Midwest Partners in Amphibian and Reptile Conservation

2022 Annual Conference

Regional Species of Greatest Conservation Need

Schedule and Abstracts

Sponsored by John Ball Zoo, Pierce Cedar Creek Institute, and Potter Park Zoo

JOHN BALL ZOO

Pierce Cedar Creek Institute
for environmental education

POTTER PARK ZOO

Friday, September 9

Field Trip

Location: Pierce Cedar Creek Institute, 701 W. Cloverdale Rd, Hastings, MI 49058

Agenda: 11 am - Meet at visitor center, lunch to follow (bring yours or provided by the Institute if purchased with registration)
12:00 pm - Depart for the field
3:30 pm - Wrap up field trip, depart for Grand Rapids

Details: The 850 acres of this nature center and environmental education Institute are home to many rare amphibians and reptiles, and their habitats. The site has been the focus of a long-term eastern massasauga research project, as well as an eastern box turtle head-starting project. After lunch, we will explore the hardwood forests, prairies, and fen habitats that harbors these herps. The Institute opens at 9 am, and you are welcome to arrive early to explore their trails. A map of the property, and the trails, is linked here: https://cedarcreekinstitute.org/TrailGuide.pdf.

Please wear sturdy, comfortable boots and long pants, as there is abundant poison ivy and sumac on the property. Please also bring water and sun protection, and a raincoat for potentially inclement weather. For biosecurity reasons, we will ask everyone to bleach the bottoms of your footwear prior to heading into the field. We will have bleach stations available.

Social

Location: John Ball Zoo, 1300 Fulton St W, Grand Rapids, MI 49504

Agenda: 6 - 8 pm. Check-in to get your name tag; meet your fellow MWPARC conference attendees; make new friends and connections; re-meet people IRL; bid on silent-auction items; preview some awesome posters. We will provide an open bar, with non-alcoholic and alcoholic beverages, and snacks.

Silent auction: Open for bidding

Details: All meeting events will be held in the John Ball Zoo's Ballroom. The Ballroom is located in the upper floor of the John Ball Zoo's Administration Building just south of the main entrance. The Administration Building is brick with a green awning. Attendees can park in the Zoo's main lot at no cost.

Poster Presenters: Please set up posters Friday night, if possible, to give attendees extra time to view your work.

Saturday, September 10

Location: John Ball Zoo, Ballroom

Agenda: Oral presentations, poster presentations, and ADHriFT workshop. Posters will be set up Friday night and Saturday morning. Please use break periods to peruse the posters and meet with the authors.

Silent auction: Open for bidding

Details: Check-in starts at 8am, there will be coffee and bagels available

Remote access: Will be sent to all attendees a few days before the meeting

Schedule:

Time	Speaker	Title
Session: Welcome and Plenary		
8:45	Bill Flanagan	Welcome to John Ball Zoo
8:50	MWPARC Co-Chairs	PARC / MWPARC Updates and Announcements
9:15	Jacqueline Litzgus	Plenary Talk: Chasing catastrophes slowly: Changes in turtle population patterns over time
Break 10:00-10:15		
Session: Tracking Turtles in Michigan		
10:15	Diana Methner	Wood Turtle Spatial Ecology and Use of Recently Restored Oak-Savanna Habitat
10:30	Bria Spalding	Analysis of nesting movements in Blanding's Turtles and Wood Turtles using resistance landscape models
10:45	Elizabeth Cubberley	Habitat Use of Blanding's Turtles and Wood Turtles in Michigan
11:00	Trish Brockman	She's Going the Distance: Wood Turtle Movement on a Managed Forest Landscape
Session: Genetics		
11:15	Caleb Krueger	A range-wide genomic dataset for spotted turtle conservation
11:30	Mark Jordan	Conservation Genetics of Blanding's Turtle in Indiana, Ohio, and Michigan
Lunch and Posters 11:45-12:45 Lunch included in Registration; provided by John Ball Zoo		
Session: State Updates		
12:45	State Reps/Reps	State/State Chapter Updates - Lightning round
Session: Partners in PARC		
13:15	Matt Cross	A Model for Increasing Diversity and Inclusion in Conservation: A Case Study Using Rare Turtles
13:30	David A. Mifsud	The Michigan Amphibian and Reptile Conservancy (MARC): Education, Stewardship and Conservation of Michigan's Amphibians and Reptiles

Session: Demographics		
13:45	Dan Thompson	What 27 years of head-starting Blanding's turtles has taught us and done for our populations
14:00	Michael "Mic" Rohde	Population demographics of Blanding's Turtle (Emydoidea blandingii) in the northern Lower Peninsula of Michigan
Break 14:15 - 14:30		
Session: Occupancy and Landscape Modeling		
14:30	Dan Earl	Blanding's Turtle Occupancy and Abundance in the Lake Erie Watershed in Michigan and Ohio
14:45	Melissa B Youngquist	Long-term monitoring of the enigmatic Blanchard's cricket frog in Ohio: Occupancy, turnover, and landscape connectivity
15:00	Eric McCluskey	Where will the turtle cross the road?
Session: Natural History		
15:15	Katy Greenwald	Do common species eat common prey? Dietary diversity of rare vs. abundant snake species
15:30	Thomas Anderson	Life history traits of ringed and marbled salamanders in response to hydroperiod variation
15:45	Michael Lannoo	The Value of Old-Timey Natural History
Break 16:00 - Transition to Workshop		
Session: Workshop		
16:10	Megan Seymour	AHDriFT Workshop-The AHDriFT survey technique combines traditional drift fences with game cameras housed in a modified bucket to effectively capture photos of herps, small mammals, and many other critters. Participants will help assemble the buckets that house the cameras and learn how to install these in the field.

Dinner is "on your own"

Sunday, September 11

Location: John Ball Zoo, Ballroom

Agenda: Gather for coffee and bagels starting at 8 am. From 9-12, task team and working groups will meet. We've allotted time for each group so people can join any/all discussions they want. Please take down posters by 12 pm.

MWPARC meeting ends at 12 pm. Afterwards, attendees will be able to visit the John Ball Zoo for free with their name badge.

Silent auction: Closes at 10 am

Schedule:

Time	Group	Team Lead / Topic
8:00	Breakfast	Gather for Coffee and Bagels
9:00	Outreach and Communications Task Team	Jennifer Lamb / 2022 Roundup and 2023 Plans
10:00	Crawfish Frog Task Team	Nate Engbrecht / Best Management Practices
11:00	Blanding's Turtle	Matt Cross / Conservation Plan Draft Discussion

Lunch is "on your own"

Visit the animals at the Zoo using your MWPARC name badge as an 'entry' ticket.

