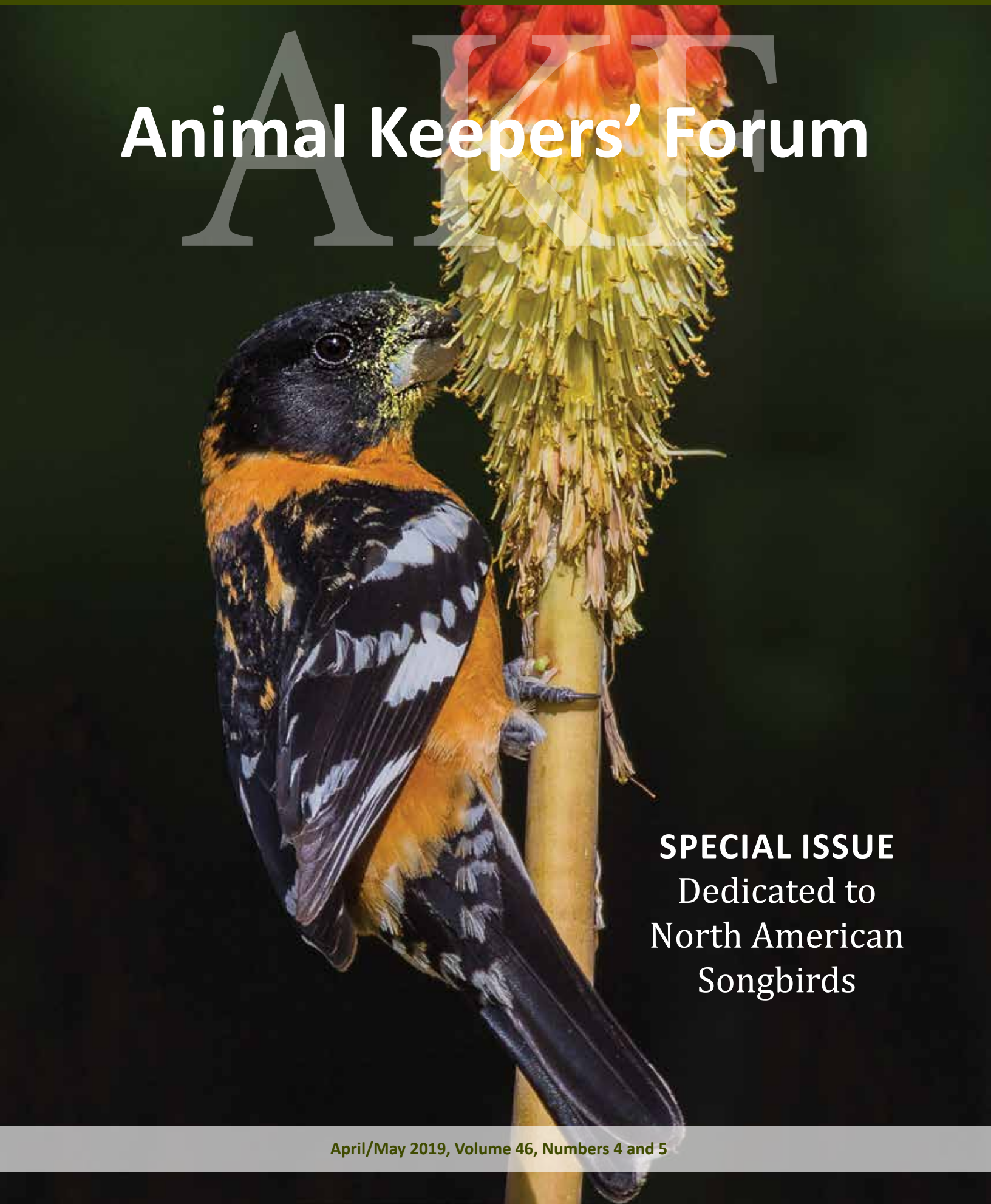
The Journal of the American Association of Zoo Keepers, Inc.

Animal Keepers' Forum



SPECIAL ISSUE
Dedicated to
North American
Songbirds

April/May 2019, Volume 46, Numbers 4 and 5

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Lazuli Bunting. Photo by Eric Peterson.

109 ABOUT THE COVER

110 FROM THE PRESIDENT

111 COMING EVENTS

114 INTRODUCTION

115 THANK YOU SPONSORS

116-119
Working Towards a Bright Future for Native Songbirds: The North American Songbird Working Group
Sara Hallager

120-121
Building a North American Songbird Collection with Rehab Birds
Nikki Smith

122-125
So You Think You Want a Motus Station
Michael Kreger, Ph.D., Ed Diebold, Kevin Kerr, Ph.D, Frank Ridgley, DVM, Joe Smith, DVM, and Stephen Spear, Ph.D.

126-128
World Migratory Bird Day - Are you celebrating?
Anne Tieber

129-132
Raising Awareness About Bird-window Collisions at Zoological Facilities
Kim Roth Nelson

133-135
Urban Refuge: Why Zoos are Important Green Spaces for Migrating Birds
Aniko Totha

136-138
Importance of Monitoring North American Songbird Populations in Urban Areas
Rachel Santymire

140-142
Fat Scoring Captive North American Migratory Songbirds
Sarah Steele and Elizabeth Fisher

143-144
Saving Songbirds from Strikes
Lindsay Jacks

145-147
The Happiest Place on Earth for Purple Martins *(Progne subis)*
John Thomton

148
Building a Chimney Swift Tower
Kevin Kollar

149-152
Lights Out for Birds: Community solutions to avian conservation
Matthew B. Shumar, Shane J. Good, and Tim Jasinski

153-157
The Plight of the Loggerhead Shrike: A One-Plan Approach to Saving an Iconic Grassland Bird in North America
Dr. Amy Chabot

158-163
Brevard Zoo and Florida Scrub-Jays: Saving a Species in Peril
Michelle Smurl

164-165
Outdoor "Pets": A Real Cat-astrophe
Michelle Smurl and Elliot Zirulnik

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MISSION STATEMENT

American Association of Zoo Keepers, Inc.

The American Association of Zoo Keepers, Inc. exists to advance excellence in the animal keeping profession, foster effective communication beneficial to animal care, support deserving conservation projects, and promote the preservation of our natural resources and animal life.

ABOUT THE COVER

As animal care professionals we have a tendency to focus only on the species we care for and envelop our lives around all things involving that species. For 15 years of my career I was no different. I happily ate, drank and slept all things elephants at Utah's Hogle Zoo. In 2009 my wife and I went to Kenya on our honeymoon and my life would change forever. While there, our guides pointed out amazing species of birds to us. All the while I was snapping photos of each and every one of them. By the end of the trip I had seen almost 90 species of birds.

Upon returning to Utah, I wondered what species of birds we had here. Surely they could not match the beauty of the birds seen in Africa. I put out bird feeders and soon spring migration started. Birds started showing up left and right and the colors rivaled the prettiest birds I saw in Africa. One of those species was a Black-headed Grosbeak (*Pheucticus melanocephalus*) seen on the cover. Even more amazing was that they were in my own yard. I did not have to go to a park to see them, just look out the window.

Ten years and close to one thousand species later I am still capturing the beauty of birds through my camera, including now as an ambassador animal keeper in "Creekside"- a new riparian interactive area at Utah's Hogle Zoo connecting kids to nature. The goal of my photography is not only to capture nature in all its splendor but to entice every person who views my work to appreciate the world around them and create a passion to preserve and protect the beauty of our world. *Eric Peterson, Utah's Hogle Zoo*

Articles sent to *Animal Keepers' Forum* will be reviewed by the editorial staff for publication. Articles of a research or technical nature will be submitted to one or more of the zoo professionals who serve as referees for *AKF*. No commitment is made to the author, but an effort will be made to publish articles as soon as possible. Lengthy articles may be separated into monthly installments at the discretion of the Editor. The Editor reserves the right to edit material without consultation unless approval is requested in writing by the author. Materials submitted will not be returned unless accompanied by a stamped, self-addressed, appropriately-sized envelope. Telephone, fax or e-mail contributions of late-breaking news or last-minute insertions are accepted as space allows. Phone (330) 483-1104; FAX (330) 483-1444; e-mail is shane.good@aazk.org. If you have questions about submission guidelines, please contact the Editor. Submission guidelines are also found at: aazk.org/akf-submission-guidelines/.

Deadline for each regular issue is the 3rd of the preceding month. Dedicated issues may have separate deadline dates and will be noted by the Editor.

MEMBERSHIP SERVICES

Animal Data Transfer Forms available for download at aazk.org. AAZK Publications/Logo Products/ Apparel available at AAZK Administrative Office or at aazk.org.

ANIMAL KEEPERS' FORUM

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FROM THE PRESIDENT

I encourage each of you to inquire as to whether your facility is a partner with AAZK. The benefits are mutual.

Our Mission is simple; AAZK exists to advance excellence in the animal keeping profession, foster effective communication beneficial to animal care, support deserving conservation projects, and promote the preservation of our natural resources and animal life. AAZK is comprised of approximately 2700 members, who are associated with 114 AAZK Chapters and nearly 170 zoological institutions. AAZK also has a variety of partnerships, represented in the form of Conservation Partners, Commercial Members, Institutional Members and Corporate Sponsors.

Six out of seven members of our Board of Directors come from facilities that hold Institutional Memberships with AAZK. Institutional Membership is a partnership that provides facilities the opportunity to reach and recruit staff from across the country by posting unlimited job opportunities on the AAZK website. It offers access to the *Animal Keeper's Forum*, which is highly respected in the industry as a resource for keeper training and husbandry. AAZK also offers more than $40,000 in annual grants. Our endowed grants in Conservation, Research, Continuing Education and Reforestation are available to AAZK members, including Institutional Members. I encourage each of you to inquire as to whether your facility is a partner with AAZK. The benefits are mutual. We look forward to building our team with new Institutional Members.

In 2018, AAZK Chapters raised an estimated $800,000 and donated to as many as 350 notable conservation efforts worldwide, including their host institutions. AAZK currently has 31 Conservation Partners who are regularly represented in the pages of the *AKF* or as exhibitors and speakers at the annual conference. Our most significant conservation program is Bowling for Rhinos, which has raised 7.75 million dollars for species and habitat conservation in Africa and Asia since 1990. A complete list of Conservation Partners can be found on the AAZK website.

Commercial Members and Corporate Sponsors are also an important form of partnership for us. AAZK is committed to providing an outstanding annual conference program for delegates. Corporate Sponsors contribute to our mission of furthering the education of zoo keepers through sponsorship of not only the annual Conference, but also the *Animal Keeper's Forum*. This dedicated issue of the *AKF* is made possible by eight generous sponsors which are featured on P. 115 of this issue. We very much appreciate your role in helping us achieve our goals.

I hope you enjoy this issue featuring songbirds. Happy Spring!

Warm Regards,

Bethany
Bethany.bingham@aazk.org

COMING EVENTS

Post upcoming events here!
e-mail shane.good@aazk.org

July 13-19, 2019
Felid TAG:
Husbandry Courses - July 13-15
SSP Meetings - July 15-16
TAG Meetings - July 17-19
Omaha, NE
Hosted by Omaha's Henry Doorly Zoo and Aquarium
More information coming soon!

July 22-26, 2019
Prosimian TAG Husbandry Workshop and Mid-year Meeting
Dallas, TX
Hosted by the Dallas Zoo
Three day workshop followed by TAG meetings
For more information contact: PTAG2019@dallaszoo.com

August 4-8, 2019
17th Annual Symposium on the Conservation and Biology of Tortoises and Freshwater Turtles - Tucson, AZ
Hosted by the Turtle Survival Alliance and the IUCN Tortoise and Freshwater Turtle Specialist Group. For more information go to: https://turtlesurvival.org/2019symposium/

August 26-28, 2019
Orangutan SSP Husbandry Workshop
Fort Wayne, IN
Hosted by the Fort Wayne Children's Zoo
For more information go to: http://www.orangutanssp.org/2019-workshop.html

September 7-11, 2019
AZA Annual Conference
New Orleans, LA
Hosted by Audubon Zoo and Audubon Aquarium of the Americas
For more information go to: aza.org

September 22-27, 2019
ASSOCIATION OF ZOO VETERINARY TECHNICIANS Annual Conference
Colorado Springs, CO
Hosted by
Cheyenne Mountain Zoo
For more information go to: https://www.azvt.org/page-7741

September 30 - Oct. 4, 2019
New World Primate TAG Husbandry Workshop
New Bedford, MA
Hosted by
Buttonwood Park Zoo
For more information go to: https://www.bpzoo.org/nwptag-conference-registration/

October 7-11, 2019
Giraffe Care Workshop
Colorado Springs, CO
Hosted by
Cheyenne Mountain Zoo
For more information go to: http://www.cmzoo.org/index.php/giraffe-care-workshop/

October 7-11, 2019
"From Good Care to Great Welfare" workshop
Detroit, MI
Hosted by Detroit Zoological Society's Center for Zoo and Aquarium Animal Welfare and Ethics
For more information go to: http://www.czaw.org/events

AMERICAN ASSOCIATION of ZOO KEEPERS

August 18-22, 2019
AAZK National Conference
Indianapolis, IN

Hosted by Indy AAZK and the Indianapolis Zoo

www.indyaazk.org

April 4-9, 2020
AZA Mid-Year Meeting
Palm Springs, CA
Hosted by The Living Desert Zoo and Gardens
For more information go to: https://midyear.aza.org/

PHOTOS COURTESY OF ERIC PETERSON

Cedar Waxwing

Brown-headed nuthatch

White-eyed vireo

Yellow-throated warbler

Ovenbird

Golden-winged warbler


Red-winged blackbird


Black-headed Grosbeak


Blue grosbeak

Photos courtesy of Eric Peterson

Introduction

Sara Hallager, Curator of Birds
Smithsonian National Zoological Park

Nikki Smith, Assistant Curator
North America and Polar Frontier
Columbus Zoo and Aquarium

You probably don't even realize just how many songbirds are a part of your life. Songbirds surround us and are the soundtrack to our outdoor adventures. Odds are the first animal you see or hear when you go outside in the morning is a bird. They wake us up at 3:00 am with their melodies. They brighten the winter garden. They hail the arrival of spring. They amaze us by their incredible migrations and remind us of the change in seasons. Although we can explore the surface of Mars, we do not yet fully understand how a 12g blackpoll warbler can fly 1,500 miles without stopping. Songbirds play a role in our national identity and our culture. For each state there is a state bird, and of these, well over half are songbirds. In sports, literature, and pop culture birds are a continual source of inspiration.

Songbirds around the world on every continent and in every country are in trouble. They are declining fast. Worldwide declines due to habitat loss, climate change, pet trade, sport and food all contribute to the loss of songbirds. In North America, our beloved backyard birds are being killed by outdoor cats with estimates of up to 1 billion birds being killed each year. Another billion birds are estimated to die from hitting buildings. BirdLife International (2008) reports over half of Neotropical migratory songbirds have suffered widespread declines over the last 40 years.

Conservation actions for songbirds may feel overwhelming but there are easy things every single person can do. Own a cat? Keep it indoors. Drink coffee? Buy certified bird-friendly brands. Have a window in your home or office? Make it bird-friendly. Have a garden? Grow native plants and don't use insecticides or pesticides. There are many ways each of us can help birds and our ability to help songbirds extends way beyond ourselves. We have the power and the responsibility to spread these simple messages of hope to the 183 million people each year who visit our zoos and aquariums in North America.

The first steps toward supporting native songbird conservation are already occurring at many zoos and aquariums. As you read this issue, you'll learn about some of the projects in zoos and aquariums. For example, native songbird feeding stations, Christmas bird counts on zoo/aquarium grounds, bird-friendly glass treatments on buildings and exhibits, celebrating World Migratory Bird Day, and educating guests about native songbirds are just some of the projects AZA organizations are doing to help birds.

This special issue of *AKF* is brought to you by The North American Songbird Working Group (NASWG). The NAWSG is an initiative of the AZA Passerine TAG. Our Vision is simple: "The North American Songbird Working Group is a recognized leader in the conservation of North American songbirds" and our Mission is clear: "The mission of the North American Songbird Working Group is to raise awareness of issues facing North American songbirds and to promote their conservation through AZA facilities."

This issue of *Animal Keepers Forum* is dedicated to our native songbirds. We hope it inspires you, increases your appreciation of these birds, and provides you with new insight into these incredible animals. Poet Henry van Dyke tells us to "Use what talents you possess; the woods would be very silent if no birds sang there except those that sang best." We hope these articles help motivate you to contribute to the conservation of bird species in whatever way you can; big or small.

THANK YOU SPONSORS

Working Towards a Bright Future for Native Songbirds: The North American Songbird Working Group

Sara Hallager, Curator of Birds
Smithsonian National Zoological Park

The North American Songbird Working Group (NASWG) is an initiative of the AZA PaCCT (Passeriformes, Apodiformes, Coliiformes, Caprimulgiformes and Trogoniformes) Taxon Advisory Group. If you don't take care of birds, should you read this article? The answer is Yes! Absolutely! Many of the issues, threats and solutions that affect songbirds also affect reptiles, amphibians, small mammals, insects, plants and marine life in our care and in our neighborhoods. So please keep reading because we need your help, more than ever!

Altamira Oriole. Photo courtesy of Eric Peterson.

The North American Songbird Working Group helps raise awareness of North America's native songbirds within the AZA community. We all know birds are important. There's even a whole book just on this topic (Why Birds Matter, Edited by Çagan H. Sekercioglu, Daniel G. Wenny, and Christopher J. Whelan, 2016). But did you know that many of our most familiar and favorite backyard birds are in real trouble with recent estimates of 50% of Neotropical migratory birds suffering substantial declines over the past 40 years (BirdLife International, 2008). More than one-third (37%) of North American bird species are of high conservation concern and at risk of extinction without significant conservation action (State of

the Birds Report 2016). And although many of our common birds still number in the millions, let us not forget the story of the passenger pigeon whose population went from 1 billion to 0 in less than 50 years. We don't want that to happen to any of our beloved songbirds. And so, we work for them. And we hope to inspire you to save our songbirds. We all must play a role in songbird conservation and ultimately, in the conservation of reptiles/amphibians, mammals, insects, marine life and so much more.

The causes of songbird decline are well documented, as are the solutions. Unlike conservation actions that occur in faraway places, there are many actions we can do to save songbirds, most of which are achievable with simple lifestyle changes. Presented here are six initiatives championed by the NASWG. Many of these initiatives are further expanded upon in other articles within this dedicated issue of *AKF*.

The Six Initiatives of the North American Songbird Working Group

1. Outdoor Cats.

Outdoor cats are among the top threats to global biodiversity (Doherty et al., 2016) and the top source of direct, anthropogenic mortality to birds in the United States and Canada (State of the Birds, 2014). A 2016 study (Doherty et al., 2016) found that feral cats have driven 40 bird species to extinction worldwide since 1500. Loss et al., (2013) found that cats kill 1.3-4 billion birds (median 2.4 billion), 6.3-22.3 billion mammals (median 12.3 billion), and likely hundreds of millions of reptiles (median 478 million) and amphibians (median 173 million) each year in the US. Cats shed toxoplasmosis which affects marine life and humans, often with lethal consequences (https://www.cdc.gov/parasites/toxoplasmosis/gen_info/faqs.html). The *Toxoplasma gondii* parasite found in cat feces is killing many of the ocean's highly endangered mammals such as sea otters and seals, including the highly endangered Hawaiian monk seal (See http://www.marinemammalcenter.org/about-us/News-Room/2017-news-archives/toxoplasmosis.html for more information).

Conservation Action: Keep your cat indoors to save wildlife
Who: Animal care and Education staff in bird, reptile, mammal, aquatic areas of each and every AZA facility
How: Keeper talks, signage, links to webpages on your website, educational programs or informational carts. Make the case for improved welfare of the cats when kept indoors.

2. Glass strikes.

Zoos and aquariums use glass to present their exhibits for an enhanced guest viewing experience. As conservation organizations, we have a responsibility to design our exhibits to be bird-friendly. Recently, AZA institutions have begun to take a leadership role in addressing collisions of wild birds with glass in their operations. This can be seen in the adoption of bird-friendly design strategies in new construction as well as the redesign of existing exhibits. There are simple and affordable strategies guests and their families can do to take an active role to protect birds at home. For example, putting up bird tape on windows at home is an easy action (https://abcbirds.org/program/glass-collisions/abc-birdtape/ or http://www.conveniencegroup.com/featherfriendly/feather-friendly). We can model AZA values as we continue to integrate bird-friendly glass into the design of our newest buildings or to retrofit older buildings with bird-friendly products. It is a powerful message that together we can build bird-friendly architecture and educate millions of visitors each year on the glass strike issue, conservation implications, and the attainable solutions.

