STATE of the STRAIT

Urban Bird Summit: Status, Trends, and Risks to Species that Call the Corridor Home

2018

Cover photo credit: Tom Schneider (Telecommunications maintenance staff assisting with banding osprey nesting on cellular phone tower).

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2018

Edited by: Steven Francoeur, Eastern Michigan University; Jan Ciborowski, University of Windsor; Jessica Ives, University of Windsor; Donna Kashian, Wayne State University; and John Gannon, USGS Great Lakes Science Center (ret.).

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1.0 Introduction

The State of the Strait is a binational, one-day conference held biennially that brings together governmental managers, researchers, students, environmental and conservation organizations, and concerned citizens to assess ecosystem status and provide advice to improve research, monitoring and management. The "Strait" is the Huron-Erie Corridor, which extends from the headwaters of the St. Clair River at Lake Huron, runs through the St. Clair River, Lake St. Clair, and the Detroit River, and discharges into Lake Erie. Past conferences have focused on water quality, land use, ecological indicators, and conservation efforts in southeastern Michigan and southwestern Ontario (web2.uwindsor.ca/softs).

The Urban Bird Summit theme of the 2017 State of the Strait addressed urban birds in the Detroit and Windsor region. It was held at the Detroit Zoo's Ford Education Center on November 9, 2017 with about 150 people in attendance. The conference was a collaboration among the State of the Strait (stateofthestrait.org), the Detroit Zoo (detroitzoo.org) and the Metro Detroit Nature Network (umdearborn.edu/business-community/office-metropolitan-impact/strategic-community-partners/metro-detroit-nature-network). These conferences are not mandated by any governmental program; rather, individuals voluntarily convene to explore the ways and means of documenting and improving the environmental quality and conservation of natural resources in the Detroit and Windsor region. Each conference has been free-of-charge to participants thanks to generous financial support and in-kind services donated by numerous sponsors. Furthermore, each conference has striven to educate students, our future advocates and professionals, about environmental and conservation issues where they live and go to school. This year, the conference hosted students from the Medicine and Community Health Academy at Detroit's Cody High School (www.mchcody.com).

So why urban birds? Don't avid birders or even casual birders strive to get out of city to bird watch in predominately rural areas where habitats are more pristine, widespread and diverse? Yes, sometimes; but opportunities to watch birds and enjoy nature also abound in the urban setting. The convergence of lands and waters in the Huron-Erie Corridor provides a diversity of river, stream, wetland, woodland and prairie habitats that attract birds and other biota. In spite of urbanization and industrialization of the region, pockets of significant natural areas remain and are being added to annually through habitat preservation, restoration and rehabilitation projects. These areas provide habitat for resident and migratory birds. The Huron-Erie Corridor is an important migratory flyway in the spring and fall, including waterfowl and birds of prey (raptors).

There is a long history of citizens in the Detroit and Windsor region getting together to enjoy urban birds. There are five Audubon Society clubs in the Detroit metropolitan area and the Ontario Field Ornithologists and Essex County Field Naturalists' Club are active in Windsor and environs. Folks on both sides of the border participate in citizen science bird monitoring activities, including Christmas Bird Counts (www.audubon.org/Christmas-Bird/Count, www.birdscanada.org/volunteer/cbc/), Feederwatch (http://feederwatch.org, www.birdscanada.org/volunteer/pfw/) and Hawkwatch (www.drhawkwatch.org, www.hbmo.ca), among other activities.

The importance of urban habitats for birds and other wildlife prompted the formation of the Metro Detroit Nature Network that was spawned at a workshop at the University of Michigan-Dearborn in May, 2015. Today, over 30 organizations have signed on to the Network's Partnership Agreement with the vision "…that all people in the metropolitan Detroit region have access to and actively steward nature and promote ecosystem sustainability." Complementing the Metro Detroit Nature Network, Detroit was designated the 27th city in the U.S. to be an Urban Bird Treaty City. The Urban Bird Treaty Program (www.fws.gov/birds/grants/urban-bird-treaty.php) is a collaboration between the U.S. Fish and Wildlife Service and local cities that "…brings together federal, state, and municipal agencies, non-governmental organizations and academic institutions to create bird-friendly environments and provide citizens, especially youth, with opportunities to connect with nature through birding and conservation." Specific Urban Bird Treaty goals include:

- Protection, restoration, and enhancement of urban/suburban bird habitats
- Reduction of urban/suburban hazards to birds
- Education and engagement of urban/suburban citizens in caring about and conserving birds and their habitats

With all of this recent activity in support of urban birds and their habitats, this Urban Bird Summit in the Detroit and Windsor region is timely and important. The conference's specific topics of *resident and migratory raptors, colonial waterbirds, avian ecology in urban habitats,* and *urban bird causality reduction*, all complement Urban Bird Treaty goals, and should improve avian conservation and management in this region.

2.0 Summary and Recommendations

In today's world, wildlife must increasingly coexist with anthropogenic environments. Urban environments present both traditional and unique (e.g., bird strikes on illuminated buildings) management challenges to wildlife. In recognition of this fact, and of Detroit's recent designation as an Urban Bird Treaty city, the 2017 State of the Strait conference brought together stakeholders for an urban bird summit.

Some presentations highlighted successes in bird conservation, such as the control of toxins such as dichlorodiphenyltrichloroethane (DDT), the establishment of protected habitats, and the implementation of effective monitoring and breeding programs. Other speakers identified continuing challenges, including persistent contaminants, bird strikes, and habitat loss. Finally, some speakers described new technological innovations and programs (such as Lights Out and Plants for Birds), which will hopefully facilitate future improvements. In panel discussions, managers, scientists, and concerned citizens (including local students) summarized recent developments in bird conservation, considered individual and collective strategies to address management challenges, and recommend steps for the future.

The following recommendations arose from presentations and panel discussions:

- *Detroit River Hawk Watch and Holiday Beach Hawk Watch should engage in joint marketing, promotion, recruitment, and training. These two hawk watches should also issue joint reports every 3-5 years.*

  These two organizations have similar missions, focus on complementary geographical regions, and engage a potentially-overlapping set of volunteers. Closer coordination and cooperation between the two organizations has great potential for mutual benefit.

- *Detroit River Hawk Watch and Holiday Beach Hawk Watch should establish partnerships with universities and nongovernmental organizations to foster shared use of their datasets.*

  Thanks to decades of detailed observations, these two organizations have amassed a wealth of long-term raptor population data. Historically, the majority of effort has been devoted to the collection and storage of these data, rather than their analysis and synthesis. Recent advances in database management have made these valuable data much more accessible, and thus now is an appropriate time to expand data sharing efforts with the wider community in order to accelerate the pace of data analysis.

- *Additional efforts should be made to educate the public and law-makers regarding the danger of glass and illuminated structures to birds, and the steps that can be taken to remediate these hazards.*

  Bird strikes are an important source of avian mortality. The technical issues regarding illumination and transparent/reflective surfaces, as well as effective techniques for mitigating these hazards, are well-understood amongst specialists. However, the wider public, including homeowners, architects, and policy-makers are generally unaware of this

issue. Some initial projects have had success, but additional public information campaigns, covering broad geographical regions, are needed. Zoos are well-placed to deliver such educational messages to the general public.

- *Legislation requiring newly-built structures to follow bird-friendly building guidelines would reduce bird strike deaths, as would retrofitting exiting structures.*

  There is a long history of legislation successfully mitigating environmental problems. An underlying base of knowledge sufficient to create technically-feasible solutions is a key precondition for success of such legislative efforts. This knowledge base exists for bird strikes, and several pilot projects have demonstrated that certain mitigation strategies are effective. Thus, effective legislative/regulatory solutions should be possible.

- *Continued monitoring and management efforts are needed for the conservation of many avian species in this region.*

  The successful implementation of some notable conservation efforts does not mean that management is no longer needed. Continued monitoring of bird populations and contaminant loads are required to provide data for sound management of bird species. Some species also require additional active management (e.g., predator control or vegetation removal) to achieve conservation goals. Individual, citizen-based efforts (e.g., volunteer monitoring and habitat improvement around private residences) can also be beneficial.

3.1.1 Migratory Raptors Session Summary

Contact information:
John Hartig, johnhartig1@gmail.com
Richard Wyma, RWyma@erca.org

Hawks have migrated each fall over Southeastern Michigan and Essex County Ontario following the coastline of the Detroit River on their journey southward for ages.

In 1974, a large-scale organization, the Hawk Migration Association of North America (HMANA), was established when over 300 hawk watchers gathered in Syracuse, New York. Attendees established HMANA as a volunteer, non-profit organization of field birders, research scientists, banders and conservationists.

A semiformal volunteer hawk count began at Malden Centre, Ontario in 1971. The count was relocated in 1977 south off County Road 50 to the then Holiday Beach Provincial Park's western most parking area bordering Lake Erie shore and Big Creek Marsh. The Provincial Park later became Holiday Beach Conservation Area (HBCA) and is managed by the Essex Region Conservation Authority (ERCA). Holiday Beach Migration Observatory (HBMO) became a more formalized organization in the 1990s, with the acquisition of governing bylaws, written standardized count protocols, standardized hourly count data sheets, and an electronic database to store the count data. It became established as a Canadian Charity in 2012. HBMO has some 43 years of observation data recorded and stored in the HMANA database, HawkCount.org.

In Michigan during the fall of 1983, Tim Smart was attempting to find the best place to observe and count raptors moving south along the Detroit River. Many areas had promise, like the southern parking lot of the Pointe Mouillee State Game Area to the northern portions along Jefferson Avenue near the Trenton Power Plant and, of course, points in between. The ideal count location became the current count site for the Detroit River Hawk Watch (DRHW) and is adjacent to the boat launch within the Lake Erie Metropark complex. The DRHW is a partnership among the U.S. Fish and Wildlife Service, the International Wildlife Refuge Alliance (the Refuge's Friends Organization), the Huron-Clinton Metropolitan Authority, and the Detroit River Hawk Watch Advisory Committee. There exist some 33 years of observation data recorded and stored in the HMANA database, HawkCount.org.

These two hawk watch sites have some of the largest fall flights of raptors north of the Mexican border and, as a result, are recognized as two of the top hawk watch sites in North America. On one occasion in September 1999, observers at both sites recorded a combined total of Broad-winged Hawks of 575,975 birds. This turned out to be 33% of the total number of Broad-wings tallied at Veracruz, Mexico later that year (1,745,123). That is a very large portion of the population nesting in northern Ontario that passes through the Western Basin of Lake Erie.

As part of the 2017 Urban Bird Summit, a special panel session was held on migratory raptors. This panel session began with excellent overview talks on the Detroit River Hawk Watch by Jerry Jourdan and on the Holiday Beach Hawk Watch by Bob Pettit. Both speakers were joined on the

panel by Claire Sanders, former HBMO bander and current Detroit River Canadian Cleanup Coordinator, and Will Weber, former President of HBMO and current member of the DRHW Advisory Committee.

Richard Wyma, General Manager of ERCA, and John Hartig, Manager of the Detroit River International Wildlife Refuge, facilitated the panel discussion. After several minutes of historical context of the two hawk sites, and Q and A with the audience, the panel focused on opportunities for improving current and future collaboration of the two hawk watches. The group agreed that:

- Partnerships should be established with universities and nongovernmental organizations to make better use of these extensive databases in the context of climate change, changes in urban land use patterns and natural area cover, etc.;
- There should be joint reporting between the two hawk watches every 3-5 years;
- There should be joint marketing and promotion; and
- The two hawk watches should consider a common campaign to recruit and train the next generation of counters.

3.1.2 Detroit River Hawk Watch: Citizen Science at Work

Contact information:
Jerome S. Jourdan, jerry.jourdan@gmail.com

Abstract
The Great Lakes form a natural barrier to raptor migration. Thermals, or pockets of rising heat, provide buoyancy to raptors and vultures that allow them to soar for hours without flapping their wings. These thermals disappear over open water, thus requiring raptors to avoid open-water crossings as much as possible. Migrating raptors from Canada are forced to pass to the west or east of the Great Lakes before heading south across the US to their wintering grounds in Mexico, Central and South America. For those birds traveling to the east around the Great Lakes, the region of Essex, ON and Gibraltar, MI hosts some of the largest flights of raptors north of the Mexican border.
Thanks to the volunteer efforts of dedicated hawk watchers, The Detroit River Hawk Watch has become recognized as one of the top hawk watch sites in North America. With annual fall counts of almost 130,000 raptors the annual fall migration through the Gibraltar, MI hawk site is highlighted by spectacular kettles of approximately 70,000 broad-winged hawks and 50,000 turkey vultures. With additional thousands of red-tailed and sharp-shinned hawks, plus hundreds of eagles, harriers and falcons the DRHW is a premier destination for raptor enthusiasts and photographers.

This presentation will explore factors that influence migration through the Great Lakes region, effects of weather on daily counts, and highlights of 35 years of citizen science.

Background
Detroit River Hawk Watch is the premier citizen science initiative of the Detroit River International Wildlife Refuge. A partnership among the U.S. Fish and Wildlife Service, the International Wildlife Refuge Alliance (the Refuge's Friends Organization), Huron Clinton Metroparks, and the Detroit River Hawk Watch Advisory Committee. Raptor count data are entered into a North American database (hawkcount.org) managed by the Hawk Migration Association of North America (HMANA).

On any given day between 1 September and 30 November, the skies over Gibraltar, MI could fill with large kettles of migrating hawks or vultures, or steady streams of accipiters, buteos, falcons and eagles. The highlights of the DRHW are the tens of thousands of broad-winged hawks and turkey vultures that migrate seasonally through the region. Numbers are only surpassed by those from southern count sites like Galveston, TX or Veracruz, MX. Our numbers correlate well with those from Holiday Beach Hawk Watch just 15 kilometers away in Ontario, CA.

History
Detroit River Hawk Watch gets its origin from the Lake Erie Metropark Hawk Watch that was founded by Tim Smart in 1983. Tim was a former counter at Holiday Beach Hawk Watch who felt

that the large numbers of migrating raptors following the Lake Erie shoreline must be crossing into the United States somewhere near Lake Erie Metropark (LEMP) in Gibraltar, MI. He soon discovered that the boat launch at LEMP and nearby Pointe Mouillee State Game Area Headquarters were viable sites for counting hawks crossing Lake Erie. He would serve as coordinator for the count site for 16 years and establish LEMPHW as one of the premier hawk watch sites in North America.

In 1998 the Lake Erie Metropark Hawk Watch gained non-profit status and became the Southeast Michigan Raptor Research (SMRR). Jeff Schultz took over as coordinator and served until his retirement in 2001. He then turned over the reins to Paul Cypher, who would serve as President of SMRR until 2008. During this time DTE Energy generously provided SMRR a significant stipend to fund a full-time hawk counter. 2007 brought funding from the Detroit River International Wildlife Refuge to upload hourly data into the national database (www.hawkcount.org).

In 2008 SMRR turned over the count to the U.S. Fish and Wildlife Service at the newly established International Wildlife Refuge (IWRA). The count name was officially changed to Detroit River Hawk Watch (DRHW). Federal funds were made available to compile and analyze data collected since 1991 (Panko & Battaly, 2011).

The Detroit River Hawk Watch Advisory Committee was formed in 2010 to help develop a site protocol, and provide recommendations for managing data, analyses, partnerships and cooperative projects. 2010 also brought a newly developed website (see https://sites.google.com/a/drhawkwatch.org/temp-page/).

Factors Influencing Hawk Migration

Georgian Bay and the north shores of lakes Erie and Ontario block raptors moving south from their eastern Canadian breeding grounds. Thermals do not form over water, so the birds are forced in one of two directions: east around Lake Ontario or west around Lake Erie. Those that move west follow the north shore of Lake Erie until they reach the mouth of the Detroit River. Turning back is not an option, so they are forced to cross the 4-mile span to southeast Michigan, specifically at Lake Erie Metropark (LEMP) and Pointe Mouillee State Game Area (PMSGA). They lose altitude as they cross the water, making it easier for them to be observed.

Weather plays an important role, as well. Cold fronts bring clear skies, increased barometric pressure and decreased humidity, which can aid in passage of birds as they cross over the count site.

Protocol

A detailed protocol was developed by the DRHWAC to coincide with guidelines established by HMANA (Detroit River Hawk Watch 2011). Birds are counted when they pass to the west-southwest of an imaginary line crossing the middle of the waters separating U.S. from Canada. Up to 10X power binoculars can be used to find birds. Spotting scopes can only be used to assist with identification. Hourly totals are recorded for each species along with detailed weather information. Migrating bald eagles and osprey are differentiated from resident birds by their altitude, use of thermals, and straight flight lines. Depending upon prevailing winds, raptors can pass to the south or north of the hawk watch, thus being missed by the counters. Historical locations like PMSGA HQ to the south, or Elizabeth Park to the north can be utilized for counting

migrating raptors, but the numbers must be kept separate in order to maintain the integrity and consistency the data submitted to HawkCount.

Raptors of the Detroit River Hawk Watch

Sixteen species of accipiters, buteos, falcons, eagles and vultures have been recorded at DRHW. During the month of October, it is possible to record all 16 species in a single day.

The highlight of the count is the tens of thousands of broad-winged hawks and turkey vultures that pass through the region each fall. On 17 September 1999 a staggering 543,533 broad-winged hawks, 3,263 sharp-shinned hawks, 336 American kestrel, and 14 peregrine falcons were recorded by Jeff Schultz, Vic Berardi and Tim Smart (hawkcount.org).

Trends

Figure 1 shows a trend map generated from data compiled between 1991 – 2008 (Panko & Battaly, 2011). This graph can be used by visitors to predict optimal dates for watching migrating raptors at the count site. The annual HawkFest at Lake Erie Metropark coincides with the peak of the broad-winged hawk migration (September 16 – 21) each year, which could yield up to 10,000 birds a day. Turkey vultures peak in October, while more boreal birds like golden eagles and rough-legged hawks can be observed in November.

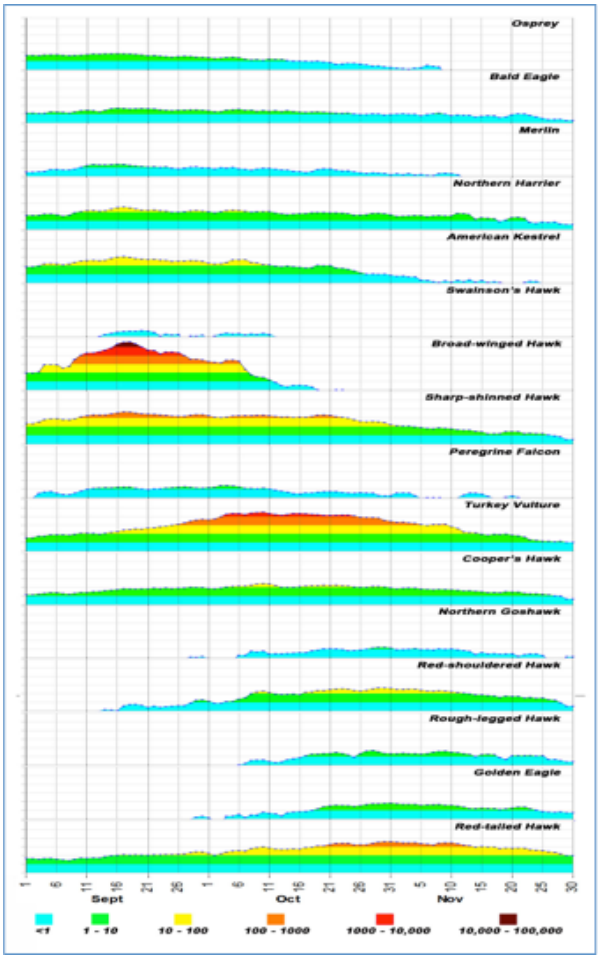

Figure 1. Trend graph showing distribution of migrating raptors at Detroit River Hawk Watch between 1 September and 30 November. Results are based on a 3-day running average of count data collected between 1991 – 2008 (Panko & Battali, 2011).

