
TOLEDO
ZOO
& AQUARIUM
CONSERVATION
ANNUAL REPORT
2018

INSPIRING OTHERS TO JOIN US IN CARING FOR ANIMALS

CONSERVING THE NATURAL WORLD.

TOLEDOZOO.ORG/CONSERVATION

CONTENTS

CONSERVATION AROUND THE GLOBE

ARCTIC

Supporting **Polar Bear International's** work conserving the **Polar Bear** and partnering with the **Alaska SeaLife Center** to assist with research and recovery efforts for the **Steller's Eider**.

Polar Bear

Steller's Eider

MICHIGAN

Rescue-rearing and releasing **Piping Plovers** from abandoned nests at **Sleeping Bear Dunes State Park** where the endangered birds congregate prior to migration.

MICHIGAN & OHIO

Captive breeding, reintroduction and research of the endangered **Karner Blue Butterfly**.

WYOMING

Surveying and monitoring **Wyoming Toad** populations in **Laramie Basin, Albany County**.

OHIO

Rearing more than 500 **Hellbender salamanders** in conjunction with Penta Career Center for release into portions of their former range in **eastern and southern Ohio**.

INDIANA & MICHIGAN

Breeding and reintroducing endangered **Mitchell's Satyr Butterflies** to restored wetland sites.

Installing more than 40+ acres of **native prairies** on Zoo grounds and at partner organizations throughout **northwest Ohio**.

Reintroducing **Lake Sturgeon** to the **Maumee River** with the help of partner organizations.

Researching Ohio's imperiled **turtle species,** including **Blanding's Turtles**, for 12+ years.

Researching Ohio's rare snake species, including **Kirtland's Snakes**.

MEXICO & OHIO

Assisting threatened **Monarch Butterfly** populations by creating summer habitats in our native prairies and rearing and releasing approximately 1,000 butterflies for their annual migration to over-wintering areas in **Mexico**.

CUBA

Working with the US Navy to use radio telemetry to track the habitat use and activity patterns of the largest snake in the Caribbean, the **Cuban Boa**.

ARUBA

Conserving the **Aruba Island Rattlesnake** through research and education for the last 27+ years.

TANZANIA

Utilizing our captive breeding program to reintroduce more than 600 **Kihansi Spray Toads** into their native **Kihansi Gorge**.

NORTH EAST CHINA

Managing the US assurance population of critically endangered **Amur Leopards**.

KYRGYZSTAN

Participating in **Snow Leopard** radio collaring efforts with Panthera.

PACIFIC ISLANDS

Conserving several species of imperiled **Pacific birds**, including translocation efforts to sanctuary islands.

Pink-necked Fruit Dove

Many-colored Fruit Dove

MARIANAS ISLAND

AMERICAN SAMOA

SOLOMON ISLANDS

CHINA

Supporting the **Scaly-sided Merganser Task Force** in efforts to bolster population numbers and increase healthy habitat for this endangered bird.

TASMANIA

Partnering with **Save the Tasmanian Devil Program** to support species recovery from Devil Facial Tumour Disease.

NEW ZEALAND

Aiding **Kiwis for Kiwi** efforts to conserve this iconic nocturnal bird species.

REPRODUCTIVE BIOLOGY OF THE CUBAN BOA

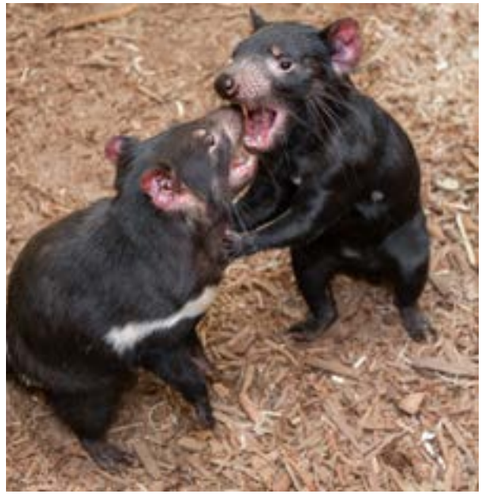
2003-Present

The Toledo Zoo Conservation staff has been working with the U.S. Navy to carry out research on the Cuban Boa, *Chilabothrus angulifer*, on Naval Station Guantánamo Bay for nearly 20 years. The result has been the collection of data on home range, habitat use, prey preferences, and reproductive biology that is unparalleled since the description of this species in 1843. Our current work focuses on the reproductive biology of the Cuban Boa, including courtship, gestation, and reproductive effort of the females. We are currently tracking 14 large Cuban Boas, implanted with radio-transmitters. Two of the females gave birth, one to a clutch of 22 offspring, almost the largest litter recorded for the research snakes.

