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EDUCATION

Empowering the Next Generation of Conservationists

by Jennifer Torpie, Education Manager

What do you call a clever duck?
A wise quacker!

While funny for elementary school children (and dads everywhere), jokes like these elicit eye-rolls from most teenagers. But, beneath that “too cool” exterior are curious minds passionate about making a difference.

At the National Aviary we take our teen visitors seriously. We empower young people with a scientific understanding of pressing conservation issues, and encourage them to act on behalf of an environment that cannot speak for itself.

Since 2018, we have expanded our high school programs, offering courses that include up-close encounters with animal ambassadors and give students real world experiences like those they would have in careers devoted to animal care or conservation. In Birds and Conservation, students get involved in ornithological citizen science and

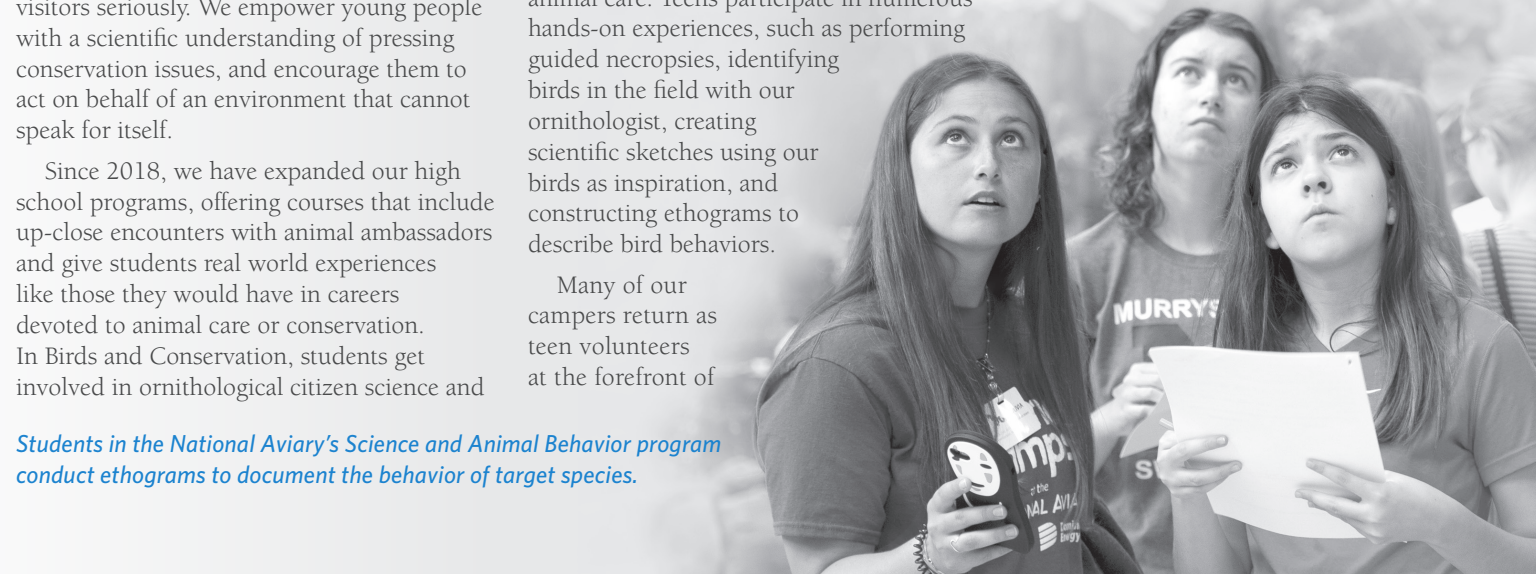
environmental advocacy, while in Science and Animal Behavior, students explore ornithological research tools and observe bird behavior in the National Aviary.