Support
The success of the Detroit River Hawk Watch would not be possible without the dedication of volunteers who log hundreds of hours counting hawks in all weather situations, or without support from the United States Fish and Wildlife Service, The International Wildlife Refuge Alliance, Hawk Migration Association of North America, and the Huron Clinton Metroparks. DRHW also wishes to recognize Greg Norwood (USFWS, MDNR) for his efforts coordinating the hawk watch since 2008, helping to form the Advisory Committee, and promoting the scientific aspect of the count. Volunteers are always welcome, and visitors are urged and invited to come out to the boat launch at LEMP to join in our efforts.

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3.1.3 Holiday Beach Hawk Watch

Contact information:
Robert Pettit, redknot@earthlink.net
Paul Pratt, hbmo.ca@gmail.com

Early Hawk Watching and HMANA
Before World War II, hawk flights were systematically recorded at Hawk Mountain, PA and Cape May, NJ. In the northeastern part of the United States, flights of Broad-winged Hawks were also being witnessed in large numbers. In 1971, several hawk watch sites became loosely organized as the New England Hawk Watch (renamed Northeast Hawk Watch in 1991) to map the migration of these flights of Broad-winged Hawks. A larger-scale organization, the Hawk Migration Association of North America (HMANA), was established in 1974 when over 300 hawk watchers from across North America gathered in Syracuse, NY. Attendees at the Syracuse meeting included individuals from government, academic and amateur researchers (including banders). Attendees established HMANA as a volunteer, non-profit organization of field birders, research scientists, banders and conservationists. The decline in Bald Eagle, Osprey and Peregrine Falcon due to the effects of DDT dramatically mobilized citizen hawk groups to investigate the numbers of migrant raptors at specific known passage sites.

HMANA Goals
HMANA established goals for the organization to promote and conduct studies of the migratory patterns and behavior of diurnal birds of prey by:

- creating a formal network of observers throughout North America,
- standardizing the recording of empirical data,
- providing a central clearing house for those data,
- encouraging the exchange of information, and
- making those data available to the public and to professional and amateur ornithologists,
- educating the public about birds of prey and their role in the world's environment, and
- helping develop improved methods of estimating bird of prey species populations, and identifying and assessing fluctuations of these populations.

Beginning of Hawk Watching in Essex County Ontario and HBMO
Birds have migrated over Essex County, Ontario, for ages. Casual birders recorded large numbers of hawks during Septembers since the 1950s. The count site was near a school 5 miles east of Amherstburg at the current junction of County Roads 50 and 20 known as Malden Centre. Members of the Detroit Audubon Society made sporadic visits during September and recorded big flights of Broad-winged Hawks and other raptors.

A semiformal volunteer hawk count began at Malden Centre in 1971. The count was relocated in 1977 south off County Road 50 to the then Holiday Beach Provincial Park's western most parking area near the Lake Erie shore and bordering Big Creek Marsh. The Provincial Park later became Holiday Beach Conservation Area and is managed by the Essex Region Conservation Authority (ERCA). Count volunteers used this ground-based site until 1986 when Detroit Edison of Michigan donated a 40 foot, three-tiered, wooden observation tower it owned near Port Huron. ERCA

dismantled the structure, moved it, and reestablished the "Hawk Tower" near the old hawk watching site.

HBMO became a more formalized organization in the 1990s with governing bylaws, written standardized count protocols, standardized hourly count data sheets, and an electronic database to store the count data. It became established as a Canadian Charity in 2012.

In fall 1996, HBMO and members of several eastern hawk sites devised a crude internet system to share daily hawk totals in an attempt to get a bigger picture of daily migration. A wider scope of communication was needed and the choice was to use LISTSERV, an industry standard email list management software. The University of Arizona had several birding-related listservs and was willing to create one for hawks. The BIRDHAWK listserv was established and hosted by the University of Arizona from 1997 to 2012; it is now housed at HMANA. BIRDHAWK allows hawk watchers to communicate directly with the greater hawk watching community by enabling daily hawk count reports to be submitted and automatically distributed to subscribers (currently 245 subscribers). This allows users to see what hawk species and their numbers were migrating on a specific day and time. When daily data are entered into HawkCount.org after the count is concluded, a summary is automatically sent to BIRDHAWK and then on to subscribers.

Early HBMO watchers casually recorded hourly observations on whatever paper the observer had that day. Weather data were taken each hour by using a thermometer, and the Beaufort Scale was used for estimating the wind speed and direction. Weather data are now obtained using handheld electronic weather instrument. All data were later entered on a special 'computer form' developed by HMANA called the "green sheet." The collection of a watch sites' "green sheets" were sent and housed in a filing cabinet in a university in Pennsylvania.

This static storage of "green sheets" did little to advance the knowledge of raptor migration. In mid-October 1999, Jason Sodergren visited the Hawk Tower at Holiday Beach. At some point, he was approached and after many conversations on the need to computerize the HBMO's data, Jason developed a model electronic database entry system he named HawkCount that could store the daily/hourly data. Data entry is simple to do and is password-protected.

In 2001, HBMO authorized that HawkCount was to be given to HMANA to maintain for all of their hawk watches. Data for more than 200 hawk watches in the Americas are stored on servers and available for viewing at HawkCount.org under the heading: "Today's Hawkwatch Results". One may wish to subscribe to BIRDHAWK and get a digest of daily spring and fall hawk count sites.

All count data are the sole property of the individual hawk watches. Researchers and governmental agencies may request to use individual site data by connecting with HMANA's Data Release Request page and completing the Data Release Form (www.hmana.org/data-policies/data-release-form/).

HBMO Educational Programs

For over 30 years, HBMO has hosted several weekend festivals during September that engage a community of birders and non-birders alike to readily learn about the hawks that migrate through Essex County on their flight southward. The festival format has evolved over that period into a very well-organized educational program. Hawk ID workshops are held each day of our festivals

and on special occasions when we have adult learner programs affiliated with the University of Windsor. The Hawk ID workshop consists of three learning components:

1. A one-page hawk ID table handout that explains and summarizes specific characteristics of the 16 species of raptors that are seen each fall.
2. An electronic slideshow presentation that contains photographs of each hawk species in flight that reinforces the hawk ID table. Live narration accompanies this show so that feedback can be given when attendees have specific questions that need correct explanations.
3. Attendees view hawks from the observation tower while the main counter and seasoned volunteers help new visitors by pointing out individuals as they pass and giving cues to their identification. Tower visitors are informed that the ID table handout and the electronic slideshow are both downloadable items on our website under the Education tab. The classroom building or the HBMO office is used for slideshow events.

These workshop sessions were supplemented with onsite captured, in the hand, banded hawks. Authorized banders assist in showing visitors parts of the bird that tells the story of its age, gender, and the specific clues for in flight identification. Copies of the hawk table are also available on the tower.

The HBMO web page (hbmo.ca) has many useful identification items under the Publication tab that are available for free download:

• 2017 Raptor Migration Almanac	Shows historic high counts for species.
• 2017 Non-raptor Migration Almanac	Shows historic high counts for species.
• Timing of Migratory Raptors at Holiday Beach	Gives dates of passage.
• Highest Daily Raptor Fall Counts at Holiday Beach	Top 10 days for a species.
• Hawk Migration Field Manual	Out of date. Being revised.

HBMO Data Analysis

Forty-three (43) years (3532 days) of fall data (September 1- November 30) are saved to HawkCount.org with 36 years as exclusively hourly totals, zero (0) years as exclusively daily totals, and 7 years as mixed hourly/daily totals.

For several years an annual fall report of the migration count has been written. Its content summarizes the passage of each raptor species observed and submitted to HawkCount.org. There is also a summary of the non-raptor birds observed with some discussion of possible changes in numbers witnessed from previous years. There is a comparison of a change in hawk numbers for the past 20 years and for the past 10 years but no statistical analysis is done.

In 2014 an additional study was done. A regression analyses of each species of raptors was done to compare the observed hawks per hour as a percentage of change from observed hawks per hour in 1976. A trend graph of the data for each species was constructed and each shows a trend line and a specific formula for its slope along with its associated R^2 value. From the formula, the number preceding the 'x' value is the "trend number" for that species. Figure 1 gives a more detailed explanation of how to interpret results. Hawk species and associated graphs are grouped according to their 'x' values (the observed birds/hour change) as seen in Table 1. The groups are as follows:

- Birds that have **undergone a strong increase** in birds/hour.

- Birds that have **not seen a very significant change** in birds/hour.
- Birds that have **undergone strong to moderate decreases** in birds/hour.

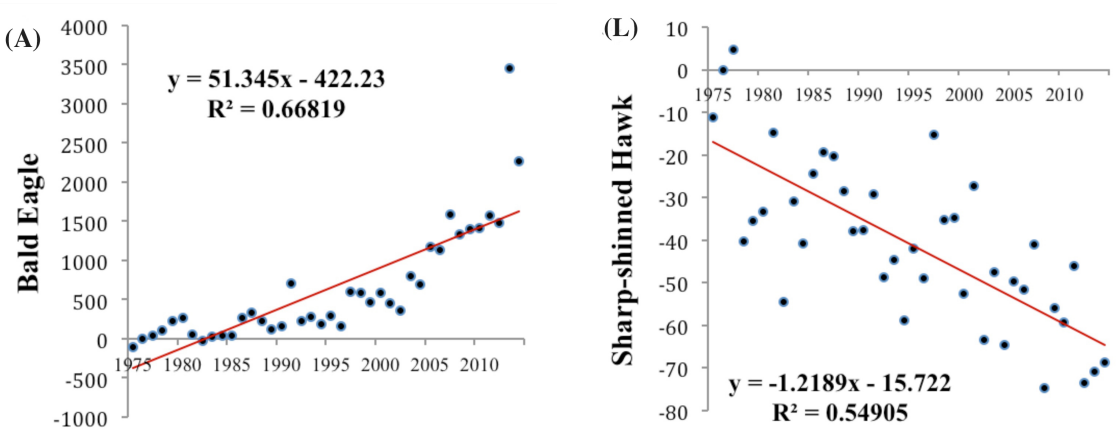

Figure 1. Examples of plots for detailed explanation of how to interpret results. In example (A) above, the trend line for the Bald Eagle gives the formula: y=51.345x–422.23 with R^2=0.66819. The 'x' value, the observed birds/hour change, is 51.345 or 51% average trend increase in Bald Eagles per hour each year. In example (L) above the trend line for the Sharp-shinned Hawk gives the formula: y= –1.2189x–15.722 with R^2=0.54905. The 'x' value, the observed birds/hour change, is -1.2189 or -1.22% average trend decrease in Sharp-shinned Hawks per hour each year.

Raptor Species Observed 1976-2014 by HBMO	Trend 'x'	R^2 Value	Change Based on HBMO Trend
	Percentage of Birds/Hour 1976-2014		
Bald Eagle	51.35	0.66819	Strong Increase
Turkey Vulture	33.29	0.86037	Strong Increase
Golden Eagle	29.06	0.44949	Strong Increase
Merlin	26.31	0.7111	Strong Increase
Peregrine Falcon	15.11	0.52719	Strong Increase
Cooper's Hawk	1.31	0.05569	Not significant
Osprey	0.43	0.03768	Not significant
Northern Harrier	0.33	0.0502	Not significant
Northern Goshawk	-1.86	0.00817	Not significant
Broad-winged Hawk	-1.44	0.02784	Not significant
Red-shouldered Hawk	-1.21	0.1348	Not significant
Sharp-shinned Hawk	-1.22	0.54905	Strong to Moderate Decreases
American Kestrel	-1.45	0.41706	Strong to Moderate Decreases
Red-tailed Hawk	-1.56	0.34056	Strong to Moderate Decreases
Rough-legged Hawk	-5.87	0.46027	Strong to Moderate Decreases

Table 1. When comparing the observed hawks per hour as a percentage of change of observed hawks per hour in 1976 a trend value ('x') is generated. The R^2 value is also generated for each regression line.

3.2.1 Resident Raptors Session Summary

Contact information:
Claire Sanders, sanders@detroitriver.ca

After experiencing severe population declines across the Great Lakes, Osprey (*Pandion haliaetus*), Bald Eagles (*Haliaeetus leucocephalus*), and Peregine Falcons (*Falco peregrinus*) are now recovering in southern Michigan and southern Ontario due to the concentrated efforts and dedicated partnerships between government agencies, industry, non-profit organizations and hundreds of volunteers.

Populations of these species began to decline almost 80 years ago due to the widespread use of DDT and habitat degradation. Over 40 years of pollution prevention and the banning of DDT in the US and Canada in the late 1960s and early 1970s has led to significant ecological recovery and re-bounding populations. Indeed, the return of these species is a tremendous sign of ecosystem recovery in the Detroit River itself!

Numbers of Bald Eagle and Osprey nests across southern Michigan continues to increase, as does nest productivity. Similarly, the adaptability of Peregrine Falcons to urban environments has marveled researchers and, in a follow-up good news story, shortly after the conference, the Committee on the Status of Endangered Wildlife in Canada recommended to the federal government that the peregrine be delisted as a threatened species.

Citizen science continues to play an important role in both identifying new nest sites and collecting data for all of these species in both the US and Canada. For management agencies, despite their increasing numbers, there are many continuing challenges to manage the dangers associated with birds living in urban environments, including disturbances, persecution by people, and environmental contaminants.

3.2.2 Michigan Falcons turn City Slickers

Contact information:
Julie Oakes, Oakesj@michigan.gov

Introduction
The mission of Michigan Department of Natural Resources (MDNR) Wildlife Division is to "enhance, restore and conserve the State's wildlife resources, natural communities, and ecosystems for the benefit of Michigan citizens, visitors and future generations. The Peregrine Falcon is one of those species that the MDNR can call a true wildlife success story. This is not a research study, but a story of a successful intervention on behalf of a pair of peregrines names Barry and Majesty.

Background
The peregrine falcon (*Falco peregrinus)* is a crow-sized bird of prey that has a wingspan of 36-44 inches. Adults have slate-gray backs and barred breasts and are known for their distinct grey hood and prominent cheek (moustache) marks on either side of head. Female peregrines are larger than males. They are known as the fastest animal on earth and can reach up to 200 m.p.h. when diving after prey. The peregrine eats mainly other birds including small ducks and pigeons. Peregrines historically nest on high cliffs and ledges that are inaccessible to predators. They usually lay 3-4 eggs on a shallow scrape. In Michigan, the nesting time is between April and September. Though never abundant in Michigan, historically there were 13 known nest sites (eyries) in Michigan, all located in the cliffs of the Upper Peninsula. The last documented successful nesting in Michigan before restoration efforts began was in 1957 in Delta County.

During the 1950's the population of peregrines decimated mostly due the use of DDT. By the 1970's DDT had been banned in U.S, though Michigan was the first to ban DDT in 1969! The falcon was listed as endangered in 1970 and restoration efforts began.

The MDNR Natural Heritage Program (nongame) began a peregrine reintroduction program in 1987. One hundred thirty-nine falcon chicks were released in Michigan with most in the UP and 31 in urban areas (Grand Rapids and Detroit). In 1993, the first wild chicks were born in Detroit by Judy and Pop. This program was extremely successful, and the numbers of peregrine falcons rose (Figure 1). The peregrine falcon soared off the list of federally endangered species in 1999. The population expanded throughout southern Michigan, as well as the U.P (Figure 2).

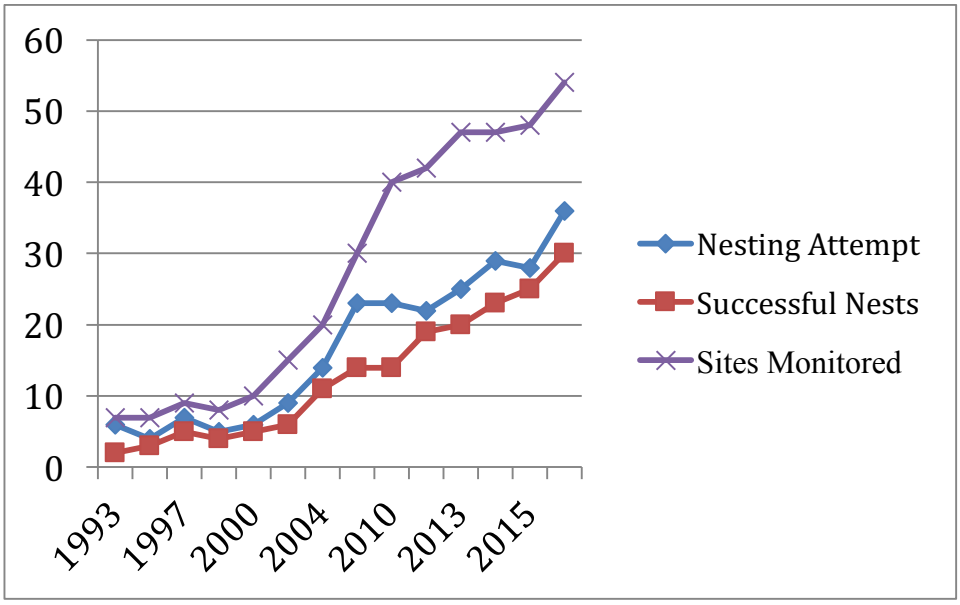

Figure 1. Michigan peregrine population (MDNR).

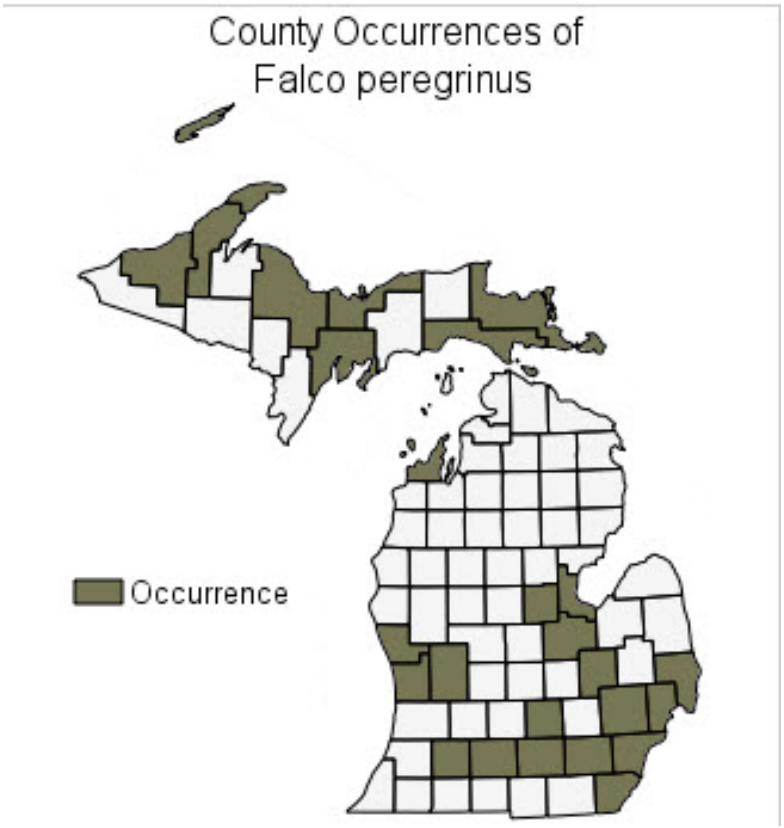

Figure 2. Falcon occurrences in Michigan (Michigan Natural Features Area Report).