Poster and Oral Presentation Abstracts

In alphabetical order. Abstracts for oral presentations are hyperlinked within the schedule.

Life history traits of ringed and marbled salamanders in response to hydroperiod variation

Thomas Anderson, Southern Illinois University Edwardsville; Jessica Sandoval, Southern Illinois University Edwardsville; Mariah Mack, Southern Illinois University Edwardsville

Hydroperiod, or the duration that a body of water remains inundated, is a critical abiotic constraint on the life history of aquatic organisms. Aquatic life stages of pond-breeding amphibians are particularly influenced by hydroperiod, as they require inundation periods that are long enough for metamorphosis to be completed. Plasticity in development and growth rates also allows some species to respond to changes in hydroperiod and complete their life cycle before pond drying occurs, though sometimes at a cost (e.g., reduced metamorphic size). We investigated how variation in hydroperiod affected the life histories of larval ringed (*Ambystoma annulatum*) and marbled (*A. opacum*) salamanders. We reared both species in outdoor mesocosms under one of three hydroperiod durations: constant water levels, medium hydroperiod duration (228 days) and shortened hydroperiod duration (214 days). We recorded size and date of metamorphosis of individuals, as well as survival of each species. Only two individuals completed metamorphosis in the short hydroperiod treatments, whereas all but two individuals that survived completed metamorphosis in the medium and constant treatments. Survival did not differ across hydroperiod treatments. Individuals in the constant water level treatment had the longest body lengths, heaviest masses, and latest dates of metamorphosis. Overall, we found that neither ringed nor marbled salamanders strongly alter growth rates to complete metamorphosis in response to hydroperiod variation, but benefit from remaining in ponds longer, as it allows them to achieve larger sizes at metamorphosis, a proxy for adult fitness. Out suggests that under future climate change scenarios, ringed and marbled salamanders may have limited capacity to respond to predicted alterations of hydroperiod regimes.

Correlation of Road Proximity with Sex Ratio and Body Size in Freshwater Turtle Populations within a Large Urban Wetland Complex

Katherine Brandewie, Purdue University Fort Wayne; Mark A. Jordan, Purdue University Fort Wayne

Turtle species are experiencing a global decline due to habitat loss and fragmentation, pollution, climate change, overharvesting, and road mortality. Urban habitats pose acute challenges, with roads being an especially adverse factor. Investigating impacts of road proximity on freshwater turtles can contribute to better local and global conservation strategies. In some areas, proximity to roads has been positively correlated to male biased populations and negatively correlated with average body size in freshwater turtle populations. The objective of this study was to evaluate if these correlations occur at the Eagle Marsh Nature Preserve, in Fort Wayne, Indiana, a large wetland complex surrounded by human infrastructure. The northern and western edges of the property are bordered by a four-lane road and interstate respectively. In May and June of 2018 – 2021 trapping was conducted at 8 sites of varying road proximity and wetland habitat. Four turtle species were captured: Painted Turtle (*Chrysemys picta*), Snapping Turtle (*Chelydra serpentina*), Spiny Softshell (*Apalone spinifera*), and Pond Slider (*Pseudemys scripta*). *C. picta* (n=438) and *C. serpentina* (n=131) were further analyzed due to their greater numbers. It appears that sex ratios for both species are male biased, regardless of road proximity with the mean *C. picta* male to female ratio at 2.2:1 and the mean *C. serpentina* male to female ratio at 3.4:1. Painted turtles trapped near the four-lane road had smaller carapace lengths and greater ratios of carapace width to length. Our results broadly support the hypothesized effects of roads on turtle sex ratio and morphology, but also suggests that the spatial scale of road proximity needs consideration.

She's Going the Distance: Wood Turtle Movement on a Managed Forest Landscape

Trish Brockman, Michigan State University; Bradly A. Potter, USFWS; Darren A. Miller, NCASI, Inc.; Steven M. Gray, MSU; Gary J. Roloff, MSU

In private working forests of Michigan's western Upper Peninsula, the wood turtle (*Glyptemys insculpta*) is a focal species of a collaborative conservation among the U.S. Fish and Wildlife Service (USFWS), National Alliance of Forest Owners (NAFO), National Council for Air and Stream Improvement, Inc. (NCASI), Michigan State University (MSU) and others. Wood turtles are currently being considered for listing under the Endangered Species Act of 1973, but little information is available on wood turtle conservation in private working forests. One aspect of wood turtle ecology that is of particular interest to forest managers is the extent of seasonal movements from occupied rivers. Wood turtles spend the fall, winter, and spring in and near these rivers, and move into adjacent uplands during the summer. Using VHF radio-telemetry, we collected location data from 10 adult females between early May and late October of 2021 and 2022 in two watershed basins of Michigan's Upper Peninsula. Preliminary analysis from 2021 showed that seasonal movements from the river by wood turtles were similar to those observed in other regions. Female wood turtles remained within 50m of the river until the end of the nesting season in mid-June. Afterwards, they moved inland and were observed farthest from the river during the first week of August at an average distance of 165m (SD = 68.51; range = 66m to 248m). In mid-August, wood turtles traveled back and, by late October, were all located within the river. Upon conclusion of our 2022 field season, we will rerun our analysis with this new data and model wood turtle distance from occupied rivers as a function of Julian date. This more detailed analysis will incorporate uncertainty into the estimates and help guide timing of management practices, informing wood turtle conservation efforts in private working forests of Michigan's Upper Peninsula.

A Model for Increasing Diversity and Inclusion in Conservation: A Case Study Using Rare Turtles

Matt Cross, Toledo Zoo; Chrissy Mominee, Toledo Zoo; Cari Ritzenthaler, Bowling Green State University

A major goal for the science, technology, art, engineering, and mathematics (STEM) disciplines has been to attract students from diverse social and cultural backgrounds. To pursue a career in the STEM field, individuals must gain real-world experience through field-based internships or technician positions. However, some of these pre-career STEM positions may limit accessibility to underrepresented groups through unintentional barriers such as cost, scheduling, and specialized equipment. To address this issue in our community, we initiated a conservation internship program, which developed a framework to identify and overcome barriers to increasing inclusion and diversity in field conservation. We collaborated with Toledo-area high school teachers to identify six individuals interested in pursuing a career in conservation, or a related field, and made them part of our field teams conducting surveys for Blanding's Turtles (*Emydoidea blandingii*). While the goal for this program is to increase diversity in conservation biology through providing a valuable work experience, we also evaluated the program's effectiveness through increasing conservation knowledge, feelings of inclusions, and influencing career choices. This talk will focus on implementation, preliminary results from the first field season, and ways to duplicate this program in other communities.