Conservation Action: Make all windows bird-friendly at your zoo or aquarium, and at your home to help save songbirds
Who: Exhibit designers, Public Relations departments, Education departments, Animal Care staff
How: Incorporate messaging and signage in all animal areas that have bird-friendly windows; apply bird-friendly products to your homes and offices; educate guests on this topic and what they can to help; expand messaging of bird-friendly glass through venues such as Facebook Live events on how to apply bird-friendly tape, and through venues such as Migratory Bird Day

3. World Migratory Bird Day.

World Migratory Bird Day (WMBD) https://www.environmentamericas.org/imbd-2/ highlights and celebrates the migration of birds around the world including nearly 350 species of migratory birds between nesting habitats in North America and non-breeding grounds in Latin America, Mexico, and the Caribbean. Many AZA-accredited facilities celebrate world Migratory Bird Day with interactive exhibits, bird banding demonstrations and special events to introduce visitors to North American songbirds. Events like these show visitors that birds are an important part of our world and help demonstrate why birds matter. Don't have native birds on exhibit in your zoo? Talk about the wild ones that visit your zoo or celebrate the day at your Asian or African songbird aviary! The important thing is just to celebrate the day and the importance of birds. The theme of WMBD for 2019 is about plastic, pollution and ways to reduce both. The 12 focal bird species selected for World Migratory Bird Day 2019 represent diverse groups of birds, the habitats they use, and their foraging behaviors. Despite their differences, each of these birds and their habitats have been impacted by plastic pollution. Reducing the use of plastic and cleaning up the waste that is currently contaminating our natural environments is essential to migratory bird conservation

Conservation Action: Birds are important and we all can help birds
Who: Bird staff, Educators, Communication departments
How: Interactive exhibits and tables, bird banding demonstrations and special events; website promotions; promote lifestyle changes e.g. drink bird-friendly coffee or eat grassland-bird-friendly hamburgers; keep your cat indoors, don't use pesticides or insecticides which harm birds; recycle what you can; plant bird-friendly gardens; help clean up your local waterways, install bird-friendly window treatments; become a citizen scientist to monitor local birds; reduce your use of single-use plastics

4. Conservation Breeding and Science.

As experts in husbandry, reproductive biology, nutrition, wildlife health, population management, physiology and welfare, AZA zoos and aquariums offer specialized expertise and skills to aid in the recovery of threatened and endangered songbird populations. Some AZA zoos are participating in a North American songbird initiative http://conservationcenters.org/programs/native-species-forces/songbirds/ led by the Conservation Centers for Species Survival (C2S2), which seeks to grow connectivity between *ex situ* and *in situ* populations of songbirds through a One Plan Approach. The loggerhead shrike is a C2S2 songbird priority species and a model for this larger songbird initiative. Zoo-based North American songbirds have been used in research, some of which is directly applicable to *in situ* conservation. For example, the Smithsonian National Zoo's song sparrow colony was used in research investigating the bill as a thermoregulatory organ and a captive colony of wood thrush helped researchers understand the relationship of food availability on the non-breeding grounds to breeding success. By establishing native songbird populations in managed care and working to understand the needs of migratory birds, zoos and aquariums are able to offer assistance to populations in decline. These populations can assist avian researchers by providing models for rare species, understanding avian health, life history, and testing potential field methods.

Conservation Action: AZA zoos and aquariums offer specialized expertise and skills to aid in the recovery of songbirds. The time to study and learn about these birds is now, before populations reach critical levels.
Who: All AZA bird caretakers, Education departments
How: Encourage your zoo or aquarium to exhibit native songbirds (even just one species is great!) to begin to gain familiarity with the husbandry of these birds.

5. Lights Out.

Every year, billions of birds migrate north in the spring and south in the fall, the majority of them flying at night. However, as they pass over cities on their way, they often become disoriented by artificial lights. All living creatures rely on the Earth's regular rhythm of day and night to regulate internal cycles. Many use the protection of darkness to safely forage and mate.

Blue Grosbeak. Photo by Eric Peterson.

Conservation Action: Take steps to decrease the amount of light our cities emit to reduce bird deaths and help all wildlife. Protecting the night sky is a valuable step to conserving bio-diversity by restoring the natural nighttime darkness. This saves money by reducing energy consumption, and supports your organization's sustainability goals.
Who: Housekeeping, buildings and grounds staff, education departments, neighborhoods/businesses surrounding AZA facilities
How: Learn more about Lights Out Programs near you at https://www.audubon.org/conservation/project/lights-out and about the importance of darkness to animal well-being at https://www.darksky.org/light-pollution/wildlife/

6. Songbird Programs.

Collectively, AZA institutions welcome over 183 million annual visitors - more visitors than NFL, NBA, NHL, and MLB annual attendance combined. Therefore, the opportunity to engage the public at large in programming focused on North American songbirds and their conservation issues is immense at AZA zoos and aquariums. Birds are everywhere! We can leverage our status as animal experts and our grounds as a home for birds (and other wildlife) to foster a connection between visitors and their local bird community.

Conservation Action: Create an empathetic connection to birds and show that we all can help birds
Who: Bird staff, Educators, Communication departments
How: Communicate songbird conservation messages to visitors through signage and programming; partner with local organizations that can assist with events and crafting messages; engage in citizen science programs focused on birds.

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References

BirdLife International. 2008. State of the world's birds: Indicators for our changing world. Cambridge, UK: Birdlife International

Doherty, T., Glen, A., Nimmo, D., Ritchie, E. and Dickman, C. 2016. *Proceedings of the National Academy of Sciences* 113 (40):11261-11265

Loss, S.R., Will, T. and Marra, P.P. 2013. The impact of free-ranging domestic cats on wildlife of the United States. *Nature Communications* 4:1396. http://dx.doi.org/10.1038/ncomms2380

North American Bird Conservation Initiative. 2016. The State of North America's Birds 2016. Environment and Climate Change Canada: Ottawa, Ontario. 8 pages. www.stateofthebirds.org. Cat. No.: CW66-527/2016E ISBN: 978-0-660-05104-8.

North American Bird Conservation Initiative, U.S. Committee. 2014. The State of the Birds 2014 Report. U.S. Department of Interior, Washington, D.C. 16 pages.

Visitor Demographics, Association of Zoo & Aquariums. (2019, February 20). Retrieved from: https://www.aza.org/partnerships-visitor-demographics

Building a North American Songbird Collection With Rehab Birds

Nikki Smith, Assistant Curator, Columbus Zoo

Exhibiting North American songbirds is a vibrant and colorful way to connect our visitors to a conservation crisis happening in our own backyards. Zoos have a great opportunity to highlight the plight of native songbirds through exhibiting non-releasable rehab birds. Some zoos have permits that allow them to collect from the wild. If your institution is interested in opening a native songbird aviary but do not wish to collect from the wild there are alternatives. Three quarters of the birds that I work with in our North American songbird aviary came to us from wildlife rehabilitators. These birds were deemed non-releasable and many rehabbers are not permitted for long-term possession or exhibition of these birds. There is a need to find permanent placement options or rehabbers are forced to euthanize these birds. Spring and fall are a busy time for rehabbers; there are many animals competing for space and resources at these facilities. Most commonly we see wing injuries, though we also see some with eye or foot injuries. These injuries have not kept these birds from leading very full lives in our walk -through aviary. We make accommodations for these birds with creative perching and roosting options and modify feeding stations and nest boxes to meet the needs of our collection.

Wildlife rehabilitators are passionate conservationists and are eager to get the animals in their care released into their native ranges. When that is not possible, they actively search for placement for their birds. When accepting a rehab bird it is important to determine if this bird will be a good fit for your aviary. Some birds are more successful than others in different settings depending on what their particular needs will be. Our most successful residents come to us able to feed and forage for themselves and with the ability to fly or flutter short distances. You might be able to accommodate birds with different needs depending on your aviary. Is it indoor, walk-through or perhaps outdoor but not walk-through? Always ask what the bird is currently eating; you'll want to be sure you can accommodate this bird's diet and feeding needs even if you plan to transition to your facility's diet once the bird arrives. These birds have survived a traumatic event and are under stress. It will be important to try to ease their transition when they move to your quarantine space. It is also important to try to gather as much information on the medical care this bird has received. You will want to request this information early and you will likely be receiving hand-written medical records with the bird when it arrives.

Once you've determined the abilities of this bird it's time to start the permitting process. You will need the rehabber to obtain a letter of non-release from their veterinarian, stating why the bird cannot be released to the wild. Next they will need to submit a transfer request to USFWS. You should familiarize yourself with federals laws governing migratory birds, specifically 50 CFR 21.31 and 50 CFR 21.12. The Code of Federal Regulations, in regards to non-releasable birds states that, "(iii) You must euthanize any bird that cannot feed itself, perch upright, or ambulate without inflicting additional injuries to itself where medical and/or rehabilitative care will not reverse such conditions. You must euthanize any bird that is completely blind, and any bird that has sustained injuries that would require amputation of a leg, a foot, or a wing at the elbow or above (humero-ulnar joint) rather than performing such surgery, unless: (A) A licensed veterinarian submits a written recommendation that the bird should be kept alive, including an analysis of why the bird is not expected to experience the injuries and/or ailments that typically occur in birds with these injuries and a commitment (from the veterinarian) to provide medical care for the bird for the duration of its life, including complete examinations at least once a year; (B) A placement is available for the bird with a person or facility authorized to possess it, where it will receive the veterinary care described in paragraph (e)(4)(iii)(A) of this section; and (C) The issuing

office specifically authorizes continued possession, medical treatment, and rehabilitative care of the bird." There is a lot of discussion recently about the language in this section. Rehabbers and their partners in AZA need to have honest discussions about the abilities of any birds being considered for placement. Some of us have seen or worked with birds at our institutions that likely should not have been offered or accepted into the collection. Conversely, many birds missing a wing, portion of a wing or portion of a leg may do just fine in your aviary. For example, Sandhill Cranes in a number of zoos are missing a significant portion of a wing and many species of waterfowl do quite well; other birds are not as easy to judge. Video clips from the rehabber that highlight the abilities of these birds are very important in determining if you should move forward in your acquisition. Habitats can be modified to meet the needs of many different species but in the end you need to be able to say no to a bird that you know will not thrive in your exhibit. On limited occasions, we've received a bird that was not able to display the abilities we believed that it could. In that rare instance, we elect for humane euthanasia to ensure we are not keeping birds in situations where their welfare is poor.

Your institution may be exempt from the 50 CFR 21.12 permit and that is also very important to be aware of in the event you are going to transfer birds zoo to zoo in the future. As an exempt institution you may acquire birds from rehabbers, nature centers and other facilities that hold education or exhibition permits. You cannot transfer a bird from an exempt institution to a non-exempt institution. If you acquire a bird that is not a good fit for your collection you can transfer that animal to another institution provided you are both exempt or that you both hold the same permit for education or exhibition

For many of us, shipping animals is a common occurrence. Bear in mind that this may be a rehabber's first time placing an animal at a zoo or aquarium; they are likely unfamiliar with your acquisition or quarantine processes. In the spring especially, they have many animals in their care and can easily be scared off by the sheer amount of paperwork involved in this process. Please be patient with them, they often have a full time job in addition to their duties at the wildlife rehab center. Offer to ship a crate to them so they don't need to get one ready for the flight. Flexibility on when you can receive can go a long way; often times these animals need quick placement to ensure room at the rehab center for another critical case. Other times, the paperwork seems to take forever to get together due to time constraints on the rehabber's part, government shutdowns or a backlog at their local permitting office as there are differences from region to region. Patience pays off and this rehabber will call you again when they have a bird to place if you are able to dedicate the time to assist them with their first placement at your facility.

The last step before transfer will be for the rehabber to obtain a health certificate (good for 10 days if you're flying the bird and 30 days for ground transport) signed by their consulting veterinarian. Here in Ohio, if our rehab partner is from out of state, we need to have them apply for an import permit from our Department of Agriculture. Be sure to check and ensure you're meeting any local regulations- your registrar or your local Department of Agriculture office should be able to advise you on any pertinent laws.

The 2014 State of the Birds report lists 33 once common birds now considered to be in steep decline, a warning that habitats these birds rely on are disappearing. These birds join the 86 identified on the Partners in Flight (PIF) list as a call to action for all of us concerned with conserving and securing the future of these species. Habitat loss, collisions, and cats pose huge threats to our native songbirds and many zoos are actively supporting *in situ* projects and educating our guests through Year of the Bird and World Migratory Bird Day events. Exhibiting native passerines is another way to spread the message! The PaCCT TAG's North American Songbird Working Group is working to create and foster a communication network that can help place birds in a setting where they will not only survive but thrive. We regularly share information on birds that are not a good fit for our aviary; more often than not there are other institutions that are happy to receive a bird that would not have worked at our home zoo.

JOIN THE AZA LIST SERV

to receive e-mail updates about available birds!

List serv name: BraZN
Bird Rehabilitator and Zoo Network

If you are not an AZA member, please contact

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Listings of birds available for placement can also be found on the website for International Wildlife Rehabilitation Council at iwrc.org.

So You Think You Want a Motus Station

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As zoos and aquariums, we are always on the lookout for innovative ways to contribute to species conservation. If it's affordable, that's a bonus. Along comes Motus. Motus is not an acronym, it's Latin for *movement*. The Motus Wildlife Tracking System is a collaborative international research network that uses cooperative automated radio telemetry to track the movements of flying animals. It is a program of Bird Studies Canada (BSC) in partnership with contributing researchers and organizations. The majority of species being studied are birds, but it is also used to track bats and even insects like dragonflies. If you can fit a nano-transmitter (Nanotag) on it, you can track it. The hallmark of the system is the network of receiving stations or Motus stations that are set up throughout the landscape to answer important research questions.

Using birds as an example, while citizen science tells us where birds are, to understand the migratory behavior of an individual bird, or group of birds, you need to track it. What is its full annual cycle migratory route? Where are the stopover points? How long does it stay there? Is there important habitat along the way that should be protected? You can begin to answer research questions addressing how climate change, habitat change, urban light, or ecological disasters like oil spills affect migration. You can get some information from bird banding and geolocators, but then you have to re-catch the bird to know where it is or where it's been. You could use satellite telemetry, but transmitters are expensive and their weight restricts their use to larger species. Or you could use radio telemetry and a network of receiver stations so you could pick up location data every time the bird passes within range of a station. That's what Motus does. Not only do you get a more precise view of a bird's migratory movements, but you do not need to recapture it to know where it goes. According to the website (http://motus.org), in the last hundred years, bird banding has produced 64 million data points. In five years, Motus projects have already produced 750 million data points! Since its inception in 2015, over 16,000 individuals of 120 bird species, bats, and insects have been detected (see https://motus.org/data/numbers).

Zoos have only started exploring the Motus system a couple of years ago, so we've had to learn a lot. So far, Columbus Zoo & Aquarium, Riverbanks Zoo & Garden, The Wilds (Fig. 1), Toronto Zoo, and Zoo Miami are the only zoos with operating Motus stations. At the time of writing, Fort Wayne Children's Zoo and others are at different stages in participation. We've learned that there are three ways that zoos can support migratory bird conservation through the Motus system: expanding the network through infrastructure support, participating in research projects, and using the system to inspire guests and researchers through education and outreach.

Infrastructure support: This is where most of us are now. This includes Motus station construction, usually on zoo property, to fill-in or add another data point to the international network of stations (Fig. 2). Some zoos have the stations on grounds with associated graphics. Others have them on other zoo-managed property. For example,

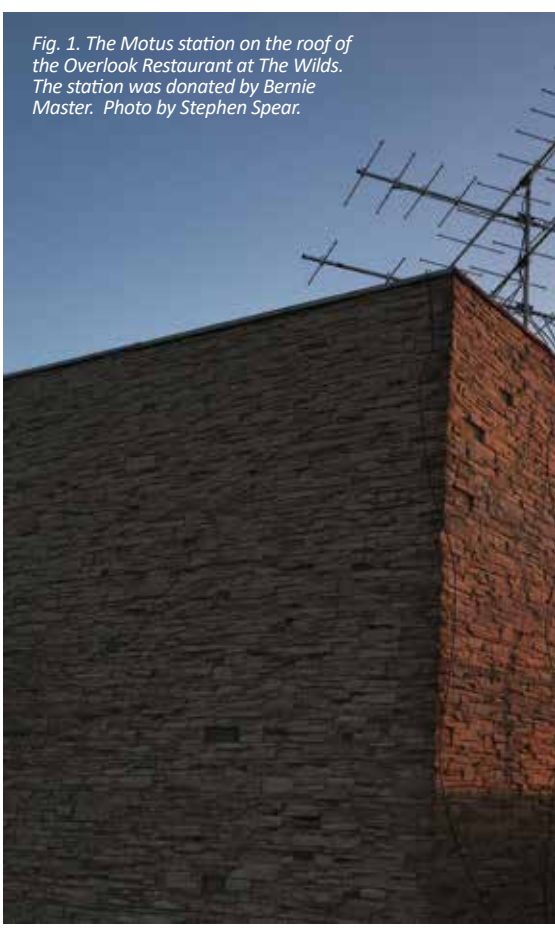

Fig. 1. The Motus station on the roof of the Overlook Restaurant at The Wilds. The station was donated by Bernie Master. Photo by Stephen Spear.

Fort Wayne Children's Zoo will be deploying a station at the zoo and three stations on land acquired through a partner in northeast Indiana (Smith, pers. com., Feb. 2019). Riverbanks Zoo & Garden has its station at its botanic garden due to the garden's higher elevation (Diebold, pers. com., Feb. 2019). There are currently over 600 stations, most of them in Canada and the United States. They are concentrated in certain areas such as the southern shores of the Great Lakes, along the Gulf of Mexico, and the Atlantic coast (See Motus map: https://motus.org/data/receiversMap?lang=en). However, there are large areas across the country, many of which are very important to migratory animals, which do not have coverage. This limits the power of the network to some extent. Our stations contribute to the numerous ongoing studies that have tagged birds, bats, or insects flying across the landscape. We are responsible for maintaining the stations and downloading and sending the data periodically to Bird Studies Canada. In the future, the data will be livestreamed directly to BSC from the station receiver. Zoo Miami and the U.S. Fish and Wildlife Service are working with zoos throughout Florida to establish a cross-state network of stations for this important bird region (Ridgley, pers. com., Feb. 2019).

Zoo-directed or collaborated research projects: Zoos can directly participate in or design their own studies. For example, Columbus Zoo is working with Powder Mill Nature Reserve (Carnegie Museum of Natural History), the Ohio Wildlife Center, and Lights Out Columbus to tag and release birds that have been rehabilitated after window strikes. Do these birds survive once released? Do they continue their migration? Are there species or other differences in migratory behavior? Toronto Zoo is working with partners in the Eastern Loggerhead Shrike (*Lanius ludovicianus* spp.) Recovery Team and has detected migrating captive-bred birds that were released elsewhere in the province with their station and others. Toronto Zoo has also hosted Environment Canada researchers studying the stopover ecology of Barn Swallows (*Hirundo rustica*) – a Species At Risk in Ontario. They have

Fig. 2. John Davis, Riverbanks' Director of Animal Care & Welfare, powers-up the Riverbanks station. Photo by Ed Diebold.

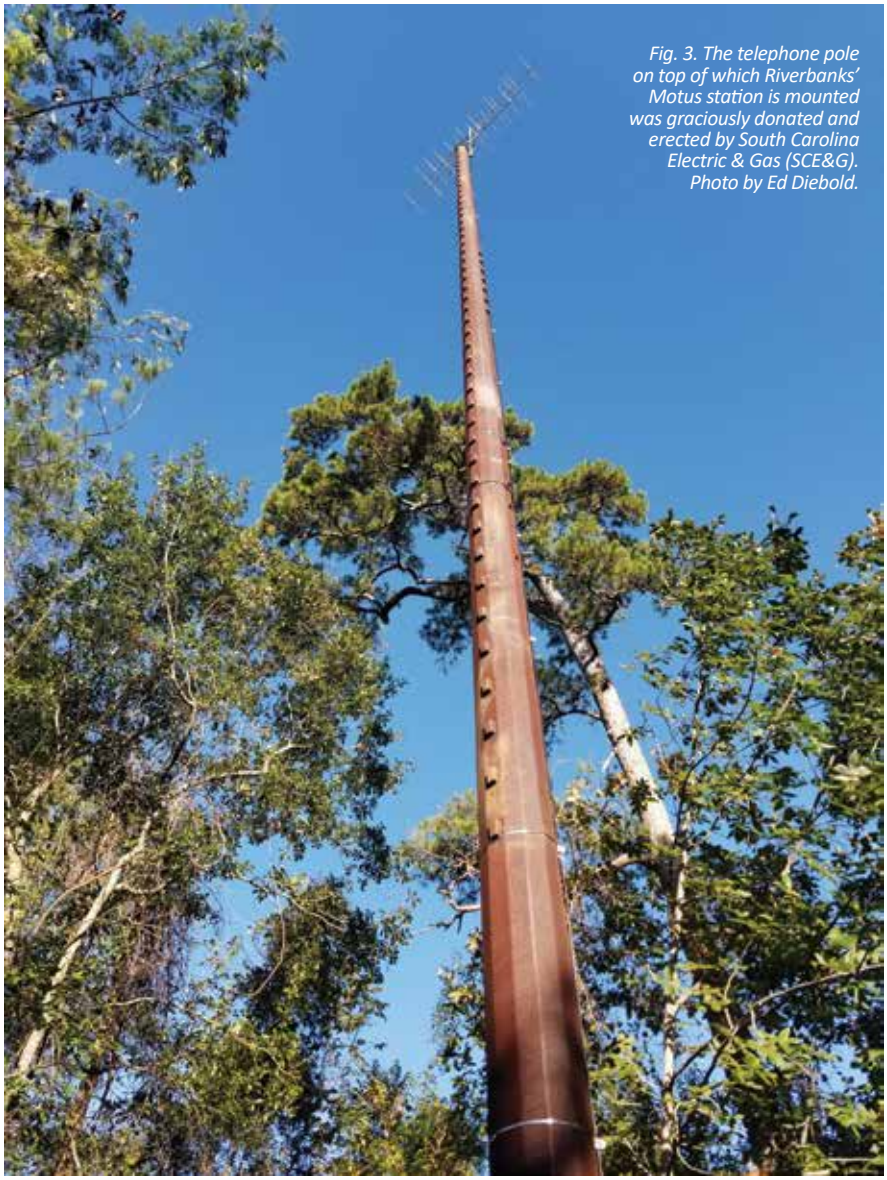

Fig. 3. The telephone pole on top of which Riverbanks' Motus station is mounted was graciously donated and erected by South Carolina Electric & Gas (SCE&G). Photo by Ed Diebold.

nanotagged swallows breeding on zoo grounds to identify their wintering areas (Kerr, pers. com., Feb. 2019). Zoo Miami is working with partners at Audubon's Everglades Science Center in the Florida Keys to detect Roseate Spoonbills (*Platalea ajaja*) (Ridgley, pers. com., Feb. 2019). Riverbanks Zoo & Garden is considering putting up a station on private land in Ecuador that is bordered by nearly pristine protected bird habitat (Diebold, pers. com., Feb. 2019). The station would be monitored by local partners. Some of the species that migrate past the zoo in Columbia, South Carolina, like Swainson's Thrush (*Catharsus ustulatus*), winter in Ecuador.

Education and outreach: Zoos can use the stations to talk about migratory species, the value of wildlife tracking, and the role of zoos in wildlife research and conservation. It allows us to build a connection between wildlife in our own backyards and where it travels before and after it gets there. Those who currently have stations have static graphics (Fig. 4), but educators may also develop interactive activities or educational materials. Zoos also share information about the system and projects through social media and their websites.

