

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

PROGRESS REPORT-2022

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Mark Shieldcastle, Research Director
Black Swamp Bird Observatory
13551 W State Route 2
Oak Harbor, OH 43449
markshieldcastle@bsbo.org

INTRODUCTION

In 2022, Black Swamp Bird Observatory continued a long-term passerine migration study on the Ottawa National Wildlife Refuge complex 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 are reluctant to navigate open water which results in major concentrations along the southwestern shore of Lake Erie, a phenomenon that is 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 corridors 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: Birds use habitat farther inland much more than habitat along the shore. A complex of study sites is 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 three 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), as well as 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 (Sillert and Holmes 2002). To offset the energetic costs of migration, many long-distance, intercontinental migrants deposit substantial lipid reserves which may double their body weight (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; Krementz & 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 decade has there been a movement to recognize the air column as a vital habitat for 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 could have been undetected. In addition to communication towers, wind turbines pose a similar threat to migratory birds. The cumulative negative effect on the avian resource by towers and turbines in a highly important stopover area such as the western basin is of great concern to the future maintenance of avian populations throughout the eastern United States.

To this end, this project is an important part of a large-scale 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 in 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 that resource managers can 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. 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.

METHODS AND MATERIALS

In 2022, migrating and resident passerines were sampled on the Navarre Unit of the Ottawa National Wildlife Refuge in the Great Lakes region. Banding and point count efforts covered a minimum of 75% of each migration period for the study site. Every attempt was made to equalize any un sampled parts of the migration period to the beginning and ending time frame (Shieldcastle 2018). The migration period covers both short-distance and long-distance (Neotropical) migrants. An additional project centered on Prothonotary Warblers for a habitat use and migrational pathways telemetry program using Motus nanotags (Taylor et. al. 2017). All birds captured were banded and energetic condition recorded for long-term comparisons. In fall, 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 to the beginning and ending time frame (Shieldcastle 2018). The migration period covers both short-distance and long-distance (Neotropical) migrants. The spring migration operation in 2022 began early-April and continued through early-June for point counts and late-May for banding. Fall migration banding was mid-August to early November. All banding was conducted under Master Station Permit #24127.

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 an equal chance of capture. Bird size affects the chances of being captured and held in the net, species behavior can impact the probability of a given species being captured, height of bird activity is a factor as mist nets only sample part of the airspace, 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 extracted from the net, and placed in a cloth holding bag to be carried to a central location for processing. The band number was recorded for previously captured birds. During processing, each bird was banded with a standard U.S. Fish & Wildlife Service leg band, then aged and sexed following the guidelines in Pyle 1997, the Bird Banding Manual, and Woods Manual (Woods 1969). Fat and breast muscle were visually inspected and scored: fat on a 7-point scale (Helms and Drury 1960) and muscle on a 4-point scale (Barlien 1995). Morphometric measurements were taken including closed wing chord and body mass. The net round during which each bird was captured was recorded and weather data were compiled from hourly readings of Energy Harbor Davis-Besse Nuclear Power Station.

Point count locations were spaced evenly throughout the banding area which is 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 each banding day, weather and bird abundance permitting, 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 run immediately after opening nets each morning during which every bird seen and heard within a five-minute interval was recorded. Point counts were canceled on extremely high wind or high bird activity days.

A daily list of species was compiled to document presence/absence at the Navarre banding area. 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 daily, weather permitting, in the Navarre Unit in 2022 for the 40th year. Spring 2022 was characterized by normal temperatures and precipitation in Northwest Ohio except for a late April snow storm. This pattern appeared to affect migration timing for both short-distance and long-distance Neotropical migrants. Low pressure cells had a tendency to track up into the Great Lakes. There was relatively high species diversity but below average volume at the Navarre Station in spring 2022.

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 affect 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 drainage. 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 seven days. Each “wave” of migrants is dominated by certain species and sex classes of birds with a large number of associated species. During

migration, males tend to precede females by a week to ten days in most species.

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 2022, this wave had a good first pulse (24-26 April) and second pulse, peaking 02 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 good in volume and occurred 09-12 May with a second pulse on 19-23 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 2022, the third wave peaked 26-27 May. The second pulse of this wave was poor with a slight movement on 29 May.

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

In spring 2022, the Navarre Banding Station was operated 45 days for 4,742.4 net hours. Including hummingbirds, 5,832 new birds were banded and a total of 6,703 birds handled (Table 1). The capture rate for new birds was 123.0 birds/100 net hours. The long-term average capture rate shows no change over time at Navarre. Ninety-nine species were banded in Navarre during spring 2022 (Table 2). The most unusual species included Cerulean Warbler, Pine Warbler, Worm-eating Warbler, and Eastern Bluebird. The ten most abundant species banded were Magnolia Warbler (497), Myrtle Warbler (425), Traill's Flycatcher (335), White-throated Sparrow (324), Gray Catbird (297), Yellow Warbler (265), American Redstart (237), Common Yellowthroat (207), Western Palm Warbler (189), and Swainson's Thrush (159).

