NORTHEAST PARTNERS IN AMPHIBIAN AND REPTILE CONSERVATION

2013 Annual Meeting
New Jersey School of Conservation
1 Wapalanne Road, Branchville, NJ 07826
July 24-26, 2013

FEATURED PRESENTATION ABSTRACTS

(in order of presentation)

Title: The Turtle Conservancy's Global Turtle Conservation Strategy

Author: A. Ross Kiester, Turtle Conservancy, 49 Bleecker St, Suite 601, New York, NY 20012; ross@turtleconservancy.org

Abstract: The Turtle Conservancy's mission is to protect the most endangered turtles and tortoises and their habitats worldwide. To succeed at our mission we use whatever conservation tools are the most effective for each species and each country. We combine *in situ* work with our *ex situ* program at the Behler Chelonian Center in California and strive to have these two approaches reinforce each other. We also work to halt illegal trade and to raise awareness for turtle conservation. Here I will detail our strategic vision and illustrate it with particular projects involving several different species and countries.

Title: Rattlesnake Conservation: From the Continent to the Caribbean.

Author: Howard K. Reinert, Department of Biology, The College of New Jersey, P.O. Box 7718, Ewing, NJ 08628; hreinert@tcnj.edu.

Abstract: The presentation will highlight over 35 years of conservation-related field research involving rattlesnakes. Topics covered will include the surprising findings regarding the response of Timber Rattlesnakes (Crotalus horridus) to commercial logging operations, the outlook for the future of the Eastern Massasauga (Sistrurus c. catenatus), arguably one of the most endangered of US rattlesnake species, and the results of twenty years of conservation research efforts on one of the world's rarest rattlesnake species, the Aruba Island Rattlesnake (Crotalus unicolor).

ORAL PRESENTATION ABSTRACTS

(in order of presentation)

Title: Assessing priority amphibian and reptile conservation areas in the North Atlantic Landscape Conservation Cooperative

Authors: Allison T. Moody*, Department of Wildlife Ecology, University of Maine, Orono, ME 04469; allison.moody@maine.edu; Cynthia Loftin, U.S. Geological Survey, Maine Cooperative Fish and Wildlife Research Unit, University of Maine, Orono, ME 04469; cynthia.loftin@maine.edu; Phillip deMaynadier, Maine Department of Inland Fisheries and Wildlife, Bangor, ME, 04401; phillip.demaynadier@maine.gov; William Sutton, School of Agriculture, Forest and Environmental Sciences, Clemson University, Clemson, SC 29634; billsutton.wv@gmail.com; Kyle Barrett, School of Agriculture, Forest and Environmental Sciences, Clemson University, Clemson, SC 29634; rbarre2@clemson.edu; Priya Nanjappa, Association of Fish and Wildlife Agencies, 444 North Capitol Street, NW, Suite 725, Washington DC; pnanjappa@fishwildlife.org.

Abstract: Reptile and amphibian populations are threatened by habitat loss and fragmentation, climate change, pollution, disease, illegal collection, and introduced species. Yet formulating conservation solutions is limited by a lack of information about their population status and distributions. Comprehensive surveys rarely document species distributions across large regions such as the northeastern U.S., and opportunistic sightings can be biased towards easily seen or heard species in accessible areas. We are modeling northeastern reptile and amphibian occurrences to identify Priority Amphibian and Reptile Conservation Areas (PARCAs) where conservation resources can be focused on species of global, national, or regional conservation significance or on areas of exceptional herpetological diversity. Using biotic and abiotic variables (e.g., temperature, precipitation, hydrology, land cover) and known species occurrences in Program Maxent, we predict potentially suitable sites. Areas where species have a high probability of occurrence suggest potential PARCAs. We also consider landscape integrity of potential PARCAs, especially extensive, contiguous habitat patches that can support viable populations. Predicted species distributions can be overlaid to identify areas with exceptional species richness. We will evaluate our models by comparing observed and predicted occupancy for a subset of species, and by model review by expert

herpetologists. We present PARCAs for Maine as a pilot for the Northeast. PARCAs identified across the region will be assessed in a concurrent analysis for resiliency to projected climate change, a novel stressor that could inform which PARCAs are likely to retain conservation value.

Title: Determining Vulnerability of Priority Amphibian and Reptile Conservation Areas in the North Atlantic Landscape Conservation Cooperative to Climate Change

Authors: William B. Sutton*, School of Agriculture, Forest and Environmental Sciences, Clemson University, Clemson, SC 29634; billsutton.wv@gmail.com; Kyle Barrett, School of Agriculture, Forest and Environmental Sciences, Clemson University, Clemson, SC 29634; rbarre2@clemson.edu; Allison T. Moody, Department of Wildlife Ecology, University of Maine, Orono, ME 04469; allison.moody@maine.edu; Cynthia Loftin, U.S. Geological Survey, Maine Cooperative Fish and Wildlife Research Unit, University of Maine, Orono, ME 04469; cynthia.loftin@maine.edu; Phillip deMaynadier, Maine Department of Inland Fisheries and Wildlife, Bangor, ME, 04401; phillip.demaynadier@maine.gov; Priya Nanjappa, Association of Fish and Wildlife Agencies, 444 North Capitol Street, NW, Suite 725, Washington DC; pnanjappa@fishwildlife.org.

Abstract: Climate change represents one of the most complex and globally important ecological stressors. As virtually all ecosystems are projected to face impacts from climate change, it is essential to develop appropriate strategies that include pro-active conservation planning measures. The effort to establish Priority Amphibian and Reptile Conservation Areas (PARCAs) was enacted to identify valuable habitat for priority herpetofauna throughout the United States, using a system informed by scientific criteria and expert review. Implicit in the identification of these habitats includes understanding long-term persistence to ecological stressors. We will present a preliminary framework for assessing the long-term vulnerability of proposed PARCAs in the North Atlantic Landscape Conservation Cooperative region to climate change. Our framework will determine vulnerability by incorporating exposure (i.e., extent of climate change experienced by a species or locale), sensitivity (i.e., degree to which survival, persistence, or fitness may be impacted), and adaptive capacity (i.e., capacity of a species or locale to cope with climate change) of proposed PARCAs. We will use a variety of spatially-explicit metrics including projected temperature change, projected landuse change, priority amphibian and reptile species sensitivity, geographic context, patch size, and topographic relief in a GIS-based framework to assess climate change vulnerability of selected PARCAs. Overall, our efforts will provide a science-based structure to assess the long-term vulnerability of these habitats to climate change, which will permit appropriate allocation of conservation efforts to landscapes based on projected climate resiliency.

Title: The Vermont Vernal Pool Mapping Project: Using Aerial Photo Interpretation and Field-verification to Map State-wide Distribution of Vernal Pools

Authors: Steven D. Faccio*, Vermont Center for Ecostudies, PO Box 420, Norwich, VT 05055; sfaccio@vtecostudies.org; Michael Lew-Smith, Arrowwood Environmental, 1315 Hopkins Hill Road, Hardwick, VT 05843; michael@arrowwoodvt.com; Aaron Worthley, Arrowwood Environmental, 950 Bert White Road, Huntington, VT 05462; aaron@arrowwoodvt.com.

Abstract: Vernal pools are typically small, shallow wetlands characterized by alternating flooded and dry phases. Yet, despite their small size and ephemeral nature, they support a rich assemblage of invertebrates and breeding amphibians. Many of these species are considered High and Medium priority Species of Greatest Conservation Need (SGCN) in the Vermont Wildlife Action Plan, including Ambystomid salamanders, Odonates, Fairy Shrimp (Eubranchipus spp.), and freshwater snails. However, due to their small size and seasonal nature, most vernal pools do not appear on National Wetland Inventory maps and their location and distribution across Vermont was largely unknown. We used color infrared aerial photo interpretation to map the location of “potential” vernal pools statewide, and trained citizen scientists to help field-verify a proportion of mapped pools. A total of 4,856 “potential” vernal pools were mapped statewide. Of these, 636 (13%) were field-visited; 54% of which were confirmed to be vernal pools. However, 71% (n = 207) of sites that were not pools were other types of wetlands (e.g. beaver ponds, shrub swamps, seeps, etc.), while only 13% were artifacts of remote mapping, primarily shadows from conifers. Among field-verified pools, the most commonly detected species were Lithobates sylvatica and Ambystoma maculatum, found breeding in 78% and 73% of confirmed pools respectively. A. Jeffersonianum was found in

10% of confirmed pools, A. Laterale in 3% of pools, and Eubranchipus spp. in 5% of pools. At least 115 volunteers participated in field-verification of vernal pools, submitting data from 301 field visits.

