FIFTH SYMPOSIUM ON THE ECOLOGY, STATUS, AND CONSERVATION OF THE DIAMONDBACK TERRAPIN

12-14 NOVEMBER 2010

THE LOUISIANA UNIVERSITIES MARINE CONSORTIUM (LUMCON) CHAUVIN, LA

The 5th Symposium on the Ecology, Status, & Conservation of the Diamondback Terrapin

November 2010: Of course all turtles are charismatic, but diamondback terrapins are special. Terrapins are fascinating turtles, as anyone attending this conference can tell you. One of the ways in which *Malaclemys* is fascinating is that this monotypic genus has an entire group of well-wishers devoted to its study and conservation. With this meeting, the fifth such meeting, terrapins unofficially join the ranks of elite company such as gopher tortoises, desert tortoises, and European pond turtles, which also have seriously devoted followings who meet to talk about them. As far as I can tell, not one of the sea turtle species is so honored. I don't know exactly what this means, but I do know some of the implications. One of these is that it is possible for all the people who care deeply about terrapins to meet in a room that is not too big to shout across, and we can pretty much know each other's names. While I welcome newcomers, I hope this group does not get much bigger.

We collaborate on projects, read each other's papers and grant proposals, and we share our students, but we're not all academics. What's most important is that once every three years we get together and share ideas and questions. We talk about the problems of convincing land managers that terrapins matter, we talk about using hatchling releases as educational devices, and we talk about how much fun it is to see the first terrapin nesting each year. Some of my colleagues study fruit flies and nematodes; I don't think they have this much fun at their meetings. We are fortunate to have chosen well.

Here at LUMCON we follow in the footsteps of the 1st meeting, which was organized with foresight by Rich Siegel and Whit Gibbons, the 2nd organized by Roger Wood, the 3rd by Joe Butler, and the 2007 meeting organized by Willem Roosenburg. The DTWG also exists as five regional groups, which meet irregularly between these national meetings to discuss more local issues. We decided to meet on the Gulf Coast because we wanted to encourage more terrapin researchers in that region to join us, and from the looks of the registration list I think we succeeded. We didn't anticipate the Deepwater Horizon oil spill, of course, which has had such an impact on this area. And I face the interesting challenge of organizing a meeting 1300 miles away at a place I've never seen. I am grateful to the wonderful LUMCON staff that has helped so much.

Welcome to the 5th DTWG meeting. Become a member if you're not already, and renew your membership if it's time. Enjoy, listen, and contribute. Make new friends and embarrass old ones. Introduce yourself to a student and find out what he/she is doing. Bid way too much on the auction items; ignore what they are actually worth. Ask for help with your terrapin problems; tell someone how you solved a terrapin problem. Offer to join committees and collaborations. And when it's time to leave, go away enthusiastic and invigorated!

Willem M. Roosenburg and Russell Burke – Co-directors of the Diamondback Terrapin Working Group
Workshop organizer – **Russell Burke**, Biology, Hofstra University, Hempstead, NY
Workshop Hosts – **Nicole Cotton**, LUMCON, Chauvin, LA
Silent Auction Coordinator – **Kayleigh Erazmus**, Biology, Hofstra University, Hempstead, NY

The Diamondback Terrapin Working Group logo was developed by Barbara Kemp of Kemp Design Services from a photo of a northern diamondback terrapin (*Malaclemys terrapin terrapin*) from the Patuxent River in Maryland waters of Chesapeake Bay.

MEETING SCHEDULE IN BRIEF

Friday, Nov 12	Saturday, Nov 13	Sunday, Nov 14
	7-8:00 Breakfast in cafeteria	7-8:00 Breakfast in cafeteria
12:00, 14:00, 16:00, 18:00, 20:00, 22:00 shuttles leave airport for LUMCON	8-12 Morning Paper Sessions	8:30-10:30 Poster session in cafeteria
14:00–18:00 Registration	12:20-13:20 Lunch in cafeteria	10:30-12:30 Regional Representatives Update and Breakout Sessions
14:00 DTWG business meeting	13:20-17:20 Afternoon Paper Sessions	12:30-13:30 Lunch in cafeteria
Dinner on your own	18:00 – 22:00 Banquet at LUMCON & Keynote address	Concluding remarks
18:00-23:00 Welcome Social	12-1 pm Lunch	12:00, 14:00, 16:00 Shuttles leave LUMCON for airport

MEETING SCHEDULE IN DETAIL

Friday, Nov 12

14:00–18:00 Registration

14:00 DTWG Business Meeting

Dinner on your own

18:00-23:00 Welcome Social **at LUMCOM**

Saturday, Nov 13

7-8:00 Breakfast in cafeteria

8:00-12:00 Registration Continues

8:30 Welcome: Russell Burke, Co-Director DTWG--Auditorium

Session 1: Joe Butler, Session Chair

8:40 **Predicting hotspots of diamondback terrapin nest predation on a Virginia barrier island**

Hackney, Amanda[1], Robert Baldwin[1], Patrick Jodice[2], [1]Department of Forestry and Natural Resources, Clemson University, [2]U.S. Geological Survey South Carolina Cooperative Fish and Wildlife Research Unit, Clemson University

9:00 **Nesting Ecology of the Mississippi Diamondback Terrapin (*Malaclemys terrapin pileata*) in Southeastern Mississippi**

Mohrman, Christina F.[1,2], Thomas J. Mohrman[3], Rachelle Cooley[4], and Mark S. Woodrey[2,5], [1] NOAA Environmental Cooperative Science Center, Florida A&M University, [2]Grand Bay National Estuarine Research Reserve, [3]The University of Southern Mississippi, Department of Biological Sciences, [4]The University of Southern Mississippi, Gulf Coast Research Lab, [5]Coastal Research and Extension Center, Mississippi State University

9:20 **"So I Stay or Should I Go Now": Ecology of Terrapin Hatchling Emergence Timing**

Roosenburg, Willem M. [1] and Jared DeForest[2], Center for Ecology and Evolutionary Studies, [1]Department of Biological Sciences, [2]Department of Environmental and Plant Biology, Ohio University

9:40 **Rescuing Hatchling Diamondback Terrapins *(Malaclemys terrapin terrapin)* from Storm Drains along the Southern New Jersey Coast**

Grottola, J.M.[1], K. Toft[1], and R.C. Wood[2], [1] School Based Youth Services, Lower Cape May Regional High School, [2] The Wetlands Institute.

10:00 **Evaluation of recovery strategies for the management of diamondback terrapins in Alabama, *Malaclemys terrapin pileata***

Coleman, Andy [1], Thane Wibbels[1], Ken Marion[1], Taylor Roberge[1], David Nelson[2], and John Dindo[3], [1]University of Alabama at Birmingham, [2]University of South Alabama and [3]Dauphin Island Sea Lab

10:20 **Coffee Break**

Session 2: Kristen Hart, Session Chair

10:40 **A comprehensive look at the efforts of the Terrapin Educational Research Program of Savannah since 2007**

Gray, Jordan Marshall, Kathryn Craven, Michelle Calvo, Tiffany Burgess, and Ulrike Umbehr, Department of Biology, Armstrong Atlantic State University

11:00 **Terrapin Barrier Fences along the Atlantic Coast of Southern New Jersey**

McLaughlin, D.J. and R.C. Wood, The Wetlands Institute

11:20 **Quantifying Bermuda's native diamondback terrapin population: a tale of two trap designs**
Outerbridge, Mark, Bermuda Zoological Society

11:40 **Bulkheading: A Threat to the Nesting Ecology of the Diamondback Terrapin in Barnegat Bay Estuary, NJ**
Winters, Julianne M. [1], Walter F. Bien[1], James R. Spotila[1], Edward A. Standora[2], and Harold W. Avery[1], [1]Drexel University, [2]Buffalo State College

12:00 **Estimating survival times for diamondback terrapins, *Malaclemys terrapin*, trapped in submerged crab pots**
Baker, Patrick J.[1,2], Amy Thomson[3], Itzick Vatnick[3], and Roger C. Wood[2,4], [1]Department of Biology, Swarthmore College, [2]The Wetlands Institute, [3]Department of Biology, Widener University, [4]Richard Stockton State College

12:20 **Lunch--Cafeteria**

Session 3: Barbara Brennessel, Session Chair

13:20 **Roles of coloration and color perception in the visual ecology of the diamondback terrapin**
Dominy, Abigail E. and Harold W. Avery, Department of Biology, Drexel University

13:40 **Hearing Capability of the Diamondback Terrapin (*Malaclemys terrapin*): Auditory Brainstem Response Technique and Behavioral Responses to Boat Engine Sounds**
Lester, L. A. [1], E. A. Standora[2], W. F. Bien[1], and H. W. Avery[1], [1]Drexel University, [2]Buffalo State College, Buffalo, NY.

