

# DIAMONDBACK TERRAPIN WORKING GROUP

SOUTHEAST REGIONAL MEETING



FRIDAY, NOVEMBER 5TH  
5:00 PM - 8:00 PM



zoom

Hosted by Turtle Survival Alliance and Georgia Southern University



**Schedule**  
**2021 Southeast Regional Meeting of the**  
**Diamondback Terrapin Working Group**  
**—Virtual—**  
**November 5, 2021**  
**(All sessions are listed in Eastern Daylight Time)**

Friday, November 5, 2021	
5:00	Opening Remarks JORDAN GRAY
<b>North Carolina</b>	
5:05	Implementation of Diamondback Terrapin Management Areas as a Bycatch Reduction Strategy in the North Carolina Blue Crab Fishery JOE FACENDOLA
5:20	Assessment of the Impact of Gear Modifications on Diamondback terrapin ( <i>Malaclemys terrapin</i> ) Bycatch in the North Carolina Crab Fishery BRETT WILSON
<b>South Carolina</b>	
5:35	Sampling Biases During Long-Term Study of Diamondback Terrapins at Kiawah Island, South Carolina KRISTEN CECALA
<b>Georgia</b>	
5:50	Clear and Present Danger: Terrapin Mortality on the U.S. Highway 80 Causeway JORDAN GRAY*
6:05	A Tybee Terrapin Tale: Recognizing the Need for Conservation and Education to Prevent Further Decline of Local Diamondback Terrapin Populations NIKE PAPPAS
6:20	Terrapin Educational Research Program of Savannah (TERPS): A 2021 Update KATHRYN S. CRAVEN
6:35	Independent Loss of Cloacal Bursae and Age-dependent Surfacing Postures in Diamond-Backed Terrapins ( <i>Malaclemys terrapin</i> ) MEGAN WRIGHT
6:50	Evaluating Monitoring Methods to Detect Management Responses in Diamondback Terrapins DANIELLE R. BRADKE
7:05	2021 Diamondback Terrapin ( <i>Malaclemys terrapin</i> ) Downing-Musgrove Causeway Conservation Program JAMIE GAMBY
7:20	Research-informed Placement of a 1,000-foot Fence to Reduce Terrapin Mortality DAVID ZAILO
7:35	Medical and Surgical Management of Traumatic Injuries in Diamondback Terrapins ( <i>Malaclemys terrapin carolina</i> ) TERRY M. NORTON
<b>Discussion and Q&amp;A</b>	
7:50	Moderated by Jordan Gray
DBT	Closing Remarks JORDAN GRAY

\* Indicates proxy representation

## ABSTRACTS

### 2021 Southeast Regional Meeting of the Diamondback Terrapin Working Group

—Virtual—

November 5, 2021

#### **Clear and Present Danger: Terrapin Mortality on the U.S. Highway 80 Causeway**

**CHANTAL AUDRAN<sup>1</sup>, NIKE PAPPAS<sup>2</sup>, JORDAN GRAY<sup>3</sup>, AND KATHRYN S. CRAVEN<sup>4</sup>**

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U.S. Highway 80 connects Wilmington Island, GA, and Tybee Island, GA, and laterally bisects Fort Pulaski National Monument as a 9.6 km causeway. The Carolina Diamondback Terrapin (*Malaclemys terrapin centrata*) utilizes the causeway's shoulders, embankments, and adjacent man-made upland habitats for nesting and dispersal between April-July. Adult female and juvenile (aged ~3-4 yrs.) terrapins are found to cross the causeway from north to south and south to north. With overland movements by females and juveniles coinciding with increased vehicular traffic of the late spring and summer months, the causeway is a source of high annual terrapin mortality. The Terrapin Educational Research Program of Savannah and Tybee Island Marine Science Center has since 2005 collected quantitative and qualitative data on terrapin activity and mortality. Annually, 100-200 female and juvenile terrapins are fatal victims of auto strikes. In 2021, Chantal Audran and Nike Pappas continued the data collection effort. The mobile application HuntWise™ continued to be used as the primary method for recording GPS points, as well as a Beta version of TRAX - The Roadkill App, an in-development product of Animex® Wildlife Fencing & Mitigation Solutions, was tested. In addition to GPS data point collection, photo vouchers of each deceased terrapin were recorded at their point of origin, as well as photographs taken of habitat adjacent to the north and south asphalt boundaries. To ensure terrapin fatalities were not recounted, carcasses were collected and discarded at the time of data collection. In 2021, we recorded 137 road mortalities including 73 females and 64 juveniles. Data collected in 2021 continues to demonstrate the entire length of the causeway to be traversed by terrapins, resulting in terrapin-automobile interactions. These annual interactions continue to pose a clear and present danger to both terrapins and motorists utilizing the U.S. Highway 80 causeway corridor.