Title: Wildlife Guardians Project: Improving Permeability of Wildlife Habitats in NJ

Authors: Kelly Triece*, Department of Biology and Molecular Biology, Montclair State University, Montclair, NJ 07043; triecek1@mail.montclair.edu; Natalie Sherwood, Environmental Management Program, Montclair State University, Montclair, NJ 07043, sherwoodn1@mail.montclair.edu; Meiyin Wu, Department of Biology and Molecular Biology, Montclair State University, Montclair, NJ 07043wum@mail.montclair.edu; Gretchen Fowles, New Jersey Division of Fish and Wildlife, Endangered and Nongame Species Program, Clinton, NJ 08809; gretchen.fowles@dep.state.nj.us; Brian Zarate, New Jersey Division of Fish and Wildlife, Endangered and Nongame Species Program, Clinton, NJ 08809; brian.zarate@dep.state.nj.us

Abstract: Human impacts are threatening biological systems that sustain populations on Earth, and its consequences are significant and extremely intricate. Habitat fragmentation has a large negative impact on biodiversity; animals need to be able to move through the landscape to find food, mates, and other resources. Human transportation roadways often intersect habitats and reduce wildlife habitat permeability. New Jersey's extensive road network has been shown to impact wildlife populations in multiple ways, including direct mortality of individuals and creating barriers to wildlife movement and genetic exchange. Wildlife Guardians Project aims to identify wildlife crossing and mortality hotspots by surveying forty selected road segments three times per week during Spring 2013. Evidence of wildlife crossing and road mortality will be recorded and photographed. Species found on selected road transects include Northern spring peeper (*Pseudacris crucifer crucifer*), green frog (*Rana clamitans melanota*), pickerel frog (*Rana palustris*), wood frog (*Rana sylvatica*), Northern gray treefrog (*Hyla versicolor*), bullfrog (*Rana catesbeiana*), spotted salamander (*Ambystoma maculatum*), red-spotted newt (*Notophthalmus viridescens viridescens*), common snapping turtle (*Chelydra serpentina*), Northern water snake (*Nerodia sipedon sipedon*), and Eastern garter snake (*Thamnophis sirtalis sirtalis*). At the end of the project period, the results will be integrated into New Jersey's Habitat Connectivity Project and used to 1) identify and validate GIS-modeled movement corridors, 2) prioritize wildlife crossing hotspots for supplemental monitoring, 3) determine habitat characteristics associated with the mortality hotspots, 4) use significant landscape characteristics to predict other possible mortality hotspots and 5) when applicable, inform road infrastructure mitigation strategies to reduce future vehicle-wildlife conflicts.

Title: Impact of Global Climate Change on Low-Dispersal Organisms: Refining Ecological Niche Models Using GIS Tools

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Abstract: Climate warming is one of the most important threats to biodiversity. Ectothermic organisms such as amphibians and reptiles are especially vulnerable as climatic conditions affect them directly. Ecological niche models (ENMs) are increasingly popular in ecological studies, but several drawbacks exist, including the limited ability to account for the dispersal potential of the species. In this study, we use ENMs to explore the impact of global climate change on the Caspian whip snake (Dolichophis caspius) as model for organisms with low-dispersal abilities and to quantify dispersal to novel areas using GIS techniques. Models were generated using Maxent 3.3.3k and GARP for current distribution and future climatic scenarios. A cost-distance analysis was run in ArcGIS 10 using geomorphological features, ecological conditions and human footprint as "costs" to dispersal of the species to obtain a Maximum Dispersal Range (MDR) raster. All models developed are statistically significant ($p<0.05$) and the models recover the current distribution of D. caspius. Models projected on future climatic conditions using Maxent predict a doubling of suitable climatic area, while GARP gives a more conservative expansion. Both models agree on an expansion of suitable area northwards, with minor decreases in southern distribution limit. The MDR area calculated using the ENMs generated in Maxent represents a third of the total area of the projected

model. The MDR based on GARP models recovers only about 20% of the total area of the projected model. Thus, incorporating measures of species' dispersal abilities greatly reduce estimated area of potential future distributions.

Title: Breaking the Demographic Mold: How the Ridge and Valley Salamander (*Plethodon hoffmani*) Differs From the Eastern Red-backed Salamander (*P. cinereus*)

Authors: Christopher J. Thawley*, Dept. of Biology, Penn State University, 208 Mueller Laboratory, University Park, PA 16802; cthawley@gmail.com; Bradley E. Carlson, Dept. of Biology, Penn State University, 208 Mueller Laboratory, University Park, PA 16802; bec169@psu.edu; Sean P. Graham, Dept. of Biology, Penn State University, 208 Mueller Laboratory, University Park, PA 16802; szg170@psu.edu

Abstract: Studies of the life histories of many amphibians have provided key information to support effective management, and these data are now even more important in light of global environmental change which may affect similar species differently due to varying aspects of their biology. Life histories of many plethodontid salamanders, especially Plethodon cinereus, have been studied in detail, but elements of the biology of the closely related P. hoffmani (the Ridge and Valley Salamander) remain unknown. We conducted a mark-recapture study to gather baseline data about P. hoffmani and to test two hypotheses: Does this species exhibit high site fidelity and small home ranges as does P. cinereus, and do morphology and microhabitat selection of P. hoffmani and P. cinereus differ in sympatry vs. allopatry? Based on low recapture and fidelity rates, we reject the hypothesis that P. hoffmani has similar demographic patterns to those of P. cinereus. Plethodon hoffmani had an even sex ratio and lower densities than comparable P. cinereus populations. When comparing P. hoffmani and P. cinereus in sympatry and allopatry, P. hoffmani was larger in allopatry and occupied warmer, but not drier, microhabitats. These data indicate that P. hoffmani and P. cinereus may converge in aspects of their life histories, resulting in potential character displacement or competition for niche space in sympatry. However, P. hoffmani and P. cinereus do differ in some population characteristics, indicating that these species may respond differently to global change and potential resultant range shifts.

Title: Native Fish and Anuran Assemblages Differ between Impoundments with and without Non-Native Centrarchids and Bullfrogs

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Abstract: Centrarchids (sunfish and bass species) and Bullfrogs (*Lithobates catesbeianus*) have been introduced into aquatic systems around the world and have the potential to negatively impact native fish and anurans. We surveyed fish and anuran assemblages from 26 impoundments in the New Jersey Pinelands, USA. We excluded non-native species and used ordination analysis to generate four native-species community gradients based on native-fish and anuran presence–absence and abundance data. All four community gradients paralleled an increase in the percentage of upstream-altered land (development and upland agriculture) and an increase in either nonnative-centrarchid richness or abundance. Based on presence–absence and abundance data, native-fish and native-anuran assemblages, including restricted species (those generally limited to the Pinelands region) and widespread species (those widely distributed in New Jersey), differed between impoundments with and without non-native centrarchids. Compared to widespread species, the greatest differences between impoundment types were found for restricted species. Three non-native-frog species, including Bullfrogs, were associated with degraded impoundments that supported non-native fish. Our results demonstrate that watershed conditions and native fish and anuran assemblages differ between impoundments with and without non-native centrarchids, and suggest that some restricted species may be especially vulnerable to impacts from watershed disturbance and non-native species. Our findings support the idea that the environmental resistance associated with intact water-quality conditions may help prevent the invasion of non-native fish and anurans. We recommend that land-use activities that degrade water quality and reduce invasion resistance be avoided in unaltered watersheds to conserve native-fish and native-anuran community integrity.

Title: Metapopulation Dynamics of Pool-Breeding Amphibians: The Marbled Salamander (*Amybstoma opacum*) in Western Massachusetts.