Teens 13 to 16 years of age can go behind the scenes during summer camps to learn about zoo jobs, including horticulture, education, nutrition, ornithology, and animal care. Teens participate in numerous hands-on experiences, such as performing guided necropsies, identifying birds in the field with our ornithologist, creating scientific sketches using our birds as inspiration, and constructing ethograms to describe bird behaviors.

Many of our campers return as teen volunteers at the forefront of

environmental education, learning to share their interest in birds with the public and make the most of informal education opportunities with our visitors.

They might roll their eyes at our “dad jokes,” but teens are serious about making a difference, and the National Aviary is committed to helping them do it. ■



Students in the National Aviary's Science and Animal Behavior program conduct ethograms to document the behavior of target species.

RECENT PUBLICATIONS

First Estimates of Rates of Survival From the Andes

by Steven Latta

Conservation rests on knowing whether bird populations are increasing or decreasing, or if communities are changing in subtle ways.

The most direct way to determine survival rates is to sample the population on a regular basis, using the same methods over many years. This sort of “constant effort” population monitoring can be accomplished with point counts (comprehensive visual and auditory detections of birds from specific spots for a set length of time), with mist net captures, or by combining both of these approaches.

In a recently published paper (Tinoco et al. 2019), we have provided the first assessment of survival rates for birds in the Tropical Andes. Over 11 years we banded more than 3,500 birds representing 72 species from three habitats that varied in how much they had been modified by human activities. These included native forest, introduced forest, and shrubs. Because we returned to the same sites three times each year, we recaptured many of the same birds. We used these recaptures to calculate the apparent survival rates of 28 species across the three habitats.

Apparent survival rates varied from just 7% for Black-crested Warblers (*Margarornis squamiger*) to 75% for Violet-throated Metaltails (*Metallura baroni*), but we found no significant differences in survival rates either among habitats, or among species grouped by their habitat specialization. Because we found similar

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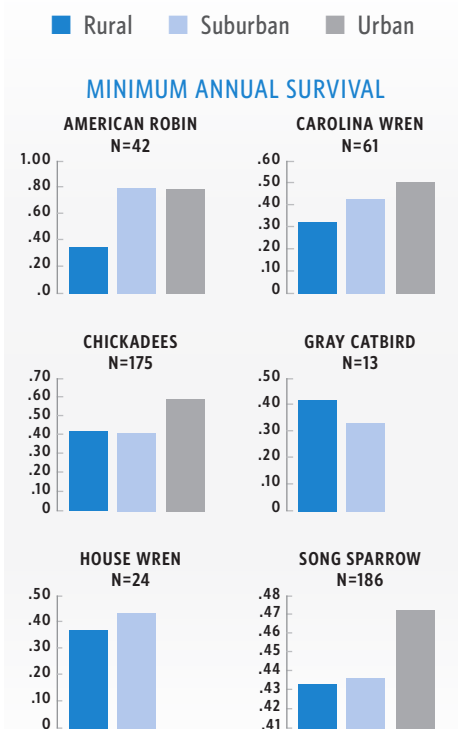
HUMAN POPULATION IMPACTS

Pittsburgh Neighborhood Nestwatch: What Have We Learned So Far?

by Robert Mulvihill

For the past six years the National Aviary has executed a Smithsonian Institute-sponsored citizen science study of urban birds, Neighborhood Nestwatch, right here in Pittsburgh. Ours is one of six Neighborhood Nestwatch projects spun off from the original study begun in Washington, D.C. in 2000. For a “by design” long-term study such as this, six years is early for findings to be considered statistically significant or definitive, but it provides some comparative summaries and a few provisional analyses.