Discussion

Peregrine falcons found that there were pros and cons of moving in the city. Though they did not need to worry much about predators, they had other hazards to deal with. Windows, traffic, electrical wires, high rise congestion and construction were real threats to living in the city for

these city slickers. A case study that I had the opportunity to work on was a relocation effort in the city of Flint Michigan (The Flint Journal 2008).

The Durant hotel was a historic Icon. The Durant Hotel was built in 1929 and was one of the finest convention hotels for over 50 years. Named after the found of General motors, William C. Durant, the hotel ended up vacant after the auto industry took a downward slide. But with a new initiative to rebuild Flint, the developer Buildtech proposed a $22 million renovation of the hotel.

Unfortunately, this affected a pair of residents that resided on the roof of the hotel, our lovely peregrine pair of Barry and Majesty. The renovation activities included restoring the parapet of the building where the pair had their one resting chick named Maize. It was decided that the best chance for the survival of the chick was to remove the chick from the ledge and place it across the street at the U of M Northbank building which is about 200' away.

The chick was netted by MDNR staff and placed across the street, only to find that the female quickly refocused her efforts on an unhatched egg that lied several feet away. A second intervention was done to remove the unfertilized egg to hopefully encourage Majesty to notice her chick was now on the other side of the street. The birds were observed throughout the day by volunteers and staff, and right before sundown, Majesty was observed on the new building, feeding her 3-week-old chick. Success!

Wildlife Managers working with urban birds have faced many challenges both good and bad. With social media and the amount of public that view the birds; when birds are grounded, or become injured, it doesn't take long before someone reports it to the MDNR to ask for help. Many urban falcon chicks will prematurely fledge and end up down on a busy street corner. We have had great success taking these downed chicks and placing them with a volunteer raptor rehabilitator who takes care of them, sometimes for weeks, and when they are ready, will release them to the original location, where they successfully rejoin their family and are immediately taken back under the "watchful wing" of their parents.

Social media also has taken interest in the birds where webcams and Facebook pages, have joined to watch these urban birds raise young right in front of their eyes on their computer screens. Of course, mother nature can be cruel and sometimes this means that webcam operators are scrambling for answers when a chick doesn't make it and hundreds of employees are watching the webcam.

One of our newest challenges with urban peregrines is that many of these birds have found their homes on coal-fired powerplants. These structures offer a high nesting location, no predators, and an abundance of small birds to prey on. Unfortunately, many of these power plants are outdated and scheduled for demolition. So, our current challenge is can we find a nearby tall structure (or make one) put up a nesting box and encourage them to use it…. Or are these efforts a lost cause and a huge waste of money, resources and staff time for a species that is no longer a species of greatest conservation need? Only time will tell, but in the meantime anytime you are driving in downtown Detroit or Flint… look up... and if you are lucky you will catch a glimpse of our urban birds of prey, the peregrine falcon.

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3.2.3 Osprey in Southeast Michigan: Adaptable Birds to an Urban Environment

Contact information:
Tom Schneider, tschneider@dzs.org

Background

Osprey are a summer resident, and in Michigan historically nested in the northern Lower Peninsula and the Upper Peninsula (Figure 1). One reason that they did well is that they are adaptable to human presence and often nest on man-made structures. The DNR installed specially-designed nesting platforms at many of the flooded wildlife management areas in the northern Lower Peninsula (Figure 2). The birds adapted to these sites and were very successful in raising chicks on these impoundments.

Figure 1. Osprey nesting sites in Michigan (Postupalsky, 1991).

Figure 2. Occupied nesting platform.

The Michigan DNR Wildlife Division was interested in attracting nesting osprey to southern Michigan, and a plan was developed to relocate, or hack, young osprey chicks to release towers located at several areas in southern locations, (Julie Oakes, personal communication). This method has been successfully used with osprey in other parts of the country, as well as with peregrine falcons in Michigan. The hacking program took place from 1998 to 2007.

Goals

The goal of the osprey translocation project was to establish a breeding population of at least 50 breeding pairs in the southern part of the state by 2020 and to provide opportunities for wildlife viewing.

Objectives
The objective was to relocate osprey chicks from nests in northern Michigan to hacking sites in southern Michigan. The relocation would occur when the chicks were five to six weeks old, and the chicks would be cared for until they fledged. Four release sites were identified including at Kensington and Stoney Creek Metroparks, Maple River State Game Area, and a site in Barry County.

Methods
Most osprey that nest on platforms in northern Michigan were routinely monitored, and nests with three healthy chicks were identified. One of the three chicks from those nests were removed, transported to southern Michigan, inspected by veterinarians, and placed in towers that were constructed at the hacking locations. They were fed prepared fish, which was placed in bowls within the hack box. Once the chicks fledged, at nine to ten weeks of age, they were released from the hacking box. While food was offered after they fledged, the birds quickly learned how to fish and did not take the food after a few days. The birds would leave the area after a few days or weeks and eventually begin their southern migration.

Year	Kensington MP	Stoney Creek MP	Maple River SGA	Barry County
1998	4			4
1999	6			6
2000	6			5
2001	6			
2002	2			
2003		4	3	
2004		4	2	
2005		3	2	
2006		4		
2007		4		

Table 1. Hacked osprey chicks by location and date.

Approach
Sixty-five osprey chicks were hacked (Table 1), and all relocated osprey chicks successfully fledged. While all birds were banded with both USGS and individual bands (Figure 3), no effort was made to track birds once migration started. Although some mortality was expected, it was anticipated that some birds would return in two to three years. Right on schedule, a 1999 hacked bird, C09, returned to its original hack site in 2001 and began nesting on a platform located 100 meters from the hack tower in 2002. This was the first recorded nesting in southern Michigan. He is still a productive bird and nested on a cell tower in 2017.

Figure 3. Individual ID bands.

In 2003, a second pair was established. Between the two nests, four chicks were produced. In each subsequent year, more nests were established. By 2007, there were 13 nests, and 23 chicks were produced. This was the last year of the hacking program. Since that time, nesting osprey have been monitored by a group of volunteers. As Figure 4 shows, the number of nesting pairs continued to increase every year.

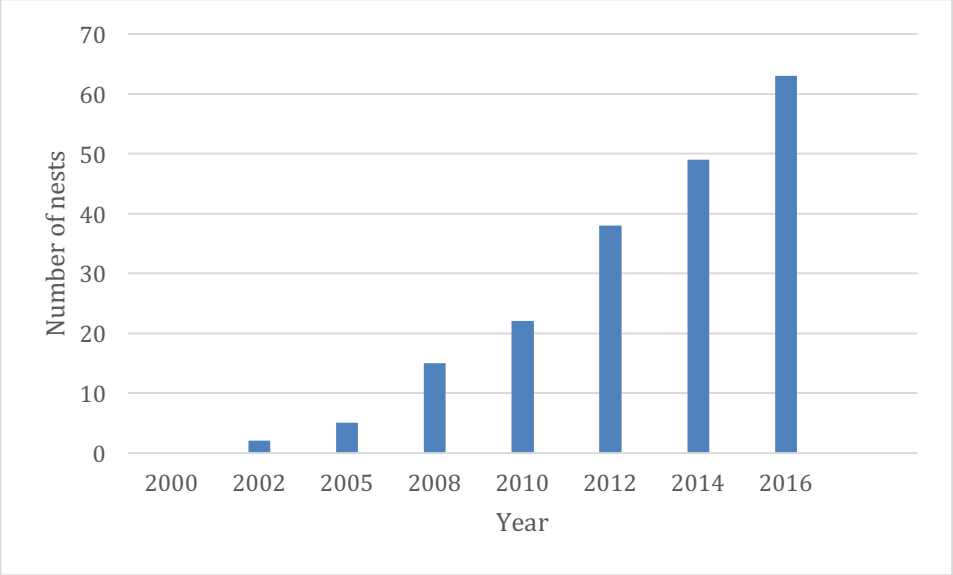

Figure 4. Osprey nests in southern Michigan, as reported by OWSEM volunteers.

Outcome

When the ten-year relocation project was completed in 2007, the program shifted to a monitoring and banding program. The original objective of 50 nesting pairs by 2020 was meet five years early when over 50 nests were observed in 2015. While nesting platforms were placed in appropriate

habitat, and were used in a number of locations, osprey began nesting on cell towers which allowed for many additional nesting opportunities. This was certainly a factor in the growth of the population.

One important development during the release program was the development of a dedicated group of volunteers, led by Barb Jensen, which began monitoring osprey nests as they became established. These volunteers eventually formed a non-profit group, Osprey Watch of Southeast Michigan (OWSEM), which has been instrumental in not only verifying and monitoring reported nests, but also in organizing the banding effort. There was concern that the cell tower companies would discourage osprey from nesting on the towers. Barb Jensen and OWSEM made direct contact with the cell tower owners and explained the importance of accommodating nesting osprey. As a result, not only did the cell tower companies protect the nests by restricting access during nesting season, but their maintenance crews lower the chicks from the towers for banding (Figure 5).

Figure 5. Maintenance staff assisting with banding, and signage at cell towers.

In 2013, OWSEM funded the placement of satellite telemetry units on up to four birds a year. The goal of this five-year project was to identify migration routes and wintering areas. A total of 22 birds were tagged from 2013 to 2017 and 20 survived long enough to begin migration. Seven died during the migration, and 13 arrived in either Central or northern South America. Unfortunately, only one bird, Ozzie, made a northern migration and then only to West Virginia. He did not nest and his signal was lost after he arrived back in South America. This project is now completed and details on the flight of each tagged bird can be found at michiganosprey.org/.

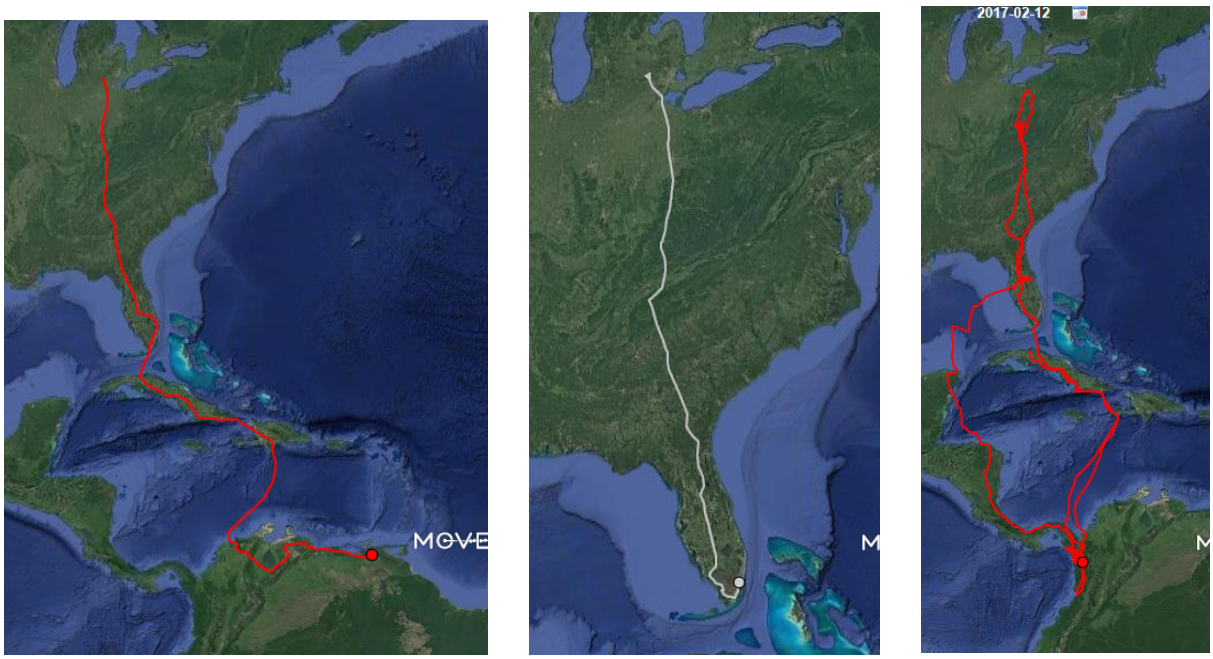

Figure 6. Example migration track to winter site, a track showing mortality during migration, and "Ozzie's" migration track.

Since osprey began nesting in southeast Michigan, the dedicated volunteers associated with OWSEM have been tracking the expanding number of nests. Other volunteers have observed birds as they have moved into other southern parts of the state. However, detailed annual reports have not been completed and the information has not been published.

Beginning in 2018, the Michigan DNR Wildlife Division, USDA Wildlife Services National Wildlife Research Center, and the Detroit Zoological Society will work with OWSEM and other volunteers to develop a citizen science osprey-monitoring program. Data collection has been standardized, with the goal of visiting every known osprey nest in Michigan's Lower Peninsula three times during the nesting season: once as the nests are being established, once during incubation, and at least once when chicks have hatched but not fledged. An annual report will be published at the end of the year, detailing osprey nesting success throughout the Lower Peninsula.

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3.2.4 Bald Eagle Indicator Trends in Southeast Michigan

Contact Information:
Chris Mensing, chris_mensing@fws.gov
Nicole LaFleur
John Hartig, johnhartig1@gmail.com

Background

Bald eagles (*Haliaeetus leucocephalus*) are large fish-eating raptors, averaging 10-14 lbs (4.5-6.4 kg) for females and 8-9 lbs (3.6-4.1 kg) for males, with an approximate seven-foot (2.1 m) wingspan (Figure 1). The bald eagle has been identified as an indicator of aquatic ecosystem health in the Lake Erie Lakewide Management Plan and by the State of the Lakes Ecosystem Conference (SOLEC) (Environment Canada and the U.S. Environmental Protection Agency 2003).

Bald eagles were documented in the early-1900s as being "evenly distributed" throughout Michigan (Michigan DNR 2005). The population then declined through the mid-1900s due to loss of nesting habitat and persecution by humans (shooting, poisoning, trapping, and electrocution). In the 1950s, the decline of eagles in Michigan accelerated until they were on the brink of extinction in the 1970s. This trend was similar throughout the lower 48 states and southern Canada. This decrease was a result of several factors, most influential being the increased use of organochlorine compounds such as dichlorodiphenyltrichloroethane (DDT) and polychlorinated biphenyl (PCBs) following World War II (Colborn 1991, Bowerman et al. 1995, Bowerman et al. 1998, Bowerman et al. 2003). Exposure to these contaminants in avian species causes reproductive failure, sterility, life-threatening deformities such as crossed bills and egg shell thinning, altered behavior such as impaired foraging abilities, increased susceptibility to disease through immune system dysfunction, and in cases of acute poisoning, death.

These reproductive impairments reached a peak in the mid-1970s, resulting in only 38% of Michigan's bald eagle populations successfully fledging young. In 1980, bald eagles nesting along the Lake Erie shoreline experienced complete reproductive failure. Bald eagle recovery efforts in the U.S. and throughout North America began in the early 1970s with the banning of DDT in the United States in 1972 and the passage of the Endangered Species Act in 1973. As a result, from 1981 through 2005 the Michigan bald eagle population has continually increased and continues to do so (Figure 1, USFWS, unpub. data).

Geographic Area of Coverage

For the purpose of this indicator report, the geographic area of coverage is southeast Michigan, including Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne counties. The results of long-term reproductive monitoring are summarized below for all bald eagles nesting within the seven-county region.

Use as a biological indicator
Biological indicators are important tools for estimating ecosystem health. Bald eagles are ideal as biological indicators because they are a vulnerable species with low tolerance to environmental contaminants (Golden and Ratner 2003). The increasing population of bald eagles suggests that contaminants in the ecosystem are less prevalent. However, not all population shifts are due to environmental toxins. In Michigan, anthropogenic factors such as collisions with vehicles are the main cause of female eagle mortality and should be considered when planning management actions (Simon 2016).

Status and Trends
In Michigan, the Michigan Department of Environmental Quality and the USFWS coordinate a monitoring program aimed at assessing the health of bald eagles. For this indicator report, bald eagle data have been compiled from a combination of fixed-wing aircraft and helicopter surveys and citizen reports.

From 1961 to 1987 there were no bald eagles produced in Metropolitan Detroit due primarily to organochlorine contamination (Figure 1, USFWS unpub. data). Since 1991, there has been a steady increase in the number of occupied bald eagle nests per year in metropolitan Detroit. From 2012-2015, at least 25 active nests have been documented each year, resulting in the fledgling of 28 or more young per year. An average of 1.06 eaglets were fledged per occupied nest in southeast Michigan from 1995-2015, which is indicative of a stable or increasing population and meeting the U.S. recovery goal. In 2007, the USFWS removed the bald eagle from the endangered species list because their populations recovered sufficiently across the United States.

Management Next Steps
The bald eagle remains federally protected in the U.S. under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act, and is classified as a "species of special concern" in Ontario, Canada. Efforts should be undertaken to protect existing nesting and foraging habitats (Watts 2015). Management should continue to place a priority on controlling contaminants at the source and on the remediation of contaminated sediment "hot spots", to ultimately ensure that contaminant levels in fish and other aquatic prey do not result in reproductive impairment of bald eagles. Reproductive outcomes and contaminant exposures should continue to be monitored. This species will also benefit from increased public outreach and awareness of the threats to the health of the species and the ecosystem.

Research/Monitoring Needs
Yearly monitoring of bald eagle populations should continue throughout the Detroit River and western Lake Erie watersheds. Eaglets should continue to be banded and have representative samples taken to monitor levels of contaminants, to determine health status of individual eagles and the ecosystems in which they reside. Contaminants of concern include organochlorine compounds and heavy metals, as well as emerging new generation compounds. Furthermore, additional laboratory and field studies may be necessary to clarify the role of environmental endocrine disruptors on reproduction in avian populations (Bowerman et al. 2000).

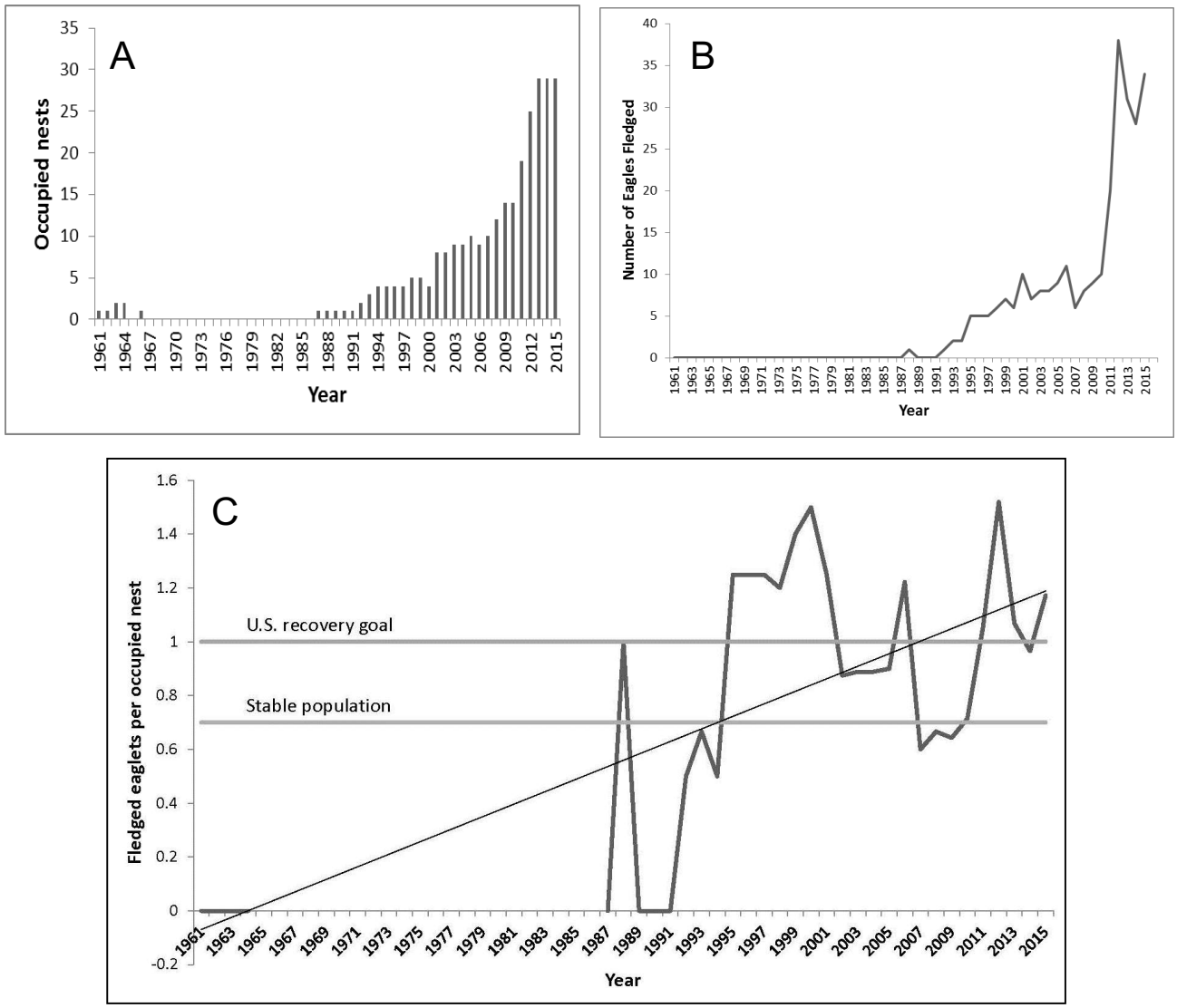

Figure 1. A: Number of occupied bald eagle nests in southeast Michigan, 1961-2015; B: Number of eaglets fledged in southeast Michigan, 1961-2015; and C: Number of eaglets fledged per occupied nest in southeast Michigan, 1961-2015 (data source: U.S. Fish and Wildlife Service, unpub data).

