

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

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INTRODUCTION

In 2014, 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 21st 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. Netting was also conducted on an active beach ridge outside the lakefront dike in Navarre during fall migration. This location allows the opportunity to study avian use of a beach ridge from its formation into maturity. 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, Petersburg site in southeastern Michigan, 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 Petersburg site in southern Michigan is shrub habitat that is located past the lake effect zone for bird migration. This site provides a comparison of a habitat away from the lake proper and potentially gives some indications to how quickly migrants spread out across the landscape. 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 2014, migrating and resident passerines were sampled on the Navarre Unit of the Ottawa National Wildlife Refuge and three other sites in the Great Lakes region: Creek Bend, Shaker Lakes, and Petersburg (Figure 1). Sites operated near Cleveland and Lindsey, Ohio, and Monroe, Michigan 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 2013 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 6-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, Creek Bend, and Petersburg sites in 2014. Spring 2014 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 across the country. Good diversity and 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 2014, this wave had a poor first pulse but had a good second pulse, peaking 30 April -04 May. 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 07-16 May with a second pulse on 18-22 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 2014, the third wave appeared as part of the last pulse of the second wave and continued 25-28 May with little movement in June.

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

In spring 2014, the Navarre banding station was operated on 50 days for 7,571.7 net hours. Including hummingbirds, 7,866 new birds were banded and a total of 9,516 birds handled (Table 1). The capture rate was 125.7 birds/100 net hours. This compares to the long-term average (1992-2013) of 121.1 birds/100 net hours (+4% from average). The long-term average shows no change over time of the capture rate at Navarre. One hundred and six species were banded in Navarre during spring 2014 (Table 2). The most unusual species and subspecies included Solitary Sandpiper, Green Heron, Eastern Screech Owl, Belted Kingfisher, Swainson's Warbler, Cerulean Warbler, Louisiana Waterthrush, Pine Warbler, Prairie Warbler, Yellow Palm Warbler, and Northern Mockingbird. This was the first Mockingbird for the banding station and the first spring Belted Kingfisher. The ten most abundant species banded were Magnolia Warbler (615), Yellow-rumped Warbler (563), Gray Catbird (466), American Redstart (449), Yellow Warbler (430), Traill's (Alder/Willow) Flycatcher (340), Swainson's Thrush (330), Common Yellowthroat (311), White-throated Sparrow (305), and Wilson's Warbler (250).

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 46 days during spring 2014. One hundred and thirty-nine species and 21,154 individuals were recorded (Table 3). Northern Cardinal, Red-winged Blackbird, Common Grackle, Tree Swallow, Song Sparrow, and American Robin were observed each count day. The most abundant species recorded was Red-winged Blackbird (3,838) followed by Canada Goose (1,989), Tree Swallow (1,516), Blue Jay (1,444), and Common Grackle (983).

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

This site permits comparison to the Lake Erie coastal sites as a riverine travel lane. 2014 was the 7th year of data collection at this site. Banding operations were conducted on 30 days with 600 new birds banded in 646.8 net hours (92.8 birds/100 net hours) (Table 4). Sixty-three species (Table 5) were

banded with the ten most abundant species being Gray Catbird (69), White-throated Sparrow (52), Nashville Warbler (35), Tennessee Warbler (32), Common Yellowthroat (29), American Redstart (29), Indigo Bunting (28), Magnolia Warbler (24), American Goldfinch (21), and Western Palm Warbler (21). Station surprises included Philadelphia Vireo, Cape May Warbler, Yellow-breasted Chat, and Blackburnian Warbler.

Petersburg Banding Station, Monroe County, Michigan (415-0833)

This site is located west of Lake Erie and north of Toledo and permits comparison to the Lake Erie sites as birds migrate around the lake and disperse through the landscape. 2014 was the 20th year of banding at this site. Banding operations were conducted on 7 days with 145 new birds banded in 943.4 net hours (15.4 birds/100 net hours) (Table 6). Forty species (Table 7) were banded with the six most abundant species banded being Myrtle Warbler (17), Swainson's Thrush (17), Gray Catbird (12), American Goldfinch (10), American redstart (8), and American Robin (8).

Point counts were conducted on 7 days during spring 2014. Thirty-two species with 179 individuals were recorded (Table 8). The most abundant species recorded was American Robin (27) followed by Black-capped Chickadee (25), Northern Cardinal (20), Field Sparrow (12), Blue Jay (11), and American Crow (11).

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

This site is located east of Cleveland at the Nature Center of Shaker Lakes and 2014 was the 13th 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 fourteen days, with 304 new birds banded in 472.8 net hours (64.3 birds/100 net hours). A total of 389 birds were handled (82.3 birds/100 net hours) during spring migration (Table 9). Fifty-five species (Table 10) were banded with the ten most common banded being Ruby-crowned Kinglet (35), Gray Catbird (29), American Goldfinch (28), Canada Warbler (16), American Robin (16), American Redstart (12), Magnolia Warbler (10), Swainson's Thrush (10), White-throated Sparrow (9), and Common Yellowthroat (9). Spotted Sandpiper and White-eyed Vireo were pleasant surprises for the site.

Point counts were conducted on 14 days during spring 2014. Fifty-three species with 470 individuals were recorded (Table 11). The most abundant species recorded was American Robin (69) followed by American Goldfinch (39), Canada Goose (29), Song Sparrow (26), Gray Catbird (26), Mallard (23), Northern Cardinal (20), and Warbling Vireo (20).

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 below 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 9,058.3 net hours. Five thousand nine hundred and eleven birds were banded with a total of 8,045 birds handled including recaptures (Table 12). This was the 22nd fall season in which an extensive netting effort had been conducted on a daily basis. The capture rate for 2014 was 65.3 birds/100 net hours. A total of 85 species were banded during fall 2014 (Table 13). The ten most abundant species banded were Blackpoll Warbler (1,137), Swainson's Thrush (648), White-throated Sparrow (417), Gray Catbird (339), Hermit Thrush (327), Gray-cheeked Thrush (319), Golden-crowned Kinglet (311), Myrtle Warbler (239), Ruby-crowned Kinglet (229), and Magnolia Warbler (152). Several surprises were captured during the fall season and included Cooper's Hawk, Pine Siskin, American Tree Sparrow, Golden-winged Warbler, Prairie Warbler, Marsh Wren, and Red-breasted Nuthatch.

Fall point counts were conducted on 67 days during 2014. A total of 19,501 individuals of 106 species were recorded (Table 14). The Northern Cardinal was observed on all count days. The most abundant species were Red-winged Blackbird (5,183), Canada Goose (2,401), European Starling (1,886), Rusty Blackbird (1,046), and White-throated Sparrow (835).

For the 22nd year, additional nets were run on an active beach ridge just outside the lake front dike near the main study site. This ridge has one band of 60-80 feet tall Cottonwoods about 30 feet wide and 50 yards long. In recent years this ridge has decreased in size with erosion from Lake Erie. The ridge presents an opportunity to document avian use as the habitat matures. This ridge has seen considerable loss of sand the past six years with a major narrowing of the vegetated portion resulting in reduced habitat with higher levels of Lake Erie. In 2014, five nets were run on 64 days for 1,792.6 net hours (Table 15). The capture rate for fall 2014 was 61.5 birds/100 net hours. Unusual captures included Yellow-billed Cuckoo and Nelson's Sparrow. One thousand One hundred and three birds of 61 species were banded on the beach ridge (Table 16). The top ten species banded were Blackpoll Warbler (327), Golden-crowned Kinglet (134), Gray Catbird (94), Swainson's Thrush (69), White-throated Sparrow (44), Ruby-crowned Kinglet (33), Tennessee Warbler (30), Hermit Thrush (29), Common Yellowthroat (25), Magnolia Warbler (24), and Gray-cheeked Thrush (24).

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

Banding operations were conducted on 43 days with 4,000 new birds banded in 3,464.8 net hours (115.5 birds/100 net hours) (Table 17). A total of 4,293 birds were handled for a 123.9 birds/100 net hours at the station. Seventy-nine species (Table 18) were banded with the ten most abundant species being American Goldfinch (1,541), Song Sparrow (363), Indigo Bunting (202), Ruby-crowned Kinglet (162), Myrtle Warbler (155), White-throated Sparrow (135), Lincoln Sparrow (114), Common Yellowthroat (110), Pine Siskin (107), and Swamp Sparrow (100). Considering the habitat

of this site the capture of Scarlet Tanager and Marsh Wren was unexpected. Additional captures of Vesper Sparrow, Pine Siskin, Savannah Sparrow, Yellow-throated Vireo, Connecticut Warbler, and Blue-gray Gnatcatcher 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 29 days with 552 new birds banded in 884.8 net hours (62.4 birds/100 net hours). A total of 655 birds were handled (74.0 birds/100 net hours) during fall migration (Table 19). Sixty-six species (Table 20) were banded with the ten most abundant species being American Goldfinch (78), White-throated Sparrow (58), Myrtle Warbler (42), Swainson's Thrush (40), Magnolia Warbler (27), Golden-crowned Kinglet (23), Ruby-crowned Kinglet (23), Gray Catbird (21), Slate-colored Junco (20), and American Redstart (14). Belted Kingfisher, Pine Siskin, Philadelphia Vireo, Northern Parula, and Connecticut Warbler added to the diversity captured at this site.

Point counts were conducted on 29 days during fall 2014. Fifty-one species and 965 individuals were recorded (Table 21). The most abundant species recorded was Chimney Swift (261) followed by American Goldfinch (161), Canada Goose (92), American Robin (52), and Song Sparrow (34).

SUMMARY BANDINGS

Total combined bandings for passerine migration 2014 for the Black Swamp Bird Observatory is in Table 22. Totals without parentheses are for the National Wildlife Refuge complex. The ten most abundant species banded on Ottawa NWR complex were Blackpoll Warbler (1,582), Swainson's Thrush (1,047), Gray Catbird (899), Myrtle Warbler (812), Magnolia Warbler (791), White-throated Sparrow (766), American Redstart (538), Hermit Thrush (524), Golden-crowned Kinglet (497), and Yellow Warbler (484). Inclusive totals of all sites were topped by American Goldfinch (1,699), Blackpoll Warbler (1,608), Swainson's Thrush (1,162), Gray Catbird (1,079), Myrtle Warbler (1,033), White-throated Sparrow (1,023), Magnolia Warbler (935), Ruby-crowned Kinglet (629), American Redstart (623), and Golden-crowned Kinglet (596). A combined total of 120 species of 20,481 individuals (82.5 birds/100 net hrs) were banded. Totals for each study site and for each season are shown in Table 23. Species with greater than 50 individuals sampled had fall age ratios generally lower than the long-term average (Table 24).