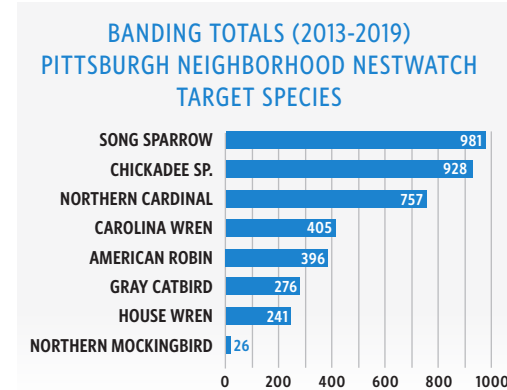
In all, we have visited 189 different sites since 2013. Many of these sites were available for only one or two years of the study. Nevertheless, we have visited more than 60 sites for four or more consecutive years. In all, we have banded 4,039 individual birds of the eight target species (American Robin, Chickadee note: *Black-capped and Carolina Chickadees are lumped together with presumed hybrid chickadees*, Carolina Wren, House Wren, Gray Catbird, Northern Cardinal, Northern Mockingbird, Song Sparrow). These color-banded birds form the foundation of the Pittsburgh Neighborhood Nestwatch study.



A major objective of Neighborhood Nestwatch is determining if there are differences in survivorship of birds depending on the surrounding landscape. This assessment relies a great deal on observations of individually color-banded birds subsequent to our capture and banding of those birds. Because the target species all are either permanent, year-round residents, or at least breeding residents, we can expect that they will stay (or return) year after year in the same territory (i.e., backyard) as long as they are alive.

For example, if we start with a sample of 100 banded Song Sparrows and assume 50% survive each year, then participants

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NATIONAL AVIARY
PITTSBURGH, PA

The National Aviary inspires respect for nature through an appreciation of birds.

Editor

Steven Latta, Ph.D.
Director, Conservation and Field Research
steven.latta@aviary.org

Managing Editor

Robert Mulvihill, M.Sc.
Ornithologist
robert.mulvihill@aviary.org

700 Arch Street
Pittsburgh, PA 15212-5201
412-323-7235



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FROM THE EDITOR

Collaborations Strengthen Conservation

It often feels like there are far too many conservation problems facing birds for any of us to solve. Indeed, the challenges for birds and other wildlife have many different sources. It is for this reason that effective conservation has come to depend on diverse grassroots partnerships and professional collaborations. At the National Aviary, we maintain several long-standing partnerships, and we are always open to developing new relationships that can broaden our efforts to promote the conservation and protection of birds and their habitats.

In this issue of *Flightpaths* we highlight a new and exciting collaboration with *Project Principalis*, an incredibly dedicated group of searchers who collectively know more about the history and ecology of the Ivory-billed Woodpecker than almost anyone anywhere. The group includes two self-described “reformed” lawyers from New York and Ohio, a retired wildlife biologist from Louisiana, a retired engineer from Arkansas, a research veterinarian from Texas, an industrial monitoring specialist from Louisiana, and students from Louisiana and Georgia. Together they have seen and heard enough to be convinced of the Ivory-bill’s continuing survival in an undisclosed area the group has monitored for many years. Our goals are to bring cutting edge science and technology to their search for a nesting pair, and then to help save the species from extinction — a tall order that clearly will require many collaborations!

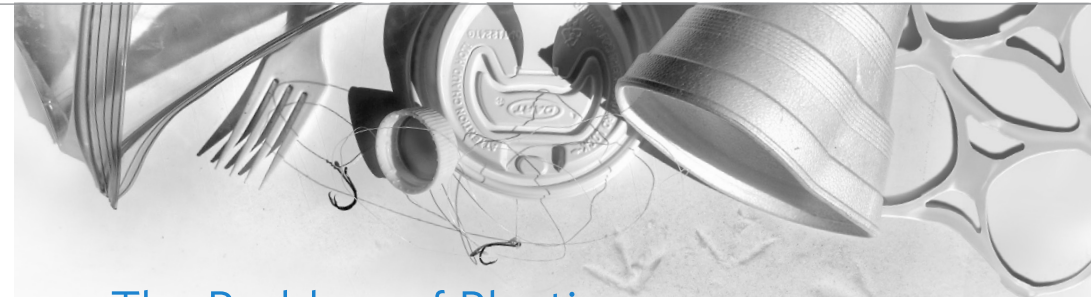
Other long-standing partnerships highlighted in this issue of *Flightpaths* cross international boundaries. Our work in community outreach and education for the conservation of endemic birds in the Western Pacific is only possible with help from Pacific Bird Conservation, the government of the Commonwealth of the Northern Mariana Islands, and other zoos. In Ecuador, we partner with Bioparque Amaru and Universidad de Azuay.

