



2016 Great Bay Terrapin Project Summary - Permit # SC2016034

January 9, 2017

Purpose of Study:

The main purpose of this project is to reduce the amount of road kills and injuries of adult female Northern diamondback terrapins (*Malaclemys terrapin terrapin*) in the Barnegat Bay, Great Bay, and Absecon Watersheds (Ocean and Atlantic Counties). Each year Conserve Wildlife Foundation of NJ (CWF) recruits volunteers (NJDFW - Wildlife Conservation Corps) to assist with seasonal road patrols to protect nesting terrapins from becoming road killed or injured while attempting to cross roadways. During the nesting season, from May through July, CWF biologists and volunteers (surveyor) conduct patrols of roads using a motor vehicle. The surveyor drives a route and looks for terrapins in the roadway. If and when they encounter a live, injured or dead terrapin, they stop and collect data on the encounter.

In addition to collecting sighting data on nesting terrapins found in the roadway, this year's project also signified the beginning of a long-term mark and recapture study. When our volunteer student intern, Carly Sibia, University of Richmond '17, encountered a terrapin, she collected data on the turtle's size and health, and notched its carapace with an identification code. Mark and recapture is a research method commonly used to estimate animal population size; however, it also provides information on the health and movement patterns of individual terrapins. Therefore, while real-time terrapin rescue is still the main objective of the study, the data collected by our intern and the volunteers both contribute to our overall understanding of the health, movement, and size of the local terrapin population.

Methods and Materials:

Methods for conducting the surveys consist of volunteers traveling the length of road a number of times per day during the nesting season. Using motor vehicles volunteers conducted surveys between 0600-2100 hours depending on that area's high tide, as we know nesting adult females are more active during the diurnal high tide, especially spring tides. Volunteers recorded the location and condition of live and dead individuals encountered on roadways and/or roadsides. One to two volunteers covered each road during the day sometimes overlapping with our intern.

Carly, CWF intern, conducted surveys in a similar fashion by driving up and down Great Bay Boulevard while collecting information on the terrapins she encountered on or near Great Bay Blvd. In addition to recording the time, location, and basic condition (live, injured, or dead), measurements of carapace length, carapace width, plastron length, and plastron width were taken with a large caliper ruler (mm). Each captured terrapin was also weighed on a 2,000-gram digital scale. Other noted variables include environmental conditions including, air temperature and tidal stage, as well as the estimated age, gravidity, and scute number (marginal, costal, and vertebral) of the individual. Each terrapin was checked for previous identification. If the individual did not have a PIT or existing notches, a unique 6-letter identification code was assigned and notched into the carapace (See **Figure 1**) using a V shaped metal file. All terrapins were photographed alongside their alpha-code and released *where they were found or in the direction they were headed* within 8-15 minutes of their capture time.

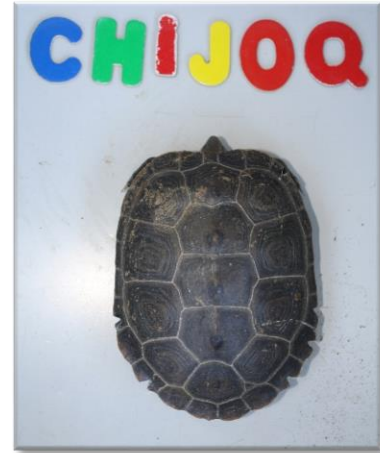


Figure 1. A captured terrapin photographed with its notch code.

All locations were determined using a Garmin GPS or personal smartphone using the iNaturalist application. If injured terrapins were encountered, they were transported to the Wetlands Institute in Stone Harbor or Stockton University for treatment and care. Dead terrapins were moved off the road and onto the shoulder of the road in woody vegetation to avoid recounting. If a kill is recent and the female is gravid, the eggs were harvested and transported to a local hatchery or placed in a man-made nest cavity protected by a predator enclosure.

Ocean County Roads	<i>Live</i>	<i>Dead</i>	<i>Total</i>
Route 72	0	3	3
Cedar Run Dock Rd	307	6	313
West Creek Dock Rd	1	0	1
Great Bay Blvd	737	46	783
Burlington County			
Route 9	0	6	6
Atlantic County Roads			
Route 30	2	141*	143
Route 152, Longport	0	25	25
Total:	1047	227	1274

Figure 2. Summary of terrapin sightings on road patrolled in 2016. *Replicates may be included on Route 30 as many of the road-killed terrapins could not be moved from their location due to safety concerns.

