



NORTHEAST PARTNERS IN AMPHIBIAN AND REPTILE CONSERVATION
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FEATURED PRESENTATION ABSTRACTS

Title: Conserving Snake Species of Greatest Conservation Need Threatened by an Emerging Fungal Skin Disease

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Abstract: Within the past several years, there appears to be an increase of observations of snake species exhibiting facial lesions, leading to many studies as to the cause. Recent work has correlated these facial lesions to fungal species *Ophiodiomyces ophiodiicola*, also known as snake fungal disease (SFD). These lesions often involve the orbit, pit-organ, or labial region, causing concern for the individuals' survivorship. Following protocols of the New England Timber Rattlesnake (*Crotalus horridus*) research of SFD by Roger Williams Park Zoo (Providence, RI), we currently have a 9 state SWG grant (2014-2015) to investigate effects of SFD on populations. With this study we assess the presence of SFD in all snake species in nine states by submitting biopsies to the National Wildlife Health Center. We're also assessing treatment strategies for severely infected individuals. In addition, the one MA population of Timber Rattlesnakes with the highest report of SFD is currently being radio tracked to assess if there are any differences between infected and non-infected regarding overwintering, movements, and habitat use. We are currently assessing management strategies of headstarting and captive breeding for populations not only suffering from SFD, but isolation, inbreeding, and increased mortality from road kill, poaching, and intentional killings. Our future project includes introducing a new population in a protected area within the Quabbin Reservoir, in Massachusetts.

Title: The Spiny Softshell Turtle: A Threatened Species in Vermont

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Abstract: The spiny softshell turtle (*Apalone spinifera*) is a medium to large aquatic turtle found in Lake Champlain and the lower sections of some of its tributaries. Individuals may live more than 50 years and females, which are larger than males, mature at age 12 or older. Gender is genetically determined. The softshell was listed as threatened in Vermont in 1987, was listed nationwide as threatened in Canada in 1991, and Québec officially listed it as threatened in 1999. One historic Vermont population has been lost, and two remain. Threats include habitat loss and degradation, angler hooking, propeller and boat strikes, nest depredation and flooding, and parasitic flies. Management of important communal nesting areas has allowed us to save many hatchling softshell turtles, as well as hatchlings of other species. Communal sites are protected from human disturbance, mammal depredation, habitat degradation, and flooding. This is accomplished by monitoring, signage, fencing, wire mesh nest covers, trapping mammals, vegetation management, and substrate enhancement. One hundred twenty-seven softshell nests were examined during 2015, 960 hatchlings emerged from 80 nests not disturbed by predators and another 209 live hatchlings and embryos not yet ready to emerge from underground nests were rescued. The Vermont Eastern Spiny Softshell Turtle Recovery Plan includes the following criteria for delisting: Having at least five nesting sites with a minimum of five nests each; evidence that at least 200 nests are protected each year; and successful emergence is occurring from at least 50 nests per year. We are making progress.

Title: Spotted Turtle (*Clemmys guttata*) Mark-recapture Results 2004-2015 at a Pennsylvania National Guard Training Site

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Abstract: The study area, a military installation in Southcentral Pennsylvania, is located on over 17,000 acres of grassland, shrubland, woodland, and wetland. Spotted and several other turtle species are involved in a long-term mark-recapture monitoring program that began in 2003. Spotted turtles have been the most elusive of the three species with just 37 marks on record from 2003 to August 2015. Known capture sites have been consistent, but staff have found one new site in the last two years and may have detected an additional site in 2015. Traditional estimators suggest a population of roughly 57 to 77 turtles, depending on the model (Lincoln-Petersen, Bailey, Schnabel, Cormack-Jolly Seber). Seemingly reliable custom models in Program MARK suggest an installation-wide population of 92-104 animals over the entire period. With 21 turtles

already captured in 2016 (13 new to the study), it is likely that the population is still well underestimated annually despite 11 years of close monitoring and that Program MARK total animals estimates for the study period may be closer to the real estimate than annual estimates from the same. While that statistic seems to violate assumptions, longer-term recaptures may support survival rates high enough to achieve those upper estimates. This has implications for military training, federal listing potential, and conservation management decisions at the installation.