Partnerships are also important for work we do closer to home. Our popular Neighborhood Nestwatch program is made possible through our relationship with the Smithsonian Institution and with the families that voluntarily engage in this citizen science initiative. Our recent study of avian malaria in the Caribbean is a collaboration among three countries: the U.S. (University of Missouri-St. Louis), Canada (Western Ontario University), and the Dominican Republic (Ecological Foundation of Punta Cana and Grupo Acción Ecológica).

Partnerships like these not only amplify what we can do, they also provide exceptional opportunities to expand our outreach and educational activities, and they enrich, educate, and inspire our staff as they strive to protect and conserve birds and their habitats around the world.

Steven Latta, Ph.D.
Director, Conservation and Field Research

ISSUES IN INTERNATIONAL BIRD CONSERVATION



The Problem of Plastics

by Robert Mulvihill

Ironically, it was, in part, a desire to protect wildlife that motivated the invention of synthetic polymers, or plastics, in the late nineteenth century. Prior to that, elephants and other animals were killed for their natural ivory, used for everything from billiard balls to piano keys. Similarly, humans exploited sea turtles for their “tortoise shell,” which was used to craft fashionable eyeglass frames.

After World War II plastics began showing up everywhere: in our cars, in our kitchens, in our garages, and on every store shelf. The amount of plastic produced worldwide went from zero to more than 320 million tons in the short space of just 65 years.

Although some kinds of plastic can be recycled or repurposed, most plastics become part of an ever-growing stream of litter that eventually empties into the world’s oceans. In the marine environment, especially, this mass of plastic detritus entangles, maims, and kills wildlife, often in horrific ways.

One of the most compelling examples of the unintended consequences of our love affair with plastics is the impact that they have had on nesting seabirds far out in the Pacific Ocean. Populations of Laysan, Black-footed, and Short-tailed Albatrosses on Midway Island are tricked into feeding plastic to their chicks because the odor of the phytoplankton coating the plastic pieces equates to natural food. Although consuming the plastic pieces does not necessarily result in direct mortality, it is one of many factors casting a shadow on the long-term survival of these long-winged and long-lived bellwethers of the world’s interconnected ocean ecosystems.

We and our planet’s birds are faced with an existing mass of many millions of metric tons of uncontained plastic pollution. It

“lives” in our oceans as shape-shifting gyres, like the “Great Pacific Garbage Patch,” swirling over thousands of square miles. Our plastic waste, plastic from mismanaged waste streams, as well as fishing nets and lines, capsized cargo ship contents, and more have resulted in so much plastic pollution that the collective “biomass” of ocean plastic is projected to exceed the living biomass of the oceans’ fishes by 2050. The physical degradation of this plastic waste into ever-smaller pieces, or microplastics, means that plastics now enter the very base of our planet’s food chain, zooplankton.

There is no arguing the many very positive, even life-saving benefits of plastic to humans, but their excessive production and use has contributed to a throwaway mentality that could one day threaten the very organic stability of our global ecosystem.

As Laura Parker summarized in *National Geographic* in their June 2019 *Environment Explainer*:

Plastics revolutionized medicine with life-saving devices, made space travel possible, lightened cars and jets — saving fuel and pollution — and saved lives with helmets, incubators, and equipment for clean drinking water... today, single-use plastics account for 40 percent of the plastic produced every year. Many of these products, such as plastic bags and food wrappers, have a lifespan of mere minutes to hours, yet they may persist in the environment for hundreds of years.

