooded Warbler were pleasant surprises for the site.

Point counts were conducted on 16 days during spring 2016. Fifty-three species with 731 individuals

were recorded (Table 6). The most abundant species recorded was American Goldfinch (84) followed by , Canada Goose (75), Rock Pigeon (55), American Robin (49) ,Song Sparrow (48), Northern Cardinal (44), Eastern Phoebe (25), Red-winged Blackbird (25), White-breasted Nuthatch (23), and Brown-headed Cowbird (21).

## FALL

Fall migration starts in July for many species and some breeding Neotropical migrants (e.g., Yellow Warbler) have left the study area by mid-August. Average fall temperatures were near normal with average temperature in much of September and October (Figure 3). Fall bird migration is dominated by different stimuli than in spring. Weather conditions appear less important and food availability appears to be a key factor. Additional factors include young inexperienced birds and molt status of individuals.

### Navarre Banding Station, Ottawa County, Ohio (413-0830)

The Navarre main station was operated 70 days for 7,635.0 net hours. Four thousand two hundred and seventy seven birds were banded with a total of 5,332 birds handled including recaptures (Table 7). This was the 24th fall season in which an extensive netting effort had been conducted on a daily basis. The capture rate for 2016 was 56.0 birds/100 net hours. A total of 91 species were banded during fall 2016 (Table 8). The ten most abundant species banded were Blackpoll Warbler (783), Swainson's Thrush (481), Gray Catbird (343), Golden-crowned Kinglet (320), Gray-cheeked Thrush (209), Hermit Thrush (170), Magnolia Warbler (166), White-throated Sparrow (158), Common Yellowthroat (137), and Ruby-crowned Kinglet (114). Several surprises were captured during the fall season and included Green Heron, Northern Saw-whet Owl, Yellow-billed Cuckoo, Blue-winged Warbler, Golden-winged Warbler, Marsh Wren, and Red-breasted Nuthatch.

Fall point counts were conducted on 62 days during 2016. A total of 14,706 individuals of 109 species were recorded (Table 9). The Northern Cardinal and Red-winged Blackbird were observed on all count days. The most abundant species were Red-winged Blackbird (5,733), Canada Goose (1,299), Gray Catbird (518), Northern Cardinal (511), and White-throated Sparrow (481).

### Creek Bend Banding Station, Sandusky County, Ohio (412-0832)

Banding operations were conducted on 35 days with 3,168 new birds banded in 3,043 net hours (104.1 birds/100 net hours) (Table 10). A total of 4,063 birds were handled for a 133.5 birds/100 net hours at the station. Seventy-five species (Table 11) were banded with the ten most abundant species being American Goldfinch (1,597), Song Sparrow (195), Myrtle Warbler (96), Ruby-crowned Kinglet (93), Indigo Bunting (92), White-throated Sparrow (81), Golden-crowned Kinglet (80), Common Yellowthroat (71), Magnolia Warbler (62), and Lincoln Sparrow (56). Additional captures of Vesper Sparrow, Savannah Sparrow, Blue-headed Vireo, and Connecticut Warbler added surprises to the station. The large volume of American Goldfinches banded at this site was a direct result of a 5 acre patch of forbs and fourth year sunflowers next to the banding station. This food plot was part of the

County Park District land management plan for the year. Changes to this management rotation will affect species captured and will need to be documented on an annual basis to interpret banding results over time.

#### Shaker Lakes Banding Station, Cuyahoga County, Ohio (412-0813)

Banding operations were carried out on Mondays, Wednesdays, and Fridays and were conducted on 28 days with 799 new birds banded in 874.5 net hours (41.4 birds/100 net hours). A total of 946 birds were handled (108.2 birds/100 net hours) during fall migration (Table 12). Sixty-three species (Table 13) were banded with the ten most abundant species being American Goldfinch (175), White-throated Sparrow (84), Magnolia Warbler (46), Ruby-crowned Kinglet (35), Gray Catbird (32), Swainson's Thrush (32), Nashville Warbler (29), American Redstart (29), Golden-crowned Kinglet (25), and Winter Wren (18). Philadelphia Vireo, Yellow-bellied Sapsucker, Cape May Warbler, and Connecticut Warbler added to the diversity captured at this site.

Point counts were conducted on 26 days during fall 2016. Fifty-two species and 1,185 individuals were recorded (Table 14). The most abundant species recorded was American Goldfinch (252) followed by, Chimney Swift (157), Canada Goose (124), Rock Pigeon (95), and American Robin (58).

#### SUMMARY BANDINGS

Total combined bandings for passerine migration 2016 for the Black Swamp Bird Observatory is in Table 15. Totals without parentheses are for the National Wildlife Refuge complex. The ten most abundant species banded on Ottawa NWR complex were Blackpoll Warbler (854), Gray Catbird (740), Swainson's Thrush (732), White-throated Sparrow (635), Magnolia Warbler (544), Yellow Warbler (513), Nashville Warbler (424), Ruby-crowned Kinglet (398), Golden-crowned Kinglet (370), and Myrtle Warbler (366). Inclusive totals of all sites were topped by American Goldfinch (1,823), Blackpoll Warbler (879), Gray Catbird (820), White-throated Sparrow (816), Swainson's Thrush (809), Magnolia Warbler (656), Ruby-crowned Kinglet (544), Yellow Warbler (518), Nashville Warbler (495), and Myrtle Warbler (477). A combined total of 118 species of 15,026 individuals (86.2 birds/100 net hrs) were banded. Totals for each study site and for each season are shown in Table 16. Species with greater than 50 individuals sampled had fall age ratios generally lower than the long-term average (Table 17).

#### RETURNS AND RECOVERIES

A long term study of this type has an added benefit to develop return rates and survival rates over time. One assumption that has not been verified is that passerines often return to the same breeding grounds to nest. There is substantial evidence for this but more research is needed to confirm the rate of this phenomenon. There is less evidence available regarding site fidelity to migration stopover sites. During 2016, 247 birds of 24 species were captured as returning birds at the Navarre sites (Table 18). This total includes 55 Yellow Warblers with the oldest being banded in 2009, 50 Gray Catbirds with the oldest from 2009, 6 Common Yellowthroats (oldest from 2012), 30 Red-winged

Blackbird (oldest from 2011), 27 Northern Cardinals (oldest from 2014), 9 American Robin (oldest from 2012), and 15 Baltimore Orioles (oldest from 2008). The long term study at Navarre has resulted in state longevity records for the Indigo Bunting, Yellow Warbler, Prothonotary Warbler, Warbling Vireo, Eastern Wood Pewee, Brown Creeper, Northern Waterthrush, Ovenbird, Great-crested Flycatcher, Cedar Waxwing, and Hermit Thrush. The Yellow Warbler and Indigo Bunting records surpass the species record as reported by the Bird Banding Laboratory. Continued analysis in this area will hopefully shed some light on turnover rate and site fidelity in some species. An additional 31 birds of 10 species were return captures at Shaker Lakes in 2016 (Table 19). Creek Bend had 54 individuals of 9 species return from previous year bandings (Table 20). Several foreign captures were made of study birds and are reported in Table 21 captured during the 2016 study year.

## DISCUSSION

Black Swamp Bird Observatory has conducted bird migration monitoring research in the Lake Erie Marsh Region for more than 35 years. Annual variation in migrational monitoring numbers makes statements concerning populations very risky, even with long-term datasets. This past spring resulted in a below average capture rate which followed a low year of 2015. This cycle that is emerging is interesting and needs to be investigated further. Determining what contributes to this great variability and how can it be quantified is a challenge. Does the variability represent true population fluctuation, is it an artifact of sample design, vagrancy of weather patterns, or some combination of these and untold factors? Understanding these vital questions will provide considerable value to bird conservation initiatives both today and into the future. It is through long-term studies such as this that these answers may be sorted out and some sense of landbird populations be made. To implement and accomplish life cycle conservation many hard questions will need to be addressed. Climate change is on the front burner of many conservation efforts today. Only through long-term comparisons will real change and avian response be documented. Will there be breeding and wintering range changes; will there be vegetative response to climate change; will migration timing be altered in response to food sources, or will there be biological cost? Long-term studies will allow for a more in depth analysis of weather patterns and bird activities in migration to tease apart annual variability and trend changes.

Long-term data do not support a major change in migrational timing of the core of any population. However, there may be evidence of an increase in early individuals of some species in the spring. This may be an indicator of a larger portion of a species “short-stopping” in southward migration or an increased survival of those that are always an exception to the norm. Fall migration is much more drawn out with heavy age affects on observations. Even with 20 years of data, annual variation still clouds inference of migrational changes. Core timing can be established for both spring and fall for most landbird species covered by this study.

Black Swamp Bird Observatory operates multiple banding stations to acquire a clearer picture of migration along Lake Erie and its environs. Many questions pertaining to stopover habitat values and use can be addressed by multiple sites that can't be by any one site alone. Not all species utilize the stopover habitat that makes up the marsh region the same. Several species such as Yellow-rumped “Myrtle” Warbler and White-crowned Sparrow appear common everywhere but are much more



common away from the lake shore. Magnolia Warbler concentrates heavily on the beach ridges and occurs at a much lower frequency a half mile or more from the lake. Station comparisons have identified that a much wider range of habitats are of importance and in need of protection to accomplish conservation goals in the region. Lake effect on migrating landbirds is demonstrated through the multiple banding sites. Lake Erie is a major water barrier to landbirds. Reluctance to cross the lake results in large concentrations seen at birding “hotspots” such as Magee Marsh Wildlife Area and Ottawa National Wildlife Refuge. Banding data from the Navarre station indicate spring averages of 8,000 birds banded and fall at 5,500 when up to four times as many birds should exist in the population. This spring-dominated figure is a direct result of lake effect and how birds use the habitat. Spring and fall comparisons of sites show differential use and species composition which provides valuable information to habitat priorities in land acquisition and management. Lake effect may also be a player when reviewing the data for distance from the lake. Spring indicates concentrations are largely adjacent to the lake on the beach ridges, birds pushing against the barrier. Fall paints another story. Much lower bird concentrations are seen along the lake shore in fall but a vast increase is noted at the more inland sites such as Creek Bend during fall migration. This may represent the descending range of those crossing the lake. The species composition also differs with distance from lake. Warblers and thrushes dominate along the shore; while sparrows are most abundant inland. Studying age ratios during migration gives an insight to reproductive success and habitat use variation. Few of these species can be adequately studied on their breeding or wintering grounds, so as a result, migration becomes a window of opportunity to look at population based parameters for conservation. These age ratios can be compared between sites, between years, between seasons to better understand population status, habitat needs, and conservation priorities.