14:00 **Seasonal changes in thermal environment and metabolic enzyme activity in the diamondback terrapin (*Malaclemys terrapin*)**
Williard, Amanda Southwood and Leigh Anne Harden, Department of Biology and Marine Biology, University of North Carolina Wilmington

14:20 **Population ecology of Jamaica Bay Diamondback Terrapins**
Burke, Russell, and Alexandra Kanoniak, Department of Biology, Hofstra University

14:40 **The Effects of Habitat Loss on the Nesting Population of *Malaclemys terrapin centrata* on Sawpit Island in Northeast Florida**
Simmons, Mike [1,2] and Joseph Butler[1], [1]Biology Department, University of North Florida, [2]Florida Department of Environmental Protection – Talbot Islands State Parks

15:00 **Foraging of Northern diamondback terrapins (Malaclemys terrapin terrapin) in eelgrass (*Zostera marina*) beds of the York River subestuary, Chesapeake Bay**
Tulipani, Diane C., and Romuald N. Lipcius, Virginia Institute of Marine Science, College of William & Mary

15:20 **Coffee Break**

Session 4: Michael Dorcas, Session Chair

15:40 **Roadkill Rollercoaster: Twenty Years of Monitoring Terrapin Mortality along the Atlantic Coast of Southern New Jersey**
Wood, R.C and D.J. McLaughlin, The Wetlands Institute

16:00 **A Report from the North: From Lab to Field and Back Again**
Brennessel[1], Barbara A., Shawn McCafferty[1], Julia Simindza[1], Amanda Shorette[1] and Tracey Spoon[2], [1]Wheaton College, [2] Mystic Aquarium

16:20 **Survey of the Distribution and Population Status of the Ornate Diamondback Terrapin (*Malaclemys terrapin macrospilota*) in the Big Bend Region of Florida**
Butler, Joseph A.[1] and George L. Heinrich[2], [1]Department of Biology, University of North Florida, [2]Heinrich Ecological Services

16:40 **Historical and Current Distribution of the Texas Diamondback Terrapin (*Malaclemys terrapin littoralis*): Barriers to Recolonization**
Guillen, George [1, 2], Curtis Wilson[2] and Emma Clarkson[1, 2], [1]Environmental Institute of Houston, University of Houston Clear Lake, [2]School of Science and Computer Engineering, Environmental Science Program, University of Houston Clear Lake

17:00 **Status of Diamondback Terrapins in North Inlet-Winyah Bay NERR, South Carolina**
King, Peter and John P. Ludlam, Department of Biology, Francis Marion University

17:20-18:00 **Poster set up**

18:00 – 22:00 **Banquet at LUMCON cafeteria & Keynote address by Dr. Peter Lindeman:**
"Shaking the Graptemys Tree: How Phylogeny Elucidates Ecology in the Map Turtles and Sawbacks and Diamondback Terrapins"

Sunday, Nov 14

7:00-8:00 **Breakfast in cafeteria**

8:30-10:30 **Poster session in cafeteria**

10:30-12:30 **Regional Representatives Updates and Breakout Sessions, concluding remarks**

12:30-13:30 **Lunch in cafeteria**

12:00, 14:00, & 16:00 **Shuttles leave LUMCON for airport**

Presentations at the 5th Symposium on the Ecology, Status, & Conservation of the Diamondback Terrapin

Alford, April and Dr. Amanda Southwood Williard
University of North Carolina Wilmington

Use of Modified Crab Pots to Monitor Diamondback Terrapin (*Malaclemys terrapin centrata*) Populations at Masonboro Island, NC

Although long-term population data is lacking in many geographical areas, it is assumed that diamondback terrapins (*Malaclemys terrapin centrata*) are declining throughout their entire range. Previous studies have indicated that diamondback terrapins utilize marsh habitat at the backside of Masonboro Island, North Carolina, but estimates of population size and demographics are lacking for this site. The purpose of this study was four fold: to evaluate the efficacy of using modified crab pots as a means to capture diamondback terrapins, determine presence and abundance of local populations, establish a long-term monitoring program to evaluate population status and health, and provide data on terrapin distribution to the Department of Marine Fisheries for use in management of blue crab fisheries. Eight modified crab pots were strategically placed in five locations from May 2010 to October 2010. Crab pots were sampled weekly for a twenty-four hour period. Captured terrapins were measured, photographed, and externally marked with a unique code notched on the marginal scutes. To date, 26 individual diamondback terrapins have been captured with 3 recaptures. Long-term data is needed in order to evaluate the effects of environmental stressors, such as blue crab pots and habitat degradation, on local terrapin populations.

Poster presentation

Atkinson, Benjamin K.
Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, FL 32611

Impacts of Ghost Traps on Diamondback Terrapins in Florida

There is a serious need for terrapin population data and management-based conservation efforts in Florida. In particular, actions need to be taken regarding incidental mortality among blue crab fisheries. I propose to initiate an outreach program to train citizen scientists and fishermen to evaluate and reduce by-catch of terrapins in derelict crab traps throughout the state. Management decisions for the species require information on terrapin mortality and fishermen attitudes in order to balance an economic and sustainable crab fishery while addressing by-catch concerns. Since data are largely lacking, I will employ an interdisciplinary research approach to fill these gaps and improve the conservation outlook for Florida's terrapins. Focused ghost trap roundups will be a crucial part of this study. Salvaged terrapin skeletal material recovered from traps will be used to determine minimum mortality estimates. I will also map crab fishery information using GIS and incorporate terrapin habitat and distribution data to determine priority zones of greatest conservation concern. Globally, efforts to reduce by-catch in fisheries have been met with some resistance. Researchers have had varied success, depending on the fishery, gear, and sociopolitical climate of the region. Modern conservation depends on managing people and shifting industry actions towards sustainable practices.

Poster presentation

Bachman, C.[1] and Kays, D.[2]
The Wetlands Institute, 1075 Stone Harbor Boulevard, Stone Harbor, NJ 08247
[1]Richard Stockton College, NJ
[2]Messiah College, PA

Comparative Analysis of *Malaclemys terrapin terrapin* diet at two different sites in New Jersey

The diet of *Malaclemys terrapin terrapin* at two different New Jersey study sites, one in the Hackensack Meadowlands and one on the Cape May Peninsula, was analyzed. These sites differ in salinity, water temperature, and documented sources of pollution. The study was carried out by collecting and examining fecal samples from terrapins at both sites, and by examining the contents of gastrointestinal tracts of road-killed females collected on the Cape May Peninsula. Fifteen different species of fish, arthropod or mollusk remains were identified, showing that these terrapin populations feed on a much wider variety of species than is generally indicated in literature. There was a substantial amount of crossover of species found at both sites; however, each site had unique species, and the most common prey species were different at each site. These results support that terrapins are opportunistic eaters, and that they do not depend on only a few prey items for survival, but are able to eat many different species. It was also apparent in the data from the Hackensack Meadowlands that mostly larger terrapins were eating blue crab, showing that terrapin size is a factor in prey selection.

Poster presentation

Baker, Patrick J.[1,2], Amy Thomson[3], Itzick Vatnick[3], and Roger C. Wood[2,4]
[1]Department of Biology, Swarthmore College, Swarthmore, PA
[2]The Wetlands Institute, Stone Harbor,NJ
[3]Department of Biology, Widener University, Chester, PA
[4]Richard Stockton State College, Pomona, NJ

Estimating survival times for diamondback terrapins, *Malaclemys terrapin*, trapped in submerged crab pots

Turtles undergo the longest aquatic dives of any air-breathing vertebrate. Despite this remarkable ability, incidental drowning occurs when a turtle entrapped in fishing gear cannot reach the surface. Mortality in crab pots is a major threat to populations of the diamondback terrapin, *Malaclemys terrapin* (Latreille), a turtle that inhabits brackish waters along the Atlantic coast of the USA. We integrated laboratory and field observations to estimate survival time for a terrapin submerged in a crab pot. In the laboratory, voluntary dive time (8.4 ± 5.7 min) was compared to a calculated aerobic dive limit derived from mass-specific lung volume and metabolic rates. By this estimate, an active 200 g terrapin has sufficient oxygen stores to sustain aerobic metabolism for ~ 16 min at 20°C. In the field, average time of submergence for crab pots set in shallow tide creeks over a 4-day period was 58 ± 54 min for diurnal high tides and 314 ± 61 min for nocturnal high tides. Accordingly terrapins captured in crab pots during the day had lower plasma lactate concentrations those caught at night. Both groups returned to baseline levels within 12 h. Our data suggest that voluntary dives are terminated before the diving lactate threshold has been reached. However, terrapins that are trapped in crab pots can be submerged for several hours at high tide and must rely extensively on their ability to sustain anaerobic metabolism. Without access to air, entrapped terrapins will become acidotic within a few hours and die.

Oral presentation

Brennessel[1], Barbara A., Shawn McCafferty[1], Julia Simindza[1], Amanda Shorette[1] and Tracey Spoon[2]
[1]Wheaton College, Norton, MA
[2] Mystic Aquarium, Mystic, CT

A Report from the North: From Lab to Field and Back Again

Cape Cod has several isolated clusters of diamondback terrapins, most notably those in Wellfleet Harbor; Eastham, near first Encounter Beach; Barnstable, at Sandy Neck, and on the SouthCoast in Buzzards Bay. A remnant population resides in Pleasant Bay, Orleans. Mark/recapture studies indicate that female terrapins remain in their population clusters but movement of males between clusters cannot be ruled out. Genetic analysis, using microsatellite markers, points toward population structuring among the Wellfleet, Barnstable and SouthCoast clusters although not to a degree in which individual terrapins can be assigned to a particular cluster. When the clusters were compared at a gene region that might confer adaptive traits, the MHC Class 1 locus, the Cape Cod clusters were identical suggesting that this gene region is evolving at a turtle's pace. Our nest protection efforts and turtle gardening programs are producing significant increases in the number of diamondback terrapin nests and the number of hatchlings emerging each year. With the ability to identify nesting females and retrieve their hatchlings, we have conducted a paternity study using terrapins from Wellfleet Harbor. Similar to other species of turtles, diamondback terrapins exhibit multiple paternity. In approximately 30-50% of Wellfleet nests that we examined, the hatchlings have been sired by more than one male.