Riverbanks Zoo & Garden's education department will incorporate the Motus story into its programming, specifically in programs that highlight native Carolina species or explore population biology, data collection, or STEM. The guest engagement team will highlight Motus as appropriate.

What have we learned about the system? Most of what you need to know to construct a station, build or buy a receiver box, and manage data can be found on the Motus website. Prices for materials vary depending on what you need or what you have. For example, can you attach the array (kind of like a TV antenna) to an existing pole or do you need to purchase a pole to get the array high enough? At the Columbus Zoo and The Wilds, it cost about $5,000 for each station, including the receiver.

There are technical challenges. Motus stations are typically deployed at field study sites. In a zoo, you have competing bandwidth with zoo radio systems, technology security firewalls, and potential obstructions (ideally you want the arrays to have a clear "view" of

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the horizon). To get it's antennae above the treeline, Riverbanks Zoo & Garden installed an 85 foot tall telephone pole and put the antennae on top with the help of an engineering drone that was utilized to ensure that the antennae were at a sufficient height (Fig. 3). While you can contact BSC for technical support, it is very worthwhile to have zoo information technology support staff involved in the process. Like any wildlife technology, it takes time and practice to become familiar with how it operates, in this case, maintaining and troubleshooting problems with hardware, the procedure to download data, sending it to BSC, and interpreting the results. However, it is thrilling to find you have detected a bird and added data to the migration of that bird that would have gone unknown otherwise. It is a simple way to contribute to multiple field conservation projects.

What can we expect from Motus in the future? Like all telemetry technologies, Motus will adapt and improve over time. Tag technologies are improving and the Motus receivers are regularly upgraded to keep pace. Most Motus summary data are open for use by the public, researchers, and zoos wishing to explore the data in more detail. The network will continue to grow as educators, public land managers, and zoos continue to put stations on the landscape and fill in gaps across the Flyways. And as the network expands, the system becomes more informative and nanotagging will become an attractive option to more researchers. Zoo graphic designers or educators are welcome to use any of the information to develop animations or materials that display animals flying past our stations and where else they could have been detected.

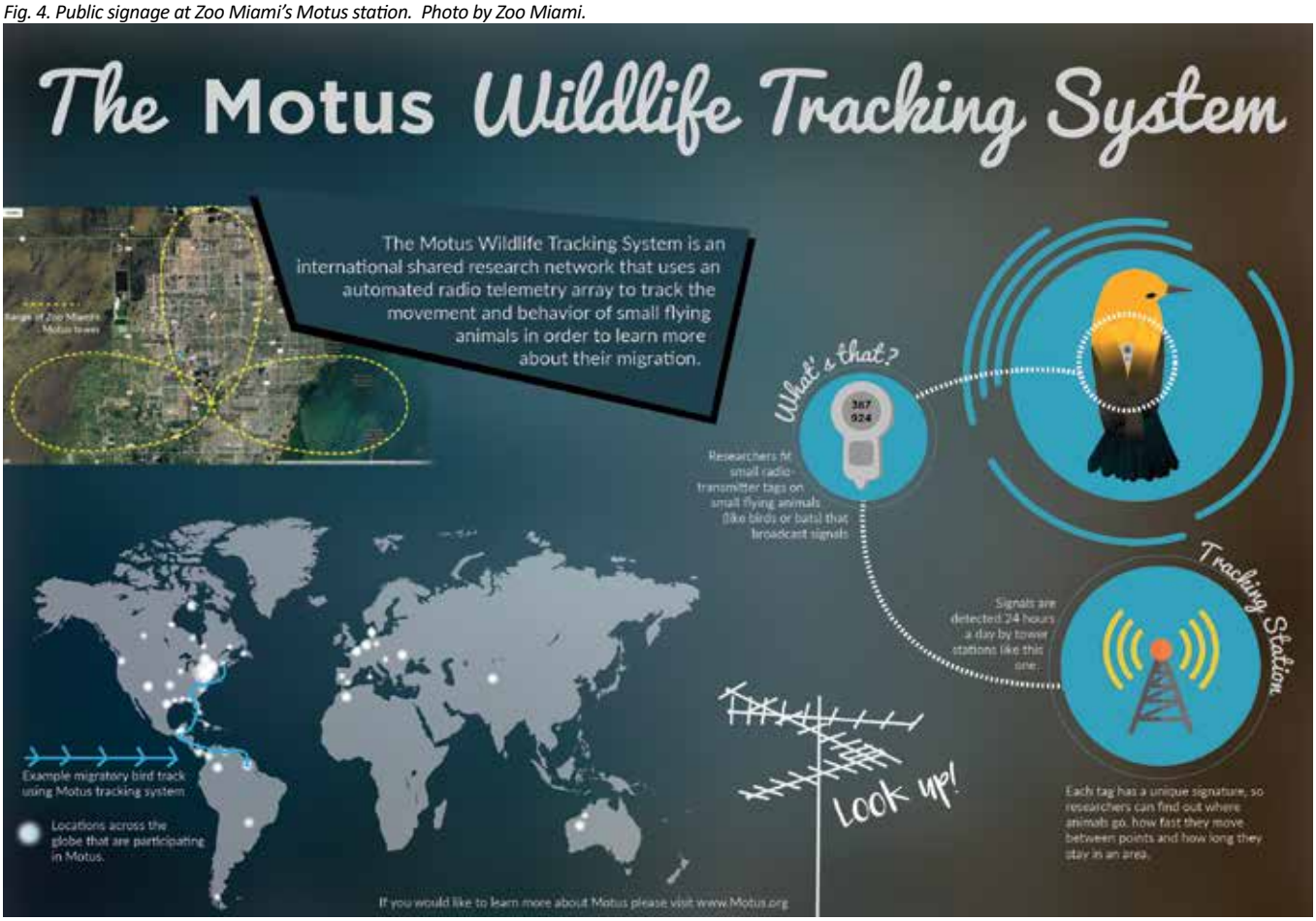
As more zoos host stations, a Motus working group could be developed to coordinate the zoo community and provide great value to our network. This group would be a point of contact on technology and would share information, graphics, and perhaps identify research priorities and potential collaborations.

Here is the bottom line - Motus is an affordable, cutting edge technology that allows zoos and aquariums to contribute to or conduct research on migratory species in their own backyards. It is a valuable tool for inspiring visitors and informing management decisions that will ultimately help save migratory birds.

Acknowledgements

The authors wish to thank Stuart Mackenzie, Director, Migration Ecology, Bird Studies Canada, for his comments on this manuscript.

Fig. 4. Public signage at Zoo Miami's Motus station. Photo by Zoo Miami.



World Migratory Bird Day - Are you celebrating?

Anne Tieber
St. Louis Zoo

As spring approaches, the weather starts to warm, and our thoughts turn to spring. Our outdoors come to life with bird songs and it reminds us that spring bird migration is upon us. More than 300 species of migratory birds travel from Latin America, Mexico and the Caribbean back to their summer breeding grounds in North America and Canada. In 2018, we celebrated "The Year of the Bird" and the anniversary of the Migratory Bird Treaty Act (MBTA). As a conservation organization, the Saint Louis Zoo also celebrates International Migratory Bird Day, now dubbed World Migratory Bird Day (WMBD), highlighting the spectacular event of bird migration. For St. Louis, being in the Mississippi flyway, we have many species of migratory birds that come through our area every spring and fall, so it offers the perfect opportunity to highlight this event and share with our visitors the unique beauty and diversity of birds. The array of neotropical migrants coming through offers dedicated birders a chance to add species to their life lists or just enjoy the beauty of seeing birds that are not normally found here.

According to BirdLife International (2008), over half of neotropical migratory songbirds have suffered widespread declines over the last 40 years. The main threats include habitat loss and degradation, predation by domestic cats, and collisions with buildings and towers. Now more recently, climate changes and pesticides (neonicotinoids) are recognized as detrimental to songbirds. Some species have seen as much as an 80 percent decline since the late 1960's while others have declined by 50 percent or more.

World Migratory Bird Day officially takes place the second Saturday in May but this may not work for everyone, so now people are encouraged to celebrate any time of the year. By celebrating we help create public awareness of the threats to our migratory songbirds and empower our visitors to become involved in what they can do to help. We can encourage our visitors to help birds by participating in citizen science programs, in which volunteers and scientists work together to answer real-world questions and gather data. These programs can be a fun and engaging way to get the family out and learn a little more about the birds in your area as well as just getting out and enjoying nature. Some of these citizen science

Bird Walk Tour at the Denver Zoo, photo by Denver Zoo.

Selfie station photo by Marija Eldon, Saint Louis Zoo

The inspiration for the development of these interpretive signs was a book called: *"Bringing Nature Home: How You Can Sustain Wildlife with Native Plants"* by Douglas W. Tallamy, renowned Entomologist.

This book shows the intricate relationship of native plants to native caterpillars (and other invertebrates) and the dependence of birds to these caterpillars. Did you know that some species of native Oak trees are hosts to an astonishing 532 species of moth and butterfly caterpillars, where non-native boxwood or forsythia are host to only one? Or that it can take over 6000 caterpillars to fledge one clutch of chickadees?

Unlike alien plants, all native plants have evolved with local soil critters and native wildlife and serve a critical purpose in the environment. They stabilize soil and rebuild it, help prevent flooding, hold carbon and give us oxygen. They create nest sites, they supply nectar and pollen for pollinators and leaves for the caterpillars which birds need for fat and protein for their nestlings. Best of all, native plants are also low maintenance.

We hope our graphics and stories encourage people to consider growing native plants to help songbirds. Just by planting native wildflowers around your house, you can participate in conservation.

Many Thanks goes out to our Creative Design Services personnel, Greg Linton and Mary Brong who designed these beautiful graphics as well as to Ed Spevak, Ph.D., Curator of Invertebrates, and Director of the Center for Native Pollinator Conservation.


National Zoo, photo by Jim and Pam Jenkins


National Zoo, photo by Jim and Pam Jenkins

projects that help experts determine important trends in bird populations include; The Great Backyard Bird Count, Project Feeder Watch, The Christmas Bird Count and eBird challenges just to name a few.

Celebrating Migratory Bird Day in Zoos has gained momentum over the years and staff have enlisted the help of their education departments, partnered with local Audubon centers, wildlife/wild bird rehab centers as well as their local parks, to tell the amazing stories of bird migration. By utilizing entities such as Environment for the Americas (EFTA), they can help us focus by providing yearly themes such as "*Stopover Sites*", "*Restore Habitat. Restore Birds*" and "*Why Birds Matter*". For 2019, the theme is "*Protect Birds: Be the Solution to Plastic Pollution*". By contacting EFTA via their website (WWW.environmentamericas.org), you can have access to their many resources such as banners, coloring sheets, education activities, social media packets, posters and an array of other promotional materials. They are happy to provide these materials free of charge in order to easily encourage people to celebrate and they like to remind people, "every day is bird day", allowing World Migratory Bird Day to be celebrated almost year-round.

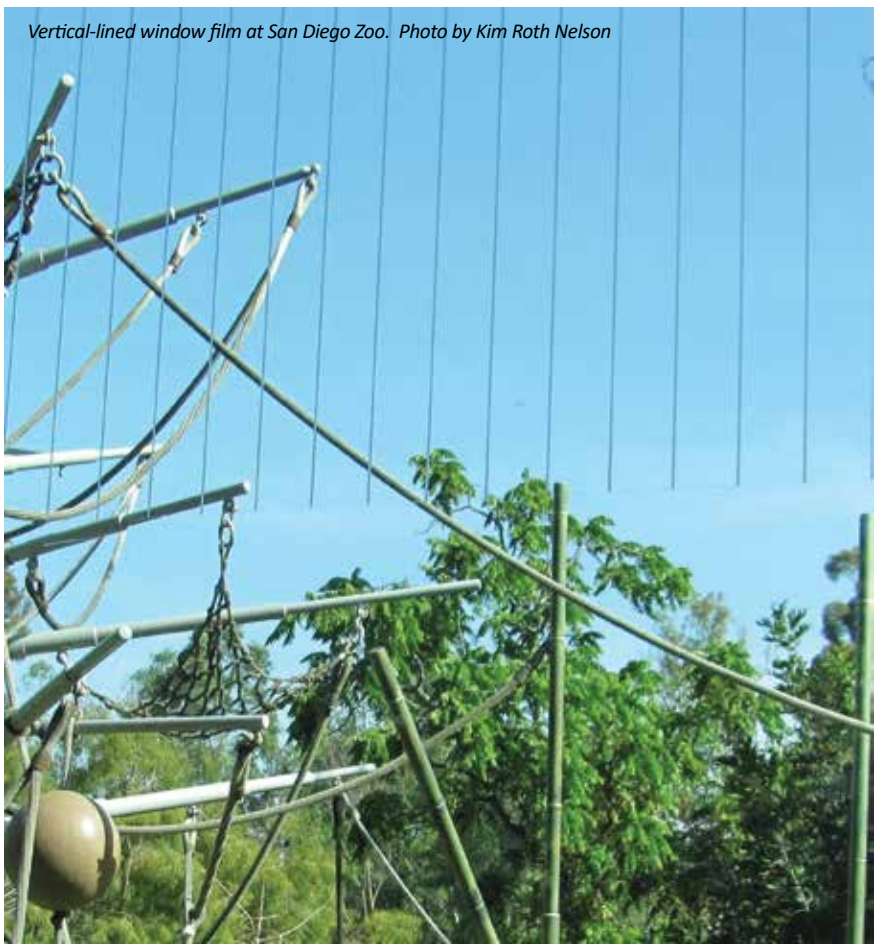
Some of the activities zoos do to promote this include banding demonstrations, interactive maps that show migration patterns, puppet shows, offer shade grown coffee, animal ambassadors, guided bird walks and kids' craft stations where they can make things like seed bombs, pinecone feeders, and homemade binoculars. Discussing difficult topics like bird collisions, domestic cat predation and habitat loss as well as talking about how visitors can help migratory birds simply by putting up bird feeders, encouraging everyone to plant native plants that support local bird life and buying shade grown coffee can empower visitors to make worthwhile behavior changes. Every year zoos and aquariums have over 180 million visitors collectively come thru our gates, this allows us ample opportunity to share information about bird populations and encourage simple actions that can benefit their native birds.

National Zoo, photo by Jim and Pam Jenkins

No matter how or when you celebrate World Migratory Bird Day, the point is to celebrate! Have fun and engage as many people as you can. You can be the champion for Birds!

Raising Awareness About Bird-window Collisions at Zoological Facilities

Kim Roth Nelson, Senior Bird Keeper
San Diego Zoo
San Diego, California



Vertical-lined window film at San Diego Zoo. Photo by Kim Roth Nelson

Introduction

Peer-reviewed research has estimated that up to one billion birds are killed by bird-window collisions (BWCs) in the U.S. alone each year (Klem & Saenger, 2013; Loss et al., 2014). Birds play an important role in ecosystem functionality, and therefore, processes like pollination, seed dispersal, and decomposition would greatly decrease as avian populations decline (Dirzo et al., 2014; Şekercioğlu et al., 2004). Additionally, some species that have been recorded as victims of BWCs are considered to be national Birds of Conservation Concern (Loss et al., 2014). All of these findings strongly demonstrate the need for raising more awareness about BWC prevention.
BWCs happen because birds are unable to perceive glass as a solid barrier due to its transparent and/or reflective properties. This causes birds to fatally injure themselves while attempting to get to habitat seen reflected in or through windows (Klem, 2008). BWCs have been known to happen anywhere that glass structures exist and this includes zoological facilities (Kahle et al., 2016; Sabo et al., 2016).
Based on multiple studies, it is largely believed that birds are highly unlikely to fly through a space that is less than two inches high and four inches wide (Klem & Saenger, 2013). This finding has helped create various window treatment applications that aid in the prevention of BWCs. These treatments are known to vary in terms of their effectiveness, aesthetics, cost, and permanence.

The best predictor of BWCs has been said to be bird density within the vicinity of glass, water, vegetation, and food sources (Klem, 2008). In recent years, outdoor glass-viewing windows have become increasingly popular in zoo and aquarium settings as a safe and optimal way to let visitors view animals. Since many zoos and aquariums have large open exhibits that feature glass paneling, water sources, landscaping, and food availability, one might expect BWCs to be a common occurrence at zoological facilities across North America. In order to determine whether this was true or not, I decided to conduct a survey examining the contribution of zoological facilities towards the causation and prevention of BWCs.

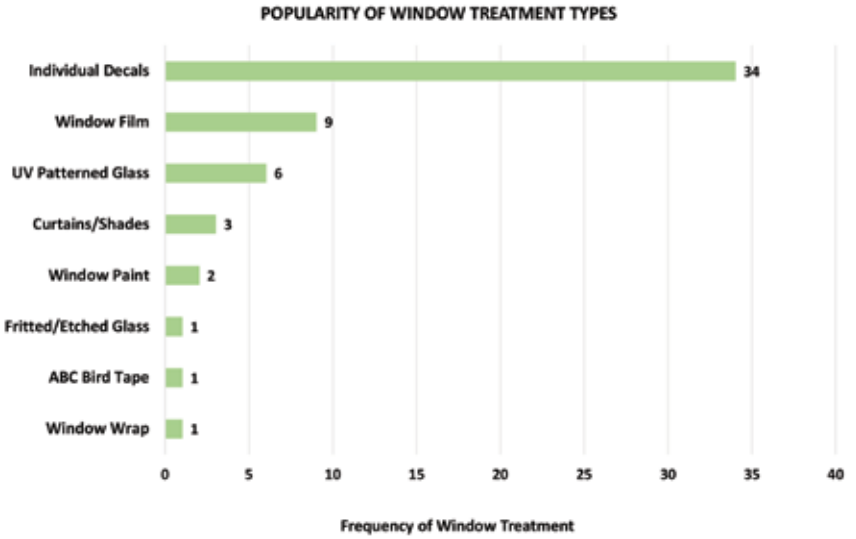
Methods

An online survey was conducted in the fall of 2016. A mass e-mail was sent out using the Avian Scientific Advisory Group's Institutional Representative Listserv. This listserv goes out to approximately 200 different zoological representatives across North America. In addition to looking at whether the frequencies of BWCs were being tracked at each facility, one purpose of the study was to examine how many zoos and aquariums were using prevention methods, what kinds of window treatments they were using, if their treatments were effective, and what types of obstacles they were facing when attempting to install treatments. Another purpose of the study was to compare how location (i.e. urban, suburban, or rural areas) influenced the frequency of collisions. The last goal of the survey was to determine if any facilities were conducting public outreach on the topic of BWCs.

I requested that representatives forward the survey on to whomever was most familiar with collisions at their particular institution. This was usually a Bird Curator, Bird Manager, or Pathologist. This request was done to prevent potential bias from multiple people within the same institution submitting responses since participation was kept anonymous. The survey was conducted online using Google Forms and the data collected was then downloaded to Microsoft Excel for analyses. JMP Pro Version 13 software was later used to run an ordinal logistic regression model.

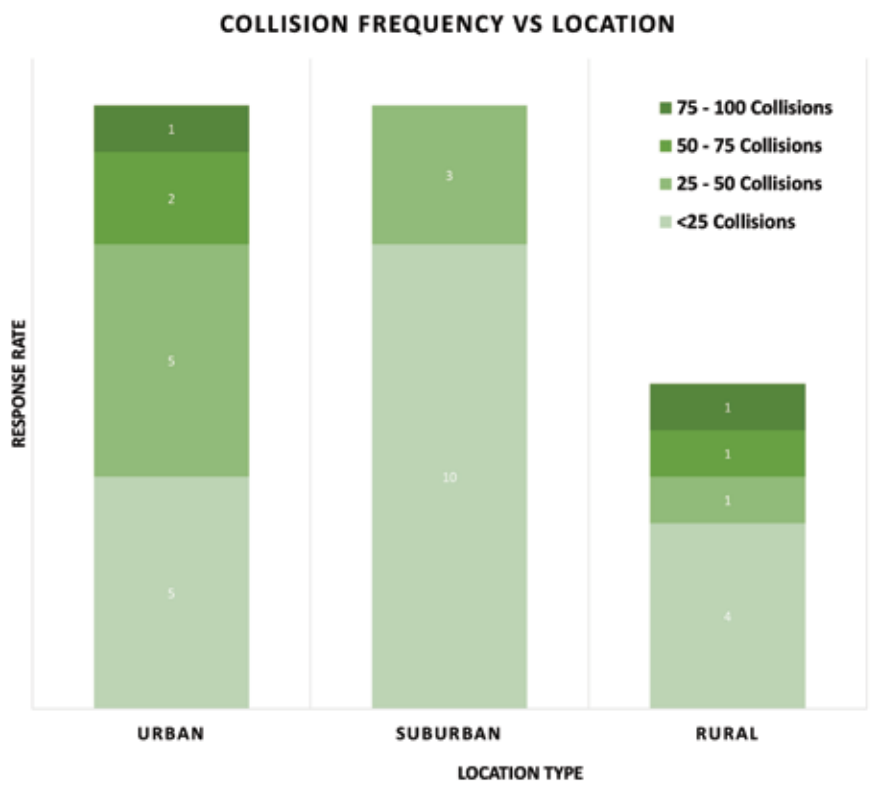
Results

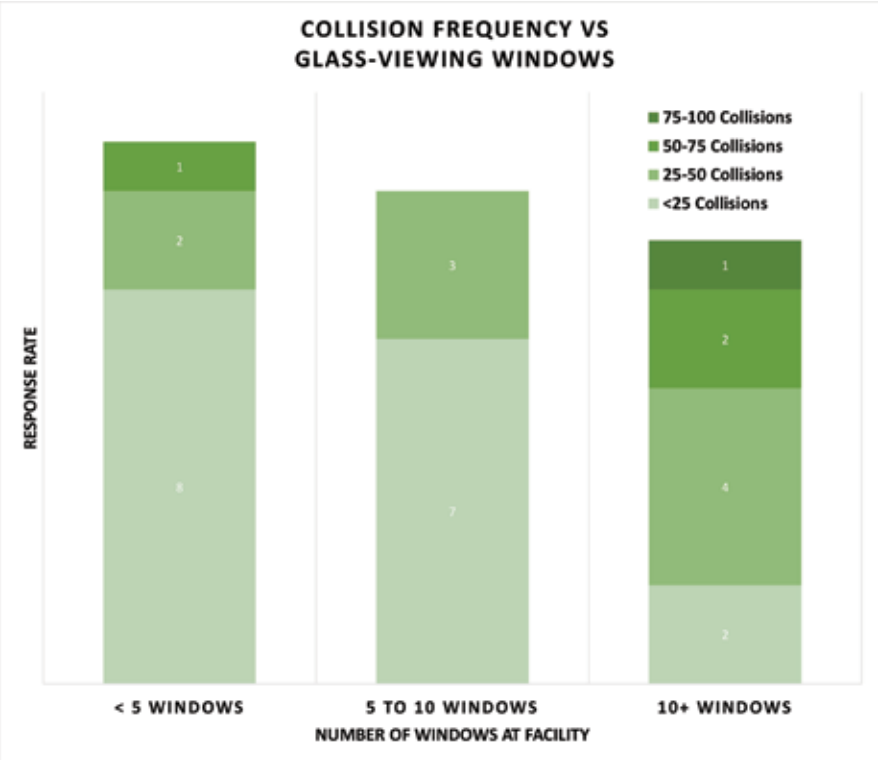
Of the sixty zoological facilities that participated in the survey, 72% (n=43) reported they were using window treatments to prevent collisions. The reasons given for not using any window treatments besides BWCs not being an issue (n=10), were budget (n=5), aesthetics (n=3), BWCs being a new issue (n=1), and BWCs not being a frequent enough issue (n=1). Individual vinyl decals such as hawk-shaped or UV leaf patterns were by far the most popular treatment (n=34). Window film (n=9) and Ornilux glass (n=6) were the next most popular options. Additionally, only two facilities reported ever receiving any guest complaints about the use of preventative treatments (See Figure 1).