Comparing spring and fall migration is an important part of life cycle conservation. It is not just breeding, wintering, and migration. Considerably different drivers are of importance between the two migrational seasons. Spring migration is driven northward by the urge to breed. These hormonal factors contribute to individuals pressing against unfavorable environmental conditions that can have serious survival ramifications. Fall migration appears to be more laid back as birds build body condition from the stresses of breeding or are facing their first migrational experience. Fall tends to be slower with longer stopover. Many species demonstrate differential migration routes between the two migrational periods. Three distinct patterns are apparent in the northward migration from Central America. There is the Caribbean route, trans-Gulf route, and the westward passage around the Gulf of Mexico. All three groups join in the Great Lakes. Several species show a more direct route up the Mississippi River in their core movement north to the Northwest Territories of Canada and Alaska. Others are moving through the Lake Erie region to the boreal forest of eastern Canada and northern United States. The Great Lakes also create a funneling affect during fall migration as birds from the prairies to eastern Canada make contact with the lakes north shores. Some cross the continent diagonally from the northwest into the Great Lakes and southward to the Appalachians and Atlantic seaboard. Others come from eastern Canada and continue towards Texas and southward. Another important aspect of avian life cycle conservation is the understanding of connectivity among habitats utilized across the year. A coordination of multiple banding stations provides opportunity to link wintering grounds, migrational pathways, and breeding areas for a species or population. As these linkages are better understood a better ability to manage species will be reached. Many larger well-studied species such as waterfowl are recognized to have many independent populations of a given species; each of these having different stressors, threats, and habitat needs. The importance of population differences is totally unknown among landbird species and hinders strong and sound

conservation efforts.

The results of this project suggest the need to establish a standardized sampling protocol across the Great Lakes region. The collection of similar data has the advantage that it allows comparisons across different study sites throughout the landscape. This study has developed a multi-method approach that can be reproduced anywhere in the upper Midwest. A combination of banding, count surveys, and daily species list permits the strengthening of weaknesses of each and builds on their individual strengths. It also allows for the use of other, less skill intensive methods such as counts to be done along a broader front and still be comparable to more detailed banding operations. This protocol will accommodate new methods such as radar and acoustics as they become available.

This study is the building block for such a network being considered for the Great Lakes region by the U.S. Fish and Wildlife Service at this time. This network's goal is to bring multiple field researchers together to collaborate on big picture questions for the region. Similar field methods allow for site comparisons, habitat comparisons, body condition, migrational timing, and decision support for wind turbine placement among regional questions. This network, supported by a central database (the Midwest Avian Data Center) will assist researchers, sample design, and analysis effectiveness. Data from this study will be submitted to the Data Center.

Birds far from breeding or wintering areas are seldom encountered multiple years at the same stopover location. Little is known about how strong migrational route fidelity is in passerines. Before 2011, this study had only two individual birds not known to breed close to the marsh region recaptured at this site in two different migrational seasons, out of 350,000 birds banded. This highlights the importance of the seven returns of Blackpoll Warblers during fall 2011 and an additional two in fall 2012. A species that breeds from Alaska across the subarctic front and wintering in South America was a long way from terminus locations. To have this many encounters homing to a single stopover location indicates an extreme importance of the region to this species' life cycle conservation. This total included a bird first banded in 2006, an individual that has logged a minimum of 50,000 miles in migration and endured at least five crossings of the Atlantic Ocean to South America, each consisting of 80 hours of non-stop flight. Repeated use of stopover habitat in the marsh region supports the continental importance of the region to migratory birds.

One of the biggest emerging threats to migratory birds in the past decade is the proliferation of wind power in the upper Midwest. Only in the past few years has the importance of the air column as a habitat to birds been recognized. Much of their life cycle is spent in this habitat. With the Lake Erie marsh region being possibly the most important stopover habitat in eastern North America, identifying habitat needs and use of migrants is of utmost priority for informed decision making of regulatory agencies. Risk to migratory birds need to be identified. This includes documentation of ascent and descent rates and angles of migrants into the stopover habitat, elevation and volume of migrants, feeding flight activity, movement in relationship to lake shore, and movement over the open lake. Project personnel have been instrumental in bringing partners together to begin answering these questions. U.S. Geological Survey and Bowling Green University have provided radar units to document nocturnal movements, Ohio State University has a graduate student conducting point counts in the region, while BSBO provides the systematic banding program. Objectives are to answer bird movement questions and to evaluate the effectiveness of banding and point counts to represent migration.

Long-term studies of this nature offer opportunities to annually address research questions but to also consider those that only long-term datasets can access. Personnel are presently working on manuscripts addressing the use of DNA analysis to document a first species record for Ohio, the use of migrational banding stations to address population trends in species of concern, migrational timing and effects of climate change, and use of age ratios in addressing population health. Future analyses will include development of migrational species accounts for the region. Additional manuscripts with partners working with radar technology will be developed as those projects mature.

### ENVIRONMENTAL EDUCATION

A secondary goal of this study is to educate the general public on avian migration, research, habitat management, and ecosystems. During 2016, project personnel entertained 30 groups at Navarre and the Black Swamp Bird Observatory Nature Center educating 1,200 individuals on migration and banding. In addition, seven presentations were made to 400 people on avian ecology and migration. In addition, an estimated 55,000 individuals were educated through face to face interaction and print and video media about the importance of the western basin of Lake Erie as a stopover habitat for migrating landbirds during the Biggest Week in American Birding Festival in early May.

### MANAGEMENT RECOMMENDATIONS

Adequate stopover habitat is a necessity if migrating birds are to successfully reach breeding and wintering home ranges each year. While the Lake Erie marsh region may contain extremely important breeding habitats for some species, it is of much greater importance in meeting migration stopover needs. The combination of quality marshland, scrub-shrub upland and swamps, and wooded beach ridges provide food, water, and shelter for migrants. Intensively managed wetlands form the base for this habitat complex in the Lake Erie Marsh Region. The invertebrate populations required by the massive bird movement are born from these wetlands and shelters in the scrub and on beach ridges. This scrub-shrub and beach ridge habitat provides shelter from weather and protection from predators as well as their food source. Rough-leaved Dogwood dominates the shrub habitat providing vast surface area for invertebrates as well as fall migrating birds. Any management scheme at this latitude needs to recognize the over-riding importance of the region as stopover habitat for migrants. With the exception of the Gulf coast, no other region of eastern North America can demonstrate concentrations of avian migrants like Lake Erie's coast.

Management of these habitats needs to ensure protection of the remaining beach ridges and to provide both healthy wetlands and adequate shrub habitat. The mature forests of the Great Black Swamp once held many breeding species, but this habitat should not be a management priority. While migrational needs can be addressed in concentrated habitat units, to meet acreage requirements to influence breeding volume is presently beyond management resources. Wetland and moist soil habitats need to be managed to ensure water inundation during critical spring months to provide the substrate required for abundant invertebrate production. A well planned rotation of management units must be incorporated for summer and fall management plans to accommodate the habitat needs of the different migrant species, including deep water marshes, shallow water marshes, and moist soil areas. Shrub and grassland habitat management should consider migration as well as breeding needs. Management scenarios should also include food and cover during migration as well as protection

during breeding season. Dike systems should be designed to incorporate scrub borders to provide travel lanes for migrants to mimic the limited beach ridges and to augment passerine breeding in shrub management units. Research has not been conducted to determine to what extent dike nesting success may influence overall regional avian production. This needs to be assessed to fully examine this habitat use. In theory, dikes should be looked to as additional habitat for breeders spilling over from more productive shrub habitat blocks. Scrub-shrub habitats need to be maintained to provide adequate surface area for invertebrates, cover for migrant and breeders, and to encourage fruit production for fall migration. This will require periodic rejuvenation of units on a rotational basis.

This study will provide components for an informed decision matrix for regulatory agencies in wind power placement in the Great Lakes region. Black Swamp Bird Observatory will use results from data analysis of this project to formulate comments and positions on regulatory decisions on governmental policy.

Wise management of wetlands, shrub, grasslands, and riparian woodlands will not only benefit passerines on a year-round basis, but will also enhance other avian groups, mammals, reptiles, amphibians, and native plant associations.

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Table 1. Daily banding totals for Navarre, spring 2016.