Authors: Brad C. Timm*, University of Massachusetts, Amherst, MA 01003; timm@eco.umass.edu; Kevin McGarigal, University of Massachusetts, Amherst, MA 01003; mcgarigalk@eco.umass.edu; Lloyd R. Gamble, World Wildlife Fund, Washington, D.C., 20090; lloyd.gamble@wwfus.org; Bradley W. Compton, University of Massachusetts, Amherst, MA 01003; bcompton@eco.umass.edu

Abstract: Pool-breeding amphibian populations operate at multiple spatial scales, from the individual pool to surrounding upland habitat to clusters of pools. When metapopulation dynamics play a role in long-term viability, conservation efforts limited to the protection of individual pools or even pools with associated upland habitat may be ineffective over the long-term if connectivity among pools is not maintained. In this presentation we will discuss the results of a 10-year landscape-level study of a marbled salamander (*Ambystoma opacum*) metapopulation distributed among 14 seasonal pools in western Massachusetts. In addition to presenting direct results of this study, we will highlight the importance of applying conservation strategies beyond the scale of individual breeding wetlands and their surrounding uplands for the effective long-term conservation of pool-breeding amphibians.

Title: Terrapins in the Meadows: The History of Diamondback Terrapins (Malaclemys terrapin) in the NJ Hackensack Meadowlands

Authors: Paola Dolcemascolo, Department of Earth and Environmental Studies, Montclair State University, 1 Normal Ave., Montclair, NJ 07043; dolcemascop1@gmail.com; Brett Bragin, New Jersey Meadowlands Commission, 1 DeKorte Park Plaza, Lyndhurst, NJ 07071; Brett.Bragin@njmeadowlands.gov

Abstract: The Diamondback terrapin (*Malaclemys terrapin*) is the only turtle in North America adapted to brackish environments, inhabiting estuaries, coastal salt marshes and mangrove swamps. Its range extends along the Atlantic coast of the US, from Cape Cod to Texas. There is evidence of terrapins in the New York/New Jersey area dating back to prehistoric times, with these turtles being used as a source of meat by both pre-Europeans and colonists. A lucrative market for terrapin meat sprang up and because of this there are fairly good written records of terrapin presence and abundance dating to colonial times. No records of terrapins in the NJ Hackensack Meadowlands exist prior to the late 1970s. Habitat suitable for terrapins was scarce to non-existent before 1950 and the origin of the Meadowlands population is undetermined. This study looked at the natural history of the Meadowlands and the genetics of the terrapins in Sawmill Creek Wildlife Management Area to determine the characteristics of this population and the relationship of these terrapins to those in another highly urbanized environment, Jamaica Bay, NY. Meadowlands terrapins appear to be more closely related to each other than they are to terrapins in Jamaica Bay. This could be an indication of site fidelity, of long-term isolation of Meadowlands terrapins, or both. This population of terrapins, on which studies have begun relatively recently, can shed further light on how this species can survive and thrive in highly urbanized environments.

Title: Preliminary Results From Head-start Program For Wood Turtles

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Abstract: Head-starting techniques for wood turtles (*Glyptemys insculpta*) have been implemented on the Great Swamp National Wildlife Refuge, New Jersey, USA for the purpose of augmenting an existing small population. Forty-two hatchlings

were collected from five protected nests in 2011. Nearly half of the hatchlings (mean CL = 39 mm; mean weight = 9 g) from each clutch (total of 20) were directly released in Sept 2011 and the remaining 22 were head-started and released in May 2012. The head-started individuals were reared for 9 months in a greenhouse by high school students. All 22 hatchlings survived the head-start period and were brought back to the Great Swamp NWR in May 2012 for release; all were affixed with radio transmitters and tracked. At the time of release, head-started wood turtles were measured (mean CL = 98 mm; mean weight = 140 g) and were comparable in size to 4-yr-old wild juveniles. Survivorship and movement data on the 22 head-starts that has been collected for one-year post-release will be presented (May 2012-May 2013). We have been able to document successful establishment of home ranges, growth of the released head-starts, and successful over-winter hibernation. The surviving individuals continue to be radio-tracked (2013-) and head-started hatchlings from a 2nd cohort (2012) are planned for release in May 2013. Assessing the benefits of head-starting turtles has been debated and requires subsequent multi-year monitoring. Our project has a long-term monitoring commitment and more results will be forthcoming.

Title: Radio telemetry and the neonate ecology of the Northern Pinesnake (*Pituophis melanoleucus*)

Authors: Kevin P.W. Smith*, Biodiversity, Earth, and Environmental Science Department, Drexel University, Philadelphia, PA, 19104; kevinpwsmith@gmail.com; Walter F. Bien, Biodiversity, Earth, and Environmental Science, Drexel University, Philadelphia, PA, 19104; wbien205@comcast.net.

Abstract: Due to the cryptic and fossorial nature of neonate pine snakes (*Pituophis melanoleucus*) there is a lack of data on their early life behavior and dispersal. An understanding of first season life history traits from hatching to ingress is particularly difficult to monitor. Without field observations it is difficult to elucidate key developmental processes, such as shedding rate, feeding rate, diet preference, habitat preference, dispersal patterns, and the spatial ecology after leaving the nest. Until recently, the use of radio telemetry was only applicable for adult pinesnakes. In addition, external transmitters are not appropriate for semi-fossorial constrictors as they interfere with normal snake behaviors. However, we surgically implanted eight *P. melanoleucus* neonates with small weight to mass transmitters and radio-tracked them after leaving their nests to fall ingress. We monitored neonate activity daily and recorded environmental and behavioral data.
Two months after egress neonates were preying on adult small rodents. Neonates shed multiple times over the first season. Radio telemetry confirmed that black racers (*Coluber constrictor*) were a predator of neonate pinesnakes. Neonates travel distance from the nest ranged from 30m to 300m. Neonates from the same nests with pit-tags only were observed within 70m of the nest throughout the field season. Our data suggest that the use of radio-implanted transmitters in neonate pinesnakes does not negatively impact normal snake activity, behavior, and movement patterns. Further studies will help identify habitats in need of management for neonate pine snake success and dispersal.

Title: Surface Activity and Body Temperature of Eastern Hognose Snakes (*Heterodon platirhons*) at Cape Cod National Seashore, Massachusetts.

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Abstract: Snakes, as ectotherms, rely heavily on environmental temperature to drive physiological processes. Surface activity, in turn, is heavily influenced by environmental temperature, but is influenced by additional climatic, temporal, and ecological factors, as well. Understanding when and under what conditions a species is most likely to be active can be particularly important when dealing with a cryptic species and/or a species that occurs at low densities. Surface activity, body temperature (Tb), and microclimatic data were collected during a radiotelemetry study of *17 Heterodon platirhinos* in an early-successional sand dune ecosystem from 2009-2011 using temperature sensitive radio transmitters. Mean Tb (27.9 ˚C, SE = 0.24) and Tb range (5.5 – 39.5 ˚C) were similar to those reported in other studies of *H. platirhinos*. Mixed effects logistic

regression was used to assess the relationship between snake surface activity and selected microclimatic and temporal variables. Hours post sunrise and relative humidity emerged as the top variables influencing pre-oviposition gravid females. Hours post sunrise and ambient air temperature emerged as the top variables influencing male activity. Our data suggest that activity in H. platirhinos occurs as a function of a multitude of environmental, temporal, and ecological factors and varies based on sex and reproductive class. When considering activity, future studies on terrestrial ectotherms should consider not only the relationships of sex, but of reproductive class as well.

Title: Anuran decline research: effects of time, region, and invasive vegetation on survival and fitness in tadpoles transplanted to an extirpation zone.

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Abstract: Understanding the ecological processes and causes behind species declines that lead to extirpations is critically important but difficult to investigate once populations have vanished. This is especially true for amphibians, and frogs in particular, for which many extirpations have occurred enigmatically without overt links to factors such as hunting, habitat loss, or other direct human impact. Herein we present our efforts to apply retrospective methods using in situ enclosures and tadpole transplant experiments to test the effects of one potential threat, the invasive grass Phragmites australis, on survival and fitness in leopard frogs that vanished from parts of the northeastern US. We collected eggs from extant sites outside the extirpation zone and reared mixed-sibling tadpole groups within historical wetlands across the extirpation zone. We tested the hypothesis that survival and fitness decrease with increased levels of invasion and repeated our experiments over several seasons and locations to look at spatial and temporal differences as well. We also selected donor frogs from two different source wetlands to test for differences between source sites.
Our results indicate increased success among tadpoles raised in heavily invaded wetlands. We also observed faster growth rates in tadpoles deployed in mid-spring versus those deployed in mid-summer. Our within-site results were similar (across repeated trials) but our between-site results varied considerably. This type of research can provide value to researchers studying the effects of environmental, ecological, and temporal conditions on amphibian survival and growth, but also has applications in invasive species study, conservation, and restoration.