Point counts were initiated in 1995 as 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 48 days during spring 2022. One hundred and thirty-three species and 10,562 individuals were recorded (Table 3). Brown-headed Cowbird, Red-winged Blackbird, Common Grackle, Song Sparrow, Northern Cardinal, and American Robin were observed each count day. The most abundant species recorded was Red-winged Blackbird (1,477) followed by Blue Jay (1,317), Tree Swallow (786), Common Grackle (460), and European Starling (420).

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. 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 72 days for 7,416.2 net hours during fall migration. Four thousand, eight hundred and fifty-eight birds were banded with a total of 5,976 birds handled including recaptures (Table 4). This was the 32nd fall season in which an extensive netting effort had been conducted on a daily basis. The capture rate for 2022 was 65.5 new birds/100 net hours and total birds at 80.6 birds/100 net hours. A total of 88 species were banded during fall 2022 (Table 5). The ten most abundant species banded were White-throated Sparrow (582), Golden-crowned Kinglet (413), Swainson's Thrush (398), Blackpoll Warbler (375), Gray Catbird (323), Myrtle Warbler (322), Hermit Thrush (274), Ruby-crowned Kinglet (223), American Robin (222), and Gray-cheeked Thrush (123). Several surprises were captured during the fall season and included Eastern Screech-Owl, Northern Saw-whet Owl, American Woodcock, Cooper's Hawk, Red-tailed Hawk,

Broad-winged Hawk, Eastern Whip-poor-will, Yellow-breasted Chat, and Marsh Wren.

Fall point counts were conducted on 71 days during fall 2022. A total of 12,929 individuals of 115 species were recorded (Table 6). The most abundant species were Red-winged Blackbird (3,396), European Starling (1,342), Common Grackle (867), American Robin (635), Canada Goose (590), White-throated Sparrow (509), Gray Catbird (391), Northern Cardinal (346), Ring-billed Gull (278), and Golden-crowned Kinglet (252). An average species total was recorded in 2022.

SUMMARY BANDINGS

Total combined bandings for passerine migration 2022 for the Navarre Station is in Table 7. The ten most abundant species banded at Navarre were White-throated Sparrow (906), Myrtle Warbler (748), Gray Catbird (620), Magnolia Warbler (587), Swainson's Thrush (557), Golden-crowned Kinglet (535), Blackpoll Warbler (417), Hermit Thrush (365), Ruby-crowned Kinglet (360), and Traill's Flycatcher (340). A combined total of 111 species made up of 10,690 individuals (87.9 birds/100 net hrs) were banded.

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 that passerines return to the same breeding grounds but less evidence available regarding site fidelity to migration stopover sites. During 2022, 175 birds of 25 species were captured as returning birds at the Navarre site (Table 8). This total includes 22 Yellow Warbler with the oldest being banded in 2016, 13 Prothonotary Warbler (oldest from 2017), 53 Gray Catbird (oldest from 2015), 10 Red-winged Blackbird (oldest from 2015), 10 Northern Cardinal, 10 House Wren, 3 Warbling Vireo (oldest from 2016), and 3 Baltimore Oriole (oldest from 2017). 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, Prothonotary Warbler, and Indigo Bunting records surpass the species record as reported by the Bird Banding Laboratory. Foreign encounters of study site birds are shown in Table 9. Continued analysis in this area will hopefully shed some light on turnover rate and site fidelity in some species.

DISCUSSION

Black Swamp Bird Observatory has conducted bird migration monitoring research in the Lake Erie Marsh Region for more than 42 years. Annual variation in migrational monitoring numbers makes drawing conclusions about populations very risky, even with long-term datasets. Determining what contributes to this great variability and how it can be quantified is a challenge. Does the variability represent true population fluctuation? Is it an artifact of sample design or vagrancy of weather patterns? Or of 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 costs? 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 effects 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 cannot be addressed any one site alone but can be addressed by multiple sites. Not all species utilize the stopover habitat that makes up the marsh region in the same way. 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 averages of 8,000 birds banded in spring and at 5,500 in fall 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 for 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 with 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 inland during fall migration. This may represent the descending range of those crossing the lake.

The species composition also differs with distance from the 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, and 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 lax as birds build body condition after 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 effect 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 the 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 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.