Date	Net Hour	Banded	Banded/ 100 net hr	Returns	Recaptures	Total birds*	Total bird/ 100 net hr
416	76.59	53	69.20	4	0	58	75.73
417	115.00	74	64.35	5	7	87	75.65
418	143.75	45	31.30	4	10	59	41.04
419	126.50	21	16.60	3	4	28	22.13
420	141.68	23	16.23	4	11	38	26.82
422	118.68	70	58.98	1	5	76	64.04
423	109.25	13	11.90	1	6	20	18.31
424	111.09	15	13.50	3	7	25	22.50
425	189.75	294	154.94	3	5	302	159.16
426	126.50	212	167.59	2	5	220	173.91
427	149.50	177	118.40	5	34	216	144.48
429	120.75	100	82.82	6	42	148	122.57
430	134.09	45	33.56	3	32	80	59.66
501	115.00	29	25.22	3	34	66	57.39
502	138.00	68	49.28	3	28	99	71.74
503	138.00	71	51.45	7	25	103	74.64
504	184.00	186	101.09	10	11	207	112.50
505	126.50	84	66.40	5	15	104	82.21
506	126.50	61	48.22	5	16	82	64.82
507	180.09	550	305.40	8	12	570	316.51
508	161.00	237	147.21	8	46	291	180.75
509	138.00	118	85.51	12	21	151	109.42
511	149.50	460	307.69	14	34	508	339.80
512	109.25	181	165.68	9	10	200	183.07
513	157.09	162	103.13	10	22	194	123.50
514	161.00	450	279.50	14	28	492	305.59
515	134.09	300	223.73	6	83	389	290.10
516	184.00	239	129.89	12	117	368	200.00
517	138.00	280	202.90	6	47	333	241.30
518	161.00	138	85.71	4	70	212	131.68
519	138.00	78	56.52	8	50	136	98.55
520	138.00	106	76.81	13	21	140	101.45
522	130.41	99	75.91	6	20	125	95.85
523	130.41	77	59.04	6	27	110	84.35
524	161.00	389	241.62	6	20	415	257.76
525	176.41	639	362.22	7	22	668	378.66
526	153.41	403	262.70	4	45	452	294.64
530	130.41	31	23.77	4	9	44	33.74
<b>TOTAL</b>	<b>5322.20</b>	<b>6578</b>	<b>123.60</b>	<b>234</b>	<b>1001</b>	<b>7816</b>	<b>146.86</b>

\* Total birds include Brown-headed Cowbirds and European Starlings released unbanded.

Table 2. Spring banding totals, Navarre, 2016.

Species	Banded	Species	Banded	Species	Banded
American Woodcock	1	Field Sparrow	5	Bay-breasted Warbler	44
Mourning Dove	2	Slate-colored Junco	11	Blackpoll Warbler	71
Sharp-shinned Hawk	4	Song Sparrow	27	Blackburnian Warbler	48
American Kestrel	1	Lincoln Sparrow	100	Black-th.-Green Warbler	110
Yellow-billed Cuckoo	1	Swamp Sparrow	85	Kirtland's Warbler	1
Black-billed Cuckoo	4	Fox Sparrow	4	Pine Warbler	3
Hairy Woodpecker	2	Eastern Towhee	2	Western Palm Warbler	216
Downy Woodpecker	4	Northern Cardinal	28	Yellow Palm Warbler	3
Red-bellied Woodpecker	2	Rose-breasted Grosbeak	15	Ovenbird	70
Yellow-shafted Flicker	2	Indigo Bunting	43	Northern Waterthrush	52
Whip-poor-will	1	Scarlet Tanager	3	Connecticut Warbler	3
Ruby-th. Hummingbird	41	Summer Tanager	2	Mourning Warbler	51
Eastern Kingbird	1	Barn Swallow	5	Common Yellowthroat	222
Great-crested Flycatcher	24	Tree Swallow	21	Yellow-breasted Chat	3
Eastern Phoebe	2	Cedar Waxwing	9	Hooded Warbler	1
Olive-sided Flycatcher	2	Red-eyed Vireo	126	Wilson's Warbler	133
Eastern Wood Pewee	17	Philadelphia Vireo	35	Canada Warbler	48
Yellow-bellied Flycatcher	49	Warbling Vireo	48	American Redstart	238
Acadian Flycatcher	13	Yellow-throated Vireo	1	Gray Catbird	397
Trail's Flycatcher	247	Blue-headed Vireo	26	Brown Thrasher	14
Least Flycatcher	82	White-eyed Vireo	8	Carolina Wren	2
Blue Jay	71	Black and White Warbler	59	House Wren	96
Red-winged Blackbird	62	Prothonotary Warbler	11	Winter Wren	13
Orchard Oriole	3	Blue-winged Warbler	13	Marsh Wren	1
Baltimore Oriole	38	Golden-winged Warbler	3	Brown Creeper	10
Rusty Blackbird	1	Nashville Warbler	397	White-breasted Nuthatch	2
Common Grackle	10	Orange-crowned Warbler	16	Black-capped Chickadee	1
Purple Finch	2	Tennessee Warbler	111	Golden-crowned Kinglet	50
American Goldfinch	31	Northern Parula	59	Ruby-crowned Kinglet	284
Savannah Sparrow	1	Cape May Warbler	29	Blue-gray Gnatcatcher	61
White-crowned Sparrow	52	Yellow Warbler	490	Wood Thrush	23
Gambel's Wh.-Cr. Sparrow	3	Black-th.-Blue Warbler	34	Veery	52
White-throated Sparrow	477	Myrtle Warbler	295	Gray-cheeked Thrush	40
American Tree Sparrow	4	Magnolia Warbler	378	Swainson's Thrush	251
Clay-colored Sparrow	1	Cerulean Warbler	2	Hermit Thrush	97
Chipping Sparrow	1	Chestnut-sided Warbler	95	American Robin	13

Table 3. Number of days observed and totals of species seen on point counts, Navarre spring 2016.

Species	# days	#Observed	Species	# days	#Observed	Species	# days	#Observed
Pied-billed Grebe	1	1	Alder Flycatcher	4	7	Golden-winged Warbler	1	1
Herring Gull	5	7	Willow Flycatcher	4	19	Nashville Warbler	17	61
Ring-billed Gull	25	90	Traill's Flycatcher	1	1	Orange-cr. Warbler	1	1
Bonaparte's Gull	3	13	Least Flycatcher	8	20	Tennessee Warbler	12	46
Caspian Tern	2	5	Blue Jay	31	1,820	Northern Parula	9	44
Dou.-cr. Cormorant	20	81	E. Starling	33	172	Cape May Warbler	5	8
Hooded Merganser	1	1	Bobolink	1	1	Yellow Warbler	28	641
Mallard	14	38	Brown-headed Cowbird	31	328	Black-th.-Blue Warbler	9	17
Gadwall	4	8	Red-winged Blackbird	34	1,907	Myrtle Warbler	24	64
Northern Shoveler	1	1	Orchard Oriole	5	6	Magnolia Warbler	7	26
Wood Duck	13	38	Baltimore Oriole	20	218	Chestnut-sided Warbler	15	57
Lesser Scaup	1	8	Rusty Blackbird	10	39	Bay-breasted Warbler	4	8
Canada Goose	33	1,366	Common Grackle	34	366	Blackpoll Warbler	6	12
Trumpeter Swan	8	27	Am. Goldfinch	20	95	Blackburnian Warbler	3	4
Mute Swan	1	6	Pine Siskin	1	3	Black-th.-Green Warbler	14	26
Least Bittern	1	1	White-cr. sparrow	5	12	W. Palm Warbler	16	45
Gr.-blue Heron	30	96	White-th. Sparrow	30	461	Ovenbird	15	27
Great Egret	16	30	Slate-colored Junco	1	2	No. Waterthrush	12	23
Black-cr. N. Heron	1	1	Song Sparrow	33	143	Mourning Warbler	4	13
Sandhill Crane	12	36	Lincoln Sparrow	7	10	Com. Yellowthroat	22	100
Sora	4	5	Swamp Sparrow	14	27	Wilson's Warbler	7	24
American Coot	1	1	Eastern Towhee	9	13	Canada Warbler	3	11
Solitary Sandpiper	2	2	No. Cardinal	34	356	American Redstart	15	91
Killdeer	2	3	Rose-br. Grosbeak	8	27	Gray Catbird	24	342
Mourning Dove	12	26	Indigo Bunting	15	33	Brown Thrasher	18	44
Northern Harrier	1	1	Scarlet Tanager	7	17	Carolina Wren	3	3
Sharp-sh.. Hawk	1	1	Summer Tanager	1	1	House Wren	30	194
Bald Eagle	10	14	Purple Martin	8	22	Winter Wren	1	1
Osprey	1	1	Cliff Swallow	1	1	Marsh Wren	5	5
Great horned Owl	26	37	Barn Swallow	16	45	White-breasted Nuthatch	9	11
Yellow-billed Cuckoo	5	37	Tree Swallow	34	829	Black-capped Chickadee	18	34
Black-billed Cuckoo	4	13	Bank Swallow	5	10	Golden-crowned Kinglet	1	1
Downy Woodpecker	19	38	Rough-winged Swallow	10	19	Ruby-crowned Kinglet	21	148
Red-b. Woodpecker	7	9	Cedar Waxwing	7	98	Blue-gray Gnatcatcher	28	93
Yellow-shafted Flicker	17	40	Red-eyed Vireo	8	40	Wood Thrush	5	12
Chimney Swift	6	12	Philadelphia Vireo	3	4	Veery	9	11
Ruby-th. Humming.	3	3	Warbling Vireo	20	86	Gray-cheeked Thrush	2	2
Eastern Kingbird	12	25	Yellow-throated Vireo	1	1	Swainson's Thrush	9	33
Great-cr. Flycatcher	9	16	Blue-headed Vireo	6	7	Hermit Thrush	4	5
Eastern Phoebe	5	5	White-eyed Vireo	6	7	American Robin	33	174
E. Wood Pewee	6	23	Black & White Warbler	15	24	Unk. warbler	21	155
Yellow-bel. Flycatcher	3	9	Prothonotary Warbler	13	29	Unk. Hawk	1	1
Acadian Flycatcher	1	1	Blue-winged Warbler	4	5			



Table 4. Daily banding totals for Shaker Lakes, spring 2016.