Oral presentation

Buhlmann, Kurt A. [1], Andrew M. Grosse[1], Tracey D. Tuberville[1], Brian Crawford[2], John C. Maerz[2], Terry Norton[3], Michelle Kaylor[3], Linda Pirie[3], Lisa Rodriguez[3], Simon Dilts[3] and Michelle Kaylor[3]
[1]Savannah River Ecology Lab, University of Georgia, Aiken, SC 29802
[2]Daniel B. Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA, USA
[3]Georgia Sea Turtle Center, 214 Stable Rd., Jekyll Island, GA, 31527

Experimental Techniques Employed for the Conservation of Diamondback Terrapins (*Malaclemys terrapin*) on the Jekyll Island Causeway, Georgia

Vehicle-induced mortality is an important factor contributing to terrapin population declines. Each year, between late April and mid-July, hundreds of female diamondback terrapins (*Malaclemys terrapin*) leave the salt marsh habitat and cross the Jekyll Island Causeway (JIC), Georgia while searching for suitable terrestrial sites to deposit their eggs. The roadsides of man-made causeways that bisect salt marsh habitats are attractive places for female terrapins to nest. Unfortunately, female terrapins search for elevated, well drained sites and often continue across roadways and are hit by cars. In an attempt to lessen terrapin mortality, two research projects were initiated. In 2009, we established 12 elevated, well-drained nesting mounds using dredge spoil along the JIC. The goal was to provide female terrapins exiting the marsh with sparsely vegetated, attractive nesting targets which would reduce the likelihood of terrapins crossing the causeway. In 2010, we initiated a study to determine if temperature variation in nesting habitats

along the causeway (e.g., sparsely vegetated, shrub-dominated) including constructed nest mounds affect hatchling sex ratios and nest success. Preliminary data show that terrapins successfully nest on mounds and nests will successfully incubate and hatch. Temperature data suggest that the availability of multiple nesting habitats may be important for future production of male and female terrapins on the causeway.
Poster presentation

Burgess, Tiffany and Dr. Kathryn Stephenson Craven
Biology Department, Armstrong Atlantic State University, Savannah, GA

Effects of Temperature on the Growth of Hatchling Terrapins
The diamondback terrapin is native to the coastal brackish waters of the Atlantic and Gulf states in the US. Nesting occurs from May through July and eggs incubate for about 60 days. This project was designed to test the effect of temperature on the growth of hatchling terrapins and assess the potentially positive effect of global warming on reptiles. One clutch of captive bred Carolina diamondback terrapin hatchlings were divided into 2 treatment groups (N=4 turtles). Treatment 1 was maintained in the laboratory at 26°C, and treatment 2 was maintained in a separate tank at 28.7°C. Both tanks were otherwise identical. Hatchlings were fed individually at ambient temperature four times per week. Weekly measurements of weight, straight-line carapace length and width (SCL and SCW), straight-line plastron length and width (SPL and SPW), along with shell height were recorded for 24 weeks along with periodic photo-documentation for individual identification and phenotypic changes. An overall trend of greater growth of weight and distance were observed in the warmer tank (treatment 1), although there were some individual differences between hatchlings in growth rate.
Poster presentation

Burgess,Tiffany, Jordan Gray, and Kathryn Stephenson Craven
Biology Department, Armstrong Atlantic State University, Savannah, GA

Environmental Influences on Phenotypic Plasticity in Hatching Terrapins
The diamondback terrapin has several phenotypic variations within the species. The exact cause for this variation is still unknown but is considered to have both genetic and environmental influences. Possible environmental influences could have positive adaptive effects for the species in time of habitat changes. This study has been designed to explore the possible effects of habitat coloration on the shell and skin phenotypic characteristics of captive hatchlings. Two experimental groups (Group 1: completely white and Group 2: completely black habitats) and a tan control group with typical captive habitat are kept at identical temperature and water conditions and fed equally. Measurements and pictures to determine individual progress will be taken weekly during the study period of approximately seven months. Each individual's phenotype will be measured using a predetermined scale at the end of the study. A significant difference between the two experimental groups would indicate an environmental influence on phenotype development and suggest a likelihood of phenotypic adaptability.
Poster presentation

Burke, Russell, and Alexandra Kanoniak
Department of Biology, Hofstra University, Hempstead NY, 11549

Population ecology of Jamaica Bay Diamondback Terrapins

Terrapin populations have been heavily influenced by commercial hunting and marsh conversion, especially near urban centers such as New York City. Currently they are impacted range-wide by drowning as by-catch, marsh erosion, and subsidized predators. We have been conducting a mark-recapture study of the Jamaica Bay (JB) terrapin population since 1998 and have uniquely marked over 600 adult females. The number of nests laid on the main nesting ground has been dropping steadily and is now 37% lower than in 1999. However, our estimates of the number of females in the population have remained fairly constant at about 965 adults. It appears that the number of nests/females is decreasing, which has not been documented in any other turtle population. This may be a response to decreasing resources, due to the rapid erosion of JB salt marshes. Hatching success of JB terrapin eggs under laboratory conditions is >90%, under good field conditions it is >80%. However, subsidized predators, such as raccoons (*Procyon lotor*) predate about 92% of eggs from unprotected nests, and Norway rats (*Rattus norvegicus*) predate terrestrial hatchlings. It appears that recruitment in this population is affected both indirectly, through declining resources, and directly, through subsidized predation, natural predators, and nest failure.

Oral presentation

Butler, Joseph A.[1] and George L. Heinrich[2]

[1]Department of Biology, University of North Florida, Jacksonville, Florida 32224

[2]Heinrich Ecological Services, 1213 Alhambra Way S., St. Petersburg, Florida 33705-4620

Survey of the Distribution and Population Status of the Ornate Diamondback Terrapin **(***Malaclemys terrapin macrospilota***)** in the Big Bend Region of Florida

One important recommendation from a national group of terrapin biologists was to identify diamondback terrapin population centers so they can be studied and managed. Little is known about the ornate diamondback terrapin from the Big Bend region of Florida and only 12 museum specimens from this area are known. We surveyed for terrapins from the St. Marks River south to the Suwannee River in order to identify terrapin populations, locate and assess nesting habitats, create maps demonstrating these areas, and offer management recommendations to improve terrapin conservation in this region. We used a combination of trapping, head counts in tidal creeks, and land surveys to accomplish our goals. We recorded 37 new terrapin sites, captured 5 live terrapins, recorded 6 intact nests, 16 crawls, terrapin remains from 48-49 individuals, and 453 raided nests. This survey documents the importance of this region as habitat for terrapins. These terrapin populations and their habitats warrant protection and large-scale development along this coastline should be resisted. We also recommend the continuation of Florida Fish and Wildlife Conservation Commission funding for diamondback terrapin surveys along the Gulf coast of Florida so that other population centers can be identified.

Oral presentation

Clarkson, Emma, Abby Marlow, and George Guillen

University of Houston – Clear Lake

Environmental Institute of Houston

Site Fidelity and Range of An Island Population of Diamondback terrapin *(Malaclemys terrapin)* in West Galveston Bay, Texas and the Implications for Management.

Mark – recapture and radiotelemetry was used for three years (2008-2010) to determine individual range and site fidelity of the Texas Diamondback terrapin (*Malaclemys terrapin littoralis*) on South Deer Island in Galveston Bay, TX. We found high variance in the range and site fidelity of each terrapin. The longest and shortest straight line distance between two capture points on the island was 435 m and 2.2m respectively. While 435 m may seem to be a low migration rate in other study areas, our island was only 667 m in diameter. Therefore 435 m represents a large percentage of the total possible usable subtidal and intertidal habitat. The majority of the terrapin showed low site fidelity to a specific tidal creek, and instead exhibited a highly dispersed distribution around the island and between tidal creeks. Very few terrapin showed high fidelity to one any one tidal creek. The most significant movement observed during the study was between South and North Deer Island which are located approximately 1.4 km from each other. Previous studies have found that on a larger scale, high site fidelity limits terrapin's ability to re-colonize depopulated tidal creeks. Our study suggests terrapin can potentially repopulate nearby tidal creeks within and between coastal islands. This information has significant management implications for organizations and agencies responsible for the management and conservation of populations of terrapin inhabiting islands and associated tidal creek systems. The potential for natural re-colonization between islands and tidal creeks may be higher than previously documented in the literature.

Poster presentation

Coleman, Andrew[1], Thane Wibbels[1], Ken Marion[1], Taylor Roberge[1], Yu-hui Huang[1], Nicole White[2], David Nelson[3], and John Dindo[4]

[1]University of Alabama at Birmingham, Birmingham, AL

[2]Birmingham Southern College, Birmingham, AL

[3]University of South Alabama, Mobile, AL

[4]Dauphin Island Sea Lab, Dauphin Island, AL

Investigation of maternal effects on egg size and hatchling fitness in the Mississippi diamondback terrapin, *Malaclemys terrapin pileata*

Numerous populations of diamondback terrapins, *Malaclemys terrapin*, are experiencing declines from historic levels. Along the Gulf Coast of Alabama, only isolated remnant aggregations of Mississippi diamondback terrapins currently exist. To address high levels of nest predation by raccoons, which represent a major threat, a head-start program was initiated at U.A.B. In the summer of 2009, twelve clutches (average of 7.75 eggs/clutch) were obtained from females that subsequently were measured, weighed, and tagged. The length, width, and mass of every egg were measured. After hatching, carapace length and width, plastron length, and mass of every hatchling were measured once a week. Each clutch was fed daily until satiation. Effects of female size and age on egg size and hatchling growth were examined. Rates of hatchling growth were treated as an indicator of hatchling fitness along with righting response. So do larger and older females produce more fit hatchlings? The results did not agree with the predictions of the optimal egg size theory. Instead, a new hypothesis was proposed and tested with data from 2010. This evolutionary question has conservation implications for populations facing extirpation due to road mortality of nesting females.

Poster presentation

Coleman, Andy [1], Thane Wibbels[1], Ken Marion[1], Taylor Roberge[1], David Nelson[2], and John Dindo[3]
[1]University of Alabama at Birmingham, Birmingham, AL
[2]University of South Alabama, Mobile, AL and
[3]Dauphin Island Sea Lab, Dauphin Island, AL

Evaluation of recovery strategies for the management of diamondback terrapins in Alabama, *Malaclemys terrapin pileata*

Diamondback terrapins were once so abundant in Alabama that the world's largest terrapin farm existed along its coast. The "Biloxi" terrapin was shipped by the thousands to the markets of the Northeast. However, once the commercial crab fishery became firmly established, terrapin populations were decimated and have never fully recovered. This comprehensive study assessed the current conservation status of terrapins in Alabama. The results from field surveys (mark-recapture, head, depredated nest) indicate the presence of remnant isolated aggregations. Population estimates of the aggregation inhabiting the same location as the terrapin farm (Cedar Point Marsh) signify severe population depletion. Also, crab trap mortality and nest predation represent the most important threats to terrapin survival. To address crab trap mortality, the efficacy of a 5"x12" bycatch reduction device (BRD) was investigated in a side by side crab trap comparison in Cedar Point Marsh. Marketable size crab capture was not significantly affected, but traps not fitted with BRD's caught significantly more terrapins. For nest predation, a head-starting program was initiated at U.A.B. To date, 300 eggs have been obtained from females nesting in Cedar Point Marsh, and 50 head-started juveniles have been released. Future monitoring will evaluate the success of these individuals.