Habitat Use of Blanding's Turtles and Wood Turtles in Michigan

Elizabeth Cubberley, Purdue University Fort Wayne; Reine Sovey; Dr. Bruce Kingsbury, Department of Biology, Purdue University Fort Wayne

Wood Turtles (*Glyptemys insculpta*) and Blanding's Turtles (*Emydoidea blandingii*) are found throughout Michigan, where they are both listed as Special Concern. With both species in decline across their range and

currently under consideration for federal listing, it is important to understand their conservation needs. This study took place in Michigan's northern lower peninsula at a site that includes extensive habitat tracts with an interspersed network of aquatic features. We used VHF radio telemetry to track turtles during their 2018 and 2019 active seasons to better understand their patterns of habitat use at the landscape, home range, and microhabitat levels. To investigate macrohabitat use, we used Minimum Convex Polygons (MCP) to estimate seasonal activity ranges for 10 Blanding's Turtles and 12 Wood Turtles. We used Euclidean Distance Analysis to examine selection and avoidance of habitat types and compared how each species interacted with the landscape. To investigate microhabitat use, we collected 14 microhabitat variables at each turtle's location and at a random point once per week for 14 Wood Turtles and 24 Blanding's Turtles. Microhabitat use was modeled for each species using conditional logistic regression, with a generalized estimating equation element to limit bias due to individual variation. Home range estimations for both species ranged widely but were similar among Wood Turtles and Blanding's Turtles. Habitat selection was evident at the landscape level, with Wood Turtles indicating favorable use of creek, mid-canopy, and high-canopy upland habitat types and avoidance of river habitat and Blanding's Turtles showing selection of scrub-shrub and cut or burned areas. Neither Wood Turtles nor Blanding's Turtles selected for habitat selection at the home range level. Evidence for microhabitat selection in Blanding's Turtles was also weak. Wood Turtles were associated with sites farther from water with fewer trees, less overstory canopy cover, and more ground cover than random points. Ultimately our goal for this research was to supply baseline knowledge about the site's imperiled turtle populations that would inform future research efforts and to guide their management, particularly in the event of these species receiving federal protection.

Blanding's Turtle Occupancy and Abundance in the Lake Erie Watershed in Michigan and Ohio

Dan Earl, Michigan Natural Features Inventory; Bruce Kingsbury; Yu Man Lee; Greg Lipps; Jesse Sockman; Mark Jordan; Dan Guinto; and Matt Cross

Determining sites that can support larger and healthier populations, is critical for species management. Blanding's Turtles (*Emydoidea blandingii*) are a wide-ranging species of conservation concern in the Midwestern United States occurring at many isolated localities but with few estimates of population and habitat trends. Across the Lake Erie Watershed, in Michigan and Ohio, 800-m diameter plots (n = 97 in Michigan, n = 103 in Ohio) were surveyed using a combination of rapid assessment and long-term surveys. Rapid assessment sites had probability of occupancy for juvenile and adult turtles predicted using single season occupancy modeling with NLCD landcover types within the plot being used as covariates. Detection covariates included climate data, length of trapping survey, and Julian date. Blanding's Turtle abundance was also estimated using the same covariates fit to N-Mixture abundance models. Long-term surveys had population estimates derived from spatially explicit mark recapture (secr) methods. Naïve occupancy for Michigan was 0.602, the fitted model predicted a range from 0 – 0.92. Ohio naïve occupancy was 0.307, the fitted model predicted a range from 0 – 0.38. Length of survey and Julian date proved significant on influencing Blanding's detection, with decreasing capture rates by trap night and a peak detection in mid-May through mid-July. In Michigan, undisturbed upland and woody wetlands had the largest positive influence on occupancy predictions. In Ohio total forest was negatively associated with occupancy, with this result largely due to sites consisting of open water habitat. Abundance covariates were largely the same as occupancy covariates. Estimates abundance ranged from 0.49 – 8.48 turtles/site in Michigan; and 0.24 - 42 turtles/site in Ohio. When compared to secr estimates, N-mixture abundance predictions were significantly lower. Results from this study were used to inform development of a Blanding's turtle monitoring framework and conservation plan for Michigan and Ohio.

Genomic analyses and a common garden rearing experiment bring new insights into the relationship between the Streamside (*Ambystoma barbouri*) and Smallmouth (*Ambystoma texanum*) salamanders

Victor Fitzgerald, Miami University; Jason T. Bracken, Miami University; Tereza Jezkova, Miami University

Ambystoma barbouri and *A. texanum* are considered two separate, closely related salamander species. The defining feature of these two salamanders are traits associated with their breeding behavior. Ambystoma barbouri is generally a stream breeding salamander, which attaches its eggs in a single layer underneath flat rocks of first and second order streams. *Ambystoma texanum* is generally a vernal pool breeder which deposits eggs in small clumps on submerged vegetation, as is typical for the genus Ambystoma. These differences in reproductive traits together with deep mitochondrial DNA divergence found within these two salamanders have been used to delineate the two species. However, the distribution of mtDNA lineages and reproductive traits is not congruent and genetic and observational studies show evidence of hybridization between the two species. Here, we use ddRAD sequencing and a common garden rearing experiment to explore genetic differences between the two species. Our genomic analysis of A. barbouri and *A. texanum* sampled across Ohio, Indiana, and Kentucky revealed three, extensively introgressing, genetic groups, which do not support the delimitation of the species. Our experiment revealed that the females of each species retain their distinct reproductive traits under a common treatment and their larvae show differences in hatch time, hatch size, size at metamorphosis, time to metamorphosis, and pigmentation. The two species readily hybridized, hybrid larvae did not show an apparent reduction in fitness (as measured by hatching and metamorphosis rate), and the hybrid larvae showed an apparent maternal effect. We conclude that the two species do not form two monophyletic lineages, but do exhibit phenotypic differences that signal presence of local adaptation.