Date	Net Hour	Banded	Banded/ 100 net hr	Returns	Recaptures	Total birds	Total bird/ 100 net hr
420	34.0	10	29.41	3	0	13	38.24
425	32.5	20	61.54	1	0	21	64.62
427	36.5	13	35.62	4	0	17	46.58
429	29.0	9	31.03	4	4	17	58.62
502	34.0	23	67.65	2	5	30	88.24
504	35.0	9	25.71	1	3	13	37.14
506	33.0	5	15.15	2	1	8	24.24
509	33.0	10	30.30	0	2	12	36.36
511	40.0	15	37.50	1	3	19	47.50
513	33.5	11	32.84	1	3	15	44.78
516	34.5	11	31.88	1	3	15	43.48
518	43.0	20	46.51	0	3	23	53.49
520	39.0	15	38.46	1	3	19	48.72
523	34.5	8	23.19	0	3	11	31.88
525	37.0	15	40.54	4	3	22	59.46
527	37.5	10	26.67	0	1	11	29.33
529							
<b>TOTAL</b>	<b>566.0</b>	<b>204</b>	<b>36.04</b>	<b>25</b>	<b>37</b>	<b>266</b>	<b>47.00</b>

Table 5. Daily banding totals Shaker Lakes, spring 2016.

<b>Species</b>	<b>Banded</b>	<b>Species</b>	<b>Banded</b>	<b>Species</b>	<b>Banded</b>
Hairy Woodpecker	1	Eastern Towhee	1	Common Yellowthroat	7
Downy Woodpecker	1	Indigo Bunting	1	Hooded Warbler	1
Eastern Phoebe	1	Philadelphia Vireo	1	Wilson's Warbler	1
Eastern Wood Pewee	2	Black and White Warbler	1	Canada Warbler	6
Yellow-bellied Flycatcher	1	Nashville Warbler	4	American Redstart	3
Traill's Flycatcher	1	Orange-crowned Warbler	1	Gray Catbird	26
Blue Jay	1	Tennessee Warbler	5	House Wren	3
Brown-headed Cowbird	1	Yellow Warbler	5	Winter Wren	1
Red-winged Blackbird	2	Black-th.-blue Warbler	2	Tufted Titmouse	1
Baltimore Oriole	4	Magnolia Warbler	4	Black-capped Chickadee	6
Common Grackle	2	Myrtle Warbler	3	Ruby-cr. Kinglet	18
American Goldfinch	5	Chestnut-sided Warbler	1	Wood Thrush	3
White-throated Sparrow	16	Western Palm Warbler	5	Veery	2
Song Sparrow	6	Ovenbird	2	Swainson's Thrush	8
Lincoln's Sparrow	3	Northern Waterthrush	4	Hermit Thrush	2
Swamp Sparrow	5	Mourning Warbler	4	American Robin	15
Northern Cardinal	6				

Table 6. Point count days conducted and species totals, spring season, Shaker Lakes, 2016. 731 birds

<b>Species</b>	<b># days</b>	<b># birds</b>	<b>Species</b>	<b># days</b>	<b># birds</b>	<b>Species</b>	<b># days</b>	<b># birds</b>
Herring Gull	2	2	Eastern Wood Pewee	1	3	Tennessee Warbler	3	6
Hooded Merganser	2	3	Blue Jay	9	17	Yellow Warbler	2	2
Mallard	8	17	American Crow	2	3	Magnolia Warbler	1	1
Wood Duck	5	14	Brown-head. Cowbird	9	21	Northern Waterthrush	1	2
Canada Goose	10	75	Red-wing . Blackbird	14	25	Gray Catbird	8	16
Great Blue Heron	5	6	Baltimore Oriole	10	20	House Wren	5	8
Green Heron	1	1	Common Grackle	1	1	White-br. Nuthatch	13	23
Black-cr. Night-Heron	2	3	House Finch	1	3	Red-breasted Nuthatch	1	1
Mourning Dove	2	4	American Goldfinch	15	84	Tufted Titmouse	10	17
Rock Pigeon	7	55	White-th. Sparrow	5	7	Black-cap. Chickadee	9	12
Belted Kingfisher	1	1	Chipping Sparrow	1	1	Ruby-crowned Kinglet	4	8
Hairy Woodpecker	1	1	Song Sparrow	15	48	Blue-gray Gnatcatcher	2	3
Downy Woodpecker	6	6	No. Cardinal	16	44	Wood Thrush	2	3
Red -bell Woodpecker	10	15	Rose-br. Grosbeak	3	3	Swainson's Thrush	1	1
Yellow-sh. Flicker	2	2	Barn Swallow	1	1	American Robin	14	49
Chimney Swift	2	5	N. Rough-wing Swal.	2	3	Unk.Flycatcher	1	1
Ruby-th.Hummingbird	1	1	Cedar Waxwing	1	1	Unk. Gull	7	14
Gr-cr Flycatcher	8	15	Red-eyed Vireo	6	8	Unk. Warbler	4	4
Eastern Phoebe	13	25	Warbling Vireo	6	9	Unk. Woodpecker	2	3

Table 7. Daily banding totals for Navarre, fall 2016.

Date	Net Hour	Banded	Banded/100 net hr	Returns	Recaptures	Total birds*	Total bird/ 100 net hr
704	97.75	49	50.13	3	14	66	67.52
815	107.41	37	34.45	0	3	40	37.24
817	109.25	41	37.53	1	4	46	42.11
818	107.41	20	18.62	0	4	24	22.34
819	103.50	22	21.26	0	4	26	25.12
820	103.50	27	26.09	1	2	30	28.99
822	107.41	38	35.38	0	2	40	37.24
823	109.25	30	27.46	0	4	34	31.12
824	107.41	24	22.34	0	7	31	28.86
825	103.50	14	13.53	0	7	21	20.29
826	107.41	23	21.41	0	5	28	26.07
827	109.25	32	29.29	1	4	37	33.87
828	99.00	18	18.18	0	6	24	24.24
829	109.25	15	13.73	0	7	22	20.14
830	109.25	29	26.55	0	4	33	30.21
901	109.25	31	28.37	0	8	398	35.70
902	103.50	35	33.82	0	6	41	39.61
903	103.50	26	25.12	0	1	27	26.09
904	109.25	30	27.46	0	7	37	33.87
905	109.25	40	36.61	0	5	45	41.19
906	109.25	39	35.70	1	9	49	44.85
907	109.25	26	23.80	0	12	38	34.78
908	103.50	43	41.55	0	6	49	47.34
909	115.00	53	46.09	0	10	63	54.78
910	107.41	77	71.69	0	11	88	81.93
911	126.50	89	70.36	1	13	103	81.42
912	138.00	102	73.91	0	13	115	83.33
913	138.00	80	57.97	0	15	95	68.84
914	103.50	34	32.85	1	7	42	40.58
915	141.50	98	69.26	0	14	112	79.15
916	109.25	64	58.58	0	14	78	71.40
917	109.25	107	97.94	1	13	121	110.76
919	115.00	50	43.48	0	7	57	49.57
920	115.00	118	102.61	1	10	129	112.17
921	109.25	86	78.72	0	12	98	89.70
922	109.25	75	68.65	0	11	86	78.72
923	132.25	185	139.89	0	16	201	151.99
924	120.75	112	92.75	0	20	132	109.32
925	115.00	115	100.00	0	19	134	116.52
927	138.00	231	167.39	0	28	259	187.68
928	40.25	48	119.26	1	10	59	146.58
930	130.41	148	113.49	1	52	201	154.13
1001	115.00	72	62.61	0	40	112	97.39
1002	115.00	116	100.87	0	26	142	123.48
1003	115.00	53	46.09	1	17	71	61.74
1004	103.50	35	33.82	0	19	54	52.17
1005	115.00	41	35.65	0	34	75	65.22
1006	103.50	76	72.46	0	18	93	89.86
1007	103.50	51	49.28	1	20	72	69.57
1008	130.41	146	111.96	1	20	167	128.06
1009	115.00	82	71.30	1	28	111	86.52
1010	138.00	175	126.81	0	32	207	150.00
1011	103.50	61	58.94	0	42	103	99.52
1012	115.00	59	51.30	0	39	98	85.22
1013	138.00	78	56.52	0	45	123	89.13
1014	103.50	96	92.75	0	22	118	114.01
1015	103.50	30	28.99	1	19	50	48.31
1016	103.50	20	19.32	0	20	40	38.65
1017	99.59	16	16.07	0	17	33	33.14
1018	69.00	15	21.74	0	8	23	33.33
1019	109.25	95	86.96	0	10	105	96.11
1022	109.25	102	93.36	0	29	131	119.91
1023	107.41	54	50.28	0	25	79	73.55
1024	99.59	56	56.23	0	15	71	71.29
1025	95.68	32	36.58	1	15	51	53.30
1026	69.00	19	27.54	0	4	23	33.33
1027	95.68	22	22.99	2	15	39	40.76
1028	95.68	26	27.17	0	8	34	36.54

1029	99.59	23	23.10	0	11	34	34.14
1031	103.50	63	60.87	1	9	73	70.53
<b>TOTAL</b>	<b>7635.00</b>	<b>4277</b>	<b>56.02</b>	<b>22</b>	<b>1033</b>	<b>5332</b>	<b>69.84</b>

\* Total birds include Brown-headed Cowbirds and European Starlings released unbanded.

Table 8. Fall banding totals, Navarre 2016.