Data Collected:

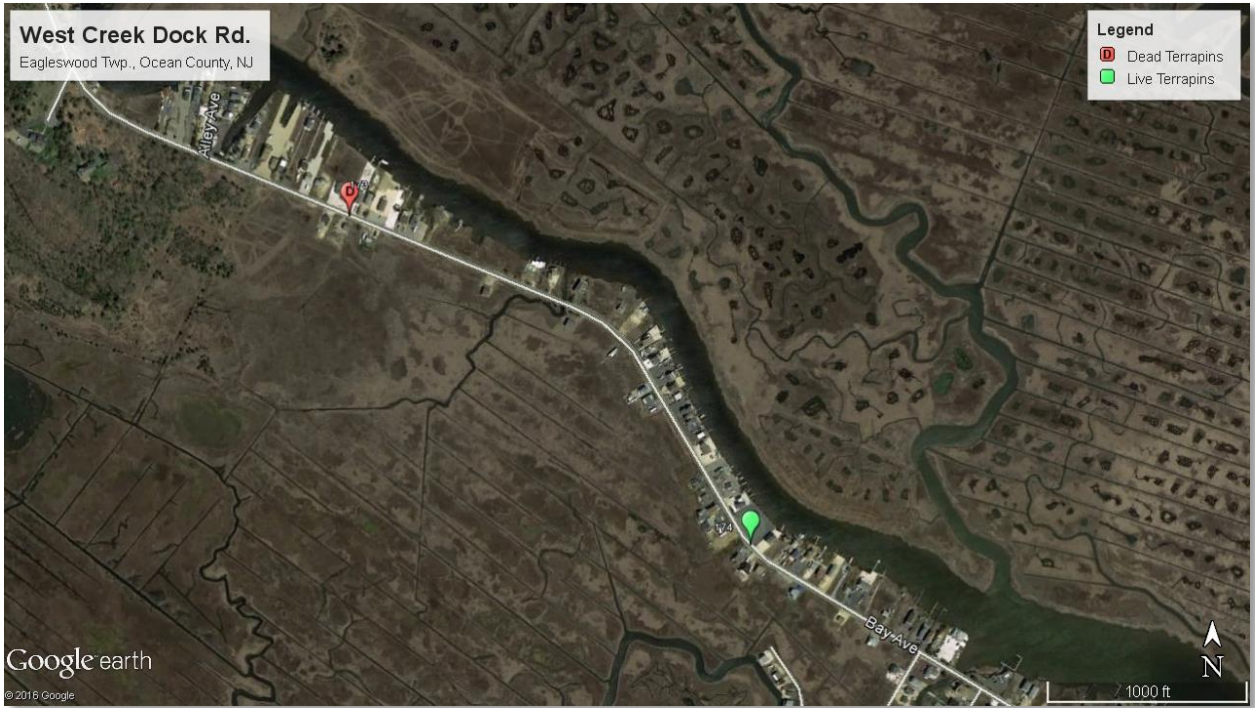
From early June through mid-July volunteers conducted road patrols along roads where high road mortality of terrapins had been documented. This year, these roads include: Route 72, Cedar Run Dock Road, West Creek Dock Road, Great Bay Boulevard, Route 9, Route 30, and Route 152 in Longport. Volunteers filled out sightings on the provided datasheets and marked locations using the handheld Garmin GPS unit.