Dynamic or Unchanging: Sexual Dichromatism in American Toads (*Anaxyrus americanus*)

Andrea Fondren, St. Cloud State University; Jennifer Y. Lamb, St. Cloud State University

Sexual dichromatism can serve multiple functions including for crypsis, thermoregulation, and intraspecific communication. Sexual dichromatism is a form of sexual dimorphism used to describe differences in color and or pattern between males and females of a species. Sexual dichromatism can include both chromatic and achromatic color differences. Bufonid toads (Family Bufonidae) exhibit sexual dichromatism, but species outside of tropical regions have received less attention. In this study, we ask whether American Toads (*Anaxyrus americanus*) are dichromatic with respect to achromatic or chromatic color, and if that dichromatism varies seasonally. We captured and collected digital images and other data from phenotypic male, phenotypic female, and juvenile toads during (N = 77) and outside of the breeding season (fieldwork is ongoing, N = 26) at Lake Maria State Park in central Minnesota. We analyzed dorsal and lateral multispectral images in imageJ to quantify the average dorsal mottling score and the proportional area covered by dark pigment for each toad. We also used these images to calculate normalized reflectance values (red, green, and blue) and average brightness from each surface. Here, we summarize our findings and share the results of preliminary analyses comparing demographic groups and among seasons. This study will improve our understanding of sexual dimorphism in North American Bufonids and provide a foundation for future studies to ask questions about the role of color in anurans.

Do common species eat common prey? Dietary diversity of rare vs. abundant snake species

Katy Greenwald, Eastern Michigan University; Molly Dixon, U.S. Fish and Wildlife Service; Richard King, Northern Illinois University; Emily Virgin, Utah State University

Amidst massive losses in biodiversity, it is vital to identify the factors driving species declines. The main objective of this research was to assess dietary differences between the common and abundant snake species *Storeria*

dekayi and *Thamnophis sirtalis* and their less abundant and more geographically restricted sister species, *Storeria occipitomaculata and Thamnophis butleri*. We hypothesized that greater abundance and more cosmopolitan distribution are associated with consuming a wide variety of prey and more nonnative prey. To assess diets, we conducted field surveys of *Storeria* and *Thamnophis* species in Illinois and Michigan and analyzed DNA metabarcoding data from fecal samples. We found no significant differences in the dietary diversity or proportion of nonnative prey in the diets of common vs. rare *Storeria* or *Thamnophis* species. The diet of *S. occipitomaculata* was dominated by the slug *Deroceras laeve* (native), whereas *T. butleri* specialized on the *earthworm Lumbricus rubellus* (nonnative). Distribution of both native and introduced prey species may influence snake distribution, but our results suggest that all four species may flexibly adjust their diet based on local prey availability.

Conservation Genetics of Blanding's Turtle in Indiana, Ohio, and Michigan

Mark Jordan, Department of Biological Sciences, Purdue University Fort Wayne; Daniel Guinto, Purdue University Fort Wayne; Connor Dempsey, Purdue University Fort Wayne; Jessica Hinson, Purdue University Fort Wayne; Daniel Earl, Purdue University Fort Wayne; Greg Lipps, Ohio State University; Yu Man Lee, Michigan Natural Features Inventory; Bruce A. Kingsbury, Purdue University Fort Wayne; J.J. Apodaca, (Tangled Bank Conservation; Matt Cross, Toledo Zoo

Understanding the distribution and level of genetic variation is fundamental to making conservation decisions to prioritize populations for potential recovery and to develop strategies for population augmentation. The Blanding's Turtle (*Emydoidea blandingii*) is of conservation concern across the Midwest, but there is limited information on the genetic status of populations in Indiana, Ohio, and Michigan. We surveyed turtles at localities within the species' native range of the first two states and in southeast Michigan. Turtles were genotyped using 7,839 single nucleotide polymorphism loci (SNPs) discovered using RADseq [3RAD, n = 89, localities = 23)] and 13 microsatellite loci (n = 313, localities = 16), respectively. Analyses of genetic structure in the RADseq dataset suggested the presence of two weakly differentiated clusters aligned with the Lake Michigan and Lake Erie watersheds. Similar analyses of microsatellite data also revealed weak differentiation but identified four to six clusters within an overall pattern of isolation by distance. Levels of heterozygosity and allelic richness in microsatellite loci within localities were moderate to high, and comparable to other regions within the geographic range. No evidence of genetic bottlenecks was found, and although estimates of effective population size (Ne) were found to be dependent on sample size, a locality with the largest sample had an Ne = 137. We modeled the retention of genetic variation for the next 200 years and found approximately 50% loss of allelic variation when populations decline to or are maintained at 20 individuals. We conclude that while genetic variation appears to be robust at present, the reduced distribution, apparently low recruitment, and projected loss of alleles argues for management actions to augment populations. If translocation occurs within the sampled region, the minimal genetic differentiation among populations allows a focus on increasing numbers in declining populations without concern for fitness loss.

A range-wide genomic dataset for spotted turtle conservation

Caleb Krueger, W. K. Kellogg Biological Station, Michigan State University; Madison Whitehurst, Virginia Commonwealth University; Elyse Mallinger, Purdue University - Fort Wayne; Whitney Anthonysamy, University of Health Sciences and Pharmacy in St. Louis; Matt Cross, Toledo Zoo; Christina Davy, Carleton University; Mark Jordan, Purdue University - Fort Wayne; Yu Man Lee, Michigan Natural Features Inventory; Greg Lipps, Ohio State University; Eric McCluskey, Grand Valley State University; Jennifer Moore, Grand Valley State University; Richard Phillips, Wittenburg University; Rodney Dyer, Virginia Commonwealth University; Fredric Janzen, W. K. Kellogg Biological Station, Michigan State University

Spotted turtles (*Clemmys guttata*) occupy shallow wetland habitats along the Atlantic seaboard from Florida to Maine and throughout the Great Lakes from Ontario to Illinois. However, this broad geographic extent belies a drastic population decline, estimated at over 50% range wide and driven largely by habitat loss and illegal

collection for the pet trade. In response, spotted turtles have received legal protections across much of their range. Still, the active management and conservation of this species would benefit immensely from an understanding of its phylogeographic history and genetic structure. To address this need, our network of collaborators compiled ~1400 tissue samples representing all states and provinces in which the species occurs. Following a double digest restriction site-associated DNA (ddRAD) sequencing protocol, we have generated a genome-wide SNP dataset which will be used in subsequent analyses of demographic history, genetic diversity, and population structure. Results will inform the management and conservation of this imperiled species by guiding the delineation of management units and developing genetic assays to identify source populations of confiscated individuals.