<b>Species</b>	<b>Banded</b>	<b>Species</b>	<b>Banded</b>	<b>Species</b>	<b>Banded</b>
Green Heron	1	Lincoln's Sparrow	10	Blackburnian Warbler	6
American Woodcock	1	Swamp Sparrow	41	Black-th.-Green Warbler	7
Sharp-shinned Hawk	1	Fox Sparrow	15	Western Palm Warbler	1
No. Saw-whet Owl	1	Rufous-sided Towhee	1	Ovenbird	84
Eastern Screech Owl	2	Northern Cardinal	49	Northern Waterthrush	32
Yellow-billed Cuckoo	1	Rose-breasted Grosbeak	11	Connecticut Warbler	5
Hairy Woodpecker	2	Indigo Bunting	4	Mourning Warbler	9
Downy Woodpecker	35	Scarlet Tanager	2	Common Yellowthroat	137
Red-bellied Woodpecker	1	Cedar Waxwing	9	Hooded Warbler	1
Yellow-shafted Flicker	3	Red-eyed Vireo	50	Wilson's Warbler	17
Ruby-th. Hummingbird	2	Philadelphia Vireo	22	Canada Warbler	11
Eastern Phoebe	22	Warbling Vireo	4	American Redstart	48
Eastern. Wood Pewee	20	Yellow-throated Vireo	1	Gray Catbird	343
Yellow-bellied Flycatcher	22	Blue-headed Vireo	6	Brown Thrasher	5
Acadian Flycatcher	1	Black and White Warbler	29	Carolina Wren	5
Trail's Flycatcher	5	Prothonotary Warbler	18	House Wren	52
Least Flycatcher	6	Blue-winged Warbler	1	Winter Wren	60
Blue Jay	5	Golden-winged Warbler	1	Marsh Wren	1
Red-winged Blackbird	3	Nashville Warbler	27	Brown Creeper	44
Baltimore Oriole	9	Orange-crowned Warbler	1	White-breasted Nuthatch	5
Rusty Blackbird	13	Tennessee Warbler	34	Red-breasted Nuthatch	13
Common Grackle	65	Northern Parula	2	Black-capped Chickadee	13
Purple Finch	22	Cape May Warbler	15	Golden-crowned Kinglet	320
House Finch	8	Yellow Warbler	23	Ruby-crowned Kinglet	114
American Goldfinch	5	Black-th.-Blue Warbler	62	Wood Thrush	9
White-crowned Sparrow	4	Myrtle Warbler	71	Veery	17
White-throated Sparrow	158	Magnolia Warbler	166	Gray-cheeked Thrush	209
Chipping Sparrow	1	Chestnut-sided Warbler	34	Swainson's Thrush	481
Field Sparrow	2	Bay-breasted Warbler	58	Hermit Thrush	170
Slate-colored Junco	16	Blackpoll Warbler	783	American Robin	28
Song Sparrow	45				

Table 9. Number of days observed and totals of species seen on point counts, Navarre fall 2016.

Species	# days	#Observed	Species	# days	#Observed	Species	# days	#Observed
Herring Gull	18	44	Red-bell. Woodpecker	12	16	Prothonotary Warbler	2	2
Ring-billed Gull	36	160	Yellow-sh. Flicker	34	85	Tennessee Warbler	4	5
Bonaparte's Gull	12	68	Chimney Swift	24	69	Cape May Warbler	4	6
Common Tern	1	1	Ruby-th. Hummingbird	13	17	Bl-th-blue Warbler	10	10
Caspian Tern	7	11	Eastern Kingbird	5	8	Myrtle Warbler	12	23
D-c. Cormorant	10	231	Eastern Phoebe	10	10	Magnolia Warbler	7	7
Mallard	35	307	Eastern Wood Pewee	10	15	Bay-breasted Warbler	8	11
American Black Duck	10	46	Horned Lark	2	5	Blackpoll Warbler	39	262
Gadwall	6	21	Blue Jay	57	309	Blackburnian Warbler	1	2
American Wigeon	5	44	European Starling	42	325	Blk.-th-green Warbler	3	3
Am. Green-winged Teal	1	2	Brown-headed Cowbird	7	23	Ovenbird	4	7
Blue-winged Teal	5	22	Red-winged Blackbird	62	5,733	Common Yellowthroat	12	14
Northern Shoveler	1	1	Baltimore Oriole	21	83	Wilson Warbler	1	1
Northern Pintail	6	52	Rusty Blackbird	16	233	Canada Warbler	1	1
Wood Duck	23	88	Common Grackle	42	458	American Redstart	7	9
Canada Goose	55	1,299	Purple Finch	7	22	Gray Catbird	41	518
Trumpeter Swan	9	25	House Finch	4	13	Brown Thrasher	8	11
Great- blue Heron	32	65	American Goldfinch	37	105	Carolina Wren	31	51
Great Egret	21	26	White-th. Sparrow	32	481	House Wren	20	30
Green Heron	8	9	Slate-colored Junco	2	2	Winter Wren	21	33
Black-cr. Night-Heron	1	1	Song Sparrow	21	43	Brown Creeper	9	12
Sandhill Crane	13	31	Swamp Sparrow	1	1	White-br. Nuthatch	30	52
Virginia Rail	1	1	Fox Sparrow	4	4	Red-br. Nuthatch	17	33
American Woodcock	1	1	Eastern Towhee	2	3	Tufted Titmouse	1	1
Lesser Yellowlegs	1	1	Northern Cardinal	62	511	Black.-cap. Chickadee	36	90
Killdeer	2	2	Rose-br. Grosbeak	10	22	Golden-cr. Kinglet	25	194
Mourning Dove	20	55	Indigo Bunting	3	6	Ruby-cr. Kinglet	14	29
Cooper's Hawk	2	2	Purple Martin	11	72	Wood Thrush	3	4
Red-tailed Hawk	2	2	Barn Swallow	10	26	Verry	1	1
Bald Eagle	23	38	Tree Swallow	19	119	Gray-cheeked Thrush	21	130
Merlin	1	1	Bank Swallow	10	141	Swainson's Thrush	35	261
Peregrine Falcon	1	1	No. Rough-wing Swal.	6	13	Hermit Thrush	13	22
Eastern Screech Owl	1	1	Cedar Waxwing	28	111	American Robin	54	379
Yellow-billed Cuckoo	1	1	Red-eyed Vireo	9	11	Unk. Duck	12	129
Great-cr. Flycatcher	3	4	Philadelphia Vireo	1	1	Unk. Shorebird	1	1
Hairy Woodpecker	15	18	Warbling Vireo	15	36	Unk. Swallow	2	2
Downy Woodpecker	57	222	Blue-headed Vireo	5	6	Unk. Warbler	38	317
Yellow-bel. Sapsucker	3	5	Black & White Warbler	2	2			

Table 10 . Daily banding totals for Creek Bend County Park, fall 2016.

Date	Net Hour	Banded	Banded/ 100 net hr	Returns	Recaptures	Total birds	Total bird/ 100 net hr
902	72	56	77.78	2	0	58	80.56
906	68	32	47.06	1	0	33	48.53
909	72	19	26.39	0	2	21	29.17
911	72	43	59.72	2	6	51	70.83
912	72	45	62.50	0	3	48	66.67
914	54	21	38.89	0	4	25	46.30
918	90	62	68.89	6	7	75	83.33
919	80	49	61.25	3	7	59	73.75
921	84	35	41.67	1	8	44	52.38
923	84	41	48.81	4	8	53	63.10
924	84	57	67.86	1	9	67	79.76
926	72	33	45.83	1	7	41	56.94
927	84	52	61.91	2	14	68	80.95
928	42	10	23.81	3	3	16	38.10
930	18	26	144.44	1	7	34	188.89
1003	126	163	129.37	2	14	179	142.06
1004	105	98	93.33	1	17	116	110.48
1006	105	137	130.48	2	22	161	153.33
1007	105	117	111.43	4	22	143	136.19
1008	105	218	207.62	1	51	270	257.14
1010	147	275	187.08	4	63	342	232.65
1011	63	100	158.73	5	30	135	214.29
1012	84	55	65.48	0	19	74	88.10
1014	105	169	160.95	0	62	231	220.00
1015	105	121	115.24	1	91	213	202.86
1016	126	71	56.35	0	45	116	92.06
1019	105	209	199.05	2	27	238	226.67
1022	80	133	166.25	0	23	156	195.00
1023	105	203	193.33	1	43	247	235.24
1024	105	139	132.38	4	41	184	175.24
1025	105	171	162.86	2	101	274	260.95
1028	105	106	100.95	2	49	157	149.52
1031	63	25	39.68	0	10	35	55.56
1101	63	12	19.05	0	6	18	28.57
1105	88	65	73.86	0	16	81	92.05
<b>TOTAL</b>	<b>3043</b>	<b>3168</b>	<b>104.11</b>	<b>58</b>	<b>837</b>	<b>4063</b>	<b>133.52</b>

Table 11. Fall banding totals for Creek Bend County Park, fall 2016.