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 2014, 340 birds of 23 species were captured as returning birds at the Navarre sites (Table 25). This total includes 78 Yellow Warblers with the oldest being banded in 2006, 101 Gray Catbirds with the oldest from 2007, 14 Common Yellowthroats (oldest from 2008), 55 Red-winged Blackbird (oldest from 2009), 10 Northern Cardinals (oldest from 2010), 13 American Robin (oldest from 2010), and 13 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 33 birds of 11 species were return captures at Shaker Lakes in 2014 (Table 26). Creek Bend had 55 individuals of 15 species return from previous year bandings (Table 27). A Gray Catbird was captured at Creek Bend on 5 May and recaptured at Navarre on 10 May. A slight reverse migration was noted in a Nashville Warbler banded at Navarre on 26 April and recaptured at Creek Bend one day later. This is an indication that migrants back off the lake shore on unfavorable northerly winds. Petersburg had 12 returns of 4 species (Table 28). Several foreign captures were made of study birds and are reported in Table 29 as well as two foreign banded bird that were captured during the 2014 study year. A Wilson's Warbler banded in 2013 in Illinois and a Canada Warbler banded in 2011 in Ontario were captured in Navarre during the spring migration. The biggest surprise of the spring came in the form of a Common Yellowthroat banded in the fall at Navarre was recaptured in Florida 28 days later.

ENERGETIC CONDITION

The relationship between energetic condition during migration and breeding success is not well known in passerines. There are many factors that could affect the amount of fat a bird may carry at any given time. We are collecting data on several factors that may affect lipid deposition, but it will be several years before those trends may be tied to productivity. For 2014, 35 species (Table 30) had adequate sample sizes in both 2013 and 2014 to look at the changes in average fat deposits during spring migration. There was considerable variability in species when comparing 2013 and 2014. Twenty species indicated higher fat deposits in 2014 and 15 in 2013.

For passerines it is extremely difficult to acquire an adequate sample of breeding pairs to assess annual production on the breeding grounds. Considerable work has been conducted on larger species, especially waterfowl, on the relationship of spring body condition and reproductive success that breeding season. One method of assessing annual production in passerines is to compare fall age ratios (e.g. production) to spring migration body condition where an adequate sample may be acquired. Of 13 species with adequate sample sizes of spring fat and fall age ratios, eight appeared to show a similar trend in fat between 2013 and 2014 and the percent change in age ratios for these species between the two years. This relationship will be monitored for potential usefulness in assessing species productivity.

In 2014, fall fat composition was higher in 2013 in 7 species with 13 species higher in 2014 ($p < .05$) (Table 31).

DISCUSSION

Black Swamp Bird Observatory has conducted bird migration monitoring research in the Lake Erie Marsh Region for more than 30 years. Annual variation in migrational monitoring numbers makes statements concerning populations very risky, even with long-term datasets. This past spring resulted in an above average capture rate which followed the low year of 2012 which followed a record number of birds banded the spring 2011 and an extremely low total in 2010. 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 indepth 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 2014, project personnel entertained 50 groups at Navarre and the Black Swamp Bird Observatory Nature Center educating 1,300 individuals on migration and

banding. In addition, nine presentations were made to 500 people on avian ecology and migration. As a part of International Migratory Bird Day events, banding demonstrations were presented on the Magee Marsh State Wildlife Area for some 1,500 people. 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 2014.

Date	Net Hour	Banded	Banded/ 100 net hr	Returns	Recaptures	Total birds*	Total bird/ 100 net hr
410	94.25	63	66.84	3	0	66	70.03
412	109.25	56	51.26	2	2	60	54.92
417	128.42	94	73.20	8	7	109	84.88
418	118.84	100	84.15	2	5	107	90.04
419	159.08	37	23.26	7	8	53	33.32
420	145.59	34	23.35	3	7	45	30.91
421	151.41	85	56.14	1	6	92	60.76
422	118.84	26	21.88	1	8	35	29.45
423	141.68	26	18.35	4	10	40	28.23
424	126.50	15	11.86	0	7	24	18.97
425	69.00	54	78.26	0	6	60	86.96
426	145.59	67	46.02	2	13	84	57.70
427	128.41	13	10.12	0	9	22	17.13
428	111.09	4	3.60	1	2	7	6.30
429	166.75	46	27.59	2	13	61	36.58
430	180.09	205	113.83	1	16	222	123.27
501	132.25	44	33.27	8	14	66	49.91
502	125.35	48	38.29	3	20	71	56.64
503	155.25	223	143.64	5	16	244	157.17
504	193.58	344	177.70	5	15	364	188.04
505	166.75	100	59.97	5	30	136	81.56
506	159.09	92	57.83	6	31	129	81.09
507	149.50	211	141.14	9	41	262	175.25
508	176.41	509	288.53	12	22	543	307.81
509	182.09	531	291.61	16	22	569	312.48
510	187.84	471	250.75	22	53	546	290.67
511	182.09	278	152.67	16	75	369	202.65
512	191.59	353	184.25	14	63	430	224.44
513	170.59	494	289.58	11	40	545	319.48
514	149.50	319	213.38	6	61	386	258.19
515	RAIN						
516	212.75	334	156.99	17	139	491	230.79
517	95.84	51	53.21	4	39	94	98.08
518	189.75	152	80.11	6	98	256	134.91
519	180.16	243	134.88	5	55	303	168.18
520	184.00	360	195.65	6	55	421	228.80
521	138.00	309	223.91	8	29	346	250.73
522	176.41	243	137.75	8	38	289	163.82
523	161.00	124	77.02	10	51	186	115.53
524	164.84	99	60.06	8	38	145	87.96
525	170.59	202	118.41	4	16	222	130.14
526	155.25	164	105.64	2	23	190	122.38
527	162.91	189	116.02	2	18	209	128.29
528	161.00	111	68.94	6	35	154	95.65
529	128.41	58	45.17	6	24	88	68.53
530	159.09	54	33.94	4	16	74	46.52
531	153.41	45	29.33	4	13	62	40.42
601	132.25	33	24.95	2	6	41	31.00
602	159.09	57	35.83	5	11	73	45.89
603	134.16	37	27.58	3	16	56	41.74
604	136.09	59	43.35	2	8	69	50.70
TOTAL	7571.67	7866	103.89	287	1350	9516	125.68

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

Table 2. Spring banding totals, Navarre, 2014.

Species	Banded	Species	Banded	Species	Banded
Green Heron	5	Swamp Sparrow	121	Pine Warbler	1
Solitary Sandpiper	1	Fox Sparrow	11	Western Palm Warbler	240
Mourning Dove	4	Eastern Towhee	1	Yellow Palm Warbler	2
Sharp-shinned Hawk	4	Northern Cardinal	45	Prairie Warbler	1
Eastern Screech Owl	1	Rose-breasted Grosbeak	17	Ovenbird	121
Belted Kingfisher	1	Indigo Bunting	35	Northern Waterthrush	172
Black-billed Cuckoo	2	Scarlet Tanager	4	Louisiana Waterthrush	6
Downy Woodpecker	3	Tree Swallow	14	Connecticut Warbler	6
Yellow-bellied Sapsucker	1	Cedar Waxwing	10	Mourning Warbler	98
Red-bellied Woodpecker	1	Red-eyed Vireo	130	Common Yellowthroat	311
Yellow-shafted Flicker	6	Philadelphia Vireo	26	Yellow-breasted Chat	2
Whip-poor-will	1	Warbling Vireo	29	Hooded Warbler	7
Ruby-th. Hummingbird	72	Blue-headed Vireo	22	Wilson's Warbler	250
Eastern Kingbird	3	White-eyed Vireo	8	Canada Warbler	92
Great-crested Flycatcher	27	Black and White Warbler	80	American Redstart	449
Eastern Phoebe	6	Prothonotary Warbler	5	Northern Mockingbird	1
Eastern Wood Pewee	35	Swainson's Warbler	1	Gray Catbird	466
Yellow-bellied Flycatcher	91	Blue-winged Warbler	14	Brown Thrasher	16
Acadian Flycatcher	7	Golden-winged Warbler	2	Carolina Wren	3
Trail's Flycatcher	340	Nashville Warbler	221	House Wren	72
Least Flycatcher	54	Orange-crowned Warbler	14	Winter Wren	18
Blue Jay	17	Tennessee Warbler	176	Marsh Wren	1
Red-winged Blackbird	199	Northern Parula	51	Brown Creeper	17
Baltimore Oriole	27	Cape May Warbler	34	Red-breasted Nuthatch	1
Rusty Blackbird	4	Yellow Warbler	430	Black-capped Chickadee	6
Common Grackle	27	Black-th.-Blue Warbler	52	Golden-crowned Kinglet	52
Purple Finch	1	Myrtle Warbler	563	Ruby-crowned Kinglet	130
American Goldfinch	14	Magnolia Warbler	615	Blue-gray Gnatcatcher	67
White-crowned Sparrow	23	Cerulean Warbler	2	Wood Thrush	25
White-throated Sparrow	305	Chestnut-sided Warbler	149	Veery	73
Chipping Sparrow	1	Bay-breasted Warbler	78	Gray-cheeked Thrush	62
Field Sparrow	5	Blackpoll Warbler	118	Swainson's Thrush	330
Slate-colored Junco	13	Blackburnian Warbler	28	Hermit Thrush	168
Song Sparrow	32	Black-th.-Green Warbler	89	American Robin	21
Lincoln Sparrow	51				

Table 3. Number of days observed and totals of species seen on point counts, Navarre spring 2014.