Oral presentation

Craven, Kathryn S., and Michelle Calvo
Armstrong Atlantic State University, Savannah, GA USA

Feeding Preferences in Captive Diamondback Terrapins, *Malaclemys terrapin centrata*

In this study, the feeding preferences of captive raised Carolina diamondback terrapins were examined. Cafeteria-style feeding trials were conducted using four different native prey species (*Uca, Littorina, Ilyanessa, Palaemonetes*) collected from a local salt marsh. Prior to testing, terrapins were housed in lightly salted water (< 5ppt, 22C). Males and females were tested individually and presented with single prey choices, or mixed prey. Feeding trials were conducted in artificial sea water (22C, 25ppt) in a 57 L tub behind a blind. Results were analyzed to look at prey preference by sex, head size and maturity. All adult terrapins preferred to eat fiddler crabs. Crabs were preferred by both males and females without regard to head size and there was no significant bias toward consumption of potentially less dangerous female crabs (34 males, 38 females consumed). The captive terrapins had only sporadic exposure to live prey; their typical diet consisted of floating pellets. Results indicated that prey choice in GA terrapins differs from other parts of the Southeastern US. If prey preference has evolved regionally and is hard wired, there may be a more urgent need to define areas of critical habitat and focus on preserving favored prey species.

Poster presentation

Dominy, Abigail E. and Harold W. Avery
Department of Biology, Drexel University, Philadelphia, Pennsylvania 19104, U.S.A.

Roles of Coloration and Color Perception in the Visual ecology of the diamondback terrapin

Visual ecology combines the studies of evolutionary ecology, animal behavior, and the physiology of vision. Compared to other closely related Emydid turtles, the terrapin has a high degree of individual phenotypic variation. Turtles may use visual cues in communication, especially in courtship interactions. Sexual selection may be the driving force supporting the phenotypic variation that we observe in the coloration of the diamondback terrapin. To determine the visual ability of the terrapin, a thin slice of the retina will be viewed under a microspectrophotometer. To quantify variation, spectral reflectance spectra and several forms of color space were measured. Digital photographs were also taken to quantify carapace and plastron patterns. Blood samples were also taken from all males and gravid females that were captured, and tissue samples were taken from all hatchlings with known mothers. All samples are being DNA-fingerprinted based on six microsatellite loci. Hatchling paternity will be determined from sampled adult males. If sexual selection is occurring, we expect females and/or males to select mates based on differential coloration or patterns.

Oral presentation

Ehret, Dana J.[1], and Benjamin K. Atkinson[2]
[1] Florida Museum of Natural History, University of Florida, Gainesville, FL 32611, USA
[2] Department of Wildlife Ecology and Conservation, University of Florida, Gainesville, FL 32611, USA

The Diamondback Terrapin Fossil Record: Shedding Light on the Paleohistory of *Malaclemys terrapin*

The fossil record of diamondback terrapins is scant. Only two published accounts exist for the genus: a Holocene shell and postcranial elements from Bermuda and two Pleistocene carapace fragments recovered from South Carolina. Here we report additional fossils from Edisto Beach, SC, material from the South Brunswick River, Georgia, and specimens from the Aucilla and Wekiva Rivers in Florida. In total, we identify 16 new fossil specimens expanding the fossil record for *Malaclemys* into GA and FL. Additions to the *Malaclemys* fossil record are compared to the original material described from SC and the extensive extant osteological collections at the Chelonian Research Institute. Today, terrapins occur along the Atlantic and Gulf coasts of the United States from Cape Cod, Massachusetts to south Texas, with a population of questionable origin existing in the Bahamas. Unlike other emydid, *Malaclemys* is completely adapted to brackish water salt marshes, estuaries, and tidal creeks. Paleoclimatological evidence suggests that sea level has changed dramatically during the Pleistocene in areas where terrapin fossils have been recovered. These localities appear to reflect historical shorelines during Pleistocene glacial-interglacial cycles. Sea level changes may be responsible for the paucity of known fossilized material, due to a lack of geological exposures.

Poster presentation

Erazmus, Kayleigh
Hofstra University, Hempstead, NY, United States

Dramatic Annual Differences in the Diets of Adult Female Jamaica Bay Terrapins

The diet of 112 adult female Northern Diamondback Terrapins (*Malaclemys terrapin terrapin*) was examined during three consecutive nesting seasons at the Jamaica Bay Wildlife Refuge, Queens, New York. Few such studies have been performed on the diet of *Malaclemys*, and none in the Northeast, where potential prey species differ from those that occur elsewhere in the range. Based on work from other locations in the *Malaclemys* range and the previous research of *Graptemys* diets, I predicted that JBWR terrapins consume primarily snails, clams, crabs and mussels. I found that clams, crabs and mussels do make up a large portion of their diets; however there was little evidence of snail consumption. I also found a higher abundance of vegetation, especially sea lettuce (*Ulva*), than previously documented. In addition to this, the predominant prey taxa differed between the three years, with ribbed mussels (*Geukensia demissa*) and crabs (crustacea) being most abundant in 2008, and soft shell clams (*Mya arenaria*) and sea lettuce (*Ulva*) in 2009 and 2010. The reason for this dietary shift is not clear, but suggested that long-term studies may be necessary to fully characterize *Malaclemys* diets.

Poster presentation

Gray, Jordan Marshall, Kathryn Craven, Michelle Calvo, Tiffany Burgess, and Ulrike Umbehr

Department of Biology, Armstrong Atlantic State University, Savannah, Georgia, USA

A comprehensive look at the efforts of the Terrapin Educational Research Program of Savannah since 2007

The Terrapin Educational Research Program of Savannah (T.E.R.P.S) and Project Diamondback at the Armstrong Atlantic State University are a conjoined effort between students and faculty to promote local terrapin conservation through field and laboratory research, community outreach, rescue and rehabilitation, and captive-rearing. T.E.R.P.S members are active throughout the year with responsibilities including promoting conservation and providing hands on terrapin education at regional festivals and events, canvassing local highways for injured and dead-on-road females during nesting season, seining tidal creeks for population assessment and repatriation efforts, and performing laboratory experiments using "rear and release" hatchlings to obtain both qualitative and quantitative data on *M.t.centrata.* The efforts of the T.E.R.P.S organization have proven highly successful in terms of outreach and awareness as they have garnered much community and media attention, further promoting conservation and awareness of the diamondback terrapin and chelonians in general. Success has also been shown in the active participation and continued recruitment of new student volunteers into the program. Research and subsequent findings to assess the effectiveness of repatriation efforts, determining tidal creek population dynamics, and controlled laboratory experiments are ongoing and provide preliminary data and substance for subsequent studies.

Oral presentation

Grosse, Andrew M., and John C. Maerz

Daniel B. Warnell School of Forestry and Natural Resources, University of Georgia, Athens, GA, USA

Commercial Crabbing as a Selective Pressure Affecting Diamondback Terrapin Growth Rates in GA

Human activities have been characterized as the greatest contemporary selective pressure affecting other species. In coastal ecosystems, commercial fisheries act as a major source of predation for both target and non-target species. For example, the diamondback terrapin, *Malaclemys terrapin*, is frequent by-catch in commercial and recreational crab pots. Crab pots predominantly kill young females and males, which are smaller than mature females. The effects of crab pots on terrapin population size, age and sex ratio are documented; however, there have been no attempts to document whether crab pots effect terrapin phenotypes. We used population and size data for 24 tidal creeks along the Georgia coast that vary in the presence of commercial crabbing activity. We found that the average age and size *M. terrapin* was greater in creeks with crabbing activity. We also found that estimated growth rates of both male and female *M. terrapin* were faster in creeks with crabbing activity. While we cannot rule out whether increased growth rates are the result of reduced competition associated with reduced population size, we hypothesize that crabbing has selected for the faster growth rates in terrapins. Our results suggest that crab pots function as gape limited predators within estuaries that are having an evolutionary effect on the growth rates and size distributions of terrapins.

Poster presentation

Grottola, J.M.[1], K. Toft[1], and R.C. Wood[2]

[1] School Based Youth Services, Lower Cape May Regional High School, 687 Route 9, Cape May, NJ 08204, USA

[2] The Wetlands Institute, 1075 Stone Harbor Boulevard, Stone Harbor, NJ 08247, USA

research@wetlandsinstitute.org

Rescuing Hatchling Diamondback Terrapins *(Malaclemys terrapin terrapin)* from Storm Drains along the Southern New Jersey Coast

Prior to intensive human development of the New Jersey coast, the traditional nesting sites for diamondback terrapin (*Malaclemys terrapin terrapin)* were sand dunes on barrier beach islands. These dunes were, for the most part, obliterated long ago. However, where access to the salt marsh side of these islands is still unrestricted, terrapins continue to come ashore during the nesting season to nest in people's yards. Storm drains in these island communities are a significant hazard for terrapin hatchlings when they emerge from their nests and attempt to return to the salt marsh. Terrapin hatchlings fall into these drains and become trapped in water which potentially contains toxic chemicals and pathogens. Many drown. Since 1999, students from Lower Cape May Regional High School have been involved in the rescue, care, and release of these otherwise doomed hatchlings. Students have been monitoring storm drains and rescuing terrapins with dip nets in a 20 block area adjacent to the salt marsh in Wildwood Crest and Lower Township, New Jersey. Over 2,500 hatchlings have been rescued so far, with roughly 90% of them successfully released. Storm drains are a potentially significant source of terrapin mortality that has not previously been reported.

Oral presentation

Guillen, George [1, 2], Curtis Wilson[2] and Emma Clarkson[1, 2]

[1]Environmental Institute of Houston, University of Houston Clear Lake, Houston, Texas 77058

[2]
School of Science and Computer Engineering, Environmental Science Program, University of Houston Clear Lake, Houston, TX, 77058

Historical and Current Distribution of the Texas Diamondback Terrapin (*Malaclemys terrapin littoralis*): Barriers to Recolonization

The Texas Diamondback Terrapin (DBT) (*Malaclemys terrapin littoralis*) was once hunted to the brink of extinction for production of terrapin soup. Today, most observed Texas DBT mortality appears to be caused by drowning in baited blue crab traps, although other sources are poorly documented. The Texas DBT is not currently listed as endangered or threatened at the federal or state level within Texas. However, little data exists on the current distribution and status of Texas DBT and how this contrasts with their historical range and density. In order to assess their current and past status we initiated an inventory of the current distribution of Texas DBT starting in Galveston Bay using field surveys. In addition we conducted a comprehensive literature review that, along with the field data, is being used to create a statewide database of their past and current distribution. By comparing new information on density and movement with historical distribution data we will be able to determine the potential for repopulation of their former range. Factors that are being evaluated include distance to previous inhabited areas and current land-use. Ongoing field surveys will be completed for the entire Texas coast within the next 3 years.