TASMANIAN DEVIL MONITORING PROJECT

2014-Present

This long-term project, monitoring the populations of Tasmanian Devils in areas affected by the contagious Devil Facial Tumor Disease (DFTD) has been ongoing since 2014. Eight sites are monitored annually and the findings directly influence management decisions for each population. In 2018, results indicate most populations are persisting, despite DFTD, with at least one population increasing, but numbers at other locations are on the decline. An encouraging sign from this year's surveys was the discovery of a number of older, healthy individuals in a site with DFTD.



SANTA CRUZ GROUND DOVES

2017-Present

The Santa Cruz Ground Dove was once common among the islands of the Santa Cruz archipelago, in the Pacific Ocean, but has been severely impacted by human activities and invasive species. Following a volcanic eruption that killed many of the remaining birds, 110 doves were confiscated from the illegal wildlife trade, and placed in temporary holding while repatriation plans were solidified. On December 31, 2018, the first chick hatched in captivity – a major milestone for the conservation of this species. Ultimately, the goal is to construct a permanent breeding center in Honiara.

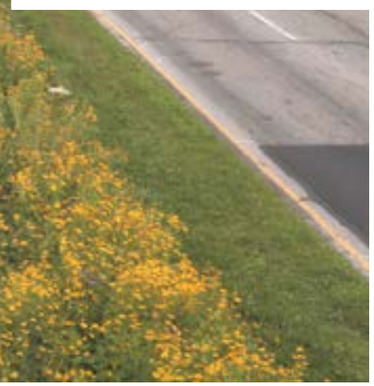
WILD TOLEDO PRAIRIE INITIATIVE

Increasing urban biodiversity

2013-Present

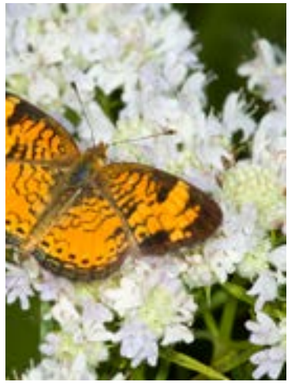
Pollinator decline is a global phenomenon driven primarily by loss of habitat and use of pesticides. Pollinators play a crucial role in food production as well as provided reproductive assistance to most flowering plants. Pollination services are estimated to be worth $217 billion globally. The prairie initiative seeks to increase pollinator habitat by utilizing abandoned and otherwise under-utilized properties for prairie plantings.

Toledo Zoo started planting prairies on-grounds and on the Anthony Wayne Trail median in 2013 and have expanded the program to include over 48 plantings as of 2018. The success of the 2017 Ohio Environmental Protection Agency Conservation Education grant helped create an educational off-shoot of the prairie program named Project PRAIRIE. All three new prairie installs in 2018 were paid school sites participating in Project PRAIRIE.



NATIVE PLANT SALES

Wild Toledo began selling native plants produced from seed at the Zoo to employees and the general public in 2017. 2018 saw the expansion of that program including bi-weekly visits to the Perrysburg Farmers Market and several on-ground sales opportunities. The native plant sales fill a currently unoccupied niche in the local floral market for native plants while allowing Wild Toledo to spread its mission of increasing local biodiversity beyond larger areas that are suitable for prairie installations. A new online shopping website, to debut in 2019, will allow shoppers to buy from Wild Toledo at their own convenience and pick up their purchases at pre-determined pick-up dates at the Zoo.



EFFICACY OF URBAN PRAIRIES ON BIOLOGICAL DIVERSITY

Insect and small mammal diversity in the on-grounds installations have been measured since 2014, allowing us to understand the efficacy of the urban plantings. Data from 2018 matched previous years indicating the on-grounds prairie installations are mature ecosystems with self-sustaining populations. In general, urban prairie plantings result in a 20-26x increase in butterfly species abundance, ~40x increase in invertebrate species abundance and the appearance of local mammal species not often seen in the area.