On the Distribution of the Queensnake, *Regina septemvittata* (Say, 1825), in the Middle Fox River Drainage, Illinois, USA

Nathan J. Kutok, Illinois Natural History Survey, 1816 Oak St., Champaign, Illinois 61820, USA; Tristan D. Schramer, Department of Biological Sciences, Clemson University, 190 Collings St., Clemson, SC 29634, USA; Joseph T. Cavataio, West Chicago Environmental Commission, 475 Main St., West Chicago, Illinois 60185, USA

The queensnake (*Regina septemvittata*) is a medium-sized New World natricine snake found in the eastern United States with a specialized diet of crayfish. Its extant distribution in Illinois is restricted to the northern half of the state in three major watersheds, including the broader middle to upper Illinois River basin. In the Chicago region, queensnakes can be locally abundant within portions of the Des Plaines and Kankakee River drainages, but their documentation in other catchments is scant. One such case is the middle Fox River drainage, which has only yielded a few isolated reports and voucher specimens. To clarify the known distribution of *R. septemvittata* along the middle Fox River drainage in Kendall, Kane, and McHenry Counties, Illinois, we compiled records from natural history museum collections, citizen science observations, and field surveys, which were conducted at 32 sites opportunistically from 2016 to 2019. As a result, we report four previously unknown subpopulations, which were documented with voucher photographs and one salvaged specimen. These records, which represent the contemporary distribution of local subpopulations, help fill distributional gaps between historic specimens and improve our understanding of the zoogeography of *R. septemvittata* in the middle Fox River watershed, situated at the periphery of its range

Trapping turtles with cameras and nets: preliminary comparison of two methods

Jennifer Y. Lamb, St. Cloud State University, St. Cloud, MN; Deanna Leigh. MN Dept. of Natural Resources, Division of Parks and Trails, Sauk Rapids, MN; Bailey R. Richards. St. Cloud State University, St. Cloud, MN.

Populations of many freshwater turtles are declining across North America. To conserve and manage these populations we need efficient and effective monitoring strategies. A common approach is to use traps to capture individuals within wetlands and other aquatic habitats. Trapping is time intensive, and some species are less likely to enter traps than others. Recent studies have used trail cameras to document herpetofauna in terrestrial and aquatic habitats. We are conducting a two-year study of turtle populations in lakes and wetlands in central Minnesota. One of our focal taxa is the Blanding's Turtle, *Emydoidea blandingii*, a state threatened species. Here, we present preliminary findings from our first field season. In Summer 2022 we deployed basking platforms and trail cameras in 10 aquatic sites at Lake Maria State Park. Trail cameras recorded one image each hour from sunrise to sunset, and captured images when triggered by motion. We also used aquatic traps (i.e., hoop nets and minnow traps), to capture turtles at 8 of these sites on two separate occasions. All traps were baited and deployed for four consecutive days. Turtles detected with either method were identified to species, and those captured in traps were sexed, measured, marked, and released the same day. Thus far, we have detected four species of turtles across our sites, including Western Painted Turtles (*Chrysemys picta bellii*), Spiny Softshells

(*Apalone spinifera*), Eastern Snapping Turtles (*Chelydra serpentina*), and *E. blandingii*. We will use this dataset to compare species detection between these two methods.

The Value of Old-Timey Natural History

Michael Lannoo, Indiana University

The tasks performed by American field biologists and their approximate dates of origin fall out as follows: what species are out there? (= Natural History [= Biodiversity]): 1803; how do species change over time? (= Evolutionary Biology): 1859; how do different species fit together to form relationships? (= Ecology/Animal Behavior [Ethology]): 1875/1935; how can we save the species we want? (= Wildlife Biology): 1889; how can we save all species? (= Conservation Biology): 1900; and how can we bring back the species (or species functions) we could not originally save? (= Restoration Biology): 1935. The early natural history phase as it applied to ecology was succinctly encapsulated in Frederic Clements and Viktor Shelford's beautiful book, Bio-Ecology (1939). However, G. Evelyn Hutchinson's criticism of Bio-Ecology (in general, a lack of mathematical rigor) produced a re-orientation of ecology towards phenomena such as energy flow and nutrient cycling (so called "modern ecology"). In the wake of Hutchinson, ecology transitioned from "organisms having relationships" to "relationships having organisms." Here, using examples from our work on Crawfish Frogs (*Lithobates areolatus*), I offer that by regaining an appreciation of natural history facts—i.e., by re-embracing the approach of Bio-Ecology—we empower the members of local/regional conservation groups such as MWPARC to make important contributions to our understanding of global biodiversity.

Increased Diversity of Urban Amphibians in Cook County Restored Wetlands

Ian LaPat, North Central College; Dr. Melissa Youngquist, John G Shedd Aquarium

Habitat destruction, degradation, and fragmentation pose serious threats to wildlife in all reaches of the globe. Green spaces around Cook County vary in size, vegetation, proximity to other green spaces, and restoration status. Cook County Forest Preserves and Chicago Park District sites provide an opportunity to explore the habitat used by amphibians in an urban environment. The objective of our study was to explore the differences in abundance and species richness of larval amphibians between sites of varying characteristics to expand our understanding of how conservation practices affect amphibian communities. We sampled five sites in Cook County, two sites had prairie wetlands, two sites had forested wetlands, and one site had both prairie and forested wetlands. We compared the distribution and abundance of amphibian species across sites, and tested for effect of vegetation, habitat type, restoration stage (unrestored, recently restored, fully restored), site size, and proximity to other green spaces. Preliminary observations suggest that un-restored sites host the least diversity compared to sites that have been fully restored and managed long-term. Un-restored and recently restored sites typically supported two species. Restored prairie sites supported three species. Restored forested sites had the highest diversity and supported four to five species. We noted that toads are present across nearly all our sites, but tiger salamanders and blue spotted salamanders are only present in the fully restored, forested sites. Our initial results indicate a need for long term restoration, placing focus on vegetation removal within the basin and periphery of vernal pools.

Using historical climate data to test the overwinter mortality hypothesis for Blanchard's cricket frog (*Acris blanchardi*) declines in Ohio

Rick Lehtinen, The College of Wooster; John McCall, Michigan Technological University

Blanchard's cricket frog (*Acris blanchardi*) has enigmatically declined in the northern parts of its range in recent decades. Consequently, the species is listed as a species of concern, threatened, or endangered in Ohio, Michigan, Wisconsin, and Minnesota and is extirpated in Canada. In Ohio, previous surveys and collated cricket frog

presence data from 61 Ohio counties estimate that its range has contracted ≈120 km compared to historical records but has since stabilized in the western third of the state. Particularly cold and dry winters in the Midwest (especially from 1976-1978) coincide temporally with this decline and associated overwinter mortality is one hypothesis to explain it. This overwinter mortality hypothesis predicts that areas where declines occurred should have experienced more severe winters than areas where declines have not occurred. To test this prediction, we analyzed temperature and precipitation data measured from 1948 to 2003 at 20 weather monitoring stations in the current (n = 10) and historical (n = 10) range of cricket frogs in Ohio. Using a principal components analysis, we decomposed these variables into two dimensions measuring winter severity that explained 76% of the historical winter climate variation. Plotting the first two principal components indicated that temperature and precipitation variation in areas of cricket frog decline and in areas of cricket frog persistence were highly overlapping. While ordination of these data did confirm that the winters from 1976-1978 were unusually severe, western Ohio (where cricket frogs did not decline) generally had colder and drier winters than central Ohio (where declines occurred). This pattern of climate variation is the reverse of what is predicted by the overwinter mortality hypothesis and casts doubt on this hypothesis as a causal explanation for cricket frog declines in the Midwest.