Oral presentation

Hackney, Amanda, and Robert Baldwin
Department of Forestry and Natural Resources, Clemson University, Clemson, SC, USA

Power of policy for conservation: an analysis of status of the diamondback terrapin (*Malaclemys terrapin*) throughout its broad geographic range

Most of the globe is not in reserve systems and turtles in particular are under-represented in the protected areas network. The diamondback terrapin (*Malaclemys terrapin*) has recovered from historical overharvesting yet still faces a multitude of risks. To assess gaps in policy protections, we created a spatially explicit range map, and then assessed how much of the terrapin range fell within the current reserve system of GAP1-3 lands, and found only 5.5% coverage suggesting a strong role for policy in habitat protection. We then surveyed laws of the 16 states in the species' range (56,409 km2), and federal laws applying to harvest and estuarine environments. All 16 states regulated harvest, but only a quarter require Bycatch Reduction Devices (BRDs) and listings ranged from critically imperiled/imperiled(5) to apparently secure(4). We found 8 federal laws that directly or indirectly influence terrapin and their habitat through regulated take, and/or habitat degradation of wetland, and/or coastal ecosystems (CBRA, CWA, Estuary Protection Act, FWCA, Lacey Act, NAWCA, NEPA, WPFPA). Such analyses help to illuminate the range of laws already in place that if implemented, enhanced, and importantly, coordinated across multiple jurisdictions range wide, could alleviate pressure on populations and augment protections provided by reserve networks.

Poster presentation

Hackney, Amanda[1], Robert Baldwin[1], Patrick Jodice[2]
[1]Department of Forestry and Natural Resources, Clemson University, Clemson, SC, USA

[2]U.S. Geological Survey South Carolina Cooperative Fish and Wildlife Research Unit, Clemson University, Clemson, SC, USA

Predicting hotspots of diamondback terrapin nest predation on a Virginia barrier island

Worldwide populations of many species of turtle are declining, with a major factor being reproductive failure due to nest disturbance and predation. We developed and validated a predictive model for the spatial distribution of predated diamondback terrapin nests using nest points (N=198) collected in 2008, at Fisherman Island NWR, Virginia. We used infra-red aerial photographs to identify patches of possible nesting habitat, and searched each patch for depredated nests collecting location and random-point microhabitat data when found. We built models for the probability of finding a predated nest using nest and random (N=220) points and validated with a reserve set (N=67). Five variables in 9 a priori models were used and the best selected model (AIC weight 0.9797) reflected positive associations with sand patches near marshes and roadways. Model validation using reserve points had an average capture rate of actual predated nests of 84.14% (26.17 - 97.38%, Q1 77.53%, median 88.07%, Q3 95.08%). Microhabitat selection results suggest females use edges of sand patches adjacent to upland shrub/forest that may serve as structure for predators. Our results suggest that conservation efforts to secure nests from subsidized predators should focus on sand patches near marshes and edges where sand meets upland habitat.

Oral presentation

Hackney, Amanda[1], and Pamela Denmon[2]
[1]Department of Forestry and Natural Resources, Clemson University, Clemson, SC, USA
[2]USFWS Eastern Shore of Virginia NWR, Cape Charles, VA, USA

Results of 2010 Road Monitoring on Fisherman Island National Wildlife Refuge in Cape Charles, VA

Highway mortality is a major problem for nesting female diamondback terrapins. In June and July of 2010, we monitored highway crossings and mortality on the Chesapeake Bay Bridge Tunnel in Virginia which crosses Fisherman Island NWR. Along a historically known mortality area, we constructed a drift fence made of 6" plastic corrugated pipe using a modified design by John Cuthbert of the Wetlands Institute in NJ. We surveyed both fenced and unfenced sections of roadway by car and foot for 35 days. When located, females were assigned an ID number, measured, marked and photographed. Date, GPS coordinates, time of roadway crossing and/or carcass detection were recorded for live and dead terrapins. We counted 39 dead and 37 live females. We concluded that the new fence design was effective; however, four mortalities occurred near fence ends. At least four terrapin crawled under the fence in areas where it was not pulled tight enough or the ground had a dip in elevation. Nesting female mortality could be decreased further by extending the fence to protect other terrapin crossing areas. The ends of the drift fence should be constructed to make crossing more difficult. Impacts to nests by deterred terrapins need to be investigated.

Poster presentation

Ismail, Niveen S.[1], David J. Velinsky[2], Jeffrey T. Ashley[3], and Robert W. Sanders[1]
[1]Department of Biology, Temple University, Philadelphia, PA 19122, USA
[2]Patrick Center for Environmental Research, Academy of Natural Sciences, Philadelphia, PA

19103, USA
[3]Department of Chemistry, Philadelphia University, Philadelphia, PA 19144, USA

Bioaccumulation of Polychlorinated Biphenyls in the Northern Diamondback Terrapin *(Malaclemys terrapin terrapin)*

Polychlorinated biphenyls (PCBs) are persistent organic pollutants that can bioaccumulate in organisms. PCBs are documented endocrine disrupting chemicals and are known to cause developmental, reproductive, and neurobiological disorders. We examined the bioaccumulation of PCBs in two populations of the northern diamondback terrapin (*Malaclemys terrapin terrapin*). These are located in Cape May County, NJ, a site with low levels of contamination and Jamaica Bay, NY, which is a highly contaminated site. The utility of the chorioallantoic membrane (CAM) as a non-lethal sampling technique for PCB analysis was evaluated. In order to determine the viability of the CAM, maternal transfer of contaminants was also studied. Egg and CAM samples were obtained from both field sites and liver samples were also collected from Cape May County terrapins. PCB levels and congener profiles were similar in both field locations. While PCB congeners were detected in liver, egg, and CAM samples, less chlorinated congeners preferentially partitioned in the CAM. Examination of homolog groups indicated a strong correlation between hexachlorinated biphenyls in all three sample types. Preliminary study results confirm that maternal transfer of PCB contaminants does occur with selective partitioning of congeners into the CAM.

Poster presentation

King, Peter and John P. Ludlam
Department of Biology, Francis Marion University, Florence, SC, USA.

Status of Diamondback Terrapins in North Inlet-Winyah Bay NERR, South Carolina.

Data will be presented from a five-year mark recapture study in North Inlet-Winyah Bay NERR, South Carolina. Terrapins were caught mainly by seining tidal creeks draining *Spartina alterniflora* marsh. To date 382 terrapins have been marked and 104 recaptures have been recorded. Eighty six percent of recaptures were in the same creek as they were first caught indicating high site fidelity. Thirteen percent moved to an adjacent creek. Three major nesting areas have been identified by the presence of depredated nests. Signs of nesting have been observed from May 26 to June 21. The maximum clutch size was 8 eggs. Raccoons have been identified as the major predator based on camera trapping data and disturbance at nest sites. Terrapin density has been estimated using data from 2008-2010 in four creeks that drain a 0.65 km2 section of marsh, using a closed captures mark-recapture model. Calculated density is 709.7 (575.7 - 916.8, 95% CI) terrapins/km2 giving an estimated abundance in the estuary of 16606.8 (13471.2 - 21452.4) terrapins. This long-term population study in a near pristine salt marsh estuary will provide vital data for comparisons with other terrapin populations.

Oral presentation

Lester, L. A. [1], E. A. Standora[2], W. F. Bien[1], and H. W. Avery[1]
[1]Drexel University, Philadelphia, PA, USA
[2]Buffalo State College, Buffalo, NY, USA

Hearing Capability of the Diamondback Terrapin (*Malaclemys terrapin*):

Auditory Brainstem Response Technique and Behavioral Responses to Boat Engine Sounds
Hearing is one of the most important senses for the diamondback terrapin (*Malaclemys terrapin*) because vision is often limited by the turbidity of estuarine waters. Auditory brainstem recordings (ABRs) were performed in-air to determine the terrapin hearing range. Terrapins hear a narrow range of low-frequency sounds (100 to 1000 Hz) in-air and they can undoubtedly hear a wider range of sounds underwater. Boat engines produce sounds that are within this hearing range. Playback recordings of boat engine sounds were presented to terrapins *in situ* to determine their behavioral responses. We measured the depth, orientation, and swimming speed of terrapins (n=80) before, during, and after playback of boat engines of various sizes. Although terrapins can hear boat sound frequencies, there was no significant behavioral response to the boat engine sounds. Of over 3,000 terrapins captured as part of an ongoing mark-recapture study in Barnegat Bay, New Jersey, 12-14% of the terrapins have scars that are evidence of boat propeller strikes. The failure of terrapins to behaviorally respond to anthropogenic sounds may be detrimental to their survival in areas with intense boating. Closure of some wildlife areas to boating may be necessary to decrease injury and mortality rates of terrapins.
Oral presentation

Mauro, Nancy
Office of the Cape May County Engineer, 4 Moore Road, Cape May Court House, NJ 08210, USA, nmauro@co.cape-may.nj.us

Impacts of Roadway Improvements on Northern Diamondback Terrapin *(Malaclemys terrapin terrapin)* Nesting Activity in Southern New Jersey
For four years (2007 – 2010), I have been conducting a study of nesting habitat of the northern diamondback terrapin adjacent to two roadway projects along the Atlantic coast of Cape May County, NJ. The study was mandated by permitting requirements of the State of New Jersey. My study sites were at Corsons and Townsends Inlets. A pre-construction survey of the nesting area was required prior to road improvements, followed by a post-construction study over the following three years. Study parameters were determined by the NJDEP. Field work was conducted a minimum of two days per week, prior to 11 am. During new or full moons, the sites were observed for four consecutive days. Terrapin activity, mortalities, nest predation, erosional loss of nests, temperature, weather, and the effectiveness of terrapin barrier fencing were documented. Results indicated that roadway improvements did not negatively affect the terrapins. Consideration of terrapins in project design such as installation of barrier fencing and construction of nesting habitat proved effective. No correlation was found between moon phases or time of day with nesting activity while factors like tide and temperature did show influence. The erosion/deposition of sand also appears to have impacted nesting activity.
Poster presentation