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3.3.1 Colonial Waterbirds Session Summary

Contact information:
Tom Schneider, tschneider@dzs.org

Colonial waterbirds in the Lake St. Clair/Detroit River/western Lake Erie basin have undergone declines because of habitat changes, human disturbance, fluctuating lake levels, and changes in predator composition. Many of the species are state listed and there are conservation efforts with many of these species. These presentations discussed the status, management efforts, and research occurring for three species.

Common terns (*Sterna hirundo*) are a cosmopolitan species that historically bred by the thousands in the LSC/Detroit River/Western Lake Erie corridor. However, over the last 50 plus years, the species has declined and there are now less than 500 pairs over three different nesting locations. All colonies are monitored, and active management occurs on the Lake St. Clair and Belle Isle sites. A newly-formed pier has been constructed off of Stoney Island, and attempts are being made to attract birds there in upcoming years with the use of decoys and sound system; following the protocols established on Belle Isle. The goal is for numbers to remain stable or increase.

Black terns (*Chlidonias niger*) are a Michigan Species of Special Concern that require mats of floating vegetation in shallow wetland areas for nesting. One of the most important nesting areas in Michigan is the St. Clair Flats. The Detroit Audubon and Audubon Great Lakes have been studying the breeding success and productivity of this species since 2013. The results of these studies have provided estimates of the number of nesting terns, the breeding success, and factors that limit breeding success. The goal is to incorporate these results into management decisions, ultimately improving reproductive success.

Finally, new technologies are allowing researchers to understand movements of birds across all stages of their annual life cycle. Scientists at Ohio State University have used Motus tower receivers to track the movement of Black-crowned Night-Herons (*Nycticorax nycticorax*) across the western Lake Erie basin and satellite transmitters to identity migratory routes and wintering sites. These units have also been used with black terns in the St. Clair Flats. As a wider array of Motus towers becomes established across the country, additional studies will provide more information needed to protect these species during their entire life span.

3.3.2 The Conservation and Management of the North American Black Tern (*Chlidonias niger surinamensis*) in Michigan

Contact information:
Caleb Putnam, cputnam@audubon.org
Stephanie Beilke, sbeilke@audubon.org
Erin Rowan, erowan@audubon.org

Introduction

Since 2013, Detroit Audubon and Audubon Great Lakes have studied Black Terns (*Chlidonias niger*) at St. Clair Flats, Michigan with the primary goals of estimating colony size, breeding success and productivity of this Michigan Species of Special Concern. St. Clair Flats has been and remains Michigan's largest colony for this important species. The data collected are being used to determine land management and conservation strategies needed to abate threats to breeding success and remove limiting factors to colony occupancy.

A species of conservation concern in most Great Lakes states, the Black Tern, is receiving increasing attention by federal and state agencies, including the Upper Mississippi River/Great Lakes Joint Venture. Black Tern populations have experienced a decline of 48-71% between 1991 and 2006 in Michigan, and range-wide losses of 61% between 1966 and 1996 (Scharf 2011). This constitutes a three percent annual reduction in numbers. New research (Wyman and Cuthbert 2017) shows that colony abandonment has occurred at a faster rate than the population decline, and suggests that large colonies, like those at St. Clair Flats, hold the highest conservation value. Both the proximate and ultimate causes of the population decline are unclear. Preliminary demographic data from studies in breeding colonies in Wisconsin (Shealer 2007) suggest adult survivorship may be too low in some areas to support population maintenance. Basic demographic information for most colonies is lacking.

Any effort to measure population demographics involves a long-term dataset and annual focused effort, and this project is no exception. Models from Wisconsin (Shealer 2007) and Maine (F. Servello, pers. comm.) required trapping of over 1,000 adult Black Terns over a decade or more in order to properly estimate adult survivorship, for example. Shealer (2007) estimates adult survivorship in those populations at approximately 62-65%, which is too low to viably maintain a population. In order to better evaluate survivorship at a regional scale, long-term mark-recapture surveys need to be replicated in additional colonies. These replicative studies will confirm adult and natal site fidelity (best achieved with satellite transmitters), juvenile survivorship to breeding age (2 years), colony exchange rates (transmitters), and all relevant demographic information (Putnam 2016). These concerns led to the expansion of the productivity survey to include trapping and banding of adult and young Black Terns in 2013.

This dataset will inform land managers how best to remove limiting factors to Black Tern population growth.

Methods

Monitoring Effort. Volunteer and staff technicians monitored the Black Tern colony on St. Clair Flats in periods of two days every 7-10 days, between May 15 and July 30, 2016, depending on weather and the departure date of the Black Terns. Technicians used a small mud boat provided by Michigan Department of Natural Resources to access the flats and work in pairs of two for safety and to maximize monitoring effort.

Early in the season, monitoring goals were to gather nest counts and nest sub-colony location information, and to assess nesting phenology, which varies greatly between years in accordance with changing weather conditions (Putnam 2016). As the season progressed, monitoring goals shifted to capturing and banding adult Black Terns. Monitoring goals for the end of the season were to assess nesting success, number of young fledged and banding chicks.

Nest Monitoring. All nests were geo-referenced with a handheld GPS unit (2013-2016) or smart phone via ArcGIS Collector App (2017), and revisited two to three times throughout the season to determine nest success (until hatching or nest failure, whichever occurs first). A float test of the eggs provided additional corroboration of incubation stage to help predict the actual hatching date, which assisted technicians in prioritizing adult capture and visitation schedules. Adult capture was most efficient within one week of the estimated hatch date, when adults are most invested in the nest (pers. obs.).

Capture and Banding of Adults and Chicks. Two active radio-controlled, bow traps, and four passively-entered top entry (2) and side entry (2) chicken-wire traps were utilized each season, depending on the nesting substrate and behavior of nesting adults. Once real eggs were safely removed from the nest and replaced with dummy eggs, traps were placed over the nest. Technicians and volunteers then moved a safe distance from the nesting site, allowing adults to settle down into the traps. The line of sight of the traps was marked with a PVC pole placed 5-10' behind the nest. Knowing what distance to stand back from the colony, and how to maximally place multiple traps simultaneously to maximize the overall capture rate is imperative and requires practice. Trapping was done in one area for roughly 1-2 hours, depending on the number of active traps in use, by which time, technicians moved onto another area to reduce stress on the adults.

Trapping sites and dates were scheduled based on the estimated hatching date of each clutch. Adult trapping is most successful within 7-10 days of the hatching date (pers. obs.). All chicks handled were banded with stainless steel USGS bands and measured for mass. All adults handled were banded and measured for mass, wing length, head and bill length, body and flight feather molt, feather wear, and molt limits.

Population Estimation. Populations have been proven difficult to estimate over such a large area and often fluctuating sub-colonies. The number of nests found at each sub-colony serve as an initial estimate of the number of pairs of adults present, but due to missed nests due to technician error, nests failing, and re-nesting attempts (which can also involve relocation to another sub-colony), this method is not entirely accurate. Additionally, technicians counted the number of adults flushed upon arrival at a breeding sub-colony. While this count is taken throughout the season, technicians did an additional targeted simultaneous flushed count of each sub-colony in

as short a period as possible in mid-June, to minimize double-counting of re-nesting adults at separate sub-colonies, and guarantee maximum colony occupancy at the time of survey, which was approximately June 15-25. Targeted flush counts are used in conjunction with nest counts (only where flush counts were not possible) to obtain an overall population estimate.

Hatching and Fledging Success. Ideally, hatching and fledging success would be measured by following each egg through to fledging. However, hatchlings begin swimming away from the nest 2-3 days post-hatching and eventually leave the nesting platform permanently. As a result, tracking chicks to fledging is not possible without intense individual marking or telemetry, and may not be feasible with current technology. Instead, hatching success is used as a surrogate for fledging success. Future efforts to clarify mortality rates of pre-fledged hatchlings are highly desirable, as technology allows.

Until it is possible to track any individual chick to fledging, technicians counted flying fledglings, which provided an indirect and highly imprecise metric of fledging success. It is completely unknown how quickly flying juveniles might depart the flats and many are likely missed due to limited time spent in the field. More data are necessary to confirm whether the absence of flying juveniles connotes evidence that no hatchlings survived to flightworthiness.

Results and Discussion

Colony locations. Black Terns changed nesting locations between and within seasons, in response to changing distributions of floating dead bulrush stem mats. The distribution of Black Tern sub-colonies on St. Clair Flats remains similar, with some notable between-year changes. Perhaps most notably, Muscamoot was the epicenter of breeding activity in 2016 and 2017, while Strawberry colony dropped precipitously. Mackie colony increased significantly, while other colonies stayed roughly the same.

Water levels on the flats were the highest in 2016 and 2017. Many areas which were fairly deep in 2015, such as Strawberry, were too deep for nesting in subsequent years. The overall increase in water depth however, makes the colonies increasingly difficult for land-based predators to reach and a significant number of nests were found.

Black Terns are clearly adept at adjusting to micro-habitat conditions between years and within years (during re-nest attempts).

The number of Black Terns nesting at St. Clair Flats. The minimum tally of pairs found nesting at St. Clair Flats over the years confirms that roughly 300 adults are present at St. Clair Flats annually. This suggests at least 150 single nesting attempts. Given that many nests fail, and pairs then re-nest, at times in different areas and in differing numbers between years, the overall number of nests found may not be a suitable surrogate for estimating the actual number of adults. All population estimates made could include some double-counting of adults which switched colonies during the brief period during which we conducted peak counts. For 2016 and 2017, most of these counts were made during June 9-22 during concentrated flush counts.

Year	2013	2014	2015	2016	2017
Adults	200	145	150	150	156

Table 1. The total estimated minimum number of pairs of adult Black Terns at St. Clair Flats during 2013-2016. These estimates are inherently subjective (see text), and these numbers represent what we believe are reliable minimum estimates, and very likely undercounts.

Black Tern Nests at St. Clair Flats. More nests have been found each year at St. Clair Flats (Table 2). This very likely is not representative of an increase in the number of nests, but rather an increase in the technician's skill at finding them. Given that an estimated 300 adults are present each year, likely more (see above), these findings suggest that technicians are missing a lot of nests. Missing nests is unavoidable, as not all areas can be searched effectively each week. Colonies that fail early are often missed entirely, because the area is unable to be surveyed prior to a storm failure or predation event. A more complete survey would require more technicians, boats, and person-hours. Ultimately, this would require more funding and multiple technicians, or perhaps daily visits of one technician.

Year	2013	2014	2015	2016	2017
Nests	50	68	81	101	247*

Table 2. The number of total Black Tern nests found on St. Clair Flats during 2013-2017. * 2017 is preliminary and may include 2nd, 3rd and possibly 4th nesting attempts after nest failure and possibly a small number of duplicates.

Hatching & fledging success. Ideally, hatching and fledging success would be measured by following the ultimate fate of each egg to completion, but with current technology, this is not possible. Instead, as previously mentioned, hatching success is used as a surrogate for fledging success. This method infers an actual hatching rate of between 50% and 89%, most years at St. Clair Flats, which is very high.

Banding of adults. The number of adults has steadily increased over the years due to technicians fine-tuning capture methods over time (see Table 3). In 2016 there was a slight drop in capture rates due to reduced effort in the field and a new technician being trained. In 2017, an increase in capture rates and effort resulted in 63 newly-banded adults.

Year	Adults	Chicks
2013	9	32
2014	12	67
2015	37	76
2016	35	65
2017	63	132
Project Total	**156**	**372**

Table 3. Summary of annual adult and chick Black Terns banded at St. Clair Flats since 2013. Totals represent only newly-banded adults (omits recaptures).

Banding of Chicks. Chick banding totals are shown in Table 3. While 372 flightless chicks have been banded, the actual number present was certainly much higher. Infrequent visitation to the colony prior to 2017 prevented a higher capture rate.

Recaptures. Fifteen individuals have been recaptured to-date, including two natal recruits. These recaptures are not included in the totals in Table 3. The most exciting recapture to date (band #2451-31818), was banded as a chick in Mackie colony on June 30, 2014, and recaptured in Muscamoot on June 20, 2016. This bird was not captured in 2015, and represented the first ever natal recruit for St. Clair Flats.

Storms. Strong thunderstorms continue to be the primary threat to tern nests on St. Clair Flats. In lieu of having camera traps which can nail down such nest failures with certainty, these results are based on nest monitoring efforts that observed nest failures following storm events each year. In particular, Fisher Highway appeared to experience significant nest loss, and subsequent abandonment by nesting adults following the May 28 and June 4-5, 2016 storms (E. Rowan, unpub. data) and has not been recolonized since. Increased water depth during 2016 and 2017 may have exacerbated storm damage, as wave action could have been more intense. It is also possible that fish predation may be exacerbated by deeper water, as Pike (*Esox lucius*), Smallmouth Bass (*Micropterus dolomieu*), or Muskellunge (*Esox masquinongy*) may be better able to access the nesting areas. This merits further study.

Predation issues. Mammalian and avian predation generally are minimal at the flats, with weather a more important source of nest and chick loss (Putnam 2016). Most years, only a small amount or no evidence of nest depredation was observed. In 2016, eggs had been found destroyed by what appeared to be piercing, possibly by a Black-crowned Night-Heron (*Nycticorax nycticorax*). However, no Black-crowned Night-Herons were observed on the flats and no diurnal heron activity in the colonies was noted (other than a flyover by a Great Blue Heron at Fisher Highway on July 7). MDNR biologists reported single Black-crowned Night-Herons (unpub. data) in 2016 on Harsen's Island, though none have been observed on the flats.

Chick predation was extremely difficult to document, given that chicks are frequently on the move and impossible to locate after a short time following hatching. That said, a single chick was found with laceration wounds on its belly and back, injuries that were most consistent with a Smallmouth Bass attack (John Darling, Erin Rowan pers. comm.). Pike or Muskellunge would have produced puncture wounds, and a Snapping Turtle (*Chelydra serpentina*) would have killed the chick. This chick recovered in the care of our technician and was released.

A single raccoon was observed in May of 2016 swimming across Doty channel toward Doty East, though no Black Terns were yet nesting. This is a potential predation source to be aware of in the future. Each year technicians witnessed Northern Water Snakes (*Nerodia sipedon*), especially near Mackie and Doty East, and also in Muscamoot. Predation of young and eggs has not been observed however. Muskrats and minks continue to be present in the Black Tern colonies at St. Clair Flats, but do not seem to exert any undue predation pressure.

New Technology. MOTUS Wildlife Tracking System (motus.org) uses coordinated automated radio telemetry arrays to track the movements of wildlife internationally. Digitally encoded radio transmitters, or nano-tags, are affixed to individuals and broadcast signals to MOTUS towers which have been erected across the globe. Fourteen of these nano-tags were attached to banded Black Tern adults in 2017, and a MOTUS tower was erected on Harsens Island thanks to partners at

Canadian Wildlife Service. MOTUS data will help determine migration routes and wintering grounds of the Black Terns at St. Clair Flats.

Two camera traps were utilized in 2017, thanks to partners at the Detroit Zoo, which will hopefully elucidate causes of nest failure and potential nest and hatchling predation at St. Clair Flats.

Surveys of additional Black Tern colonies

As previously mentioned, to better understand Black Tern survivorship at a regional scale, long-term mark-recapture surveys need to be replicated in additional colonies. Outside of St. Clair Flats, Audubon Great Lakes and partners surveyed Black Terns at Ogontz Bay (Delta Co., Michigan) in 2016 and 2017. This site was sadly abandoned in 2017. Surveys will be attempted again in 2018 in the hopes that Black Terns return to the area.

Baseline surveys of a Black Tern colony were conducted at Wigwam Bay State Wildlife Area (Arenac Co., Michigan) in 2017 and more robust survey work is planned for the summer of 2018. This research aims to measure the potential preferences of Black Terns for vegetation management strategies. The goal of this vegetation management is to recruit nesting Black Terns into new areas and inform land managers of best practices.

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3.3.3 Status of Common Terns in Southeast Michigan

Contact information:
Jessica Jozwiak, jjozwiak@dzs.org

Background

Common terns (*Sterna hirundo*) are Neotropical migratory birds that winter along the east and west coasts of South America. They return to breeding grounds in Michigan in mid-April, with the breeding season spanning May through July. Breeding sites in southeast Michigan, specifically along the Detroit River corridor and western Lake Erie, were historically some of the most productive. The population overall and number of breeding sites have declined in the last three decades across the Great Lakes region where they are listed as either threatened, endangered or extirpated. Common terns have been listed as a threatened species in Michigan since 1979.

Discussion

The construction of shipping lanes, canals and piers, and the subsequent deposit of dredge spoils created suitable habitat for common tern nesting along the Detroit River in the 1960s. During this time, they were observed at five breeding sites, reaching a peak of 4,500 pairs (Figure 1; Norwood et al. 2011). Mud Island, located midway on the Detroit River, provides a good example of breeding habitat succession: As water levels rose, most of the island was lost, forming a shoal; dredge spoils were deposited on the shoal in the mid-1960s, which created suitable nesting habitat. From 1966-1972, "several thousand" chicks were banded (Courtney and Blokpoel 1983). Numbers started to steadily decline thereafter mainly due to habitat loss resulting from displacement by earlier nesting gulls, plant succession and human disturbance, and egg and chick predation. As plant succession occurred, the island became covered in dense vegetation and was no longer suitable for common tern nesting.