PRAIRIE UNDER GLASS

Wild Toledo staff were predominately preoccupied with museum duties during the 2018 season and the creation of the new prairie greenhouse. The prairie greenhouse will debut at the May 2019 opening of The ProMedica Museum of Natural History and will allow guests to learn more about the urban prairie program and experience a real prairie first-hand throughout the seasons. The prairie will roughly mimic outdoor conditions, going through a shortened and less severe winter than NW Ohio. In addition to over 50 species of prairie plants, the prairie will feature native Box Turtles and various species of native butterflies and invertebrates.

PROGRAM SUSTAINABILITY

To create a sustainable conservation program and grow with the increased demand for native plants and gardens, Wild Toledo will begin charging for installations as well as native garden creation. Prices for installation of 1 acre of prairie will be roughly $3,500 for the first year with $750 annual maintenance thereafter. Several local agencies, homeowners and businesses have expressed interest in the program. The increased program revenue will allow Wild Toledo to add additional staff as needed to meet growing demand and turn a small profit.

NATIVE BUTTERFLY CONSERVATION

Research and captive rearing of imperiled butterflies in the region

1997-Present

Lepidopteran species are looked at as ecological canaries, indicating the relative health of the local environment. Environmental damage and loss of habitat has led to a global reduction in Lepidopteran abundance by more than 20% with some species, such as monarchs, declining upwards of 94%.

Toledo Zoo conservation staff have been working with local and federal stake-holders to help conserve butterflies since 1997. In 2018, the butterfly program was awarded a $50,000 grant from USFWS for the purchase of a low-temperature growth chamber to be used to overwinter larvae and eggs as well as outfit the new butterfly conservation lab in the upcoming ProMedica Museum of Natural History. The new lab will provide a state-of-the-art facility for captive rearing of endangered Lepidopterans as well as allow guests to view the operation through large glass windows.

MONARCH

(Danaus plexippus plexippus)

The overwintering Monarch population in Mexico has seen a 90-95% reduction of its highest population numbers. As with most pollinators, the plight of the Monarch is closely tied to loss of suitable breeding habitat and an increased use of pesticides across their home range. Toledo Zoo released 998 tagged, migratory Monarchs during the 2018 season, matching prior years. All releases were performed by the education department during regular afternoon releases in Nature's Neighborhood.

MITCHELL'S SATYR

(*Neonympha mitchellii mitchellii***)**

The 2018 season was marked by declines across the remaining populations of satyrs and only five of our permitted 30 breeding adults were able to be collected. The 18 resultant larvae will be overwintered in the conservation greenhouse and be the first occupants of the new butterfly conservation lab. We are pursuing permit amendments that change the collection requirements and permitted collection locations to mitigate future shortages in breeding adults. Furthermore, we have received permission from USFWS to maintain a year-round captive colony that will serve as the majority of the breeding stock in future years, reducing the impact of wild population decline on our ability to successfully rear and reintroduce the species.

The new butterfly lab in The ProMedica Museum of Natural History has been designed to greatly increase our capacity to maintain a captive colony as well as allow us to control environmental conditions.

KARNER BLUE BUTTERFLY

(*Lycaiedes melissa samuelis*)

While wild collection of Karner Blue Butterflies (KBB) went well in 2018, we encountered another issue with fertility of the species. Of 114 eggs that were laid in captivity, only 18 of the eggs were fertile and resulted in adulthood. Those 18 adults were released at the Ohio KBB site however the reason for the low fertility is currently unknown. During rearing, mating was recorded on several occasions indicating fertility was likely caused by an external factor, such as inbreeding depression or disease. We are currently attempting to secure a grant to investigate these issues further.

In 2018, we began a long-term study with a grant from the Ohio Division of Wildlife to deploy 100 temperature loggers in KBB sites in Ohio and Michigan. The loggers record temperature every five minutes throughout the year. Along with the deployed loggers, each population is surveyed for population size in both the first and second flights using DISTANCE survey techniques made possible through the purchase of a high-precision GPS unit and laser rangefinder purchased with funding from USFWS. This is the first time many of these populations have had an accurate population estimate made. Over the long-term, reliable population size data, coupled with temperature data from the loggers will allow us to understand how weather impacts Karner population size and likelihood of extinction.