#### **Evaluating Monitoring Methods to Detect Management Responses in Diamondback Terrapins**

**DANIELLE R. BRADKE<sup>1</sup>, BRIAN A. CRAWFORD<sup>2</sup>, JOHN C. MAERZ<sup>1</sup>**

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Monitoring is fundamental to adaptive management; however, programs rarely evaluate the sensitivity of monitoring approaches to detect population changes. The result can be high uncertainty about whether management actions have been effective. This is particularly important when evaluating actions with high uncertainty or for species with low detection. Among the key threats to diamondback terrapin (*Malaclemys terrapin*) populations is bycatch mortality in commercial and recreational crab pots. The impact of crab fisheries on terrapins has prompted states throughout the species' range to consider bycatch reduction measures. Our objective was to determine the likelihood that our current monitoring approach using manual seining of tidal creeks would be sufficient to detect a true increase in terrapin survival over a 15-year period with the implementation of bycatch reduction devices. We used a 10-year robust-design dataset of diamondback

terrapins captured via manual seining methods to develop a Bayesian model of annual survival, availability, and capture probability. Using this model, we simulated 100 independent datasets assuming that monitoring was conducted over 15 years and that crabbing regulations resulted in a 20% increase in mean terrapin survival. The mean estimated effect on survival among all 100 data sets accurately reflected the true increase in survival; however, survival increases were detected in only 28% of simulated datasets. In other words, current monitoring methods would be relatively unlikely to detect a real management effect at a single site. Our results indicate that monitoring bycatch reduction will require more than a few study sites or the use of more robust capture methods. We discuss potential ways to integrate more monitoring approaches to increase the likelihood of detecting bycatch reduction effects.

## **Sampling Biases During Long-Term Study of Diamondback Terrapins at Kiawah Island, South Carolina**

**KRISTEN CECALA<sup>1</sup>, PHILIP GOULD<sup>2</sup>, CRIS HAGEN<sup>3</sup>, AND WHIT GIBBONS<sup>4</sup>**

<sup>1</sup>*Department of Biology, University of the South, Seawee, Tennessee, 37383, USA*

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Long-term data are necessary for understanding the population dynamics of organisms, but even more so for long-lived species like turtles. Recent modeling efforts have demonstrated that monitored populations should be expected to decline due to biases associated with selecting sampling locations. Therefore, it should be unsurprising that the methodology used to sample terrapins during long-term study may also be subject to biases. Using the long-term dataset of diamondback terrapin captures at Kiawah Island using seines, we evaluated environmental factors that may influence the detection of terrapins and potentially bias the conclusions we may draw about the current status or trajectory of populations. Recent surveys on Kiawah Island have detected far more young and new individuals than previous sampling, and environmental factors such as tide amplitude and time of year significantly influence our ability to capture terrapins with seines. We are optimistic that these data signal a potential recovery of terrapin populations at Kiawah Island, but more years of data will be necessary to determine if this trend will continue. Furthermore, these data indicate that we should interrogate our capture method for bias and carefully use that information to either adjust our methods or incorporate additional modeling terms to provide more accurate estimates of ongoing population trends.

