Survey and Monitoring of Amphibians and Reptiles with an Emphasis on Restored Habitats.

Three Rivers Park District. Minnesota
MWPARC – 2014 Annual Meeting
22-24 August 2014

MWPARC – 2014 Annual Meeting Survey and Monitoring of Amphibians and Reptiles with an Emphasis on Restored Habitats

**Field Trips**
Crow Hassan Park Reserve – Rogers MN
French Regional Park – Plymouth, MN

**Meeting Accommodations**
Camp Ihduhapi
YMCA Conference, Retreat and Team Building Center
3425 Ihduhapi Road
Loretto, MN  55357

**Planning Committee**
Carol Hall – MN DNR – Biological Survey
Erica Hoaglund – MN DNR – Nongame Wildlife Program
Krista Larson – MN DNR – Nongame Wildlife Program
Jeff LeClere – MN DNR – Biological Survey
Tim Lewis – Univ. of St. Thomas – Biology Dept.
Madeleine Linck – Three Rivers Park District
John Moriarty – Three Rivers Park District
Meeting Schedule

Friday – August 22nd

10:00 – 5:00  Field Trip of Restored Prairies and reptile reintroductions at Crow Hassan Park Reserve, Rogers MN
5:00 – 9:00  Registration and Check in at Camp Ihduhapi
7:00 - ?  Informal Social – Camp Ihduhapi Lodge

Saturday – August 23rd

7:00 – 12:00  Registration – The Lodge
8:00-9:00  Breakfast- Dining Hall
  Silent Auction Starts
9:00 – 12:00  Presentations (see abstracts for titles)
  9:00  Andrew Bradje
  9:30  Todd Arnold
  10:00  Gary Casper
  10:30 - Break
  11:00  Emily Stulik
  11:30  Walt Sadinski
12:00-1:00  Lunch - Dining Hall
1:30-3:30  Presentations (see abstracts for titles)
  1:30  Paul Bartelt
  2:00  John Moriarty
  2:30  David Staples
  3:00  Sheri Sanders
3:30 – 4:30  State Updates
4:30 -5:30    Posters and exhibitors

**Saturday – August 23rd (continued)**

5:30-6:30    Dinner - Dining Hall
7:00-8:00    Keynote Sue Galatowitsch
8:00-9:30    Posters and exhibitors
9:30        Silent Auction ends

**Sunday – August 24th**

8:00-9:00    Breakfast - Dining Hall
9:00        Bunk House Check out
9:00-12:00   National PARC update
             State updates - continued
             PARC Advisory Group
             Working Groups

10:00 – 11:30   Tour of Ihduhapi Bog (for folks not in working groups)

12:00        Lunch - Dining Hall

1:30        Field Trip/Visit of Turtle Beach at French Regional Park, Plymouth, MN
Keynote Speaker

Susan Galatowitsch
Professor and Head, Department of Fisheries, Wildlife and Conservation Biology
University of Minnesota, St. Paul, MN

Sue Galatowitsch is a Distinguished Teaching Professor at the University of Minnesota, where she has taught courses in restoration ecology, landscape ecology, horticultural science, and conservation biology. She also taught restoration ecology at the University of Cape Town while a Fulbright Fellow. Dr. Galatowitsch earned a B.A. in Environmental Biology from St. Mary's College-Minnesota, an M.S. in Botany from the University of Minnesota, and a Ph.D. in Ecology and Evolutionary Biology from Iowa State University. Her research focuses on revegetation, management of invasive species, and climate change adaptation for wetland and riparian ecosystems. In addition to many research publications, she is the author of the recently published Ecological Restoration (Sinauer 2012) and Restoring Prairie Wetlands: An Ecological Approach (with Arnold van der Valk) (Iowa State 1994).