Only 35% (n=21) of the facilities stated that they were actively tracking the number of BWCs happening at their locations. The majority of facilities not keeping track stated that collisions were either not an issue (n=16) or were not a frequent enough issue (n=7). While two institutions said they were planning to start recording BWCs in the future, other reasons given for not keeping track included not enough time (n=4), lack of protocol (n=3), lack of designated person (n=3), and it not being a priority (n=3).

Sixty-three percent of the facilities (n=19) that were keeping track of BWCs





reported they received less than 25 collisions per year. Only four facilities reported collisions being greater than 50 per year with none greater than 100. In terms of location, there was a significant difference between whether facilities were located in urban, suburban, or rural areas with data suggesting that urban areas had significantly higher numbers of BWCs (See Figure 2).

Additionally, facilities with more than ten outdoor glass-viewing windows were significantly more likely to encounter BWCs (See Figure 3).

Lastly, only six facilities said they were conducting any public outreach regarding BWC prevention. However, eleven facilities said they were planning to do so in the future.

Discussion

Despite 23 respondents stating that collisions were not an issue or not a frequent enough issue at their facilities, it is difficult to truly assess how large of an issue BWCs are in North American zoos and aquariums. Many facilities decided not to participate in the survey, and out of the 60 institutions that did take part, many decided to refrain from answering certain questions.

Additionally, only 35% of the facilities said they were actually tracking the number of BWCs, so the remaining facilities would therefore be basing their answers on impression only. With that in mind, it is likely that most facilities were underestimating the actual number of collisions since research has shown that BWC victims often go undetected due to them being hidden out of view or removed by scavengers (Klem et al., 2008; Kahle et al., 2016).

Urban zoological facilities were found to have significantly higher rates of BWCs. I believe this increase may have been due to urban facilities acting as important stopover sites for birds during migration. This was also suggested by Sabo et al. (2016) in their study at the Virginia Zoo. However, this finding does not mean that suburban and rural areas were in the clear. In fact, one of the facilities with the highest frequency of collisions in this study was located within a rural area. I believe this may have been due to this particular facility having a large number of outdoor glass-viewing windows since research by Klem (2008), Hager et al. (2013), Borden et al. (2010), as well as this study, have found a positive correlation between collision frequency and total glass surface area. Additionally, Hager et al. (2017), found that collision mortality was greatest in rural areas that contained extensive lawns, few structures, and occasional large buildings. This description could definitely be applicable to many zoological institutions.

Seventy-two percent (n=46) of the facilities reported that they used window treatments. However, 34 of those facilities were using individual decals such as hawk-shaped or UV leaf patterns to prevent collisions. This method has been found to be largely ineffective at preventing BWCs since decals are often spaced too far apart (Klem & Saenger, 2013).

Six facilities also reported the use of UV glass, which is manufactured to have a UV pattern that birds can see while still appearing clear to humans. However, Klem & Saenger (2013) found this method to be ineffective during times of low UV index such as early in


American Woodcock found after window collision. Photo by Shane Good.

ABC Tape, Photo Courtesy of Virginia Zoo

the morning. This is unfortunate since clear glass would be an excellent option for the several facilities that stated they were reluctant to add window treatments for aesthetic reasons. As for the facilities that reported using other treatments such as window film, fritted glass, window wrap, and ABC Bird Tape, all of those methods were reported as being effective at preventing collisions.

Despite the appearances of these different window treatments, only two facilities reported receiving any guest complaints about them. This finding supports the use of window treatments in zoos and aquariums regardless of aesthetics. This also suggests that adding educational signage explaining why window treatments are needed would eliminate any guest concern. With that said, only six zoos and aquariums said that they were providing any public outreach regarding BWC prevention. This was much less than I was expecting. However, eleven facilities said they were planning to do so in the future, so this is quite promising. Roe et al. (2014) found that 80% of zoo visitors wanted to learn more about actions they could take at home to help with conservation, so hopefully, this paper's findings will encourage more facilities to spread awareness about BWCs to their guests. Besides educational signage, public outreach could also include press releases, newsletters, blogs, flyers, interactive displays, and partnering with local bird advocacy organizations. All of these options are relatively cheap and easy to do.

In conclusion, I hope the findings from this article will help to create new industry standards and save many birds' lives. The application of a standardized method for tracking collisions as well as promoting cheap and effective prevention methods within the zoological field could do just that.

For more information about window treatment options, please see the following websites:

American Bird Conservancy's website regarding collision prevention methods: www.birdsmartglass.org

AZA's website regarding collision prevention methods: https://www.aza.org/green-practices-bird-safe-buildings

References

Borden, W.C., Lockhart, O.M., Jones, A.W., and Lyons, M.S. 2010. Seasonal, Taxonomic, and local habitat components of bird-window collisions on an urban university campus in Cleveland, OH. *The Ohio Journal of Science* 110(3):44-52.

Dirzo, R., Young, H.S., Galetti, M., Ceballos, G., Isaac, N.B., and Collen, B. 2014. Defaunation in the Anthropocene. *Science* 345(6195):401-406.

Hager, S.B., Cosentino, B.J., McKay, K.J., Monson, C., Zuurdeeg, W., and Blevins, B. 2013. Window area and development drive spatial variation in bird-window collisions in an urban landscape. *PloS One* 8(1).

Hager, S.B., Cosentino, B.J., Aguilar-Gómez, M.A., Anderson, M.L., Bakermans, M., Boves, T.J., and Calderón-Parra, R. 2017. Continent-wide analysis of how urbanization affects bird-window collision mortality in North America. *Biological Conservation* 212:209-215.

Kahle, L.Q., Flannery, M.E., and Dumbacher, J.P. 2016. Bird-Window Collisions at a West-Coast Urban Park Museum: Analyses of Bird Biology and Window Attributes from Golden Gate Park, San Francisco. *PloS One* 11(1), e0144600.

Klem, D. 2008. Avian mortality at windows: the second largest human source of bird mortality on Earth. Tundra to tropics: connecting birds, habitats and people. *Proceedings of the 4th International Partners in Flight Conference*, 13–16 February 2008. McAllen, TX.

Klem, D., and Saenger, P.G. 2013. Evaluating the effectiveness of select visual signals to prevent bird-window collisions. *The Wilson Journal of Ornithology* 125(2):406-411.

Loss, S.R., Will, T., Loss, S.S., and Marra, P.P. 2014. Bird-building collisions in the United States: Estimates of annual mortality and species vulnerability. *The Condor* 116(1): 8-23.

Roe, K., McConney, A., and Mansfield, C.F. 2014. The Role of Zoos in Modern Society—A Comparison of Zoos' Reported Priorities and What Visitors Believe They Should Be. *Anthrozoös* 27(4):529-541.

Sabo, A.M., Hagemeyer, N.D., Lahey, A.S., and Walters, E.L. 2016. Local avian density influences risk of mortality from window strikes. *PeerJ* 4, e2170.

Şekercioğlu, Ç.H., Daily, G.C. and Ehrlich, P.R. 2004. Ecosystem consequences of bird declines. *Proceedings of the National Academy of Sciences* 101(52).

Educational Signage, Columbus Zoo and Aquarium, Photo by Amanda Carberry

Urban Refuge: Why Zoos are Important Green Spaces for Migrating Birds

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Introduction

Ordinarily, the term 'urban' is based on the density of the population, administrative boundaries, and the amount of land development for human use (Francis & Chadwick, 2012). An urban area in the United States is an area that outpaces 186 persons per km^2. According to these 'urban standards', about 80% of the US population live in urban areas (Francis & Chadwick, 2012). As the human population continues to grow, urban environments expand, transforming natural habitats into residential homes, office buildings, and other forms of development.

Tufted Titmouse. Photo by Eric Peterson.

Establishing these areas caused the destruction of wild places and converted them into cities and industries. This urban transformation forces wild animals and plants out of their native habitats. Because of this, they have to either find new green spaces to thrive in, or adapt to the urban landscape. As a result, several species now cross paths with humans more frequently (Francis & Chadwick, 2012). The development of a natural area affects the resident wildlife directly and can create light pollution, noise pollution, car collisions, and habitat fragmentation, which in return also affect humans. Due to the urbanization of habitats, there is an insufficient amount of green space available for both humans and animals. Conserving and preserving green spaces is essential in order to achieve environmental quality goals for both humans and animals. Preserving green spaces also creates a more appealing urban environment, not only environmentally, but also economically and socially (Ward, Parker, Shackleton, 2010).

Birds in Urban Environments (Resident and Migrant)

The majority of research done on the urbanization of fauna has been conducted on birds.

Scientists have found that bird species' ability to adapt to urban environments can be behavioral, physiological, or morphological. In some studies, birds' ability to adapt to an urban landscape is determined by their ability to breed (Francis & Chadwick, 2012). Birds' ability to breed includes opportunities for copulation, successful copulation, egg fertility, and decreased predation on eggs and chicks (Francis & Chadwick, 2012) Research suggests that some avian species are 'preadapted' to urban landscapes (Francis & Chadwick, 2012). It is known that some birds have more vocal variability which may indicate that some species exhibit plasticity within urban environments (Francis & Chadwick, 2012). Bird populations that have exhibited adaptability have benefited from the amount of resources available in an urban environment (Parker & Nilon, 2012). Populations that have synurbanized (adapted to urban environments) have displayed behaviors of decreased fear of humans, increased competition, and changes in urban populations (Parker & Nilon, 2012).

The Atlantic Coast migratory route, the Atlantic flyway, that birds use every spring and fall is becoming increasingly more urbanized with every year that passes. Research in bird mass suggests that urban landscapes prove to be

Common Redpoll. Photo by Eric Peterson.

a beneficial stopover site for birds to refuel and rest before they move on to their next point (Seewagen & Slayton, 2008, Seewagen, Slayton, Guglielmo, 2010). Different species of migrating birds utilize various areas of the forest, even if it is a small patch. Some species found in the Northeastern U.S, like thrushes *(Turdidae)* and thrashers (*Mimidae)* will mainly be found foraging on the forest floor. Others, like the red-eyed vireo (*Vireo olivaceus*) and Northern parula *(Setophaga americana*) are both primarily found high in the canopy. Other species are known to utilize all levels of the forest (Rinker, 2001). Research has also shown that areas with invasive plants, high densities of birds, and destroyed natural habitat may create competition and put a strain on the migrating birds' ability to refuel (Seewagen & Slayton, 2008). Birds expel more energy and time at the stopover sites looking for food than they do during flight. The success of the migration depends on the richness and ability to refuel during their stopovers (Seewagen et al., 2010).

Urban Zoos

Zoos within and around urban areas offer great opportunities for several wild species to explore and utilize these green spaces. The global conservation work that zoos accomplish is incredible, but urban zoos maintaining green spaces can support hyperlocal conservation also. Wild birds are usually the most frequent visitors and residents to take advantage of these zoos as green spaces within a city hub. Wildlife Conservation Society's (WCS) Bronx Zoo (BZ) in Bronx, New York is 265 acres of green space in the New York City metropolitan area. The Bronx River flows through the park and is lined with old growth and secondary growth forest as well as untouched habitat. The Bronx Zoo also neighbors the New York Botanical Gardens which is 250 acres of land. The two together make up over 500 acres of green space in the concrete jungle of New York, making it an important and established bird migratory waypoint (Seewagen & Slayton, 2008). For many years, birders have used the BZ green space to bird-watch and wait for sometimes rare sightings through the migration season.

In 1910, Dr. William Beebe, the first curator of the ornithology department at the Bronx Zoo (The Gale Group, 2004), conducted a bird census on BZ grounds. He was a pioneer in the field of conservation and known as one of the first neotropical ecologists (The Gale Group, 2004). Although the methods for Beebe's data collection are not certain, it is assumed that William Beebe surveyed zoo grounds as a birder with a pair of binoculars and a love of birds. On Beebe's census, 73 birds were noted. Today, 71 of those 73 species are still seen today during the year. With the help of bird enthusiasts and Cornell Lab of Ornithology's **e-bird.org**, about 159 species of birds have been reported seen at the zoo since 1910.

What's Next?

As the human population grows, so does the rate of urbanization. With the increase in land development, we can be hopeful that the interest in wildlife by the general public also increases (Magle, Hunts, Vernon, & Crooks, 2012). The ecological role of urban landscapes

is growing in importance because of the rate these landscapes are growing. When developing an area, land developers are slowly becoming more aware of consulting with biologists and ecologists on the importance of an area. Environmental mitigation laws have been put into place so that if development is taking place in one area, another nearby must be set aside as a green space (Magle et al., 2012). Those green spaces have proven their importance to several species including birds and humans. Some benefits to these green spaces within urban environments include improvement to air quality, pollination opportunities (which means food for humans and other wildlife), and mental health benefits for humans (Magle et al., 2012).

Since the beginning of human settlement, birds have been demonstrating their ability to adapt, live, and thrive alongside us, excluding the ones humans have hunted to extinction. As lands continue to be developed, the need to monitor bird populations and to stress the importance of green spaces within urban environments increases. Our human population will continue to grow, but that does not mean there aren't ways to manage both our quality of life along with wildlife's quality of life.

Is it possible for all urban zoos to set aside green space for wild critters, birds and migrating birds? Are other urban zoos curious about what wild bird species roam their grounds? Let's do more towards hyperlocal conservation and encourage migrating birds to visit urban zoos at stopover sites.

Bullock's Oriole. Photo by Eric Peterson.

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References

City of New York. (n.d.). History of the Bronx Zoo. Retrieved November, 2017, from https://www.nycgovparks.org/about/history/zoos/bronx-zoo

ebird 2017. Bronx Zoo. Retrieved October 30, 2017, from http://ebird.org/ebird/hotspot/L692462?yr=all&m=&rank=mrec

Fowle, M., and Kerlinger, P. 2001. The New York City Audubon Guide to Finding Birds in the Metropolitan Area. *Cornell University Press*

Francis, R.A., and Chadwick, M.A. 2012. What makes a species synurbic? *Applied Geography* 32(2):514-521. doi:10.1016/j.apgeog.2011.06.013

Hussel, D.J., and Ralph, J.C. 1998. Recommended Methods for Monitoring Bird Populations by Counting and Capture of Migrants. *Committee of the Migration Monitoring Council,* 1-24.

Magle, S.B., Hunts, V.M., Vernon, M., and Crooks, K.R. 2012. Urban wildlife research: Past, present, and future. *Biological Conservation,* 155:23-32.

Møller, A.P., Diaz, M., Flensted-Jensen, E., Grim, T., Ibáñez-Álamo, J.D., Jokimäki, J., . . . Tryjanowski, P. 2012. High urban population density of birds reflects their timing of urbanization. *Oecologia* 170(3): 867-875. doi:10.1007/s00442-012-2355-3

Newhouse, M.J., Marra, P.P., and Johnson, L.S. 2008. Reproductive Success of House Wrens in Suburban and Rural Landscapes. *The Wilson Journal of Ornithology* 120(1): 99-104. doi:10.1676/06-156.1

Parker, T.S., and Nilon, C.H. 2012. Urban landscape characteristics correlated with the synurbization of wildlife. *Landscape and Urban Planning* 106(4):316-325. doi:10.1016/j.landurbplan.2012.04.003

Seewagen, C.L., and Slayton, E.J. 2008. Mass Changes Of Migratory Landbirds During Stopovers In A New York City Park. *The Wilson Journal of Ornithology* 120(2):296-303. doi:10.1676/07-087.1

Seewagen, C.L., Slayton, E.J., and Guglielmo, C.G. 2010. Passerine migrant stopover duration and spatial behaviour at an urban stopover site. *Acta Oecologica* 36(5):484-492. doi:10.1016/j.actao.2010.06.005

The Gale Group. 2004. William Beebe. Retrieved November 22, 2017, from http://www.encyclopedia.com/people/science-and-technology/zoology-biographies/william-beebe

Ward, C.D., Parker, C.M., and Shackleton, C.M. 2010. The use and appreciation of botanical gardens as urban green spaces in South Africa. *Urban Forestry & Urban Greening* 9(1):49-55. doi:10.1016/j.ufug.2009.11.001

Importance of Monitoring North American Songbird Populations in Urban Areas

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Anthropogenic activities are affecting wildlife populations at a global scale whether it is climate change or changing the landscape through urban development. In order to thrive, wildlife will need to adapt to the rapidly changing environment through alterations in behavior and other physical traits. Species that do not adapt to the changing landscape may risk extirpation. An example of an avian urban adapter is the peregrine falcon (*Falco peregrinus*). It uses buildings to perch and nest while hunting rock pigeons (*Columba livia*) (Chace and Walsh, 2006). Species that are not able to cope (i.e. urban avoiders) will need to disperse away from the city or may experience population die off. Finally, urban exploiters thrive on human resources. These species generally are not native and are found in homogenized landscapes throughout the world (reviewed in McKinney, 2002). Some examples of avian urban exploiters include American crows (*Corvus brachyrhynchos*), house sparrow (*Passer domesticus*), European starling (*Sturnus vulgaris*) and rock pigeons (McKinney, 2002; Bonier, 2012).

For birds, converting the landscape from its native features and functions with more urban structures and human-use areas, may limit the availability of resources. For example, native shrubs and trees may be replaced with grassy fields, like parks. Pesticides may be used, which could kill necessary prey, such as insects, in addition to being endocrine disruptors and affecting avian reproductive success (Ottinger et al., 2002). Water availability may become scarce because of the water run-off from impervious surfaces (Arnfield, 2003). Cities are also known to be heat-islands, which could be beneficial in the colder climates, but could alter resource availability. Another cost of urban areas is light pollution. Light at night may be perceived as an extended photoperiod disrupting reproduction and/or behaviors, such as migration and breeding. Finally, it may be more difficult to find a mate due to communication disruption from the anthropogenic noise from

Male Red-winged Blackbird. Photo by Dr. Valerie Buxton.



Red-winged Blackbird nest, nestling, and fledgling. Photos by Dr. Valerie Buxton

traffic and blocked or deflected calls by urban structures. Conversely, there are some benefits to a human-dominated landscape including anthropogenic food sources, like trash, birdfeeders and/or ornamental plantings. Another benefit of the urban ecosystem may be lack of predators and possibly competitors. Unfortunately, the effects of urbanization on most avian species is not known (Evans et al., 2015; Meillere et al., 2015). However, we know that wildlife are able to cope with changes in their environment, such as urbanization, through behavioral and physiological changes.

At Lincoln Park Zoo, we have been studying urban wildlife for 10 years and have an entire science center, the Urban Wildlife Institute, devoted to understanding the interaction between urban development and the natural ecosystem to develop scientific standards for minimizing conflict between these overlapping areas. This supports the zoo's vision, which is to inspire communities to create environments where wildlife will thrive in our urbanizing world. In partnership with the Urban Wildlife Institute, my work at the Davee Center for Epidemiology and Endocrinology at Lincoln Park Zoo studies wildlife responses to urbanization by measuring hormones, which are chemical messengers that serve as the mediators between internal (i.e. physiological) and external (i.e. behavioral) reactions.

The urban ecosystem poses many challenges that would elicit a stress response in wildlife. Typically, when something is perceived as stressful, a cascade of hormonal events occur internally. In the brain, the hypothalamus releases corticotrophin releasing hormone. This causes the anterior pituitary to release adrenocorticotrophic hormone, which travel via the blood stream to the cortex of the adrenal glands; this is the HPA-axis. This is where glucocorticoids (GC; stress hormones like cortisol and corticosterone) are produced. These stress hormones will circulate in the blood to target tissues like the heart and brain to help the individual cope with the stressor, such as fleeing from a predator. This is an adaptive response and depends on past experiences that results in individuals having variable reactions and may eventually habituate to the stressor. Conversely, an individual may not be able to cope and may have repeated or chronic stress response. The long-term stimulation of the HPA axis may lead to suppression of the immune system, reproductive inhibition, lower cognitive ability and poorer body condition (Sapolsky et al., 2000; Romero, 2002).

Monitoring GC production is a valid method to study how wildlife are responding to the changing environment. However, it is pertinent not to stress the individual when collecting samples to study its stress physiology. In small mammals and birds, GCs from handling stress can be measured in blood within two to three minutes (Romero and Reed, 2005). Therefore, non-invasive methods of measuring GCs have developed over the years. One technique that has been used to study stress in mammals and birds is to analyze fecal glucocorticoid metabolites (Palme et al., 2005). GCs are steroid hormones and after they have activated their target tissues, the body rids them by making them hydrophilic so that they can be excreted in feces and urine. Therefore, fecal hormone metabolite concentrations reflect a prior stress response of an individual that could have occurred 6 to 72 hours previously depending on the species (Palme et al., 2005).