Establishing a standardized sampling protocol for banding across the Great Lakes and upper Midwest regions will allow for comparison of migration ecology 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 lists creates a holistic dataset to support answering a variety of specific questions. It also allows for the use of other, less labor-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 instituted for the Great Lakes region by the Midwest Migration Network and 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 comparisons of site, habitat, body condition, and migrational timing and for decision support for wind turbine placement, among other regional questions. This network, supported by a central database (the Midwest Avian Data Center) will assist researchers with 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 the station 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 bird annually since. 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. In addition to the apparent Blackpoll connection to Lake Erie, a first Magnolia Warbler was captured a second year at Navarre in migration. 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 of and use by migrants is of utmost priority for informed decision making of regulatory agencies. Risk needs to be identified for migratory birds. 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 relation to the 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 State University have provided radar units to document nocturnal movements, Ohio State University has a graduate student conducting point counts in the region, and 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 also to consider those questions 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 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 2022, project personnel were reduced in providing in-person educational programming due to lingering Covid protocols. Nine presentations were made to 600 people on avian ecology and migration through in-person and Zoom remote programs.

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 provides 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 shelter 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 a food source. Rough-leaved Dogwood dominates the shrub habitat providing vast surface area for invertebrates as well as for fall migrating birds. Any management scheme at this latitude needs to recognize the overriding 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, meeting 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 the 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 considered 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 migrants 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 2022. (Missing dates are due to weather events)

Date	Net Hour	Banded	Banded/ 100 net hr	Returns	Recaptures	Total Birds	Total Birds/ 100 net hr
405	107.18	143	133.40	11	0	154	143.68
407	80.50	71	88.20	0	8	79	98.14
408	86.25	28	32.46	0	4	32	37.10
410	107.41	33	30.72	2	12	47	43.76
411	69.00	82	118.84	0	1	83	120.29
412	115.00	76	66.09	3	15	94	81.74
413	95.91	38	39.62	0	11	49	51.09
415	95.91	52	54.22	0	9	61	63.60
416	115.00	25	21.74	2	8	35	30.43
417	109.25	23	21.05	1	14	38	34.78
419	42.09	12	28.51	0	7	19	45.14
420	115.00	16	13.91	0	19	35	30.43
422	118.91	64	53.82	1	3	68	57.19
423	115.00	96	83.48	1	16	113	98.26
424	115.00	153	133.04	0	5	158	137.39
426	122.59	278	226.77	2	9	289	235.75
427	65.09	149	228.91	2	19	170	261.18
428	78.66	30	38.14	0	19	49	62.29
429	118.68	34	28.65	1	14	49	41.29
430	111.09	17	15.30	0	11	28	25.20
501	141.68	299	211.04	5	11	315	222.23
502	120.75	342	283.23	2	15	359	297.31
505	116.84	51	43.65	3	23	77	65.90
508	120.75	64	53.00	10	16	90	74.53
509	115.00	165	143.48	2	11	178	154.78
510	155.25	632	407.09	15	8	655	421.90
511	120.75	528	437.27	6	11	545	451.35
512	136.16	239	175.53	14	45	298	218.86
517	23.00	10	43.48	1	0	11	47.83
518	49.68	78	157.00	4	9	91	183.17
519	122.59	312	254.51	7	37	356	290.40
520	109.25	218	199.54	3	37	258	236.16
521	76.59	219	285.94	5	25	247	322.50
523	116.84	257	219.96	4	21	282	241.36
524	118.68	89	74.99	4	22	115	96.90
525	122.59	114	92.99	5	42	161	131.33
526	84.18	127	150.87	5	34	166	197.20
527	88.09	139	157.79	2	18	159	180.50
528	120.75	82	67.91	6	32	120	99.38
529	116.84	147	125.81	6	26	179	153.20
530	113.16	64	56.56	4	15	83	73.35
531	116.84	76	65.05	2	21	99	84.73
601	113.16	70	61.86	5	12	87	76.88
602	99.59	25	25.10	3	12	40	40.16
603	92.00	16	17.39	1	16	33	35.87
TOTAL	4,742.37	5,832	122.98	150	721	6,703	141.34

Table 2. Spring banding totals, Navarre 2022.