Species	# days	#Observed	Species	# days	#Observed	Species	# days	#Observed
Pied-billed Grebe	37	129	Great-cr. Flycatcher	9	23	Black & White Warbler	26	65
Herring Gull	11	16	Eastern Phoebe	4	10	Prothonotary Warbler	24	45
Ring-billed Gull	31	113	Olive-sided Fly.	1	1	Blue-winged Warbler	3	3
Bonaparte's Gull	6	14	E. Wood Pewee	13	23	Nashville Warbler	11	83
Common Tern	3	4	Yellow-bel. Flycatcher	2	2	Orange-cr. Warbler	1	1
Caspian Tern	7	10	Acadian Flycatcher	1	1	Tennessee Warbler	15	122
Dou.-cr. Cormorant	22	356	Alder Flycatcher	5	6	Northern Parula	7	22
Hooded Merganser	1	1	Willow Flycatcher	16	69	Cape May Warbler	1	2
Mallard	18	49	Traill's Flycatcher	1	1	Yellow Warbler	36	942
Gadwall	8	54	Least Flycatcher	15	24	Black-th.-Blue Warbler	5	9
American Wigeon	1	3	Blue Jay	45	1444	Myrtle Warbler	27	272
Am. Green-wing. Teal	1	2	E. Starling	42	444	Magnolia Warbler	17	111
Wood Duck	30	104	Bobolink	5	10	Cerulean Warbler	3	3
Lesser Scaup	8	55	Brown-headed Cowbird	43	371	Chestnut-sided Warbler	18	45
Bufflehead	2	2	Red-winged Blackbird	46	3838	Bay-breasted Warbler	13	41
Canada Goose	44	1989	Orchard Oriole	4	5	Blackpoll Warbler	18	76
Trumpeter Swan	15	42	Baltimore Oriole	31	388	Blackburnian Warbler	10	16
American Bittern	1	1	Rusty Blackbird	16	193	Black-th.-Green Warbler	19	61
Least Bittern	2	3	Common Grackle	46	983	Pine Warbler	3	3
Gr.-blue Heron	44	215	Purple Finch	1	9	W. Palm Warbler	19	66
Great Egret	19	33	Am. Goldfinch	32	109	Ovenbird	12	33
Little Blue Heron	1	1	White-cr. sparrow	2	7	No. Waterthrush	19	96
Green Heron	2	2	White-th. Sparrow	30	683	Connecticut Warbler	3	3
Black-cr. N. Heron	2	2	Chipping Sparrow	1	2	Mourning Warbler	7	9
Sandhill Crane	14	29	Field Sparrow	1	1	Com. Yellowthroat	34	210
Sora	1	1	Slate-colored Junco	6	20	Hooded Warbler	1	1
Virginia Rail	3	3	Song Sparrow	46	233	Wilson's Warbler	17	75
Lesser Yellowlegs	3	7	Lincoln Sparrow	6	7	Canada Warbler	7	22
Solitary Sandpiper	1	1	Swamp Sparrow	24	88	American Redstart	23	175
Killdeer	4	5	Fox Sparrow	3	7	Gray Catbird	33	752
Mourning Dove	34	105	Eastern Towhee	15	23	Brown Thrasher	27	107
Sharp-sh.. Hawk	3	4	No. Cardinal	46	851	Carolina Wren	20	34
Red-tailed Hawk	35	41	Rose-br. Grosbeak	11	35	House Wren	33	194
Bald Eagle	25	51	Indigo Bunting	22	81	Winter Wren	5	8
American Kestrel	1	1	Scarlet Tanager	11	15	Marsh Wren	16	22
Peregrine Falcon	1	1	Purple Martin	14	35	Black-capped Chickadee	21	39
Turkey Vulture	1	1	Barn Swallow	21	33	Golden-crowned Kinglet	2	13
Yellow-billed Cuckoo	7	7	Tree Swallow	46	1516	Ruby-crowned Kinglet	22	138
Black-billed Cuckoo	11	31	Bank Swallow	9	15	Blue-gray Gnatcatcher	28	145
Belted Kingfisher	2	2	Rough-winged Swallow	8	11	Wood Thrush	27	111
Downy Woodpecker	22	34	Cedar Waxwing	18	384	Veery	10	16
Red-head. Woodpeck	1	1	Red-eyed Vireo	23	171	Gray-cheeked Thrush	8	13
Red-b. Woodpecker	4	4	Philadelphia Vireo	4	4	Swainson's Thrush	18	98
Yellow-shafted Flicker	33	99	Warbling Vireo	28	148	Hermit Thrush	12	44
Chimney Swift	14	49	Yellow-throated Vireo	2	2	American Robin	46	441
Ruby-th. Humming.	5	5	Blue-headed Vireo	11	13	Unk. Flycatcher	2	2
Eastern Kingbird	21	49	White-eyed Vireo	5	7	Unk. warbler	28	268

Table 4. Daily banding totals for Creek Bend, spring 2014.

Date	Net Hour	Banded	Banded/ 100 net hr	Returns	Recaptures	Total birds	Total bird/ 100 net hr
411	5.00	1	20.00	1	0	2	40.00
412	15.00	6	40.00	7	0	13	86.67
413	2.00	2	100.00	4	0	6	300.00
418	18.00	9	50.00	1	3	13	72.22
419	13.50	10	74.07	1	0	11	81.48
421	22.50	8	35.56	3	2	13	57.78
423	13.50	11	81.48	2	0	13	96.30
424	5.50	1	18.18	0	4	5	90.91
425	19.50	14	71.80	1	4	19	97.44
429	4.50	3	66.67	0	0	3	66.67
430	13.50	3	22.22	0	1	4	29.63
504	19.50	29	148.72	1	1	31	158.97
505	29.75	26	87.40	3	2	31	104.20
506	25.50	33	129.41	0	0	33	129.41
508	47.50	70	147.37	8	3	81	170.53
509	22.00	30	136.36	4	0	34	154.55
510	38.00	76	200.00	6	4	86	226.32
511	34.00	30	88.24	2	3	35	102.94
513	26.00	49	188.46	2	3	54	207.69
516	26.00	40	153.85	3	3	46	176.92
517	26.00	23	88.46	3	7	33	126.92
518	26.00	18	69.23	1	5	24	92.31
519	37.50	33	88.00	2	5	40	106.67
520	16.50	6	36.36	1	5	12	72.73
522	19.50	18	92.31	2	3	23	117.95
523	32.50	15	46.15	2	2	19	58.46
524	19.50	10	51.28	1	6	17	87.18
527	26.00	13	50.00	1	5	19	73.08
530	26.00	10	38.46	1	7	18	69.23
602	16.50	3	18.18	2	2	7	42.42
TOTAL	646.75	600	92.77	65	80	745	115.19

Table 5. Daily banding totals Creek Bend, spring, 2014.

Species	Banded	Species	Banded	Species	Banded
Downy Woodpeck	2	Eastern Towhee	1	Black-th-green Warbler	3
Red-bellied Woodpec	1	Northern Cardinal	4	Western Palm Warbler	21
Eastern Wood Pewee	1	Rose-br. Grosbeak	1	Ovenbird	8
Yellow-bellied Flycat.	2	Indigo Bunting	28	Northern Waterthrush	6
Traill's Flycatcher	17	Scarlet Tanager	1	Mourning Warbler	4
Least Flycatcher	11	Cedar Waxwing	3	Common Yellowthroat	29
Blue Jay	1	Red-eyed Vireo	6	Yellow-breasted Chat	1
Red-winged Blackbird	2	Philadelphia Vireo	1	Wilson's Warbler	15
Orchard Oriole	4	Warbling Vireo	5	Canada Warbler	6
Baltimore Oriole	4	White-eyed Vireo	5	American Redstart	29
American Goldfinch	21	Nashville Warbler	35	Gray Catbird	69
White-cr. Sparrow	3	Tennessee Warbler	32	Brown Thrasher	2
White-th. Sparrow	52	Northern Parula	2	House Wren	9
Am. Tree Sparrow	3	Cape May Warbler	1	Golden-crowned Kinglet	1
Chipping Sparrow	1	Yellow Warbler	16	Ruby-crowned Kinglet	13
Field Sparrow	4	Black-th-blue Warbler	2	Blue-gray Gnatcatcher	9
Slate-colored Junco	4	Myrtle Warbler	6	Wood Thrush	2
Song Sparrow	13	Magnolia Warbler	24	Gray-cheeked Thrush	3
Lincoln Sparrow	11	Chestnut-sided Warbler	3	Swainson's Thrush	12
Swamp Sparrow	12	Blackpoll Warbler	4	Hermit Thrush	2
Fox Sparrow	1	Blackburnian Warbler	1	American Robin	5

Table 6. Daily banding totals for Petersburg, spring 2014.

Date	Net Hour	Banded	Banded/ 100 net hr	Returns	Recaptures	Total birds	Total bird/ 100 net hr
426	171.6	26	15.17	3	0	29	16.90
508	145.0	52	35.86	4	1	57	39.31
511	108.4	22	20.30	2	5	29	26.75
516	166.6	19	11.40	1	5	25	15.01
518	123.4	12	9.72	3	1	16	12.97
519	108.4	5	4.61	0	2	7	6.46
522	120.0	9	7.50	0	0	9	7.50
TOTAL	943.4	145	15.37	13	14	172	18.20

Table 7. Daily banding totals Petersburg, spring, 2014.

Species	Banded	Species	Banded	Species	Banded
Solitary Sandpiper	1	Rose-breasted Grosbeak	1	Canada Warbler	1
Hairy Woodpecker	1	Warbling Vireo	1	American Redstart	8
Yellow-bellied Flycatcher	1	Black and White Warbler	2	Gray Catbird	12
Willow Flycatcher	2	Nashville Warbler	1	Winter Wren	2
Blue Jay	3	Orange-crowned Warbler	1	White-breasted Nuthatch	1
Red-winged Blackbird	1	Tennessee Warbler	2	Tufted Titmouse	1
Baltimore Oriole	1	Black-throated Blue War.	1	Ruby-crowned Kinglet	4
Common Grackle	1	Myrtle Warbler	17	Blue-gray Gnatcatcher	1
American Goldfinch	10	Magnolia Warbler	7	Veery	5
White-throated Sparrow	3	Chestnut-sided Warbler	1	Gray-cheeked Thrush	2
Chipping Sparrow	1	Western Palm Warbler	4	Swainson's Thrush	17
Field Sparrow	1	Ovenbird	3	Hermit Thrush	3
Eastern Towhee	1	Northern Waterthrush	7	American Robin	8
Northern Cardinal	5				

Table 8. Point count days conducted and species totals, spring season, Petersburg, 2014.

Species	# days	# birds	Species	# days	# birds	Species	# days	# bird
Wood Duck	1	1	European Starling	1	1	Ovenbird	1	1
Canada Goose	3	6	Brown-head. Cowbird	3	3	Common Yellowthroat	2	2
Marbled Godwit	1	1	Red-winged Blackbird	2	3	Wilson's Warbler	1	1
Ring-necked Pheasant	1	2	Baltimore Oriole	1	1	American Redstart	3	3
Mourning Dove	2	4	Common Grackle	4	6	Gray Catbird	2	6
Red-bellied Woodpec	4	8	American Goldfinch	3	3	House Wren	1	1
Yellow-sh. Flicker	1	2	Chipping Sparrow	3	3	Black-cap Chickadee	6	25
Gr.-cr. Flycatcher	2	3	Field Sparrow	5	12	Verry	1	1
Eastern Wood Pewee	4	6	Eastern Towhee	2	2	Swainson's Thrush	2	2
Blue Jay	7	11	No. Cardinal	7	20	American Robin	7	27
Am. Crow	5	11	Myrtle Warbler	1	1			

Table 9. Daily banding totals for Shaker Lakes, spring 2014.