Title: Species decline in outwardly-healthy habitat: NY's enigmatic Northern Cricket frog

Author: Jay Westerveld, Forensic ecology, New York Natural History council, 114 Kings Hwy., Sugar Loaf, NY 10981-0114; biocouncil@yahoo.com

Abstract: The role of the Water-lily Plant hopper (*Megamelus davisi*) and the Aquatic springtail (*Podura aquatica*) in Northern Cricket frog (*Acris crepitans*) migration and population sustenance; How collateral water-lily planthopper eradication may have secondarily-effected Cricket frog decline in New York. In New York State, the Northern Cricket frog has evidenced acute decline since the 1970s. At NY's largest remaining Cricket frog metapopulation node, the Water-lily plant hopper occurs en masse over hundreds of acres of wetland habitat. Cricket frogs are observed to predate this delphacid with near-exclusivity throughout the warmer months. Comprehensive surveying of other NY historic/extirpated Cricket frog habitat in Harriman State Park, etc., reveals absence of Water-lily plant hoppers. Much of this historic-extirpated habitat was (aerially) treated with pesticides in the 1970s to control invasive outbreaks of gypsy moth (*Lymantria dispar*); The Glenmere metapopulation site, centered around a public water supply, was spared broadcast of this non-specific pesticide. In contrast to the Gypsy moth, the Water-lily plant hopper is both a habitat specialist and, in most cases, flightless, and thus unlikely to demonstrate rapid repopulation of treated habitat. The collateral eradication of Water-lily plant hopper populations at historic Cricket frog habitats may help to explain the present site vicariance. The possible role of collateral Water-lily plant hopper eradication in

Cricket frog decline and the proactive reestablishment of Water-lily plant hopper populations at planned Cricket frog repopulation sites is discussed, as is the role of water-lily plant hopper dispersal in seasonal Cricket frog in/out migration.

POSTER ABSTRACTS

(alphabetical by first author last name)

Title: Chopsticks For Salamanders

Author: Lauren Augustine*, Department of Herpetology, Center for Animal Care Sciences, Smithsonian's National Zoological Park, 3001 Connecticut Ave NW, Washington, D.C. 20008, USA; Augustinel@si.edu

Abstract: In September 2012 a new conservation initiative, "Chopsticks For Salamanders", was created in response to global amphibian declines and the international deforestation for the disposable chopsticks industry. This organization is supported by three founding American Association of Zoo Keepers (AAZK) chapters: the New York City Chapter, the National Capital Chapter, and the Greater Baltimore Chapter. The mission of Chopsticks for Salamanders (CFS) has three significant goals; 1) to disseminate information about the production of disposable chopsticks, 2) increase awareness about salamander diversity in the United States, 3) raise money for salamander conservation, education, and research.
CFS raises money to support salamander conservation, education, and research through the sale of reusable chopsticks in branded carrying bags. This year the CFS grant received seven applications and The University of Georgia's Odum School of Ecology student Todd Pierson was awarded $1500 for his proposal "Monitoring of Appalachian Salamanders Using Environmental DNA."Todd's research ties in with the organization's mission of preserving the salamanders of the Appalachian region. Additionally, CFS contributed $500 to Jamie Weyer of the Omaha's Henry Doorly Zoo and Aquarium. She will be accompanying scientists in the field to release and track head started Eastern Hellbenders for the Ohio Conservation Plan. With the growing support of AAZK chapters around the country, including the Greater Philadelphia chapter and the Detroit Chapter, Chopsticks For Salamanders will be able to reach a larger audience and have a greater impact on the disposable chopsticks use in the United States, while benefitting salamander conservation.

Title: A New System For Marking Hatchling Turtles Using Visible Implant Elastomer (VIE)

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Abstract: The study of hatchling turtles can provide invaluable information on the survival rates, ecology, and population dynamics of this often poorly-studied life history stage. Numerous techniques have been applied to marking hatchling turtles; however, many of these marking techniques require shell or limb modification and may not remain visible as the turtle ages and grows. A technique known as Visible Implant Elastomer, which involves injecting a small amount of fluorescent dye just below the skin of the organism, has been used on hatchling turtles with some success. Many of these marking systems apply multiple colors of elastomer to the legs, toe webbing, and tail. Most of these techniques only designate cohort marks for groups of hatchlings; thus, these systems do not allow the researcher to create an intuitive, recognizable numbering system for individuals and require the use of several different colors of elastomer. In order to address these issues, we developed a binary marking system in which each of the twelve plastral scutes were numbered in a manner similar to Ernst et al. (1974). So far, the technique has been successfully applied to 81 hatchling Northern Map Turtles (*Graptemys geographica*) in the Susquehanna River in Maryland during 2012 and 2013. Recaptures of marked hatchlings have already provided valuable information about survival and growth rates. This marking method provides an inexpensive and potentially long-lasting technique for marking and tracking hatchling and sub-adult turtles.

NORTHEAST PARTNERS IN AMPHIBIAN AND REPTILE CONSERVATION

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New Jersey School of Conservation
1 Wapalanne Road, Branchville, NJ 07826
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Title: Analysis of Diamondback Terrapin (*Malaclemys terrapin*) Hatchling Adaptations to Marine and Terrestrial Habitats

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Abstract: The Diamondback terrapin (*Malaclemys terrapin*) is a threatened keystone turtle that inhabits salt marshes of the U.S. Atlantic Coast. Knowledge of its early life history is vital to conservation efforts. Previous research has produced anecdotal evidence of hatchling terrestrial overwintering, occurring perhaps more frequently than any other aquatic turtle. Terrapins have lachrymal glands used in osmotic regulation; however the ability of hatchlings to survive in various salinity environments is poorly understood. Starting immediately after hatching we raised terrapin hatchlings in six laboratory treatments of differing salinities (0.0, 1.0, 4.5, 9.0, 12.0, 18.0ppt) and other hatchlings in a terrestrial habitat. Over the subsequent year hatchlings were tested for desiccation tolerance, salinity tolerance, and habitat preferences to detect ontogenetic changes. The hatchlings in moderately brackish water (4.5 and 9.0 ppt) experienced the greatest growth. Hatchlings in the terrestrial habitat had the lowest mortality, while those in the 0.0 ppt treatment were the highest. Both the desiccation and salinity tolerances were influenced by treatment; the terrestrial hatchlings being more desiccation-tolerant and the 18ppt hatchlings were more salinity-tolerant. The other treatments developed greater tolerance with age; however tolerance did not drastically increase overall. Habitat preferences indicated a high affinity for terrestrial habitats across all treatments and a tendency for specimens from lower salinity treatment to prefer higher salinities and vice-versa. Our results suggest that terrapin hatchlings are physiologically flexible and can readily acclimate to a variety of diverse habitats.

Title: The Natural History of the Parasitic Trematode *Pleurogonius malaclemys* in Diamondback Terrapins *Malaclemys terrapin*

Authors: Nicole Chodkowski* Department of Biology, Hofstra University, Hempstead, NY 11549; nicole.chodkowski@hofstra.edu; Russell L. Burke Department of Biology, Hofstra University, Hempstead, NY 11549; biorlb@hofstra.edu; Jason D. Williams Department of Biology, Hofstra University, Hempstead, NY 11549; Jason.D.Williams@hofstra.edu

Abstract: Hunter (1961, 1967) described a parasitic trematode (*Pleurogonius malaclemys*), whose definitive final host is the diamondback terrapin (*Malaclemys terrapin*). The diamondback terrapin is found in brackish waters of the eastern and southern coasts of the United States. Hunter showed that the eastern mud snail (*Ilyanassa obsoleta*), an abundant terrapin prey species, is an intermediate host for *P. malaclemys*. Byers et al. (2011) further showed that the frequency of *P. malaclemys* cysts on mud snails can be an accurate indirect measure of terrapin abundance. Our studies censusing *P. malaclemys* cysts on mud snails in Jamaica Bay (JB), NY and Great South Bay, NY have confirmed that the trematode occurs further north than previously reported, that the trematode cysts infect snails year round but that snail infection frequencies vary dramatically by season. Therefore value of *P. malaclemys* cyst frequency on mud snails as a measure of terrapin abundance may be ascertained locally and seasonally. We also found that juvenile terrapins can be infected by *P. malaclemys* under laboratory conditions, but that many of the consumed cysts do not result in adult trematodes in the gut. We also measured the prevalence and intensity of *P. malaclemys* infections in wild adult terrapins, and conducted field and laboratory studies of the lifecycle of *P. malaclemys* infection on terrapins. *P. malaclemys* is capable of encysting on other biological substrates, particularly those found to be a part of terrapin diets, and this could account for the high infection loads in wild terrapins.