Species	Banded	Species	Banded	Species	Banded
Mourning Dove	1	Lincoln's Sparrow	39	Blackpoll Warbler	42
Sharp-shinned Hawk	2	Swamp Sparrow	102	Blackburnian Warbler	41
Yellow-billed Cuckoo	2	Fox Sparrow	61	Black-th. Green Warbler	39
Black-billed Cuckoo	9	Eastern Towhee	3	Pine Warbler	1
Hairy Woodpecker	1	Northern Cardinal	59	Western Palm Warbler	184
Downy Woodpecker	4	Rose-breasted Grosbeak	13	Prairie Warbler	1
Yellow-bellied Sapsucker	2	Indigo Bunting	41	Ovenbird	40
Red-bellied Woodpecker	3	Scarlet Tanager	3	Northern Waterthrush	34
Yellow-shafted Flicker	11	Tree Swallow	29	Louisiana Waterthrush	2
Ruby-th. Hummingbird	32	Cedar Waxwing	5	Connecticut Warbler	8
Eastern Kingbird	6	Red-eyed Vireo	119	Mourning Warbler	54
Great Crested Flycatcher	24	Philadelphia Vireo	16	Common Yellowthroat	207
Eastern Phoebe	14	Warbling Vireo	18	Yellow-breasted Chat	2
Olive-sided Flycatcher	2	Yellow-throated Vireo	1	Hooded Warbler	3
Eastern Wood-Pewee	35	Blue-headed Vireo	12	Wilson's Warbler	58
Yellow-bellied Flycatcher	140	White-eyed Vireo	15	Canada Warbler	67
Acadian Flycatcher	25	Black-and-white Warbler	74	American Redstart	237
Traill's Flycatcher	335	Prothonotary Warbler	13	Gray Catbird	297
Least Flycatcher	74	Worm-eating Warbler	1	Brown Thrasher	25
Blue Jay	71	Blue-winged Warbler	11	Carolina Wren	4
Brown-headed Cowbird	17	Golden-winged Warbler	2	House Wren	90
Red-winged Blackbird	141	Nashville Warbler	48	Winter Wren	8
Baltimore Oriole	8	Orange-crowned Warbler	7	Brown Creeper	46
Rusty Blackbird	21	Tennessee Warbler	35	Red-breasted Nuthatch	2
Common Grackle	15	Northern Parula	15	Golden-crowned Kinglet	122
American Goldfinch	8	Cape May Warbler	14	Ruby-crowned Kinglet	137
White-crowned Sparrow	12	Yellow Warbler	265	Blue-gray Gnatcatcher	45
White-throated Sparrow	324	Black-th. Blue Warbler	59	Wood Thrush	11
American Tree Sparrow	49	Myrtle Warbler	425	Veery	35
Chipping Sparrow	1	Magnolia Warbler	497	Gray-cheeked Thrush	21
Field Sparrow	8	Cerulean Warbler	2	Swainson's Thrush	159
Slate-colored Junco	15	Chestnut-sided Warbler	127	Hermit Thrush	91
Song Sparrow	60	Bay-breasted Warbler	102	American Robin	13
				Eastern Bluebird	1

Table 3. Number of days observed and totals of individuals seen on point counts, Navarre spring 2022.

Species	# Days	# Observed	Species	# Days	# Observed	Species	# Days	# Observed
Pied-billed Grebe	2	2	Eastern Phoebe	1	1	Northern Parula	14	20
Herring Gull	15	18	Olive-sided Flycatcher	1	1	Cape May Warbler	3	4
Ring-billed Gull	21	35	Eastern Wood-Pewee	14	27	Yellow Warbler	31	350
Bonaparte's Gull	4	5	Yellow-bel. Flycatcher	3	4	Black-th. Blue Warbler	9	11
Caspian Tern	5	5	Alder Flycatcher	11	30	Myrtle Warbler	13	90
Dou.-cr. Cormorant	28	199	Willow Flycatcher	6	7	Magnolia Warbler	15	27
Am. White Pelican	1	1	Traill's Flycatcher	4	4	Chestnut-sided Warbler	9	21
Common Merganser	4	9	Least Flycatcher	4	16	Bay-breasted Warbler	9	20
Mallard	18	68	Blue Jay	36	1,317	Blackpoll Warbler	11	30
American Black Duck	1	2	American Crow	2	4	Blackburnian Warbler	9	17
Gadwall	13	55	European Starling	47	420	Black-th. Green Warb.	11	21
American Wigeon	1	1	Brown-head. Cowbird	48	266	W. Palm Warbler	7	19
Green-winged Teal	3	7	Red-winged Blackbird	48	1,477	Ovenbird	1	1
Blue-winged Teal	1	1	Baltimore Oriole	25	85	No. Waterthrush	4	6
No. Shoveler	3	5	Eastern Meadowlark	1	1	La. Waterthrush	1	1
Wood Duck	19	64	Rusty Blackbird	24	269	Connecticut Warbler	3	3
Lesser Scaup	5	21	Common Grackle	48	460	Mourning Warbler	9	10
Ring-necked Duck	3	8	Purple Finch	2	2	Com. Yellowthroat	32	146
Canada Goose	47	301	Am. Goldfinch	10	25	Wilson's Warbler	17	35
Trumpeter Swan	32	72	White-cr. Sparrow	1	2	Canada Warbler	12	19
Gr. Blue Heron	41	114	White-th. Sparrow	31	241	American Redstart	21	130
Great Egret	19	26	Am. Tree Sparrow	5	7	Gray Catbird	29	273
Green Heron	8	14	Chipping Sparrow	2	3	Brown Thrasher	30	58
Sandhill Crane	24	52	Field Sparrow	3	4	Carolina Wren	39	70
Virginia Rail	4	4	Slate-colored Junco	4	8	House Wren	33	253
Sora	7	7	Song Sparrow	48	327	Winter Wren	5	5
Killdeer	7	10	Lincoln's Sparrow	2	3	Marsh Wren	7	7
Mourning Dove	45	173	Swamp Sparrow	26	76	Brown Creeper	3	4
Northern Harrier	1	1	Fox Sparrow	15	44	White-breast. Nuthatch	8	9
Red-tailed Hawk	1	1	Eastern Towhee	14	20	Red-breasted Nuthatch	1	3
Bald Eagle	25	38	No. Cardinal	48	293	Black-cap. Chickadee	8	8
American Kestrel	1	1	Rose-br. Grosbeak	8	20	Golden-cr. Kinglet	15	49
Eastern Screech-Owl	2	2	Indigo Bunting	4	4	Ruby-cr. Kinglet	10	56
Great Horned Owl	1	1	Scarlet Tanager	4	5	Blue-gray Gnatcatcher	23	76
Yellow-billed Cuckoo	9	15	Purple Martin	8	15	Wood Thrush	5	7
Black-billed Cuckoo	1	3	Barn Swallow	8	12	Veery	1	2
Belted Kingfisher	3	3	Tree Swallow	47	786	Gray-cheeked Thrush	2	2
Hairy Woodpecker	3	4	Cedar Waxwing	15	156	Swainson's Thrush	8	14
Downy Woodpecker	30	59	Red-eyed Vireo	18	48	Hermit Thrush	3	4
Red-h. Woodpecker	13	18	Philadelphia Vireo	1	1	American Robin	48	194
Red-b. Woodpecker	17	22	Warbling Vireo	23	76	Eastern Bluebird	2	2
Yellow-shafted Flicker	25	47	White-eyed Vireo	3	3	Unk. Blackbird	2	145
Chimney Swift	8	12	Black-and-white Warb.	8	17	Unk. Duck	9	74
Ruby-th. Hummingbird	1	1	Prothonotary Warbler	24	59	Unk. Gull	2	3
Eastern Kingbird	13	21	Nashville Warbler	9	19	Unk. Warbler	8	18
Great Cr. Flycatcher	9	13	Tennessee Warbler	8	39			