Species	Banded	Species	Banded	Species	Banded
American Woodcock	1	Swamp Sparrow	47	Northern Waterthrush	2
American Kestrel	1	Fox Sparrow	9	Connecticut Warbler	3
Hairy Woodpecker	2	Northern Cardinal	22	Mourning Warbler	2
Downy Woodpecker	18	Rose-breasted Grosbeak	3	Common Yellowthroat	71
Yellow-bellied Sapsucker	3	Indigo Bunting	92	Wilson's Warbler	9
Red-bellied Woodpecker	3	Cedar Waxwing	2	American Redstart	13
Yellow-shafted Flicker	1	Red-eyed Vireo	5	Gray Catbird	22
Eastern Phoebe	4	Philadelphia Vireo	3	Brown Thrasher	1
Yellow-bellied Flycatcher	10	Blue-headed Vireo	1	Carolina Wren	4
Traill's Flycatcher	3	Black and White Warbler	1	House Wren	30
Brown-headed Cowbird	18	Nashville Warbler	38	Winter Wren	9
Red-winged Blackbird	12	Orange-crowned Warbler	4	Brown Creeper	15
Purple Finch	6	Tennessee Warbler	10	White-breasted Nuthatch	9
House Finch	17	Northern Parula	1	Red-breasted Nuthatch	3
American Goldfinch	1,597	Cape May Warbler	1	Tufted Titmouse	8
Vesper Sparrow	1	Black-th. Blue Warbler	6	Black-capped Chickadee	7
Savannah Sparrow	12	Myrtle Warbler	96	Golden-crowned Kinglet	80
White-crowned Sparrow	47	Magnolia Warbler	62	Ruby-crowned Kinglet	93
White-throated Sparrow	81	Chestnut-sided Warbler	3	Wood Thrush	1
American Tree Sparrow	16	Bay-breasted Warbler	2	Veery	2
Chipping Sparrow	23	Blackpoll Warbler	24	Gray-cheeked Thrush	23
Field Sparrow	52	Blackburnian Warbler	1	Swainson's Thrush	37
Slate-colored Junco	55	Black-th. Green Warbler	4	Hermit Thrush	25
Song Sparrow	195	Western Palm Warbler	10	American Robin	2
Lincoln's Sparrow	56	Ovenbird	15	Eastern Bluebird	1



Table 12. Daily banding totals for Shaker Lakes, fall 2016.

Date	Net hour	Banded	Banded/ 100 net hr	Returns	Recaptures	Total birds	Total bird/ 100 net hr
822	32.5	15	46.15	1	0	16	49.23
824	34.0	10	29.41	1	3	14	41.18
826	32.5	21	64.62	1	0	22	67.69
829	29.5	8	27.12	0	4	12	40.68
831	35.0	39	111.43	1	7	47	134.29
902	37.0	72	194.60	1	5	78	210.81
905	33.5	29	86.57	0	4	33	98.51
907	32.5	12	36.92	0	5	17	52.31
909	27.5	10	36.36	0	4	14	50.91
912	36.0	41	113.89	0	2	43	119.44
914	32.5	10	30.77	0	8	18	55.39
916	31.5	20	63.49	0	3	23	73.02
919	28.0	27	96.43	1	3	31	110.71
921	32.0	17	53.13	0	8	25	78.13
923	28.5	12	42.11	0	5	17	59.65
926	23.5	4	17.02	0	3	7	29.79
928	29.5	18	61.02	0	3	21	71.19
930	37.0	73	197.30	0	11	84	227.03
1003	28.0	15	53.57	0	7	22	78.57
1005	35.5	41	115.49	1	3	45	126.76
1007	29.5	22	74.58	0	1	23	77.97
1010	45.0	74	164.44	0	4	78	173.33
1012	28.5	26	91.23	0	1	27	94.74
1014	25.5	22	86.28	0	5	27	105.88
1017	26.5	17	64.15	0	6	23	86.79
1019	27.0	30	111.11	0	7	37	137.04
1026	32.5	74	227.69	0	21	95	292.31
1102	24.0	40	166.67	0	7	47	195.83
Total	874.5	799	91.37	7	140	946	108.18

Table 13. Daily banding totals Shaker Lakes, fall 2016.

<b>Species</b>	<b>Banded</b>	<b>Species</b>	<b>Banded</b>	<b>Species</b>	<b>Banded</b>
Hairy Woodpecker	1	Rose-breasted Grosbeak	2	Common Yellowthroat	7
Downy Woodpecker	9	Red-eyed Vireo	2	Wilson's Warbler	9
Yellow-bellied Sapsucker	1	Philadelphia Vireo	1	Canada Warbler	2
Eastern Wood Pewee	8	Blue-headed Vireo	5	American Redstart	29
Yellow-bellied Flycatcher	8	Black and White Warbler	2	Gray Catbird	32
Trail's Flycatcher	1	Nashville Warbler	29	Carolina Wren	1
Least Flycatcher	6	Orange-crowned Warbler	4	House Wren	9
Blue Jay	10	Tennessee Warbler	7	Winter Wren	18
Common Grackle	1	Cape May Warbler	1	Brown Creeper	3
House Finch	12	Black-thr. Blue Warbler	9	White-breasted Nuthatch	5
Purple Finch	1	Myrtle Warbler	12	Red-breasted Nuthatch	3
American Goldfinch	175	Magnolia Warbler	46	Tufted Titmouse	18
White-crowned Sparrow	3	Chestnut-sided Warbler	3	Black-capped Chickadee	6
White-throated Sparrow	84	Bay-breasted Warbler	9	Golden-crowned Kinglet	25
Chipping Sparrow	2	Blackpoll Warbler	1	Ruby-crowned Kinglet	35
Field Sparrow	3	Blackburnian Warbler	2	Wood Thrush	2
Slate-colored Junco	12	Black-th. Green Warbler	1	Veery	3
Song Sparrow	15	Western Palm Warbler	1	Gray-cheeked Thrush	8
Lincoln's Sparrow	4	Ovenbird	10	Swainson's Thrush	32
Fox Sparrow	4	Northern Waterthrush	7	Hermit Thrush	15
Northern Cardinal	17	Mourning Warbler	3	American Robin	4

Table 14. Point count days conducted and species totals, fall season, Shaker Lakes, 2016.

Species	# days	# birds	Species	# days	# birds	Species	# days	# birds
Mallard	6	19	Yellow-bellied Flycatcher	1	1	American Redstart	2	3
Wood Duck	4	9	Blue Jay	21	39	Northern Mockingbird	1	1
Canada Goose	8	124	Common Grackle	1	1	Gray Catbird	19	28
Great Blue Heron	1	1	American Goldfinch	26	252	House Wren	2	2
Green Heron	6	6	White-crowned Sparrow	1	1	White-br. Nuthatch	14	23
Mourning Dove	4	6	White-throated Sparrow	7	35	Tufted Titmouse	7	8
Rock Pigeon	10	95	Chipping Sparrow	1	1	Black-capped Chickadee	11	20
Cooper's Hawk	2	2	Slate-colored Junco	2	5	Golden-crowned Kinglet	5	9
Red-tailed Hawk	1	1	Song Sparrow	19	42	Ruby-crowned Kinglet	4	13
Red-shouldered Hawk	2	2	Swamp Sparrow	2	4	Swainson's Thrush	4	6
Belted Kingfisher	5	6	Northern Cardinal	16	25	American Robin	13	58
Hairy Woodpecker	15	17	Rose-breasted Grosbeak	3	4	Unk. Warbler	3	4
Downy Woodpecker	17	28	Scarlet Tanager	1	1	Unk. Kinglet	1	7
Yellow-bellied Sapsucker	1	1	Cedar Waxwing	1	18	Unk. Thrush	1	2
Red-bellied Woodpecker	20	37	Red-eyed Vireo	3	3	Unk. Duck	1	2
Yellow-shafted Flicker	3	3	Warbling Vireo	1	2	Unk Sparrow	1	6
Common Nighthawk	1	1	Myrtle Warbler	1	4	Unk Flycatcher	2	4
Chimney Swift	15	157	Magnolia Warbler	1	2	Unk Woodpecker	1	3
Ruby-th. Hummingbird	6	15	Blk-th-green Warbler	1	1	Unk. Hawk	1	1
Eastern Phoebe	3	3	Common Yellowthroat	3	4	Unk. Swallow	1	3
Eastern Wood Pewee	3	3						

Table 15. Total bandings Black Swamp Bird Observatory, passerine migration , 2016.