Title: Constructing Upland Vernal-pool Habitat to Manage for Sea-level Rise in Cape May, NJ

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Abstract: Changing climate patterns in the northeastern United States are expected to cause increasing temperatures and fluctuations in precipitation leading to seasonal water deficits and premature drying of vernal pools. Abbreviation of hydroperiod in vernal pools will influence species composition, lead to reproductive failures in breeding amphibians, and isolate larger vernal pools as smaller pools become unsuitable, diminishing metapopulation dynamics. Vernal pools in low-lying coastal areas will also be at risk of salt-water intrusion or inundation from rising sea levels. In New Jersey state-endangered eastern tiger salamanders, *Ambystoma tigrinum,* are limited to 15 known breeding pools, 13 of which are along the Cape May Peninsula. Based on coastal elevation data and sea-level rise modeling from the EPA only 10 of these breeding pools will remain above sea-level rise over the next century. To mitigate for these losses and increase connectivity, we are constructing vernal pool complexes along a utility line right-of-way that runs northward along the Peninsula. These complexes will link existing breeding pools, create new metapopulations, and assist migration of vernal-pool species away from the coast. To establish robust, genetically diverse eastern tiger salamander populations at these pools, we are introducing egg masses from local, stable populations through headstarting and in-situ cages. The success of these treatments will be evaluated against natural migration using maternal DNA collected from each egg mass and subadults before egress. This project is part of a larger goal to create a strong-hold for eastern tiger salamanders in New Jersey.

Title: Post Emergence Behavior, Habitat Selection, and Survival of Neonatal Wood Turtles (*Glyptemys insculpta*) in an Unusual Landscape

Authors: Jeffrey Dragon[12], Thomas Akre[23], William McShea[2], and J.D. Kleopfer[4]
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Authors: Neonate turtles have been referred to as the missing link in the life histories of North American turtles due to their cryptic nature and difficulty to track. Although little is known from field studies, data suggests that hatchling turtles have higher mortality rates than adults due to their smaller size, more potential predator species, and an increased vulnerability to fluctuating environmental conditions. Therefore, understanding the factors that influence survival in this critical and poorly known life stage is a crucial step for turtle conservation. The North American wood turtle is considered endangered by the IUCN due to habitat loss, poaching for the illegal pet trade, increases in subsidized predators, and climate change. Nevertheless, little is known about the first season of life in this species as few studies have examined hatchling behavior and only one study has followed hatchling wood turtles from emergence until hibernation. Our study site, at the southern end of the range, is unlike typical wood turtle habitat in that it lacks natural nest beaches; therefore hatchling turtles emerge in habitats predicted to be less conducive to survival. Forty hatchling turtles from five different nest patches were radio tracked from emergence until depredation, signal loss, or the 80 day expected battery life of the transmitter was reaching. We measured habitat selection and post-emergence behavior to determine what factors ultimately influence survival in neonate wood turtles. Preliminary results from the 2012 season will be presented and discussed as well as plans for 2013.

Title: Long-term Demography, Movements, Nesting Ecology, Nest Site Enhancement, and Phenological Behavior of Wood Turtles, *Glyptemys insculpta*, in Northern New Jersey.

Authors: Thomas J. Duchak*, Department of Biology, Hofstra University, Hempstead, NY 11549; thomas.j.duchak@hofstra.edu; Russell L. Burke, Department of Biology, Hofstra University, Hempstead, NY 11549; russell.l.burke@hofstra.edu

Abstract: We are continuing a long-term (since 1998) wood turtle, *Glyptemys insculpta*, study in a relatively undisturbed section of northern New Jersey. We have collected a wealth of mark-recapture data to estimate population size and determine growth rates, age to maturity, adult survivorship and sex ratios, long-term changes in habitat/site preference, and injury and abnormality incidence. Several males and females were radio-tracked to obtain home range and habitat use data and to locate nesting sites. Nesting sites were monitored yearly to record typical nest locations and nest characteristics, annual variation in frequency of reproduction, clutch size, incubation conditions, incubation duration, natural nest survivorship, hatching success, hatchling sex ratio, and hatchling survivorship. In spring 2013, with the cooperation of state land managers, we began manipulating/enhancing nesting sites, hoping to facilitate and expedite the nesting process for gravid females. We also attached "I-button" temperature loggers to the shells of all radioed animals to obtain records of the environmental temperatures experienced by each turtle. Temperature loggers were also placed in water, full sun, and shaded thickets for comparison with "turtle temperature" data. The collection of consistent temperature data, made possible by the joint use of temperature loggers and radio transmitters, will allow us to answer questions about wood turtle activity, thermoregulation, and, possibly, migration routes to and from nesting areas and summer habitats. We will provide a complete summary of our past and present wood turtle work and discuss our research goals for the near future.

Title: Detecting long-term population trends for an elusive reptile: the Eastern Box Turtle (*Terrapene carolina carolina*) in Massachusetts

Authors: Lori Erb[1]*, Lisabeth Willey[2], and Lori Johnson[3]
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Abstract: Many species of turtles are imperiled globally and within the U.S., including the Eastern Box Turtle (*Terrapene carolina carolina*), which has been documented to be in decline throughout its range. Monitoring long-term population trends in this species is imperative to help guide listing status determination and to inform conservation and management actions. Box turtles are at the northern edge of their range in Massachusetts, where population densities are critically low, and they are a cryptic species making them difficult to find. Creating robust monitoring programs for rare, elusive species across a large landscape area can be challenging. We developed and implemented a statewide occupancy-based monitoring program for the box turtle, collecting baseline data during 2010-2012. Survey plots were identified within box turtle nesting habitat and sampled during the nesting season. PRESENCE software and Royle-Nichols models were used to evaluate our study design. A total of 62, 4-ha monitoring plots were sampled among four conservation management regions. We captured 188 box turtles at 53 sites and spent 720 person hours during surveys. Averaged site-occupancy was high (0.93) and detection probability was 0.25 +/- 0.104 (mean + SE). The mean site-specific abundance estimate was 2.62 +/- 0.05. A power analysis indicated that our study design will have an 80% chance of detecting a 10% change in abundance within 10 years time, and an 88% chance of detecting a 5% change in 20 years.

Title: Eastern Box Turtle, *Terrapene carolina*, Home Ranges at Brookhaven National Laboratory, New York

Authors: Miranda Figueras*, Biology Department, Hofstra University, Hempstead, NY 11549; mirandafigueras@aol.com; Dr. Russell Burke, Biology Department, Hofstra University, Hempstead, NY 11549; russell.l.burke@hofstra.edu; Dr. Timothy Green, Brookhaven National Laboratory, Upton, NY 11973; tgreen@bnl.gov; Arthur Calichio, Biology Department, Hofstra University, Hempstead, NY 11549; acalic1@pride.hofstra.edu; David Simon, Biology Department, Hofstra University, Hempstead, NY 11549; dsimon17@pride.hofstra.edu

Abstract: Eastern Box turtles, *Terrapene carolina*, mainly inhabit mesic forests and ecotone habitats in the eastern and central United States. Home range sizes within and between studies are widely divergent. Part of this variation may be due to methodological differences, for example, how long individuals are tracked and whether to include overwintering and nesting sites. We have begun a study to explore why, even when methodological issues are resolved, such as within a single study,

different *T. carolina* have dramatically different home ranges. The home ranges of 25 *T. carolina* from Brookhaven National Laboratory, NY, were determined through radio telemetry. Each turtle was recaptured between 4 and 14 times from June through September 2012. GPS locations were used to calculate minimum convex polygons, 50%, and 95% kernel areas. There was no significant difference between home range sizes of male and female *T. carolina*, and there was also no relationship between home range sizes and the number of times each turtle was located. There was, however, a very large variation in home range sizes, ranging from 0.01-155.00 ha. These differences in home range size could be due to disparities in habitat quality, as indicated by availability of food. Our next step will be to quantify major food types within the 95% kernel of each box turtle's home range to test whether there is a correlation between food availability and home range size.