Effects of hydroperiod and predation risk on *Ambystoma texanum* development

Mariah Mack, Southern Illinois University Edwardsville

Hydroperiod is the length of time in which a habitat is inundated with water and is an important environmental factor for aquatic-breeding amphibians that require inundation for successful larval development. In addition to water availability, predation risk has direct and indirect effects on amphibian development, such as by causing mortality or reducing foraging behavior. Some amphibians exhibit plasticity in their development time, growth rate, body size, and behavior to mitigate the unfavorable conditions posed by variable hydroperiods and predator presence. The aim of this study is to determine the potential range of developmental plasticity in *Ambystoma texanum* (Small-mouthed salamander) under different hydroperiod regimes and fish predation risk treatments. I am conducting a mesocosm experiment with three drying (hydroperiod) treatments and two predator treatments to test the effects of a short, medium, and constant hydroperiod crossed with the periodic additions of either an aqueous predator cue from Bluegill (*Lepomis macrochirus*) or a predator-free control cue. Treatments were replicated 6 times for a total of 30 mesocosms. I am quantifying salamander development by measuring the duration of the larval stage, growth rate, size and mass at metamorphosis, and the proportion of individuals that complete metamorphosis. I hypothesize that shorter hydroperiods and predator cue additions will accelerate *A. texanum* development, influence growth rates, and reduce size at metamorphosis. Understanding the effects of hydroperiod and predation risk on *A. texanum* life history traits is important for predicting how this species may respond to climate change-induced shifts in water availability and introduced predators.

Where will the turtle cross the road?

Eric McCluskey, Grand Valley State University; Caley Johnson, Grand Valley State University; Robert Sanders, MDNR; Jennifer Moore, Grand Valley State University

Roads pose a major threat to wildlife populations via long-term chronic mortality associated with wildlife-vehicle collisions and habitat fragmentation. Understanding the landscape context where wildlife species are more likely to encounter and cross roads can therefore provide important information that can be applied to mitigation measures and monitoring programs. Turtle populations are especially vulnerable to road mortality as slow moving, long-lived organisms and the potentially higher mortality rates incurred by nesting females. Blanding's turtle is a semi-aquatic species that often uses a variety of wetland types throughout its active season. These attributes and its status as a widespread species in decline make it ideal for assessing road related risks. We are developing road crossing models for Blandings Turtle in Manistee National Forest in northwestern Michigan to predict landscape risk along roadways for this sensitive species. We applied a common species distribution modeling (SDM) program Maxent to identify landscape features associated with Blandings turtle road records in

this region. These models will be compared to road risk models in New York State to determine if similar landscape features are associated with road crossing locations or if road mitigation measures will need to focus on region specific information.

Wood Turtle Spatial Ecology and Use of Recently Restored Oak-Savanna Habitat

Diana Methner, Grand Valley State University; Dr. Jennifer Moore; Dr. Eric McCluskey; Dr. Paul Keenlance

In the United States and Canada, approximately 38% of testudines are under significant worldwide threat primarily due to anthropogenic causes including overexploitation and habitat degradation, fragmentation, and loss. Wood turtles (*Glyptemys insculpta*) are one such species that is at-risk and as such, the United States Fish and Wildlife Service is scheduled to make a listing decision for this species under the U.S. Endangered Species Act. This study gathered spatial and habitat data of a wood turtle population in the northwestern Huron–Manistee National Forests in Michigan, USA. We sought to compare home ranges and movement in relation to recent and planned oak-savanna barrens restoration by the United States Forest Service. In 2021 and 2022, we radio-tracked 21 wood turtles to collect location, activity, and habitat use data. We analyzed 50% (core activity area) and 95% (total) home ranges and found a significant difference between home range sizes for males and separately, females. We found consistent use of forested habitat adjacent to, and open canopy habitat within, managed areas. Evidence of frequent use and nesting occurring in managed areas exemplifies the potential positive effects of local habitat restoration on this wood turtle population. Management of habitat utilized by an at-risk species, such as the wood turtle, establishes a need for population monitoring to ascertain the success and effects of management on the local faunal community. Continued monitoring is required for a more comprehensive understanding of this wood turtle population's response to restoration in this area.

The Michigan Amphibian and Reptile Conservancy (MARC): Education, Stewardship and Conservation of Michigan's Amphibians and Reptiles

David A. Mifsud, Michigan Amphibian and Reptile Conservancy; Melissa Sano; Jim Harding; Chris Woodley

The Michigan Amphibian and Reptile Conservancy (MARC) is a 501c3 Nonprofit dedicated to the conservation of amphibians and reptiles through education, training, stewardship, and research in Michigan and the Great Lakes Region. MARC's focus is to educate on the importance of herpetofauna, what species are of greatest risk, the necessity of keeping common species common, and ways individuals and organizations can become involved. This proactive strategy helps foster and create stewards across Michigan, helping to serve as advocates for our Species of Greatest Conservation Need and all herpetofauna! Only with the support of our community and through local level bottom-up actions and engagement will we be truly effective at protecting and conserving our herpetofauna heritage. This presentation will focus on the goals and objectives of MARC, projects underway, and opportunities to get involved. We will also discuss upcoming workshops and meetings to connect and mobilize our community in helping protect Michigan's amphibians and reptiles.