Table 4. Daily banding totals for Navarre, fall 2022. (missing dates were weather events)

Date	Net Hour	Banded	Banded/ 100 net hr	Returns	Recaptures	Total Birds	Total Birds/ 100 net hr
815	107.18	50	46.65	4	0	54	50.38
816	113.16	25	22.09	2	1	28	24.74
817	113.16	16	14.14	1	2	19	16.79
818	115.00	20	17.39	1	0	21	18.26
819	113.16	36	31.81	3	3	42	37.12
820	111.09	26	23.40	2	4	32	28.81
822	116.84	29	24.82	6	6	41	35.09
823	116.84	31	26.53	1	1	33	28.24
824	126.50	29	22.92	1	2	32	25.30
825	119.60	20	16.72	2	9	31	25.92
826	109.25	9	8.24	1	2	12	10.98
827	115.00	21	18.26	0	2	23	20.00
828	109.25	12	10.98	1	3	16	14.65
831	126.50	40	31.62	2	4	46	36.36
901	115.00	87	75.65	3	6	96	83.48
902	118.68	58	48.87	2	12	72	60.67
903	113.16	37	32.70	0	3	40	35.35
904	36.34	13	35.77	0	4	17	46.78
905	111.09	39	35.11	1	3	43	38.71
906	111.09	40	36.01	0	9	49	44.11
907	107.18	33	30.79	0	4	37	34.52
908	111.09	47	42.31	0	5	52	46.81
909	105.34	56	53.16	1	6	63	59.81
910	115.00	31	26.96	0	5	36	31.30
911	115.00	48	41.74	0	10	58	50.43
912	107.18	37	34.52	2	8	47	43.85
913	113.16	40	35.35	0	7	47	41.53
914	105.34	74	70.25	0	4	78	74.05
915	115.00	62	53.91	1	4	67	58.26
916	115.00	62	53.91	3	8	73	63.48
917	101.66	51	50.17	0	6	57	56.07
918	111.09	56	50.41	1	8	65	58.51
920	109.05	57	52.27	1	2	60	55.02
921	111.09	42	37.81	4	10	56	50.41
922	107.18	71	66.24	0	5	76	70.91
923	101.66	88	86.56	0	16	104	102.31
924	103.50	67	64.73	0	11	78	75.36
926	99.39	82	82.50	3	12	97	97.60
927	105.34	103	97.78	0	27	130	123.41
928	101.66	74	72.79	1	27	102	100.33
929	107.18	78	72.77	0	36	114	106.36
930	107.18	76	70.91	0	18	94	87.70
1001	93.84	54	57.54	0	10	64	68.20
1002	49.68	18	36.23	0	6	24	48.31
1003	111.09	176	158.43	0	22	198	178.23
1004	105.34	132	125.31	0	23	155	147.14
1005	105.34	93	88.29	0	24	117	111.07
1006	99.59	89	89.37	1	19	109	109.45
1007	84.18	60	71.28	0	11	71	84.34
1008	107.18	158	147.42	0	33	191	178.20
1009	95.68	95	99.29	1	24	120	125.42
1010	107.18	189	176.34	0	31	220	205.26
1011	107.18	144	134.35	0	42	186	173.54
1012	97.75	77	78.77	0	40	117	119.69
1013	99.59	75	75.31	1	35	111	111.46
1014	118.68	165	139.03	1	50	216	182.00
1015	93.84	64	68.20	1	42	107	114.02
1016	91.59	92	100.45	0	42	134	146.30
1018	63.25	106	167.59	1	17	124	196.05
1020	92.00	153	166.30	0	35	188	204.35
1021	95.68	86	89.88	0	54	140	146.32
1022	92.00	54	58.70	1	36	91	98.91
1023	101.66	83	81.64	0	31	114	112.14
1024	92.00	97	105.43	0	13	110	119.57
1025	101.66	143	140.67	0	20	163	160.34
1027	97.75	198	202.56	0	11	209	213.81
1028	92.00	107	116.30	0	19	126	136.96
1029	93.84	80	85.25	1	19	100	106.56
1030	69.00	12	17.39	0	9	21	30.43