Feathers also provide an opportunity to study a bird's stress physiology. Feathers are composed of the protein keratin and are highly vascularized during growth and maintenance. Because of the exposure to the blood, compounds, like hormones, will be deposited in the feathers during growth (Bortolotti et al., 2008). Unlike feces, hormones extracted from feathers provide a longer-term, retrospective measure of stress physiology. But similar to feces, birds do not have to be handled to get the samples since feathers found in the nest can be used.

Recently, I teamed up with Dr. Valerie Buxton, then a PhD student at the University of Illinois Urbana Champaign, and her advisor, Dr. Thomas J. Benson, who is also affiliated with the Illinois Natural History Survey, to determine how urbanization was affecting the red-winged blackbird (*Agelaius phoeniceus*) in Illinois. The advantage of studying birds is locating nests, which could provide valuable information on habitat preference and reproductive success (clutch size, hatching and fledging success). Nests

also provide opportunities to observe behavior and sample birds. During the summers of 2012 and 2013, Dr. Buxton conducted bird surveys on 30 grassland sites along an urban to rural gradient in forest preserve districts of Northeast Illinois, including Cook, DuPage, Kane and McHenry counties, which make up the Chicagoland area. In nine of those sites, she searched for nests and recorded eggs or nestlings every three days until the nestlings fledged or the nest failed. A nest was considered a failure when there were signs of predation. From three urban patches and three rural patches, nestlings, between five to nine days old, were weighed, tarsus length was measured and fecal samples were collected. Sites were classified as urban if they had greater than 59% developed cover compared to <14% in rural sites. Hormonal metabolites were extracted from the feces and analyzed on a corticosterone enzyme immunoassay at Lincoln Park Zoo's Davee Center Endocrinology Laboratory (Buxton, Santymire and Benson, 2019).

In the two years, ~3,800 red-winged blackbirds were counted across the 30 sites in Chicagoland. Population density was negatively influenced by the urban development of the site with the highly developed sites having the lowest population density. Dr. Buxton located 216 nests and found that nest survival depended upon the year, patch size and the amount of development. Interestingly, nest survival was greater in more developed urban sites. Both brood parasitism and fecal corticosterone metabolites were higher in rural sites. However, clutch size, fledging success, weight and tarsus lengths were similar across the urban and rural sites.

These results pose the question of why red-winged blackbirds, a habitat generalist, are not taking advantage of the urban environment. Here, these urban sites seem to provide greater habitat quality with lower nest predation, brood parasitism and nestling fecal corticosterone metabolites. With higher population density in the rural sites, Dr. Buxton postulates that it may be a misconception and that birds are falling into the ecological trap in the rural areas because other birds have chosen that habitat. However, we need more research to determine the signals that are cues to birds when evaluating habitat quality in urban areas.

More research is needed to determine the impact of urbanization on birds. Because most zoos are located in or near cities, we can help to determine how anthropogenic activities are affecting birds. Specifically, we can conduct bird point counts across the year. Zoos can communicate the importance and enjoyment of urban birds. We can talk to zoo visitors about best practices for feeding birds, such as how to keep a birdfeeder clean, which native shrubs would be beneficial, keeping our cats indoors and how to prevent window strikes. We can create and/or evaluate the habitat for birds and determine if and how they are using it. Zoos may even serve as a safe haven for many birds species because we monitor and control the number of threats, like predators, on grounds. We do need to be cautious and prevent the introduction of disease to our collection that may stem from wild birds. And we can do this by not establishing natural habitat near our collection species. For example, at Lincoln Park Zoo, we have created a natural setting, Nature Boardwalk, on zoo grounds that provides native habitat for wildlife and for human recreational activities. Native plantings and structures have allowed wildlife to have a place among our zoo animals and people.

In conclusion, it is important to understand the impact of urbanization on wildlife. We found that the habitat quality was better in the urban sites versus rural; however, the red-winged blackbirds were not selecting the prime habitat (Buxton, Santymire and Benson, 2019). We need to determine the cues that signal habitat quality to, in the future, attract wildlife to urban areas. Zoos can play an important role in monitoring bird populations in urban settings and on zoo grounds. Zoos also can provide habitat and a safe haven for native birds. Here at Lincoln Park Zoo we provide habitat for birds and other wildlife species in a highly urbanized area, but also provide areas for human recreational activities in the hopes that people will observe wildlife and value its presence.

References

Arnfield, A.J. 2003. Two decades of urban climate research: a review of turbulence, exchanges of energy and water, and the urban heat island. *International journal of climatology* 23(1):1-26.

Bonier, F. 2012. Hormones in the city: endocrine ecology of urban birds. *Hormones and Behavior* 61(5):763-772.

Bortolotti, G.R., Marchant, T.A., Blas, J. and German, T. 2008. Corticosterone in feathers is a long-term, integrated measure of avian stress physiology. *Functional Ecology* 22(3): 494-500.

Buxton, V.L., Santymire, R.M. and Benson, T.J. 2018. Mixed effects of urbanization on density, nest survival, and nestling corticosterone of a generalist passerine. *Ecosphere* 9(12):p.e02517.

Chace, J.F. and Walsh, J.J. 2006. Urban effects on native avifauna: a review. *Landscape and urban planning* 74(1):46-69.

Evans, B.S., Ryder, T.B., Reitsma, R., Hurlbert, A.H. and Marra, P.P. 2015. Characterizing avian survival along a rural-to-urban land use gradient. *Ecology* 96(6):1631-1640.

McKinney, M.L. 2008. Effects of urbanization on species richness: a review of plants and animals. *Urban ecosystems* 11(2):161-176.

Meillère, A., Brischoux, F., Parenteau, C. and Angelier, F. 2015. Influence of urbanization on body size, condition, and physiology in an urban exploiter: a multi-component approach. *PloS One* 10(8):p.e0135685.

Ottinger, M.A., Abdelnabi, M., Quinn, M., Golden, N., Wu, J. and Thompson, N. 2002. Reproductive consequences of EDCs in birds: What do laboratory effects mean in field species? *Neurotoxicology and teratology* 24(1):17-28.

Palme, R., Rettenbacher, S., Touma, C., El-Bahr, S.M. and Möstl, E. 2005. Stress hormones in mammals and birds: comparative aspects regarding metabolism, excretion, and noninvasive measurement in fecal samples. *Annals of the New York Academy of Sciences* 1040(1):162-171.

Romero, L.M. 2002. Seasonal changes in plasma glucocorticoid concentrations in free-living vertebrates. *General and comparative endocrinology* 128(1):1-24.

Romero, L.M. and Reed, J.M. 2005. Collecting baseline corticosterone samples in the field: is under 3 min good enough?. *Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology* 140(1): 73-79.

Sapolsky, R.M., Romero, L.M. and Munck, A.U. 2000. How do glucocorticoids influence stress responses? Integrating permissive, suppressive, stimulatory, and preparative actions. *Endocrine reviews* 21(1):55-89.

Songbird Conservation at the Smithsonian's National Zoo:

New exhibit coming in 2021

Bird migration is one of the most spectacular events in the natural world. In the next few years, the National Zoo's historic 1928 Bird House will transform into a first-of-its-kind attraction that immerses visitors in the journeys of western hemisphere birds. The new exhibit will focus on migratory songbirds, waterfowl, and shorebirds of North America and Central America. The exhibit invites Zoo visitors to engage in pioneering research led by scientists at the Smithsonian's Migratory Bird Center and encourages them to participate in efforts to conserve these unique species.

We look forward to being able to highlight the diversity of native birds and the incredible journey that they take.

NATIONAL AAZK APPEAL

Smithsonian
National Zoological Park

Fat Scoring Captive North American Migratory Songbirds

Sarah Steele, Animal Keeper
Smithsonian's National Zoo
Washington, DC

Elizabeth Fisher, Animal Keeper
Smithsonian's National Zoo
Washington, DC

Figure 1. The ESF fat scoring system from Ringers' Manual (Redfern and Clarke, 2001)

Fat Score	Description
0	no visible fat. Dark red
1	F: wide wedge of fat. A: trace of fat. Light red
2	F: completely covered but deeply concave. A: slips of fat. Light yellow
3	F: moderate fat reserves cover ends of inter-clavicles but concave. A: flat or slightly bulging pad. Light yellow
4	F: filled up to far end of clavicles. A: covered by clearly bulging pad of fat. Yellow
5	F: convex bulge, perhaps overlapping breast muscles. A: extreme convex bulge. Yellow
6	F and A: fat covering breast muscles by several mm.
7	F and A: ¾ of breast muscles covered. Yellow
8	F and A: breast muscles not visible. Yellow

(F=Furcular region or tracheal pit; A=Abdomen)

The Smithsonian's National Zoo is preparing for a one of a kind bird exhibit that is currently under construction. Called "Experience Migration", this exhibit will focus on migratory songbirds, shorebirds and waterfowl of the Americas. In preparation for this exhibit, the National Zoo has brought in many new species of migratory songbirds that few, if any, AZA zoos currently have in their collections. This shift has highlighted many things that make migratory songbirds unique. As these birds transitioned from the wild to our collection, we had many questions to answer. How much food should be presented to them? What is a healthy weight? Migratory songbirds go through seasonal weight fluctuations, sometimes doubling their weight in preparation for migration, then losing weight during the journey. In a zoo setting, this fluctuation still occurs without the associated migration following it to reduce the weight. What was normal for seasonal fluctuations in weight and what was unhealthy?

When the first seven species of migratory songbirds joined our collection in the spring of 2016, they began to gain weight over the summer and fall. This weight gain was within our expectations for their natural seasonal behavior in preparation for migration. Our number one goal with these new birds was to keep them thriving in our care as we learned the best husbandry techniques. We worked closely with our nutritionist and veterinarians to monitor diet consumption and body condition. We decided a high weight was better than a low weight as we ironed out the details of their diets and care. We routinely performed body condition scores, which showed our songbirds were in excellent flying form. However, we noticed visible fat deposits on many of our birds. Animal Keeper Sarah Steele had former experience with banding birds and performing fat scores on wild passerines. We began to incorporate this type of scoring system into our husbandry and soon realized that body condition score was not a good indication of overall health for migratory passerines.

We quickly learned there were a lot of different ways to fat score birds. There is no one system of fat scoring that all banders use in the field (Dunn, 2003). We started with the scoring system published in the U.S. Department of Agriculture's "Handbook of field methods for monitoring landbirds" (Ralph et al., 1993). This was an effective system, but left room for individual interpretation. For example, one keeper may score a bird as a six, but another might decide on a five based on how the keeper interprets "greatly" or "slightly" bulging. We needed a system that left less room for variation. Since our birds usually had larger fat stores, it was also important to us to be able to distinguish

Table 1 Shows how weights and fat scores do not always correlate to each other and can change rapidly.

Individual	Date	Weight (g)	Fat score
Scarlet Tanager 1 (Piranga olivacea)	5-Dec-17	50.7	7
	28-Feb-18	50.7	6
Scarlet Tanager 2	24-Dec-18	46	5
	31-Dec-18	46.1	6
Wood Thrush (Hylocichla mustelina)	27-May-18	49.8	3
	26-Sept-18	53.4	2

the range of high fat scores. Eventually, we settled on the ESF scoring system as found in the Ringers' Manual (Redfern and Clarke, 2001) (Figure 1). This had clear descriptions of the fat deposits and had enough variation for the high scores to meet our needs.

Fat scoring has clarified many of the questions we started with when we began taking care of migratory songbirds. The use of fat scores allows us to see when a bird is in a healthy condition or obese. Body condition scoring can show healthy muscle condition, but unless the bird is at the most extreme limits of obesity, it doesn't show the whole picture. We have had birds score a perfect body condition score, but have a fat score too high for their health. Fat scores are also useful, as weight alone cannot tell us everything either, as we have learned that there is no way to judge a fat score based only on weight. We have seen instances when the bird weighed the same amount at two different times and the fat score varied. Even in as little as a week the fat score will change, but the weight stays the same (Table 1).

We learned how dangerous and unhealthy sustained high fat stores could be when we lost an ovenbird (*Seiurus aurocapilla*) that was scored at a 6 out of 7 on the Ralph et al. (1993) scale and weighed 27 grams. A wild ovenbird can be between 16 grams and 28 grams (All About Birds, 2017) meaning that this was within our expected weight range but on the high end. This ovenbird had so much fat stored that it may have compressed or crowded the air sacs leading to decreased respiratory capacity. He died after a prolonged catch which led us to modify both our catching protocols as well as our understanding of what a high fat score could mean. We now limit our catch times based on the size of the exhibit and individual behavior during the catch. We watch for signs of stress such as open mouth breathing and plan on catching birds that are known to be more stress-prone first. We also keep sugar water on hand as a boost for any bird that begins open mouth breathing either during or after the catch. In the case of the ovenbird, the high weight and fat score was taken in April; this is right in the middle of migration season when we would expect high weights. However, this ovenbird had also been at a high weight (as much as 30 grams) since at least the previous October. We now give our songbirds diet reductions when they have maintained high weights longer than a few weeks or whenever they score a 4 or higher on the Ringers' Manual (Redfern and Clarke, 2001) ESF scale. Now that we have more information about each songbird species from the time they've spent in our collection we monitor each bird within its individual weight range. For example, we may expect one ovenbird to be between 17 and 24 grams and another to be between 18 and 25 grams.

High fat scores call for a diet reduction, but low fat scores don't necessarily lead

Abdominal fat store of a common yellowthroat (Geothlypis trichas) scored a 5 on Ringers' Manual scale. Photo by Elizabeth Fisher.

Elizabeth Fisher fat scoring Baltimore oriole (Icterus galbula). Photo by Sarah Steele.

Fercular fat store of a common yellowthroat (Geothlypis trichas) scored a 5 on Ringers' Manual scale. Photo by Elizabeth Fisher.

Sarah Steele fat scoring ovenbird. Photo by Elizabeth Fisher.

Side fat store of a common yellowthroat (Geothlypis trichas). Photo by Elizabeth Fisher.

to a diet increase. A fat score of 0, which indicates no visible fat, does not mean the bird has no fat stores (Ścisłowska and Busse, 2005). We consider a low score of 1 or 2 to be a good score and a 0 can still be acceptable. Whenever we score a bird at a 0 we look at historic weights and fat scores for comparison. If the weight is low and the fat score is low, then we increase the diet. But if the fat score is low and the weight is normal, we closely monitor the bird's behavior and how much food they are eating before deciding whether the diet needs to be increased.

Determining the best care for migratory passerines is an ongoing process. Currently, we are able to get regular voluntary weights and quarterly hands on fat scores in order to monitor body condition and adjust diet if needed. When our new 'Experience Migration' exhibit opens, these birds will be transferred to large indoor aviaries where they will be living with many other birds including Psittacines, Galliforms, and Columbiforms. This means they will have access to many different diets and that catching them for fat scores will be challenging. During the time we have now to prepare for our new exhibit we want to use fat scores to formulate the best diet to maintain healthy body conditions. We are currently experimenting with diet options, nutrient profiles, and insect amounts. This will undoubtedly continue as long as we care for these birds.

We also plan to expand our fat scoring database to include information from the Smithsonian Migratory Bird Center (SMBC), to see how the fat scores of the migratory songbirds in our collection correspond to the fat scores of wild migratory songbirds. Since most banders, including those in SMBC, use a variety of scales, we are unable to compare our scores to theirs at this time. In the future, we hope to find a scale that works for the birds in our collection as well as the SMBC. We have, however, been able to incorporate deceased wild songbirds found on zoo grounds into our data set by teaching our pathologists to score fat deposits using the ESF system from the Ringer's Manual. This will give us an idea of normal fat score ranges for wild birds using consistent techniques.

There is still a lot to learn about the smallest members of our bird collection. We need to continue collecting data while our birds are in holding and we have easier access to weights and fat scores. Then we need to go through the data in a statistical and scientific way, rather than looking at general trends and anecdotal evidence. We need to look at the seasonal variability and work with our nutritionist to see how diet changes have affected their weight and fat scores. If weight gain or loss is hormonal or seasonal, then there are more factors at work than simply the amount of food they have access to (Deviche, 1992; Bairlein, 2002). That may mean that during parts of the year, we need to take other action to prevent our birds from storing an unhealthy amount of fat. Our research continues on these birds and likely will always be part of their husbandry. We will continue modifying our care protocols as we learn more and as our collection grows. It will be of critical importance to ensure the best care possible for these birds to ensure longevity, health, and sustainable captive populations.

References

All About Birds: Ovenbird. c2017. The Cornell Lab of Ornithology. [Accessed 3/1/2019] https://www.allaboutbirds.org/guide/Ovenbird/id

Bairlein, F. 2002. How to get fat: Nutritional mechanisms of seasonal fat accumulation in migratory songbirds. *Naturwissenschaften*. 89(1). https://link.springer.com/article/10.1007%2Fs00114-001-0279-6

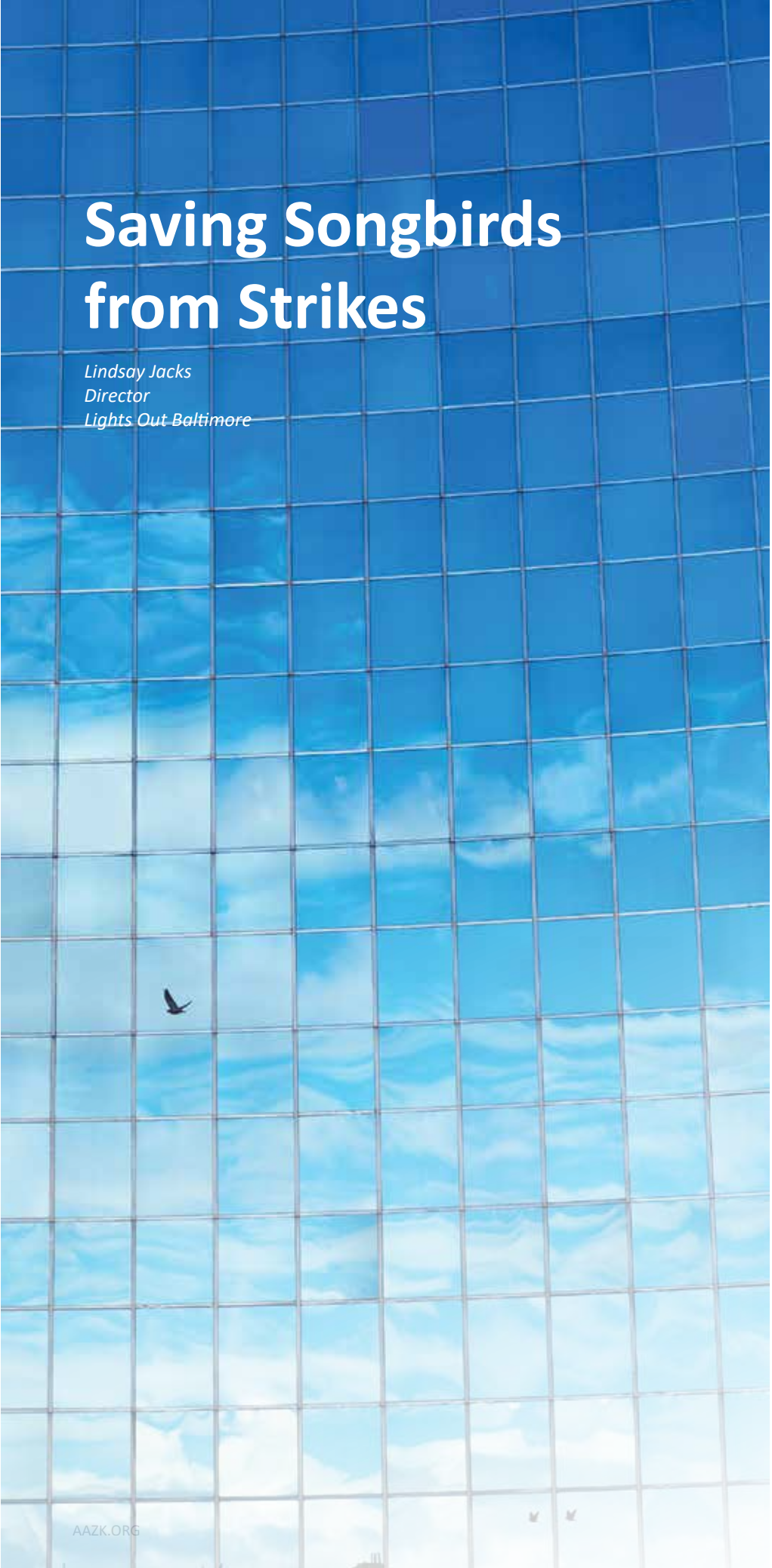
Deviche, P. 1992. Testosterone and opioids interact to regulate feeding in a male migratory songbird. *Hormones and Behavior*. 26(3):394-405. https://www.sciencedirect.com/science/article/pii/0018506X9290009K

Dunn, E. 2003. Recommendations for Fat Scoring. *North American Bird Bander*. April-June 2003. https://sora.unm.edu/sites/default/files/journals/nabb/v028n02/p0058-p0063.pdf.

Ralph, C.J., Geupel, G.R., Pyle, P., Martin, T.E., and DeSante, D.F. 1993. Handbook of field methods for monitoring landbirds. General Technical Report PSW-GTR-144-www. Albany, CA: Pacific Southwest Research Station, Forest Service, U.S. Department of Agriculture. Page 20.

Redfern, C.P.F., and Clarke, J.A. 2001. Ringers' Manual. Thetford: British Trust for Ornithology (BTO).

Ścisłowska M., and Busse P. 2005. Fat reserves and body mass in some passerines migrating in autumn through the southern Baltic coast. *The Ring* 27(3):31. https://www.degruyter.com/downloadpdf/j/ring.2005.27.issue-1/v10050-008-0014-1/v10050-008-0014-1.pdf



Saving Songbirds from Strikes

Lindsay Jacks
Director
Lights Out Baltimore

One billion. This is the number of birds that die by building collisions annually in the U.S. alone. Imagine the number globally? With the many threats that face migratory birds from pesticides to climate change to habitat loss and more, it can seem overwhelming, but as keepers conserving and educating about these threats is just part of the job. Reducing the number of bird deaths by collisions and educating the public at the same time can be achieved by instituting bird-friendly buildings and exhibit glass on zoo and aquarium grounds.