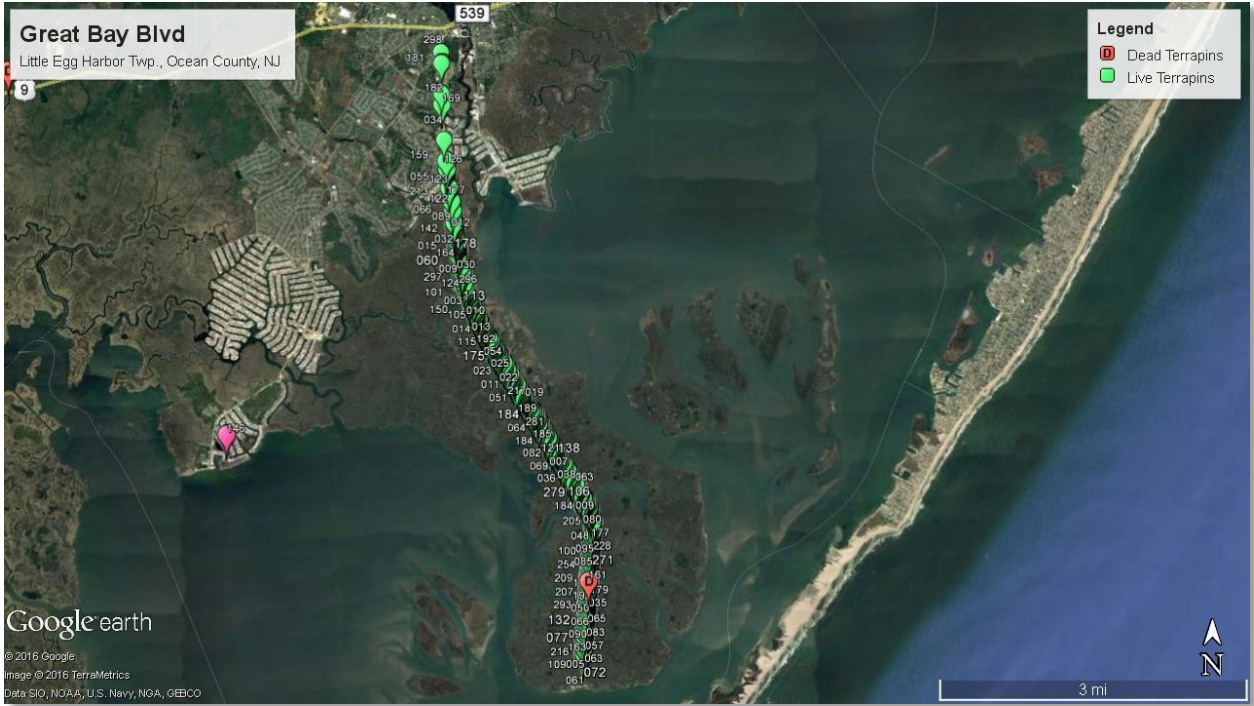
From June 4 to July 20, we collected a total of 1274 terrapin sightings. Of these, a total of 227 were found dead on or near a road.

