

## **Characterizing Head-started and Juvenile Diamondback Terrapin (*Malaclemys terrapin*) Habitat and Movement Using Radio Telemetry**

*Kirstine Grab, University of Minnesota*

For many turtle species, the hatchling and juvenile life stages remain a mystery that leaves parts of populations unmonitored and vulnerable to threats. To better understand the young life stages, I used new radio telemetry technology to track head-started diamondback terrapins and gather data on their movement and habitat choice using a combination of stationary and mobile receivers. Sixteen turtles (82.4 – 145.4g) were outfitted with radio transmitters (5.4 – 5.9g) and released in the salt marsh at The Wetlands Institute. From July 9 – 26, we relocated 13 turtles (81.25%) at least once, for a total of 33 locations. When individuals were relocated, I recorded the turtle's position, behavior, and characterized light levels and vegetation in a 1-m<sup>2</sup> quadrat. Distances travelled from the release points varied among individuals and light levels below vegetation were significantly lower than above the vegetation across all days and individuals. For individuals located more than once, vegetation height did not change with time since released. All, but one individual, were relocated in the marsh and the outlier relocated along the densely vegetated trail edge. From these results, we can begin to understand where and how far young turtles go and their habitat preferences which will allow us to have more life stage focused conservation practices.

## **Behavior and Nest Site Selection in a Mixed-Species Colony of Black Skimmer (*Rynchops niger*) and Common Tern (*Sterna hirundo*)**

*Jamie Infanti, University of Connecticut*

Coastal birds are being restricted to smaller habitats in denser conditions due to shrinking available habitat from human development and sea level rise. Black Skimmers, currently listed as endangered in New Jersey, and Common Terns are at risk from these threats. When nesting closer together, these species may benefit from protection against predators by their neighbors, but may expend more energy defending territory against neighboring birds. To better understand how these species are impacted by dense habitats, this study was completed at a mixed species colony on Ring Island in Stone Harbor, NJ that compared the success of differing site compositions for nesting Black Skimmers and Common Terns. Frequencies of behaviors deemed beneficial (preening, sleeping, etc.) and disadvantageous (barking, flushing, etc.) were compared for five focal territories. It was determined that site composition affected the behavior of Black Skimmers, but may not have impacted Common Terns as greatly. Sites with higher density of Black Skimmers had the highest counts of detrimental behavior ( $33.17 \pm 4.12$ ). Sites with an increased number of Common Terns had a better balance between detrimental and beneficial behaviors. The site with a medium density (4-5 nests) and an equal distribution of species provided the most benefit to Black Skimmers ( $7.93 \pm 1.64$ ) and saw the greatest nesting success in this area. Common Tern activity levels remained consistent across the varying densities, but Black Skimmers had large fluctuations based on site composition. These findings will be important for better managing these vulnerable species and ensuring their long-term success.

## **Understanding Mass-Specific Physiological and Metabolic Differences in Head-started Diamondback Terrapins (*Malaclemys terrapin*)**

*Sarah Kerr, Clemson University*

In response to worldwide turtle declines, head-starting has become a popular conservation strategy for chelonian species, including the diamondback terrapin. Through The Wetlands Institute's program, terrapins are reared in captivity from eggs through their first year, then released into the salt marsh larger than they are at that age in the wild. The objective of this study is to understand the effect of size on head-starter fitness and movements. To answer this question, the physiological and metabolic rates of two groups of eight terrapins were studied. Masses of Group 1 ranged from 23.3 grams to 49.75 grams, Group 2 ranged from 89.8 grams to 145.4 grams. Oxygen consumption was tested on all terrapins using a Sable Systems Oxygen Analyzer. Oxygen consumption of Group 1 averaged 0.405 mL O<sub>2</sub> hour<sup>-1</sup>gram<sup>-1</sup> while Group 2 averaged 0.683 mL O<sub>2</sub> hour<sup>-1</sup>gram<sup>-1</sup>. Physiological rates were determined using a treadmill paired with Arduino. Acquisition tests using fiddler crabs, and self-righting tests were conducted in two temperatures. Movements of Group 2 were tracked in the surrounding marsh using radio telemetry. Group 1 did not last as long on the treadmill before tiring, and they did not feed on fiddler crabs as aggressively as Group 2. However, Group 1 righted themselves faster. Distance traveled for the smallest terrapin (89.8g) was 49.56m over 8 days, while the largest terrapin (127.4g) traveled 159.906m over 13 days. Overall, larger size may provide a fitness advantage, however a conclusion cannot be made based on small sample size and the short duration of this study.

