

Attachment 4
PPBEP COMMUNITY GRANT FINAL RESEARCH REPORT FORM

Agreement No.:	FY2425-05		
Grantee Name:	Escambia County Natural Resources Management		
Grantee Address:	221 S Palafox St., Pensacola, FL 32502		
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Project Title:			
The Panhandle Terrapin Project: Education and Monitoring of Diamondback Terrapins			
Please submit any high-resolution photos related to the project (include photo credit for possible use by PPBEP for use in our e-newsletter, annual report, social media, or website) with your report as image files to mbwalkinshaw@ppbep.org .			

Abstract

The Panhandle Terrapin Project monitors diamondback terrapins (*Malachlemys terrapin*) in the Panhandle region, including Escambia, Santa Rosa, and Okaloosa counties. Here, we describe monitoring efforts through participatory science programs and through collaborations with county, state, and federal agencies. The work described is the first step in establishing routine monitoring methods of terrapins in the Florida Panhandle. A suitable habitat model was created to identify suitable primary and secondary habitats based on the presence of salt marshes and/or seagrass beds. The suitable habitat model indicated several new habitats to consider in monitoring activities, supported our actively monitoring nesting beaches, and, when compared to active known active nesting sites, shows that nesting beaches may occur outside of the suitable habitat range. Nesting beach surveys have begun for the 2025 season with 84 surveys completed across 6 beaches where 7 encounters (tracks or depredated nests) have been counted. In April and May 2025, trapping stents with modified crab traps occurred within Escambia, Santa Rosa, and Okaloosa counties. 1 adult male terrapin was captured in Okaloosa County, 0 were captured in Escambia County, and 15 (2 juvenile females and 12 adult males) were captured in Santa Rosa County. In addition to trapping stents, adult females have been captured in Santa Rosa and Okaloosa counties by hand through volunteers or the public. Three of these adult females have been satellite tagged for movement ecology. Acoustic monitoring will begin in the 2025 season for fine-scale movement monitoring within Santa Rosa Sound.

Introduction

Diamondback terrapins (*Malaclemys terrapin*) are a chelonian (turtle) species that inhabit 16 coastal states from the northeast Atlantic to the western Gulf. Florida is native to five of the seven subspecies of terrapins, contributing to approximately 20% of their entire range (Butler and Heinrich, 2013). Terrapins exhibit top-down control as a keystone species in their environments by controlling snail populations (Suarez et al., 2021). However, unlike other states such as Maine, Alabama, and New Jersey, Florida does not have diamondback terrapins listed as a species of concern, despite having protection measures in place like bycatch reduction devices

(BRDs). The Florida Panhandle region contains dense seagrass and saltmarsh habitats (Catizone et al., 2024), and based on modeling, it is suggested that terrapin populations should be supported in this region. Suarez et al. (2021) described terrapin populations in Franklin County (FL); however, there are no known population studies on Panhandle terrapins west of Gulf/Franklin County and east of Mobile County (AL). The International Union for Conservation of Nature (IUCN) has identified the habitat range of the five subspecies ranging across Florida, excluding the Florida Panhandle due to the lack of data regarding terrapin populations. In recent years, Florida Sea Grant and US Geological Survey (USGS) have partnered to create the Panhandle Terrapin Project which utilizes citizen scientists to locate terrapin habitats and nesting sites between Baldwin County, AL and Franklin County, FL, serving as the first steps to understand terrapin habitat use, movements, and identify terrapin populations.

The Panhandle Terrapin Project utilizes participatory scientists to conduct surveys, monitor populations, conduct education and outreach, and assist with research projects regarding diamondback terrapins. Here, we describe methods for the objectives (1) locate and monitor nesting beaches, (2) determine terrapin populations, (3) monitor female terrapin movements.