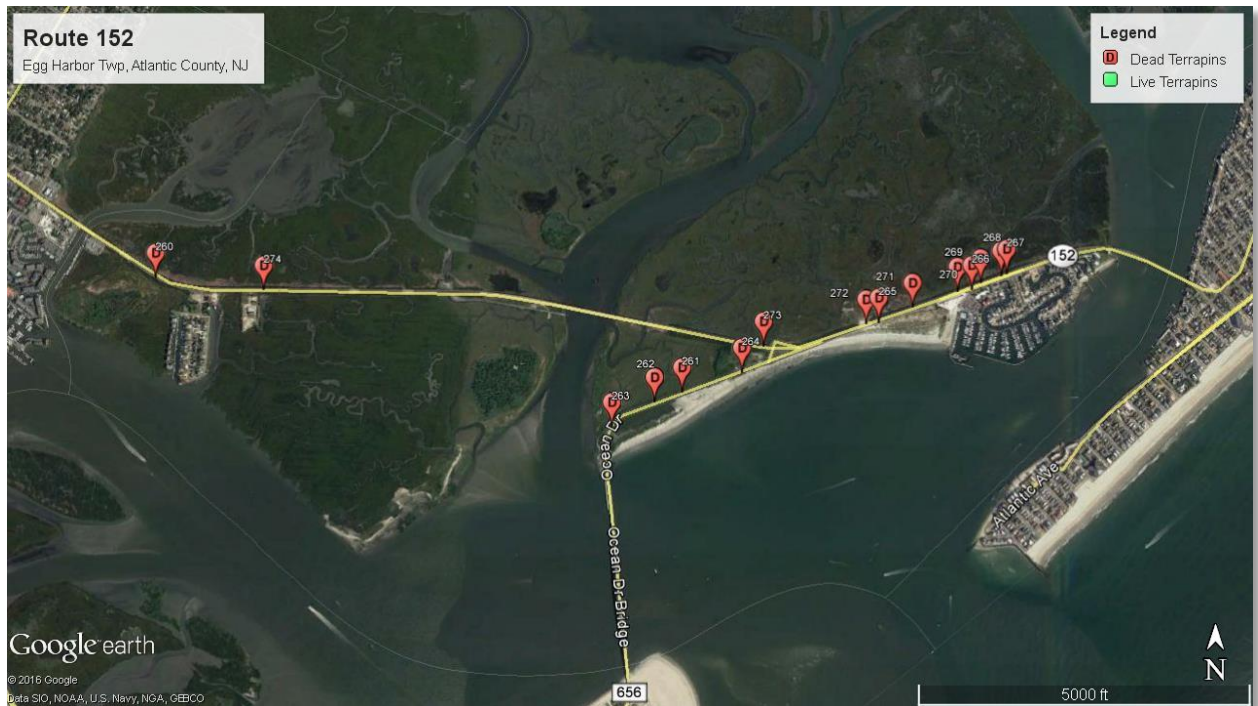
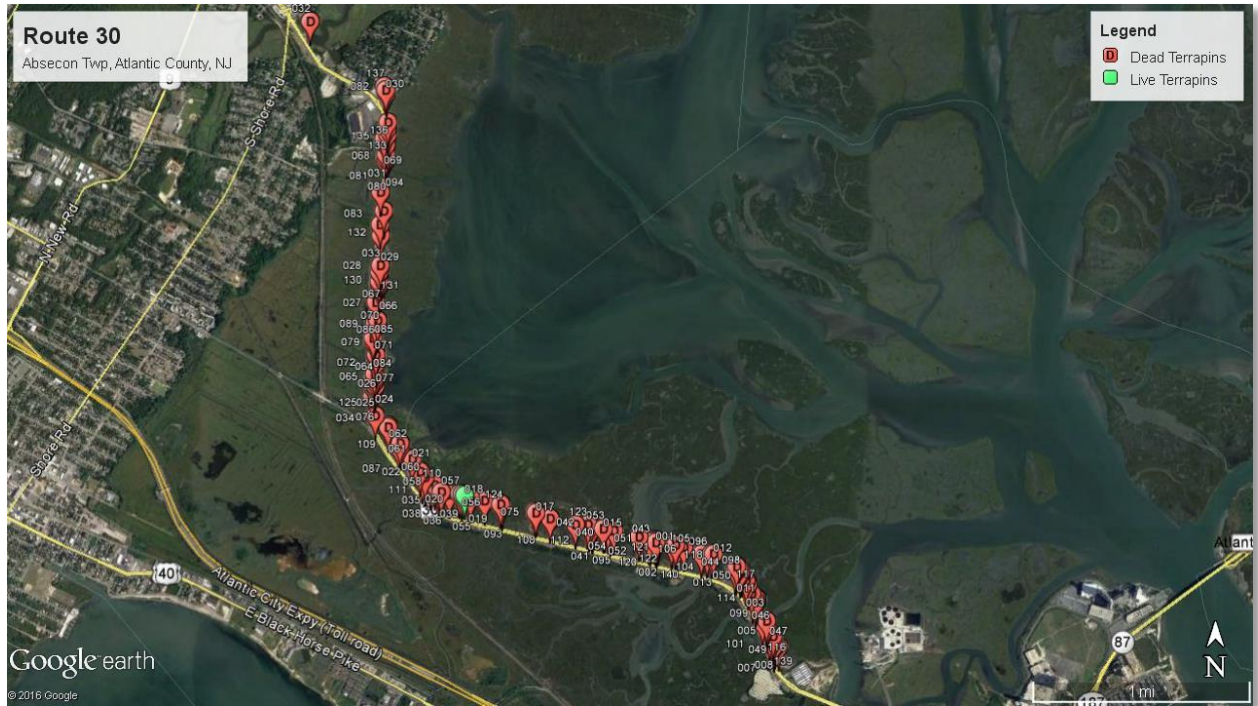
Maps:

Below are maps which depict all sightings within the different areas that we patrol. Raw data from these sightings will be submitted to ENSP through a bulk data import form for input into Biotics. Along with this report, we will include sightings in .KML format.