Date	Net Hour	Banded	Banded/ 100 net hr	Returns	Recaptures	Total birds	Total bird/ 100 net hr
421	34.00	14	41.18	2	0	16	47.06
423	30.00	21	70.00	8	3	32	106.67
428	34.50	25	72.46	2	2	29	84.06
502	35.00	33	94.29	3	2	38	108.57
505	34.50	12	34.78	0	5	17	49.28
507	25.00	16	64.00	2	3	21	84.00
509	33.00	27	81.82	6	2	35	106.06
512	36.50	22	60.27	2	4	28	76.71
514	35.50	19	53.52	0	5	24	67.61
516	28.75	41	142.61	3	9	53	184.35
519	35.00	19	54.29	2	3	24	68.57
521	36.50	29	79.45	1	3	33	90.41
523	39.50	22	55.70	2	6	30	75.95
526	35.00	4	11.43	1	4	9	25.71
TOTAL	472.75	304	64.30	34	51	389	82.28

Table 10. Daily banding totals Shaker Lakes, spring 2014.

Species	Banded	Species	Banded	Species	Banded
Spotted Sandpiper	1	Rose-breasted Grosbeak	1	Common Yellowthroat	9
Hairy Woodpecker	1	Indigo Bunting	3	Wilson's Warbler	8
Downy Woodpecker	3	Red-eyed Vireo	5	Canada Warbler	16
Eastern Phoebe	2	White-eyed Vireo	1	American Redstart	12
Yellow-bellied Flycatcher	1	Black & White Warbler	5	Gray Catbird	29
Traill's Flycatcher	1	Nashville Warbler	1	House Wren	4
Least Flycatcher	1	Tennessee Warbler	12	White-br. Nuthatch	2
Blue Jay	2	Yellow Warbler	4	Tufted Titmouse	1
Brown-headed Cowbird	1	Black-th. Blue Warbler	6	Black-capped Chickadee	1
Red-winged Blackbird	4	Myrtle Warbler	1	Golden-cr. Kinglet	3
Baltimore Oriole	3	Magnolia Warbler	10	Ruby-cr. Kinglet	35
Common Grackle	1	Chestnut-sided Warbler	8	Blue-gray Gnatcatcher	2
American Goldfinch	28	Bay-breasted Warbler	1	Wood Thrush	2
White-throated Sparrow	9	Blackburnian Warbler	1	Veery	1
Field Sparrow	1	Black-th Green Warbler	1	Swainson's Thrush	10
Slate-colored Junco	1	Western Palm Warbler	6	Hermit Thrush	7
Song Sparrow	1	Ovenbird	4	American Robin	16
Lincoln's Sparrow	1	Northern Waterthrush	7		
Northern Cardinal	4	Mourning Warbler	3		

Table 11. Point count days conducted and species totals, spring season, Shaker Lakes, 2014.

Species	# days	# birds	Species	# days	# birds	Species	# days	# birds
Mallard	10	23	Acadian Flycatcher	1	1	Black-th-blue Warbler	1	1
Wood Duck	2	3	Blue Jay	8	15	Magnolia Warbler	1	1
Canada Goose	8	29	American Crow	2	3	Chestnut-sided Warb.	1	1
Great Blue Heron	4	7	Brown-head. Cowbird	2	3	Wilson's Warbler	1	1
Solitary Sandpiper	3	5	Red-wing . Blackbird	12	17	American Redstart	1	1
Spotted Sandpiper	1	1	Baltimore Oriole	7	10	Gray Catbird	10	26
Mourning Dove	4	8	Common Grackle	1	1	White-br. Nuthatch	5	5
Rock Pigeon	3	11	American Goldfinch	11	39	Tufted Titmouse	8	12
Red-tailed Hawk	1	1	White-th. Sparrow	2	5	Black-cap. Chickadee	10	18
Belted Kingfisher	4	4	Song Sparrow	13	26	Ruby-crowned Kinglet	1	3
Hairy Woodpecker	2	2	No. Cardinal	12	20	Blue-gray Gnatcatcher	3	3
Downy Woodpecker	1	1	Scarlet Tanager	1	1	Wood Thrush	2	2
Yellow-bel. Sapsucker	1	1	N. Rough-wing Swal.	1	1	Hermit Thrush	1	1
Red -bell Woodpecker	6	7	Red-eyed Vireo	5	12	American Robin	14	69
Chimney Swift	5	10	Warbling Vireo	8	20	Unk. Gull	6	7
Gr-cr Flycatcher	5	7	Blue-headed Vireo	1	1	Unk. Warbler	6	7
Eastern Phoebe	5	6	Tennessee Warbler	3	4	Unk Swallow	1	1
Eastern Wood Pewee	1	1	Yellow Warbler	4	5			

Table 12. Daily banding totals for Navarre, fall 2014.

Date	Net Hour	Banded	Banded/100 net hr	Returns	Recaptures	Total birds*	Total bird/ 100 net hr
704	99.59	45	45.19	3	11	59	59.24
715	126.50	88	69.57	8	31	127	100.40
802	53.17	17	31.97	0	2	19	35.73
820	141.84	35	24.68	1	3	39	27.50
821	132.25	28	21.17	0	9	37	27.98
822	115.00	26	22.61	0	2	28	24.35
823	111.09	15	13.50	0	2	17	15.31
824	109.25	23	21.05	1	6	30	27.46
825	109.25	5	4.58	0	5	10	9.15
826	103.50	7	6.76	0	2	9	8.70
827	126.50	30	23.72	1	1	32	25.30
828	115.00	25	21.74	0	6	31	26.96
829	111.16	10	9.00	0	5	15	13.49
830	111.90	11	9.83	0	6	17	15.19
831	113.09	8	7.07	0	5	13	11.50
901	115.00	14	12.17	0	4	18	15.65
902	111.09	12	10.80	0	7	19	17.10
903	130.41	44	33.74	0	6	50	38.34
904	120.75	34	28.16	0	3	37	30.64
905	115.00	31	26.96	0	4	35	30.44
906	109.25	40	36.61	0	5	45	41.19
907	124.59	35	28.09	0	12	47	37.72
908	128.41	38	29.59	0	8	46	35.82
909	138.00	49	35.51	0	11	60	43.48
910	120.75	43	35.61	1	4	48	39.75
911	132.25	48	36.30	0	9	57	43.10
912	138.00	79	57.25	0	11	90	65.22
913	120.75	147	121.74	0	22	169	139.96
914	138.00	142	102.90	1	20	163	118.12
915	130.41	166	127.29	0	35	201	154.13
916	145.59	153	105.09	0	23	176	120.89
917	147.59	162	109.76	0	34	196	132.80
918	138.00	108	78.26	0	29	137	99.28
919	126.50	103	81.42	0	30	135	106.72
920	136.09	97	71.28	0	30	127	93.32
921	132.25	299	226.09	0	23	322	243.48
922	138.00	304	220.29	0	96	400	289.86
923	145.59	160	109.90	1	51	212	145.61
924	139.91	72	51.46	1	44	117	83.63
925	134.16	48	35.78	1	28	77	57.39
926	136.09	49	36.01	0	31	80	58.79
927	122.59	53	43.23	0	23	76	62.00
928	126.50	40	31.62	0	27	67	52.96
929	134.16	78	58.14	0	26	104	77.52
930	136.09	77	56.58	0	29	106	77.89
1001	143.75	77	53.57	0	27	104	72.35
1002	139.91	55	39.31	0	30	85	60.75
1003	92.00	26	28.26	0	24	50	54.35
1004	149.50	175	117.06	0	52	227	151.84
1005	124.59	192	154.11	0	71	263	211.09
1006	134.16	120	89.45	0	83	203	151.31
1007	130.41	83	63.65	1	98	182	139.56
1008	155.25	112	72.14	0	77	189	121.74
1009	149.50	246	164.55	0	86	332	222.07
1010	149.50	111	74.25	0	77	188	125.75
1011	139.91	127	90.77	0	71	198	141.52
1012	118.84	57	47.96	0	42	99	83.31
1013	138.00	73	52.90	0	59	132	95.65
1014	126.50	28	22.13	0	52	80	63.24
1015	136.09	51	37.48	0	48	99	72.75
1016	149.50	311	208.03	0	33	344	230.10
1017	172.50	195	113.04	0	59	254	147.25
1018	153.41	163	106.25	0	91	254	165.57
1019	149.50	152	101.67	0	62	214	143.14
1020	136.09	50	36.74	0	30	80	58.79
1021	126.50	27	21.34	0	30	57	45.06
1022	138.00	171	123.91	0	29	200	144.93

1023	157.09	107	68.11	0	32	139	88.48
1025	130.41	63	48.31	0	40	103	78.98
1029	126.50	41	32.41	0	28	69	54.55
TOTAL	9058.27	5911	65.26	20	2112	8045	88.81

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

Table 13. Fall banding totals, Navarre 2014.

Species	Banded	Species	Banded	Species	Banded
Sharp-shinned Hawk	1	Fox Sparrow	17	Prairie Warbler	1
Cooper's Hawk	1	Eastern Towhee	1	Ovenbird	67
Yellow-billed Cuckoo	3	Northern Cardinal	56	Northern Waterthrush	52
Hairy Woodpecker	1	Rose-breasted Grosbeak	28	Connecticut Warbler	11
Downy Woodpecker	21	Indigo Bunting	5	Mourning Warbler	8
Yellow-bellied Sapsucker	2	Scarlet Tanager	1	Common Yellowthroat	89
Yellow-shafted Flicker	10	Cedar Waxwing	28	Wilson's Warbler	23
Ruby-th. Hummingbird	2	Red-eyed Vireo	56	Canada Warbler	10
Great-cr. Flycatcher	2	Philadelphia Vireo	7	American Redstart	76
Eastern Phoebe	12	Warbling Vireo	15	Gray Catbird	339
Eastern. Wood Pewee	20	Blue-headed Vireo	6	Brown Thrasher	6
Yellow-bellied Flycatcher	38	Black and White Warbler	27	Carolina Wren	5
Trail's Flycatcher	5	Prothonotary Warbler	12	House Wren	33
Least Flycatcher	10	Golden-winged Warbler	2	Winter Wren	70
Blue Jay	7	Nashville Warbler	53	Marsh Wren	1
Red-winged Blackbird	8	Orange-crowned Warbler	4	Brown Creeper	60
Baltimore Oriole	2	Tennessee Warbler	135	White-breasted Nuthatch	4
Rusty Blackbird	17	Northern Parula	3	Red-breasted Nuthatch	1
Common Grackle	61	Cape May Warbler	91	Black-capped Chickadee	10
Purple Finch	31	Yellow Warbler	43	Golden-crowned Kinglet	311
American Goldfinch	6	Black-th.-Blue Warbler	44	Ruby-crowned Kinglet	229
Pine Siskin	2	Myrtle Warbler	239	Wood Thrush	14
White-crowned Sparrow	11	Magnolia Warbler	152	Veery	19
White-throated Sparrow	417	Chestnut-sided Warbler	7	Gray-checked Thrush	319
American Tree Sparrow	1	Bay-breasted Warbler	45	Swainson's Thrush	648
Slate-colored Junco	37	Blackpoll Warbler	1137	Hermit Thrush	327
Song Sparrow	52	Blackburnian Warbler	5	American Robin	54
Lincoln Sparrow	11	Black-th.-Green Warbler	14		
Swamp Sparrow	94	Western Palm Warbler	6		

Table 14. Number of days observed and totals of species seen on point counts, Navarre fall 2014.