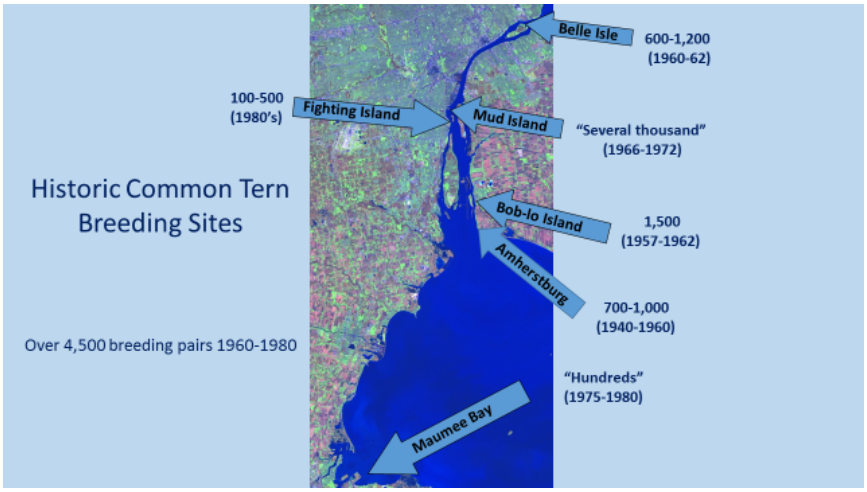

Figure 1. Historic Common Tern Breeding Sites on Detroit River.

In recent years, the numbers along the Detroit River have fluctuated between 316 nesting pairs in 2003 (Szczechowski and Bull 2007) to 135 nesting pairs in 2008 (Cuthbert and Wires 2008; Norwood 2009). An informal census conducted by Detroit Zoo personnel in 2017 estimated the Detroit River population at 79 nesting pairs at three breeding sites. There are currently four breeding sites in southeast Michigan: three located on the Detroit River and one located on Lake St. Clair (Figure 2).

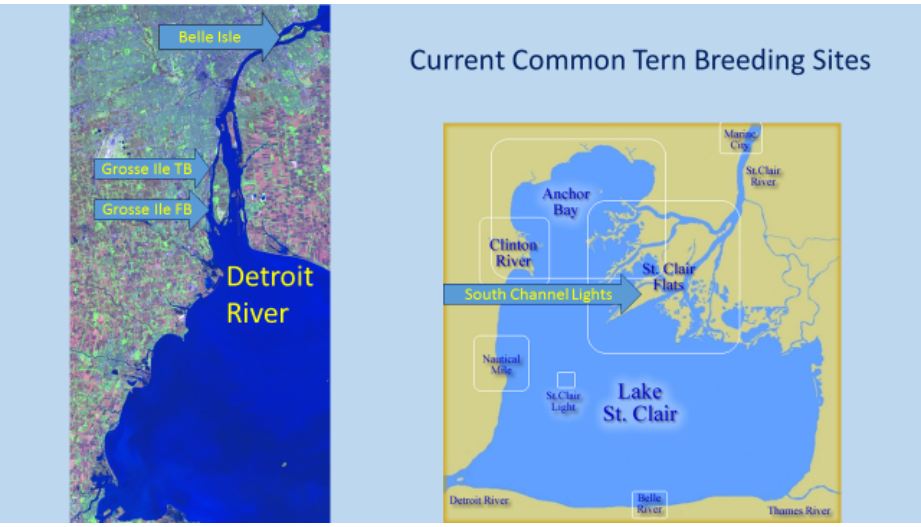

Figure 2. Current common tern breeding sites on the Detroit River and Lake St. Clair.

The Wayne County Bridge, locally known as the "Free Bridge", is one of two swing bridges that crosses the Trenton Channel and connects the island of Grosse Ile with the mainland. Common terns have been nesting on the north and south protection piers since the early 2000s. In 2003, a non-governmental organization added a limestone chip substrate to both piers to make the habitat more suitable for common tern nesting. Nesting pairs have been observed annually since then, but productivity has remained low due to egg and chick predation by both avian and mammalian predators. A high level of nocturnal desertion also occurred at this site, mainly due to nightly visits by black-crowned night herons and great horned owls during the peak of the breeding season. The U.S. Fish and Wildlife Service most recently managed this site but it has remained unmanaged from 2015 to present day. This has resulted in little if any productivity due to lack of predator control and increased plant succession. Rising water levels have also submerged up to half of the north pier the last 2 years. Approximately 30 adults were observed 2017.

The Grosse Ile Toll Bridge is located 5.2 km north of the Wayne County Bridge and is privately owned and operated by the Bridge Company. Common terns have been nesting on the north and south protection piers since the late 1990s. In the early 2000s, a non-governmental organization improved the habitat by adding a limestone chip substrate to both piers; the bridge owners have completed vegetation management annually thereafter. This site has been difficult to monitor due to owner constraints but appears to remain productive. In 2011, approximately 100 breeding pairs were noted (Norwood et al. 2011) and 130 adults in 2017; fledglings have been observed annually. The isolated piers, surrounded by a steel seawall, protect this site from mammalian predators, but fledgling and adult predation by great horned owls has occurred.

Another nesting site is located on Belle Isle, which is an island park located near the mouth of the Detroit River. It is owned by the City of Detroit and managed by the Michigan Department of Natural Resources (MI-DNR) through a 30-year lease. The tern breeding site is located on an artificial peninsula at the northern end of the island. The peninsula is part of the City of Detroit municipal water intake, which is under the auspices of the Great Lakes Water Authority/Detroit Water and Sewerage Department. Historically this was the most productive breeding site on the Detroit River and in southeast Michigan. Records from 1959 and 1960 note 1,500 and 1,200 nesting pairs with 2,914 and 2,401 chicks banded respectively (Nickell 1959-60). Terns abandoned the site in the mid-1960s due to human disturbance. In 2009, the Detroit Zoo collaborated with the Detroit Water and Sewerage Department and the US Fish and Wildlife Service to restore the breeding habitat. Small trees and shrubs were removed and a sand/gravel substrate was added; the site was further expanded in 2011. Social attraction methods consisting of a solar-powered sound system that plays non-aggressive common tern calls, and decoys were used to lure common terns back to the site. In 2010, four terns were observed exploring the site, and in 2011, twelve nesting pairs produced eggs (Jozwiak 2010-2017). Raccoons predated all the eggs, which facilitated the installation of a portable, electrified fence. It was suspected and later confirmed that fox snakes were predating eggs and chicks. A free-standing snake preclusion fence was added, but was ineffective. The electrified fence was eventually modified to preclude snakes by installing a section of poly-mesh with an overhang. The MI-DNR granted a threatened/endangered species permit (fox snakes are listed as a state threatened species) which allowed the capture and relocation of snakes found near the site to other parts of the island. These efforts appear to have largely limited snake predation resulting in 14 nesting pairs and 12 fledglings in 2017 (Jozwiak 2010-2017).

The fourth nesting site is located on one of two decommissioned South Channel range lights located in Lake St. Clair near the southeastern tip of Harsens's Island. The non-profit group Save Our South Channel Lights (SOS) supports both structures. The Detroit Zoo collaborated with SOS in 2011, and in 2012 removed overgrown vegetation on the north range light habitat making it more suitable for common tern nesting. Prior to the north range light habitat restoration, the terns nested on the south range light, which has since been repurposed for other use by SOS. The terns relocated to the north range light the following year with an estimated 98 nesting pairs and numerous chicks fledging. In 2017, there were an estimated 130 nesting pairs. Since this site is isolated from land and surrounded by a steel seawall, it should continue to have few limiting factors other than vegetation management.

Recommendations

During a Common Tern Roundtable held in 2010, tern managers, researchers and experts agreed that the number of pairs nesting at sites on the Detroit River should be maintained at current levels and productivity increased where possible. Productivity is measured by the number of chicks fledged at each site, and is directly correlated to the annual investment in predator control, habitat management, and monitoring that occurs at each site.

The Lake St. Clair and Grosse Ile Toll Bridge sites should continue to be productive with annual vegetation management. There is potential for productivity to increase at the Belle Isle site, but this will require intensive predator management to achieve the population number that can withstand some predation pressure. The Grosse Ile Free Bridge site will remain unmanaged due to the resources required to conduct the intensive predator management required. The Detroit Zoo

will continue to take a larger role in monitoring common tern productivity at all sites in southeast Michigan (Figure 2).

The establishment of an additional common tern breeding site is planned for 2018. The site will be located on a newly restored protective shoal adjacent to Stony Island. The uninhabited island is located in the lower Detroit River near the Livingstone Channel and managed by the Michigan Department of Natural Resources as part of the Pointe Mouillee State Game Area. Development of the common tern habitat was part of a larger Great Lakes Restoration Initiative funded project to restore the Stony Islands existing protective shoals, which in turn will help protect the islands wetlands. The MI-DNR and the Detroit Zoo will collaborate on site management and plan to use decoys to attract terns to the site.

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3.3.4 Multiscale Movements of a Threatened Population of Black-crowned Night-Herons in Lake Erie, Ohio Using Satellite and Automated Telemetry

Contact information:
Kristie A. Stein, stein.405@osu.edu
Laura J. Kearns
Christopher M. Tonra, tonra.1@osu.edu

Introduction

Advances in tracking technology, such as tag minimization and increased battery life, are allowing scientists to better understand how individuals move during all stages of their life cycle. Limited information, primarily obtained from band recoveries, exists on the movement ecology of Black-crowned Night-Herons (*Nycticorax nycticorax*) breeding in North America. In the Great Lakes region, the Black-crowned Night-Heron is listed as threatened, endangered, or a species of special concern in 7 of the 8 bordering states. In Ohio, the number of nesting pairs and active colonies within the state has been declining since the 1970s. To identify local movements and migratory strategies, we deployed ten platform transmitting terminals (Tag mass: 29g, TAV-2630, Telonics, Inc.) onto adult Black-crowned Night-Herons and 60 nanotags (Tag mass: 4.8g, NTQB-6-2, Lotek Wireless) onto juveniles in the western Lake Erie basin in July-August of 2016. Tagged adults were tracked via the Argos satellite system, and we used an array of 13 Motus automated telemetry towers to track movements of juvenile birds. We found evidence of variation in local and large-scale movements of adult and juvenile night-herons. Survival of nestlings differed between island populations. Once night-herons fledged from the islands, survival rates were similar between the islands. By understanding local survival rates as well as establishing connectivity of Ohio's breeding population to wintering sites, we further our understanding of potential hazards to this species and can identify states with which to partner in conservation efforts.

Objectives

Objective 1: Estimate survivorship of pre- and post-fledging juvenile night-herons
Objective 2: Determine the migratory behavior and wintering range of adult night-herons

Methods

Study Site. This research was conducted on two breeding colonies of Black-crowned Night-Herons, West Sister Island National Wildlife Refuge (WSI) in Lucas County and Turning Point Island (TPI) in Erie County, Ohio. WSI is a 31-hectare island located 13 km north of Ottawa National Wildlife Refuge and is home to the largest nesting site of Black-crowned Night-Herons in Ohio. TPI is a 2-hectare man-made island located 0.22 km offshore in Sandusky Bay. Both islands provide nesting habitat for other species of waterbirds including Great Egrets (species of special concern), Snowy Egrets (state-endangered), Cattle Egrets (state-endangered), Great Blue Herons, and Double-crested Cormorants.

Nestling monitoring and tracking. Nestlings were hand captured twice at the nest during the period before they fledge. Measurements made at initial capture include tarsus length, culmen length, wing length, and weight using standard procedures (Pyle 1997). Additionally, nestlings were marked with a nail clip for further identification. On the second nest check, we recaptured the same individuals and recorded the same measurements. All individuals were given an aluminum band (Size 7A) and a colored alpha-numeric band on the opposite leg. One nestling of appropriate weight was fitted with a nanotag (Tag mass: 2.6g, NTQB-6-2, Lotek Wireless Inc.) attached to a figure-8 harness (Rappole and Tipton 1991). Nanotags did not exceed 0.01% of the individual's body weight.

We operated 13 radio telemetry towers on the western and southern shores of Lake Erie, with sites in both Ohio and Michigan (Figure 1). Each tower is fixed with two 9-element Yagi antennas connected to an automated receiver (Lotek Wireless, Inc.) powered by a solar panel and marine battery. Antennas are located approximately 10 m above the ground on all towers, and detection range for towers is approximately 15 km. Tag identification number, date and time, antenna number, and signal strength were recorded for each received signal.

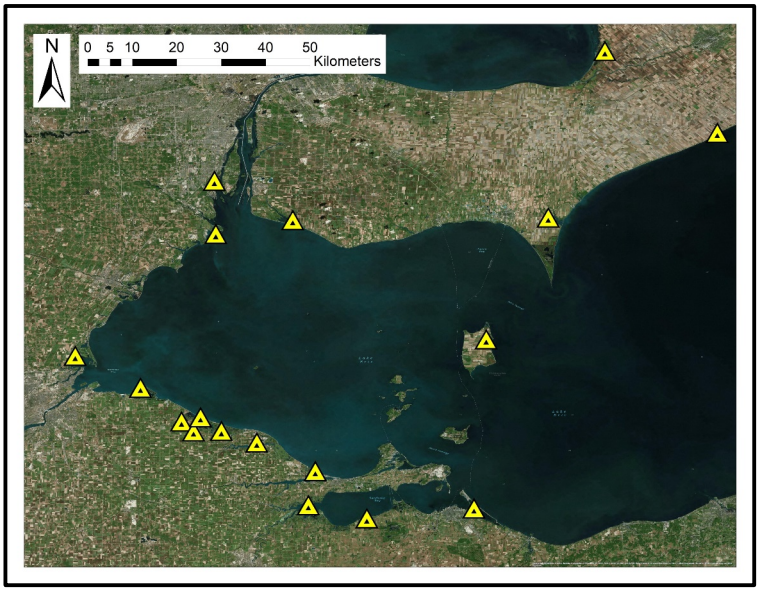

Figure 1. Location of automated telemetry towers in the Western Lake Erie basin used to track fledgling Black-crowned Night-Herons. The 13 towers from Sandusky to Detroit are managed by the night-heron project. The remaining 5 towers are managed by Bird Studies Canada.

Adult capture. We captured adults using a baited whoosh net technique at both local marinas and Ottawa National Wildlife Refuge (Figure 2). Upon capture, adults were measured and fitted with a uniquely numbered aluminum band (Size 7A), a colored alpha-numeric band on the opposite leg, and a backpack-style Argos satellite transmitter (Tag mass: 29g, TAV-2630, Telonics, Inc.). Satellite transmitters were attached using flexible Teflon ribbon harnesses. The transmitter weight did not exceed 5% of the individual's body weight.

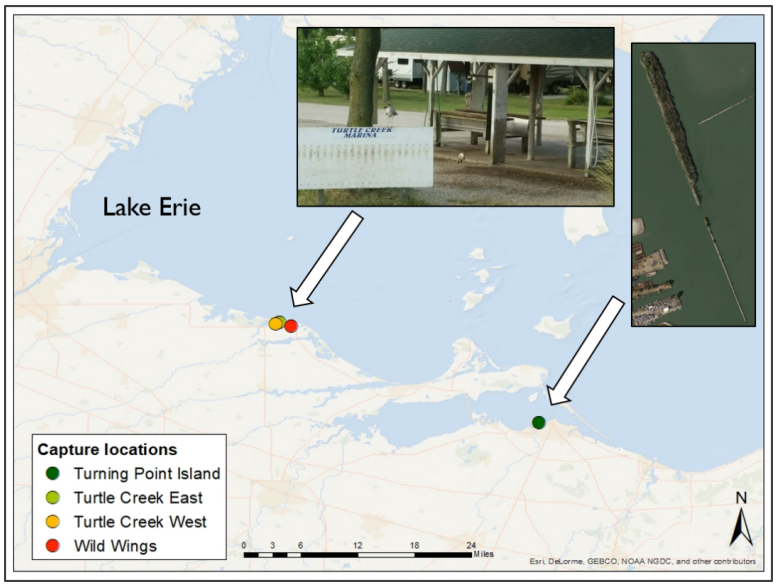

Figure 2. Capture locations of adult Black-crowned Night-Herons during June-August 2016.

Results

Nestlings. A total of 40 nests and 136 nestlings were monitored during the 2016 breeding season (n=72 at WSI and n=64 at TPI). Of these nestlings, 60 individuals were fitted with nanotags. During the period from hatching to 25 days, we found survival of nestlings at WSI to be significantly higher than at TPI (WSI = 75.9% and TPI = 56.8%, p = 0.031, Figure 3). Mean age of death between islands was 7.4 days old (Figure 4). When considering survival of radio-marked birds from hatching to post-fledging dispersal, we found survival to be similar between islands at 68.8% at TPI and 62.4% at WSI (p = 0.93, Figure 5).

Nano-tagged fledglings were detected on all 13 of our local towers (Figure 1). During the post-fledging period, movements between wildlife areas were very common. Most emigration from the study area occurred in October and November. Outside of the 13 local towers, juvenile birds were detected on 7 towers around Lake Erie (n=7) and 4 towers in North Carolina, South Carolina, and Florida (n=6).

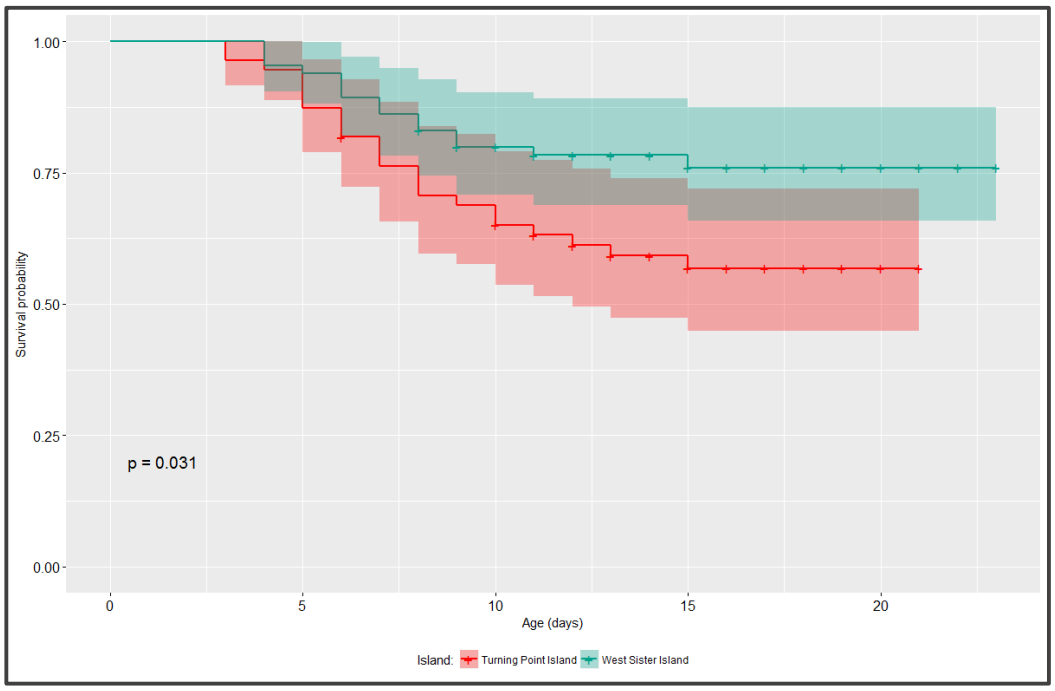

Figure 3. Kaplan-Meier survival curve (with 95% CI highlighted) illustrating cumulative survival curves for nestling Black-crowned Night-Herons through 25 days old at two island breeding colonies.