NATIVE TURTLE CONSERVATION

Monitoring local turtle populations

2005-Present

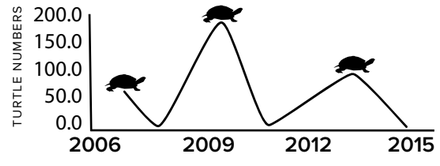
Turtles are globally on the decline and are generally considered the most threatened of the major vertebrate groups. Turtles face many familiar threats including habitat destruction, exploitation, pollution, climate change and disease. As populations decline, there has been an increase in conservation efforts targeting turtles. Long-term studies are rare as these efforts typically require a considerable amount of resources to provide meaningful data.

Blanding's Turtle

Toledo Zoo has been monitoring local turtles since 2005 in an effort to determine population sizes and conduct long-term monitoring to document potential changes. These efforts have included trapping surveys, tracking movements and habitat use with radio-telemetry and GPS loggers and, more recently, using turtle-sniffing Spaniels to help locate Box Turtles.

To date, Toledo Zoo has accumulated the only long-term turtle dataset for northwest Ohio. We work closely with local agencies to ensure our efforts produce actionable results.

Population size of Painted turtles in the Oak Openings Preserve



SPOTTED TURTLES

(Clemmys guttata)

In 2018, we continued our Spotted Turtle surveys and recaptured five individuals, including one originally marked by a researcher in 2007. Population estimates for our study site range from 34-79 individuals. This area in particular has undergone restoration work in recent years and long-term studies like this are critical to understanding how turtle populations respond to management.

BLANDING'S TURTLE

(Emydoidea blandingii)

2018 was a record year for the Zoo's Blanding's Turtle surveys with 18 captures, one of which was a female last seen in 2013. Radio-telemetry of 21 Blanding's Turtles has shown us that these turtles have the large home ranges typical of their species, but there are differences between the turtles in the large Lake Erie marshes and those in the highly-fragmented Oak Openings Region. Occasionally, one of the turtles moves out of radio-telemetry range and into areas with limited access. When this happens, our partners at the Ohio Division of Wildlife have let us join their pilot, Joe Barber, in their fixed-wing aircraft outfitted for telemetry. This lets our researchers cover a lot of ground in a short period of time and grants access to difficult areas.

WOODLAND BOX TURTLE

(Terrapene carolina)

We continued tracking 17 Box Turtles in the Oak Openings Preserve, but also added nine from Wildwood and one found in a woodlot near Perrysburg. About half of the Box Turtles are outfitted with GPS loggers that will provide much more detailed information on habitat use and movements. In 2018, we employed turtle-sniffing Spaniels to help researchers locate 29 Box Turtles in the metroparks. These turtles continue to provide useful information to managers, particularly in regards to prescribed fire, and serve as an ambassador for our turtle programs.

OTHER SPECIES

While surveying for Blanding's Turtles, we encounter other turtles and record the same data as we do with our focal species. These data can tell us about the entire turtle assemblage of an area and provide insight on the factors influencing turtle populations. Our compiled data from some of our study sites highlights the importance of long-term population data for turtles.

KIRTLAND'S SNAKE RESEARCH

Exploring the ecology of a rare snake

2015-Present

Kirtland's Snake

In 2017, the Kirtland's Snake was petitioned for listing under the Endangered Species Act, but was declined citing lack of data. Little is known about this cryptic species, making conservation planning difficult. There have been recent efforts, within Ohio, to census populations and revisit locations with historical sightings.

Beginning in 2015, Toledo Zoo began searching for Kirtland's Snakes at historic and high-potential sites in northwestern Ohio. These efforts have resulted in a number of Kirtland's Snake sightings, including one new county record for the state.

Using tiny transmitters (0.3 g), we began to track these snakes to follow their movements and look at habitat use. The snakes typically have small activity areas, but spend more time above ground than expected.