AMPHIBIAN USE OF RESTORED WETLANDS

Of the many causes of amphibian population declines, habitat loss has likely taken the greatest toll. Consequently, wetland restoration is considered a valuable approach for increasing local amphibian species richness. However, over the past few decades, it has become increasingly clear that restoration site selection, design, and management need to be informed by project goals to achieve the desired outcomes. So, restored wetlands are more likely to sustain populations of particular amphibian species if their ecological needs inform project planning. For amphibians, wetland hydropattern, connectivity among wetlands, and upland land use/land cover can strongly affect colonization and population persistence. For all three of these features of restored wetlands, design guidelines to promote amphibian use are complex. Short duration hydroperiods limit predation intensity but also reduce persistence during droughts. High connectivity can facilitate colonization but favor arrival of invasive species, as well. Some upland features, such as roads, are clearly detrimental to amphibian use, whereas others, such as many suburban uses have variable effects on amphibian use. Nonetheless, it is possible to incorporate knowledge of amphibian habitat use and life-cycle requirements to enhance the biodiversity function of restored wetland ecosystems.
Presentation Abstracts

Todd Arnold
University of Minnesota, St. Paul, MN

USING MARK-RECAPTURE METHODS TO ESTIMATE POPULATION SIZE AND VITAL RATES

Mark-recapture methods can be an important tool for monitoring reptile and amphibian populations, but the methods are data-hungry and quantitatively demanding. In this talk, I’ll discuss some of these inherent trade-offs by considering mark-recapture methods along a continuum ranging from analyses of marked animals only (mark-recapture studies), mixtures of marked and unmarked animals (mark-resight models), or unmarked animals only (N-mixture models). Although it’s theoretically possible to estimate population size and vital rates from analyses of unmarked animals only, mark-recapture and mark-resight methods make fewer assumptions and provide more robust estimates of population size and annual survival. Using examples from local mark-recapture studies of painted turtles, bullsnakes, and plains hog-nosed snakes, I’ll highlight best-design practices for designing and implementing mark-recapture methods into long-term monitoring studies.

Andrew Badje
Wisconsin Department of Natural Resources; Bureau of Natural Heritage Conservation, Madison, WI

THE WISCONSIN TURTLE CONSERVATION PROGRAM

In Wisconsin, 11 species of turtles reside throughout a diverse array of wetland and upland habitats. Turtles are an evolutionary masterpiece, having survived the age of dinosaurs, numerous ice ages, and even early human cultures. Unfortunately they are having a much harder time coping with modern societies due to the increasing need for human transportation. The construction of roads, highways, and even railroads pose serious threats that turtles cannot avoid. Transportation creates habitat fragmentation and alteration of prime turtle habitat. Also causing direct roadside mortality of turtles by collisions with vehicles. The Wisconsin Turtle Conservation Program was initiated to find and catalogue these existing turtle crossing locations, so that road agencies, maintenance crews, and citizen conservationists can work together to make passages safer for turtles and other wildlife. This presentation will describe the design and implementation of the program as well as show recent citizen science success stories. As this project is still in its infancy years, we’ll show you where the Wisconsin Department of Natural Resources plans to take the program in future years, so that we can conserve turtles for future generations to enjoy.
RESPONSE OF ANURANS TO WETLAND RESTORATION ON AN AGRICULTURAL LANDSCAPE

Winnebago County, IA, is a national leader in wetland restoration. How do amphibians respond to the restoration of thousands of acres of wetlands scattered across an agricultural landscape? We measured occupancy rates, colonization rates, and movements of Chorus frogs (*Pseudacris triseriata*), Northern leopard frogs (*Lithobates pipiens*) and American toads (*Anaxyrus americanus*) among 22 restored wetlands in Winnebago County between 2008-2011. We measured occupancy with multiple surveys and program MARK, general dispersal patterns with mark/recapture and genetic analysis, detailed movements of individuals with radio-telemetry, and physiological costs of different habitats with biophysical models. Post-breeding movement patterns were mapped and analyzed with a Geographic Information System. Chorus frogs occupied 87-100% of the sites; leopard frogs occupied 59-91%; American toads occupied 71-89% of the sites. Chorus frogs always colonized restored sites within a year of restoration; depending on the distance to the nearest occupied wetland, American toads required 1-2 years and leopard frogs up to 3 years to colonize restored wetlands. Based on the movements of 22 frogs and 54 toads from April through October, toads traveled an average distance of 698 m (range = 58 – 2943 m), while frogs averaged 176 m (range = 44 – 654 m). Frogs did not leave wetlands or surrounding prairies, whereas some toads used croplands extensively after the crops attained sufficient growth and cover. Seasonal variation in physiological costs among habitats may explain some of these differences. These results will help us understand how land cover features on agricultural landscapes facilitate amphibian movements among restored wetlands.