McCafferty, S. Shawn, Jessica Smith, and Barbara Brennessel
Biology Department, Wheaton College, Norton, MA 02356 USA

REAAL-SINEs of genomic variation in the diamondback terrapin (*Malaclemys terrapin*).
It is well known that diamondback terrapin populations have experienced steep declines in the last 100 years throughout their range (Brennessel, 2006). Population bottlenecks and low effective population sizes can profoundly impact the level of genomic variation potentially

leading to reductions of population fitness and threatening the long term viability of a species. In order to assess the overall level of genomic variation in local Massachusetts' populations of diamondback terrapins, we developed a novel method that we call Retroelement Anchored Anonymous Loci using Short Interspersed Nuclear Elements (REAAL-SINEs). Here we describe this technique and its potential benefits, plus present preliminary data from 7 anonymous nuclear loci surveyed from 3 Massachusetts populations of diamondback terrapins. Our results suggest overall low levels of nucleotide variation at these 7 loci in contrast to substantial levels of variation at 6 microsatellite loci. The implications of these results are briefly discussed.
Poster presentation

McGee, Brittany
The Wetlands Institute, 1075 Stone Harbor Boulevard, Stone Harbor, NJ 08247, USA
and University of Rhode Island, Kingston, RI, USA, brittany.m.mcgee@gmail.com

Preliminary Results of a Headstarting Project for Northern Diamondback Terrapins *(Malaclemys terrapin terrapin)* in Southern New Jersey

Headstarting of turtles tends to be controversial. Concern has been expressed about whether this kind of activity has value as a conservation tool. We think it does, at least for the population of northern diamondback terrapins *(Malaclemys terrapin terrapin)* that we have been monitoring over the past twenty years in southern New Jersey. Since 1997, researchers at the Wetlands Institute have been microchipping headstarted terrapins prior to their release. Analysis of recapture data indicates that some of the headstarted terrapins are surviving and returning to nest at the Wetlands Institute, where they were originally released. These preliminary findings are of interest for two reasons: (1) headstarted terrapins are surviving long enough to contribute to the population gene pool; and (2) these headstarters are clearly exhibiting nest site fidelity. We are still in an early stage of this long-term study. Increasingly large numbers of headstarted terrapins are being released into our population every year. As we continue to monitor the population we anticipate being able to develop a clearer understanding of the extent to which our headstarting project is succeeding.
Poster presentation

McLaughlin, D.J. and R.C. Wood
The Wetlands Institute, 1075 Stone Harbor Boulevard, Stone Harbor, NJ 08247, USA
research@wetlandsinstitute.org

Terrapin Barrier Fences along the Atlantic Coast of Southern New Jersey

Every year during their nesting season (typically late May – mid July), hundreds of adult female northern diamondback terrapins *(Malaclemys terrapin terrapin)* are killed on roads crossing or adjacent to salt marshes along the southern New Jersey coast. To mitigate this problem, researchers at the Wetlands Institute have conducted experiments to find out whether roadside fencing might be an effective means of preventing nest-seeking female terrapins from wandering onto heavily-trafficked summertime roads. Our research has demonstrated that terrapin barrier fences significantly reduce the number of terrapin road kills. Their widespread use in appropriate places can save hundreds of terrapin lives every nesting season. We have experimented with several different terrapin barrier designs: silt fencing, plastic mesh fencing, concrete blocks made from dredge disposal material, corrugated plastic tubing, and chicken wire

attached to roadside guardrails. Citizen conservationists may chose to implement any of these barrier designs with the help of Institute staff. We continue to investigate new barrier designs.
Oral presentation

Mohrman, Christina F.[1,2], Charles H. Jagoe[1], and Roger C. Wood[3,4]
[1]NOAA Environmental Cooperative Science Center, Florida A&M University, 1515 Martin Luther King Boulevard, Tallahassee, FL 32307, USA.
[2]Grand Bay National Estuarine Research Reserve, 6005 Bayou Heron Road, Moss Point, MS 39562, USA.
[3]The Wetlands Institute, 1075 Stone Harbor Boulevard, Stone Harbor, NJ 08247, USA.
[4]Richard Stockton College of New Jersey, PO Box 195, Pomona, NJ 08240, USA.

Mercury in Mangrove Terrapins from the Florida Keys

Because of their life history habits and role as a top predator in salt marsh and mangrove ecosystems, terrapins may serve as an important indicator species for contamination of estuarine ecosystems. Previous work has documented metal and organic pollutant burdens and effects in terrapins from sites along the Atlantic coast; however, little or no data is available for most terrapin subspecies. We collected non-lethal blood and scute samples from mangrove terrapins (*Malaclemys terrapin rhizophorarum*) from two locations in the Florida Keys National Wildlife Refuge and analyzed them for total mercury. Collection locations are small, uninhabited mangrove islands between Key West and the Marquesas. Scute mercury concentrations ranged from approximately 50-350 ppb dry weight. Blood concentrations were much lower. Blood mercury levels represent recent exposure while scute concentrations represent a longer-term, integrative record of mercury accumulation. Mercury concentrations generally increased with turtle size and weight, although relationships were not significant. This may be due to the relatively narrow size range of the captured turtles. For comparative purposes, we are also sampling Mississippi diamondback terrapins (*Malaclemys terrapin pileata*), which occur from the Florida panhandle to western Louisiana. Like mangrove terrapins, there is no data on the mercury burden of this subspecies.
Poster presentation

Mohrman, Christina F.[1,2], Thomas J. Mohrman[3], Rachelle Cooley[4], and Mark S. Woodrey[2,5].
[1] NOAA Environmental Cooperative Science Center, Florida A&M University, 1515 Martin Luther King Boulevard, Tallahassee, FL 32307, USA.
[2]Grand Bay National Estuarine Research Reserve, 6005 Bayou Heron Road, Moss Point, MS 39562, USA.
[3]The University of Southern Mississippi, Department of Biological Sciences, 118 College Drive, Hattiesburg, MS 39401, USA.
[4]The University of Southern Mississippi, Gulf Coast Research Lab, 703 Beach Boulevard, Ocean Springs, MS 39564, USA.
[5]Coastal Research and Extension Center, Mississippi State University, 1815 Popps Ferry Road, Biloxi, MS 39532, USA.

Nesting Ecology of the Mississippi Diamondback Terrapin (*Malaclemys terrapin pileata*) in Southeastern Mississippi

We studied Mississippi diamondback terrapin (*Malaclemys terrapin pileata*) nesting ecology at several sites in southeast Mississippi during four consecutive nesting seasons, from 2007–2010. Nests depredated by raccoons were used as an index for intact nests. Annually, approximately 200 nest sites were identified and characterized during the nesting season (April-August). Aspects of nest site selection, clutch size, and egg size were significantly different from Atlantic Coast populations. A significant number of nest sites were located in vegetated versus open beach areas, converse to Atlantic coast terrapin populations. Saltmeadow cordgrass (*Spartina patens*) was the most frequently occurring plant species at nest sites. Soil temperatures were lower and less variable in vegetated areas; temperatures causing anomalies and mortality occurred much less frequently in vegetated versus open areas (2008: 6% versus 30%). Compared to northern populations, smaller clutch size and larger egg size were observed in intact clutches, further corroborating observations in previous studies that clutch and egg size vary with latitude. This study represents the most extensive examination of diamondback terrapin nesting ecology in Mississippi, and highlights both important range-wide differences in terrapin life history and ecology as well as the need for additional study of poorly known Gulf Coast terrapin populations.

Oral presentation

Outerbridge, Mark
Bermuda Turtle Project Coordinator
Bermuda Zoological Society

Quantifying Bermuda's native diamondback terrapin population: a tale of two trap designs

Bermuda's native population of diamondback terrapins is highly localized to only three brackish water ponds on a private golf course at the eastern end of the island. Between 2008 and 2010 a mark-recapture census was undertaken in an effort to determine the size and structure of this isolated oceanic population. Differences in the physical characteristics of each pond necessitated the use of two different trap designs to catch the terrapins; a modified wire mesh crab trap and a modified collapsible fish trap. Both designs were effective at catching terrapins; however the collapsible fish traps were significantly more effective than the crab traps. The mark-recapture results indicated that Bermuda's adult population is very small (less than 100 individuals) and dominated by females. Additionally, the observed recruitment levels of sub-adults throughout this period were very low.

Oral presentation

Richards-Zawacki, Cori and Danielle Drabeck
Department of Ecology and Evolutionary Biology
Tulane University, New Orleans, Louisiana

Investigating the effects of the Deepwater Horizon oil spill on Louisiana's gulf coast salt marsh endemic reptiles

We are initiating a new project to investigate the population-level effects of contaminant exposure on Louisiana's gulf coast salt marsh endemic reptiles: the Diamondback Terrapin (*Malaclemys terrapin*) and the Salt Marsh Snake (*Nerodia clarkii clarkii*). Louisiana populations of these species are thought to be small and isolated. However, they have been little studied and little is known about the status of their populations. Using a combination of

molecular genetic techniques and contaminant (PAH) analyses from blood samples, our work aims to provide information about the size, connectivity, health, and genetic variability of populations and to test for changes in these factors associated with contaminant exposure in the wake of the Deepwater Horizon oil spill and clean-up effort. Effects of such changes could range from reduced fitness to local extinction and are expected to be especially severe if populations are currently small and isolated. We are in the beginning stages of this project and are looking to make contact with potential collaborators and funding sources.
Poster presentation

Roosenburg, Willem M. [1] and Jared DeForest[2]
Center for Ecology and Evolutionary Studies
[1]Department of Biological Sciences, roosenbu@ohio.edu
[2]Department of Environmental and Plant Biology, deforest@ohio.edu
Ohio University, Athens Ohio 45701,