Title: A Predictive Model for Identifying Suitable Habitat for the Eastern Hellbender (*Cryptobranchus alleganiensis*) in New York and Pennsylvania

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Abstract: Over the past three decades, range-wide declines have been observed in populations of the Eastern Hellbender (*Cryptobranchus alleganiensis*), an aquatic salamander endemic to the Eastern United States. Hellbenders are an elusive species with a lifestyle that presents significant challenges to detection. Many areas within the species' range lack reliable data on hellbender presence. Maximum Entropy (MaxEnt) modeling was used to assess the suitability hellbender habitat on streams throughout the Allegheny and Susquehanna River watersheds in both New York and Pennsylvania. Numerous potential hellbender sites were revealed in both states. Preliminary ground-truthing of predicted habitat in the New York portion of the Susquehanna basin indicated a high degree of accuracy in identifying sites with suitable rock cover for hellbender habitation. Stream size (based on upstream catchment area), buffering capacity, and elevation were the strongest predictors of the presence of suitable habitat. This modeling approach has the potential to improve our ability to identify focal areas for the systematic survey efforts needed to fill in data gaps regarding hellbender occupancy.

Title: State of the Salamander: An In-depth Interpretative Piece on Salamanders that Highlights their Biology, Ecological Role, Threats, and Conservation Efforts

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Abtract: The Partners in Amphibian and Reptile Conservation's mission is "to conserve amphibians, reptiles and their habitats as integral parts of our ecosystem and culture through proactive and coordinated public-private partnerships." For the past several years, PARC has led yearly campaigns to raise the awareness of the value of and threats to various groups of amphibian and reptiles by dedicating a year to promoting that group; past and current efforts include Year of the Turtle (2011), Lizard (2012), and Snake (2013). As part of the campaign, a comprehensive document (accessible to the general public) to promote the awareness of the value of and threats to their existence is researched, prepared, and released at the beginning of the calendar year. A draft of "State of the Salamander" has been prepared for the upcoming 2014 PARC Year of the Salamander campaign. This scholarly work highlights research on salamander biology and ecology as well as provides information on threats and conservation needs for this group. The document incorporates images and other visual aids (e.g., graphs, charts, maps) and is presented in a manner to generate interest in and promote salamander conservation.

Title: Microhabitat Use of *Pituophis melanoleucus*: Implications for Mitigation in New Jersey

Authors: LeeAnn R. Haaf*, Laboratory of Pinelands Research, Department of Biodiversity, Earth, and Environmental Science

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Abstract: Northern Pine snakes (*Pituophis melanoleucus melanoleucus*) are large bodied colubrid snakes noted for their association with sandy soils of pine-oak forests, like those in the pine barrens of New Jersey, where it is considered threatened. This study examines a suite of microhabitat variables that were collected as part of a larger radio telemetry study at Warren Grove Gunnery Range in NJ. The results of our analyses suggest that microhabitat use varies between sexes, as males chose cooler microhabitats, with less leaf litter than females. Furthermore, male microhabitat selection varies more before and after mating periods, whereas female selection does not. This variation may be indicative of differing physiological needs that should be considered when trying to enhance less favorable habitats. On average, snakes chose sites approximately one meter from a tree, with 42.6% canopy cover and 83% leaf litter cover. This indicates moderately dense habitat may be typical for pine snake use. Mitigation, therefore, while developing habitat heterogeneity, should focus on maintaining these averages.

Title: Preliminary Migration Distances of Unisexual Salamanders in Maine

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Abstract: Maine regulates a 250 ft (76 m) radius zone of consultation around highly productive pools under the Natural Resources Protection Act. However, migration distance by the blue-spotted salamander complex (*A. laterale* and unisexuals) remains relatively unexplored. Unisexual salamanders are an almost all-female lineage within the blue-spotted complex that carries nuclear DNA of *A. laterale* and at least one other ambystomatid species. Those identified in Maine contain the genome of the Jefferson salamander (*A. jeffersonianum*) and are polyploid. Our objective was to quantify the distances that unisexuals traveled post-breeding from 4 breeding pools in Orono and Old Town, Maine. We surgically implanted radio transmitters into unisexual salamanders and tracked them daily. Unisexuals tended to remain in one location for an average of 3.5 days between movements. The median total distance traveled from the breeding pool at the time of submission was 147 m, and the maximum was 283 m. The median distance traveled in one night was 57 m, with a maximum distance of 193 m. Six of 13 tracked unisexuals have migrated beyond Maine's zone of consultation.

Title: Interviewing public and private sector experts to inform an effective, regional approach to vernal pool conservation

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Abstract: In the northeastern United States, vernal pools are a unique class of small, isolated, ephemeral wetlands that serve an important ecological role providing habitat for specialized invertebrate and amphibian species. Their small size, dynamic nature, and isolation from larger water bodies combine to create challenges to their conservation. Existing legislative protections are not uniform. We examined state-level regulations governing vernal pools across the region. We interviewed a panel of experts from the public and private sector to obtain input for identifying conservation criteria necessary to protect these resources more effectively. Six of the jurisdictions surveyed have legislated policies that directly recognize and provide protection to vernal pools, although the degree of protection varies widely. The remaining eight jurisdictions lack regulations that specifically target vernal pools; however, five of these do have other regulations that limited protection. Key informant interviews were used to develop a metric to evaluate the effectiveness of existing state-level legislation. By incorporating perspectives from various experts, we are able to evaluate the relative effectiveness of policies across regional jurisdictions.

Characterization of conservation criteria and benchmarks of legislative effectiveness provide direction for advocates and policymakers moving toward a more effective, cohesive regional approach to regulation and protection of vernal pools.

Title: New Jersey Audubon: Managing Habitat for Herps

Author: Gylla A. MacGregor*, New Jersey Audubon, Port Murray NJ 07865; gylla.macgregor@njaudubon.org

Abstract: New Jersey Audubon's Stewardship Department is active throughout the state maintaining, restoring and enhancing natural environments for native ecosystems and wildlife. Projects are occurring on corporate properties, public and private lands, as well as NJA-owned sanctuaries, and range from habitat enhancement to complete transformation and restoration. Reptiles and amphibians either directly driven our projects, or are a benefactor under the umbrella of other focal species. Target-species project have included habitat restoration for bog turtle, wood turtle, Northern pine snake and corn snake, marble salamander, long-tail salamander to name a few.

Title: Improving Reptile and Amphibian Habitat in the New Jersey Pinelands through Ecological Forest Management

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Abstract: The New Jersey Pinelands is a unique mosaic of pine-oak uplands and lowlands, Atlantic white cedar swamps, pine plains, and savannas. These habitats are typically characterized by sandy and nutrient-poor soils, acidic water bodies, and fire-adapted biota. Disturbances, including wildfire, windstorms, flooding, and agriculture, play a crucial role in creating various successional habitats which provide resources to many herpetofauna species. The Hovnanian Sanctuary, owned by New Jersey Audubon (NJA), is a 512.78-acre preserve located in the northeastern section of the Pinelands. This unique landscape offers habitat to species such as *Pituophis m. melanoleucus*, *Pantherophis guttatus*, and *Hyla andersonii*; however, the area has not been burned in over 50 years, leading to a more uniformly late successional pine-oak forest. In 2010, a Forest Stewardship Plan was approved and designed to mimic natural disturbances while incorporating forest thinning, prescribed fire, *Chamaecyparis thyoides* restoration, vernal pool restoration, and artificial snake den construction. In 1988, four artificial dens were constructed on site and monitored by Herpetological Associates, Inc. In 2010, the 4 historic dens were managed to increase suitability and an additional den was constructed in 2013. These areas are continually monitored in order to determine occupancy and as of 2013, overwintering activity has been confirmed at 3 of the historic den sites. In addition, a 13-acre blueberry field has been planted with *C. thyoides* seedlings in order to increase acreage of this rare plant community and a former *H. andersonii* breeding pool will be restored through woody vegetation management.

Title: Survivorship and Density of a Nesting Aggregation of Painted Turtles (*Chrysemys picta*) in Essex County, Massachusetts: A Fifteen Year Study

Authors: Betty G. Mobbs, 62 Porter Road, Andover, MA 01810; bmobbs@elanes.com; Michael T. Jones*, Massachusetts Cooperative Fish and Wildlife Research Unit, University of Massachusetts, Amherst, MA 01003; mtjones@bio.umass.edu; and Lisabeth L. Willey, Massachusetts Cooperative Fish and Wildlife Research Unit, University of Massachusetts, Amherst, MA 01003; mtjones@bio.umass.edu; lwilley@cns.umass.edu.