HERP HABITAT RESTORATION IN SOUTHEASTERN WISCONSIN

For the past decade I have been heading up efforts by various land trusts and agencies in southeastern Wisconsin to plan and implement habitat restoration projects for native wildlife, including amphibians and reptiles. Over the years it became apparent that some very basic and elementary work was required to improve habitat restoration projects, such as simply understanding what species were of local conservation interest and worthy of attention, determining what their actual critical habitat needs were, and monitoring for tracking success. Methods for the collection of baseline data, local inventory and monitoring protocols, selection of focal species, landscape level planning, and monitoring for quality control were developed in a “toolbox” format to guide these projects. I will discuss how these projects evolved, the challenges encountered, and the tools we have developed, tested, and implemented.
RESTORATION OF BULLSNAKES (*Pituophis catenifer sayi*) INTO A RESTORED PRAIRIE: A 20-YEAR SUCCESS STORY

Bullsnakes were introduced into the Crow-Hassan Park Reserve in Rogers, MN in 1991 (Moriarty and Linck 1997). The release site was a 500 acre diverse restored prairie with a good population of pocket gophers. The original reintroduction was 16 snakes captured at Sherburne NWR and a few supplemental snakes in the first three years. The original release was in the center of the restored prairie. The snakes were followed using radio-telemetry for the first year. Their movements were quite extensive with several snakes returning to original release site to overwinter. Incidental Bullsnake sightings were recorded over the last 20 years. These included adult, juvenile, and hatchling snakes and the occasional clutch of eggs, both hatched and unhatched. There was no attempt quantify the population. In 2014, a mark-recapture study was initiated at Crow-Hassan. All snakes seen during regular prairie management activities were caught and pit-tagged. To-date 30 snakes have been caught, with up to eight snakes in one day and no recaptures. This study will be conducted for the next three years to develop a population estimate for the Crow-Hassan Bullsnakes.

DESIGN AND IMPLEMENTATION OF AN EDNA PROTOCOL TO EFFICIENTLY SURVEY SALAMANDERS OF THE GENUS *Ambystoma* AND THEIR CRYPTIC HYBRIDS.

Amphibians are declining worldwide, with recent declines in frog and salamander populations. As such, never has there been a more important time to accurately survey populations in order to identify and respond to declines quickly. Surveying salamanders is particularly difficult due to their cryptic morphology and their silent, underground lives. Surveys are therefore burdened by the need for uncommon expertise, extensive man hours, and expensive genetics to identify sites and demographics. In the Midwest, surveying and identification is hindered further by the presence of hybrid species in the genus *Ambystoma*, a dominant constituent of one of the most common genera in our salamander communities. At the same time, the semi-clonal, all female hybrids may present unique risks to the populations. Here we present a set of environmental DNA (eDNA) primers that can be used to quickly identify cryptic salamander communities of the genus *Ambystoma*, without the need for herpetological expertise or expensive sequencing. While our primer sets are specific to the Great Lakes *Ambystoma*, the procedure in developing this protocol can be followed to establish primers in other genera. eDNA protocols can greatly improve the efficiency of identifying current salamander habitat and be used to provide quick community demographics, vital in the effort to monitor and conserve populations.
INTEGRATING MULTISCALE DATA FROM SATELLITE- AND GROUND-BASED SENSORS TO ASSESS CLIMATE-DRIVEN CHANGES IN ECOLOGICAL CONDITIONS IN WETLAND-UPLAND LANDSCAPES