1031	86.25	27	31.30	0	14	41	47.54
1101	86.25	14	16.23	1	7	22	25.51
1102	92.00	44	47.83	1	4	49	53.26
TOTAL	7,416.23	4,858	65.51	60	1,058	5,976	80.58

Table 5. Fall banding totals, Navarre 2022.

Species	Banded	Species	Banded	Species	Banded
American Woodcock	14	White-throated Sparrow	582	Blackburnian Warbler	5
Cooper's Hawk	1	American Tree Sparrow	1	Black-th. Green Warbler	9
Red-tailed Hawk	1	Slate-colored Junco	85	Western Palm Warbler	1
Broad-winged Hawk	1	Song Sparrow	39	Ovenbird	71
No. Saw-whet Owl	2	Lincoln's Sparrow	6	Northern Waterthrush	25
Eastern Screech-Owl	3	Swamp Sparrow	54	Connecticut Warbler	10
Yellow-billed Cuckoo	3	Fox Sparrow	25	Mourning Warbler	13
Black-billed Cuckoo	2	Eastern Towhee	3	Common Yellowthroat	61
Hairy Woodpecker	2	Northern Cardinal	41	Yellow-breasted Chat	1
Downy Woodpecker	28	Rose-breasted Grosbeak	8	Wilson's Warbler	3
Yellow-bellied Sapsucker	7	Indigo Bunting	3	Canada Warbler	7
Red-bellied Woodpecker	2	Cedar Waxwing	14	American Redstart	59
Yellow-shafted Flicker	8	Red-eyed Vireo	45	Gray Catbird	323
Eastern Whip-poor-will	1	Philadelphia Vireo	15	Brown Thrasher	5
Ruby-th. Hummingbird	18	Warbling Vireo	3	Carolina Wren	11
Eastern Kingbird	3	Blue-headed Vireo	19	House Wren	44
Eastern Phoebe	17	Black-and-white Warbler	19	Winter Wren	56
Eastern Wood-Pewee	8	Prothonotary Warbler	13	Marsh Wren	2
Yellow-bellied Flycatcher	32	Nashville Warbler	22	Brown Creeper	81
Trail's Flycatcher	5	Orange-crowned Warbler	9	White-breasted Nuthatch	7
Least Flycatcher	3	Tennessee Warbler	42	Red-breasted Nuthatch	30
Blue Jay	6	Northern Parula	6	Black-capped Chickadee	6
Red-winged Blackbird	18	Cape May Warbler	25	Golden-crowned Kinglet	413
Baltimore Oriole	2	Yellow Warbler	3	Ruby-crowned Kinglet	223
Rusty Blackbird	5	Black-th. Blue Warbler	113	Wood Thrush	6
Common Grackle	76	Myrtle Warbler	322	Veery	18
Purple Finch	9	Magnolia Warbler	90	Gray-cheeked Thrush	123
House Finch	5	Chestnut-sided Warbler	7	Swainson's Thrush	398
American Goldfinch	7	Bay-breasted Warbler	65	Hermit Thrush	274
White-crowned Sparrow	10	Blackpoll Warbler	375	American Robin	222

Table 6. Number of days observed and totals of individuals seen on point counts, Navarre fall 2022.