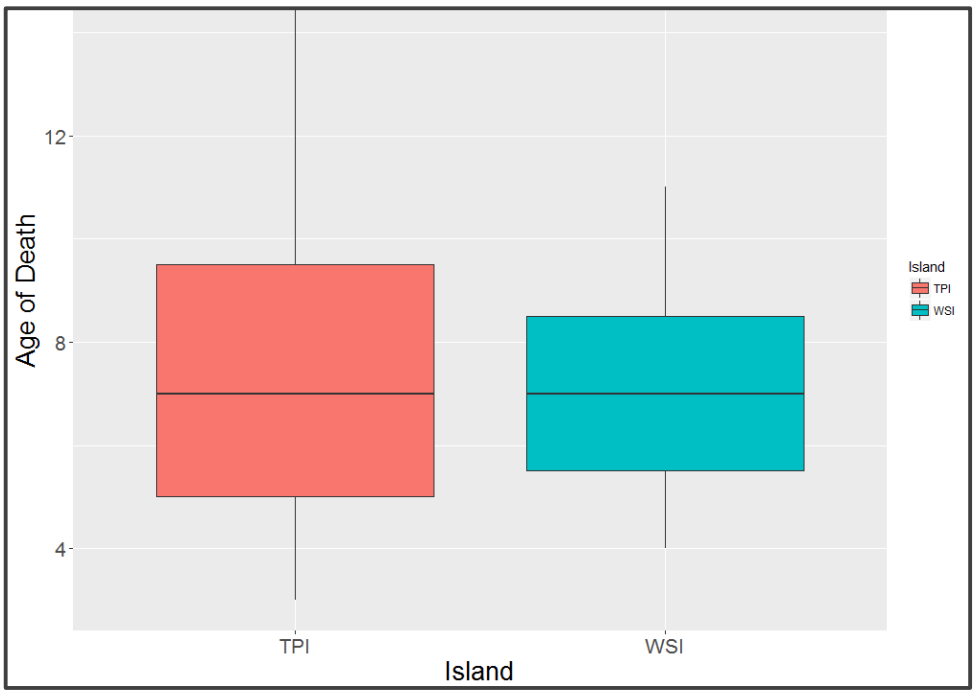

Figure 4. Age of death (days) of Black-crowned Night-Heron nestlings by breeding colony.

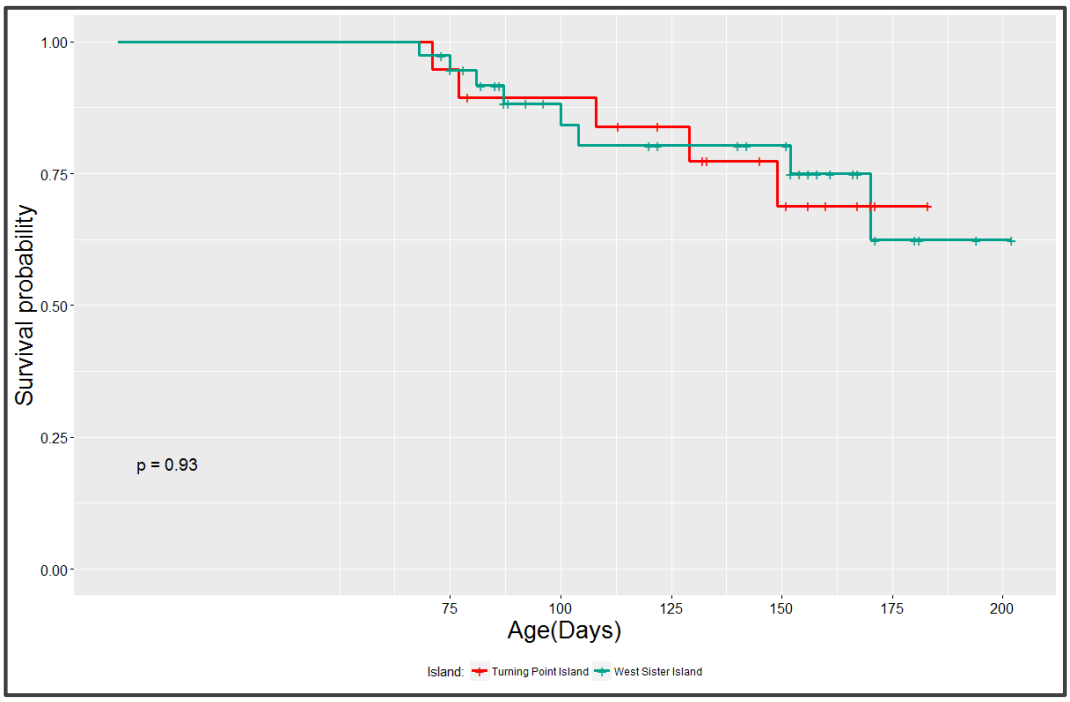

Figure 5. Kaplan-Meier survival curve illustrating cumulative survival curves for nestling Black-crowned Night-Herons through 225 days old at two island breeding colonies.

Adults. Results from satellite tracking indicate that Ohio night-herons utilize different migratory strategies with regard to timing, stopovers, and distance from breeding ground. Migration departure times were spread out over a period of 3 months with three birds departing in September, four in October, and two in November. The duration of migration ranged from 2-57 days, and stopover duration ranged from 1-48 days. Seven individuals utilized a short-distance migration strategy in that their wintering location was less than 2,000 km away from their breeding site, while the remaining two night-herons undertook a long-distance strategy (>2,000 km from breeding site). Distance to wintering sites ranged from 805-2150 km. Night-herons wintered in North Carolina, South Carolina, Florida, and Cuba (Figure 6). Most birds used a small winter home range, while the two long-distance migrants made intra-seasonal movements. These two individuals each utilized three distinct home ranges eventually moving out of Cuba in mid-February.

Discussion and conclusions

We found that survival of nestlings during the period before fledging was higher at WSI. Since TPI is located within an urban environment, access to quality foraging habitat is minimal and adult night-herons may be more food-limited at TPI than WSI. Following dispersal, survival was similar between islands during the post fledging period. Compared to published studies of other waterbird species, our estimates of post-fledging survival are relatively high. For example, survival of Little Egrets ranged from 6.5% and 55.2% during the first year (Hafner et al. 1998). Another study found Wood Stork survival to range from 6% to 44% (Hylton et al. 2006). This suggests that the post-fledging period may not be critical in regulating population growth of this species in Ohio.

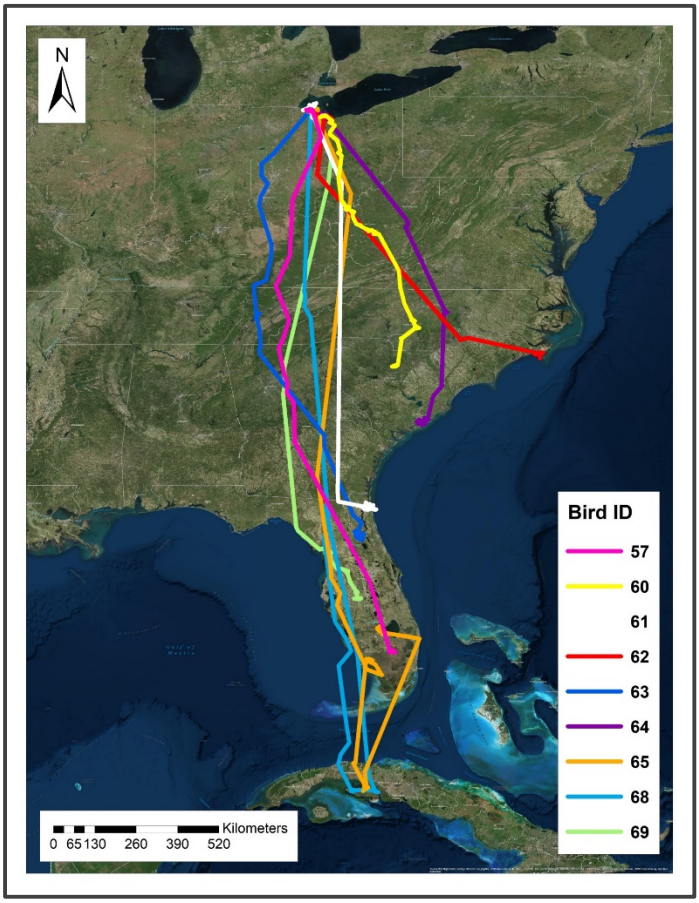

Figure 6. Migration routes of Black-crowned Night-Herons during autumn migration in 2016 as tracked by ARGOS satellite transmitters.

Our study shows that both juvenile and adult Black-crowned Night-Herons from Ohio's breeding population are migratory. We found flexibility in the timing and duration of autumn migration between individuals. Juvenile birds made large-scale movements during the post-fledging period, and long-distance migrants made intra-seasonal movements on wintering grounds. By better understanding space requirements and winter locations of herons from Ohio, we can use this information to inform conservation planning for this declining population.

During summer 2017, we deployed 7 more Argos transmitters onto adult night-herons and 48 more nanotags onto juveniles. By increasing our sample size of adult birds, we aim to understand what factors are driving the variation in migratory strategies between individuals. Moving forward, we will use age, sex and body condition in a multiple regression framework as predictors of distance to wintering ground to understand the different migratory strategies.

Over the two years of our study, we have detected 25 species of birds and 3 species of bats on our 13 telemetry towers. Except for Black-crowned Night-Herons and Rusty Blackbirds, the remaining species detected were all deployed outside of our study site. By establishing towers that will outlive the lifetime of one project, we provide resources to other researchers whose animals may pass through our array. Through the Motus array, we are increasing our understanding of the movement ecology of many species of birds and bats, especially species too small to carry heavier GPS or Argos transmitters.

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3.4.1 Avian Ecology in Urban Habitats Session Summary

Contact information:
Michelle Selzer, SELZERM@michigan.gov

Colonial waterbirds and other fish-eating bird populations in the Great Lakes have been impacted by chemical contamination but have largely rebound from low population levels seen in the 1960s and 1970s. However, there remains concerns that some colonial waterbirds may still be experiencing residual effects of persistent contaminants in the system. Dr. Keith Grasman (Calvin College) presented on a project aimed at assessing breeding numbers and reproductive rates in colonial waterbirds in the Saginaw Bay and the River Raisin Areas of Concern (AOCs) to investigate population-level effects associated with contaminants. This study will provide a set of assessment tools for work at other AOCs or contaminated sites with colonial waterbird colonies.

The Michigan's Wetland Wonders Managed Waterfowl Hunt Areas (MWHAs) in the state provide exceptional waterfowl hunting and excellent birding and wildlife watching opportunities. Joe Robison with the Michigan Department of Natural Resources, Wildlife Division presented on five MWHAs in Southeast Michigan including: Point Mouillee, Harsens Island, Shiawassee River, Nayanquing Point, and Fish Point. The presentation provided an in-depth overview of how these areas are managed for multiple benefits to wildlife and people.

The National Audubon Society is implementing a Plants for Birds program that focuses on urban habitat best suited for providing a wide variety of bird habitat throughout the year for nesting, migrating, and wintering birds. Brian Merlos with the Great Lakes Audubon presented on key secrets of success on planning and implementing native plant gardens in an urban setting. The presentation emphasized choosing locally native plants that will cater to a variety of native birds with food, shelter, and nesting sites throughout the year.

3.4.2 Five Southeastern Michigan Wetland Wonders

Contact information:
Joe Robison, RobisonJ@michigan.gov

Michigan's Wetland Wonders are seven premier Managed Waterfowl Hunt Areas (MWHAs) in the state. These areas, scattered across the southern Lower Peninsula, were created in the 1960s to provide exceptional waterfowl hunting opportunities. Today, the MWHAs are managed to continue to provide outstanding hunting opportunities as well as excellent habitat for nesting and migrating waterfowl. This management not only benefits waterfowl, but also a myriad of other wetland wildlife that thrive under our management strategies.

The primary goal of MWHAs is to provide high-quality waterfowl hunts in areas that readily attract and hold ducks, and they are managed intensively to achieve this goal. The MWHAs have been funded by hunting license fees and area use fees, but are open for anyone to visit, use, and enjoy most of the year. There are excellent bird watching and other wildlife recreation opportunities that can be enjoyed by everyone outside of the hunting season. Such as fishing, hiking, canoeing, fishing and just enjoying the outdoors. The seven MWHAs are located in southern Michigan—five on the east side and two on the west of the state. The west side areas are designed largely for goose hunting. The east side areas all offer outstanding duck hunting, although several also offer excellent goose hunting.

The Michigan Department of Natural Resources, Wildlife Division actively manages these areas in many ways, including planting crops to provide additional food resources for waterfowl and wildlife. Extensive water level management is conducted on diked impoundments using water movement infrastructure such as pumps, ditches, and water control structures. Water levels are managed for optimal use by waterfowl and hunters.

To facilitate safe, high-quality public hunting opportunities and to provide waterfowl places to rest and feed undisturbed, access is restricted in some areas from September 1 to January 1. In addition to managing hunting and access, water levels are manipulated to provide high energy food sources for migrating waterfowl in the fall. We have crops of corn, buckwheat, and millet, as well as good response from natural wetland plants—barnyard grass, wild millet, and smartweed. These crops and natural food sources along with coastal marshes provide waterfowl and other wildlife a diversity of food, cover, and water. We provide for all of these waterfowl needs at each of our MWHAs.

Area users should check with each state game area headquarters for specific access restrictions. Game area headquarter locations and contact information are listed on the DNR's web site at www.michigan.gov/wetlandwonders.

During the hunting season, area managers conduct weekly counts of birds using the refuges. Those counts are usually posted on the DNR website on Friday. Area habitat conditions are also posted on the website weekly.

Below is a quick rundown on five MWHAs in Southeast Michigan:

Point Mouillee
Point Mouillee is one of the largest freshwater marsh restorations in North America. Although the actual managed hunting area can accommodate 26 parties, the entire area is 4,040-acres, with plenty of additional open hunting on the surrounding marshes. If you don't like your draw, there's always somewhere to hunt at Point Mouillee because of all the open areas. Hunting at the managed areas takes place Tuesday mornings and Thursdays and Sundays, mornings and evenings. Birders from Michigan and Ohio regularly visit the marsh, field, and forest habitats of Pointe Mouillee to see ducks, shorebirds, herons, eagles, ospreys, warblers and more. Pointe Mouillee also often hosts rare avian visitors. In recent years, glossy and white-faced ibises, black-necked stilts, a white wagtail, king rails and a black-headed gull have made appearances in the marsh.

Harsens Island
Harsens Island (a.k.a. St. Clair Flats) is 3,600 acres on the upper end of Lake St. Clair. The managed area consists of two marsh units, lots of flooded crops, and has room for more than 80 parties. This Wetland Wonder on the shores of the St. Clair is a short ferry ride from Algonac across the St. Clair River. The 3,355-acre game area has been a destination for waterfowl hunters for many years. Outside of the hunting season, Harsens Island is an excellent birding and wildlife watching spot. Viewers can spot swans, herons, egrets, sandhill cranes, muskrats, mink, deer, bald eagles, osprey and more.

Shiawassee River
At roughly 10,000 acres, Shiawassee River is the largest managed waterfowl hunt area in Michigan. This massive floodplain in Saginaw County is found at the confluence of the Flint, Shiawassee, Bad, Cass and Tittabawassee rivers as well as Swan Creek. Although much of the area is forested and upland, the marsh area offers excellent diversity and abundance of waterfowl. It's open seven days a week with both morning and afternoon draws. Shiawassee River adjoins the Shiawassee National Wildlife Refuge, another 9,800+ acre area that allows some goose hunting, but no duck hunting, so the Federal refuge holds many ducks in the area. Not only can birders spot ducks, geese, grebes, and coots, a number of warblers, sparrows, woodpeckers, birds of prey including bald eagles, golden eagles and ospreys, and much more also move through the area.

Nayanquing Point
Nayanquing Point may be the most accessible of all the MHWAs. This 1,500-acre area on the west shore of Saginaw Bay, just north of Linwood, has plenty of areas that hunters can access on foot. It features 66 hunts units, is open seven days a week, mornings and afternoons. The area encompasses 1,500 acres and consists of cattail marsh, farmed upland fields, and shrubby lowlands. Water control structures allow for the flooding of farm fields for excellent waterfowl habitat during fall migration.

Fish Point
Fish Point is near Unionville in Tuscola County. Its 2,477 acres include 1,200 acres of diked wetland, 720 acres of marsh refuge, and 500 acres of crops. Fish Point draws more hunters than any of the other areas and offers plenty of walk-in opportunities. Located in Michigan's Thumb, this wildlife area juts out into Saginaw Bay and has been called the "Chesapeake of the Midwest." During spring and fall migrations, the habitat and food resources at this site attract thousands of ducks and other water birds such as tundra swans. Shorebirds, herons, egrets, bitterns and other marsh birds make their home here.

Looking Forward To The Future
For more than a century, forward-thinking conservationists, led by hunters and anglers, have worked to preserve and protect rapidly disappearing wildlife habitats. This movement gave rise to regulated hunting, fishing and provided public lands managed through sound, scientifically based practices.

Hunters and anglers, however, do far more than support conservation philosophically – they also back it financially. In fact, sportspersons, through the purchase of hunting and fishing licenses, fund the bulk of the state's fish and wildlife management activities. Every time a hunter or angler purchases a license, tag or permit, that money is funneled to the DNR for activities such as habitat improvements, habitat maintenance, species management, and invasive species control.

It's time to entertain the idea of a new conservation funding mechanism to help fund conservation efforts in the future. We owe a debt of gratitude to sportsmen and sportswomen for all they do to help make Michigan the great state it is today. The conservation projects taking place across the state continue to benefit the wildlife species we all enjoy.

3.4.3 Plants for Birds

Contact information:
Brian Merlos, bmerlos@audubon.org

Introduction
Birds are nature's messengers, and they're broadcasting loud and clear: They are already experiencing the devastating impacts of climate change and habitat loss, and these dangers will only grow over time.

In the face of these threats, you can help birds thrive right where you live by making your yard more bird-friendly. Follow the steps below to create a patch of vibrant habitat that attracts colorful birds and their sweet melodies. If you don't have a yard, you can still help birds by creating a native plant container garden on your patio or balcony. Even very small patches of habitat provide tired, hungry birds with exactly what they need, particularly during migration.

The secret to success lies in choosing locally native plants, which brim with nutritious insects, berries, nectar, and seeds, and give birds a vital refuge.

Discussion
Get to Know Your Space. Not all locally-native plants will thrive—or fit—in your garden. But by taking a closer look at your yard's environment, you can choose a mix that will stay healthy and cater to a variety of native bird needs for years. Head out to your yard and answer these questions:

1. Plants are usually labeled as growing best in full-sun, partial shade, or full shade. How much of the planting area is covered in shade? Is it shaded all-day, only sometimes, or never at all?
2. How damp is the soil? Do you have to water frequently to keep grass alive? Does the soil remain wet for long periods of time?
3. What is your soil type? Is it light and full of sand or heavy with clay? Is it almost black, like peaty soil, or is it very smooth, like silt soil? (If you're not sure, don't worry. Many plants do well in a variety of soils, and a local nursery may be able to advise on this.)

Pick Your Plants. Now it's time to decide what you will plant and where. If you have space for just a couple pots or plantings, this may be simple. If you have more room, think about creating a habitat to provide food and shelter for both resident and migrating birds throughout the year. Take a look at your options. Do the plants on your list provide nectar, fruit, or nuts at different times of the year? Are there shrubs or trees where birds can nest, as well as annuals, perennials, and groundcover? Take a look at your plant list and see what plants will best provide for your birds, and fit the conditions of your space.

For further research, you can check the online databases offered by the USDA (plants.usda.gov/java/) or the National Gardening Association (garden.org/plants) for information about bloom and fruiting time, growing seasons, or full-grown plant dimensions. If you would like more than what these two sites provide, you can fill in some gaps by searching online.

Plan Out Your Garden. Now it's time start planning your garden. Head back outside and draw up your plot on paper, using circles to represent individual plants. Imagine what your garden will look like and see what will best fit in your space. Remember that plants grow! Native plants have a tendency to spread, often rapidly, so your garden may affect your living space or neighbor's yard.