Landscapes of interconnected wetlands and uplands provide vital ecosystem services for humans and essential habitat for amphibians. Climate is a critical factor in determining ecological conditions in these landscapes and the persistence of amphibian populations, yet little information exists that describes measured relations between climate variables and key conditions. Producing such information is challenging because it requires long-term research integrated across biotic and abiotic variables and spatiotemporal scales. We initiated such a long-term study in 2008 as part of the Amphibian Research and Monitoring Initiative and in cooperation with a larger network of partners in the United States and Canada. We report here on initial results from 2008–2012 for four research areas in Minnesota and Wisconsin. We measured indicators of snow duration, surface water availability, amphibian occupancy and calling activity, vegetation greenness, and evapotranspiration in relation to climate variables using data collected via the MODIS satellite sensor, regional weather stations, and water-depth loggers and acoustic recorders deployed at individual wetlands. Two thousand twelve and 2010 were the 1st and 2nd hottest seasons on record, respectively, and part of a preponderance of hotter seasons over the past 40 years. Amphibian calling, which typically began after snowmelt and the week’s average daily mean temperature was ≥ 0ºC, and vegetation green-up occurred earliest in 2012. Wetland water depths were associated with the previous week’s total precipitation for the majority of wetlands we instrumented. Amphibian calling usually fluctuated with water depths and stopped when wetlands dried early, especially in 2009. Vegetation greenness and evapotranspiration changed with seasonal air temperature, precipitation, and wetland water depths, but changes in these remotely-measured indicators lagged behind those measured on the ground. Our results suggest climate strongly drove ecological conditions in these four wetland-upland landscapes and long-term integrated research is necessary to understand important real-time and future changes.

David Staples and Krista Larson
Minnesota Department of Natural Resources, St. Paul, MN

TEMPORAL TRENDS IN SPECIES' DETECTION RATES IN THE STATEWIDE MINNESOTA FROG AND TOAD CALLING SURVEY 1994-2013

We used a generalized linear mixed effect model to estimate local and statewide trends in species' detection rates in the Minnesota Frog and Toad Calling Survey for the years 1994-2013. The model included a random route effect in both the intercept and trend parameters to account for the repeated measures nature of the data and to prevent biases in trend estimates from the different sampling dates and frequencies among the sample routes; a random sample year effect was included to detect non-linearities in the long term trends. We present the overall statewide trends in detection rates for several frog and toad species in addition to the statistical and spatial distributions of trends among individual calling routes across the state.
MODELING AMPHIBIAN OCCUPANCY AND HABITAT USE IN A SYSTEM OF RESTORED WETLANDS

Amphibians have been of great conservation concern due to alarming declines in populations worldwide. These vulnerable ectotherms are threatened by habitat loss and degradation, especially in the Midwestern United States. Efforts to restore wetland habitat can mitigate some aspects of habitat loss, but effective sampling techniques and suitable analytical approaches are needed to accurately measure the quality and functionality of the restored habitat. Recently, occupancy modeling in program PRESENCE has shown promise as an innovative and advanced approach to measuring presence, absence, and habitat use of various species. This type of analysis was applied to anurans to measure occupancy rates, habitat use, and reproductive success in a 716 acre restored wetland system in Northeast Indiana. Two types of survey methods, call surveys and tadpole surveys, were used to measure anuran presence and absence. A preliminary model with constant occupancy and detection probability, denoted \( \Psi(\cdot)p(\cdot) \), revealed that all species heard and caught were suitable for occupancy modeling, with the exception of American Bullfrog tadpoles, *Lithobates catesbeianus*. This model \( \Psi(\cdot)p(\cdot) \) showed high occupancy rates in the Eastern Gray Tree Frog, *Hyla versicolor*, and The Northern Leopard Frog, *Lithobates pipiens*, for both surveys. Covariate effects on occupancy and detection probability, such as wetland size, degree of restoration, temperature, and humidity will be modeled in PRESENCE to rank occupancy models and predict habitat use. Multiple species, multiple season models will also be used to generate inferences on metapopulation dynamics and conservation statuses of these vulnerable species.
THE EFFECTS OF PLASTICS AND AQUATIC HERBICIDE APPLICATION ON SALAMANDER EGGS AND LARVAE.