Response of terrestrial salamanders to the decade following timber harvest in hardwood forests

Alison Ochs, Purdue University; Rob Swihart, Purdue University; Mike Saunders, Purdue University

The removal of canopy for timber harvesting can have strong effects on terrestrial salamanders, which are critical components of forest ecosystems and indicators of environmental change. While some harvest methods, such as clearcutting, have been studied in the short term, there is little research on methods that have been proposed as more sustainable practices, such as uneven-aged patch cutting or shelterwood harvests, and few studies that have examined the decade following harvest. We examined the effects of clearcuts, patch cuts, and the first two

stages of three-stage shelterwood harvests on salamander relative abundance one year before and up to eleven years after harvest in clearcuts, shelterwoods, and patch cuts at the Hardwood Ecosystem Experiment (HEE) in Indiana. A total of 41,858 salamanders representing ten species were captured under artificial coverboards over this period with eastern red-back (*Plethodon cinereus*) and zigzag (*Plethodon dorsalis*) salamanders dominating. No significant declines occurred in the first three years following harvest, but salamander captures declined in the 4-6 and 7-11 year periods in clearcuts and patch cuts. Notably, these years corresponded to a regional drought that likely increased temperature and decreased moisture in harvest openings, further impacting terrestrial salamanders already affected by canopy loss. Neither the first nor second shelterwood harvests produced declines in salamanders, suggesting that canopy retention could prevent declines due to changing microclimate or drought. These results highlight the need to consider compound effects of disturbances such as drought and canopy loss and the potential for canopy retention to mitigate such effects.

AHDriFT Systems Provide Greater Effectiveness than Coverboards in an Indiana Marsh Snake Survey

Trevor Proctor, Purdue University Fort Wayne; Scott Bergeson; Mark Jordan

Temporal and financial restrictions are often limiting factors in herpetological research. Survey methods that are both proficient and cost-effective are beneficial in utilizing available resources. Traditional coverboard surveys are advantageous when physical samples are required (e.g. blood samples) but can cause undue stress on studied individuals. Additionally, this traditional method demands persistent fieldwork to collect sufficient quantities of data. Adapted-Hunt Drift Fence Technique (AHDriFT system) combines motion-sensing cameras with drift fences, providing an ongoing accumulation of encounters for population surveys in which hands-on collection is unnecessary. Requisite fieldwork is condensed, only requiring the construction of the system, repairs, and retrieval/replacement of memory cards and batteries. The aim of this study was to compare the effectiveness of AHDriFT systems and traditional coverboards during snake surveys at Eagle Marsh Nature Preserve in Fort Wayne, IN, USA. Coverboard transects were placed corresponding to three AHDriFT systems. The trapping sites were a planted Quercus macrocarpa forest, a mesic broad-leaved forest, and a mesic prairie. The boards were checked intermittently from March 19, 2021, through October 4, 2021. The AHDriFT systems operated for the duration of the described study. There were 41 instances of snake captures with coverboards and 110 sightings with the AHDriFT systems. *Thamnophis sirtalis* made up the majority of sightings for both survey methods except a single *Storeria dekayi* found under a coverboard and another single *S. dekayi* identified from AHDriFT systems. There were three snakes recorded by the AHDriFT systems that could not be identified. All but two of the coverboard sightings were from the mesic prairie. Conversely, AHDriFT systems consistently collected sightings from each habitat. AHDriFT systems recorded snake activity, even at sites where coverboards did not attract snakes. These results suggest that AHDriFT systems may be more effective than coverboards in habitats with greater moisture and shade.

Biofluorescence and its variation in Western Painted Turtles (*Chrysemys picta bellii*)

Bailey Richards, St. Cloud State University; Matthew P. Davis, St. Cloud State University; Jennifer Y. Lamb, St. Cloud State University

Biofluorescence occurs when organisms absorb high energy light (e.g., ultra-violet [UV] or blue light) and then emit lower energy light, resulting in different emitted colors. Biofluorescence has been documented in many groups of reptiles, including squamates, turtles, and birds, as well as other vertebrates, like amphibians, and cartilaginous and ray-finned fishes. The only species of turtles known to biofluoresce are Hawksbill and Loggerhead sea turtles. This study sought to document biofluorescence in a species of freshwater turtle, the Western Painted Turtle (*Chrysemys picta bellii*), and to test for differences in fluorescence by body region and sex. We quantified fluorescence intensity from digital images taken under UV and blue light from multiple body regions across 22 female and 47 male turtles. We used linear mixed effects regression models to analyze the

effects of sex and body region on fluorescence intensity. We identified the best model using Akaike's Information Criterion corrected for small sample sizes. Our results indicate that Western Painted Turtles do fluoresce under both blue and ultra-violet light. Under UV light, peak emissions are in the blue spectrum (mean = 499 nm). Under blue light, peak emissions average 534 nm, which is in the range of green light. This work does not identify the function(s) of biofluorescence in Western Painted Turtles, but it is a step towards a greater understanding of freshwater turtle biology. It is also one of the few studies documenting and describing biofluorescence in turtles.

Population demographics of Blanding's Turtle (*Emydoidea blandingii*) in the northern Lower Peninsula of Michigan

Michael "Mic" Rohde, Purdue Fort Wayne; Dr. Bruce Kingsbury, Purdue Fort Wayne

Turtles fulfill critical ecosystem services such as seed dispersal, nutrient cycling, and high biomass contributions. Yet of all recognized species, over half are currently considered threatened or extinct due to habitat loss and other anthropogenically caused ecosystem perturbations. One species of imperiled turtle in the U.S. is the Blanding's Turtle (*Emydoidea blandingii*). In Michigan, the species is considered to be a species of special concern. To best conserve such species, conservationists need to have a baseline understanding of current population demographics so that further research, management, and conservation can be based on strength or weakness of each population. I am conducting a mark-recapture study in the northern Lower Peninsula of Michigan to estimate population size, sex ratio, size, and other vital demographic measures. Preliminary results show that out of the 66 total turtles from the first season the sex ratio is 39% male, 50% female and 11% Juvenile (7, 11%). Out of the 33 females, 17 met the age, weight, and size parameters to be considered breeding females. However, the recruitment appears to be ongoing. Comparisons with local populations and populations across the Blanding's Turtles range will be discussed.

Biotic Drivers of Life History Variation in a Paedomorphic Salamander

Jessica Sandoval, Southern Illinois University Edwardsville, Thomas Anderson, Southern Illinois University Edwardsville

Phenotypic variation is ubiquitous among animals and is thought to provide an evolutionary advantage for species living in variable environments. Paedomorphosis, or the retention of juvenile traits in sexually mature adults, is a model system for understanding the ecological causes of phenotypic variation. In the facultatively paedomorphic mole salamander (*Ambystoma talpoideum*), the species' complex life cycle can follow three pathways that ultimately lead to the expression of two discrete adult phenotypes. An individual may undergo traditional development from egg to aquatic larva but will (1) remain in the water as a reproductive, gilled adult (i.e., paedomorph), (2) metamorphose into a terrestrial adult, or (3) delay metamorphosis and overwinter in an immature state in ponds, eventually developing into either the terrestrial or aquatic phenotype the subsequent year. We examined the influence of species interactions on phenotypic variation by assessing how larval salamander and predator densities impacted life history outcomes in mole salamanders. In May and December of 2013-2015, we sampled twenty-one ponds in western Kentucky using minnow traps and dip-nets. Increased larval densities in the spring resulted in greater numbers of overwintering larvae the following winter. We found a weak negative relationship between larval densities and paedomorph occurrence, while predator densities did not have a strong impact on production of paedomorphs or overwintering larvae. We hypothesize that inter and intra-specific competition among larval salamanders led to reduced growth rate and an inability to reach the size required for maturation, which resulted in an increase in overwintering larvae and decrease in paedomorphs.