To adopt bird-friendly buildings, most birds need a visual barrier every 2 inches horizontal and 4 inches vertical. Hummingbirds due to their size need a visual barrier every 2 x 2 inches. Temporary solutions on glass can be designs or patterns created by using chalk markers or Tempera paint. Using soapy water on exhibit glass during migration months is a method used by Lincoln Park Zoo. Another simple method is placing tarps over exhibit glass at night until opening the following morning to prevent any nighttime or early morning collisions which are common during migration.

The next step in preventing bird strikes year around is applying permanent solutions. There are several products to achieve a long-lasting effort. ABC BirdTape was used creatively by three artists on exhibit glass at Virginia Zoo. Acopian Birdsavers, a hanging paracord also known as “Zen curtains” are installed on the exterior of a window with a horizontal beam at the top and cords vertically every four inches. The cords can be left hanging or secured on the bottom with another horizontal beam. You can order from the Birdsavers website or make your own. These cheap and easy to install Birdsavers are best to use on zoo office windows or less guest-trafficked areas.

Bird-friendly films used to cover large buildings or exhibit glass can be purchased in full sheets, cut out to create designs, custom printed, or in simple shapes like dots or squares. CollidEscape, Feather Friendly® produced by 3M, and Solyx® Bird-Safety Films are commonly used films. CollidEscape can be presented in a full sheet or a small dot pattern. Full sheets of CollidEscape is a one-way film

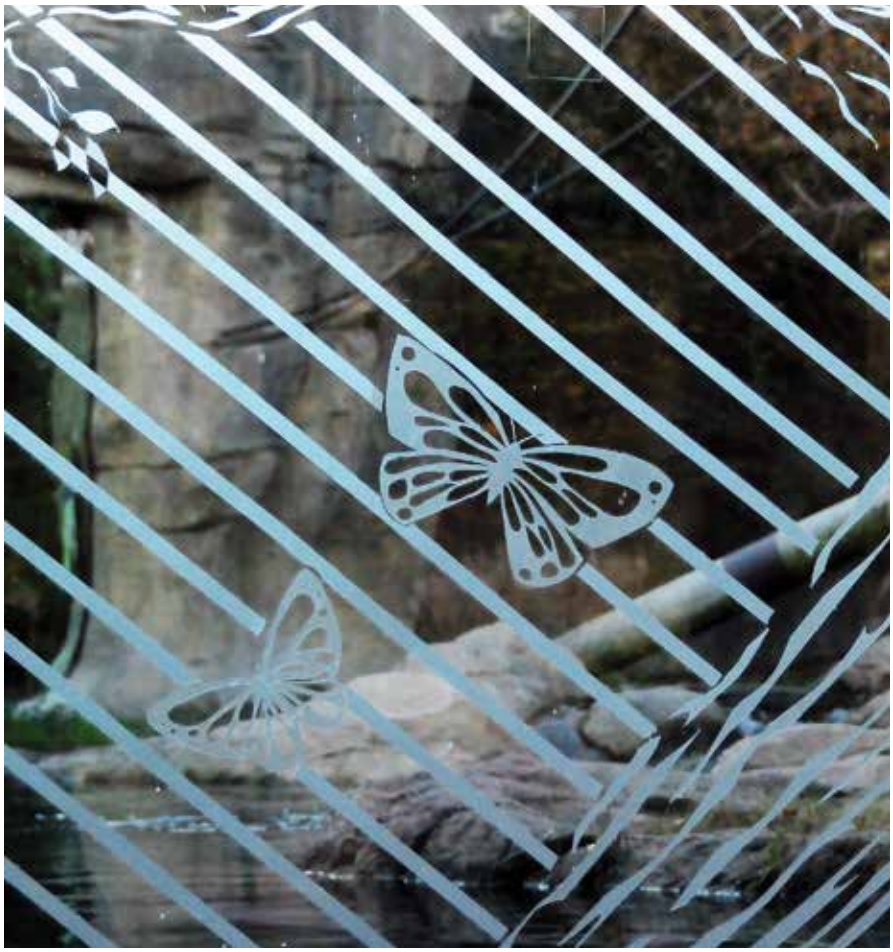
Use of Solyx film. Image by Akron Zoo

preserving the view while preventing bird collisions on the exterior. This film is perfect to custom print your logo, an aquatic scene for an aquarium, or a nature scene for a zoo. Feather Friendly markers printed by 3M is a two-way commercial film that can also be custom printed. The National Aquarium installed this product in a custom design dot and geometrical pattern. In addition to custom designed film, decals can be created from the film into desired shapes. This method was beautifully executed by Akron Zoo.

While the majority of the films have a 10-year warranty, the most cost-effective over time and permanent solution to prevent bird collisions is implementing bird-safe glass into the construction of new buildings on zoo/aquarium grounds. Bird-safe glass is designed with ultraviolet striping inside three-panel glass or manufactured with an acid etching to create the visual barriers that birds need. Walker Glass Aviprotek®, Viracon Fritted Glass, and GlasPro Bird Safe Glass are products designed to prevent bird collisions and approved by American Bird Conservancy.

Peacock design using ABC BirdTape. Image by Virginia Zoo

Whether your institution designs a new building with bird-safe glass or simply adds soapy water to exhibit glass during migration, the vital component is educating the public with signage. Explaining what collisions are and how this installation is saving birds can inspire guests to do the same at their own home. You can go a step further by adding samples of homeowner products and informational sheets about collisions. The education department can create an activity for guests, summer camps, or host it at World Migratory Bird Day to install decals to a window at your institution.



The sky's the limit with installing temporary or permanent bird-friendly products, creating signage, and educating guests about the threat of bird collisions. If every zoo and aquarium adopted bird-safe buildings/exhibits and inspired guests with their practices, the number of 1 billion would begin to shrink.

References

Klem, D., and Saenger, P.G. 2013. Evaluating the effectiveness of select visual signals to prevent bird-window collisions. *The Wilson Journal of Ornithology* 125(2):406-411.

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(1):8-23.

American Bird Conservancy: www.birdsmartglass.org

The Happiest Place on Earth for Purple Martins *(Progne subis)*

John Thomton, Animal Keeper
Disney's Animals, Science and Environment
Disney's Animal Kingdom®
Lake Buena Vista, Florida

Photo 1. Two adult male Purple Martins (left and center) and an adult female Purple Martin (right).

It's 9:30 AM and the sun is already hot on a humid, Florida morning. The local birds make their territories known in song. Among others I hear White-winged Dove (*Zenaida asiatia*), Carolina Wren (*Thryothorus ludovicianus*) and Yellow-throated Warbler (*Setophaga dominica*). A Limpkin (*Aramus guarana*) walks along on the other side of a waterway from where I'm standing. Equipped with binoculars and a spotting scope, my mission on this early May morning is to check on the Purple Martin nesting colony about 20m in front of me. Several birds are sitting in front of their nest entrances, while a handful more are perched above the nests. Their chirps and chattering are nearly constant. The beautiful, iridescent, purple-blue plumage of an adult male shimmers in the sunlight as he furiously preens on his perch. A brown female appears from behind me and wheels around the colony on the wing; she is carrying a large dragonfly she has just caught in mid-air. Immediately upon landing, she disappears into her nest. Another male flies in and lands at a neighboring nest, in a perfect spot where I can read the numbers on his leg band through my scope: D 151. I quickly jot the numbers down on my data sheet. Two years ago, this bird was outfitted with a tracking device, along with his leg band. He traveled to the Amazon region of northern Brazil and back with that tracking device before he was re-captured last year and the device was removed. It's great to see a bird returning again that has contributed so much to what we know about Purple Martin migrations. Near the end of my 30-minute observation period, a Purple Martin begins a loud alarm call, and most of the colony takes to the air. I look up and discover the reason for the distress: a dark morph Short-tailed Hawk (*Buteo brachyurus*) is hovering high overhead. Several of the adults gain altitude and begin diving at the predator, which eventually soars off to the west. All of this bird drama isn't playing out in the middle of a huge swath of protected habitat. Instead, it's happening along a golf course at Disney's Sarasota Springs Resort and Spa at the Walt Disney World Resort (WDW) in Central Florida.

Photo 2. Two-day-old Purple Martin chicks. By the time they are 26-days-old, they are the size of adults and ready to fly.

Photo 3. Disney employees at Disney's Saratoga Springs Resort and Spa at the 2018 Purple Martin Palooza.

For a birder like me who has spent most of his professional career as an animal keeper, getting to do this kind of work has been a dream come true. For a little over a year, I have been on temporary assignment with the Purple Martin Program, which is coordinated by Disney's Animals, Science and Environment (ASE) team. In 2005, the animal keepers at Disney's Animal Kingdom® (our zoo) decided to take action to help this declining species by installing a couple of houses behind-the-scenes. What began as a few concerned animal care professionals occasionally checking nests has grown and bloomed into a full-blown scientific study and conservation program that involves WDW employees from many locations and lines of business. Everyone from animal husbandry staff to merchandise and guest activities personnel help with the monitoring, and many guests have the opportunity to learn about Purple Martins through the program each year. Moreover, through partnerships and collaboration with groups like the Purple Martin Conservation Association and the National Institute of Amazonian Research in Brazil, we have continued to grow and support research and conservation efforts for the species throughout the Americas.

Because of the unique history of people and Purple Martins, zoos have the opportunity to play a key role in Purple Martin conservation. In Eastern North America, Purple Martins largely depend on humans for nesting sites. Nobody knows exactly how or why this began, but there is evidence that Native Americans put out gourds for these birds to use as nesting sites in their villages long before Europeans arrived. The practice caught on among humans and birds, and today, Purple Martins east of the Rockies prefer to nest in bird houses and are highly tolerant of human activity.

At WDW, these cavity-nesting, large swallows carry out their daily routines amongst the millions of Disney guests that share their "home" for the nesting season. The population here has grown significantly since the group of animal keepers put up the first couple houses. There are now 19 houses split between six colonies that are spread across two theme parks (Disney's Animal Kingdom® and Epcot®), two resorts (Disney's Caribbean Beach Resort and Disney's Saratoga Springs Resort and Spa), and Disney's Magnolia Golf Course. In 2018, WDW's Purple Martin houses hosted 188 nests which collectively contained 849 eggs.

Keeping track of all of those nests is a monumental task. Mounted on poles and holding between 18-24 nesting compartments, all of WDW's Purple Martin houses are lowered twice weekly to check on each individual compartment. The adult birds nesting at each house are observed twice each week through spotting scopes to identify returning birds and record data on their movement and behavior. Our team does not have enough labor to cover all of that monitoring on a consistent basis, but rather than being a limitation of the program, this has been an opportunity to engage employees across WDW in helping to care for our Purple Martins. Each house has a team of people who are trained by the ASE team to monitor Purple Martin nests. Many of these people do not work with animals directly in their everyday jobs, but they have committed to using a portion of their work day to actively participate in the conservation of this beautiful and charismatic bird.

Photo 4. Two young guests at Epcot® stop to see a Purple Martin nest check at the International Flower and Garden Festival.

The Purple Martin Program has proven to not just captivate and engage our monitors, but other audiences as well. WDW staff not associated with the program often stop and ask what monitors are doing. During the nesting season at Epcot®, advertised nest checks are an annual fixture of the International Flower and Garden Festival and resorts with Purple Martin houses also have nest checks that are promoted to guests. An ASE team member is always on-hand to interpret what is happening at the check to curious visitors, and guests have a very good chance of seeing eggs or chicks in one of the nest compartments. Many people have never seen a wild bird so closely. Seeing the guests' faces light up when they get to peek into a nest for the first time is truly one of the highlights of my job!
All of the nesting data we gather is shared with the Purple Martin Conservation Association as a part of their citizen science initiative to improve conservation of Purple Martins across North America. It also helps us keep track of the ages of the chicks so we can band both them and their parents at the best time in their nesting cycle. Chicks are ideally banded between 13-20 days old when their legs are fully-grown and they don't yet have the ability to fly. Banding adults is a little more involved, but we're fortunate that most of them like to sleep in their nesting compartments. When the time comes to band them, we cover the entrance to each nesting compartment in the middle of the night when they are sleeping so each adult Purple Martin can be removed and banded the following morning. This sets the stage for the Purple Martin Program's signature annual outreach and research event that we lovingly refer to as "Purple Martin Palooza."

During the three weeks of Palooza in late April and early May, the ASE team creates a mobile banding station and travels to each Purple Martin house across WDW. We set up tents and tables, put up banners and signs, and encourage employees and guests to stop by and see science in action. Team members that are banding birds answer questions as they work, while interpreters chat with visitors about Purple Martin natural history and our program. Many WDW employees look forward to these annual banding events and come year after year. Guests at the resorts often delight at the opportunity to see these beautiful, wild birds so close and are also fascinated by the conservation science happening right outside their rooms. Each bird is weighed, their fat and muscle content is estimated, and wing, tail and tarsus measurements are taken. All birds are given a unique ID band on their right leg, or previously-banded birds are noted in our extensive database. As part of our collaboration with the Purple Martin Conservation Association and with Dr. Kevin Fraser from the University of Manitoba, some birds are selected to receive GPS tracking devices, which are worn like tiny fanny packs. Each year, one of the highlights of Palooza is recapturing birds with tracking devices to learn about movements locally around WDW as well as on migration and at their non-breeding grounds in the Amazon region of northern Brazil. Through these tracking efforts, we have learned that it takes a Purple Martin about three weeks to make the 3000-mile journey to Brazil in the summer after nesting, and about the same amount of time to return to Central Florida in late winter.

If you're ever visiting WDW during their nesting season, we hope you'll stop by to see our amazing Purple Martins hanging out near their nests or join us for a nest check. But you don't have to come all the way to Central Florida to see them. The good news is that despite their decline, Purple Martins are still widespread and found in many areas of North America. Putting up houses for them, especially in the eastern half of the US, is a great way to help this species and to get the word out about the importance of conserving migratory birds.

Whether Purple Martins breed in your area or not, what would it look like for your zoological institution to have bird houses that benefitted wild birds where your guests can see them? Moreover, what kinds of citizen science initiatives could your zoo participate in on your own property or in the city where you are located? Impactful contributions towards the conservation of declining wildlife do not require a trip around the world. They can happen within the grounds of your own zoological institution. The possibilities are endless!

Building a Chimney Swift Tower

By Kevin Kollar
Columbus Zoo and Aquarium

The Columbus Zoo and Aquarium is located directly on the O'Shaughnessy reservoir, which is part of the Scioto river, which provides drinking water to the central Ohio area, beautiful views to zoo visitors, and a resting place for many bird species on their north-south migration routes. The zoo has always made the river a part of the visitor experience through boat rides and event spaces, but now some changes are happening that are not visible to the guests.

In April 2017, the keepers in the Shores department noticed that there were large amounts of trash located along the shoreline of the reservoir. They decided to host a small cleanup of the shoreline to celebrate World Oceans Day, which in turn inspired me to think of ways to make the shoreline more inviting for native wildlife. Although the idea sounds simple, it is always more complicated than it sounds. I decided to start with birds. Although I have worked with birds around the zoo, my knowledge of native birds was lacking and I had no idea what types of birds would be interested in nesting along the river. Because of this, I enlisted the help of various people around the zoo to provide the necessary insight into what would need to be done.

One of the curators put me in touch with Darlene. Darlene is an avid birder in the community and is very knowledgeable on bird nesting habits. Many meetings and site visits later, the group with the guidance of Darlene had decided on putting up a chimney swift tower. Then the planning began. Darlene was able to locate a local eagle scout that was willing to do the work for the tower, and I went through the process of securing funding through the Columbus Zoo's Staff Advisory Committee's special project budget. The project was brought to the attention of the senior staff of the zoo to get the necessary permission to erect the tower, making sure that the location would also not destabilize the bank of the reservoir.

After all the approvals were attained, the process went very quickly. The eagle scout assembled the pieces of the tower at his home before coming to the zoo, and because of this, he only needed to come to the zoo three days (albeit some of the days were quite long) to complete the project. The first time consisted of clearing the area and prepping the area for the concrete base, the second time for the laying of the concrete and putting the lower portion of the tower into the concrete, and the last time for completing the rest of the tower. Each time he brought with him a group of people that was quite diverse in ages from younger boy scouts to parents and advisors of the scouts. Each time a new person came to work on the project the people got a little lesson in how what they were doing was going to help native wildlife.

When the tower was completed in September 2018, it stood as a symbol of teamwork from all the people that were involved in the process, but it also stood as a symbol of hope. Staff often walked by the tower and asked what it was, and when it was explained curiosity grew. It was a statement to everyone that the zoo didn't just care about gorillas in Africa, manatees in Florida, or tigers in Asia, but they cared about animals located right here in our own backyard that are facing their own plights. Since the tower has been put up, the changing of the reservoir has continued with the addition of a monarch waystation and the plans to possibly add a small native prairie. What will be next on the list to add? It could be bat boxes, waterfowl boxes, or even an osprey platform, I'm not sure, but I do know this is just the beginning.

"Naturally chimney swifts nested in hollowed out trees, which are at risk due to logging. Chimney swifts have also adapted to a more urban environment by nesting in chimneys, hence the name chimney swifts. Unfortunately, the species is considered by many a nuisance and typically after one nesting season people who have swifts nesting in their chimneys typically cap their chimneys so that the birds are not capable of nesting in the chimney again. "

Lights Out for Birds: Community Solutions to Avian Conservation

Matthew B. Shumar
Program Coordinator, Ohio Bird Conservation Initiative

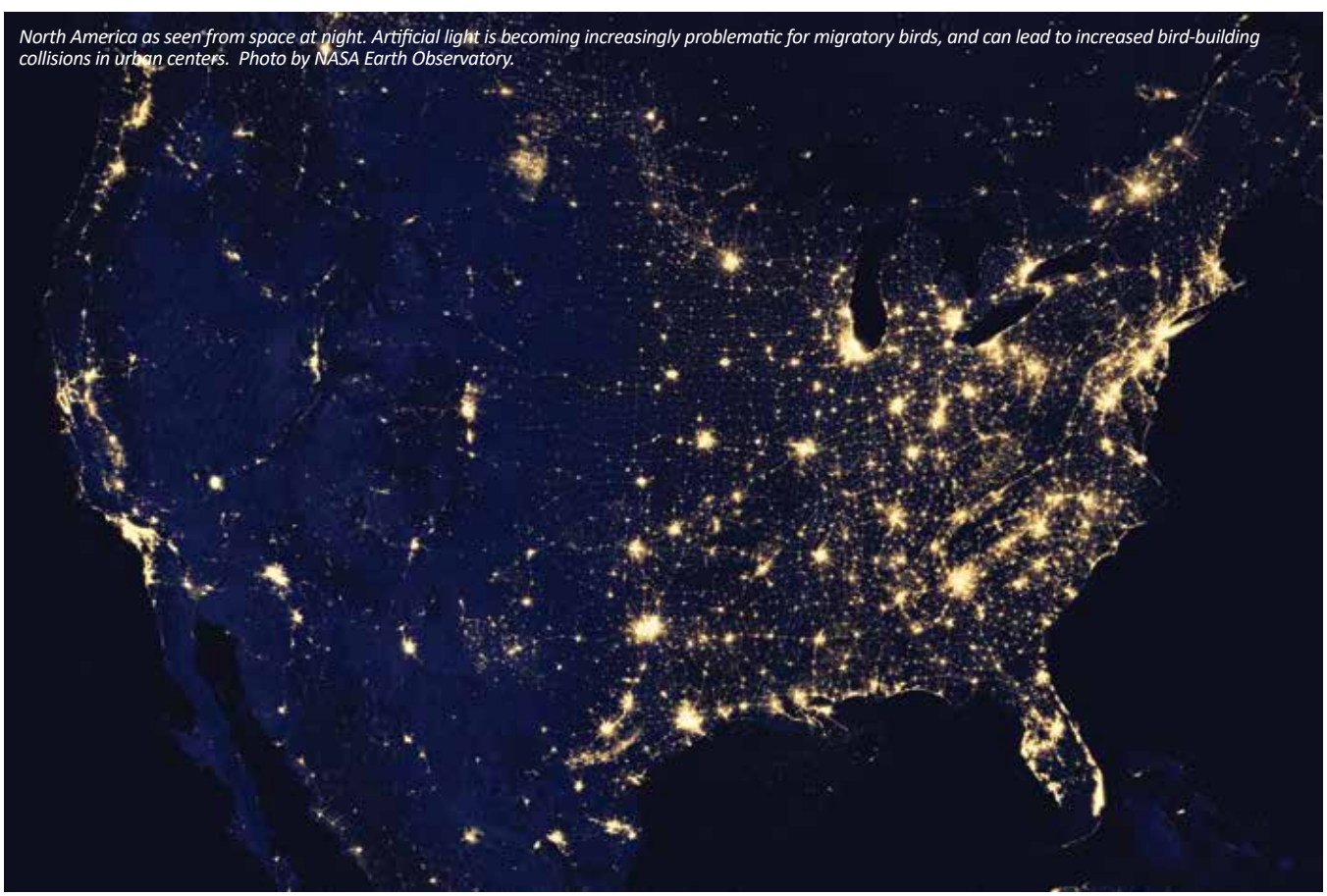
Shane J. Good
Director of Collections Management, Akron Zoo

Tim Jasinski
Wildlife Rehabilitation Specialist, Lake Erie Nature & Science Center

While the phenomenon of migration is exciting for birders and nature enthusiasts donning binoculars and fancy cameras, it is one of the most perilous periods in a bird's annual life cycle. Long-term research on Black-throated Blue Warblers (*Dendroica caerulescens*), for example, has shown that mortality during migration is at least 15-times higher than during the breeding or overwintering periods (Sillett and Holmes, 2002). More than 85% of apparent annual mortality of these Black-throated Blue Warblers occurred during migration.

This movement from overwintering locations in Central and South America to and from breeding grounds in temperate North America proves challenging enough in a natural system: the combination of unpredictable weather and increased exposure to predation for thousands of miles is nothing to bat an eye at. Add on top of that loss of stopover habitat over an increasingly developed landscape as well as countless obstacles in urban areas, and you have a rather daunting journey—one that is made twice each year!