Its recommended to plan in masses of five plants or more to make for a more attractive look and create a more successful habitat (pollinators prefer to feed from clumps of the same flower) while not making sure not to overcrowd plants in a bed. Aim for a range of plant heights, colors, and textures as diversity is key. Usually it works best to keep larger plants in the back of a border or plot, and smaller plants in front.

Choose Native Plants. Focus on native plants that provide a good variety of bird food throughout the year for nesting, migrating, and wintering birds. As you make your selections, think about providing the following food groups:

- **Bugs:** Native trees such as oaks, willows, birches, and maples, and native herbaceous plants such as goldenrod, milkweed, and sunflowers host many caterpillar species that are a vital source of protein for birds, especially during the breeding season.
- **Fruit:** Many shrubs and small trees provide berries that ripen at different times, so include seasonal variety: serviceberry and cherry for birds during the breeding season and summer; dogwood and spicebush for songbirds flying south; cedar and holly trees to sustain birds through cold winter days and nights.
- **Nuts and seeds:** Trees such as oaks, hickories, and walnuts provide fat and protein rich food that birds hide, or "cache," to provide food through the cold winter. Native sunflowers, asters, and coneflowers produce loads of tiny seeds that are finch and sparrow favorites.
- **Nectar:** Red tubular flowers such as native columbine, penstemon, and honeysuckle serve up nectar for hummingbirds. Flowers in the aster family, such as coneflowers, asters, and Joe-Pye Weed are very attractive to insect pollinators like butterflies, moths, and bees, in addition to providing seeds for birds.

Plan Your Bird Habitat. Think of your garden as a habitat that *you* are creating to provide birds with food, shelter, and nesting sites throughout the year.

- **Take stock of the plants you've already got:** Your yard may already include native plants that birds love. Your local Audubon or native plant society may be able to provide advice.
- **Know the basics about your space:**
    - *Sun or shade?* How much of the planting area is covered in shade? Is it shaded all-day, only sometimes, or never at all? Plants are usually labeled as growing best in full-sun, partial shade, or full shade, so knowing this will help you choose plants that will do well.
    - *Wet or dry?* How damp is the soil? Do you have to water frequently to keep grass alive? Does the soil remain wet for long periods of time? You may find that different areas of your yard are wetter than others, and require different plant choices.
    - *What's your soil like?* What is your soil type? Is it light and full of sand or heavy with clay? Is it almost black, like peaty soil, or is it very smooth, like silt soil? (If you're not sure, don't worry. Many plants do well in a variety of soils, and a local nursery may be able to advise on this.)

- **Map it out:** Measure your planting space and then either draw it out on paper or walk your garden bed, to figure out which plants will fit best where.
- **Create "habitat layers":** If you have room, try to provide the plant layers you might find in a natural habitat:
    - *Large canopy trees* provide many resources including nuts, nest cavities, and other roosting spots
    - *Shrubs and small trees* often provide fruit, as well as nesting sites for songbirds
    - *Herbacious plants*, including perennials, annuals, and groundcovers, provide seeds for birds and a rich habitat for pollinators
    - *Decaying leaves, wood, detritus, and soil* form the base of your habitat, and a home for many invertebrates that birds eat, including the pupae of most *moth caterpillars*—a favorite of baby birds
- **Lose some lawn:** Consider reversing the typical pattern of small garden beds surrounded by expanses of lawn. Larger patches of habitat with lawn pathways will create a rich wildlife habitat and lovely effect in your yard. (You can start small; every bit counts!)
- **Cluster plants in masses:** Group five or more of the same plant species together. This creates an attractive look and is also favored by pollinators, which prefer to feed from a mass of the same flower species.
- **Think about height:** Place taller plants towards the back of your borders, with lower-growing species at the edges of paths or lawn.
- **Design for color palettes** and continuous blooming throughout the gardening season.
- **Leave some room:** Pay attention to each species' stated dimensions when full grown, so plants aren't too crowded together.
- **Need more plant specifics?** If you're seeking more details about bloom and fruiting time, growing seasons, or full-grown plant dimensions, check the online databases offered by the USDA (https://plants.usda.gov/java/) or the National Gardening Association (https://garden.org/plants/).
- **Remember the water:** Water is an often overlooked resource that birds need year round. Include hollowed boulders that catch rainwater or a man-made bird bath for birds to drink and bathe in. Consider a drip bath or fountain feature; the sound of running water is particularly attractive to birds and may bring them flocking during migration.

Plant in spring or fall and on cooler days. Follow planting instructions carefully and get tips on mulching around plants from the plant nursery or gardening center. Water as needed after planting: Native plants are adapted to local climate conditions and generally require less added water than non-native species, in the long run. However, almost all plants need some watering and extra care till they've become well established.

Caring for Your Garden. Steward your native plant habitat with tender loving care—but don't be too neat.

- **Weed:** Remove non-native and invasive weeds. Weeding is often maligned as a "chore"... but it's also a great excuse to spend time in your garden and get to know its wildlife.
- **Don't rake:** Fallen leaves and woody debris are an important habitat layer, and serve as a natural mulch. They will reduce unwanted weed growth, keep your plants' roots cool and moist—and provide habitat for insects and the pupae of moth caterpillars, a favorite of baby birds.

- **Leave the seeds:** Don't "dead-head" all of your flowering plants after they bloom, as those seedheads can be an important source of food during the fall and winter.
- **Spare your back:** In forested areas, leave dead trees and branches. Fallen trunks and branches support the entire forest food web as they decay into rich soil. Standing tree trunks may provide homes for many cavity-nesting species: Woodpeckers often create or enlarge the cavities, but many species will nest in them, including chickadees, titmice, nuthatches, bluebirds, tree swallows, great-crested flycatchers, wood ducks, and American kestrels.
- **Build a brush pile**: Enhance your garden area by creating a brush pile to provide shelter for birds and other wildlife.
- **Lay off the pesticides:** A bird-friendly garden is a bug-friendly garden. A diversity of native plants will also attract wildlife that will keep your plant-eating bugs in check: Not only birds but also frogs, toads, bats, and insect predators such as dragonflies, praying mantises and lady bugs will help keep your garden in a healthy balance.

Conclusion
Your garden is your outdoor sanctuary. With some careful plant choices, it can be a haven for native birds as well. Landscaped with native species, your yard, patio, or balcony becomes a vital recharge station for birds passing through and a sanctuary for nesting and overwintering birds.

Each patch of restored native habitat is just that—a patch in the frayed fabric of the ecosystem in which it lies. By landscaping with native plants, we can turn a patchwork of green spaces into a quilt of restored habitat.

Remember, what's good for birds is also good for people. Here are some possible impacts of your native plant garden:
96: Percentage of land birds that rely on insects to feed chicks.
1,200: Number of crops that depend on pollinators to grow.
40 million: Acres of lawn in the U.S. currently.
80 million: Pounds of pesticides applied to lawns in the U.S. annually. Native plants, on the other hand, support a balance of predator and prey and thrive without pesticides.
800 million: Gallons of gas used annually by lawn mowers. This produces significant amounts of carbon dioxide and other greenhouse gases driving climate change.

Results

Table 1 presents the self-reported data for programs, plantings, and events that chapters and members of the National Audubon Society hosted as part of the Plants for Birds program in 2017.

Program	TOTALS
Planting Events	1,411
In-School Lessons	350
Schools Planted	57
Public Ed. Events	1,236
Outreach Events	273
Training Events	55
Total Program Events	3,325
Habitat Consults	529
Total Planting Part's	31,026
Total Ed. Part's	40,361
Total Outreach Part's	46,642
Total Training Part's	897
Total Non- School Group Part's	92,152
Total K-12 Student Part's	25,916
Total Higher Ed Student Part's	1,892
Total Program Part's	119,960
Volunteer Hours	127,251
Plants Planted, Donated, or Sold	205,111
Acres Planted, Improved, or Certified	31,709
Pounds of Seed Sown and Dist'd	462
Acres of Invasive Plants Removed	551
Pounds of Invasive Plants Removed	37,505
Private Prop's Involved	1,637
Corp. Prop's Involved	40
Acres with Improved Mgmt	465

Table 1. Self-reported data for programs, plantings, and events resulting from the Plants for Birds program in 2017.

Further reading

http://www.audubon.org/news/how-make-your-yard-bird-friendly-0
http://www.audubon.org/news/why-native-plants-are-better-birds-and-people

3.5.1 Urban Bird Casualty Reduction Session Summary

Contact information:
Erin Rowan, erowan@audubon.org

Birds face a myriad of threats every day that cause casualties, but even more so during migration. Feral cats are the largest cause of bird mortality in North America killing up to 4 billion birds annually. However, efforts to manage feral cat populations are highly controversial and solutions with public support remain elusive.

Our Urban Bird Casualty Reduction speakers and panelists have expertise with the second-highest bird-killer in North America, bird-building collisions, which kills up to 1 billion birds annually. Unlike feral cat population management, bird-building collisions have well-defined collision reduction solutions that commercial building owners and homeowners alike can implement. Annette Prince, Heidi Trudell and Bonnie Van Dam are leaders in Lights Out and Safe Passage Programs in the Great Lakes Region that work towards reducing bird-window and bird-building collisions during Spring and Fall migration.

Millions of nocturnal migratory songbirds, representing hundreds of species, fly through the Detroit River corridor, a globally recognized Important Bird Area, twice each year. These songbirds use a combination of stars and an internal compass to navigate at night. These birds are drawn to artificial light in urban centers and get disoriented; confused, they fly in circles until they either collide with a lit structure, or die from exhaustion. Lights Out Programs were established across the country to help mitigate the effects of this phenomenon by creating relationships with city governments and private building owners and managers, to encourage them to reduce or turn off their lights during Spring and Fall migration. The light reduction has benefitted not only birds, but has reduced costs related to building maintenance and energy-use as well. Lights Out Chicago, managed by Chicago Audubon, Chicago Bird Collision Monitors, National Audubon, Building Owners and Managers Association, and the City of Chicago, was the first program to have its city skyline go dark during migration. Lights Out Chicago and Chicago Bird Collision Monitors have saved tens of thousands of birds each year since 1995.

Washtenaw Audubon and Detroit Audubon manage Safe Passage Great Lakes Programs similar to the Lights Out Program, encouraging building owners to turn their lights off at night during migration and install retrofits where possible on problematic building facades. Retrofits include products such as CollidEscape film, American Bird Center bird tape, Acopian BirdSavers or bird-safe glass (i.e. Ornilux or fritted glass). The Safe Passage Program relies heavily on volunteers to monitor a series of buildings in Ann Arbor, Ypsilanti, Detroit, Troy, Southfield and Mt. Clemens. These programs are currently striving to: 1) get more buildings to participate in the Safe Passage Program and turn off their lights during migration, 2) survey more buildings, and 3) educate the public, building owners and managers, and architects about bird-building collision solutions.

One of the champions of the Safe Passage Great Lakes Program is the Detroit Zoo, who has taken it upon themselves to train their staff to survey buildings on zoo grounds and install retrofits where needed. Detroit Zoo staff has collected data on building collisions since 2013 and has installed over $100,000 worth of retrofits on zoo grounds along with interpretive signage to educate visitors about bird-window collision solutions. Leading by example, Detroit Zoo staff also sit on Detroit Audubon's Safe Passage Committee and promote the Safe Passage Great Lakes Program.

During the panel discussion, our speakers (Annette Prince, Heidi Trudell, and Bonnie Van Dam) emphasized that the existing science is unequivocal: glass and lit structures kill birds. Panelists prioritized above all else, the need to educate the public and law-makers, and encouraged the creation of legislation that would require newly built structures to follow bird-friendly building guidelines.

3.5.2 Light Reduction for the Protection of Migratory Birds

Contact information:
Annette Prince, aprincecbcm2@msn.com

In the last 25 years, as cities in North America have been building taller, brighter skylines, there has been a growing awareness of the tragic effect this has had on migratory birds. Current understanding is that birds find their way along migratory routes using - among other things - magnetic fields and celestial patterns that they learn as early as when they are nestlings. Brightly lit urban areas seem to attract and disorient birds during their nightly travels. The lights of a city bear a strong resemblance to the pattern of stars in the night sky. Urban areas are getting brighter and brighter particularly with the introduction of energy saving LED lighting. LED lighting can be less hazardous to birds and wildlife if warmer yellow spectrum lights are chosen but most cities are instead installing the brighter blue spectrum lights since these initially offered more energy savings.

External lighting and interior lights can both be fatal attractions to birds. A two-year study conducted at Chicago's McCormick Place convention center indicated that turning lights off in one building section resulted in 83% fewer bird deaths - 1,297 birds crashed into lit windows compared to 192 into unlit windows (Field Museum Press Release 2002). This study indicated the importance of light reduction by extinguishing lights or drawing blinds at night, but it did not lead to a policy for McCormick Place to keep its lights out, dimmed or shaded at night. Curtains/blinds are drawn during evening events only at the request of clients renting the convention center space. Since 1978, over 30,000 birds from 140 species have been recovered as a result of lights and glass features at this building located directly on Chicago's lakefront. Recent changes in development around McCormick Place and increased vegetation to the north of the building seem to be resulting in a decrease in bird strikes. Altered habitat may be shifting the movements of birds away from the dangers of the building.

Light without the presence of a building can also be deadly for birds as is demonstrated with the 9/11 Tribute in Light in New York City. These two beams of light projected into the night sky were first illuminated on October 11, 2001 - one month after the Twin Towers were destroyed. Thousands of birds migrating during this peak migration time were trapped in the lights and flew until many died of exhaustion. These beams of light continue to be lit every September 11, now with observers from New York City Audubon alerting the memorial operators when birds begin becoming trapped in the beams so lights can be temporarily extinguished. A memorial that endangers the lives of birds seems a poor tribute to loss of lives at the World Trade Center.

In the late 1990's conservation groups in Chicago joined with the city and BOMA (Building Owners and Managers Association) to initiate a voluntary light reduction program that was named "Lights Out! Chicago." The program asked that tall downtown buildings extinguish decorative lighting on the upper stories from 11 pm to sunrise from March 15 to June 15 in the spring and from August 15 to November 15 in the fall. This includes logos, clocks, top lighting and other displays or

illuminations. Tenants on the upper floors are encouraged to turn out lights or draw blinds after 11 pm. All buildings regardless of height directly along the lakefront or Chicago River with extensive glass exteriors should extinguish as much exterior and interior lighting as possible during these above migration times since they are positioned directly in the path of migrating birds that follow natural features such as shorelines.

With varying participation in light reduction, Chicago Bird Collision Monitors found there were still buildings leaving lights on and posing a dangerous attraction to birds as late at 2002. This footage was shot September 10, 2002 during an evening of heavy migration when lights were not extinguished on the John Hancock Center. What seems to be swarms of insects on closer inspection are migratory birds attracted and disoriented by the building lighting. They often circled until falling from exhaustion. Some are seen to eventual fly into the glass around the lights in confusion. Nights like this could result in hundreds of dead and injured birds being found at the base of buildings.

Chicago Bird Collision Monitors grass-roots volunteer project began in 2003 with the goal to recover and document dead and injured birds in the nighttime and early morning hours of spring and fall migration, raise awareness to lighting and glass hazards for birds and advocate for bird safety measures. Responding to reports by buildings and making direct contact with building management/facilities staff, Chicago Bird Collision Monitors gained participation in Lights Out! Chicago by spring 2004 for all buildings over 20 stories (approximately 100 buildings in the immediate two-square miles of downtown Chicago).

As new buildings were constructed and building management changed, Chicago Bird Collision Monitors along with Chicago Audubon Society continued their monitoring work and stayed in contact with management/facilities staff to reinforce the importance of continued participation in light reduction efforts. Chicago's BOMA has given their full support to promoting light reduction among its members. They circulate the emails announcing the beginning of light reduction for spring and fall migration and promote bird safety practices. Buildings that may occasionally need to leave their display lights on while doing evening construction or repairs on things such as rooftop antennas, have made a practice of notifying Chicago Bird Collision Monitors so that they are aware that areas around such buildings may need to be surveyed as soon as possible by morning monitors. Chicago has maintained light reduction according to the Lights Out! guidelines with 90 to 100% participation of its tall buildings since 2004.

Additional contacts with buildings continue to be made to advocate for reduction and dimming of ground level/interior lights which can attract birds in the night and early morning hours to lobby spaces that feature fountains, trees and other vegetation. While some buildings have found ways to reduce their lobby lighting that attracts birds to their glass facades, others cite the need to have lights for employees, safety, aesthetics etc. We continue to need to reinforce the idea of turning off lighting in unused office spaces and scheduling cleaning crews to work early evening rather than night or morning hours.

An unfortunate popular current trend has been observed in downtown buildings that are remodeling their entrances with amplified lighting that can draw even more birds to their glass lobbies. Designers are adding lighting to glass railings around plazas which can attract more birds to these invisible hazards.

Although the new Apple store on the Chicago River (which opened in October 2017) was willing to reduce their lighting in the evening and early morning hours, a building with all its walls made of transparent glass will not become a darkened space whose interior landscaping is masked when lights are dimmed or extinguished. Illumination from surrounding plazas, street lights, signs, river lights, etc. will shine through the Apple store rendering it an invisible space birds will try to fly through or towards. Glass treatments will be needed to retrofit a building such as this for bird safety.

Learn more about lighting and its effects on wildlife and human health and well-being in the documentary movie "The City Dark - A Search for Night on a Planet That Never Sleeps" (Cheney 2011).

Efforts are being organized to have Chicago make safer building design and lighting part of an ordinance rather than a voluntary appeal. We know that proper use of lighting and glass are important elements for reducing bird collisions. See examples of lighting and design features that can make urban areas safer for birds at commercial and private residences on the Chicago Bird Collision Monitors webpage www.birdmonitors.net.

References

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3.5.3 Bird Strikes at Windows in Eastern Washtenaw County, MI: A Preliminary Assessment

Contact information:
Heidi Trudell, heidi@bigbendnature.com
Alice Elliott, aliceell@umich.edu

Introduction

Window strikes are one of the most ubiquitous causes of unintentional and preventable bird mortality, killing approximately one billion birds per year in North America (Klem 2009; Loss et al. 2015). A citizen science, volunteer-initiated study of several low-rise public buildings in eastern Washtenaw County during 2016 provides a broad assessment of how the region's buildings impact both local and migratory bird species.

As an overview of what is happening in the Great Lakes, as well as the Midwest, this study provides some general ideas of the per-building impact of non-residential, low-rise buildings. Similar studies in the US indicate that our data fall within the anticipated scope of expected mortality (Hager et al. 2017, Ocampo-Peñuela et al. 2016). Scavenging rates measured in other studies (Hager et al. 2008, O'Connell 2001) give us perspective on numbers that were not tracked in this study, but should be comparable.

Most window collision monitoring projects in North America are heavily biased towards spring and fall migration. There are a variety of reasons for this, including peak detectability and prevention of volunteer burnout, as well as predictable timing. These data were intended to establish baselines for the individual buildings rather than seasonal summaries, so monitoring was done for spring, summer, and fall rather than year round: winter was excluded due to inclement searching conditions and to prevent volunteer burnout as well.

Background

Washtenaw County, located in southeast Michigan, is home to several college campuses and public buildings that are ideal for bird-window collision monitoring. This summary focuses on the easternmost set of buildings, including the Ypsilanti District Library, and the 14a2 Courthouse, as well as several buildings on the Eastern Michigan University campus (see Figure 1). Most window collision monitoring in the United States is done during spring and fall migration, but as 2016 was the first year of monitoring for these sites, they were searched throughout the summer as well. This data has been analyzed according to other published trends since it cannot stand alone due to the brief nature of this study at this time.

Three general research locations addressed in this study are the easternmost sites labeled on this map. Top right is Eastern Michigan University (multiple buildings, including Halle Library (H)); 14a2 Courthouse (C) at middle right; Ypsilanti District Library (L) at lower right. Locations not addressed

in this overview are Plymouth Green shopping center (top), University of Michigan North Campus (far left), and Washtenaw Community College (center).