Species	# days	#Observed	Species	# days	#Observed	Species	# days	#Observed
Pied-billed Grebe	1	1	Red-bell. Woodpecker	17	21	Tennessee Warbler	17	33
Herring Gull	22	45	Yellow-sh. Flicker	29	54	Cape May Warbler	5	6
Ring-billed Gull	51	447	Common Nighthawk	1	1	Bl-th-blue Warbler	2	2
Bonaparte's Gull	16	108	Chimney Swift	22	89	Myrtle Warbler	25	176
Caspian Tern	5	8	Eastern Kingbird	3	4	Magnolia Warbler	16	27
D-c. Cormorant	12	280	Eastern Phoebe	8	8	Blackpoll Warbler	39	337
Mallard	31	283	Eastern Wood Pewee	8	9	Blackburnian Warbler	1	1
American Black Duck	5	12	Least Flycatcher	1	1	Blk.-th-green Warbler	3	3
Gadwall	6	12	Blue Jay	65	422	Western Palm Warbler	1	1
American Wigeon	5	56	European Starling	56	1886	Ovenbird	29	62
Northern Shoveler	1	3	Brown-headed Cowbird	3	5	Northern Waterthrush	2	2
Northern Pintail	3	234	Red-winged Blackbird	61	5183	Common Yellowthroat	9	10
Wood Duck	34	148	Baltimore Oriole	15	60	Wilson Warbler	2	2
Lesser Scaup	2	15	Rusty Blackbird	20	1046	American Redstart	11	13
Canada Goose	64	2401	Common Grackle	53	772	Gray Catbird	54	378
Trumpeter Swan	7	14	Purple Finch	7	25	Brown Thrasher	12	13
Great- blue Heron	42	89	House Finch	2	3	Carolina Wren	50	139
Great Egret	6	7	American Goldfinch	28	51	House Wren	7	9
Black-cr. Night-Heron	1	1	Pine Siskin	22	109	Winter Wren	25	49
King Rail	1	1	White-th. Sparrow	34	835	Marsh Wren	1	1
Sora	11	18	Slate-colored Junco	7	27	Brown Creeper	2	3
Lesser Yellowlegs	2	2	Song Sparrow	9	13	White-br. Nuthatch	26	41
Greater Yellowlegs	2	3	Lincoln's Sparrow	1	1	Red-br. Nuthatch	4	4
Solitary Sandpiper	1	1	Fox Sparrow	2	2	Tufted Titmouse	1	1
Killdeer	1	1	Eastern Towhee	7	14	Black.-cap. Chickadee	17	28
Mourning Dove	5	6	Northern Cardinal	67	529	Golden-cr. Kinglet	19	176
Rock Pigeon	1	1	Rose-br. Grosbeak	24	56	Ruby-cr. Kinglet	21	65
Sharp-shinned Hawk	2	2	Purple Martin	3	8	Wood Thrush	4	10
Red-tailed Hawk	3	4	Barn Swallow	13	32	Verry	4	5
Bald Eagle	13	24	Tree Swallow	19	70	Gray-cheeked Thrush	34	284
Peregrine Falcon	1	1	Bank Swallow	15	38	Swainson's Thrush	41	412
Osprey	1	1	No. Rough-wing Swal.	1	1	Hermit Thrush	18	52
Eastern Screech Owl	2	2	Cedar Waxwing	49	451	American Robin	56	468
Belted Kingfisher	1	1	Red-eyed Vireo	10	17	Unk. Warbler	53	381
Hairy Woodpecker	7	7	Warbling Vireo	14	27	Unk. Flycatcher	1	1
Downy Woodpecker	57	180	Black & White Warbler	2	2	Unk. Finch	1	4
Yellow-bel. Sapsucker	6	6	Nashville Warbler	2	2			

Table 15. Daily banding totals for Navarre Beach, fall 2014.

Date	Net Hour	Banded	Banded/100 nh	Returns	Recaptures	Total birds*	Totalbird/100nh
820	31.65	5	15.80	0	0	5	15.80
821	29.17	20	68.56	0	1	21	71.99
822	24.00	7	29.17	0	0	7	29.17
823	24.15	0	0.00	0	0	0	0.00
824	20.00	0	0.00	0	0	0	0.00
825	23.75	6	25.26	0	1	7	29.47
826	23.35	15	64.24	0	0	15	64.24
827	26.25	2	7.62	0	0	2	7.62
828	21.00	3	14.29	0	0	3	14.29
829	24.59	1	4.07	0	2	3	12.20
830	24.15	3	12.42	0	1	4	16.56
831	24.59	13	52.87	0	1	14	56.93
901	25.00	5	20.00	1	1	7	28.00
902	24.59	3	12.20	0	0	3	12.20
903	27.09	10	36.91	0	1	11	40.61
904	26.65	10	37.52	0	4	14	52.53
905	25.00	5	20.00	0	2	7	28.00
906	25.00	3	12.00	0	1	4	16.00
907	27.50	9	32.73	0	1	10	36.36
908	28.75	2	6.96	0	2	4	13.91
909	31.25	12	38.40	1	2	15	48.00
910	26.25	7	26.67	0	1	8	30.48
911	29.15	3	10.29	0	0	3	10.29
912	31.25	12	38.40	0	0	12	38.40
913	25.84	26	100.62	0	1	27	104.49
914	30.00	25	83.33	1	1	27	90.00
915	28.35	23	81.13	0	0	23	81.13
916	32.92	29	88.09	0	2	31	94.17
917	30.42	16	52.60	1	7	24	78.90
918	31.25	12	38.40	0	2	14	44.80
919	27.92	15	53.73	0	0	15	53.73
920	30.00	15	50.00	0	0	15	50.00
921	27.50	150	545.46	0	5	155	563.64
922	30.00	66	220.00	0	7	73	243.33
923	31.65	24	75.83	0	7	31	97.95
924	29.59	10	33.80	0	4	14	47.32
925	28.75	8	27.83	0	6	14	48.70
926	31.25	15	48.00	0	1	16	51.20
927	26.65	1	3.75	0	2	3	11.26
928	27.50	8	29.09	1	2	11	40.00
929	30.00	19	63.33	0	3	22	73.33
930	30.00	16	53.33	0	7	23	76.67
1001	31.65	5	15.80	0	0	5	15.80
1002	30.84	7	22.70	0	1	8	25.94
1003	12.50	2	16.00	0	1	3	24.00
1004	32.92	88	267.32	0	8	96	291.62
1005	26.25	37	140.95	0	8	45	171.43
1006	28.75	11	38.26	0	4	15	52.17
1007	17.92	12	66.96	0	3	15	83.71
1008	32.50	18	55.39	0	6	24	73.85
1009	30.42	38	124.92	0	8	46	151.22
1010	32.50	9	27.69	0	2	11	33.85
1011	31.65	13	41.07	0	0	13	41.07
1012	26.25	1	3.81	0	3	4	15.24
1013	31.65	9	28.44	0	1	10	31.60
1014	26.65	4	15.01	0	0	4	15.01
1015	30.42	4	13.15	0	4	8	26.30
1016	30.84	34	110.25	0	3	37	119.97
1017	35.00	89	254.29	0	12	101	288.57
1018	26.00	17	65.39	0	5	22	84.62
1019	34.15	12	35.14	0	6	18	52.71
1020	30.00	9	30.00	0	9	18	60.00
1021	28.75	13	45.22	0	5	18	62.61
1022	31.25	37	118.40	0	3	40	128.00
TOTAL	1792.58	1103	61.53	5	169	1278	71.29

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

Table 16. Fall banding totals, Navarre Beach 2014.

Species	Banded	Species	Banded	Species	Banded
American Woodcock	3	Cedar Waxwing	2	Northern Waterthrush	6
Yellow-billed Cuckoo	1	Red-eyed Vireo	9	Connecticut Warbler	2
Downy Woodpecker	8	Warbling Vireo	2	Mourning Warbler	1
Ruby-th. Hummingbird	13	Blue-headed Vireo	5	Common Yellowthroat	25
Eastern Phoebe	3	Black and White Warbler	8	Wilson's Warbler	5
Eastern Wood Pewee	6	Prothonotary Warbler	1	American Redstart	13
Yellow-bellied Flycatcher	5	Nashville Warbler	7	Gray Catbird	94
Red-winged Blackbird	8	Tennessee Warbler	30	Carolina Wren	2
Baltimore Oriole	11	Cape May Warbler	21	House Wren	9
Common Grackle	21	Yellow Warbler	1	Winter Wren	4
American Goldfinch	1	Black-th. Blue Warbler	8	Brown Creeper	6
Nelson's Sparrow	1	Myrtle Warbler	10	White-breasted Nuthatch	1
White-throated Sparrow	44	Magnolia Warbler	24	Tufted Titmouse	1
Field Sparrow	1	Chestnut-sided Warbler	3	Golden-crowned Kinglet	134
Slate-colored Junco	7	Bay-breasted Warbler	8	Ruby-crowned Kinglet	33
Song Sparrow	5	Blackpoll Warbler	327	Veery	2
Lincoln Sparrow	1	Blackburnian Warbler	2	Gray-cheeked Thrush	24
Swamp Sparrow	2	Black-th.-Green Warbler	1	Swainson's Thrush	69
Eastern Towhee	1	Pine Warbler	3	Hermit Thrush	29
Northern Cardinal	6	Western Palm Warbler	10		
Indigo Bunting	1	Ovenbird	12		

Table 17 . Daily banding totals for Creek Bend County Park, fall 2014.