## **Terrapin Educational Research Program of Savannah (TERPS): A 2021 Update**

**KATHRYN S. CRAVEN<sup>1</sup> AND JORDAN GRAY<sup>2</sup>**

<sup>1</sup>*Department of Biology, Georgia Southern University, Savannah, Georgia, 31419, USA*

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The Terrapin Educational Research Program of Savannah (TERPS), based out of Georgia Southern University-Armstrong Campus, has remained active during the pandemic and into the new normal. Although student involvement was minimized until fall 2021, we continued with successful incubation and release efforts of Carolina Diamondback Terrapin (*Malaclemys terrapin centrata*) eggs collected through eggectomy of deceased roadkill females and inducement of injured females. Hatchlings are additionally transferred to Tybee Island Marine Science Center and Oatland Island Wildlife Center for their head start and educational programs. Our outreach went virtual and our collaborations stayed confident. Our next goal is to contribute to the understanding of the local genetics of *M. t. centrata* inhabiting Fort Pulaski National Monument. Throughout the summer of 2021, tissue samples were collected from salvaged roadkill specimens on U.S. Highway 80, a 9.6 km causeway connecting Wilmington and Tybee islands, Chatham County, GA. In particular, we have questions about the genetic profiles of the different age classes of terrapins that cross the highway.

## **Implementation of Diamondback Terrapin Management Areas as a Bycatch Reduction Strategy in the North Carolina Blue Crab Fishery**

**JOE FACENDOLA**

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The issue of incidental capture of diamondback terrapins (*Malaclemys terrapin*) in the North Carolina blue crab (*Callinectes sapidus*) pot fishery was addressed by the North Carolina Division of Marine Fisheries in the May 2020 Revision to the Blue Crab Fishery Management Plan. The North Carolina Marine Fisheries Commission fisheries adopted a framework by which multiple and discrete Diamondback Terrapin Management Areas (DTMAs) will be created, in which all crab pots fished within are required to use approved terrapin excluder devices (BRD). Multiple factors were considered in development of this targeted bycatch reduction method, such as: water depth and distance from shore, terrapin presence or absence, dimensions of the BRD, and the season which fishing occurs. This management strategy was implemented as a focused means to offer diamondback terrapin populations the greatest protection from bycatch mortality while having minimal potential impacts to the statewide blue crab pot fishery. Using the criteria established in the framework, two initial DTMAs totaling 16,419 acres have been created in waterbodies where commercial crab potting effort occurs. Preliminary monitoring of terrapin populations in these management areas indicates truncated size distributions when compared to a population in an area closed to crab potting. Ongoing long-term monitoring in the DTMAs will be required to detect any changes in terrapin demography and to fully assess the efficacy of this management strategy.

## **2021 Diamondback Terrapin (*Malaclemys terrapin*) Downing-Musgrove Causeway Conservation Program**

**JAMIE GAMBY**

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The Downing-Musgrove Causeway (DMC) leading to Jekyll Island, Georgia, is a hot spot for nesting diamondback terrapins, with road mortality and nest predation driving population declines. The Georgia Sea Turtle Center (GSTC) has been monitoring the DMC for nesting diamondback terrapins since 2007. Road surveys are conducted on the causeway mid-April through August. For the 2021 nesting season the GSTC encountered 443 diamondback terrapins total with 69% alive and uninjured at time of encounter. Of the 443 terrapins encountered, 435 were females with 70% alive and uninjured. The GSTC provided medical care to 13 injured female terrapins and thus far have successfully released six. This on-going program utilizes a wide range of strategies in an attempt to better conserve this species around Jekyll Island, GA.

## **Medical and Surgical Management of Traumatic Injuries in Diamondback Terrapins (*Malaclemys terrapin carolina*)**

**TERRY M. NORTON, RACHEL OVERMEYER, AND STEPHANIE STOWELL**

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Approximately 200 to 300 Diamondback Terrapins (*Malaclemys terrapin carolina*) are hit by automobiles annually on the Jekyll Island causeway. For those that survive, attention must be paid to emergency care, development of a prognosis, diagnostic testing (radiographs) and supportive care. Initial stabilization typically includes pain management, antimicrobials, and fluid therapy. Minimizing stress at this stage is critical. Fractures and wounds should be gently cleaned and flushed with saline or dilute betadine or chlorhexidine. Initial stabilization of shell fractures can be accomplished by using Steristrips and tissue glue, and various