## **Evaluating efforts to decrease Northern Diamondback Terrapin (*Malaclemys terrapin terrapin*) mortality rates along a coastal causeway**

*Amanda Lillie, Tufts University*

During the summer months, northern diamondback terrapin populations are vulnerable to increased road mortalities as nest-seeking females venture to find higher nesting grounds near roadways. This study aimed to assess the effectiveness of a new terrapin nesting and activity sign placed in front of The Wetlands Institute on Stone Harbor Boulevard, a major coastal causeway in Cape May County, New Jersey. This road was driven seven times a day between 6:00am and 10:00pm to gauge terrapin activity in relation to time of day and tidal patterns. Three cameras monitored activity on The Wetlands Institute property from 4:00pm through 10:00am. Road patrols found that 93.7% of terrapin road encounters occur diurnally, but camera traps detected an average of two turtles per night. Data was run through hot spot analysis using ArcGIS, finding that in summer 2017 there was a significant road mortality hotspot out front of The Wetlands Institute. During the same time frame in summer 2018 when the sign was in place, that hot spot was no longer observed. A survey conducted to gauge how the public has responded to the sign showed that in 480 responses, 66.0% reported they drove 10 with more caution after seeing the sign and 66.7% believe that flashing lights or bright colors would be most eye-catching for road signs. These results suggest that terrapin nest-seeking activity is not strictly diurnal and that though dynamic signs may change driver behavior, they may not completely eliminate road mortality.

## **Comparison of methods for surveying diamondback terrapin (*Malaclemys terrapin*) populations in tidal creeks**

*Amanda Lyons, Brown University*

The diamondback terrapin is known to inhabit coastal ecosystems, but within these ecosystems it proves challenging to sample. Since 2016, researchers at The Wetlands Institute in Stone Harbor, NJ, have performed a mark-recapture project in two tidal creeks to better understand terrapin population composition and trends in this environment. Results of the 2016-2017 study, which used modified commercial crab traps to capture turtles, suggested a population that was female-biased ( $\chi^2=35.02$ ,  $p<0.01$ ), included mostly smaller terrapins (90% of terrapins <13cm carapace length), and demonstrated a consistently low rate of recapture (3.6% in 2016 and 3.7% in 2017). To evaluate the accuracy of these trends, the tidal creek study was continued in 2018 utilizing a fyke net in addition to prior trapping methods. Results obtained using the net, which could remain deployed through multiple tide cycles and which possessed a wide mouth permitting entry to larger terrapins, challenged the findings of previous research, as fyke net turtles demonstrated a less biased sex ratio ( $\chi^2=0.06$ ,  $p=0.81$ ), a greater proportion of large terrapins (39% of terrapins >13cm carapace length), and a substantially higher rate of recapture (19.0%). Furthermore, a comparison of catch per unit effort (CPUE) for the modified crab traps and the fyke net in each of the two creeks revealed that the latter method yielded a considerably greater number of terrapins for a comparable amount of personnel effort. The results of this study indicate that the fyke net is the optimal method for surveying terrapin populations in tidal creeks.

## **Hatching Success of Laughing Gull (*Leucophaeus atricilla*) based on Habitat Use and Characteristics**

*Daniel Stoner, Kutztown University*

Human disturbance and sea level rise are degrading saltmarshes and their suitability, possibly affecting the reproductive success of Laughing Gulls nesting and rearing their chicks there. My research examined the relationship between nest characteristics and higher hatching success of Laughing Gulls on Ring Island, Stone Harbor, NJ in five plots that included 20 nests inside a 25-meter radius. Edge habitats (N = 3) were plots within 100 meters of larger waterways and center plots (N = 2) were farther than 100 meters of larger waterways. Nest location was marked with a Trimble backpack GPS unit. Factors used to characterize individual nests included distance to waterway, elevation of the nesting site, vegetation cover and species, and proximity to other nests. Distance to waterway was measured using ArcGIS. Elevation was determined using LiDAR data at the nest location, and nest cover was estimated using a light meter. Of 104 nests, 49 were determined to be successful, 16 failed, and fate was undetermined for 39 that were checked multiple times in June and July. Data on elevation, distance to closest waterway, and the nest cover showed no relationship to a higher success or failure rate among all nest ( $p = 0.82$ ). Clustered or single data was not included in the analysis due to the similarity of success and failure in all plots ( $p = 0.24$ ). A multi-year study can be done considering more variables to further analyze their nest success with changing disturbances.