Date	Net Hour	Banded	Banded/ 100 net hr	Returns	Recaptures	Total birds	Total bird/ 100 net hr
830	86.00	22	25.58	2	1	25	29.07
901	64.50	50	77.52	2	3	55	85.27
903	86.00	57	66.28	3	16	76	88.37
904	64.50	34	52.71	1	14	49	75.97
905	63.00	27	42.86	3	13	43	68.25
907	86.00	47	54.65	7	28	82	95.35
908	86.00	32	37.21	0	0	32	37.21
909	70.00	36	51.43	2	5	43	61.43
912	74.00	64	86.79	1	9	74	100.00
913	118.25	137	115.86	4	4	145	122.62
914	86.00	40	46.51	0	9	49	56.98
916	96.75	45	46.51	1	13	59	60.98
918	96.75	67	69.25	2	5	74	76.49
919	96.75	50	51.68	2	5	57	58.92
922	74.00	64	86.49	4	16	84	113.51
924	86.00	65	75.58	0	9	74	86.05
926	43.00	48	111.63	0	0	48	111.63
928	86.00	78	90.70	1	11	90	104.65
929	107.50	104	96.74	2	13	119	110.70
1001	107.50	146	135.81	1	23	170	158.14
1002	92.50	142	153.51	3	9	154	166.49
1007	107.50	189	175.81	1	18	208	193.49
1008	67.50	96	142.22	0	1	97	143.70
1009	172.00	353	205.23	3	2	358	208.14
1010	107.50	186	173.02	1	0	187	173.95
1011	86.00	131	152.33	1	0	132	153.49
1012	107.50	108	100.47	0	2	110	102.33
1013	23.75	20	84.21	1	0	21	88.42
1015	77.50	117	150.97	1	1	119	153.55
1016	107.50	181	168.37	3	1	185	172.09
1017	48.00	87	181.25	0	0	87	181.25
1018	107.50	273	253.95	1	0	274	254.88
1020	52.50	102	194.29	0	1	103	196.19
1021	75.25	115	152.82	0	2	117	155.48
1022	49.00	67	136.74	1	0	68	138.78
1023	86.00	172	200.00	0	0	172	200.00
1025	75.25	100	132.89	0	1	101	134.22
1026	75.25	132	175.42	1	3	136	180.73
1027	52.00	109	209.62	0	0	109	209.62
1029	52.00	25	48.08	0	0	25	48.08
1030	92.25	64	69.38	0	0	64	69.38
1102	33.00	16	48.49	0	0	16	48.49
1103	39.00	2	5.13	0	0	2	5.13
TOTAL	3464.75	4000	115.45	55	238	4293	123.91

Table 18. Fall banding totals for Creek Bend County Park, fall 2014.

Species	Banded	Species	Banded	Species	Banded
Downy Woodpecker	7	Rose-breasted Grosbeak	13	Mourning Warbler	8
Red-bellied Woodpecker	1	Indigo Bunting	202	Common Yellowthroat	110
Yellow-shafted Flicker	1	Scarlet Tanager	1	Wilson's Warbler	17
Eastern Phoebe	6	Red-eyed Vireo	4	Canada Warbler	1
Eastern Wood Pewee	3	Philadelphia Vireo	1	American Redstart	22
Yellow-bellied Flycatcher	12	Warbling Vireo	1	Gray Catbird	49
Trail's Flycatcher	5	Yellow-throated Vireo	1	Brown Thrasher	1
Least Flycatcher	4	Blue-headed Vireo	6	Carolina Wren	2
Blue Jay	2	White-eyed Vireo	2	House Wren	35
Red-winged Blackbird	3	Black and White Warbler	13	Winter Wren	4
Purple Finch	17	Nashville Warbler	76	Marsh Wren	2
House Finch	39	Orange-crowned Warbler	4	Brown Creeper	6
American Goldfinch	1,541	Tennessee Warbler	46	White-breasted Nuthatch	2
Pine Siskin	107	Northern Parula	2	Tufted Titmouse	4
Vesper Sparrow	2	Yellow Warbler	1	Black-capped Chickadee	8
Savannah Sparrow	33	Black-th. Blue Warbler	11	Golden-crowned Kinglet	72
White-crowned Sparrow	60	Myrtle Warbler	155	Ruby-crowned Kinglet	162
White-throated Sparrow	135	Magnolia Warbler	76	Blue-gray Gnatcatcher	1
American Tree Sparrow	7	Chestnut-sided Warbler	9	Wood Thrush	2
Chipping Sparrow	23	Bay-breasted Warbler	5	Verry	1
Field Sparrow	49	Blackpoll Warbler	18	Gray-cheeked Thrush	12
Slate-colored Junco	33	Blackburnian Warbler	3	Swainson's Thrush	36
Song Sparrow	363	Black-th. Green Warbler	8	Hermit Thrush	34
Lincoln's Sparrow	114	Western Palm Warbler	26	American Robin	1
Swamp Sparrow	100	Ovenbird	17	Eastern Bluebird	2
Fox Sparrow	11	Northern Waterthrush	4		
Northern Cardinal	20	Connecticut Warbler	3		

Table 19. Daily banding totals for Shaker Lakes, fall 2014.

Date	Net hour	Banded	Banded/ 100 net hr	Returns	Recaptures	Total birds	Total bird/ 100 net hr
818	33.50	9	26.87	2	2	13	38.81
820	19.32	0	0	1	2	3	15.53
822	31.50	7	22.22	0	3	10	31.75
825	34.00	15	44.12	0	0	15	44.12
827	33.00	27	81.82	0	4	31	93.94
829	33.50	8	23.88	0	4	12	35.82
901	32.00	7	21.88	0	2	9	28.13
903	31.50	10	31.75	0	1	11	34.92
905	29.50	1	3.39	0	3	4	13.56
908	32.00	28	87.50	1	1	30	93.75
915	29.00	14	48.28	0	1	15	51.72
917	34.00	18	52.94	0	4	22	64.71
919	29.50	10	33.90	0	2	12	40.68
922	29.50	17	57.63	1	2	20	67.80
924	31.50	14	44.44	0	3	17	53.97
926	27.50	20	72.73	1	3	24	87.27
929	30.50	33	108.20	0	2	35	114.75
1001	29.50	21	71.19	0	2	23	77.97
1003	30.00	18	60.00	0	11	29	96.67
1006	28.00	5	17.86	0	7	12	42.86
1008	31.50	25	79.37	0	5	30	95.34
1010	26.50	19	71.70	0	2	21	79.25
1013	33.50	35	104.48	0	4	39	116.42
1015	30.50	33	108.20	0	9	42	137.71
1017	31.00	25	80.65	0	0	25	80.65
1024	38.50	35	90.91	1	1	37	96.10
1031	24.00	7	29.17	0	2	9	37.50
1103	30.00	13	43.33	1	8	22	73.33
1110	30.50	78	255.74	0	5	83	272.13
Total	884.82	552	62.39	8	95	655	74.03

Table 20. Daily banding totals Shaker Lakes, fall 2014.

Species	Banded	Species	Banded	Species	Banded
Mourning Dove	2	Swamp Sparrow	1	Northern Waterthrush	6
Belted Kingfisher	1	Fox Sparrow	2	Connecticut Warbler	1
Hairy Woodpecker	2	Northern Cardinal	10	Mourning Warbler	6
Downy Woodpecker	9	Rose-breasted Grosbeak	1	Common Yellowthroat	2
Yellow-bellied Sapsucker	2	Cedar Waxwing	5	Wilson's Warbler	3
Yellow-shafted Flicker	2	Philadelphia Vireo	1	Canada Warbler	3
Gr.-cr. Flycatcher	1	Blue-headed Vireo	1	American Redstart	14
Eastern Phoebe	3	Black and White Warbler	4	Gray Catbird	21
Eastern Wood Pewee	1	Nashville Warbler	13	Carolina Wren	2
Yellow-bellied Flycatcher	3	Tennessee Warbler	4	House Wren	3
Traill's Flycatcher	1	Northern Parula	1	Winter Wren	8
Least Flycatcher	2	Yellow Warbler	2	Brown Creeper	1
Blue Jay	3	Black-thr. Blue Warbler	4	White-breasted Nuthatch	4
Common Grackle	7	Myrtle Warbler	42	Tufted Titmouse	6
House Finch	4	Magnolia Warbler	27	Black-capped Chickadee	7
American Goldfinch	78	Chestnut-sided Warbler	2	Golden-crowned Kinglet	23
Pine Siskin	1	Bay-breasted Warbler	1	Ruby-crowned Kinglet	23
White-crowned Sparrow	2	Blackpoll Warbler	4	Wood Thrush	1
White-throated Sparrow	58	Blackburnian Warbler	2	Gray-cheeked Thrush	9
American Tree Sparrow	1	Black-th. Green Warbler	4	Swainson's Thrush	40
Slate-colored Junco	20	Western Palm Warbler	2	Hermit Thrush	12
Song Sparrow	6	Ovenbird	6	American Robin	9

Table 21. Point count days conducted and species totals, fall season, Shaker Lakes, 2014.

Species	# days	# birds	Species	# days	# birds	Species	# days	# birds
Herring Gull	2	2	Eastern Phoebe	1	1	Magnolia Warbler	1	2
Double-cr. Cormorant	3	15	Olive-sided Flycatcher	2	2	American Redstart	1	1
Mallard	9	21	Eastern Wood Pewee	1	2	Gray Catbird	13	23
Wood Duck	1	1	Blue Jay	14	27	Carolina Wren	4	4
Canada Goose	11	92	Red-winged Blackbird	2	6	White-br. Nuthatch	8	13
Great Blue Heron	11	12	Common Grackle	3	9	Tufted Titmouse	9	12
Killdeer	1	1	Purple Finch	3	4	Black-capped Chickadee	7	9
Mourning Dove	7	8	American Goldfinch	18	161	Golden-crowned Kinglet	3	4
Rock Pigeon	7	26	White-crowned Sparrow	1	1	Ruby-crowned Kinglet	4	6
Cooper's Hawk	1	1	White-throated Sparrow	10	19	Swainson's Thrush	2	4
Red-tailed Hawk	1	1	Slate-colored Junco	2	8	American Robin	16	52
Osprey	1	1	Song Sparrow	19	34	Unk. Warbler	4	4
Belted Kingfisher	6	6	Lincoln's Sparrow	2	2	Unk. Kinglet	1	3
Hairy Woodpecker	5	5	Swamp Sparrow	1	1	Unk. Thrush	1	1
Downy Woodpecker	13	16	Northern Cardinal	4	4	Unk Gull	9	20
Pileated Woodpecker	2	2	Rose-breasted Grosbeak	1	1	Unk Duck	1	1
Red-bellied Woodpecker	12	15	Warbling Vireo	1	1	Unk Flycatcher	1	1
Yellow-shafted Flicker	6	7	Blue-headed Vireo	1	1	Unk Sparrow	4	11
Chimney Swift	12	261	Nashville Warbler	3	4			
Ruby-th. Hummingbird	4	5	Myrtle Warbler	4	7			

Table 22. Total bandings Black Swamp Bird Observatory, passerine migration , 2014.