Re-sightings:

Nine adult females were re-sighted. Eight were found on Great Bay Boulevard, and one on Route 30. Four of the re-sighted individuals had been notched as a part of our 2016 study (CHIQV, CHJPVX, CHIKNP, and CHIJQW). Two terrapins had previous notch codes (BHNQ and

INOPV) and three terrapins had previous PIT Tags (985-120024350864, 985-120028783731, and 985-120028601618).

Challenges:

In addition to the expected threats (i.e. road kills), two other issues presented themselves, albeit one is a recurring annual challenge. First, 6 out of 8 of our “Terrapin X-ING” signs along Great Bay Boulevard had been stolen by mid-July. Our partner, Little Egg Township, had printed one of these signs (see **Figure 3**), while the others had been hand-painted by volunteers. Signs such as “Give Wildlife a Break!” and “Slow! Terrapin Crossing” raise public awareness and



Figure 3. Sign on Great Bay Blvd. 2015.

therefore help to reduce road kills. In the years of this project and in our opinion, they are the first chance terrapins have a successfully crossing any road. In future years it will be important to have volunteers take special note of the signs so the instances of theft can be thoroughly reported. In 2017, we are planning to work with our partners within NJ Division of Fish and Wildlife and LEHT law enforcement on the possibility of conducting a “sting” type operation to identify the thieves and return the stolen signs.



Figure 4. A stolen sign on Great Bay Blvd. July, 2016.

The other issue present this year is the consistent mowing along Great Bay Boulevard during the nesting season by LEHT, despite us coordinating with them on safe mowing dates. Terrapins are often found in the grassy areas besides the road, and are unlikely to survive if hit by a large tractor with deck mower attachment. Although terrapin sightings are reduced in mid-July, mowing should not occur until after the nesting season has come to a complete halt. We’ll be working more closely with LEHT in 2017 to make sure that a delayed mowing regime is adopted on all preserved land within the Twp.

Results and Summary:

The research conducted with this project is necessary to determine how long term road mortality is affecting the local population. As we’ve noted in the past, previous studies in the area have found that adult females are smaller and less numerous (Avisar 2006). As we collect more morphometric data, we hope to partner with a graduate student to help analyze this data and guide future conservation efforts in the area. We have also wanted to fully replicate a study conducted in 2004-05 which analyzed traffic and terrapin activity on Great Bay Blvd. to help better determine how

conservation efforts have paid off. For now, the data collected from our surveys will be used to measure success of awareness efforts and with the mark-recapture data, it will help us estimate the size and health of the local population.



Figure 5. Carly measures the carapace length of an adult female terrapin.

A total of 783 terrapins were observed in our main project area, Great Bay Blvd. WMA. Of those, morphological data was collected from a total of 128 terrapins. All 128 measured were adult females, and 86.72% were gravid when captured. The average estimated age was 12.11 ± 1.78 years, and the average weight and dimensions are available in **Figure 6** below. With regards to health, 34 of the 128 (26.56%) of the measured turtles showed some sort of injury, including one or more of the following: shallow scarring to plastron or carapace, deep scarring to plastron or carapace, damage to bridge, damage to marginal scutes, missing limbs, and/or open wounds. The sources of such injuries are unknown and may be a result of anthropogenic and/or natural causes. These results do not include dead terrapins and refer only to the terrapins on Great Bay Boulevard collected by the CWF intern.

	Carapace length (mm)	Carapace width (mm)	Plastron length (mm)	Carapace height (mm)	Weight (g)
<i>Average</i>	178.680	138.172	161.484	72.828	1009.648
<i>STDev</i>	11.610	9.709	10.592	5.654	202.580

Figure 6. Average dimensions in millimeters and weight in grams for 128 captured terrapins on Great Bay Blvd.