Reducing our production and use of plastics, creating better waste management systems, increasing recycling rates for plastic products, and developing alternatives to plastic are essential steps we must take to reduce the threat that plastic pollution poses to our birds, and, ultimately, to ourselves. ■

ANIMAL PROGRAMS

Outreach Promotes Conservation on Pacific Islands

by Jennifer Haverty, Senior Aviculturist

Community outreach and education are critical elements to any successful conservation program. In the Commonwealth of the Northern Mariana Islands (CNMI), where bird populations face pressures from invasive species, the participation and support of the local community is providing hope for a bright future for birds.

The National Aviary has recently taken a leadership role in international outreach through the Mariana Avifauna Conservation (MAC) Project. Established in 2004 as a partnership between Association of Zoos and Aquariums (AZA) institutions, Pacific Bird Conservation, and governmental agencies of the CNMI, MAC aims to protect birds from the threat posed by the invasive brown tree snake, which has already caused the extinction of many bird species on the island of Guam. Biologists want to take steps to protect birds living on nearby islands in case the snakes would ever find their way to those islands.

The major focus of MAC is translocating at-risk birds to neighboring snake-free islands and breeding many of the same species in human care. Another important aspect of MAC is community outreach and education on the islands where researchers are working. Educators from different American zoos, including the National Aviary, coordinate outreach efforts during each field season, networking with the islands’ schools, libraries, community centers, and public festivals in order to make sure that people are aware of the work that the conservation team is doing in their community, and how they can support their island birds.

Local high school students have the opportunity to visit field sites, interact with zoo professionals, and learn about the conservation work on CNMI. This kind of immersive outreach experience gives the students a much deeper appreciation for their island’s birds and motivates them to help with their conservation. ■

PARTNERING FOR CONSERVATION

Of Kents and Double-knocks: Searching for the Ivory-billed Woodpecker

by Steven Latta and Mark Michaels



A new partnership between the National Aviary and Project Principalis seeks to document Ivory-billed Woodpeckers in the South. Mark Michaels and Steve Latta examine evidence of bark scaling.

Could Ivory-billed Woodpeckers still survive in remote reaches of swamp forests of the southeastern U.S.?

The Ivory-billed Woodpecker is perhaps the most legendary North American bird; it is certainly the most controversial. Although the last generally accepted sighting occurred in 1944, since then, competent observers and respected ornithologists have made numerous recordings said to be the “kent” calls or distinctive double-knocks of Ivory-bills, and they have made some grainy photos and videos purported to be living Ivory-bills. However, none of the accumulated evidence is of sufficient quality or quantity to serve as irrefutable proof of the birds’ survival.

With the ambitious goal of finding a nesting pair of Ivory-bills and providing incontrovertible evidence of their survival, the National Aviary has formally joined veteran searcher Mark Michaels and his *Project Principalis* in an intensive field effort.

The history of the Ivory-billed Woodpecker is full of controversy. Before European contact, some Native American nations valued the heads and bills, which were traded widely. Ivory-bills also appear to have been consumed as food. Mark Catesby’s first description and painting of the species, Alexander Wilson’s description of his experience with a wounded bird, and Audubon’s poetic language and stunning renditions sealed the birds’ status as a symbol of the South’s wild and nearly

impenetrable old-growth bottomland and swamp forests.

Although the Ivory-bill was probably never more than locally common, there was a post-Civil War assumption that it was fleeing before the advance of civilization and, like the forests themselves, might soon disappear altogether. Ironically, this widely held belief became a kind of self-fulfilling prophecy, increasing the demand for specimens and motivating collectors to kill the birds in large numbers.