Methods

Suitable Habitat Model

Arc Pro, NOAA feature layers for salt marshes and seagrasses, and parameters based on various literature, were used to create a suitable habitat model for Escambia, Santa Rosa, and Okaloosa counties. The suitable habitat model was created following similar parameters to Barry Bitters' model, originally created for the Panhandle Terrapin Project, to identify suitable nesting beaches. This updated map version located suitable habitats for year-round terrapin activity and nesting activity. Primary habitats were classified as areas containing both salt marshes and seagrass beds; whereas secondary habitats were classified as areas with either seagrass beds or salt marshes. The suitable nesting beaches are any beaches within a 250m range of the primary or secondary habitats (Palmer and Cordes, 1988). Polygon layers were used to identify primary and secondary habitats, with a 250m buffer polygon surrounding the suitable habitats. Suitable nesting beaches can be identified using satellite imagery and visual inspection within the suitable habitat buffer range. Suitable nesting beaches are not marked to protect nesting beaches from the illegal capture and harvesting of terrapins.

Nesting Beach Monitoring

Nesting beaches are monitored from April 1-September 30 through participatory science via the Panhandle Terrapin Project. Volunteers are trained throughout the entire Panhandle by UF IFAS Extension- Florida Sea Grant to survey, identify, and monitor (primary) nesting beaches and potential (secondary) nesting beaches. Primary beaches are classified as beaches with active nesting and secondary beaches are classified as beaches that have the potential to or historically have had nesting activity. Surveys are conducted based on the volunteer's schedule,

although each beach should be surveyed once per week, preferably within the mid-morning to early evening hours. Using nesting survey data (number of tracks or nests), a relative abundance can be calculated. Surveys are tracked using datasheets or survey123 to track volunteer hours, survey hours, frequency of sightings, and other data. Nesting beaches with confirmed activity receive temperature loggers, provided by USGS. These are deployed at 10cm deep and 12in apart (2 total per beach) and serve as a representative temperature dataset for the entire nesting beach.

Terrapin Trapping

Terrapin traps were created using crab traps with chimney modifications (figure 1) to allow air access. Holes were cut into the top of traps, with a 6-10in diameter width. Chimneys were created using 16-gauge wire with 1/2in mesh. Wire was curved to fit over the hole in the trap and secured using zip ties. Traps with pre-installed BRDs were modified to remove BRDs for terrapin access. Traps shorter than 24in were adjusted with the chimney mesh to expand the trap height to 24in or more. Traps were set at Pirates Cove (Okaloosa), Tiger Point (Santa Rosa), and Big Sabine (Escambia) for two nights total in April and May of 2025. Traps were baited with various baits (fish, squid, shrimp) to attract terrapins. Traps were allowed to soak for 24 hours between checks. Traps were set based on access and high tides, with deployment occurring at or near high tide. During checks, terrapins in traps were collected and kept together based on trap number and transported to land for full workups. Workups include notching (external tagging method), PIT tagging (internal tag), 3 tissue (4mm) biopsies from hind toe webbing, and morphological measurements including straight carapace length, width, height, plastron length, and head width (figure 2), and visual observations noted. Biopsies collected are used for genetic sampling, stable isotope analysis, and a spare for repeat analysis, if needed. Genetic samples will be used by the University of West Florida for the Janosik Lab for population genetics regarding subspecies range. Stable isotope samples are stored with USGS for analysis.

Movement Ecology

Satellite tags, provided in-kind by USGS, were used to track 3 terrapins from Santa Rosa Sound. Tags were deployed during April-May 2025 and 3 more are proposed for the remainder of the 2025 season. Satellite tags are secured, using epoxy, on the female (exceeding 800g) carapace. Tag location (figure 3) is based on the individual's carapace, tag is secured to a relatively flat region of the carapace, typically towards the front right-hand side (dorsally). Two satellite tagged terrapins were captured from Tiger Point and one was captured from Pirates Cove. Two more are proposed for Pirates Cove and one more for Tiger Point.

Vemco acoustic tags and receivers were purchased from Innovasea for the 2025 season. Two receivers were purchased with PPBEP grant funds and two additional receivers were provided in-kind by USGS, for a total of four acoustic receivers proposed for the Santa Rosa Sound (figure 4). 15 acoustic tags were purchased for deployment in the 2025 season within the Santa Rosa Sound. Receivers are expected to be deployed in Tiger Point in July 2025 for a trial

run prior to deployment within the Santa Rosa Sound. Tags will be deployed throughout the 2025 and 2026 seasons.