Overall, the impacts of this project on terrapins and the surrounding habitat have been positive. From data collected this year, we found that the average carapace length is similar to what was found in 2004-05 study on the same road, which was observed to be in decline from 1992-2002. High road mortality was believed to be the cause of the age-sex specific loss in adult female terrapins (Avisar 2006). Over the past six years we have documented a reduced road mortality rate from a study conducted in 2004-2005 (Szerlag 2006). We believe that many locals and visitors are more aware of terrapins while driving during summer months, and that the value of this project is eminent to the long-term conservation of Northern diamondback terrapins in New Jersey.

Year	2005	2010	2011	2012	2013	2014	2015	2016
# Live Terrapins	547	15	71	1027	913	342	801	737
# Dead Terrapins	53	9	19	36	38	35	34	46
Total	<i>600</i>	24*	90*	1063	951	377*	835	783

Figure 7. Comparison of Results from Previous Years on Great Bay Boulevard. *Less surveys were performed this year.

To sum up our Great Bay Terrapin Conservation Project, our volunteers patrolled for 244 hours and counted a total of 783 northern diamondback terrapins on Great Bay Boulevard and another 491 on other roads. With the dedication of our volunteers we were able to keep the mortality rate from motor vehicles low at 6.24%, which is less than average of 8.83% found in a 2005 study on Great Bay Boulevard (Szerlag 2006). Morphological data was collected from 128 adult females, and 123 of those individuals were notched with unique identification codes provided by Dr. John Wnek (MATES)(see *Excel spreadsheet for raw data*). Nine terrapins observed this year were previously caught. Four were recaptures from this year and the other five were recaptures from 2005 and 2008 by Stephanie Egger and Drexel University.

In our experience and through observations, we have found that several of the road kills occur at night or in the twilight time of day, especially in the early morning hours. We conducted two patrols at night this year and found a total of 27 terrapins on GBB. Of those two were hit by car and found dead. On GBB nesting terrapins are quite active at night, especially when high temperatures reach 90°F during the day. Research conducted by the Wetlands Institute has shown that nearly half (43%) of all roadkills occurred at night (Wood, 1997). In the beginning of the 2016 season, the majority of road mortality was discovered in the early morning when volunteers first arrived. In the month of June, at least 3 of these observations on Great Bay Boulevard were terrapins between the ages of 3-4 years old. As the season progressed however, there were less young terrapins present, and the majority of road kills were adult females.

The number of sightings and road kills on Great Bay Boulevard in 2016 was similar to the previous year's results; however the total number of terrapins decreased by 52 individuals, and the number of kills increased by 12. It's hard to confirm how or why the additional terrapins became road killed, but it could be attributed to the reduction in Terrapin X-ING signs, which

are critical to raising awareness of drivers. We hope to work on solving this issue (among other things) on GBB with Little Egg Harbor Twp. this year.

As we continue to expand our surveys to additional roads with documented terrapin road mortality, it is becoming clear which locations are consistently the most dangerous. Similar to last year's findings, the greatest number of kills was found along Route 30 in Absecon Twp. (27 in 2015; 141 in 2016). Contributing factors include the high vehicle speed limit, the concrete jersey barriers, and the lack of barrier fencing along the soft shoulders. Our intention for conducting surveys along Route 30 was to document road kills to guide the placement of barriers by NJDOT as part of a resurfacing project on the length of the road. We met with NJDOT officials several times about our work and the resurfacing project to discuss the installation of additional barriers along the road and their effects on reducing terrapin road kills. However, that project was just completed during second half of 2016, and to our dismay, no additional barriers were installed along the length of Route 30. As you can see from our data collected, terrapins enter the road along all sections of the road and 98% of them did not survive. Over time, this high rate of female-biased mortality will likely cause the population in Absecon Bay to become diminished, since terrapin traits include low recruitment, delayed maturity, long life, and limited dispersal (Haramis 2011). Aside from installing barriers along the length of Route 30, which would be costly, another effective strategy to reduce road kills could be to enhance nesting habitat away from the road within Absecon WMA. The development and hardening of shorelines along the entire coast of New Jersey has severely altered the native nesting habitat for northern diamondback terrapins. While historic habitat was blocked off, roads were created which supplemented their reproductive needs; however, vehicular traffic on roads has also added a sex-biased take breeding age adult females. Since NJDOT also maintains navigable waters of the Intracoastal Waterway System through dredging operations, we hope to inquire about a pilot project to use suitable dredge spoils to enhance terrapin nesting habitat.