In the early 20th century, the Ivory-bill was alternately pronounced to be extinct and subsequently rediscovered on several occasions; the last of these rediscoveries, in 1932, led to the only formal study of a family group of Ivory-billed Woodpeckers. In Louisiana’s Singer Tract, a Cornell University graduate student, James Tanner, worked with J. J. Kuhn, a local game warden, to record and film the family group from 1937 to 1939. In fact, the majority of what we know about the Ivory-billed Woodpecker in North America comes from Tanner’s study, and the Singer Tract photographs and audio are the only undisputed images and calls of Ivory-billed Woodpeckers from the United States. Still, reports of sightings persist.

Project Principalis, founded by Mark Michaels and the late Frank Wiley in 2010, sought the collaboration of the National Aviary in late 2018. We have seen and heard enough to believe the Ivory-billed Woodpecker has persisted at low densities in various southeastern locations. In our 2019 field season we have brought in new partners from the University of Pittsburgh, and new technologies including remote monitoring, GIS, and eDNA analyses.

Together, the National Aviary and *Project Principalis* seek to document Ivory-billed Woodpeckers, establish the species’ persistence, and start gathering behavioral data about what we believe to be at least one group of surviving birds.

Follow our search for the Ivory-billed Woodpecker at www.aviary.org/ivory-billed-woodpecker. ■

First Estimates of Rates of Survival From the Andes

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survival rates in native forest and human-modified habitats, our results underscore the potential value of habitats impacted by humans for the conservation of some species of birds in the tropics. However, these conclusions are tempered by the wide variability around our estimates of survival rates, and limitations on the number and types of species we were able to analyze.

Long-term studies like this are vitally important because the probability of persistence of a bird population is strongly determined by adult survival rates, and until now we have had very few data on the survival of birds in one of the world’s most important biodiversity hotspots: the Tropical Andes. They also have the added benefits of providing us with an opportunity to train students and field biologists in mist netting and other field ornithology techniques, and of providing a platform for additional research studies by those same Ecuadorean students and research colleagues. In fact, several students have participated in this monitoring effort, and have completed theses based on our research collaborations.

These data from Ecuador, and similar long-term studies that the National Aviary continues to pursue in Costa Rica and the Dominican Republic, are among the very few — and increasingly important — long-term data sets for resident bird populations in the Neotropics. Taken together, they shed light on the welfare of bird populations in habitats that are increasingly impacted by our own populations. ■

Tinoco, B. A., L. Graham, P. X. Astudillo, A. Nieto, J. M. Aguilar, S. C. Latta, and C. H. Graham. 2019. Survival estimates of bird species across altered habitats in the tropical Andes. Journal of Field Ornithology 90:105-116.

NOTES FROM THE FIELD

The Burden of an Inconvenient Passenger: Understanding the Effects of Malaria Parasites on Migratory Birds

by Leticia Soares, Research Associate

In a world where malaria parasites kill a child every two minutes and impair the lives of 200 million people every year, one might be surprised to find out that malaria is far from a uniquely human disease.

Single-celled organisms that clone themselves within the cells of vertebrates, but which sexually reproduce only in the guts of insects, cause malaria. Parasites that cause malaria-like disease have been described in apes, rodents, deer, bats, lizards, and birds. Due to its biological similarity and close evolutionary relationship with human strains of malaria, research into avian malaria may also inform our understanding of the mechanisms regulating disease occurrence, susceptibility, and resistance in humans.

In birds, malaria infections can cause mortality, but even non-fatal malarial infections can reduce reproductive success and lifespan.

The National Aviary’s Dr. Steven Latta is exploring patterns of malaria infections in birds as part of a multinational collaboration that includes the University of Missouri St. Louis (Dr. Robert E. Ricklefs), University of Western Ontario (Dr. Leticia Soares), and Grupo Acción Ecológica (Maria Paulino and Danilo Mejía). Together we are characterizing parasite dispersal through host migration, the occurrence of disease-causing agents in birds during winter, and the effects of these parasites on migratory performance and survival during winter, in order to better understand global declines of migratory species.