Species	# Days	# Observed	Species	# Days	# Observed	Species	# Days	# Observed
Herring Gull	11	23	Ruby-th. Hummingbird	8	16	Nashville Warbler	1	1
Ring-billed Gull	55	278	Eastern Kingbird	12	26	Tennessee Warbler	4	4
Bonaparte's Gull	9	74	Great Cr. Flycatcher	1	1	Northern Parula	5	6
Caspian Tern	4	5	Eastern Phoebe	7	7	Cape May Warbler	16	22
Dou.-cr. Cormorant	14	154	Olive-sided Flycatcher	1	1	Black-th.Blue Warbler	8	9
Mallard	32	211	Eastern Wood-Pewee	1	2	Myrtle Warbler	29	121
American Black Duck	5	7	Yellow-bel. Flycatcher	1	2	Magnolia Warbler	11	21
Gadwall	11	55	Least Flycatcher	1	1	Bay-breasted Warbler	12	16
Blue-winged Teal	3	6	Blue Jay	70	226	Blackpoll Warbler	38	156
Northern Shoveler	2	6	American Crow	3	4	Blackburnian Warbler	5	5
Northern Pintail	9	64	European Starling	71	1,342	Black-th, Green Warb.	4	5
Wood Duck	17	82	Brown-head. Cowbird	22	47	Ovenbird	6	7
Lesser Scaup	1	16	Red-winged Blackbird	69	3,396	Com. Yellowthroat	4	5
Canada Goose	66	590	Baltimore Oriole	19	69	Canada Warbler	1	1
Trumpeter Swan	17	33	Rusty Blackbird	25	143	American Redstart	9	17
Gr. Blue Heron	42	55	Common Grackle	60	867	Gray Catbird	47	391
Great Egret	15	15	Purple Finch	6	10	Brown Thrasher	7	9
Green Heron	6	8	House Finch	19	32	Carolina Wren	60	127
Sandhill Crane	9	22	Am. Goldfinch	27	52	House Wren	17	22
Sora	1	1	Pine Siskin	6	8	Winter Wren	12	20
American Woodcock	4	4	White-th. Sparrow	35	509	Brown Creeper	6	6
Lesser Yellowlegs	1	1	Slate-colored Junco	7	18	White-breast. Nuthatch	46	74
Solitary Sandpiper	1	1	Song Sparrow	33	70	Red-breasted Nuthatch	33	78
Spotted Sandpiper	1	1	Lincoln's Sparrow	1	1	Black-cap. Chickadee	15	19
Killdeer	6	7	Swamp Sparrow	4	4	Golden-cr. Kinglet	37	252
Mourning Dove	18	44	Fox Sparrow	5	6	Ruby-cr. Kinglet	25	83
Turkey Vulture	1	1	Eastern Towhee	6	8	Wood Thrush	1	1
Bald Eagle	41	63	No. Cardinal	69	346	Veery	5	5
Peregrine Falcon	2	2	Rose-br. Grosbeak	7	10	Gray-cheeked Thrush	19	56
Osprey	1	1	Scarlet Tanager	1	1	Swainson's Thrush	33	163
Eastern Screech-Owl	10	13	Purple Martin	14	59	Hermit Thrush	13	26
Great Horned Owl	1	2	Barn Swallow	20	125	American Robin	69	635
Belted Kingfisher	3	3	Tree Swallow	30	116	Eastern Bluebird	1	1
Hairy Woodpecker	23	26	Bank Swallow	14	187	Unk. Gull	3	3
Downy Woodpecker	65	176	No. Rough-wing. Swal.	7	18	Unk. Duck	8	54
Yellow-bel. Sapsucker	8	19	Cedar Waxwing	44	234	Unk. Finch	1	1
Red-head. Woodpecker	1	1	Red-eyed Vireo	7	8	Unk. Swallow	4	17
Red-bel. Woodpecker	49	63	Philadelphia Vireo	2	2	Unk. Warbler	36	221
Yellow-shafted Flicker	51	105	Warbling Vireo	10	14			
Common Nighthawk	1	1	Black-and-white Warb.	1	1			
Chimney Swift	16	44	Prothonotary Warbler	1	1			

Table 7. Total bandings Navarre Banding Station, passerine migration 2022.