bandaging materials. Oxygen therapy may be useful in some cases. Principles of wound care that are utilized on other species should be followed including regular debridement and lavage. Topical wound care products that have proven useful include Rediheal (Avalon Medical) with bone cement or tissue glue, Doxirobe gel (Pharmacia & Upjohn Company), raw honey, Medi-honey (Derma Sciences), Buck Mountain wound balm, and a variety of silver-based products. Traumatic injuries that pull the skin away from the shell can be difficult to manage. Some innovative methods have been used to repair these types of wounds. Bra hooks are adhered to the shell using epoxy cement and then the skin is sutured to the hooks. Vacuum Assisted Wound care has been successfully used for some wounds. Therapeutic laser therapy decreases the overall healing time. Most shell fractures are stabilized with screws and wires with marine epoxy putty placed over top providing waterproofing and further stability. Since most terrapins are in the process of nesting when they are hit, a high percentage still have eggs in their oviducts. Managing egg laying is a critical part of the rehabilitation process. A combination of fluids, calcium, prostaglandins, and oxytocin are used to induce oviposition. Some causes of dystocia include pelvic fractures, eggs in the urinary bladder or coelomic cavity, and malposition of an egg at the pelvic inlet. Intervention may include lubrication of the cloaca and manual removal of the egg, aspiration of the egg contents with a needle if it can be visualized through the cloaca, and in some cases surgical removal of the eggs.

### **A Tybee Terrapin Tale: Recognizing the Need for Conservation and Education to Prevent Further Decline of Local Diamondback Terrapin Populations**

**NIKE PAPPAS AND NICK FUHRMAN**

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Although the public is often exposed to wildlife, including turtles, through unplanned encounters on roads, little is known about the public's general knowledge about turtles. Also, little is also known about people's perceptions of wildlife fences to prevent turtle strikes. The researcher and professor created two separate online instruments, the first identified the current knowledge level of citizens living along coastal Georgia regarding turtles. The second was created based on the findings from the first instrument which showed most people have a low level of knowledge regarding turtles or the species diamondback terrapin (*Malaclemys terrapin*) but have a positive attitude towards assisting turtles. The second survey measured participant's perceptions towards a wildlife fence preventing diamondback terrapin from vehicle strikes and revealed that most participants have a positive perception of wildlife fences. Due to the findings of the two instruments, it is recommended that local organizations collaborate to test fencing along terrapin vehicle strike hotspots and that educational campaigns build turtle knowledge in those living along coastal Georgia.

### **Assessment of the Impact of Gear Modifications on Diamondback terrapin (*Malaclemys terrapin*) Bycatch in the North Carolina Crab Fishery**

**BRETT WILSON<sup>1</sup>, AMANDA SOUTHWOOD WILLIARD<sup>1</sup>, JOE FACENDOLA<sup>2</sup>**

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The Diamondback terrapin (*Malaclemys terrapin*) is listed as a species of "special concern" by the North Carolina Wildlife Resources Commission (NCWRC), and faces a number of threats including loss of nesting habitat, road mortality, and incidental bycatch in recreational fishing gear. Range wide efforts to reduce terrapin bycatch by fitting bycatch reduction devices (BRDs) to the funnel openings on crab pots have typically been met with strong resistance by crabbers due to perceived reductions in blue crab (*Callinectes sapidus*) catch rates. The North Carolina Marine Fisheries Commission (NCMFC) and North Carolina Division of Marine Fisheries (NCDMF) have created two Diamondback Terrapin Management Areas (DTMAs) in which BRDs are required in order to protect terrapins, but the need to explore alternative gear modifications that exclude terrapins while minimizing impacts to blue crab catch has been acknowledged. North Carolina crabbers have