Abstract: From 1998–2013 we evaluated adult female survivorship and population size of a nesting aggregation of painted turtles (*Chrysemys picta*) at a 2.3 ha gravel pit in Andover, Essex County, Massachusetts. The site was mined during the 1940s and 1950s and abandoned in the 1960s. Today the site is used for passive recreation and by ORV/ATVs. The nesting area is bordered to the west by a 20.5 ha wetland and kettle pond complex and the floodplain of the Shawsheen River. During May and June of each year, we conducted standardized nest surveys within a fixed search area representing the entire gravel pit. Over a 15 yr period, 303 females were captured and marked while making overland movements associated with nesting.

Three turtles were found dead in the nesting area of unknown causes and one was killed by an off-road vehicle. Open-population models indicate that the site was used by 778 (SE=99) turtles over the 15 yr monitoring period, with an average annual nesting aggregation of 377 painted turtles. This is equivalent to an annual density of nesting females of approximately 167.6 turtles/ha of available nesting habitat, among the highest reported in New England. Annual survivorship of nesting females averaged 0.89 (SE=0.21), and the population appears to be declining from a nesting aggregation of approximately 607 (SE=91) turtles in 1998 to 184 (SE=135) turtles in 2012. Nest depredation by mesopredators is common. Snapping turtles (*Chelydra serpentina*) and musk turtles (*Sternotherus odoratus*) have also been observed nesting in the gravel pit. Despite their evident importance to urban and suburban turtle populations, many concentrated turtle nesting areas are not afforded protection under existing state law; solutions to this oversight are proposed.

Title: Making Connections: A Case Study of the Role of Small Wetlands in Seasonal Amphibian Activity and Diversity in a New England Headwater Catchment

Authors: Terry R. Morley*, Department of Natural Sciences, Marymount Manhattan College, 221 East 71st Street, New York, NY 10021; tmorley@mmm.edu; Aram J.K. Calhoun, Department of Wildlife Ecology, University of Maine, Orono, ME 04469; Calhoun@maine.edu.

Abstract: The role of headwater wetlands in shaping amphibian presence and activity in small catchments is poorly defined and requires better understanding in order to conserve amphibians in this unique wetland setting. We assessed amphibian diversity and seasonal activity in headwater wetlands and the adjacent upland forest in Hancock County, Maine, USA, using pitfall trapping, visual encounter surveys, and cover board arrays. We captured 659 individuals over 20,626 trap nights in trap arrays and completed 106 visual encounter survey transects documenting 593 individuals in 2004 and 2005. We found 12 of the 17 amphibian species known to occur in Maine. Amphibians made extensive use of both upland and wetland ecosystems, including 'small' (< 0.36 ha) headwater wetlands. Time spent in wetland or upland habitats was highly variable among species with differences in captures between uplands and wetlands occurring during only two (April and June) of seven monitoring periods spanning from April to October. Observed species-specific activity in each ecosystem differed depending on the method used even during coincident time periods. For example, we often failed to detect the common terrestrial anuran *Lithobates sylvaticus* using visual encounter surveys however pitfall traps routinely caught individuals traveling through the forest. Our results suggest that the presence of isolated headwater wetlands extend amphibian activity from riparian zones into adjacent terrestrial forests. In addition, the timing of surveys is critical in order to accurately estimate populations, since differences in as few as two weeks may lead to imprecise conclusions regarding species presence or abundance.

Title: Bog Turtle Habitat Restoration at Northeast National Wildlife Refuges

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Abstract: Bog turtles (*Glyptemys muhlenbergii)* are known to occur in only three National Wildlife Refuges (NWRs) in the U.S. Fish and Wildlife Service's northeast region (Region 5). One of the greatest threats that this Federally-threatened species faces is the loss of its preferred open wetland habitat to natural succession and invasive species. To combat these threats, bog turtle habitat within Cherry Valley NWR (PA), Wallkill River NWR (NJ) and Great Swamp NWR (NJ) is being managed and improved by way of woody vegetation removal and exotic plant species eradication. A total of four sites are being restored (two at Cherry Valley and one each at Wallkill and Great Swamp) and include a known high-density site, two known low-density sites, and one potential site (within close proximity to a known site). Succession primarily by red maple (*Acer rubrum*),

alder (*Alnus spp.)* and poison sumac (*Toxicodendron vernix*) is being set back using the cut stump, injection, and basal bark herbicide treatment methods. Invasion mainly by common reed (*Phragmites australis*), purple loosestrife (*Lythrum salicaria*), and reed canary grass (*Phalaris arundinacea*) is being combated using the snip-and-drip and foliar herbicide treatment methods. Since bog turtles prefer sunlit wetlands, it is assumed that their response to opening the canopies and reducing the amount of shade at these sites will be favorable. In attempt to prove this, select adult individuals are being concurrently monitored via radio telemetry at the known sites to see if their home ranges expand into these open areas as a result of restoration.

Title: Diets differences within a single bay: Diamondback Terrapins Diets in Eastern and Central Jamaica Bay, New York

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Abstract: Diamondback terrapins, *Malaclemys terrapin*, inhabit salt marshes and tidal creeks of the Atlantic and Gulf Coasts of North America. Terrapins are keystone predators in estuarine ecosystems, and thus conservation of this species is critical to the maintenance of natural nutrient and energy pathways. Long term diet analysis of terrapins in Jamaica Bay (New York) show that unlike southern terrapins, Jamaica Bay terrapins do not feed mostly on snails (*Littorina*). Instead, Jamaica Bay terrapins show dramatic inter-annual diet changes among a variety of prey. Between 2008 and 2011, prey species consumed by central JB terrapins switched from a diet consisting of mostly gem clams (*Gemma gemma*), ribbed mussels (*Geukensia demissa*) and crabs (various sp.) to large amounts of vegetation (leaves, stems, sea lettuce (*Ulva*), and aquatic grasses). Jamaica Bay appears to be different in some ways from less-urbanized terrapin study sites; nesting areas are well separated from the remaining relatively large marsh fragments and the JB marsh system is smaller and more fragmented than where terrapins have been studied elsewhere. Starting in 2009 there have been increasing numbers of terrapins nesting at nearby John F. Kennedy Airport (eastern JB); this population appears to be distinct from that in central JB. The surge of terrapins in eastern JB may be due to the relatively good health of JoCo Marsh, adjacent to JFK airport. This study will assess diet differences between eastern and central terrapins using fecal analysis. Our preliminary results show marked dietary differences between the two adjacent populations.

Title: Herpetofaunal Survey of the Upland Communities in the Albany Pine Bush Preserve

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Abstract: Pitch pine-scrub oak communities dominate the Albany Pine Bush Preserve and are the main focus of conservation efforts, yet little work has investigated the herpetofauna within these areas. This study proposes the first extensive survey of these upland communities, with the objective of identifying the herpetofauna present and the factors most significant in shaping their distribution. For this study, effort is focused on trapping characteristic pine bush species including; *Scaphiopus holbrookii, Bufo fowleri, Terrapene carolina, Carphophis amoenus*, and *Heterodon platirhinos*. Many of these species are rare in occurrence and of their northern most geographical limits. Multiple methods of surveying are being used to ensure the greatest probability of finding these species including; long-line drift fence arrays with pitfall and funnel traps, cover boards, and visual encounter surveys. The data collected will be used to determine the relative strength of association of environmental variables with distribution and abundance patterns of the herpetofauna found within these communities. Thus far, twelve species have been detected including; *Notophthalmus viridescens, Plethodon cinereus, Scaphiopus holbrookii, Bufo americanus, Bufo fowleri, Pseudacris crucifer, Rana clamitans, Chrysemys picta, Heterodon platirhinos, Storeria occipitomaculata, Thamnophis sirtalis*, and *Liochlorophis vernalis.* Preliminary results suggest biodiversity and abundance measures are highly influenced by canopy cover, distance to wetlands, and contiguity of habitat at the broader scale. These findings will have important management and conservation implications, and will give a more comprehensive understanding of the reptiles and amphibians present in the Albany Pine Bush Preserve.