Species	Banded	Species	Banded	Species	Banded
American Woodcock	14	Field Sparrow	8	Blackburnian Warbler	46
Mourning Dove	1	Slate-colored Junco	100	Black-th. Green Warbler	48
Sharp-shinned Hawk	2	Song Sparrow	99	Pine Warbler	1
Cooper's Hawk	1	Lincoln's Sparrow	45	Western Palm Warbler	185
No. Saw-whet Owl	2	Swamp Sparrow	156	Prairie Warbler	1
Eastern Screech-Owl	3	Fox Sparrow	86	Ovenbird	111
Yellow-billed Cuckoo	5	Eastern Towhee	6	Northern Waterthrush	59
Black-billed Cuckoo	11	Northern Cardinal	100	Louisiana Waterthrush	2
Hairy Woodpecker	3	Rose-breasted Grosbeak	21	Connecticut Warbler	18
Downy Woodpecker	32	Indigo Bunting	44	Mourning Warbler	67
Yellow-bellied Sapsucker	9	Scarlet Tanager	3	Common Yellowthroat	268
Red-bellied Woodpecker	5	Tree Swallow	29	Yellow-breasted Chat	3
Yellow-shafted Flicker	19	Cedar Waxwing	19	Hooded Warbler	3
Eastern Whip-poor-will	1	Red-eyed Vireo	164	Wilson's Warbler	61
Ruby-th. Hummingbird	50	Philadelphia Vireo	31	Canada Warbler	74
Eastern Kingbird	9	Warbling Vireo	21	American Redstart	296
Great Crested Flycatcher	24	Yellow-throated Vireo	1	(3) Gray Catbird	620
Eastern Phoebe	31	Blue-headed Vireo	31	Brown Thrasher	30
Olive-sided Flycatcher	2	White-eyed Vireo	15	Carolina Wren	15
Eastern Wood-Pewee	43	Black-and-white Warbler	93	House Wren	134
Yellow-bellied Flycatcher	172	Prothonotary Warbler	26	Winter Wren	64
Acadian Flycatcher	25	Worm-eating Warbler	1	Marsh Wren	2
(10) Traill's Flycatcher	340	Blue-winged Warbler	11	Brown Creeper	127
Least Flycatcher	77	Golden-winged Warbler	2	White-breasted Nuthatch	7
Blue Jay	77	Nashville Warbler	70	Red-breasted Nuthatch	32
Brown-headed Cowbird	17	Orange-crowned Warbler	16	Black-capped Chickadee	6
Red-winged Blackbird	159	Tennessee Warbler	77	(6) Golden-crown. Kinglet	535
Baltimore Oriole	10	Northern Parula	21	(9) Ruby-crowned Kinglet	360
Rusty Blackbird	26	Cape May Warbler	39	Blue-gray Gnatcatcher	45
Common Grackle	91	Yellow Warbler	268	Wood Thrush	17
Purple Finch	9	Black-th. Blue Warbler	172	Veery	53
House Finch	5	(2) Myrtle Warbler	748	Gray-cheeked Thrush	144
American Goldfinch	15	(4) Magnolia Warbler	587	(5) Swainson's Thrush	557
White-crowned Sparrow	22	Cerulean Warbler	2	(8) Hermit Thrush	365
(1) White-throated Sparrow	906	Chestnut-sided Warbler	134	American Robin	235
American Tree Sparrow	50	Bay-breasted Warbler	167	Eastern Bluebird	1
Chipping Sparrow	1	(7) Blackpoll Warbler	417		

() Top ten species for the year.

Table 8. Banding year of returning birds captured at Navarre study site, 2022.

Species	2021	2020	2019	2018	2017	2016	2015	Total
American Woodcock	1							1
Mourning Dove	1							1
Eastern Screech-Owl	1			1				2
Hairy Woodpecker				1				1
Downy Woodpecker	4					1		5
Eastern Kingbird					1			1
Red-winged Blackbird	2		5	2			1	10
Baltimore Oriole	1		1		1			3
Common Grackle							1	1
White-throated Sparrow	1							1
Swamp Sparrow	3							3
Song Sparrow	8		1	1	1			11
Northern Cardinal	3		2	4	1			10
Tree Swallow	2							2
Warbling Vireo	2					1		3
White-eyed Vireo	1							1
Prothonotary Warbler	5		4	3	1			13
Yellow Warbler	12		2	4	2	2		22
Blackpoll Warbler	1							1
Common Yellowthroat	11							11
Gray Catbird	42		5	2	2	1	1	53
Carolina Wren	3							3
House Wren	10							10
Black-cap. Chickadee	3							3
American Robin	3							3
Total	120		20	18	9	5	3	175

Table 9. Foreign recoveries of study banded birds since last progress report.

Species	Band Number	Band Date	Band Location*	Recovery Date	Recovery Location
Common Grackle	0723-24785	10-18-15	Navarre	09-26-22	Navarre
Common Grackle	1713-41115	09-08-19	Navarre	06-10-22	Ohio (413-0830)
White-throated Sparrow	2831-34092	10-17-21	Navarre	03-24-22	Alabama (342-0870)
Gray Catbird	2731-91587	04-28-21	Navarre	06-06-21	Michigan (421-0831)
Gray Catbird	2891-41224	05-11-22	Navarre	06-09-22	Pennsylvania (395-0794)

*Banding coordinates for study sites: Navarre 413-0830, BSBO 413-0831.