We received a grant from the Lake Erie Protection Fund and partnered with researchers from Bowling Green State University to predict the distribution of Kirtland's Snakes in the Lake Erie watershed and explore the use of environmental DNA in surveys. Our distribution models indicate habitat is limited, but more widely spread than anticipated, and separated by large, unsuitable areas. Kirtland's Snakes were detected at 20% of our sites using eDNA, suggesting this technique could be a useful addition to future surveys.

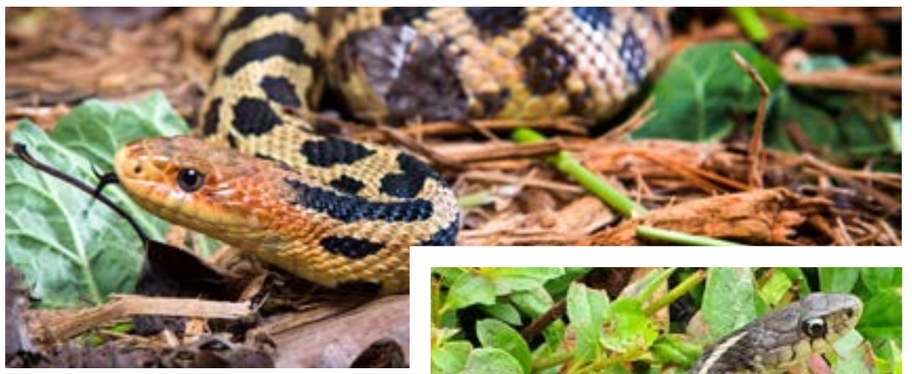
Kirtland's Snake with transmitter.

Kirtland's Snake in a crayfish burrow.

REPTILE AND AMPHIBIAN SURVEYS

Herpetofauna in urban habitats

2015-Present



Fox Snake

Garter Snake

As part of our ongoing efforts to monitor the biodiversity of our local prairies, Toledo Zoo began placing cover objects to attract reptiles and amphibians (herpetofauna). Artificial cover objects (ACOs) are ideal for surveying herpetofauna, because they are drawn to cover for food, shelter and basking sites. In 2018, we spent 22 hours flipping boards on-site for a total of 61 reptiles and amphibians from five species. Our restored prairies have a surprising amount of herpetological diversity and we occasionally get uncommon species like Butler's Garter Snake and Eastern Fox Snake under our ACOs right in Toledo!

Part of this project is to compare herpetological diversity within our restored urban prairies to what is found in the semi-natural parks and refuges throughout the area. We also survey reptiles and amphibians at 11 other sites throughout northwest Ohio. In 2018, we spent 69 hours flipping ACOs off-site and encountered 130 reptiles and amphibians from nine species.

In 2018, we noted a general decrease in the number of species encountered during our ACO surveys. However, conditions at many of these sites are variable and capture rates are heavily influenced by water levels and vegetation. This is yet another example of why long-term monitoring is necessary to determine whether trends in capture rate are natural or the result of some disturbance.

LAKE STURGEON REINTRODUCTION

Restoring an iconic species to the Maumee River

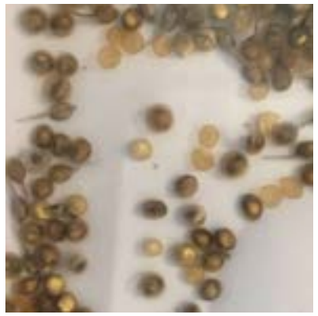
2018-Present

LAKE STURGEON

(Acipenser fulvescens)

Lake Sturgeon were historically abundant in Lake Erie, but overfishing in the late 1800s led to drastic declines and eventual extirpation. These long-lived fish, which can grow to 8’ long and weigh >300 lbs, were prized for their caviar and meat. Their decline was further compounded by anthropogenic changes in river conditions which blocked access to or degraded spawning and nursery sites. The Maumee River once supported a large number of spawning Lake Sturgeon, but an in-depth 2015 survey determined there was no evidence of spawning and the Sturgeon were unlikely to repopulate without intervention.

Streamside rearing facilities have been shown to be an effective measure for Sturgeon conservation because the young imprint to the rivers where they were born and will return to that river to spawn. Eggs are collected from a stable population, transferred to a streamside rearing facility and raised on local water to allow the fish to imprint on that waterway. As a pilot study, Toledo Zoo partnered with the US FWS and USGS to compare long-term results of fish raised at our streamside facility to fish raised at the National Fish Hatchery in Genoa, Wisconsin. The plan is to release 3,000 sturgeon, equally represented from the two hatcheries, into the Maumee River every year for the next 15-20 years.