Analysis of nesting movements in Blanding's Turtles and Wood Turtles using resistance landscape models

Bria Spalding, Purdue University- Fort Wayne; Dr. Bruce Kingsbury, Purdue University- Fort Wayne

Blanding's Turtles (*Emydoidea blandingii*) and Wood Turtles (*Glyptemys insculpta*) are two species at risk in Michigan. With continuing declines, it is important to understand the potential issues these turtles are facing. I have been exploring recruitment in both species in northern Michigan. As an aspect of this, I am interested in comparing risk-taking behavior during nesting movements between species and individuals. I used radio telemetry and data loggers to collect female movements during pre-nesting, nesting, and post nesting seasons. Data loggers were programmed to take 14 locations per day during pre-nesting and nesting, and 8 locations per day thereafter. Turtles were found using VHF telemetry a minimum of once per week to prevent losing individuals and for reprogramming units after nesting season. Resistance rasters were created using terrestrial habitat, elevation, distance from water, and road layers to determine risk, or resistance, level throughout the study site. Movements for different seasons were analyzed using both least-cost path analyses and the created resistance rasters to compare risk-taking behavior between species. I will discuss my findings to date, and the conservation and management implications of those findings. By determining which species and individuals make riskier moves and where concentrated mortality threats occur, we can shift management practices to best conserve these at-risk species.

What 27 years of head-starting Blanding's turtles has taught us and done for our populations

Dan Thompson, Forest Preserve District of DuPage County

The Forest Preserve District of DuPage County has been head-starting Blanding's turtles for 27 years. The recovery effort started in 1996 in response to small, isolated populations in DuPage County. Upon closer review of these populations, it was found that there were only older adults. The populations lacked age structure and recruitment was failing. Monitoring nest survival revealed very limited to no nest survival due to predation. Recovering the eggs in maternity pens and head-starting the hatchlings has allowed us to overcome most nest predation losses. Since 1996 over 4,000 hatchlings/juveniles have been released to bolster local populations. Recovery efforts of a species that is slow to mature sexually (12-14 years) with low fecundity takes a lot of investment and time to show significant results. This effort is much easier to handle if you invest in partnerships to help distribute the work involved. This recovery effort has the support of many organizations such as Brookfield Zoo, Shedd Aquarium, Peggy Notebaert Nature Museum and Cosley Zoo to name a few. See what 27 years of work has done for the Blanding's turtles and how much more work is still needed.

Tale of Two Mudpuppy Populations: Impact of TFM on Ohio's Second Largest SalamanderTFM

Ryan Wagner, Ohio State University; Bill Peterman

Freshwater environments are among the most imperiled ecosystems on earth due to anthropogenic degradation. Among the most at-risk freshwater organisms are amphibians, which have experienced global declines during the last several decades. The Common Mudpuppy (*Necturus maculosus*) is a large-bodied, fully aquatic salamander that inhabits both lentic and lotic environments. Despite their wide distribution, recent population declines have been documented. Perhaps the most significant threat to mudpuppy populations is the use of 3-trifluoromethyl-4-nitrophenol or TFM, a chemical lampricide used by the US Fish and Wildlife Service to control the invasive sea lamprey (Petromyzon marinus) in the Great Lakes and its tributaries. TFM is known to cause a 29% decline in mudpuppy populations immediately following treatments. In this study, we aimed to better understand the long-

term effects of TFM applications on mudpuppy populations in Ohio. We conducted a mark-recapture study of two mudpuppy populations, one regularly exposed to TFM and the other unexposed. We estimated population size (N) and survival probability (phi) in both populations using mark-recapture. Both analyses were done using a Bayesian framework in JAGS. Estimated population size for the exposed site was 193.9 ∓ 25.3, while population size for the unexposed site was 334.2 ∓ 21.6. Estimated survival for the exposed site was 0.84 ∓ 0.05, while estimated survival for the unexposed site was 0.92 ∓ 0.01. Population size and survival were higher for the TFM-unexposed site compared to the TFM-exposed site. This suggests TFM may have long-term impacts on mudpuppy population size and survival.

Long-term monitoring of the enigmatic Blanchard's cricket frog in Ohio: Occupancy, turnover, and landscape connectivity

Melissa B Youngquist, John G Shedd Aquarium; Richard Lehtinen, College of Wooster; Greg Lipps, Ohio State University; John McCall, Michigan Tech. University; Kathryn Krynak, Ohio Northern University

The decades-long range contractions of Blanchard's cricket frog (*Acris blanchardi*) across the northern and eastern portions of the midwestern US remain enigmatic. Proposed causes of declines range from pesticides, to land use changes, to climate change. In Ohio, the range contraction appears to have stabilized and cricket frogs are now present in the western third of the state. We report results from long-term population monitoring, 2004-2021, northwest Ohio. We used occupancy modeling to assess effects of land cover and landscape connectivity on species presence and population turnover. Results suggest that the proportion of wetlands and cultivated cropland in the landscape, as well as the degree of connectivity influence site occupancy as well as colonization and colonization probabilities. However, increased connectivity was correlated with lower occupancy and increased risk of extinction; suggesting that cricket frogs may not be dispersal limited and that there is some factor other than landscape connectivity limiting their distribution and recolonization of previously extirpated locations.

State and State Chapter Updates

GLIFWC – John Coleman
Illinois – Scott Ballard, Joe Kath
Indiana – Nate Engbrecht
Iowa – Paul Frese
Kansas and KHS – Dexter Mardis, Daren Riedle
Michigan – Yu Man Lee
Minnesota – Carol Hall, Jennifer Y. Lamb
MIPARC – Jennifer Moore
Missouri – Jeff Briggler
Nebraska – Dan Fogell
North Dakota – Matt Smith
Ohio and OHPARC – Megan Seymour
South Dakota – Drew Davis
Wisconsin and WIPARC – Joey Cannizzaro