The commercial Glyphosate-based herbicide Glyphomate41 is approved for use in wetlands and ponds because it is designed to be safer to aquatic wildlife than other formulations (such as Roundup or Vision). However, toxicology studies traditionally focus on direct short-term acute toxicity effects on individual study animals and do not require tests on sub-lethal effects on fitness for EPA registration. Our previous studies in the field and in the lab using plastic aquaria suggest that these aquatic herbicides cause density-dependent changes in community structure and also alter the development, growth and behavior of salamander larvae. These effects are not as intense or negative as those observed in studies using Roundup. However there is a current controversy about using plastic in experiments because it is possible for chemical contaminants such as phthalates to leach from plastic aquaria and if so they could interact with pesticides to confound experimental results. We conducted a 2x2x2 factorial study on effects of herbicide, plastic, and temperature on Jefferson Salamanders (Ambystoma jeffersonianum) by exposing salamander eggs reared in glass and plastic containers to the aquatic glyphosate-based herbicide Glyphomate41 reared at 16C and 18C. Herbicide and temperature, had significant effects on survival of eggs. Glass and plastic containers had no effect on egg survival, but all three factors affected time of hatching. We will present results on larval development, growth, behavior, and survival through metamorphosis.

MOVEMENTS OF PAINTED TURTLES BETWEEN THREE SLOUGHS IN CLAY COUNTY, MINNESOTA

In a long-term study (2001-2013), nearly 900 painted turtles (Chrysemys picta bellii) have been live-trapped in Clay County, Minnesota, to study growth rates, survival, population characteristics, and movements. Captured turtles were weighed, sexed, measured, marked by scute notches (and PIT tags starting in 2006), and released on the shoreline of the slough of capture. From 2001-2010, we live-trapped 2 sloughs that were <1 km apart and roughly 3 ha and 6 ha in size. From 2011-2013, a third slough (<0.4 ha) was trapped approximately halfway between the 2 original sloughs where cattle grazing had been excluded and shoreline vegetation was intact. The purpose was to determine if marked turtles from the original sloughs, especially the 3-ha slough with surrounding recent cattle grazing and/or plowing were moving into this undisturbed middle slough. From 2011-2013, we had over 600 captures of turtles. Of these, 22 PIT-tagged turtles (13 males, 6 females, and 3 unknown sex) moved between the 3 sloughs for a total of 82 captures. For 18 (82%) of the turtles, the 6-ha slough had at least 1 of the captures, and for 21 (95%), the middle slough did. Only 6 (27%) turtles were captured at least once in the 3-ha slough with the disturbed surrounding area. In contrast, 17 (77%) of the turtles moved back-and-forth between the middle...
slough and the 6-ha slough where vegetative cover was dense and continuous between the sloughs. The lack of vegetative cover from the cattle grazing/plowing appeared to be a deterrent for turtle dispersal between sloughs. Although documented movements between sloughs were relatively rare, we noted that a considerable number of turtles were captured in multiple traps within one of our sloughs, indicating turtles were using different habitats within each slough.

Brock T. Couch, Mark S. Mills, and David C. Ashley
Department of Biology, Missouri Western State University, St. Joseph, MO

SURVEYING AMPHIBIAN LARVAE USING AQUATIC LIGHT TRAPS

Many sampling techniques are used by researchers to obtain the best information for a study. Similar to the research being conducted, sampling techniques are always evolving to provide the easiest and most efficient way to gather data. As part of a multi-year survey to determine how amphibians were colonizing and using man-made vernal pools in the Mark Twain National Forest near Steelville, MO, we investigated whether using BioQuip® Aquatic Light Traps, was an effective way to sample for amphibian larvae. We sampled 17 man-made vernal pools using a variety of techniques, including aquatic light traps that are typically used to trap mosquito larvae and other invertebrates. We also tested the effectiveness of the lights (glow sticks) in these traps by comparing traps set with and without lights. We collected multiple species of amphibian larvae using this technique; including, *Ambystoma maculatum*, *Notophthalmus viridescens*, *Anaxyrus americanus*, *Lithobates clamitans*; and *Lithobates sphenocephalus*. We also found that the traps with lights captured over twice the number of amphibian larvae than those without lights. Used in combination with other standard collecting techniques (e.g., dip nets, minnow traps, and calling surveys), aquatic light traps may prove to be an effective way to collect amphibian larvae.