In 2018, Toledo Zoo received ~72,000 eggs collected from a population of Lake Sturgeon in the St. Clair River. These eggs were placed into hatchers and maintained on Maumee River water. Lake Sturgeon eggs are typically kept at 65°F, but a spike in river temperatures, up to 85°F, caused the eggs to hatch after three days instead of the normal 10-14.

Following the difficult transition phases, Lake Sturgeon in our facility were maintained on bloodworms and grew ~1c/wk.

Once they weighed > 10 g, the fish were implanted with PIT tags for future identification. A subset of the fish were implanted with acoustic transmitters so our partners could monitor movements post-release. In total, the Toledo Zoo reared 650 Lake Sturgeon to be released into the Maumee River. A respectable number for many first-year facilities.

On October 6, we held Toledo’s first Sturgeon release party. Over 1,000 people attended including representatives from the local and state government, families, and media. Partners setup booths to provide educational opportunities and raise awareness about the plight of Lake Erie and its inhabitants. As part of the release, participants were offered the opportunity to sponsor a sturgeon where they would be notified if their fish’s PIT tag number was found when they return to spawn as adults. These efforts raised enough money to fund the acoustic telemetry and PIT tags for the next 3-4 yrs. Overall, this first year was deemed a huge success from the standpoints of our partners and the public. These release parties will become an annual event as we continue our long-term efforts to restore Lake Sturgeon to the Maumee River.

OUTREACH AND EDUCATION

KIRTLAND'S SNAKE SURVEYS

We were having no luck catching Kirtland's Snakes at one of our survey sites until a local teenager got in touch with us. When he spotted one of our cover objects near his favorite fishing spot, curiosity got the better of him and he ended up finding three Kirtland's Snakes where our researchers had turned up empty-handed. Moving forward, this young man enrolled in our ZooTeen program and continued to survey Kirtland's Snakes at that site throughout 2018. The efforts of this local teen led to 42 Kirtland's Snake captures at one site!

BLANDING'S TURTLE CITIZEN SCIENCE

In 2014, local resident, Terry Breymaier, attended a talk by our conservation staff where he learned turtle shell patterns could be used to identify individual turtles, like a fingerprint. He took this to heart and began taking pictures of the Blanding's Turtles he would find on and around his property. He even went as far as getting his neighbors involved, turning it into a community effort. In four years, these citizen scientists gathered 115 photos of 51 individual female Blanding's turtles, the most of this species recorded in the state to date. We had the opportunity to join Breymaier in the field one evening and we found seven female Blanding's Turtles in ~1.5 hours.

Blanding's Turtle found outside of garage door.

HIGH SCHOOL TURTLE SURVEYS

In an effort to expand our outreach and work with local high schools, we began a pilot program in 2018 where we loaned our turtle traps to a local high school group and provided them with training to collect data in the same manner as our conservation researchers. The data collected by these students will contribute to our long-term turtle survey dataset and our overall understanding of how these species use urban habitats.

CONSERVATION EXPLORERS SUMMER CAMP

Since 2012, Toledo Zoo Conservation Department has annually held three, week-long summer camps focusing on our local conservation initiatives. During this time, campers get hands-on experience performing all the same research-related activities as our conservation biologists.

Box Turtle

ON-GROUNDS MESOPREDATOR SURVEYS

2013-Present

Mesopredators, specifically Opossums, Raccoons, and Skunks, have all thrived in an urban landscape, benefitting greatly from anthropogenic resources. These mesopredators are part of urban life, but can pose a threat to the Zoo's animal collection through predation or disease. Where many places remove mesopredators, the Toledo Zoo began managing the populations around our property through vaccination, deworming, and surgical sterilization, thereby creating a healthy, non-reproductive group of residents. In 2018, we put in 100 trap nights and caught eight Opossums, 12 Raccoons, and one Skunk. All of the mesopredators were released back onto Zoo grounds following their veterinary examinations.