Species	Banded	Species	Banded	Species	Banded
Green Heron	5	White-cr. Sparrow	34 (99)	(2) Blackpoll Warbler	1582(1608)
American Woodcock	3	(6) White-th. Sparrow	766 (1023)	Blackburnian Warbler	35 (42)
Solitary Sandpiper	1 (2)	Am. Tree Sparrow	1 (12)	Blk.-th. Grn. Warbler	104 (120)
Spotted Sandpiper	(1)	Chipping Sparrow	1 (26)	Pine Warbler	4
Mourning Dove	4 (6)	Field Sparrow	6 (61)	West. Palm Warbler	256 (315)
Sharp-shinned Hawk	5	Slate-colored Junco	57 (115)	Yellow Palm Warbler	2
Cooper's Hawk	1	Song Sparrow	89 (472)	Prairie Warbler	2
Eastern Screech Owl	1	Lincoln's Sparrow	63 (189)	Ovenbird	200 (238)
Yellow-billed Cuckoo	4	Swamp Sparrow	217 (330)	Northern Waterthrush	230 (260)
Black-billed Cuckoo	2	Fox Sparrow	28 (42)	Louisiana Waterthr.	6
Belted Kingfisher	1 (2)	Eastern Towhee	3 (5)	Connecticut Warbler	19 (23)
Hairy Woodpecker	1 (5)	Northern Cardinal	107 (150)	Mourning Warbler	107 (128)
Downy Woodpecker	32 (53)	Rose-breasted Grosbeak	45 (62)	C. Yellowthroat	425 (575)
Yellow-bell. Sapsucker	3 (5)	Indigo Bunting	41 (274)	Yellow-breasted Chat	2 (3)
Red-bellied Woodpecker	1 (3)	Scarlet Tanager	5 (7)	Hooded Warbler	7
Yellow-shafted Flicker	16 (19)	Tree Swallow	14	Wilson's Warbler	278 (321)
Whip-poor-will	1	Cedar Waxwing	40 (48)	Canada Warbler	102 (129)
Ruby-th. Hummingbird	87	Red-eyed Vireo	195 (210)	(9) American Redstart	538 (623)
Eastern Kingbird	3	Philadelphia Vireo	33 (36)	No. Mockingbird	1
Great-crested Flycatcher	29 (30)	Warbling Vireo	46 (53)	(4) Gray Catbird	899 (1079)
Eastern Phoebe	21 (32)	Yellow-throated Vireo	(1)	Brown Thrasher	22 (25)
Eastern Wood-Pewee	61 (66)	Blue-headed Vireo	33 (40)	Carolina Wren	10 (14)
Yellow-bell. Flycatcher	134 (153)	White-eyed Vireo	8 (16)	House Wren	114 (165)
Acadian Flycatcher	7	Black and White Warbler	115 (139)	Winter Wren	92 (106)
Traill's Flycatcher	345 (371)	Prothonotary Warbler	18	Marsh Wren	2 (4)
Least Flycatcher	64 (82)	Swainson's Warbler	1	Brown Creeper	83 (90)
Blue Jay	24 (35)	Blue-winged Warbler	14	White-br Nuthatch	5 (14)
Brown-headed Cowbird	(1)	Golden-winged Warbler	4	Red-br. Nuthatch	2
Red-winged Blackbird	215 (225)	Nashville Warbler	281 (407)	Tufted Titmouse	1 (13)
Orchard Oriole	(4)	Orange-crowned Warbler	18 (23)	Black-cap. Chickadee	16 (32)
Baltimore Oriole	40 (48)	Tennessee Warbler	341 (437)	(10) Gold.-cr. Kinglet	497 (596)
Rusty Blackbird	21	Northern Parula	54 (59)	(8) Ruby-cr Kinglet	392 (629)
Common Grackle	109 (118)	Cape May Warbler	146 (147)	Blue-gray Gnatcatch.	67 (80)
Purple Finch	32 (49)	Yellow Warbler	484 (507)	Wood Thrush	39 (46)
House Finch	(43)	Black-th. Blue Warbler	104 (128)	Veery	94 (101)
(1) American Goldfinch	21 (1699)	(5) Myrtle Warbler	812 (1033)	Gray-cheek Thrush	405 (431)
Pine Siskin	2 (110)	(7) Magnolia Warbler	791 (935)	(3) Swainson Thrush	1047(1162)
Vesper Sparrow	(2)	Cerulean Warbler	2	Hermit Thrush	524 (582)
Savannah Sparrow	(33)	Chestnut-sided Warbler	159 (182)	American Robin	75 (114)
Nelson's Sparrow	1	Bay-breasted Warbler	131 (138)	Eastern Bluebird	(2)

() numbers in bold are top ten banded species

Table 23. Banding effort totals by area and by season, 2014.

Area	Sample Days	Net Hours	Birds Banded	Birds/ 100 Net Hr	Total Captured	Total/ 100 Net Hr
Navarre	120	18,422.52	14,880	80.78	18,839	102.26
Petersburg	7	943.4	145	15.37	172	18.23
Shaker Lakes	43	13,57.57	856	63.05	1,044	76.90
Creek Bend	73	4,111.5	4,600	111.88	5,038	122.53
Season	Sample Days	Net Hours	Birds Banded	Birds/ 100 Net Hr	Total Captured	Total/ 100 Net Hr
All Stations						
Spring	52	9,634.57	8,915	92.53	10,822	112.32
Fall	77	15,200.42	11,566	76.09	14,271	93.89
TOTAL	129	24,834.99	20,481	82.47	25,093	101.04
ONWR Stations						
Spring	50	7,571.67	7,866	103.89	9,516	125.68
Fall	70	10,850.85	7,014	64.64	9,323	85.92
TOTAL	120	18,422.52	14,880	80.78	18,839	102.26

Table 24. Fall age ratios of selected species, Navarre 2014.

Species	2014		2013		Percent Change	91-13Ave. HY/AHY	2014 % Change from avg.
	Sample	HY/AHY	Sample	HY/AHY			
Baltimore Oriole	13	1.60	2	-	-	5.38	-70
Wh-th Sparrow*	461	1.53	116	2.63	-42	3.71	-59
Song Sparrow	57	2.00	44	0.76	+163	2.15	-7
Cedar Waxwing	30	9.00	0	-	-	1.87	+481
Red-eyed Vireo	65	4.42	52	2.71	+63	6.52	-32
Warbling Vireo	17	3.25	10	1.00	+225	9.89	-67
Bl. and Wh. Warbler	35	1.06	34	1.43	-26	1.90	-44
Nashville Warbler	60	1.86	33	1.36	+36	2.62	-29
Tennessee Warbler	165	2.67	232	5.11	-48	6.60	-60
Cape May Warbler	112	1.29	126	1.25	+2	1.17	+10
Bl-thr. Blue Warb.	52	2.71	39	4.57	-41	3.55	-24
Myrtle Warbler	249	1.15	66	1.54	-26	2.12	-46
Magnolia Warbler	176	1.51	102	1.17	+29	3.36	-55
Blackpoll Warbler	1464	1.59	837	1.97	-19	2.09	-24
Ovenbird	79	3.94	69	6.67	-41	6.90	-43
No. Waterthrush	58	3.46	59	8.83	-61	4.26	-19
Com. Yellowthroat	114	2.56	82	15.40	-83	7.30	-65
American Redstart	89	1.54	70	2.18	-29	2.41	-36
Gray Catbird	433	7.33	274	6.41	+14	8.51	-14
House Wren	39	1.79	32	1.67	+7	5.97	-70
Gray-cheek Thrush	343	3.03	208	1.63	+86	1.99	+52
Swainson's Thrush	717	1.57	407	1.58	+1	1.51	+4
Hermit Thrush	356	2.91	92	4.75	-39	5.25	-45
American Robin	54	3.91	19	2.80	+40	3.25	+20

*Species in bold have samples sizes for both 2013 and 2014 over 50.

Table 25. Banding year of returning birds captured at Navarre study site, 2014.

Species	2013	2012	2011	2010	2009	2008	2007	2006	2005	Total
Hairy Woodpecker	1									1
Downy Woodpecker	3	1	2							6
Eastern Kingbird			1							1
Blue Jay	1				1					2
Red-winged Blackbird	19	20	8	6	2					55
Baltimore Oriole	2	5	3	1	1	1				13
Common Grackle	2	1	1	1		1				6
Song Sparrow	6	2	1		1			1		11
Northern Cardinal	7		2	1						10
Indigo Bunting	1									1
Warbling Vireo	2		1							3
Black & White Warbler	1									1
Prothonotary Warbler	7	1	1	1						10
Yellow Warbler	37	18	14	4		3	1	1		78
Blackpoll Warbler	1		1							2
Com. Yellowthroat	7	2		2	2	1				14
Gray Catbird	56	26	9	3	2	3	2			101
Brown Thrasher	1		1							2
House Wren	1	2								3
Black-cap. Chickadee	2		1	1	1					5
American Robin	8	3	1	1						13
Total	165	81	47	21	10	9	3	2		338

Table 26. Banding year of returning birds captured at Shaker Lakes study site, 2014.

Species	2013	2012	2011	2010	2009	Total
Downy Woodpecker	2				1	3
American Goldfinch	4			1		5
White-throated Sparrow	1					1
Song Sparrow		3		2		5
Northern Cardinal		1		1	1	3
Red-eyed Vireo					1	1
Warbling Vireo	1	1				2
Gray Catbird	3	3				6
Tufted Titmouse	1		1			2
Black-capped Chickadee	3					3
American Robin	1	1				2
Total	16	9	1	4	3	33

Table 27. Banding year of returning birds captured at Creek Bend study site, 2014.

Species	2013	2012	2011	2010	2009	Total
Baltimore Oriole				1		1
American Goldfinch	4					4
White-throated Sparrow	1					1
Field Sparrow	3			1		4
Song Sparrow	3	6		2	1	12
Northern Cardinal	3	1				4
Indigo Bunting	4	1		2		7
Tree Swallow	1					1
Warbling Vireo	1					1
Common Yellowthroat	2	2	4	1		9
Gray Catbird	3	1		1	1	6
House Wren	1					1
Black-capped Chickadee	2					2
American Robin	1					1
Eastern Bluebird			1			1
Total	29	11	5	8	2	55

Table 28. Banding year of returning birds captured at Petersburg study site, 2014.

Species	2013	2012	2011	2010	2009	2008	Total
Common Grackle		1					1
Northern Cardinal	3						3
Black-capped Chickadee	4					1	5
American Robin	3						3
Total	10	1	0	0	0	1	12

Table 29. Foreign recoveries of study banded birds since last progress report.