Based on five years of sampling the blood of birds in the Dominican Republic, we have learned that populations of 14 migratory species rarely are infected with malaria parasites, whereas populations of 37 year-round resident species typically show a high

infection prevalence. We also discovered that migratory birds that are infected carry malaria strains like those found during summer in North America, and not the strains that infect resident birds elsewhere in the Caribbean.



Ongoing research in the Dominican Republic is measuring the effects of malaria on avian populations.

These patterns are intriguing, and we do not fully understand yet why migratory birds have so few infections during their wintering time in the tropics. Our goal is to continue monitoring these populations during winter, focusing on different phases of the migration cycle, such as upon arrival in the Dominican Republic, and just prior to departure back to North American breeding grounds.

Our results also have relevance to understanding the impacts of climate change. With climate change, the possibility that the mosquitoes that spread malaria may expand their geographic range could easily bring new threats to bird populations worldwide. The extinctions and population declines of several endemic Hawaiian birds due to introduced malaria serves as just one tragic example of what can happen when immunologically naïve bird populations are exposed to novel malaria pathogens. ■

STUDENTS, FIELD ASSOCIATES, AND RESEARCH ASSOCIATES

Research Associate Wins Major Award

by Steven Latta



Frantz's research has centered on the Louisiana Waterthrush (*Parkesia motacilla*) as a bioindicator of conditions in headwater stream ecosystems of the Appalachians. Because this songbird depends on both forested and aquatic habitats in these narrow streams, he has had the opportunity to quantify how waterthrush respond to a variety of habitat changes. Most of these changes are directly associated with rapid transformations over the last decade from unconventional shale gas development.

Working in a highly forested watershed of the Central Appalachians of West Virginia, Frantz banded birds and followed nest histories to document demographic shifts, changes in spatial distributions, and novel "epigenetic responses" to hydraulic fracturing and shale gas development. Epigenetic responses are actual changes to the bird's DNA, some of which can be inherited by their offspring.

Results of his research indicated that multiple habitat features, including changes to the land and the water, were altered by shale gas development resulting in an

Dynamic Changes in the Field

by Nancy Ransom, Research Associate

In the spring of 2019 I was humbled to be asked to return to my ornithological roots as the lead field technician on the National Aviary's study of Louisiana Waterthrush in the Laurel Highlands of Pennsylvania. My very first field experience was with the same study two years earlier.

Living and working with others in the field can change your relationship with the world around you, and even your relationship with yourself. Moving into the shared cabin at Powdermill Nature Reserve, which hosts our field studies, is kind of like living in a hostel. Your housemates may be strangers at first, but by the end of the season, they have become friends.

Our focus, the Louisiana Waterthrush, is the first of the wood warblers to arrive on their breeding grounds, and also the first to leave. In the short time we had to study them, from April through July, we conducted banding, nest searching, and made detailed observations.

Handling adults and handling nestlings were completely different ball games. Nestlings are so helpless, while the adults each had unique personalities. Their color-band combinations became part of our daily conversation: "I saw RX-RW today, and he was with GW-WX." It is almost as if we had seen them on the street and were gossiping about them! In truth, we were using shorthand codes signifying the unique color-band combination (two bands per leg) placed on each bird.

Just as the breeding season ends and migration begins for the Louisiana

interconnected suite of negative disturbances that precipitated a steep population decline in waterthrush in West Virginia.

BioOne is a leading nonprofit publisher of scientific research that aims to make scientific research more accessible to the public. It connects authors, publishers, professional societies, academic institutions, libraries, and research funders in the common goal of maximizing access to critical research.

After winning the award, Frantz commented, "We need to reevaluate if we should allow shale gas infrastructure and development as close to forested headwater streams as currently allowed. Our headwater stream ecosystems are largely overlooked for protection and regulation despite their importance to downstream life and despite being the source of our public drinking water."