Brock Couch, Mark Mills, and Dawn Drake
Biology Department & History and Geography Department, Missouri Western State University

USING GIS TO DETERMINE THE SUCCESS OF AMPHIBIAN REPRODUCTION IN MAN-MADE VERNAL POOLS

Amphibian populations are declining worldwide because of various factors such as habitat destruction and disease. Creating new habitat and/or rehabilitating damaged or lost habitat has become an important tool used to restore amphibian populations. For our study, we were working in Mark Twain National Forest to determine if amphibians will use man-made vernal pools. To identify the species using each pond, we used calling surveys and collected tadpoles or larvae using traps and dip nets. We found that a variety of different amphibian species used the vernal pools: including, *Lithobates clamitans; Lithobates sphenocephalus; Anaxyrus americanus; Anaxyrus fowleri; Acris blanchardi; Pseudacris crucifer; Ambystoma maculatum;* and *Ambystoma opacum*. From this data, we further wanted to determine which man-made vernal pools would be most suitable for amphibian reproduction using GIS (ESRI ArcGIS). To this end, we correlated various habitat types or categories to species richness as well as the presence of individual species.
Lauren Hall and Bruce Kingsbury,  
Indiana-Purdue University Fort Wayne, IN

BASKING PLATFORMS AND WILDLIFE CAMERAS AS NOVEL MONITORING TECHNIQUES FOR AQUATIC REPTILES

Aquatic herpetofauna are often difficult to survey by visual encounter methods because of their clandestine nature. We explored the use of artificial basking platforms and wildlife cameras to help overcome these challenges to assess habitat occupancy by aquatic herpetofauna, including the Copper-bellied Watersnake (Nerodia erythrogaster neglecta). The copperbelly is federally listed as threatened, and is endangered in Indiana, Michigan, and Ohio. The study was conducted in the area occupied by the federally threatened populations of this species. Wildlife cameras set up in this area took pictures of each platform's surface every minute during May, June, and July of 2014 to determine which reptiles utilized these platforms. The data will be compared to occupancy data from these locations from the current season to determine if the use of basking platforms and wildlife cameras is a viable alternative to visual encounter occupancy surveys for copperbellies. Preliminary data will be presented. If the monitoring technique described here is successful, it has the potential to significantly reduce costs and surveying effort for continued monitoring of these small and imperiled populations, and the approach may have broader application as well.

Broc Kokesh and Heather Waye  
Science and Math Division, University of Minnesota Morris, MN

THE EFFECTS OF WATER QUALITY ON THE HABITAT USE OF TIGER SALAMANDERS IN PRAIRIE WETLANDS

The tiger salamander (Ambystoma tigrinum) is a wide-ranging amphibian of North America common to prairie wetlands. Nevertheless, little is known about their ecology. It is therefore unclear as to what conditions in wetland ponds are well suited for tiger salamanders and what effects human activity may have on established populations. Ponds in prairie wetlands can vary greatly in water quality parameters. Previous work suggests that higher dissolved oxygen levels are ideal (Noland and Ultsch, 1981; Rose and Crumpton, 2006). Similarly, Sugalski and Claussen (1997) suggest that salamanders prefer areas of high pH, being a limiting factor in microhabitat use. Conversely, nitrate and ammonia contamination can be lethal to amphibian communities (Rouse et al., 1999) and high nitrite levels may indicate sublethal conditions leading to future nitrate contamination (Griffis-Kyle, 2007). In this study, I assessed how these parameters effect salamander survival and microhabitat use in the prairie pothole region of Western Minnesota. My goal was to see if differences in water quality between ponds may indicate habitat preferences among these salamanders, and thereby, assist in predicting where populations may migrate in subsequent years.
MONITORING AN URBAN TURTLE METAPOPULATION ON THE CAMPUS OF MISSOURI WESTERN STATE UNIVERSITY