Species	Banded	Species	Banded	Species	Banded
Green Heron	1	Am. Tree Sparrow	4 (20)	Bay-breasted Warbler	102 (113)
American Woodcock	2 (3)	Chipping Sparrow	2 (27)	<b>(2)</b> Blackpoll Warbler	854 (879)
Mourning Dove	2	Clay-colored Sparrow	1	Blackburnian Warbler	54 (57)
Sharp-shinned Hawk	5	Field Sparrow	7 (62)	Blk.-th. Grn. Warbler	117 (122)
American Kestrel	1 (2)	Slate-colored Junco	27 (94)	Pine Warbler	3
Norhtern Saw-whet Owl	1	Song Sparrow	72 (288)	Kirtland's Warbler	1
Eastern Screech Owl	2	Lincoln's Sparrow	110 (173)	West. Palm Warbler	217 (233)
Yellow-billed Cuckoo	2	Swamp Sparrow	126 (178)	Yellow Palm Warbler	3
Black-billed Cuckoo	4	Fox Sparrow	19 (32)	Ovenbird	154 (181)
Hairy Woodpecker	4 (8)	Eastern Towhee	3 (4)	Northern Waterthrush	84 (97)
Downy Woodpecker	39 (67)	Northern Cardinal	77 (122)	Connecticut Warbler	8 (11)
Yellow-bell. Sapsucker	0 (4)	Rose-breasted Grosbeak	26 (31)	Mourning Warbler	60 (69)
Red-bellied Woodpecker	3 (6)	Indigo Bunting	47 (140)	C. Yellowthroat	359 (444)
Yellow-shafted Flicker	5 (6)	Scarlet Tanager	5	Yellow-breasted Chat	3
Whip-poor-will	1	Summer Tanager	2	Hooded Warbler	2 (3)
Ruby-th. Hummingbird	43	Barn Swallow	5	Wilson's Warbler	150 (169)
Eastern Kingbird	1	Tree Swallow	21	Canada Warbler	59 (67)
Great-crested Flycatcher	24	Cedar Waxwing	18 (20)	American Redstart	286 (331)
Eastern Phoebe	24 (29)	Red-eyed Vireo	176 (183)	<b>(3)</b> Gray Catbird	740 (820)
Olive-sided Flycatcher	2	Philadelphia Vireo	57 (62)	Brown Thrasher	19 (20)
Eastern Wood-Pewee	37 (47)	Warbling Vireo	52	Carolina Wren	7 (12)
Yellow-bell. Flycatcher	71 (90)	Yellow-throated Vireo	2	House Wren	148 (190)
Acadian Flycatcher	14	Blue-headed Vireo	32 (38)	Winter Wren	73 (101)
Traill's Flycatcher	252 (257)	White-eyed Vireo	8	Marsh Wren	2
Least Flycatcher	88 (94)	Black and White Warbler	88 (92)	Brown Creeper	54 (72)
Blue Jay	76 (87)	Prothonotary Warbler	29	White-br Nuthatch	7 (21)
Brown-headed Cowbird	0 (19)	Blue-winged Warbler	14	Red-br. Nuthatch	13 (19)
Red-winged Blackbird	65 (79)	Golden-winged Warbler	4	Tufted Titmouse	0 (27)
Orchard Oriole	3	<b>(9)</b> Nashville Warbler	424 (495)	Black-cap. Chickadee	14 (33)
Baltimore Oriole	47 (51)	Orange-crowned Warbler	17 (26)	Gold.-cr. Kinglet	370 (475)
Rusty Blackbird	14	Tennessee Warbler	145 (167)	<b>(8)</b> Ruby-cr Kinglet	398 (544)
Common Grackle	75 (78)	Northern Parula	61 (62)	Blue-gray Gnatcatch.	61
Purple Finch	24 (31)	Cape May Warbler	44 (46)	Wood Thrush	32 (38)
House Finch	8 (37)	<b>(7)</b> Yellow Warbler	513 (518)	Veery	69 (76)
<b>(1)</b> American Goldfinch	46 (1,823)	Black-th. Blue Warbler	96 (113)	Gray-cheek Thrush	249 (280)
Vesper Sparrow	0 (1)	<b>(10)</b> Myrtle Warbler	366 (477)	<b>(5)</b> Swainson's Thrush	732 (809)
Savannah Sparrow	1 (13)	<b>(6)</b> Magnolia Warbler	544 (656)	Hermit Thrush	267 (309)
White-cr. Sparrow	56 (106)	Cerulean Warbler	2	American Robin	41 (62)
Gambel's W-c Sparrow	3	Chestnut-sided Warbler	129 (136)	Eastern Bluebird	0 (1)
<b>(4)</b> White-th. Sparrow	635 (816)				

**( ) numbers in bold are top ten banded species**

Table 16. Banding effort totals by area and by season, 2016.

<b>Area</b>	<b>Sample Days</b>	<b>Net Hours</b>	<b>Birds Banded</b>	<b>Birds/ 100 Net Hr</b>	<b>Total Captured</b>	<b>Total/ 100 Net Hr</b>
Navarre	108	2,957.2	10,855	83.78	13,148	101.47
Shaker Lakes	44	1,440.5	1,003	69.63	1,212	84.14
Creek Bend	35	3,043	3,168	104.11	4,063	133.52
<b>Season</b>	<b>Sample Days</b>	<b>Net Hours</b>	<b>Birds Banded</b>	<b>Birds/ 100 Net Hr</b>	<b>Total Captured</b>	<b>Total/ 100 Net Hr</b>
All Stations						
Spring	54	5,888.2	6,782	115.18	8,082	137.22
Fall	133	11,552.5	8,244	71.36	10,341	89.51
<b>TOTAL</b>	<b>187</b>	<b>17,440.7</b>	<b>15,026</b>	<b>86.15</b>	<b>18,423</b>	<b>105.63</b>

Table 17. Fall age ratios of selected species, Navarre 2016.

Species	2016		2015		Percent Change	91-15Ave. HY/AHY	2016 % Change from avg.
	Sample	HY/AHY	Sample	HY/AHY			
Baltimore Oriole	9	3.50	16	1.67	+110	5.01	-30
<b>Wh-th Sparrow*</b>	<b>158</b>	<b>6.52</b>	<b>257</b>	<b>2.43</b>	<b>+168</b>	<b>3.57</b>	<b>+83</b>
Song Sparrow	45	5.43	34	0.62	+776	2.08	+161
Cedar Waxwing	9	-	46	7.60	-	2.45	-
<b>Red-eyed Vireo</b>	<b>50</b>	<b>3.55</b>	<b>67</b>	<b>4.58</b>	<b>-22</b>	<b>6.36</b>	<b>-44</b>
Warbling Vireo	4	3.00	22	1.75	+71	9.25	-68
Bl. and Wh. Warbler	29	1.23	14	2.50	-51	1.89	-35
Nashville Warbler	27	1.45	24	3.80	-62	2.64	-45
Tennessee Warbler	34	5.80	64	2.20	+164	6.27	-7
Cape May Warbler	15	6.50	21	0.31	+1996	1.14	+470
Bl-thr. Blue Warb.	62	4.17	49	3.90	+7	3.53	+18
<b>Myrtle Warbler</b>	<b>71</b>	<b>6.10</b>	<b>252</b>	<b>1.80</b>	<b>+239</b>	<b>2.07</b>	<b>+195</b>
<b>Magnolia Warbler</b>	<b>166</b>	<b>2.77</b>	<b>82</b>	<b>2.04</b>	<b>+36</b>	<b>3.24</b>	<b>-15</b>
<b>Blackpoll Warbler</b>	<b>783</b>	<b>5.26</b>	<b>662</b>	<b>1.14</b>	<b>+361</b>	<b>2.03</b>	<b>+159</b>
<b>Ovenbird</b>	84	3.94	45	10.25	-62	6.92	-43
No. Waterthrush	32	5.40	39	3.33	+62	4.19	+29
<b>Com. Yellowthroat</b>	<b>137</b>	<b>2.51</b>	<b>74</b>	<b>3.11</b>	<b>-19</b>	<b>6.95</b>	<b>-64</b>
American Redstart	48	1.82	57	1.71	+6	2.35	-23
<b>Gray Catbird</b>	<b>343</b>	<b>12.72</b>	<b>286</b>	<b>7.67</b>	<b>+66</b>	<b>8.43</b>	<b>+51</b>
House Wren	52	2.06	39	4.57	-55	5.74	-64
<b>Gray-cheek Thrush</b>	<b>209</b>	<b>2.54</b>	<b>114</b>	<b>1.85</b>	<b>+37</b>	<b>2.02</b>	<b>+26</b>
<b>Swainson's Thrush</b>	<b>481</b>	<b>1.72</b>	<b>532</b>	<b>1.35</b>	<b>+27</b>	<b>1.51</b>	<b>+14</b>
<b>Hermit Thrush</b>	<b>170</b>	<b>7.10</b>	<b>234</b>	<b>4.85</b>	<b>+46</b>	<b>5.14</b>	<b>+38</b>
American Robin	28	4.60	137	1.91	+140	3.22	+43

\*Species in bold have samples sizes for both 2015 and 2016 over 50.

Table 18. Banding year of returning birds captured at Navarre study site, 2016.

<b>Species</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>	<b>2012</b>	<b>2011</b>	<b>2010</b>	<b>2009</b>	<b>2008</b>	<b>Total</b>
Downy Woodpecker	6	1		1					8
Yellow-shafted Flicker	1								1
Great-crested Flycatcher	1								1
Blue Jay		2					1		3
Red-winged Blackbird	12	9	4	4	1				30
Baltimore Oriole	6	2	1	3		1	1	1	15
Common Grackle			1	1					2
Song Sparrow	3								3
Swamp Sparrow	1								1
Northern Cardinal	23	4							27
Indigo Bunting	1		1						2
Tree Swallow	1	1			1				3
Warbling Vireo	2		2						4
Prothonotary Warbler	3	2	4		1				10
Yellow Warbler	26	12	9	3	4		1		55
Blackpoll Warbler	1								1
Com. Yellowthroat	4	1		1					6
Gray Catbird	23	9	7	6	3		2		50
Brown Thrasher	1								1
Carolina Wren	1								1
House Wren	8								8
White-breasted Nuthatch	1								1
Black-cap. Chickadee	2	2	1						5
American Robin	3	1	2	3					9
<b>Total</b>	<b>130</b>	<b>46</b>	<b>32</b>	<b>22</b>	<b>10</b>	<b>1</b>	<b>5</b>	<b>1</b>	<b>247</b>

Table 19. Banding year of returning birds captured at Shaker Lakes study site, 2016.

<b>Species</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>	<b>2012</b>	<b>2011</b>	<b>2010</b>	<b>2009</b>	<b>Total</b>
Downy Woodpecker	1							1
Eastern Phoebe		2						2
American Goldfinch	2	1						3
Song Sparrow	4			1				5
Northern Cardinal	4	1	2					7
Gray Catbird		1						1
White-breasted Nuthatch	2							2
Tufted Titmouse	3		1					4
Black-capped Chickadee	2					1		3
American Robin	1	1					1	3
<b>Total</b>	<b>19</b>	<b>6</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>31</b>

Table 20. Banding year of returning birds captured at Creek Bend study site, 2016.

<b>Species</b>	<b>2015</b>	<b>2014</b>	<b>2013</b>	<b>2012</b>	<b>2011</b>	<b>2010</b>	<b>2009</b>	<b>Total</b>
Downy Woodpecker		2						2
American Goldfinch	5	6	2	1				14
Field Sparrow	2		1					3
Song Sparrow	10	3	2	2		2	1	20
Indigo Bunting	2	2						4
Warbling Vireo			1					1
Common Yellowthroat	4	3						7
Gray Catbird	1	1						2
Tufted Titmouse	1							1
<b>Total</b>	<b>25</b>	<b>17</b>	<b>6</b>	<b>3</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>54</b>



Table 21. Foreign recoveries of study banded birds since last progress report.