Title: High-resolution Mapping of Potential Vernal Pools using LiDAR and Object-based Image Analysis

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Abstract: Efficient, accurate mapping is essential to regional assessment of vernal pools. Common approaches using manual interpretation of aerial photography are effective but laborious, and automated methods often focus on small study areas and cannot be easily adapted for other locales. However, automated identification of potential vernal pools is now possible with a combination of LiDAR, a remote-sensing data type that permits construction of high-resolution topographic models, and object-based image analysis (OBIA), an expert-system approach that incorporates landscape context and other traditional elements of image interpretation. OBIA modeling templates were developed for two disparate study areas in the North Atlantic region, Addison County, Vermont and Cumberland County, New Jersey. Both templates used LiDAR-derived topographic models to identify candidate landscape depressions and then used LiDAR intensity and 4-band multispectral imagery (visible bands plus near infrared) to classify them according to the likely presence of water during spring conditions. The models for both sites captured high proportions of vernal pools previously identified by statewide manual interpretation programs, effectively mimicking the contextual clues that human use to identify landscape features. High rates of commission were also observed, but the models were designed to maximize the information available to stakeholders who verify vernal pools in the field and could be adjusted to reduce the incidence of false positives. As LiDAR availability increases in the North Atlantic region, this mapping approach can facilitate vernal pools conservation by expediting initial identification of potential pools and guiding field-based examination of functional amphibian breeding habitat.

Title: Amphibian Community Composition and the Occurrence of Disease in *Lithobates Sylvaticus*

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Abstract: In 2014 and 2015, we conducted amphibian surveys at 40 amphibian breeding ponds in the Stone Valley Forest (Petersberg, PA) and we screened tadpoles from all known wood frog (*Lithobates sylvaticus*) and green frog (*Lithobates clamitans melanota*) populations for chytrid fungus (*Batrachochytrium dendrobatidis [Bd]*). While all green frog populations (n = 11) tested positive for infections, only six out of 17 wood frog populations contained individuals infected with *Bd*. Logistic regression analysis suggests that the odds a wood frog population is infected with *Bd* nearly doubles (odds ratio = 1.86) with every additional amphibian species that co-inhabited the pond. Fisher's exact tests suggest that the presence of green frogs, red-spotted newts, and spring peepers are associated with an increased likelihood that wood frog populations will be infected with *Bd*. In 2015, tadpoles from eight wood frog populations experienced mortality events associated with the presence of the viral pathogen *ranavirus* (RV). Similar to the pattern observed with *Bd*, the probability of RV-induced mortality at a pond increased as amphibian species richness increased. Maximizing species richness is often a goal of conservation biology, but our results suggest it increases the likelihood amphibian assemblages will be infected by an emergent infectious disease. Monitoring of these wood frog populations is underway to determine if the presence of disease influences future reproductive output, as well as RV recurrence. Additionally, we hope to test archived tissue samples from 2014 to determine the extent of RV presence in the year prior to mortality events.

Title: Pitfalls of Analyzing Pitfall Data on Amphibian Orientation

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Abstract: Information on the construction and use of pitfall arrays to enclose amphibian breeding pools are widely available, but there is little guidance regarding the statistical analysis of orientation data from these sites. Two common null hypotheses are that

orientation is random (goodness of fit) and that two data sets are not significantly different (test of homogeneity), and these can both be tested using circular and nonparametric statistics. We examine the efficacy of the Rayleigh test, Rao's spacing test, chi-squared goodness of fit test, chi-squared test of homogeneity, the Watson-Williams test, the Kruskal-Wallis test, and Multiresponse Permutation Procedure (MRRP) using simulated data, field data, and expert opinion to examine the effects of binning and pool shape. While the Rayleigh test was robust to binning and pool shape, Rao's spacing test had high type I error when animals were binned by pitfall trap and chi-squared goodness of fit had high type I error when the pool was shaped as an ellipse. The Watson-Williams test had high rates of type I and type II error when used on distributions with concentrations of animals similar to those of our field studies, while other tests of homogeneity were adequate for all pool shapes and binning. Expert opinion indicated that some observations that were statistically significantly different were not ecologically different. We encourage future researchers using pitfall arrays to go beyond their statistics and visually examine their results to ensure that their conclusions make sense ecologically.

Title: A Historical Approach to Conservation of the Eastern Hellbender (*Cryptobranchus alleganiensis*) in New York and Pennsylvania

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Abstract: When planning for conservation and management of declining species, lack of historical data may pose challenges for those that have not been intensively studied or collected in the past. In the case of hellbenders (*Cryptobranchus alleganiensis*), few scientific surveys were conducted prior to the late 1970s and early 1980s, and official records of hellbender harvests were generally not kept. The resulting lack of information about historic distribution and relative abundance makes it difficult to determine the extent of hellbender declines or pinpoint when and why those declines began. This study uses a variety of sources, including newspaper archives, natural history expedition records, and personal accounts to map the historical distribution of hellbenders in New York and Pennsylvania. Information relating to hellbender mortality was also examined. Preliminary results indicate that although hellbenders historically were fairly ubiquitous throughout the Ohio River basin, they had a restricted range with relatively low abundance in the Susquehanna River watershed. Early accounts indicate few hellbenders were present in the Susquehanna or its tributaries prior to the early 1800s, with reports from the West Branch Susquehanna increasing through the mid-1800s. This pattern may reflect a much later introduction to that drainage than previously believed. In addition, this research revealed a history of intense persecution of hellbenders by recreational

stream users and commercial collectors that may help to explain some of the patterns of decline seen across New York and Pennsylvania today.