We congratulate Dr. Mack Frantz on his well-deserved selection for the BioOne Ambassador Award! ■

Waterthrush, the field technicians and Ph.D. students who study them also move on. My seasons at Powdermill have been short, but my emotions are always stirred upon recalling my experiences. ■



BUILDING CAPACITY

National Aviary Builds Capacity for Ecuador's Bioparque Amaru

by Kurt Hundgen, Director of Animal Collections

The National Aviary's work to save species is not limited to Pittsburgh. Like many other Association of Zoos and Aquariums (AZA) institutions, the National Aviary has taken steps to positively impact field conservation in the native habitats of many of our bird species around the world.

In the past, AZA institutions commonly participated in field conservation through two avenues: by sending their own organization's staff to a particular country to do the conservation work, or by providing financial support for conservation efforts led by other institutions.

As international field conservation programs have progressed, a third avenue has evolved around providing training, skill set development, and mentorship to local conservationists in key species' native habitats, so they can develop and take greater ownership of their own conservation programs. This third avenue has now become a crucial component for successful international field conservation programs.

In June, Victoria Arbeláez, Chief Administrative Director for Ecuador's Bioparque Amaru visited the National Aviary and participated in a week-long intensive training in various aspects of our operations.

Bioparque Amaru is our partner in the conservation breeding of Andean Condors,

and in all of our research and conservation efforts around the critical habitats of the High Andes. Because it has the second greatest diversity of birds in the world, our support for on-the-ground conservation in Ecuador holds the promise of tremendous benefits for bird conservation.

The purpose of Ms. Arbeláez's visit was to strengthen our conservation partnership with Bioparque Amaru and support their continued growth by providing her professional experiences. We further hoped to demonstrate how aspects of our operations could be integrated into Amaru's to improve their education programming, visitor engagement, and revenue generating activities. During her stay, Ms. Arbeláez participated in education classes, visitor engagement experiences, animal encounters, and interactive feedings. Additionally, she met with Directors and Managers for Marketing, Development, Education, Volunteers, and Visitor Services, and she received training and hands-on experience daily.



Victoria Arbeláez of Ecuador's Bioparque Amaru is incorporating aspects of the National Aviary's operations — like animal encounters — into her zoo's programming back home.

Upon returning to Amaru, Ms. Arbeláez rapidly initiated a new animal encounter program, a daily interactive feeding experience similar to our Rainbow Lorikeet feeding, and expanded the types of school programs and content offered to school groups.

Having the opportunity to grow and improve conservation programs in Ecuador is an honor for the National Aviary, but it is also core to our mission of improving the welfare of birds and their habitats through locally based conservation efforts. ■

Neighborhood Nestwatch

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would (on average) submit resightings of 50 individual sparrows in the year following banding, 25 sparrows two years after banding, 12 three years after banding, and six Song Sparrows four years after banding. The question is, does the percent survival differ for Song Sparrows banded in our rural, suburban, and urban sites?

We did a simplified analysis of this based only on individuals observed at least

one year subsequent to their banding (i.e. birds known to be site faithful). Although the sample size is not very large, it appears that Song Sparrows may actually enjoy a higher rate of annual survival in our urban sites, compared to suburban and rural. In fact, preliminary analysis indicates that Carolina Wrens, chickadees, and robins all survive as well or better in urban settings compared to suburban and rural. If this pattern holds true, and especially if other Nestwatch cities show the same pattern, then further research may reveal the reasons for it.

We look forward to continuing to analyze the data that our Neighborhood Nestwatch participants have collected, and making future comparisons with the other participating cities. Our thanks to all of the Pittsburgh Neighborhood Nestwatch participants who contributed data to the study. Thanks, too, to the biologists at the Smithsonian Institute, Robert Reitsma and Brian Evans, who have helped us in so many ways to get the Pittsburgh program off the ground and up to speed with Washington and the other Neighborhood Nestwatch cities. ■