<b>Species</b>	<b>Band Number</b>	<b>Band Date</b>	<b>Band Location*</b>	<b>Recovery Date</b>	<b>Recovery Location</b>
Common Grackle	1503-02524	08-20-2016	Navarre	06-08-2017	Ohio 413-0830
American Goldfinch	2750-32970	10-27-2015	Creek Bend	08-20-2016	Ohio 413-0825
Prothonotary Warbler	2730-12507	07-04-2014	Navarre	05-13-2016	Ohio 413-0830
Yellow Warbler	2550-16253	07-27-2009	Navarre	05-14-2011	Ohio 413-0831
Black-th-Blue Warbler	2770-37641	09-27-2016	Navarre	10-14-2016	No Carolina 345-0804
Gray Catbird	2641-44440	05-18-2013	Navarre	05-25-2013	Pennsylvania 420-0800
Gray Catbird	2641-44767	05-18-2016	Shaker Lakes	06-08-2017	Ohio 411-0814
Ruby-crowned Kinglet	2380-84813	10-06-2015	Creek Bend	04-22-2016	Ohio 405-0812
American Robin	1342-10225	05-02-2014	Shaker Lakes	04-22-2017	Ohio 412-0813

\*Banding coordinates for study sites: Navarre 413-0830, Shaker Lakes 412-0813, Ottawa NWR 413-0831, Creek Bend 412-0832, Petersburg 415-0833, BSBO 413-0831.

Figure 1. Migration field sites, 1989- 2016.

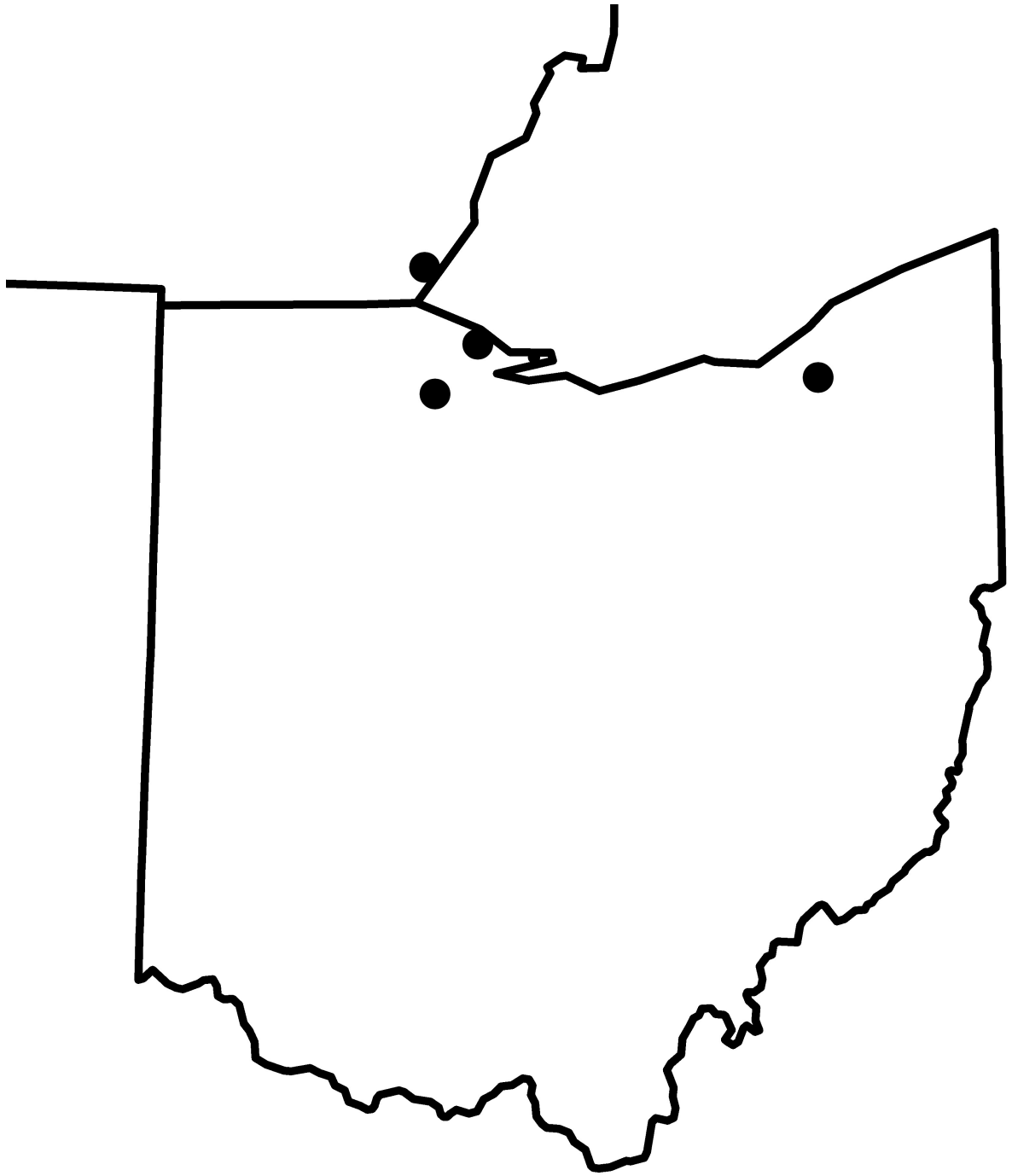


Figure 2. Spring temperature patterns, long-term average and 2016 (9 AM, 100 meters).

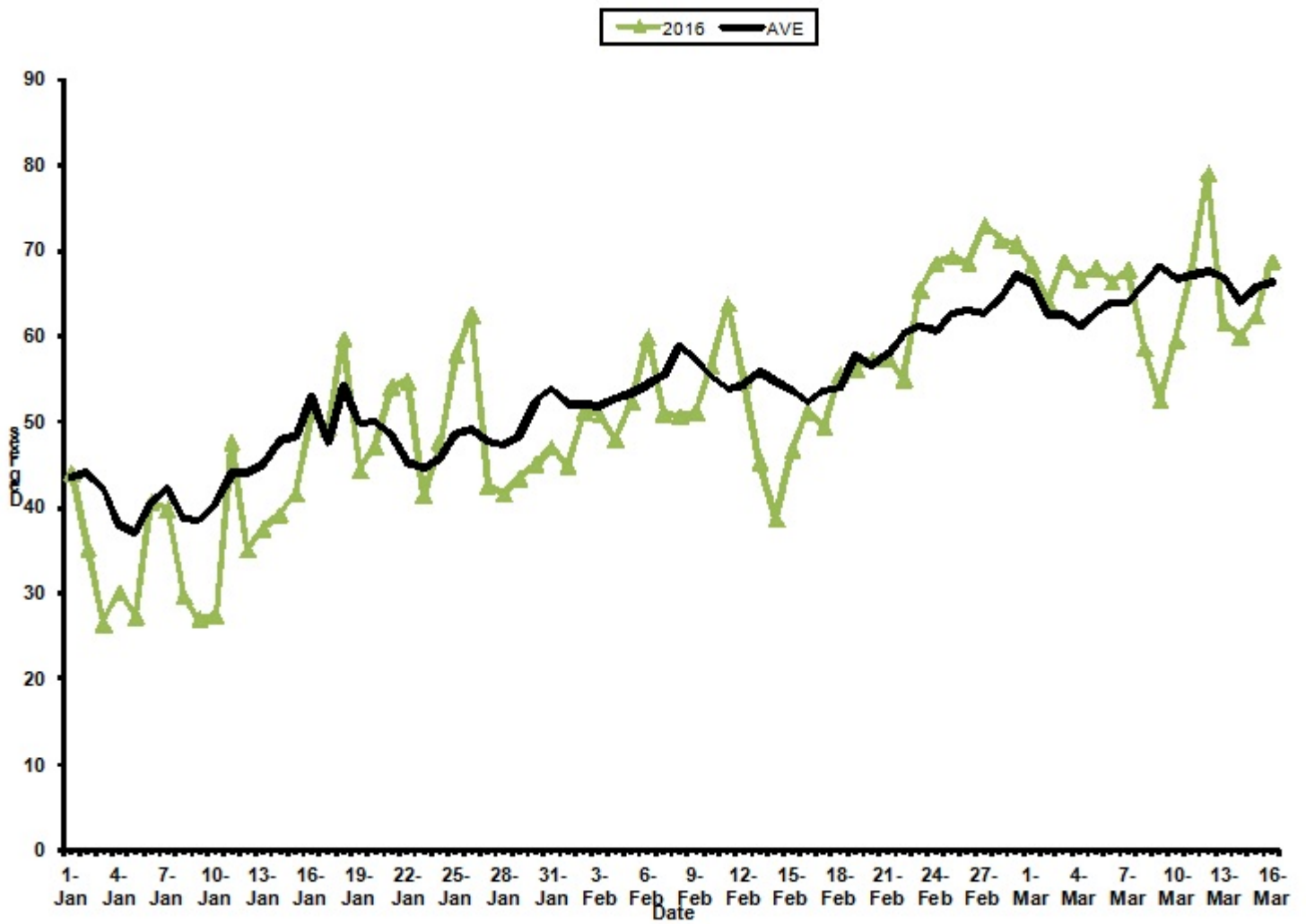


Figure 3. Fall temperature patterns, long-term average and 2016 (9 AM, 100 meters).