proposed new gear modifications that narrow the pot funnel entry without a need for a BRD fitted over the funnel opening, and this novel approach may have less impact on crab entry behavior. Fisheries-independent experimental field trials were conducted from May 2021 – September 2021 with traditional crab pots (control), a “reinforced” funnel, and a narrow funnel. Pots were set in a triplicate design, with 5-10 triplicates deployed at multiple sites, including the two DTMAs. All crab pots were modified with wire chimneys to insure that captured terrapins had access to air throughout the tidal cycle. Out of 65 terrapin captures, 10 and 19 captures were in the narrow and reinforced designs, respectively. Preliminary data suggests that the narrow funnel design effectively excludes adult females, but adult males and juvenile females/males are susceptible to incidental bycatch. An ongoing fisheries-dependent phase will be used to assess the impacts of these novel designs on blue crab catch rates in a commercial setting, and genetic studies will be conducted to assess terrapin population structure in Southeastern North Carolina. Industry sourced bycatch reduction designs have the potential to lead to broadly acceptable solutions to the problem of terrapin bycatch in the blue crab fishery, but must continue to be rigorously tested in the field before approval.

### **Independent Loss of Cloacal Bursae and Age-dependent Surfacing Postures in Diamond-Backed Terrapins (*Chelonia*: Emydidae: *Malaclemys terrapin*)**

**JADYN M. SETHNA<sup>1,4</sup>, OLLIE SHINN<sup>1,4</sup>, MEGAN WRIGHT<sup>1,4</sup>, SAM RIVERA<sup>2</sup>, ALLAN P. PESSIER<sup>3</sup>, AND JOSEPH R. MENDELSON III<sup>1,2</sup>**

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<sup>4</sup>*These authors contributed equally to the project; listed alphabetically  
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*Malaclemys terrapin* is a species of turtle that lives in brackish waters along the eastern coast of the United States from Cape Cod, Massachusetts, to Corpus Christi, Texas. We documented distinctive underwater postures during surfacing in hatchling versus individuals after one year (yearlings). Hatchlings approached the water’s surface in horizontal postures, while yearlings approached in a vertical posture. Because one function of cloacal bursae is to control buoyancy in freshwater turtles, we investigated their potential role in determining surface postures. We discovered that cloacal bursae are absent in *M. terrapin*, and thus, we attribute this absence to the osmoregulatory challenges presented by the brackish habitats of this species. We posit that the horizontal postures in the hatchlings create a broader visual target to both aerial and aquatic predators and that the younger turtles likely do not have the strength, muscle mass, lung-volume coordination, or sufficient carapacial bone density to adopt the visually streamlined vertical posture at the surface.

### **Research-informed Placement of a 1,000-foot Fence to Reduce Terrapin Mortality**

**DAVID ZAILO<sup>1</sup> AND STEVE BÉGA<sup>2</sup>**

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Terrapin populations around Jekyll Island, GA, have been a focus of significant research and conservation action since 2007; coinciding with the opening of the Georgia Sea Turtle Center and research collaborations with the University of Georgia and other partners. The Downing-Musgrove Causeway (DMC), which connects Brunswick, GA, to Jekyll Island, GA, bisects salt-marsh in the form of a ~8.7 km causeway. This causeway serves as an attractive nesting area for female diamondback terrapins; however, road mortality of adult female terrapins is predicted to be contributing to population decline. To combat such this, the Jekyll Island Authority is partnering with Animex<sup>®</sup> to install two 1,000-linear foot sections of customizable, ~51 cm height semi-permanent fencing in winter of 2022 prior to the start of nesting forays. We chose the location for future

placement after examining 14-years of road crossing data. Since monitoring began in 2007, over 4,000 diamondback terrapin road crossing attempts have been documented along the DMC. The fencing in our proposed 'hot spot' location is the most active documented location for road crossing along the DMC. The area within and around the proposed location is responsible for ~25% of known encounters along the DMC. It is our hope that this proposed management action will result in considerable benefits to the diamondback terrapin populations around Jekyll Island, GA, and will serve as a resilient, repeatable regime that will benefit imperiled wildlife.



**Diamondback Terrapin Working Group**  
**Southeast Regional Meeting Zoom Invitation Link**

Jordan Gray - Turtle Survival Alliance is inviting you to a scheduled Zoom meeting.

Topic: DTWG Southeast Regional Meeting

Time: Nov 5, 2021 05:00 PM Eastern Time (US and Canada)

Join Zoom Meeting

<https://us02web.zoom.us/j/82997644268?pwd=R1NwNG5MMlg0NDZCbKRS1UxSTIYZz09>

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