Results

Suitable habitat model suggests 19 primary habitats and 13 secondary habitats within Escambia, Santa Rosa, and Okaloosa counties (figure 5, <https://arcg.is/0z519T0>). Nesting beaches have been identified (primary beaches) within both primary and secondary habitats. The suitable habitat model supports the need to expand survey areas and can provide habitat information for areas where new terrapin sightings occur. The suitable habitat model indicated new and known habitat areas for terrapins. New areas have been reported to site coordinators and monitoring efforts have or will begin. Known areas with terrapin activities were mostly indicated as primary suitable habitats, allowing for the model to be used as a reliable resource.

In the 2025 season, 171 participants were trained across the Florida Panhandle, including Escambia, Santa Rosa, and Okaloosa counties. For the 2025 season, 84 surveys have occurred with 7 encounters. There have been 6 beaches with confirmed nesting, but the exact number of nests is currently unknown due to depredation rates, unconfirmed eggs, and due to nesting activity is counted based on tracks with no nests identified. Temperature loggers have been deployed, and data will be collected post-nesting season.

Pirates Cove (Okaloosa County) was trapped in April 2025 for two nights with 3 traps total. One adult male terrapin “Robert” (aka Captain Underpants) was captured in a trap, sampled, and released on night two. This trapping stent confirmed that modified crab traps could be successful in capturing terrapins for mark & recapture studies. A trapping stent occurred in May 2025 at Big Sabine and Tiger Point. Big Sabine was trapped for one night (3 traps total) due to weather impacts forcing the second night to be cancelled. A second trapping stent is scheduled for summer 2025. Tiger Point was trapped for two nights, where night one had 3 traps and night two had 6 traps. Traps were checked at 8am after night one where no terrapins were found. However, traps were checked again a few hours later and one juvenile female was captured, sampled, and released. Traps from Big Sabine were relocated to Tiger Point due to storms and access, allowing for 6 traps total for night two. Traps were checked 24 hours later. Fourteen terrapins were captured, two were juvenile females and twelve were adult males (figures 6-7). This trapping stent further supports the success of utilizing modified crab traps for terrapin mark & recapture studies in our area. Annual trapping stents are planned for the sites described and additional sites.

Satellite tracking data shows minimal movements this early in the tracking. Acoustics have not yet been deployed but have a tentative deployment date for early July 2025. More data will become available later this year.

Discussion and Conclusion

The suitable habitat model indicates a large number of suitable habitats, both primary and secondary. Most primary suitable habitats are monitored as primary or secondary nesting

beaches by volunteers. Additionally, some nesting beaches have been identified outside of the suitable habitat parameters. These habitats may have been excluded from the model due to the NOAA feature layers for salt marshes and seagrasses not being complete or not considering fine-scale marshes or may be just outside of the 250m buffer range. While the 250m buffer range is considered the habitat range a terrapin may travel, it does not mean terrapins do not travel outside of the range. Since most primary or secondary nesting beaches are within primary or secondary suitable habitats in the suitable habitat model, the model can be used as a reliable source for planning terrapin monitoring activities. However, the suitable habitat model should not be the only source for planning activities as some nesting beaches or habitats may not be indicated on the map.

Nest activity is counted based on identifying tracks or depredated eggs. Since locating eggs can be challenging, activity is counted for the presence of tracks. It is assumed that if a terrapin approaches a beach, she will nest that day or soon after. It can be assumed that multiple tracks found less than 16-days apart are not the same terrapin. With these assumptions, relative abundance can be calculated for the season. Relative abundance will be calculated at the end of the season in October 2025 for the 2025 season. To expand on terrapin population studies, mark & recapture study methods were implemented using modified crab traps. These traps were deployed at three sites along Santa Rosa Sound, Pirates Cove, Big Sabine, and Tiger Point. While only one terrapin was captured in Okaloosa County, he was captured in a region with known nesting. Okaloosa's trapping stent occurred in April, which is early in the season, and may have been the cause for a low capture rate. Future trappings are planned for the remaining of the 2025 season and will continue annually with early, middle, and late season trapping stents occurring. Escambia County (Big Sabine) is considered a secondary nesting beach due to historical nesting activity, but no known current activity. It was included in the mark & recapture study to monitor terrapin use of the marsh habitat. No terrapins were captured at this site; however, the trapping stent was only 1 night instead of two nights due to weather, which could be a contributing factor. Trapping stents will continue in Big Sabine to try to determine if a terrapin population exists. Tiger Point was the most successful site for trapping activities. While night one technically had no success, likely due to the overnight weather, a single terrapin was captured between 8am and 1pm on day two. Traps were checked again following night two with 14 total terrapins captured. The trapping methods are considered successful and will be continued for mark & recapture studies in all three sites and new sites moving forwards. Based on the capture rate from night one versus night two, it is evident that night two is more successful. This could be due to the hesitance of terrapins for approaching a new trap for night one. Big Sabine may have been successful on night two based on the capture rates of night one versus night two at the other two sites.