Most songbirds migrate at night, guided in part by celestial cues. Like the Sirens of Homer's Odyssey, artificial light sources in urban centers prove



North America as seen from space at night. Artificial light is becoming increasingly problematic for migratory birds, and can lead to increased bird-building collisions in urban centers. Photo by NASA Earth Observatory.

Photo 2. Red-eyed vireos, dead from collision. Photo by Tim Jasinski.

to be a perilous attraction for many passage migrants. Birds can collide with illuminated structures at night, but more substantial effects of brightly lit metropolitan areas occur through changes in stopover behavior. The skyglow of large urban centers can be perceived by migrating birds up to 300 km away (Olsen et al., 2014), and recent research has shown that migrant stopover density increases at regional scales with proximity to the brightest areas and is subsequently lower in high-quality forested habitats even a few kilometers away from urban centers (McLaren et al., 2018). It is in these urban landscapes that collision risk is magnified: highly reflective glass is often perceived by birds as an extension of the surrounding vegetation and sky.

Building collisions are second only to predation by free-ranging domestic cats as the largest source of human-caused mortality in birds, and it is estimated that between 365 million and nearly one billion birds are killed by collisions each year in the United States (Loss et al., 2014). "Lights Out" and "Safe Passage" programs across the globe have been developed in an attempt to address this problem. The Fatal Light Awareness Program (FLAP) of Toronto was the first organization in the world to address the issue of bird collisions with buildings. Since 1993 volunteers have been working with Toronto business owners to treat reflective glass and reduce nighttime lighting, and they have picked up tens of thousands of dead and injured birds during their monitoring. Unfortunately most birds are found dead, but those that are found alive have a high chance of successful rehabilitation and release.

Encouraged by the success of FLAP, Chicago launched their own program (Lights Out Chicago) in 1995, and similar efforts have been replicated throughout the United States. In 2012, the Ohio Bird Conservation Initiative (OBCI) and the Grange Insurance Audubon Center, with financial and organizational support from a number of local conservation and business groups started a Lights Out Columbus campaign. Seven buildings in downtown Columbus enrolled in the program during the first year, and enrollment has steadily increased over the past five years.

Starting in mid-March of each year, building owners, managers, and residents are encouraged to reduce exterior nighttime lighting during peak bird migration periods. From March 15 through June 1, and August 15 through October 31, building managers are encouraged to reduce their lighting as much as possible by doing the following: eliminate architectural lighting and spotlights; eliminate upper floor interior lights when not in use; use blinds and/or task lighting when interior lighting is required overnight; eliminate or dim atrium lighting; use shielded (downward facing) lighting for walkways.

While the primary objective of this effort was to reduce the number of bird collisions as much as possible, there are also many benefits for business owners and residents, including positive gains in public relations, reductions in CO_2 emissions, and potentially substantial cost savings. For example, Lights Out Wilmington estimated savings of $5,148 per year for a 20-story building participating in the Lights Out program (http://lightsoutwilm.com). In an attempt to understand enrollment motivations and increase participation, we surveyed business owners in Columbus after the first year of the program. The vast majority of respondents cited that the primary driver for their enrollment was to show consumers that they were an environmentally friendly or "green" company. To help them reach that goal, we created signs that businesses could display in their entrances and lobbies showing participation. We also included the company's logos on our website and in advertising for the program. We have seen a positive response to these actions, and we now have over half of the tallest buildings in downtown Columbus enrolled in Lights Out.

Given the success we observed in Columbus, we hoped to expand the effort to as much of Ohio as possible. However, before proceeding we wanted to be able to explicitly demonstrate that all this work was indeed having a positive effect on the rates of bird collisions. Prior to this, few studies had examined the potential for Lights Out programs to reduce bird-building collisions. Lights Out Chicago reported an 80% reduction in building collisions following reduced nighttime lighting, but we wanted to assess specific structural aspects of buildings as well as light output with respect to bird collisions. To that end, we set up a small study in Columbus to explore factors associated with bird-building collisions. For two years, a small team of volunteers surveyed the Uptown and Arena Districts of Columbus. The survey area included buildings across a range of heights and nighttime lighting brightness. Volunteers searched the perimeter of buildings early in the morning, documenting all dead and injured birds along with the specific location and time of discovery. Dead birds were taken to the Ohio

Photo 3. Birds collected by Lights Out Cleveland volunteers. Photo by Tim Jasinski.

Photo 4. Grasshopper sparrow ready for release. Photo by Tim Jasinski.

State University Museum of Biological Diversity, and injured birds were taken to the Ohio Wildlife Center for rehabilitation.

Concurrent with our collision monitoring, we took a standardized set of photographs of each building at night. Using specialized software (*AnalyzingDigitalImages*; Museum of Science 2008) we were able to quantify the percent illumination for each building. Over the course of this study, approximately 250 birds of 49 species were collected. Unsurprisingly, we found that the number of birds found at a building was positively correlated with the number of floors and the amount of light coming off that building. The good news that comes with those results is that we will effectively reduce the number of bird collisions in Columbus if we reduce the amount of light coming from each building. With that in hand, we began growing the effort into a statewide network—Ohio Lights Out.

In 2015 we launched Lights Out Miami Valley (Dayton area) with the help of Brukner Nature Center, Aullwood Audubon Center and Farm, Five Rivers Metroparks, Daytona BOMA, and Partners for the Environment. Over the last four years, Lights Out Miami Valley enrolled nearly 30 buildings across a six county area. In 2017, we continued expanding coverage with the launch of Lights Out Cleveland—a collaborative effort of OBCI, the Cleveland Museum of Natural History, Cleveland Metroparks, Lake Erie Nature & Science Center (LENSC), and the Akron Zoo. The expansion to Cleveland was a crucially important development of the project, as research has shown that migrating landbirds tend to concentrate in coastal areas, especially when there are direct barriers along migratory routes. Indeed, if you talk to any Cleveland-based birdwatcher, you're bound to hear about the myriad of excellent birding opportunities around the city.

Volunteers from the first season of Lights Out Akron sponsored by Akron Zoological Park.

Our monitoring program for downtown Cleveland was able to successfully recruit a fervent volunteer base of more than 80 individuals. This team, active daily during migration, has recovered a staggering 5,000 birds in just two years. Although we suspected higher rates of bird-building collisions in Cleveland given the city's proximity to Lake Erie, we were still surprised by the magnitude of collision numbers.

While we work within the community to mitigate collision risk, the large number of collected specimens allows us to explore factors associated with collisions. Last year the Cleveland Museum of Natural History secured funding to hire two college interns to assess factors associated with collision rates. Additionally, we have been collaborating with researchers from the Carnegie Museum of Natural History to explore survival and behavior of birds following collisions. A sample of injured birds recovered from collision

monitoring efforts that had undergone successful rehabilitation were fitted with VHF transmitters operating on the same frequency (i.e., nanotags). These nanotags are detectable by automated receiving stations in the Motus Wildlife Tracking System. Data collected from these tagged birds will provide insight not only into the long-term effects of window collisions on individuals, but also population level consequences that as of yet have been unquantified through traditional citizen science-based collision monitoring programs.

Since launching the Lights Out Cleveland program, additional cities within Ohio have joined the network. We now have focused Lights Out programs running in Akron, Canton, Cincinnati, Cleveland, Columbus, Dayton, and Toledo, which targets the bulk of the state's metropolitan areas. We also encourage building owners and even private homeowners in other reaches of Ohio to participate. Every building makes a difference. For more information on Ohio Lights Out and the regional programs, please visit https://ohiolightsout.org/

References

Loss, S.R., T. Will, S.S. Loss, and P.P. Mara. 2014. Bird–building collisions in the United States: Estimates of annual mortality and species vulnerability. *The Condor: Ornithological Applications* 116:8–23.

McLaren, J.D., J.J. Buler, T. Schreckengost, J.A. Smolinsky, M. Boone, E.E. van Loon, D.K. Dawson, and E.L. Walters. 2018. Artificial light at night confounds broad-scale habitat use by migrating birds. *Ecology Letters* 21: 356-364.

Museum of Science. 2007–2008. AnalyzingDigitalImages. Version 11. Museum of Science, Boston, Massachusetts, USA.

Olsen, R.N., T. Gallaway, and D. Mitchell. 2014. Modelling US light pollution. *Journal of Environmental Planning and Management* 57:883-903.

Sillett, T.S. and R.T. Holmes. 2002. Variation in survivorship of a migratory songbird throughout its annual cycle. *Journal of Animal Ecology* 71:296–308.

(Pictured above)
The Akron Zoo has a large North American Songbird Aviary and provides a home to many non-releasable birds that are rehabilitated as part of local Lights Out programs.

The Plight of the Loggerhead Shrike: A One-Plan Approach to Saving an Iconic Grassland Bird in North America

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The Loggerhead Shrike (*Lanius ludovicianus*) is one of only two species of shrike that occur in the New World, and the only shrike endemic to North America. The species utilizes a variety of shrub- and grassland habitats that vary from shrub-steppe in the western United States to unimproved pastureland associated with limestone plains in the eastern Canadian province of Ontario, to longleaf pine savanna in the southeast Coastal Plain (Pruitt, 2000). Shrikes breeding in northern portions of their range undertake short-distance migration to more southerly states and Mexico, wintering generally south of 47 degrees latitude (Yosef, 1996; Chabot et al., 2017). The wintering range is almost entirely encompassed within that of non-migrant conspecifics (Yosef, 1996; Chabot et al., 2017).

Many reasons have been cited as potentially contributing to the decline of the Loggerhead Shrike, including loss of habitat on the breeding and wintering grounds, pesticides, mortality associated with roads, adverse weather conditions and inter-specific competition (Yosef, 1996; Pruitt, 2000). It is likely that more than one factor is involved, potentially acting at different times throughout the annual life cycle. For example, adverse climatic trends on the breeding grounds may reduce nesting success, while road mortality may decrease the survival rate during migration, and climatic trends influenced by the North American Oscillation Index may lead to low over-wintering survival.

The breeding range of the Loggerhead Shrike prior to European colonization is unclear. The species likely expanded within northeast North America with the clearing of land for agriculture (Cadman, 1985). The shrike was considered to be common throughout the continent by the mid-1900s (Pruitt, 2000). However, by 1960 a declining trend had been observed in shrike populations throughout North America, but with the greatest contraction among migratory populations (Sauer et al., 2018). The species is now rare in much of its former range (Sauer et al., 2018), even where apparently suitable habitat still exists (Pruitt, 2000). The United States Fish and Wildlife Service considers the Loggerhead Shrike to be a bird of Conservation Concern and it is listed as a focal species in the State Wildlife Action Plans for 34 states (Natureserve, 2017). In northeastern North America, Loggerhead Shrike populations have declined precipitously to the point where the species is confined to a few small isolated populations. Until recently, conservation efforts were focused mainly in this portion of the species range, and in particular eastern Canada. Movement toward a full annual lifecycle focus and thus international collaboration is now seen as a priority.

Summary of past work

Taxonomic Reassessment

Miller (1931) conducted the first comprehensive systematic treatment of *L. ludovicianus* and, based on evaluation of external characteristics from 1,878 museum specimens, recognized 11 subspecies with broad regions of intergradation that he attributed to gradual environmental gradients, lack of sharp geographic barriers, and migration. Conservation efforts in the northeastern portion of the species' range recently gained further importance after the finding that the Loggerhead Shrikes found in Ontario represent a distinct subspecies, provisionally, *L.l. alvarensis*, separate from the *migrans* subspecies, as they had previously been considered (Chabot, 2011). The presence of a distinct genetic subspecies in the northeast implies that the species may have occurred in this region prior

Captive female on a nest from the Toronto Zoo. Photo by Kevin Kerr.

to the early 1900s, likely inhabiting areas characterized by alvars and native tallgrass prairies (Vickery and Dunwiddie, 1997). The association of Loggerhead Shrikes with alvars and, more broadly, with the limestone plains of eastern Ontario is broadly recognized (Cadman et al., 1987; Cadman et al., 2007; COSEWIC, 2014). The unique alvar ecosystem (Reschke et al., 1999; Brownell and Riley, 2000) would have historically provided suitable habitat for shrike even prior to European colonization and clearing of land, exerting unique evolutionary pressures culminating in genetic distinction for this population. Though the historic range of this subspecies likely extended throughout much of eastern Canada, at this point the only substantial breeding populations of migratory *L.l. alvarensis* exist in Ontario. A multi-faced recovery program, coordinated by Wildlife Preservation Canada, is underway to prevent these populations from disappearing. This recovery program has several major initiatives, each having achieved substantial accomplishments, as detailed below.

Wild Population Monitoring and Banding

Over the last 20+ years, Ontario recovery partners have accumulated in-depth knowledge of population dynamics and demographics of *L.l. alvarensis*, which is essential for the formulation of an effective conservation plan. This information is shared annually with provincial and federal government agencies, and serves to guide decisions around habitat protection.

There has been a particular focus on banding and resighting individuals with unique color band combinations. Almost 350 wild Loggerhead Shrike have been banded since 2003, with 228 resighting records from subsequent years thanks to well-developed survey and monitoring protocols. Ontario's banding protocol has been adopted as the standard for the species by the North American Banding Council, available online (http://www.nabanding.net/other-publications/).

Threats to Ontario's breeding population are being assessed through applied research. The impact of contaminants has been studied through analysis conducted on eggs collected from failed nests from 2000-2013. Results found only low levels of contaminants (specifically, PCBs and other organochlorids, PBDEs, and mercury) that were not considered to have deleterious effects on reproduction (Hughes et al., 2015). The impact of nest predation is assessed on an annual basis, with data gathered on both mammalian and avian predators using remote nest cameras. While much suitable habitat appears to remain in the province, many historic breeding sites continue to remain unoccupied. A hierarchical habitat analysis has been conducted to assess habitat requirements at multiple scales, including nest tree, territory, habitat patch, and landscape, providing science-based guidelines for identifying, maintaining and/or restoring suitable habitat.

International Collaboration – towards a full lifecycle approach

In 2013 a group of state, provincial and federal representatives from both Canada and the United States came together and formed the North American Loggerhead Shrike Working Group (www.loggerheadshrike.org). The collaboration of scientists and managers involved in, or beginning to work toward, conservation of the Loggerhead Shrike in North America is focused on standardizing methods used across the continent and implementing coordinated broad-scale research efforts

Wild colour banded bird seen in Virginia. Photo by Linda Chittum.

for the species. To date, work has focused on developing standardized survey and monitoring protocols, completing broad-scale Species Distribution Modeling, and expanding the color-banding program to amass range-wide demographic data and information on dispersal and site fidelity.

The color-banding program has allowed new data to be obtained on the species' population dynamics. We now have evidence of long-distance (~900 km) mid-season movements, when a breeding bird banded in spring 2016 in West Virginia was observed in August of that year in Napanee, Ontario. The increase in Loggerhead Shrike banding activity in the U.S. has also increased the frequency of band resightings, with reports of birds in both spring and fall migration.

Collaboration with academic partners has focused on priority research questions, including Loggerhead Shrike detection probability with different survey methods, wild population health assessment, and continued refinement of subspecies ranges. Finally, the Working Group is piloting a citizen science initiative, the "Shrike Force", to engage private citizens in Loggerhead Shrike recovery across the continent.

The Working Group continues to expand, with each year bringing additional partners in new regions, as shown by growing attendance at each subsequent annual meeting.

Conservation Breeding

The conservation breeding program for Loggerhead Shrike is the only program of its kind for a migratory songbird. It has been recognized internationally as a model for breeding and reintroduction programs for songbirds (Kleiman and Lynch, 2008; Soorae, 2013), and has made a significant contribution to the scientific literature on the use of conservation-breeding in species recovery (e.g. Nichols et al., 2010; Lagios et al., 2015; Parmley et al., 2015; Imlay et al., 2017). Since 2001, 1,249 juveniles have been released, with an average return rate of 8.4% since 2012, when breeding was moved largely to partner facilities, rather than *in situ* field breeding (as described in Nichols et al., 2010). Conservation-bred juveniles have shown typical migratory behavior and high post-release survival rates, highlighting their potential to contribute to the wild population (Imlay et al., 2010). Captive-origin birds make a substantial contribution to the wild population in Ontario, with breeding pairs that include at least one captive-origin bird contributing up to 40% of wild fledglings observed in recent years. The captive colony of Loggerhead Shrike, and annual release of conservation-bred juveniles, has had a stabilizing effect on the wild population, and proven key to the persistence of the species in Ontario (Tischendorf, 2009, 2015).

In addition to directly supplementing the wild population, the use of conservation-bred birds in priority research has facilitated our ability to address knowledge gaps without increasing risk to the critically small wild population. Most notable is the use of tracking devices to identify migratory routes and wintering grounds of shrike breeding in Ontario, a key knowledge gap for the species. Tracking devices are deployed on a subset of conservation-bred juveniles released each year. Research to-date suggests there are two migratory routes for shrike in Ontario: one travelling around the eastern end of Lake Ontario, and one heading west towards Windsor. With constantly improving tracking technology, there is great opportunity for exciting developments as shrike are tracked out of the province and along migration routes. More broadly, data from the use of tracking devices on conservation-bred Loggerhead Shrike can aid in refining techniques for other songbirds; shrike data were recently used in a meta-analysis of the effects of geolocators on small birds (Brlík et al., 2019).

Though conservation breeding started in Ontario, several U.S. partner institutions are now housing and breeding shrikes for subsequent release, in an effort to increase program capacity. While the breeding and release program has helped stabilize the Ontario population, efforts must ramp up over the next several years in order to evaluate whether this tool can effectively recover the wild population. To do so, the program is looking for additional partner institutions to help at least double the size and output of the captive population, which now releases over 100 birds a year. Interested institutions should contact Wildlife Preservation Canada for further details on how to get involved. In addition to being involved in the breeding program, there are opportunities to contribute to outreach and education, research, and fundraising.

Increased U.S. engagement in Loggerhead Shrike recovery is underway, in part through partnership with Conservation Centers for Species Survival (C2S2) and its members. Currently, all young produced at U.S. partner intuitions are transferred to

Ontario for release. While the benefits of using the Ontario captive population as a source for conservation breeding and release in the U.S. would be invaluable, further research is needed to determine if the current captive colony is genetically suitable to be used as release stock elsewhere, or whether new or hybridized colonies are warranted, e.g. in areas where introgression occurred historically.

Recommendations for Future Efforts and Ways to Participate

Despite the dedicated recovery efforts to date, the Loggerhead Shrike population in northeastern North America remains critically low and the species continues to exhibit declines over the majority of its range. However, the program is still relatively young, and the successes that the Loggerhead Shrike Recovery Program has achieved in Ontario over its first 20 years are substantial: a tremendous amount of knowledge has been gained, and momentum created for future recovery efforts. But more work is needed, with a potential for engagement of new partners in both *ex situ* and *in situ* communities.

In Situ Research

Loggerhead Shrikes are not well detected through roadside Breeding Bird Surveys, so a species-specific monitoring program is required to maintain the quality of the data collected. These data are important to evaluate recovery activities, protect critical habitat for the species based on site occupancy, and prioritize areas for habitat enhancement and restoration. A Population Habitat Viability Analysis is needed on the subspecies-scale to determine where sufficient habitat exists to support a viable population of Loggerhead Shrike in eastern North America, with results used to guide future recovery efforts and recovery targets. Activities should be undertaken to ensure sufficient demographic and habitat data is collected to inform management decisions, specifically: surveys of areas where probability of the species occurrence is high based on results of Species Distribution Mapping conducted by Working Group members; monitoring of breeding activity to assess lifetime reproductive success and habitat factors influencing nesting success; and identification of returning banded birds to determine if they are wild source, or captive bred.

Captive-bred juvenile being banded. Photo by Lydia Dotto, ImageInnovation Photography.

Conservation breeding

A healthy and viable captive population must continue to be maintained and managed to meet existing recovery goals and arising demands. The size of the captive population should be increased to allow a doubling of release output, increasing the speed of recovery and positive impact on the wild population. An increase in capacity will also supply more birds to be used in identification of migratory routes and wintering grounds, and allow experimentation with alternative release techniques for re-establishing populations in historic cores, without compromising existing release efforts. The captive population may also become an important source of release stock for conservation efforts in areas of the subspecies' U.S. range, and new partnerships with U.S. facilities interested in conservation breeding will be an integral part of those efforts.

Habitat stewardship and public outreach/engagement

Habitat stewardship must continue, with development of stewardship projects guided by results of the Population and Habitat Viability Analyses, to ensure sufficient habitat exists at the landscape level to achieve recovery goals. Projects should also be used to engage and raise awareness among landowners of the species' need for "heritage farming" practices. In many areas, the majority of habitat is privately owned, so landowner engagement is imperative for species' recovery.

Research to address priority knowledge gaps

While limiting factors should continue to be evaluated on the breeding grounds (e.g. nest predation, disease, environmental instability), we must also look at what could be contributing to declines outside of the breeding season. Coordination of efforts to share information internationally among jurisdictions is a priority. In particular, research should be supported to address identification of wintering grounds and migratory routes, dispersal of birds among breeding grounds, the interaction between migratory and resident populations, and the origin of immigrants into small isolated populations. Efforts should work toward the ultimate goal of gaining a better understanding of the full annual lifecycle of the species.

Conclusion

Range-wide recovery of the Loggerhead Shrike will require the collaborative efforts of multiple stakeholders across North America. Many opportunities exist for engagement in shrike

recovery, integrating both *in-situ* and *ex-situ* recovery activities. For more information on becoming involved in the recovery efforts, please contact Amy Chabot (achabot@lionsafari.com) or Hazel Wheeler (hazel@wildlifepreservation.ca).

Literature Cited

Brikl, V., J. Kolecek, M. Burgess, S. Hahn, D. Humple, and M. Krist et al. 2019. Weak effects of geolocators on small birds: a meta-analysis controlled for phylogeny and publication bias. *Journal of Animal Ecology.* Advance online publication. doi: 10.1111/1365-2656.12962.

Brownell, V.R. and Riley, J.L. 2000. The alvars of Ontario: Significant alvar natural areas in the Ontario Great Lakes region. Federation of Ontario Naturalists.

Cadman, M. 1985. Status report on the Loggerhead Shrike (*Lanius ludovicianus*) in Canada. Committee on the Status of Endangered Wildlife in Canada, Environment Canada, Ottawa, Canada.