HELLBENDERS

2014-Present

The Toledo Zoo is a key member in the Ohio Hellbender Partnership (OHP), where we hatch wild-caught Hellbender eggs and rear them in captivity for three years before release. This head-starting gives the eggs greater hatching success and increases survivorship and growth of individuals released into the wild. This effort includes a partnership with the PENTA Career Center that provides students with the opportunity to gain hands-on animal husbandry experience and participate in endangered species recovery. In 2018, 139 Hellbenders from the Toledo Zoo and PENTA were released into Ohio streams.

Top left: Inside veiw of the Hellbender pod.

Top right: Three year old Hellbenders ready to be released.

Left: Dr. Nick Smeenk (Ohio Biodiversity Conservation Partnership) poses with a Hellbender at one of the release sites.

WILDLIFE TECHNOLOGY

Using technology to aid conservation efforts

2005-Present

RADIO-TELEMETRY: Toledo Zoo has a long history of using radio-telemetry in its conservation projects. Essentially, the transmitters give each animal its own radio station that researchers can tune into and locate that individual. We are currently tracking 40 turtles at nine different sites.

GPS LOGGER WORKSHOPS: In 2018, we hosted three workshops teaching attendees how to build and use GPS loggers for field research. Commercial loggers can cost upwards of $2,000 and greatly reduce the number of animals monitored. The loggers we build in our workshops do not have the fancy bells and whistles of commercial loggers, but hold 16,000 points and components only cost ~$50. Our workshops typically target the academic crowd at professional conferences, but this year we partnered with TPS' Natural Science and Technology Center to include the high school audience. Students were introduced to soldering, wiring, coding and GIS, all skills that will be beneficial as they move on with their careers.

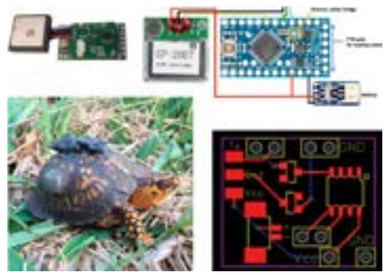
CAMERA TRAPS: We began using camera traps to survey wildlife in proposed Metroparks Toledo corridor properties in 2014. This project provided researchers with baseline information on a number of species of interest using the corridors. In 2018, this project gained new life when we brought on a graduate student to begin camera surveys targeting our local foxes. While still in the preliminary stages, the ultimate goal of this project is to outfit foxes with GPS collars to track their movements through urban habitats.

APP DEVELOPMENT: We worked with students and their professor at Bowling Green State University to develop a *beta* version of an app that will engage citizen scientists in turtle conservation. Upon completion, this app will collect valuable data that can be used in population estimates and to track individual movements.

PUBLICATIONS & GRANTS

Mission-focused Research

2018 Summary



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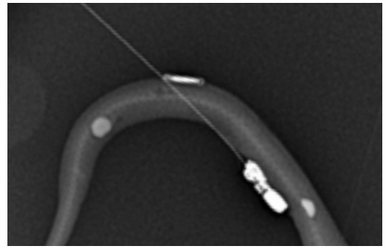

C.

PUBLICATIONS:

A. Cain and Cross. 2018. An open-source hardware GPS data logger for wildlife radio-telemetry studies: a case study using Eastern Box Turtles. HardwareX 3: 82-90.

B. Cross et al. 2018. *Clemmys guttata*: Fire scar healing. Herpetological Review 49: 107.

C. Cross et al. 2018. *Clonophis kirtlandii*: Diet. Herpetological Review 49: 336-337.

GRANTS:

Lake Erie Protection Fund: A Novel Approach to Identifying Kirtland's Snake Habitat Along Lake Erie.

USFWS Great Lakes Restoration Initiative: Captive Rearing of the Federally Endangered Mitchell's Satyr *(Neonympha mitchellii mitchellii)*

USFWS Great Lakes Restoration Initiative: Karner, Monarch, and Mitchell's Satyr Butterfly conservation

Ohio Division of Wildlife Karner Blue Butterfly captive rearing, research, and release.

CONSERVATION PARTNERS & SUPPORT

Ohio Lake Erie Commission

BGSU Bowling Green State University

U.S. Fish & Wildlife Service

Ohio Division of Wildlife

Maumee River Sturgeon Restoration

Look deep into nature,
and then you will
understand everything better.

- Albert Einstein

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