Title: Hatch Rates in a New Jersey Wood Turtle Population are influenced by Maternal Identity as much as Random Environmental Factors.

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Abstract: Monitoring efforts of wood turtles, *Glyptemys insculpta*, usually involve visual surveys to assess population health but seldom investigate rates of reproductive success. For three consecutive years (2013-2015), we found the hatching success of a New Jersey wood turtle population to be unusually low. Furthermore, annual, intra-individual hatch rates and comparisons between in-situ and artificial incubation revealed that many females consistently produced clutches with low hatch rates (<50%), regardless of incubation treatment. Additionally, the annual hatch rates of other females were either consistently high (>50%) or highly variable, ranging from as low as 0% in some years to as much as 100% during others. Repeatability analysis indicated that approximately 50% of the hatch rate variability observed in this population can be attributed to maternal identity, while 50% can be attributed to the random environmental factors that are often cited as the primary causes of reduced hatch rates in turtle populations. The reasons for these findings are unclear, but maternally-linked hatching failure in wild turtle populations could be associated with maternal nutrition, inbreeding, or environmental contamination. Additional studies are necessary to test these hypotheses and reveal the true causes of hatching failure in many turtle populations. The present study indicates that the commonly suggested hypotheses for hatching failure such as unsuitable incubation conditions or infertility are unlikely to explain all of the hatch rate variability in some populations. This study also reveals an important conservation implication for turtle populations: the presence of many nesting females does not necessarily guarantee sustainable reproductive rates.

Title: Understanding the Abundance, Detection Probability, Survival, and Dispersal of the Wood Turtle (*Glyptemys insculpta*), a Long-lived, Threatened Emydid Species.

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Abstract: The wood turtle (*Glyptemys insculpta*) is a cryptic, semi-aquatic species that is declining across its range and, like so many chelonian species, is in need of effective monitoring and management plans. In Virginia, the southernmost extent of the species' distribution in North America, the wood turtle is considered threatened and yet remains understudied relative to the degree of threat and increasing range contraction. Beginning

in 1994, a population of wood turtles on national forest property was monitored using capture-recapture sampling methods. Prior to 2014, no formal sampling scheme was adopted; instead, aquatic visual encounter surveys (VES) were conducted intermittently during the wood turtle aquatic seasons each year. From 2014 - 2016, VES were conducted in a robust sampling framework. Captures at a subset of locations that were sampled during every sampling interval were included in the analysis using hierarchical spatially explicit capture-recapture models in WINBUGS and R. We captured 77 individuals from 2014 to 2016, most of which (89.6%) were recaptures ($x = 2 \pm 1.4$ new captures per season). Estimates of turtle abundance varied from 66 to 77, and the overall estimate was 81.4 (± 2.9). Capture probability ($x = 0.64 \pm 0.07$) was fairly stable with very low recruitment into the population from immigration and/or maturity. Interestingly, several turtles were documented in adjacent watersheds in the mid-2000's as well as during the robust sampling study period. Although annual survival estimates varied somewhat, they were high overall ($x = 0.95 \pm 7.2$). On-going analyses are in final stages of completion.

Title: Combining Citizen Science and Traditional Research Reveals Regional Declines in Diamondback Terrapin Populations in the Northeast

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Abstract: Conservation of wide-ranging species is especially difficult because the necessary population trend data are usually very difficult to collect in a robust manner. Thus, it is possible for species to undergo dramatic declines before region-wide or range-wide changes are detected. The diamondback terrapin (*Malaclemys terrapin*) is North America's only estuarine turtle; it inhabits ca. 6000 km of U.S. Atlantic and Gulf salt marshes and mangrove ecosystems from Massachusetts to Texas. Despite increased scientific and conservation interest in this species, terrapin population trend data are only available from a few small scale analyses and from qualitative surveys. Here we combine long term mark-recapture data collected by citizen science and more traditional

academically-based projects from six terrapin populations in the northern portion of the terrapin range, spanning 16% of the species' range. The sites differ in terms of conservation issues, primarily nest protection and local habitat loss. We detected significant declines in two populations and more moderate declines at two more. There were overall significant increases in the number of nesting adults at two sites, but even these experienced dramatic declines in the last decade. We conclude that diamondback terrapins are extremely vulnerable in the northern portion of their range.