Species	Band Number	Band Date	Band Location*	Recovery Date	Recovery Location
Blue Jay	1152-53896	5-22-2013	Navarre	5-29-2013	Ontario 423-0802
Common Grackle	1603-67026	10-10-2012	Navarre	5-8-2013	Ohio 413-0824
Common Grackle	1603-67086	6-21-2013	Navarre	3-99-2014	Ohio 413-0825
Common Grackle	1603-67386	9-3-2012	Navarre	5-1-2014	Ohio 405-0825
American Goldfinch	2710-20025	10-16-2013	Creek Bend	1-25-2014	Ohio 391-0821
White-throated Sparrow	2441-81471	10-7-2013	Shaker Lakes	3-99-2014	Ohio 392-0814
Nashville Warbler	2620-15978	04-26-2014	Navarre	4-27-2014	Creek Bend
Yellow Warbler	2610-85628	5-9-2012	Ontario 414-0824	4-30-2013	Ottawa NWR
Black-th.-blue Warbler	2680-10512	5-19-2013	Navarre	5-20-2014	Ontario 423-0801
Common Yellowthroat	2730-13625	09-29-2014	Navarre	10-26-2014	Florida 244-0812
Wilson's Warbler	2630-23255	9-6-2013	Illinois 394-0893	5-16-2014	Navarre
Canada Warbler	2610-85330	5-17-2011	Ontario 414-0824	5-12-2014	Navarre
Gray Catbird	1891-23139	5-05-2014	Creek Bend	5-10-2014	Navarre
Gray Catbird	1991-66459	5-20-2013	Ottawa NWR	5-8-2014	Navarre

*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.

Table 30. Spring fat composition comparisons of selected species for 2013 and 2014, Navarre (Two sample T-Test, alpha = .05).

Sign. Higher 2013	Non-sign. Higher 2013	Sign. Higher 2014	Non- sign. Higher 2014
White-throated Sparrow	Yellow-bellied Flycatcher	Red eyed Vireo	Traill's Flycatcher
Lincoln Sparrow	Least Flycatcher	Golden-cr. Kinglet	Swamp Sparrow
Bay-breasted Warbler	Black & White Warbler	Ruby-cr. Kinglet	Indigo Bunting
Ovenbird	Cape May Warbler	Bl.-gr. Gnatcatcher	Nashville Warbler
Northern Waterthrush	Yellow Warbler	Veery	Tennessee Warbler
Common Yellowthroat	Magnolia Warbler	Swainson's Thrush	Myrtle Warbler
Wilson's Warbler	Chestnut-sided Warbler		Mourning Warbler
American Redstart	Blackpoll Warbler		Gray-ch. Thrush
Gray Catbird	Western Palm Warbler		Hermit Thrush
	Canada Warbler		
	House Wren		

Table 31. Fall fat composition comparisons of selected species for 2013 and 2014, Navarre (Two sample T-Test, alpha = .05).

Sign. Higher 2013	Non-sign. Higher 2013	Sign. Higher 2014	Non- sign. Higher 2014
Magnolia Warbler	Myrtle Warbler	Wh.-throated Sparrow	Swamp Sparrow
	Ovenbird	Gray Catbird	Red-eyed Vireo
	American Redstart		Black & White Warbler
	Ruby-cr. Kinglet	House Wren	Cape May Warbler
	Gray-ch. Thrush		Blackpoll Warbler
	Hermit Thrush		Common Yellowthroat
			Golden-cr. Kinglet
			Swainson's Thrush

Figure 1. Migration field sites, 1989- 2014.

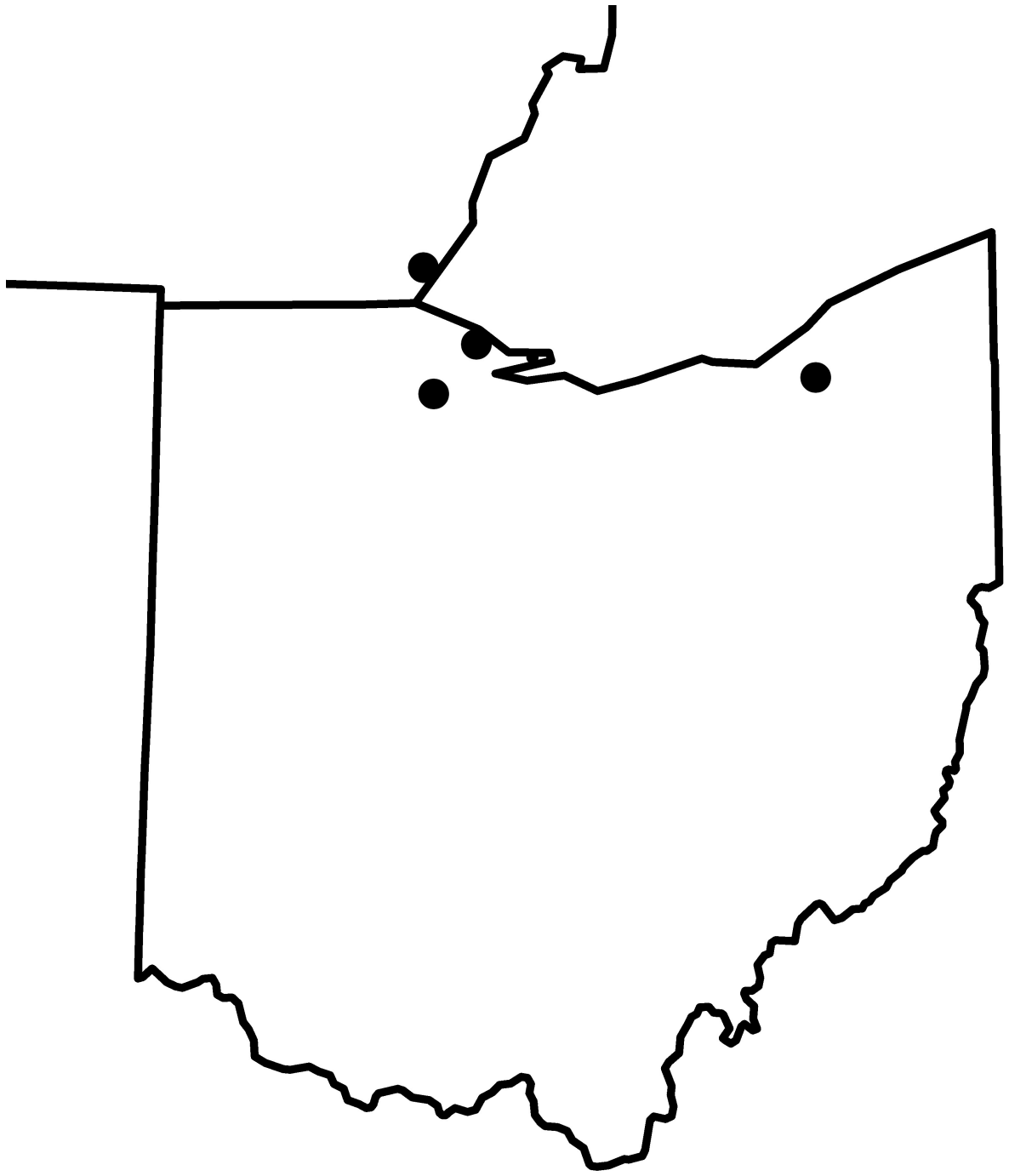


Figure 2. Spring temperature patterns, long-term average and 2014 (9 AM, 100 meters).

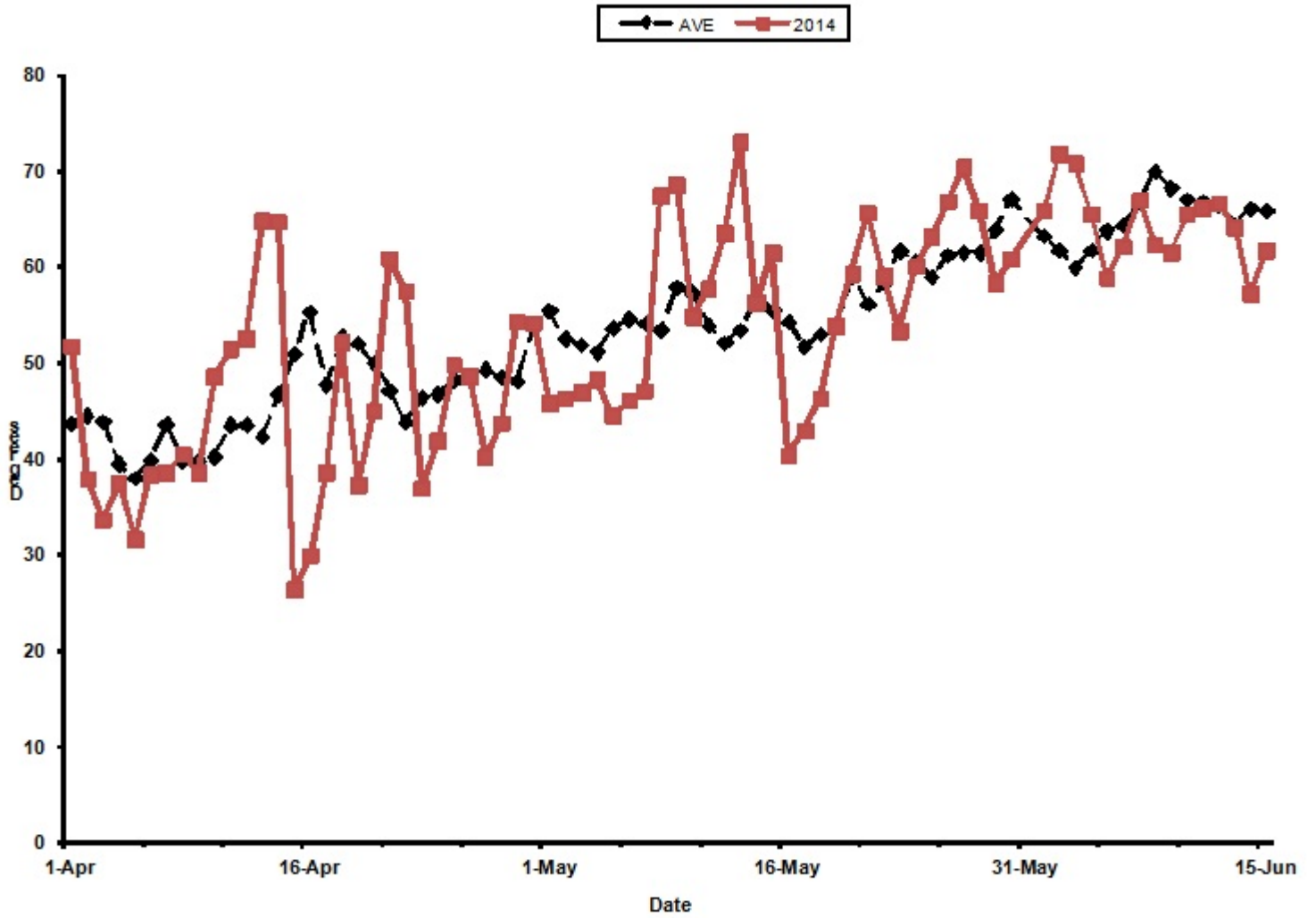


Figure 3. Fall temperature patterns, long-term average and 2014 (9 AM, 100 meters).