"So I Stay or Should I Go Now": Ecology of Terrapin Hatchling Emergence Timing
The Poplar Island archipelago consists of one 478 hectare man-made island and two natural smaller island (<30 hectares) in middle Chesapeake Bay. A population of diamondback terrapins in the archipelago uses accessible shoreline for nesting. Because raccoons are not present and foxes are removed, nest survivorship on the island is extremely high relative to mainland populations. Approximately 50% of the nests laid on Poplar Island emerge in the fall and 30% emerge in the following spring. Since 2005, I have been studying the overwintering ecology of terrapin nests to identify potential adaptive advantages of emerging in the spring vs. the fall. There are no differences in survivorship, lipid levels, and size between fall and spring emerging nests. We have found that the fall emerging nests are likely to freeze at higher temperatures due to the presence of higher levels of ice nucleating agents in the soils near nests. Furthermore, soils near overwintering nests had higher bulk density suggesting that these soils may become more compacted potentially entrapping hatchlings. Soil bulk density also can influence soil gas flux rates and the emergence of hatchlings may be affected by the gas diffusion rates within nests. I report on CO_2 efflux measured *in situ* from terrapin nests during the summer of 2010 and I will compare this between spring and fall emerging nests. We will discuss the finding of this study in the context of adaptive scenarios for emerging in the fall vs. the spring.
Oral presentation

Samodurov, Cathrena[1,2], M. Krachey[2], and R.C. Wood[1]
[1]The Wetlands Institute, 1075 Stone Harbor Boulevard, Stone Harbor, NJ 08247 USA
[2]North Carolina State University, Raleigh, NC 27695 USA

The Influence of Air Temperature, Precipitation, and Tide on Nesting Activity of Northern Diamondback Terrapins *(Malaclemys terrapin terrapin)*
The significance of environmental influences on the nesting activity of a diamondback terrapin population was examined by analyzing the correlation of air temperature, precipitation, and tide with the activity with nesting females. Over a ten-year period (2000 – 2009) researchers patrolled forty miles of roads crossing or adjacent to salt marshes every nesting season. All terrapin road kills were documented. Using the number of kills found as an indicator for the overall activity of nesting terrapins and comparing environmental conditions to the number of

kills found indicates in what way nesting behavior is influenced by environmental factors. Data suggest that terrapins avoid nesting on days when extreme air temperatures (both high and low) occur. Precipitation appears to play no significant role in the nesting activity of the terrapin population. But there is a correlation between nesting activity and tide height of the creeks running through the marsh. Terrapins are most active one to two hours before and after both high and low tides instead of only at high tides as previously suggested in the literature.
Poster presentation

Simmons, Mike [1,2] and Joseph Butler[1]
[1]Biology Department, University of North Florida, Jacksonville, FL;
[2]Florida Department of Environmental Protection – Talbot Islands State Parks.

The Effects of Habitat Loss on the Nesting Population of *Malaclemys terrapin centrata* on Sawpit Island in Northeast Florida

Coastal waters in North Florida are home to the Carolina Diamondback Terrapin, *Malaclemys terrapin centrata*. Within these coastal waters, a few small islands host suitable habitat which supports all stages of the diamondback terrapin's life cycle. Sawpit Island, an island near the Nassau Sound in Northeast Florida, has been the focus of Carolina Diamondback Terrapin research for approximately 15 years. This undeveloped coastal island is very dynamic, existing in an area where human activity is abundant and erosion has considerably altered the landscape of the island. Nesting activity was monitored throughout the nesting seasons of 2009 and 2010. In 2009, 329 nests were recorded, while, in 2010, only 177 nests have been discovered to date (with observations still coming in). Previous studies, conducted by Dr. Joseph Butler, found 454 nests in 1997 and 475 nests in 2000. Available nesting habitat has decreased from approximately 3.24 ha in 1994 to 1.99 ha in 2008, and it continues to disappear each year. Observations from each season suggest a change in nesting behavior and nest site selection, and quite possibly nest site fidelity based on the negative impacts to their nesting beach.
Oral presentation

Stone, Matthew D., and Travis Kern
Kutztown University, Kutztown, PA/Mid-Atlantic, USA

Density estimates of diamondback terrapins (*Malaclemys terrapin*) and impacts of road mortality at Wallops Island, VA

Effective conservation strategies are contingent on an understanding of population size and the variables influencing population viability. The goal of this project was to establish a long-term terrapin monitoring and educational outreach program in the coastal bays of Virginia. We are presenting data from the first year of this project at the Marine Science Consortium in Wallops Island, VA. Our primary research objectives are to determine the frequency of terrapin mortality on the route 175 causeway and to assess the population status of diamondback terrapins in the coastal bays of Virginia. We conducted road-kill surveys, daily, between June 2nd and Aug 2nd 2010. We observed annual mortality to be 27 terrapins. Mortality was female biased, accounting for 100% of observed mortalities. This road-mortality estimate is conservative due to our observation of carcasses disappearing prior to official surveys. Future projects will include correction factors to compensate for carcass loss. In addition to road-kill analysis, we conducted head-count surveys between 6 Aug 2010 and 14 Aug 2010. Transects (range = 0.1-1.8 km) were

surveyed by boat with each consisting of two passes. Overall, the relative density of terrapins was variable (range 0-47 turtles). Average density of turtles observed was 10.3 terrapins per transect.

Poster presentation

Tulipani, Diane C. [1], and Romuald N. Lipcius[2]
[1,2]Virginia Institute of Marine Science, College of William & Mary, Gloucester Point, VA U.S.A.

Foraging of Northern diamondback terrapins (Malaclemys terrapin terrapin) in eelgrass (*Zostera marina*) beds of the York River subestuary, Chesapeake Bay.

Diamondback terrapins (*Malaclemys terrapin*) are important predators in salt marsh systems, but foraging habits in seagrass beds are relatively unknown. We analyzed fecal samples of terrapins collected in 2009 and 2010 from eelgrass (*Zostera marina*) beds adjacent to salt marshes near the mouth of the York River. Terrapins fed primarily on eelgrass epibionts (e.g. barnacles *Balanus* spp. and isopod *Erichsonella attenuata*), but also consumed *Zostera* seeds, which may have been ingested coincidentally. Seeds were in fecal samples of 52% and 40% (May 2009 and 2010, respectively) of terrapins collected from seagrass beds. Captive terrapins were fed mature eelgrass seeds to determine effect on seed germination. Germination rate of egested seeds was 23% compared with *in situ* germination rate of 10%. Saurochory, dispersal of plants by reptiles, has not been extensively investigated. Given (i) the ability of terrapins to traverse entire beds, (ii) reasonable passage time of seeds through the digestive track, and (iii) their home range and site fidelity, terrapins may be an important dispersal vector for *Zostera* seeds within and between seagrass meadows. These findings represent the first report of terrapins foraging in eelgrass beds and ingesting eelgrass seeds, thereby expanding the modes of biological seed dispersal for *Zostera*.

Oral presentation

Williard, Amanda Southwood and Leigh Anne Harden
Department of Biology and Marine Biology, University of North Carolina Wilmington, 601 S. College Rd., Wilmington, NC 28403 USA

Seasonal changes in thermal environment and metabolic enzyme activity in the diamondback terrapin (*Malaclemys terrapin*)

We documented the thermal conditions experienced by diamondback terrapins from June to February in a North Carolina estuary using temperature data loggers, and investigated temperature effects on metabolic enzyme activity in terrapin muscle tissue collected during summer and winter. Activity of lactate dehydrogenase (LDH), pyruvate kinase (PK), citrate synthase (CS), and cytochrome c oxidase (CCO) was assayed at 10, 20, 30, and 40°C, thermal dependence of enzyme activity was assessed, and comparisons between summer and winter tissue were made. Terrapins experienced wide daily and seasonal fluctuations in temperature over the course of the study. The Q10 for enzyme activity varied between 1.31 and 2.11 within the temperature range at which terrapins were active (20 – 40°C). The Q10 for LDH, CS, and CCO varied between 1.39 and 1.76 between 10 – 20°C, but PK exhibited heightened thermal sensitivity within this lower temperature range, with Q10 of 2.90 for summer-collected tissue and 5.11 for winter-collected tissue. There was no significant effect of season on activity of

LDH, but activity of PK, CS, and CCO was significantly lower in winter-collected tissue compared with summer-collected tissue. Results indicate that temperature effects in combination with other factors contribute to seasonal metabolic downregulation and dormancy in terrapins.
Oral presentation

Winters, Julianne M. [1], Walter F. Bien[1], James R. Spotila[1], Edward A. Standora[2], and Harold W. Avery[1]
[1]Drexel University, Philadelphia, Pennsylvania, USA
[2]Buffalo State College, Buffalo, New York, USA

Bulkheading: A Threat to the Nesting Ecology of the Diamondback Terrapin in Barnegat Bay Estuary, NJ

With approximately 4 billion people living within 60 km of the Earth's coastline, and the global population increasing at an exponential rate, loss of habitat due to increased coastal development poses a significant risk to biodiversity worldwide. Barnegat Bay Estuary, along the New Jersey coast, has experienced the largest percentage of recent developmental increase of any Mid-Atlantic Estuary. Approximately 45% of Barnegat Bay's shoreline is bulkheaded, 36% of which has occurred within the past thirty years. The anthropogenic impacts attributed to coastal population growth here may be measured in relation to a model organism – the diamondback terrapin - one of many species which relies on the land-water interface of estuaries, an imperiled habitat becoming barricaded by bulkheading. While humans continue to build homes upon high sand dunes – preferred terrapin nesting habitat – the impact upon this species' behavior, movement, and reproductive success must be quantified. We designed an artificial bulkheading experiment using plastic water-filled road barriers arranged at the high-water line of two known terrapin beaches in Barnegat Estuary during nesting season. Data was collected in relation to nesting behavior during daily nesting surveys. Gravid females were outfitted with sonic and radio transmitters to monitor movements inter and post nesting season. Records of nest success and all other variables were compared between unbarricaded (reference) and barricaded (bulkheaded) beaches at each of the two sites. Our data show that female terrapins will continue to nest at experimental beaches, but may take more time swimming in proximity to, or walking around barricades prior to oviposition. In addition, telemetry data suggest that adult female terrapins utilize significantly different habitats during nesting season, than in the later summer months when they are found in adjacent salt marshes. Our study will also address distance travelled by females due to bulkheading, and if this added effort poses a threat to terrapin nesting ecology at the individual and population level. Through this work we will determine the strength of terrapin nesting fidelity, and the ability for a terrapin to adapt to such significant habitat alteration as bulkheading. Thanks to our findings, federal and state organizations will be able to better advise future bulkheading locations and manage primary terrapin nesting habitats; invaluable conservation actions within the Barnegat Bay Estuary and beyond.
Oral presentation

Wood, R.C and D.J. McLaughlin
The Wetlands Institute, 1075 Stone Harbor Boulevard, Stone Harbor, NJ 08247, USA
research@wetlandsinstitute.org

Roadkill Rollercoaster: Twenty Years of Monitoring Terrapin Mortality along the Atlantic Coast of Southern New Jersey

Before human development of New Jersey's coastal barrier beach islands, terrapins nested on barrier island sand dunes. However, most of this natural habitat has been leveled to create nearly continuous resort communities along the Jersey shore. Consequently, female terrapins have had to find a suitable alternative location to lay their eggs. Today, most of the readily available nesting sites for terrapins in southern New Jersey are the shoulders of heavily trafficked roads crossing and adjacent to salt marshes. The result is that hundreds of nesting females are killed by motor vehicles each year. During the terrapin nesting season, Wetlands Institute staff and student researchers monitor 41 miles of salt marsh road (located on the Atlantic coast of the Cape May peninsula, southernmost New Jersey) for nesting female terrapins. The objectives are to record the number of terrapin road mortalities, remove potentially viable eggs from female terrapins run over by vehicles, and save nest-seeking terrapins attempting to cross the road. On average, 400 to 600 gravid female terrapins are killed by motorists every year just within this transect. Over the 20 years that researchers from the Wetlands Institute have been monitoring terrapin road kills, nearly 10,000 terrapin deaths have been documented.