Title: An Evaluation of Residents' Perceptions of Timber Rattlesnakes (*Crotalus horridus*) in Central Connecticut

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Abstract: Timber rattlesnake (*Crotalus horridus*) populations are declining in Connecticut and human-caused mortality is a primary contributing factor. Knowledge about New England resident perceptions and interactions with rattlesnakes is currently lacking, making it difficult to implement effective conservation strategies. This research will enhance our understanding of human-rattlesnake interactions. Our objectives are: 1) to describe attitudes toward timber rattlesnakes, given relevant situational factors, (e.g., presence of children or pets and proximity to rattlesnake habitat), 2) to assess support for rattlesnake conservation strategies, 3) to assess willingness to report potential rattlesnake poaching activity, and 4) to assess the effectiveness of mailed informational outreach to positively influence human behaviors related to rattlesnakes. Two surveys and an information packet will be used to collect data from residents living adjacent to a known Connecticut rattlesnake population. The first survey (June 2016) characterized resident attitudes, knowledge, risk perceptions, and behaviors toward rattlesnakes, and support for rattlesnake conservation strategies. One month later, an information packet was sent to study participants, containing rattlesnake information and phone numbers to call for assistance in the event of a rattlesnake encounter. In Summer 2016, data on human-rattlesnake encounters are being recorded and spatially analyzed. A second survey will be mailed in November 2016 to query landowners about use of outreach information and rattlesnake encounters experienced in 2016. Results will aid wildlife managers in increasing effectiveness of management and outreach strategies aimed at reducing rattlesnake mortalities in this population.

Title: Bioaccumulation and Trophic Transfer of Methylmercury in Wood Frogs and Spotted Salamanders in Vermont Vernal Pools

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Abstract: Mercury contamination via atmospheric deposition and leaf fall is widespread in the Northeast, and hotspots with enhanced deposition and biological uptake have been identified throughout the region. Due to their relatively high organic matter and low oxygen levels, vernal pools provide ideal conditions for the conversion of mercury to its more toxic and bioavailable form, methylmercury. Yet little is known about mercury's presence, cycling, and methylation rates in vernal pools, its effects on vernal pool fauna, and potential export into terrestrial systems. We have been investigating the role of land-use and landscape characteristics on the production and transfer of methylmercury in vernal pool foodwebs, from water, soil, and leaf litter, to invertebrates from several trophic levels, and amphibians of all life stages. This presentation will summarize preliminary results of methylmercury concentrations in wood frog and spotted salamander eggs, larvae, and adults from six vernal pools in east-central Vermont.

Title: The North Atlantic Vernal Pool Data Cooperative: A Regional Framework to Advance Conservation Planning

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Abstract: Vernal pools provide critical habitat for a variety of wildlife, including pool-breeding amphibians, turtles, and invertebrates. However, their ephemeral hydrology and small size have made it challenging to map vernal pool occurrence on the landscape. As a result, only three states in the North Atlantic region (MA, NJ, VT) have attempted to systematically map vernal pools within their boundaries, while information on vernal pool distribution in other states are scattered among non-governmental organizations, universities, state agencies, municipalities, and others. The Vernal Pool Data Cooperative (VPDC) has compiled much of this information into a single, region-wide GIS database consisting of more than 60,000 vernal pool records from nine states and two Canadian provinces. This presentation will introduce the VPDC as a framework for geospatial vernal pool data, discuss how it will help advance vernal pool conservation on a landscape scale, and highlight data gaps where additional vernal pool mapping is needed.

It will also include a demonstration of the visualization capabilities of the North Atlantic LCC's Conservation Planning Atlas, where the VPDC is available.

Title: The Orienne Society Launches a Great Northern Forests Initiative

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Abstract: The Orienne Society works to conserve critical ecosystems for imperiled reptiles and amphibians using science, conservation, and education. To date, Orienne's North American programs have focused on species such as indigo snakes in the longleaf savannas and hellbenders in the Appalachian highlands. However, in 2016, Orienne is building on its historic work conserving timber rattlesnakes in New England to launch a Great Northern Forests Initiative (GNFI). The flagship species for the GNFI is the wood turtle and Orienne has launched broad scale inventory work to identify priority focal landscapes. As part of these surveys, we are testing the efficacy of using environmental DNA (eDNA) as a survey method. In upcoming years, Orienne plans to conserve wood turtles in these focal landscapes through land protection, restoration, and stewardship and to implement a monitoring program to assess progress. Orienne is also planning to continue its partnership with Vermont Department of Fish and Wildlife, Nature Conservancy, and the Vermont Herp Atlas to monitor and conserve timber rattlesnake populations in Vermont. Finally, Orienne is developing strategies for engaging in the conservation of vernal pool breeding amphibians in upcoming years. The launch of the GNFI marks an important step in the development of the Orienne Society as its first formal initiative out of the southeast. The staff at the Orienne Society are excited to build strategic partnerships in the region for the conservation of reptiles and amphibians.