Turtles are often common residents of urban environments, living in park lagoons, golf course ponds, urban streams and rivers, and other aquatic and terrestrial habitats. Urban areas provide unique habitats and problems for wildlife, including turtles. Nine ponds of various sizes are located on the 740-acre campus of Missouri Western State University. We began monitoring turtles in two ponds as part of laboratory exercises in the fall of 2008. We then expanded our efforts to include all nine campus ponds plus a small stream, Otoe Creek, as part of a series of summer undergraduate research projects. Since 2008 we have captured and marked over 120 turtles consisting of five native and one introduced species (number marked) living in the campus ponds: Apalone spinifera (2), Chelydra serpentina (54), Chrysemys picta (52), Graptemys pseudogeographica (1), and Trachemys scripta elegans (15), and an introduced subspecies, Trachemys scripta scripta (2). Population size estimates for each pond ranged from 4-26 turtles. These ponds are small (< 1 ha) and vary greatly in depth and hydrology, with one pond completely drying during the severe drought of 2012 and two ponds drying in 2013. Pond fidelity seems high, with several turtles being captured multiple times in the same pond over 5 years (e.g., one slider has been captured 15 times since 2009 in the same pond). However, at least 16 turtles moved among the ponds, traveling straight-line distances ranging from 133-890 m due to pond drying and other unknown factors.

Peter Sebastian (Veterinary Population Medicine, University of Minnesota), Katie Talbott (Minnesota Zoo), Tiffany Wolf (Veterinary Population Medicine, University of Minnesota and Minnesota Zoo), Irene Bueno (Veterinary Population Medicine, University of Minnesota), Sara Sokolik (Veterinary Population Medicine, University of Minnesota Matt McLaughlin, Minnesota Zoo), Allan Pessier, (Amphibian Disease Lab, San Diego Zoo for Conservation Research), and Dominic Travis (Veterinary Population Medicine, University of Minnesota)

PREVALENCE AND RISK FACTORS OF CHYTRID AND RANAVIRUS INFECTION IN A DAKOTA COUNTY AMPHIBIAN COMMUNITY

Amphibian populations are declining at an alarming rate: nearly one-third of all amphibian species are threatened with extinction. One major driver of amphibian decline is infectious disease, with both chytrid fungus (Batrachochytrium dendrobatidis) and ranaviruses (family Iridoviridae) implicated in mass die-offs. Wild amphibians are a critical component of Minnesota’s ecosystems, and act as indicators of environmental health. A handful of studies have documented the presence of both chytrid fungus and ranavirus in certain locations of Minnesota. However, much remains unknown about the epidemiology of these pathogens in Minnesota including their biogeography, risk factors, and the extent of the threat posed to the sustainability of Minnesota’s amphibian populations. We are conducting a unique collaboration among the University of Minnesota’s Veterinary Population Medicine, the Amphibian Disease Laboratory of the San Diego Zoological Society, and the Minnesota Zoo to pilot an approach to characterize the eco-epidemiology of chytrid fungus and ranavirus in Minnesota. The study is part of the Minnesota Zoo’s BioDiscovery Project aimed at documenting the diversity of local wildlife. The specific
aim of our study is to determine the prevalence of chytrid fungus and ranavirus in amphibian species commonly found on zoo grounds (Wood frogs, *Lithobates sylvaticus*; treefrogs, *Hyla* spp.; boreal chorus frogs, *Pseudacris maculata*; and American toads, *Anaxyrus americanus*) while examining the importance of pond type (vegetation community), water quality, and season. Currently, 189 swabs for each pathogen have been collected for RT-PCR analysis. Results from the study will help pilot a full-scale investigation into the impact chytrid fungus and ranavirus have on Minnesotan amphibian populations, and will also provide the Minnesota Zoo with baseline data to devise best practices for collecting frogs on site to restock native amphibian exhibits.