Cadman, M.D., Sutherland, D.A., Beck, G. G., Lepage, D. and Couturier, A.R. (eds.). 2007. Atlas of the Breeding Birds of Ontario, 2001-2005. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources and Ontario Nature, Toronto.

Chabot, A.A. 2011. The impact of migration on the evolutionary and conservation of an endemic North America passerine: Loggerhead Shrike (Lanius ludovicianus). PhD Dissertation, Queen's University.

Chabot, A.A., K.A. Hobson, S.L.VanWilgenburg, G.E. Perez and S.C. Lougheed. 2018. Migratory connectivity in the Loggerhead Shrike (Lanius ludovicianus). *Ecology and Evolution* 8:10662–10672.

COSEWIC. 2014. COSEWIC update status report on the Loggerhead Shrike Eastern subspecies *Lanius ludovicianus* ssp. and the Prairie subspecies *Lanius ludovicianus excubitorides* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. Xiii + 51 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

Environment Canada. 2010. Recovery Strategy for the Loggerhead Shrike, *migrans* subspecies (*Lanius ludovicianus migrans*), in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa.

Hughes, K.D., P.A. Martin, and S.R. DeSolla. 2015. Contaminants in eggs of eastern loggerhead shrikes (Lanius ludovicianus migrans) in Ontario from 2000-2013. Environment Canada – Ecotoxicology and Wildlife Health Division. Unpublished report for Wildlife Preservation Canada.

Imlay, T.I., J.F. Crowley, A.M. Argue, J.C. Steiner, D.R. Norris and B.J.M. Stutchbury. 2010. Survival, dispersal and early migration movements of captive-bred juvenile eastern loggerhead shrikes (Lanius ludovicianus migrans). *Biological Conservation* 143:2578–2582.

Imlay, T.L., J.C. Steiner and D.M. Bird. 2017. Age and experience affect the reproductive success of captive Loggerhead Shrike (Lanius ludovicianus) subspecies. *Canadian Journal of Zoology* 95:547–554.

Kleiman, D.G. and C. Lynch. 2008. Final report: Results and recommendations for the captive breeding/release program for the Eastern Loggerhead Shrike. Unpublished report for The Eastern Loggerhead Shrike Recovery Team.

Lagois, E.L., K.F. Robbins, J.M. LaPierre and J.C. Steiner. 2015. Recruitment of juvenile, captive-reared eastern loggerhead shrikes *Lanius ludovicianus migrans* into the wild population in Canada. *Oryx* 49:321-328.

Miller, A.H. 1931. Systematic revision and natural history of the American shrikes (Lanius). – University of California Publication in Zoology 38: 11-242.

Natureserve. 2017. NatureServe Web Service. Arlington, VA. Available http://services.natureserve.org.

Nichols, R.K., J. Steiner, L.G. Woolaver, E. Williams, A.A. Chabot and K. Tuininga. 2010. Conservation initiatives for an endangered migratory passerine: field propagation and release. *Oryx* 44:171-177.

Parmlay, E.J., D.L. Pearl, N.A. Vogt, S. Yates, G.D. Campbell, J. Steiner, et al. 2015. Factors influencing mortality in a captive breeding population of Loggerhead Shrike, Eastern subspecies (Lanius ludovicianus ssp.) in Canada. BMC Veterinary Research 11: 129.

Pruitt, L. 2000. Loggerhead Shrike status assessment. U.S. Fish & Wildlife Service.

Rand, A. L. 1960. Family Laniidae. – In Mayr, E. and Greenway, J. C., Jr. (eds.), Checklist of birds of the world, Vol. 9. Museum of Comparative Zoology pp. 309-365.

Reschke, C., Reid, R., Jones, J., Feeney, T, and Potter, H. 1999. Conserving Great Lakes alvars. The Nature Conservancy, Great Lakes Program.

Sauer, J.R., J.E. Hines, J.E. Fallon, K.L. Pardieck, D.J. Ziolkowski, Jr., and W.A. Link. 2018. *The North American Breeding Bird Survey, Results and Analysis 1966 - 2017. Version 01.30.2017 USGS Patuxent Wildlife Research Center, Laurel, MD.*

Soorae, P.S. (ed). 2013. Global re-introduction perspectives : 2013. Further case-studies from around the globe. IUCN/SSC Re-introduction Specialist Group and Abu Dhabi, UAE: Environment Agency-Abu Dhabi, Gland, Switzerland. xiv + 282 pp.

Tischendorf, L. 2009. Population viability analysis of the eastern Loggerhead Shrike (Lanius ludovicianus migrans). Unpublished report for the Canadian Wildlife Service – Ontario, Environment Canada.

Tischendorf, L. 2015. Population viability analysis of the eastern Loggerhead Shrike (Lanius ludovicianus migrans). Update unpublished report for the Canadian Wildlife Service – Ontario, Environment Canada.

Vickery, P.D. and Dunwiddie, P.W. 1997. Grasslands of northeastern North America: ecology and conservation of native and agricultural landscapes. Massachusetts Audubon Society.

Yosef, R. 1996. Loggerhead Shrike (*Lanius ludovicianus*). *In the* Birds of North America, No. 231. (A. Poole and F. Gill, eds). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C.

Brevard Zoo and Florida Scrub-Jays: Saving a Species in Peril

Michelle Smurl, Director of Animal Programs
Brevard Zoo
Melbourne, FL

Jay with B-SK band combination, or Blue-Silver Kelly.

Save our True Floridians

Of the hundreds of indigenous bird species living in Florida, only one, the Florida Scrub-Jay *(Aphelocoma coerulescens)*, is found nowhere else. The Florida Scrub-Jay is a habitat specialist that only utilizes unique oak scrub habitat, the most endangered ecosystem type in Florida. As a result, Florida Scrub-Jay populations have declined dramatically, and this bird species is federally listed as threatened.

In a state where human population has nearly quadrupled since 1960, the Florida Scrub-Jay has lost much of its choice scrub habitat to citrus groves, subdivisions and fire suppression. As a result, there has been a rapid decline in the Florida Scrub-Jay population, as much as 85% over the last 100 years (Concoby, 2005). As Florida Scrub-Jays lose habitat and become increasingly fragmented, local populations often fall below sustainable levels.

Original hack enclosure, 4x4' and 4' off the ground

Called to Action

Brevard Zoo was solicited by the United States Fish and Wildlife Service (USFWS) and county agencies in 2007 to undertake and oversee the translocation (capture, transport and release or reintroduction of plants or animals from one location to another) of Florida Scrub-Jays from marginal urban environments to restored and managed public lands in Brevard County.

Our methodology includes the translocation of entire family units, consisting of a breeding male and female and any "helpers". The Zoo's function is to trap, tame, and capture the jays prior to transferring them to hack or soft-release pens at the release site and monitor the jays' activities post-release. Potter traps baited with raw peanuts are utilized during the taming process. The Zoo's veterinarian is on hand to collect blood from captured jays for gender determination and a long-term grant funded genetic study. A United States Geological Survey (USGS) licensed ecologist utilizes a pre-determined color combination and bands each jay with color bands and a USFWS butt-end metal band with a sequence of nine numbers that help to identify the jay if re-captured, or if it loses its color bands.

The Zoo has helped to identify and collect samples for studies over the years and since November 2017 we have successfully trapped and helped process 107 Florida Scrub-Jays. The goal for managed conservation sites with Florida Scrub-Jay is to band 90% of the population in order to collect comprehensive demographic information.

Our Mission at Work

Since 2007, Zoo staff members have completed translocations of 14 imperiled Florida Scrub-Jay family units totaling 45 jays in Brevard County. The project's initial success suggests translocation is an effective tool to help save this threatened species. These translocations exemplify the Zoo's mission of "Wildlife Conservation through Education and Participation." The project has generated great public interest, participation, and investment in conservation.

In the spring of 2018, the Zoo was alerted by USFWS to a pair of Florida Scrub-Jays that were living on a parcel of land in the city of Palm Bay that was slated for development. Considered sub-optimal scrub habitat, Zoo officials were surprised to find that this pair had successfully reared an offspring. This juvenile complicated the translocation process for a few weeks due to its elusive nature. Time was running short for Zoo staff to capture and relocate the family unit of these three jays. Thanks to the cooperation from the site developer and the juvenile's increased comfort with the Potter traps as the days passed, the jays were successfully captured as a family unit early on the morning of August 1, 2018 and moved to the Malabar Scrub Sanctuary, a 400-acre sanctuary in the city of Malabar.

Before placement in a specially designed hack enclosure for 24 hours, the jays were examined by the Zoo's veterinarian and banded by a local ecologist holding a special banding permit. The hack enclosure gives the family an opportunity to become familiar with the landscape and its inhabitants. Food and water is made available during this time and for a short time after the release while the birds learn where to find food. Jay monitoring at this site is conducted on a regular basis by Zoo officials. Besides saving three important individual jays the goal is to increase the number of Florida Scrub-Jay families residing at the Malabar Scrub Sanctuary.

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Maria Zondervan (BLCA) and Craig Faulhaber (FWC) reviewing optimal scrub habitat locations.

The current range, shown in green is only a tiny fraction of the historical range, shown in gray. Map courtesy of Monica E. McGarrity.

Not known as good flyers, it is unusual for jays to disperse long distances. The 2018 translocated adult female jay flew over 10 miles to a scrub preserve and paired with an adult male from an adjacent scrub sanctuary along the way. Dispersals help to increase genetic diversity in their respective territories but also increases monitoring and resource needs since Zoo staff are now coordinating efforts to search viable scrub habitat within 10 or more miles of translocation sites for dispersed Florida Scrub-Jays.

Translocation efforts will benefit a large number of Florida Scrub-Jays while providing valuable data to a variety of public and private entities with ties to the project. Florida Scrub-Jay translocation efforts on property open to the public provide the community with an opportunity to see and be actively involved in the management of a threatened endemic species. Our efforts with community outreach allow us the opportunity to educate community members on the negative impact outdoor

Viera Preserve scrub habitat.

David Breininger, ecologist, in the field banding a juvenile Florida Scrub-Jay

cats and feral cat colonies have on birds, including the Florida Scrub-Jay.

Teetering on the Brink of Extinction

Historically, Florida Scrub-Jays were found in 39 counties in Florida, but currently only 32 counties still support Florida Scrub-Jay populations and nine of these counties have tiny populations of 10 or fewer pairs. The range of the Florida Scrub-Jay has declined dramatically statewide and within Brevard County.

Future Efforts Needed

Habitat preservation and restoration are the first lines of defense for conserving Florida Scrub-Jays. In situations where this is not enough, translocations will enhance these efforts. Data collected through the Zoo's monitoring efforts will be analyzed and integrated into long-term research of the entire Brevard County meta-population described by Breininger et al. (2006). Survival rates, reproductive success, population recruitment, population growth rate and habitat use information is critical for this research.

An excerpt from the 2018 JayWatch report for BLCA written by Maria B. Zondervan, Land Manager for the St. Johns River Water Management District (SJRWMD) states, "One of the adults observed on this year's survey (bands -SBX), was translocated to Buck Lake in 2011 and is still onsite and producing young. All translocations to Buck Lake have been very successful and should continue". Additionally, the first 2008 translocated adult breeding female has remained at the recipient site and continues to successfully rear young to adulthood. While translocations have proven successful there is still much to learn about utilizing this tool to benefit Florida Scrub-Jay populations.

Brevard Zoo's role in the conservation of the Florida Scrub-Jay at the outset was strictly translocation and monitoring. Through relationship building and our proven dedication to this species our role has grown and now the Zoo has representation on the Central Atlantic Coastal Ridges Working Group (CACRWG), a scrub habitat focused group consisting of land managers and other stakeholders, and has been instrumental in the conversations with USFWS to fund the creation of a Population Viability Analysis (PVA) for Florida Scrub-Jays. The PVA process is complicated due to the Florida Scrub-Jay's unique social structure, a cooperative breeding system, which only occurs in a few hundred species of birds worldwide (Koenig, 2004). The Zoo acts as a catalyst to secure a future for Florida Scrub Jays in Brevard County and ultimately the state of Florida.

Notwithstanding Brevard Zoo's modest success in recent past, we at Brevard Zoo remain committed to staying vigilant and will continue to act as guardians to help secure a future for Florida Scrub-Jays.

Acknowledgements

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Photos courtesy of Michelle Smurl, Brevard Zoo

References

Breininger, D.R., B. Toland, D.M. Oddy, and M.L. Legare. 2006. *Landcover characterizations and Florida Scrub-Jay (Aphelocoma coerulescens) population dynamics.* Biological Conservation 128:169-181.

Concoby, R. 2005. *Florida Scrub-Jay Experimental Translocation and Radiotelemetry Research Project: Southern Hillsborough and Manatee Counties.* Report for Mosaic Fertilizer, LLC.

Ecology and Evolution of Cooperative Breeding in Birds, ed.W.D. Koenig and J. L. Dickinson. Published by Cambridge University Press. Cambridge University Press 2004.

Woolfenden, Glen E.; Fitzpatrick, John W. 1996. Florida scrub-jay (Aphelocoma coerulescens). In: Poole, A.; Gill, F., eds. The Birds of North America. No. 228. Philadelphia, PA: The Academy of Natural Sciences; Washington, DC: The American Ornithologists' Union: 1-28.

Zondervan, Maria B. 2018. *Buck Lake Conservation Area Jay Watch Results and Discussion 2018*. Mt. Dora: St. John's River Water Management District, 2018. JayWatch.

Relevant Websites

Birds of North America - https://birdsna.org/Species-Account/bna/species/228/

Brevard Zoo – www.brevardzoo.org

Environmentally Endangered Lands Program - https://www.brevardfl.gov//EELProgram/Home

JayWatch - http://fl.audubon.org/get-involved/jay-watch

St. John's River Water Management District - https://www.sjrwmd.com/

USGS Bird Banding Laboratory - www.usgs.gov/centers/pwrc/science/bird-banding-laboratory

Outdoor "Pets": A Real Cat-astrophe

Michelle Smurl
Director of Animal Programs

Elliot Zirulnik
Communications Manager
Brevard Zoo
Melbourne, FL

Cat in Catio at Brevard Zoo. Photo by Michelle Smurl.

Brevard Zoo Catio Grows Larger. Photo by Michelle Smurl.

In spring 2018, Brevard Zoo, located on the east coast of Florida, opened Butterflies and the Magic of Nature—a temporary exhibit featuring native Florida pollinators and the plants upon which they depend. The Zoo used this opportunity to showcase the ingredients of a wildlife-friendly backyard, including the right variety of quality food, fresh water for drinking and bathing, and safe cover provided by native plants.

Unfortunately, providing the native cover is not enough to keep songbirds and other small native animals safe from introduced predators such as the feral cat. According to the Florida Wildlife Conservation Commission (FWCC) close to 10 million cats were living in the sunshine state of Florida in 2003 and the numbers have increased each year. An immense, growing population of free-roaming cats exists in the United States, and these animals are responsible for between 1.3 and 4 billion bird deaths every year (Loss et al., 2013). Globally, outdoor cats have contributed to the extinction of 63 bird, mammal and reptile species (Doherty et al., 2016).

Outdoor living is deleterious to the cats themselves, too. They are at increased risk of disease, predation and vehicle strike, which results in a shorter average lifespan than their indoor counterparts (Hatley, 2003).

Public outreach is an essential, tried-and-true tool for solving pet overpopulation. The Zoo chose to tackle the outdoor and feral cat issue by

Using the catwalk in the catio. Photo by Michelle Smurl

Brevard Zoo's original Catio design. Photo by Michelle Smurl.

constructing a "catio" (think "cat" plus "patio") for the exhibit. This screened-in extension of one's home—which may feature perches, tunnels and other feline-friendly structures—offers exposure to outdoor stimuli while maintaining a barrier between cats and wildlife. Catio designs are as diverse as the cats themselves, ranging from simple, hut-like structures to elaborate and enclosed treehouses. Kits and step-by-step instructions are available online; director. "One is animal welfare and the other is education. The catio not only protects wildlife, but also offers our feline residents a safe environment with the outdoor enrichment they need to thrive. This is an ideal partnership that enables us to visually educate cat owners on responsible pet ownership and how to protect cats from the hazards they might encounter outside." Interpretive signage around the catio provided guests information about the threats facing birds, the adoptable cats and the partnership with the Humane Society. The Zoo provided information on the prevention of bird strikes and how Florida is part of the Atlantic Flyway**,** a major north-south flyway for migratory birds in North America. Every year, migratory birds travel this route following food sources, heading to breeding locations, or finding refuge at overwintering sites.

Cat overpopulation is a human-caused problem that will not be solved by dismantling trap-neuter-release (TNR) programs or building catios. A consistent, long-term educational campaign about the impact of free-roaming cats on wildlife is needed. State and local officials can instate sterilization incentives and penalties for abandonment. Until steps are taken to fix this issue, the cat population will continue to grow, and native wildlife populations will continue to decline. In the interim, the Zoo will build on the momentum gained through sharing the catio concept and continue to provide pertinent information and potential solutions to engage community members in working to correct this issue and prevent others from occurring in order to protect native wildlife, including native and migratory songbirds. It is time to tilt the scales in favor of wildlife.

Citations

Doherty T., *et al.* 2016. Invasive predators and global biodiversity loss. *PNAS* 113 (40) 11261-11265 doi: 10.1073/pnas.1602480113

Hatley, P. 2003. Feral Cat Colonies in Florida: The Fur and Feathers are Flying. *Journal of Land use and Environmental Law* 18:441

Loss S.R. *et al.* 2012. The impact of free-ranging domestic cats on wildlife of the United States. *Nat. Commun.* 4:1396 doi: 10.1038/ncomms2380

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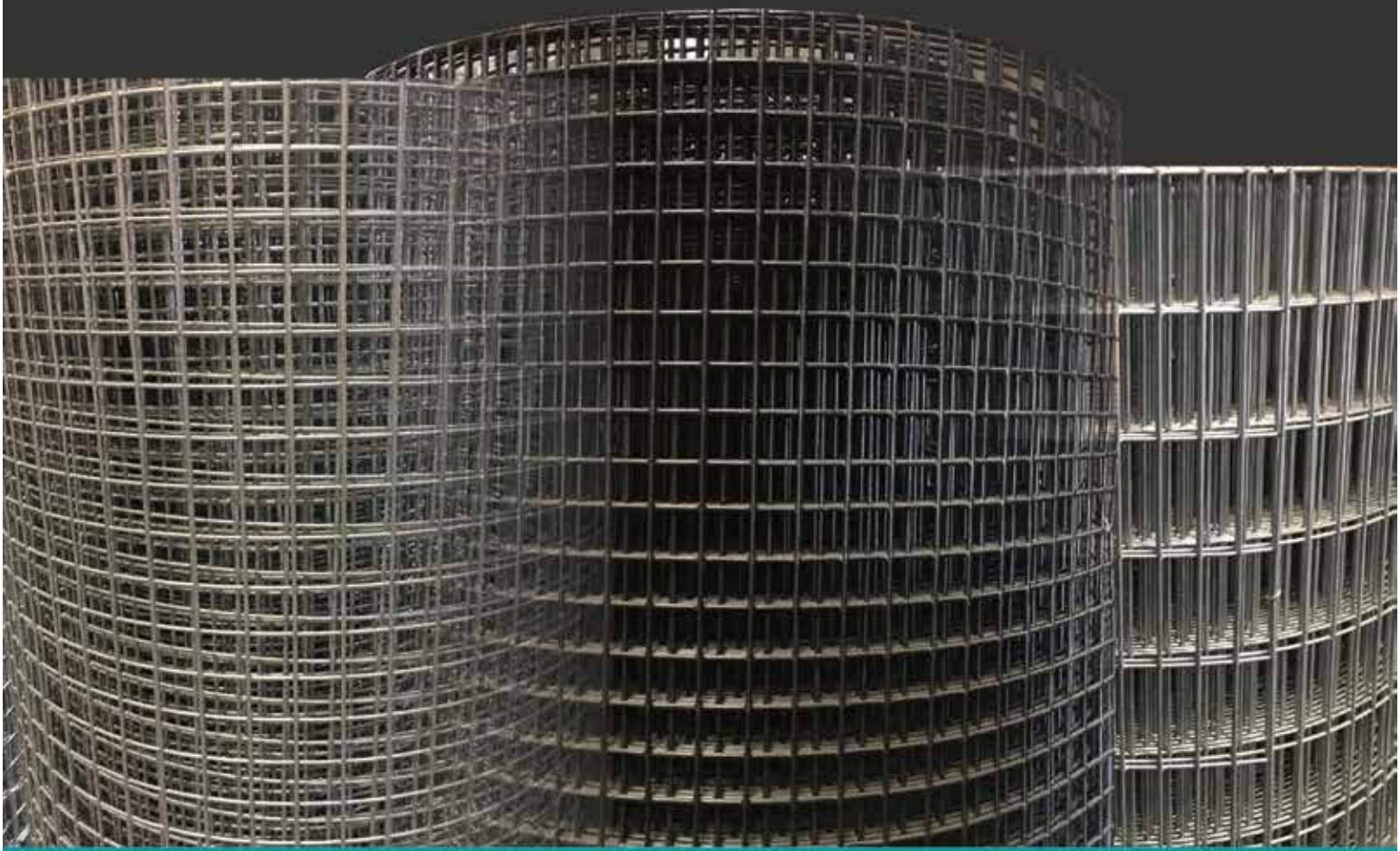

The **Bird Seed Feeder** works great to keep food flowing through the enclosure. The large base allows for conversations around the dinner table.

Set up the **Bird Feeder Log** in small places and enjoy watching the birds fly in for a snack.

Q: What flies through the jungle singing opera? A: The parrots of Penzance!

The **Rope Refuge** works great for birds. This particular **Rope Refuge** (pictured) is constructed with (6) 12" Heavy Duty Food-Grade Polyethylene Balls. Each Ball has a corrosion-resistant perch / climbing handle and are held together with 1" diameter brown Pro-Manila Rope. These do not smell. The Balls can be site-adjusted without tools to any position on the rope.

The standard rope length is 17 feet with a woven "eye splice" at the upper end and an "end whipping" wrap at the other end to prevent unraveling. A Carabiner is included to speed installation or removal.

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