Title: Can Mating Competition Benefit the Next Generation?: Effects of Sex Ratio on Male Tactics and Offspring Viability in *Rana sylvatica*

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Abstract: For many anurans, mating activity occurs over an extremely brief ("explosive") period determined by temperature and precipitation. Duration and intensity of mating competition can therefore be highly unpredictable from year to year, and variability could be exacerbated by climate change. To better understand how anurans are affected by varying levels of mating competition, we used wood frogs (*Rana sylvatica*) to examine how sex ratio and density influences male mating tactics and female fitness (i.e. number and quality of offspring produced) in the field. We video-recorded mating competition interactions in arenas placed at the edge of breeding ponds, and quantified the traits that led to male mating success. We also reared offspring from high versus no male competition mating environments, and used total offspring production as well as tadpole survivorship, competitive ability, and growth rate as proxies of female fitness. We found that males that minimized stationary searching and engaged in energetically costly behavior were more likely to mate in dense, male-skewed aggregations, whereas similarly strong selection did not appear to be present in less dense, even sex ratio aggregations. However, a female's offspring did not seem to be influenced by the mating environment. These results suggest that adverse effects of variability of sex ratio and density may not be present across generations in anurans.

Title: Spatial Ecology of the Eastern Hognose Snake at the Northern Extent of its Range in New York

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Abstract: Eastern Hognose Snakes (*Heterodon platirhinos)* are thought to be declining in many areas, and are considered a "Species of Special Concern" in New York and a "Species of Regional Concern" in the northeast. We studied the spatial ecology of Eastern Hognose Snakes in Saratoga County, NY, at the northern extent of their range in New York. We located snakes (n=12) during random encounter surveys and radio-tracked (n=6) those found before August and that were >100g. At each re-location we recorded GPS location, micro- and macro- habitat data, and behavioral observations. Home range size was determined using both minimum convex polygon (mean= 29.5 ha, range= 1.4 – 66.8 ha) and 95 percent kernel density estimators (mean= 49.3 ha, range= 3.1 – 155.0 ha). The majority of re-locations occurred in forested areas, but compositional analysis revealed that radio-tracked snakes had a strong preference for open areas, in concordance with studies in other parts of the species' range. Open habitat was used heavily after spring emergence and during the nesting season. We found no evidence of communal hibernation or communal nesting at this site. We recommend that conservation action for Eastern Hognose Snakes in the region should focus on preservation of open habitat, particularly during the spring and early summer.

Title: The Effect of Temperature Change on the Behavior of the Northern Pine Snake and Implications for Climate Change

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Abstract: Although studies have examined the spatial ecology, habitat use, and long-term hibernacula use of *Pituophis melanoleucus* (Northern pine snake) in the New Jersey Pine Barrens, few studies have focused on the influence of seasonal temperature variation on snake behavior. Because snakes are poikilotherms the temperature of their surroundings influences their behavior, ecology, and physiology. The New Jersey population is at the limit of its northern range where spring

temperatures are variable and in recent years mean spring temperature has arrived earlier. These changes may cue earlier egress from overwintering dens. We measured the soil surface and air temperature (1m above ground) at three hibernacula to determine the temperature at which snakes egressed from dens. We also measured the operative temperature (soil/air) of radio-tracked snakes from April - November in 2010 (N=21), 2011 (N=32), and 2012 (N=21) and calculated the mean linear distance traveled per day (m/day). Snakes egressed starting 7 April (2010), 10 April (2011), and 23 March (2012) when temperatures ranged between 24 and 33°C. In March 2012 two snakes were found dead within one meter of hibernacula; mortality was attributable to an unusual early warming period followed by night temperatures falling below freezing. Snakes were most surface active when temperatures ranged from 20 to 35°C (air) and 25 to 30°C (soil). Mean linear distance traveled per day was greate - =105m;+/-31m). Although more long-term data is needed, these data suggest that shifts in temperature regimes have the potential to alter egress and dispersal.

Title: The effects of road substrate on the Northern Pine Snake, *Pituophis melanoleucus*

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Abstract: Paved and unpaved roads can act as barriers to ecosystem connectivity linkages. Increased road density contributes to habitat fragmentation, wildlife mortality, loss of genetic corridors, and decreased reproductive success. Roads represent a major threat to slow moving herpetofauna that are extremely vulnerable to vehicular road injuries and death. Of 536 reported occurrences for northern pine snakes (*Pituophis melanoleucus*) in the New Jersey biotics database 120, or 23%, were dead on road. We examined the mean rate of movement of the northern pine snake across three different substrates: sand, asphalt, and concrete. We tested twelve snakes (n=12) in spring, summer, and fall 2012 at the Warren Grove Gunnery Range (WGR), Burlington County New Jersey. Snakes had the fastest rate of movement across =0.11m/s) compared to paved substrates: asphalt (0.09m/s) and concrete (0.06m/s). These data suggest that coarser substrates facilitate increased mobility of snakes. In addition, we examined whether snakes would move through under-road-culverts. We installed nine 12-inch diameter culverts under a new military runway at WGR to monitor wildlife movements. We documented 364 'visits' at the mouth of the culverts and 54 'usage' events (14.8% culvert usage by visiting fauna, including snakes). These data support that culverts are a viable option for mitigating road impacts to wildlife. To better understand the impact of roads on genetic exchange of pine snakes a landscape genetic study is warranted.

Title: North American Amphibian Monitoring Program: Northeast Regional and State Trends in Anuran Occupancy from Calling Survey Data (2001-2011)

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Abstract: We present the first regional trends in anuran occupancy from North American Amphibian Monitoring Program (NAAMP) data from 11 northeastern states using 11 years of data. NAAMP is a long-term monitoring program where observers collect data at assigned random roadside routes using a calling survey technique. We assessed occupancy trends for 17 species. Eight species had showed regional trends, of these seven were negative (Anaxyrus fowleri, Acris crepitans, Pseudacris brachyphona, Pseudacris feriarum-kalmi complex, Lithobates palustris, Lithobates pipiens, and Lithobates sphenocephalus) and one was positive (Hyla versicolor-chrysoscelis complex). We also assessed state level trends for 101 species/state combinations, of these 29 showed showed a negative trend and while nine had an increase in occupancy.

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Title: Assessing the Nesting Ecology of Diamondback Terrapins at Barnegat Bay, New Jersey After Hurricane Sandy

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Abstract: Hurricane Sandy made landfall in New Jersey on October 29, 2012, causing extensive damage along the coastline with an unprecedented storm surge. Salt marsh habitats within Barnegat Bay, New Jersey experienced significant flooding and erosion. Some shoreline habitats that serve as diamondback terrapin nesting sites were also inundated with flood water. At one nesting area, North Sedge Island, adjacent to Barnegat Inlet, the storm surge eroded a 10 cm surface layer of sandy soil from the highest area on the Island. This summer, we are comparing the number of returning nesting females at North Sedge Island (post-storm) to our long-term nesting data. We hypothesize that there will not be a significant reduction in the recapture rate of females on the Island. New recruitment on the island of reproductive female may also be lower than in past years. Our results will enable us to provide management recommendations for maintaining terrapin nesting habitat in areas susceptible to storm surge during severe storm events which are predicted to become more frequent and severe in coming years along the northeast coastal regions.

Title: Mercury in New Jersey's Diamondback Terrapins (*Malaclemys terrapin*)

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Abstract: Mercury contamination in consumed foods poses a significant threat to human health globally. The consumption of mercury contaminated turtle meat is of special concern due to mercury's capability to bioaccumulate and biomagnify, turtles are long lived animals allowing for great concentration of bioaccumulation and they are also predators allowing for mercury biomagnifications. Diamondback terrapins (*Malaclemys terrapin*) are legally harvested throughout New Jersey. Harvested turtles are usually sold to both local and global markets. This study aims to assess human consumption safety of diamondback terrapins. Diamondback terrapin specimens were provided by The Wetlands Institute and The Meadowlands Commission, New Jersey. Turtles acquired were deceased due to drowning or were impacted by cars. Thirty seven terrapins were tested for mercury concentrations. Samples were collected from turtle carapace (n=37), blood (n=24), and front leg muscle (n=33). The highest average mercury concentrations were found in the carapace (1.30ppm) and muscle (.46ppm) samples taken from turtles in the Meadowlands. The highest average mercury concentration in blood (.19ppm) was found in turtles in the Cape May area. The U.S. EPA fish mercury threshold of 0.3ppm is surpassed by 36% of all muscle samples. The result of this study suggests that on average, diamondback terrapins can pose a threat to human consumption safety.