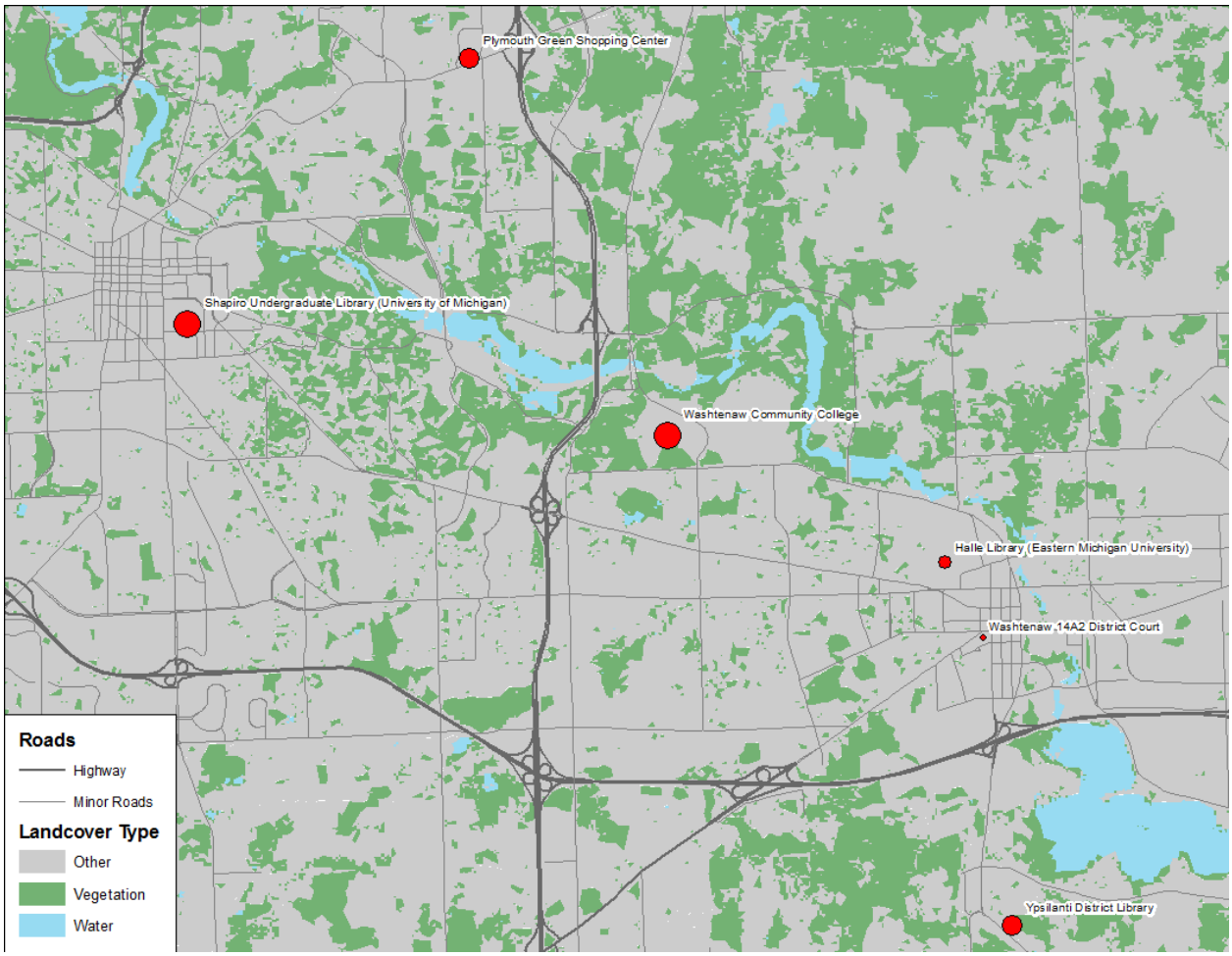

Figure 1. Map of study sites. Map created by Alice Lesemann-Elliott for Washtenaw Safe Passage.

Goals/Objectives

Identify the most hazardous buildings for birds in eastern Ypsilanti, MI.
Compare and rank the windows on the buildings identified.
Arrange remediation of problem windows if possible.

In order to rank buildings according to remediation priority, it was crucial to determine the nature of collisions both within the region and within the scope of each individual building. Buildings were selected somewhat opportunistically, based primarily on accessibility to the public for surveys, as well potential for modification. Consistent surveys of buildings would allow relatively objective comparisons within the region due to the varied amount of glass on the buildings surveyed. This overview primarily addresses comparisons between three buildings identified as problematic, as well as several "average" buildings for comparison, with the intent to provide small scale context for the larger scale geographic region.

Approach

Protocol was new and being adapted to suit the needs of the locations as well as availability of searchers throughout this study. Two primary researchers surveyed the non-campus locations

mid-morning two to three times per week except during peak migration, when surveys were performed daily at the non-campus locations. Campus surveys were done midday, approximately twice per week (weekend and mid-week) by one surveyor throughout the seasons, excluding winter. Buildings were surveyed from the base of their perimeter walls to approximately ten feet out, at a slow walking pace. The top three buildings were each surveyed on approximately two-thirds to three-quarters of their sides due to accessibility issues.

Whole dead birds, injured birds, or pieces of birds detected in that space were considered to be strikes (isolated feathers or stray clumps of down were not counted, unless they indicated significant structural damage or a likely scavenging event). Live adult birds with normal behavior, as well as fledgling/juvenile birds without enough feathering to fly were considered incidental sightings and not considered to be window strikes if within ten feet of the building.

When live birds were able to be caught, they were taken to the nearest permitted wild bird rehabilitation center, the Bird Center of Washtenaw. Dead birds, collected under salvage permits for the University of Michigan, were bagged, labeled with date, building, side of building, cause of death, species (if known), county, and finder's name.

Outcomes

"Low priority" buildings were classified as being two stories or less, and having less than 50% glass surface area, with that external glass being divided into panes (vs sheet glass) or having mullions. The average low priority building in the study resulted in 0-8 bird strikes detected. The top three buildings were roughly three to seven times worse than the low priority buildings, and there may have been a correlation between reflectivity as well as uninterrupted surface of the glass in question, in addition to surface area and quality of habitat reflected.

As no searcher efficiency or scavenging rates were determined during the course of this study, we do not have those figures. However, as our numbers and overall routes are comparable in many ways to those of other Midwestern studies, it would not be unreasonable to assume that our detected casualties represent approximately 30-70% of the actual casualties, due to scavenging and detection rates. In addition, it is likely that roughly 50% of the birds that struck the glass died, so total strikes would be significantly higher than double the detected casualty rate.

"High priority" buildings were classified as being two stories or more (buildings C, Y, H in Table 1), and having glass facade coverage of 50% or more, or a high proportion of the surface glass being treated with mirrored coatings. Internal/external lighting factors exacerbate reflectivity in the top and third high priority buildings.

The top two of the "high priority" buildings were either highly reflective due to internal/external lighting factors (Y), or mirrored glass coatings (C). The third (H) was neither mirrored nor particularly reflective, but the amount of glass, size, and location of the building relative to campus topography may have influenced the number of strikes.

Location	Spring Detections	Summer Detections	Fall Detections
14a2 Dist Courthouse (C)	9	12	12
Ypsilanti District Library (Y)	8	7	26
EMU: Boone	4	-	2
EMU: Halle Library (H)	3	3	12
EMU: Pierce	-	1	2
EMU: Phelps	1	-	-
EMU: Putnam	1	4	-
EMU: Rackham	-	-	2
EMU: Sellers	-	3	3
EMU: Student Center	3	0	-
EMU: Walton	4	2	2
EMU: Incidental/Other	-	5	4
Total carcass detection:	33	37	65

Table 1. Raw numbers for carcass detections at each building.

Discussion

Summer data were found to be quite valuable, as detection numbers were similar to spring, indicating that the quality of habitat around the buildings influenced bird activity in the area beyond peak seasons, and diversity was reflected in those numbers as well. Fourteen species were detected in spring, and fourteen species were detected in summer, however, there was very little overlap. Twenty-four species were represented between spring and summer combined.

The seasonal breakdown of numbers for 2016 (all buildings, except incidental findings):
Spring: 33 (20 from top 3 of concern)
Summer: 37* (22 from top 3 of concern)
Fall: 65 (50 from top 3 of concern)
Total: 135 (92 from top 3 of concern)
* One incidental building, with over 90% brick surface area was found to have five carcasses at one window (mirrored coating), so this indicates that even buildings with very limited glass surface areas can have disproportionately negative impacts on birds.

Buildings of non-concern compared to (C, Y, H):
Spring: 13 (9, 8, 3)
Summer: 10 (12, 7, 3)
Fall: 15 (12, 26, 12)
Total: 38 (33, 41, 18)

Historically, the assumption that fall detections average "twice as bad as spring" held up, almost exactly. The trend of summer being significantly lower (almost half) compared to spring (Hager et al., 2008 - unpublished data from the study) was inconsistent with this study. There may be several reasons for this, including intermittent summer monitoring by student volunteers for that data, or possibly habitat quality leading to a higher density of breeding birds for this study.

Conclusions

Two of the three buildings of concern (C, Y) in this study were found to well above average numbers of birds (33, 41 per year) compared to averages Loss et al. (2015) found for low rise buildings (21.7 birds/year). The third building (H) had only 18 detections, but since these numbers were determined prior to any sort of accessibility, scavenging, and searcher efficiency statistics were considered, detected totals may be a gross underestimation.

The buildings of lower concern were found to be relatively comparable to those in the Loss et al. (2015; 21.7 birds/year) when accessibility, scavenging, and searcher efficiency were considered. Buildings that reflected high quality habitat or significant amounts of vegetation were found to kill significantly more birds than those that did not.

The top three buildings of concern were responsible for 70.7% of detections, and the top two were responsible for 56.1% of total detections during the study. The eight control buildings collectively were only responsible for 29.2% of detections.

Any given building with higher than five detections in one season was flagged on the chart: if 5 carcasses are detected, average searcher/scavenger rates would indicate between 10-15 additional carcasses go undetected. Since roughly half of the birds that strike die on site, this would indicate that a detection rate of 5 carcasses in a season could be the result of 20-30 strikes overall.

Cumulatively, this indicates an alarmingly high bird mortality rate in both the region and the state due to the abundance of similar, office-park style buildings and the increasing popularity of glass facades that are comparable to the buildings of high concern.

Recommendations:

Prior to construction of new buildings, architects should anticipate bird mortality and incorporate bird strike mitigation options. A variety of existing products should be considered and compared, based on surface areas of windows, anticipated landscaping features, and overall utility of the glass.

Existing buildings with known bird strike concerns should address the problem windows immediately with proven solutions, (temporary if necessary). Additional collision data is largely unnecessary on a per-building basis, unless it is able to be paired with either a full year OR minimum two-fall study. In those cases, post-mitigation monitoring would be quite valuable. Temporary solutions are only suggested as stop-gap measures to buy time until permanent solutions are able to be installed. Seasonal solutions are discouraged unless the location has been proven to incur strikes only during spring and fall migration.

Mitigation priority should be given to sections of buildings with known strike histories, as well as those whose overall facades and landscaping indicate increased likelihood of strikes.

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3.12 How Zoos Can Contribute to Songbird Conservation at Every Level: Addressing Bird Collisions at the Detroit Zoo

Contact information:
Bonnie Van Dam, bvandam@dzs.org

Introduction
Many people aren't aware that birds and humans have different visual systems which means they see the world differently. It is very hard for birds to see glass; glass appears invisible to them, it becomes a barrier they can't see, and as a result they fly right into it. Scientists estimate that billions of North American birds meet their untimely deaths every year when they collide with glass (Loss et al., 2014). As humans continue to build structures that contain glass, the threat of bird collisions will also continue. The good news is that there are many ways to remediate glass and make it bird friendly.

Goal
The Detroit Zoological Society (DZS) facilitates and contributes to several bird conservation programs, locally and internationally. DZS also believes it has a responsibility to take care of birds that are migrating or are native residents, not just those that are Zoo residents. The Detroit Zoo has been providing bird collision remediation since 2013. The development of an ongoing bird collision program has helped address songbird collisions on Zoo property and also provides an important educational component to guests visiting the Zoo.

Approach
In 2013, the Detroit Zoo implemented a bird collision tracking/reporting system. All employees were instructed to contact bird staff and report collisions or deaths on Zoo grounds. All Zoo employees and new hires were required to complete bird collision training and reporting. Employees are required to report information such as time of day, date, weather, location and species affected. Also, staff was reminded to keep window blinds partially closed as well as turning all building lights off at night.

By the end of 2014, DZS had remediated collision areas with hawk decals and American Bird Conservancy (ABC) BirdTape. Most birds will avoid windows with vertical stripes spaced four or less inches apart, or horizontal stripes spaced two or less inches apart (www.abcbirdtape.org). A comprehensive budget was put together in 2015 after a site visit from Chris Sheppard, ABC Bird Collisions Campaign Manager. CollidEscape window film (www.collidescape.org) was purchased for several Zoo buildings. Currently, three buildings on Zoo grounds have CollidEscape window film, two more buildings will be remediated using this film in 2018.

In 2017, the Detroit Zoo purchased 3M Feather Friendly Dots (Convenience Group Inc., www.conveniencegroup.com). This window film is applied much like the CollidEscape film but it is a dot pattern. The dot patterns are available in four by four, four by two, and two by two inch

spacing. This was applied to several glass viewing areas throughout the Zoo as well as at the Belle Isle Nature Center. This product will also be used in 2018 in various areas of the Zoo.

In addition to using window film, the Zoo has also used custom designed glass to prevent bird collisions. The Polk Penguin Conservation Center which opened in April 2016, has fritted glass, a type of etching placed on the glass during production; our newly renovated giraffe building has Ornilux UV windows (ornilux.com). Some of the future Zoo projects will include the use of custom bird collision prevention glass.

Outcomes

The Detroit Zoological Society has a made a commitment to remediating glass in order to prevent bird collisions but has also made a commitment to educate their guests about bird-glass collisions. With over a million visitors a year, the educational component is just as important as remediation. Visitors are exposed to specially designed graphics that talk about bird safety. Additionally, the DZS has special flyers and messaging about the products that are used on grounds, and the ABC BirdTape is sold in the Zoo's gift shop. The Zoo has also published informative articles on its webpage as well as press releases during migration seasons. During the Zoo's Greenfest (Earth Day) celebration we have an educational table and provide information on bird safety as well as allowing guests to make decals, one for the Zoo and one to take home.

Lessons learned

Like most people, the typical first line of defense is to add bird decals to the glass. Decals will not work well if they aren't applied using the four by two inch rule and in most situations people do not apply them following that rule. The decals have to be replaced often so we only use them for short term solutions. To date, there have been no reported collisions at the buildings with CollidEscape window film or areas where bird collision glass was used; however, Zoo animal residents and wild scavengers have access to the carcasses before they might be detected by humans. The CollidEscape window film is a good product to use in one-way viewing areas, since it allows clear viewing for the public yet opaque viewing to protect the birds. There have been fewer reported collisions where the 3M Feather Friendly dots have been applied. The Feather Friendly dots work best when applied using the two by two inch pattern. This is the recommended pattern to use, and the Zoo will be adding more dots to areas where four by four inch spacing was used. The Feather Friendly dots are cosmetically appealing to use in areas where there is a need for two-way viewing. Custom bird collision glass should be considered during the architectural design of new buildings. The Detroit Zoo installed the window film in house and saved thousands of dollars that would have been spent on professional installers.

Conclusion

Since the inception of the bird collision tracking system in 2013, the Detroit Zoo has identified and remediated several areas where strikes were occurring. We continue to track reports of collisions in non-remediated areas and are always working on prevention in these areas. We have used the 3M Feather Friendly dots, in the four by four inch and the four by two inch patterns. We use bird strike decals in various areas of the Zoo; guests see them and inquire, and it is a good opportunity to educate the public on bird safety. Currently, all employees and volunteers are required to attend bird collision training, and because people have become more aware we have seen an increase in the number of collisions reported on Zoo grounds. We continue to see a decline in the collisions reported in areas where remediation has occurred.

Reference

Loss, S.R, Will T., Loss S.S., Marra P.P. 2014. Bird–building collisions in the United States: Estimates of annual mortality and species vulnerability. The Condor 116:8–23. DOI 10.1650/CONDOR-13-090.1.

4.0 Conference Program

State of the Strait & Metro Detroit Nature Network

Urban Bird Summit: Status, Trends, and Risks to Species that Call the Corridor Home

Hosted by the Detroit Zoological Society

Ford Education Center - Thursday, November 9th, 2017

Agenda and oral presentations

8:30-9:00 Registration

9:00-9:20 Welcome
Canadian Consul General Douglas George
Detroit Zoo; Scott Carter
State of the Strait; Steve Francoeur
Metro Detroit Nature Network; John Hartig

MIGRATORY RAPTORS Moderators - John Hartig & Richard Wyma

9:20-9:40 Detroit River Hawk Watch: Citizen Science at Work - Jerry Jourdan

9:40-10:00 Holiday Beach Hawk Watch - Bob Pettit

10:00-10:30 Hawk Watch panel discussion - Jerry Jourdan, Bob Pettit, Will Weber, & Claire Sanders

10:30-10:45 Coffee Break

RESIDENT RAPTORS Moderator – Claire Sanders

10:45-11:00 Michigan Falcons turn City Slickers - Julie Oakes

11:00-11:15 Osprey in Southeast Michigan: Adaptable Birds to an Urban Environment - Tom Schneider

11:15-11:30 Bald Eagle Indicator Trends in Southeast Michigan - Chris Mensing, Nicole LaFleur & John Hartig

COLONIAL WATERBIRDS Moderator – Tom Schneider

11:30-11:45 The Conservation and Management of the North American Black Tern (*Chlidonias niger surinamensis*) in Michigan - Erin Rowan & Caleb Putnam

11:45-12:00 Status of Common Terns in Southeast Michigan – Jessica Jozwiak

12:00-12:15 Multiscale Movements of a Threatened Population of Black-crowned Night-Herons in Lake Erie, Ohio using Satellite and Automated Telemetry – Kristie Stein, Laura Kearns & Christopher Tonra

12:15-1:30 Lunch & poster display

AVIAN ECOLOGY IN URBAN HABTATS Moderator – Michelle Selzer

1:30-1:50 Colonial Waterbird Breeding in Contaminated Sites - Keith Grasman
1:50-2:10 Five Southeastern Michigan Wetland Wonders – Joe Robison
2:10-2:30 Plants for Birds – Brian Merlos

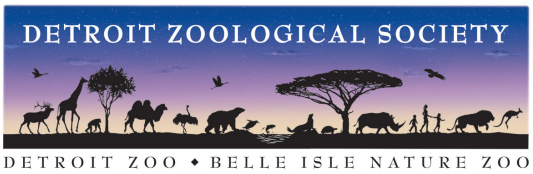
2:30-3:00 Coffee Break

URBAN BIRD CASUALTY REDUCTION Moderator - Erin Rowan
3:00-3:20 Lights Out Chicago - Annette Prince
3:20-3:40 Bird Strikes at Windows in Eastern Washtenaw County, MI: A Preliminary Assessment - Heidi Trudell & Alice Elliott
3:40-4:00 How Zoos can Contribute to Songbird Conservation at Every Level: Addressing Bird Collisions at the Detroit Zoo - Bonnie Van Dam
4:00-4:30 Bird Casualties Panel Discussion - Annette Prince, Heidi Trudell, & Bonnie Van Dam

4:30-4:40 Concluding remarks (John Hartig)

4:40-6:00 Reception


DTE Energy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