Figure 8. Comparison of hatchling and adult female terrapin size.

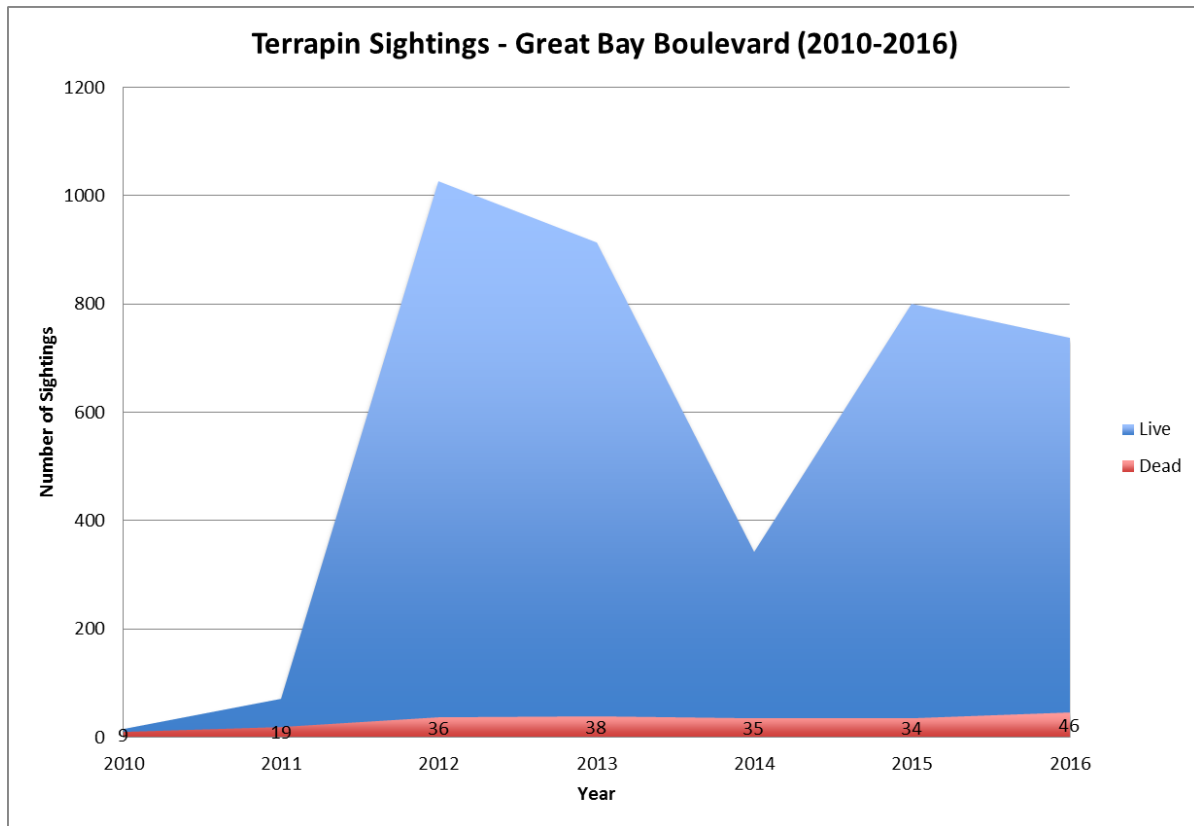


Figure 9. Graph of live and dead northern diamondback terrapins observed on GBB 2010-2016.

In summary, our data was consistent with previous years, however it clearly shows that we need to conduct more outreach and awareness efforts to help educate drivers of the occurrence of terrapins on roads. In addition to our road patrols and in close partnership with the Ocean County Marine Academy for Science and Environmental Sciences, we are beginning to enhance nesting habitat for terrapins to hopefully lure terrapins away from our deadly roadways. We're hopeful that the nongame status listing of terrapins will help garner more support for them in the future. At least for now it gives us more justification for continuing this project and we can rest easy knowing that the individuals we work hard to protect will not end up on a dinner plate in Asia. We're thankful for the support of all our dedicated volunteers, loyal donors, and support of the Endangered and Nongame Species Program staff. This project would not be possible without your valuable contributions.

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