**Rochelle M. Stiles** (Indiana State University), Chris H. La Rue (Iowa Department of Natural Resources), Michael J. Hawkins (Iowa Department of Natural Resources), William A. Mitchell (Indiana State University), and Michael J. Lannoo (Indiana University School of Medicine)

**AMPHIBIAN RESPONSE TO A LARGE-SCALE HABITAT RESTORATION IN THE PRAIRIE POTHOLE REGION**

Over the next half-century, scientists anticipate that nearly one third of the currently recognized 7,201 amphibian species will become extinct. Many organizations have responded to the challenge of conserving amphibian biodiversity, some indirectly. The United States Fish and Wildlife Service, Department of Natural Resources, and partners have been implementing habitat restoration efforts designed to protect water quality, provide recreational opportunities, and benefit wildlife at the regional level. Under the auspices of the Iowa Great Lakes Management Plan, over 130 wetlands have been restored in the past 30 years on recently purchased public lands—one of the largest wetland restoration projects conducted in the Prairie Pothole Region of the Great Plains. While not the main target of these restorations, we show that over 120 new breeding populations of native Northern Leopard Frogs (*Lithobates pipiens*; *n* = 80) and Eastern Tiger Salamanders (*Ambystoma tigrinum*; *n* = 41) have been established; in addition, we found 19 breeding populations of non-native American Bullfrogs (*L. catesbeianus*). Using the program PRESENCE, we show that the presence of Leopard Frogs was related to wetland age (<18 years old), intermediate wetland sizes, and fish absence. The presence of Tiger Salamanders was related to the absence of both fishes and Bullfrogs. Because native amphibians respond positively to newly established wetlands, these results suggest that habitat availability has regionally limited populations. These data also suggest that the presence of fishes and introduced Bullfrogs compromises the ability of native Leopard Frogs and Tiger Salamanders to colonize these restorations.
Heather L. Waye,
University of Minnesota, Morris, MN

A TEST OF THE STABILITY OF SPOT PATTERNS FOR IDENTIFICATION OF INDIVIDUAL TIGER SALAMANDERS.

There is increasing interest in the use of unique spot patterns as a way to “mark” individual amphibians as an alternative to invasive techniques for studies of free-ranging populations. However, studies testing the efficacy of the pattern recognition technique have largely drawn their conclusions from the ability to recognize recaptured individuals that were identified solely by spot pattern. Individuals whose color pattern changed significantly would therefore not be identified upon recapture. For this study, tiger salamanders (Ambystoma tigrinum) were captured in West-central Minnesota and maintained in captivity for one year, and their dorsal and ventral surfaces photographed approximately every six weeks. The stability of the spot patterns and their utility as individual identifiers were examined through comparison tests that required the matching of photographs taken 12 months apart. Each volunteer who took the test was given a sample photograph and asked to choose the corresponding photograph from four others or to choose “no match”. On average, volunteers were able to correctly match the photographs only 67% of the time. Four of the salamanders (36%) could be identified by all volunteers, whereas another 36% were matched at a rate that was no better than guessing. Two of these changed from the spotted A. tigrinum pattern to the blotched A. mavortium melanostictum pattern. The high frequency of misidentifications and the dramatic changes in coloration have implications not only for studies that involve identification of recaptured individuals, but potentially for efforts to classify the different subspecies of tiger salamanders.
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Directions to Camp Ihduhapi:

From Hwy 55 West—at Cty Rd 19, turn left (South) through Loretto to Cty Rd 11, turn right. Go West for 3/4 mile. Turn left onto gravel Ihduhapi Road at camp sign. The Welcome Center is the first building on the left.

From Hwy 394/Hwy 12—At Cty Rd 29 / Baker Park Road, turn right (North), stay on 29 which turns into Cty Rd 19 to Cty Rd 11, just before the town of Loretto. Turn left onto Cty Rd 11 for 3/4 mile. Turn left onto gravel Ihduhapi Road at camp sign. The Welcome Center is the first building on the left.

We hope that your retreat at Ihduhapi will be fulfilling and meaningful. If you have any questions about your group’s visit to Ihduhapi, please call 763-479-1146.
Meet at Trailhead 12595 Park Drive.

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