Oral presentation

Wood, R.C.[1, 2] and Larissa Smith[3]

[1]The Wetlands Institute, 1075 Stone Harbor Boulevard, Stone Harbor, NJ 08247

[2]Richard Stockton College of New Jersey, Pomona, NJ 08240 USA

[3]Conserve Wildlife Foundation of New Jersey, Woodbine, NJ 08270 USA

Predation on Northern Diamondback Terrapins *(Malaclemys terrapin terrapin)* by Bald Eagles *(Haliaeetus leucocephala)* along the Atlantic Ocean and Delaware Bay Coasts of New Jersey

Between 1999 and 2002, and again in 2010, skeletal remains were collected from a total of 20 different bald eagle *(Haliaeetus leucocephala)* nests scattered throughout New Jersey. Fourteen of these nests were located in the southern part of the state. Of these, seven adjacent rivers, lakes, or swamps contained shells of *Sternothaerus odoratus* (the stinkpot or musk turtle), a strictly freshwater species of very small adult size (maximum know carapace length = 13.7 cm). Four of the other seven nests (all located adjacent to salt marshes along the Delaware Bay and Atlantic Ocean coasts) contained only northern diamondback terrapins and musk turtles, and one had shells of both terrapins and juvenile snapping turtles *(Chelydra serpentina)*. Nearly half of the terrapin shells (N = 45) represent males (N = 21). Seven females could be identified, while the remaining shell material represents very small terrapins too disarticulated to determine sex with confidence. Measurable terrapin shells ranged in size from 9.2 to 17.1 cm in carapace length (though only two exceeded 12.9 cm in length). Bald eagles are clearly exercising strong size selection when preying upon terrapin populations.

Poster presentation

Attendees of the 5th Symposium on the Ecology, Status, & Conservation of the Diamondback Terrapin

Alford, April, University of North Carolina at Wilmington (UNCW), 2041 Burnett Blvd., Wilmington, NC 28701, ala6831@uncw.edu

Atkinson, Benjamin, University of Florida, 110 Newins-Ziegler Hall, Gainesville, Florida 32611, BKA@UFL.edu

Baker, Patrick, Texas A&E University Agmlife Research, 720 E Blackland Rd. Temple, TX 76504, patrick.baker17@gmail.com

Bolus, Matthew, University of Massachusetts, Amherst, 9 Middle St., Apt 2 Hadley, MA 01035, mbolus@eco.umass.edu

Brennessel, Barbara, Wheaton College, 26 E. Main Street Norton, MA027666, bbrennes@wheatonma.edu

Burgess, Tiffany, Armstrong Atlantic State University, 106 Greenbriar Ct. Savannah, GA 31419, tbo103@stu.armstrong.edu

Burke, Russell, Hofstra University, Department of Biology HU, Hempstead, NY 11549, Biorlb@hofstra.edu

Butler, Joe, University of North Florida, Biology Department Jacksonville, FL 32224, jbutler@unf.edu

Calvo, Michelle, Armstrong Atlantic State University, 11935 Abercorn St. Savannah, GA. 31419, pookster331@yahoo.com

Carr, John, University of Louisiana at Monroe, Department of Biology 700 University Ave., carr@ulm.edu

Coleman, Andy, University of Alabama at Birmingham, 1524 14th Ave. Apt 5 Birmingham, AL 35205, colemana@uab.edu

Craven, Kathryn, Armstrong Atlantic State University, 11935 Abercorn St. Savannah, GA. 31419, Kathryn.craven@armstrong.edu

DeGregorio, Brett, Savannah River Ecology Lab, 1133 Williams Dr. Aikeiv, SC 29803, DeGregorio@SREL.edu

Dominy, Abby, Drexel University, 3141 Chestnut St. Philadelphia, PA 19104, abbydominy@yahoo.com

Dorcas, Michael, Davidson College, Department of Biology Davidson, NC 28035-7118, midorcas@davidson.edu

Drabeck, Danielle, Tulane University, 400 Lindy Boggs Bldg. Tulane University New Orleans, LA 70118, ddrabeck@tulane.edu

Elbers, Jean, 2100 Caroline St. Mandeville, LA 70448, jean.elbers@gmail.com

Erazmus, Kayleigh, Hofstra University, 74 Knoll Ridge Court. Middletown, CT 06457, erazmusk@gmail.com

Gray, Jordan, Armstrong Atlantic State University, 1504 Noble Oaks Dr. Savannah, GA 31406, jordanmgray@comcast.net

Grosse, Andrew, Savannah River Ecology Lab, Drawer E, Building 737-A Aiken, SC 29802, agrosse@srel.edu

Hackney, Amanda, Clemson University, 10 Ames St. Seneca, SC 29678, ahackne@g.clemson.edu

Harden, Leigh Anne, The University of North Carolina at Wilmington, 1507 Military Cutoff Rd. Apt 102 Wilmington, NC 28403, lah4492@uncw.edu

Hart, Kristen, USGS, Southeast Ecological Science Center 3205 College Avenue. Davie, FL 33314, kristen_hart@usgs.gov
Henry, Paula, USGS Patuxent Wildlife Research Center, Beltsville Lab c/o Barc-East BLDG 308. Rom214A - 10300 Baltimore Ave, Beltsville MD 20705, phenky@usgs.gov
Johnson, Patricia, 427 Spring Dr. Yorktown Heights, NY 10598, TurtleAdvocate@Gmail.com
Kanonik, Alexandra, 3319 Kings Highway Apt. 1K, Brooklyn, NY 11234, AKKABONIK@GMAIL.com
King, Peter, Francis Marion University, PO Box 100547 Florence, SC 24502, pking@fmarion.edu
Lester, Lori, Drexel University, Department of Biology, 1341 Chestnut St. Philadelphia, PA 19104, LAL56@drexel.edu
Leuteritz, Thomas, US FWS, 4401 N. Fairfax ste 110. Arlington, VA 22203, thomas_leuteritz@fws.gov
Mann, Tom, Mississippi Museum of Natural Science, MS Dept. of Wildlife, Fisheries, & Parks, 114 Auburn Dr., Clinton, MS 39056-6002, natmann@bellsouth.net
McLaughlin, Daniel, The Wetlands Institute, 1075 Stone Harbor Boulevard. Stone Harbor, NJ 08247, dannyjackmcl@gmail.com
Mohrman, Tom, Grand Bay NERR 6005 Bayou Heron Rd. Moss Point, MS 39562, thomasmohrman@hotmail.com
Mohrman, Christina , Environmental Cooperative Science Center, Grand Bay NERR 6005 Bayou Heron Rd. Moss Point, MS 39562, christinamohrman@dmr.ms.gov
Mullett, Alisha, Sound Waters, 1281 Cove Rd. Stamford, CT 06902, alisha@soundwaters.org
Munscher, Eric, SWCA Environmental Consultants, 7255 Langtry Suite 100. Houston, TX 77040, emunscher@swca.com
O'Connor, Molly, Roy Hyatt Environmental Center, 1300 Tobias Road. Cantonment, FL 32533 , moconnor@escambia.k12.fl.us
O'Connor, Rick, Washington High School, 6000 College Parkway. Pensacola, FL 32504, Roconnor@escambia.k12.fl.us
Peter, Lindeman, Edinboro University, Department of Biology and Health Services, Edinboro University, Edinboro PA 16444, PLINDEMAN@EDINBORO.EDU
Richards-Zawacki, Cori, Tulane University, 400 Lindy Boggs Bldg. Tulane University New Orleans, LA 70118, cori@tulane.edu
Roosenburg, Willem, Ohio University Center for Ecology & Evolutionary Studies, Biological Services Ohio University. Athens, OH 45701, roosenbu@ohio.edu
Shemitz, Leigh, Sound Waters, 1281 Cove Rd. Stamford, CT 06902, leighshemitz@soundwaters.org
Simmons, Mike, University of North Florida, 330 1st Street Atlantic Beach, FL 32233, Michael.T.Simmons@dep.state.fl.us
Stone, Matthew, Kutztown University, PO Box 730 Kutztown, PA 19530, stone@kutztown.edu
Tuggle, Aaron, SWCA Environmental Consultants, 7255 Langtry Suite 100. Houston, TX 77040
Tulipani, Diane, Virginia Institute of Marine Science, PO Box 1346 Gloucester Point, VA 23062, dctulip@vims.edu
Umbehr, Uli, Armstrong Atlantic State University, 615 Palmetto Trace. Hinesville, GA 31313, uli.umbehr@gmail.com
Wibbels, Thane, University of Alabama at Birmingham, Dept. of Biology, UAB, 1300 Univ.

Blvd. Birmingham, AL 35294-1170, twibbels@uab.edu
Winters, Julianne , Drexel University, 2127 Walnut St. Apt #5 Philadelphia, PA 19103, JMWINTER@gmail.com
Wood, Roger, The Wetlands Institute, 1075 Stone Harbor Boulevard. Stone Harbor, NJ 08247, rogerwood41@gmail.com