The final objective was to expand on the movement ecology of terrapins. Satellite tags have been used in recent years for terrapin monitoring, but they don't allow for fine-scale monitoring. Satellite tagging is still used for movement ecology for Panhandle terrapins; however, acoustic monitoring will provide more fine-scale monitoring. Acoustic arrays will be deployed in summer 2025 with terrapin tagging occurring between 2025-2026. Prior to

deployment within Santa Rosa Sound, a short-term array will be deployed in Tiger Point. A test array was originally planned for spring 2025 for staff to establish methods, but this was delayed due to issues with purchasing and shipping of acoustic supplies. This test array will still occur in Tiger Point to allow for method development and to monitor the fine-scale movement of terrapins within this habitat. Tiger Point has become an interesting site because the western portion has indicated a high presence of adult males and some juvenile females through trapping stents, but the eastern portion has indicated a high presence of adult females and the presence of a nesting beach as observed by volunteers and homeowners.

Future research will continue to expand on fine-scale habitats and movement of terrapins within the region, with a large focus on Santa Rosa Sound. Tiger Point is a unique site with an assumed established population. To establish population abundance and status, mark & recapture studies should continue. Morphological observations indicate two terrapin subspecies within the Panhandle, the Ornate terrapin (*M. Terrapin macrospilota*) and the Mississippi Terrapin (*M. Terrapin pileata*). Additionally, some terrapins exhibit morphological characteristics of both subspecies (i.e., yellow-tone skin with shells containing concentric circles or darker shells with lighter-toned skin), indicating the cross-mating of subspecies. The Mississippi terrapin is a protected species in Mississippi and Alabama and, if found in the Panhandle, should be protected in Florida. Prior to expanding their habitat range and protections, the subspecies must be genetically identified. Future genetic studies are planned to identify subspecies and where each subspecies range overlaps and ends. This project was the first step to identify populations in the western Panhandle; however, work was contained within three sites. Work should be extended to new sites between Perdido Bay and Choctawhatchee Bay for a complete western Panhandle population study; however, sites may be limited based on the available traps and supplies. Movement ecology of terrapins within our region is widely unknown and understudied. Studies suggest that individual terrapins do not travel more than 250m outside of their habitat range; however, recently large movements have been observed in this region. Previously, a tagged female terrapin was released in Perdido Bay and traveled approximately 41 miles to Fort Morgan, AL prior to losing her tag. Early this year, a terrapin was found deceased near Big Sabine. This terrapin was sampled and found to have been a tagged terrapin released on Dauphin Island in 2024, traveling almost 70 miles from his habitat range. To continue to understand how Panhandle terrapins utilize the waterbodies, salt marshes, seagrasses, and move between each, more fine-scale tracking studies should occur through acoustics and satellite telemetry.

Diamondback terrapins are the only estuarine turtle species in the United States where they could be considered a keystone species in their habitats. Estuarine habitats (i.e. salt marshes) are vital to the ecosystem by providing habitat for organisms within all stages of life, contribute to filtering water, and provide protections against erosion and storms. Supporting diamondback terrapins through participatory science programs gets the public invested in protecting the terrapins and the marsh habitats. Participatory science programs go well beyond research as it allows for and greater understanding and appreciation for the ecosystem for volunteers, but it extends further through outreach and education. Outreach and educational materials were designed and distributed across the counties and social media was used to expand

that reach even further. Educational content and posts can be seen in figures 8- 18. Additionally, work contributed to identifying suitable habitats to provide the first step in the long-term management of terrapins. Work aligns with both goals 5 and 6 of the CCMP action plan through establishing habitats for a potentially imperiled species and through increasing wildlife monitoring efforts for terrapins both through collaborations with agencies and through participatory scientists.

References

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Palmer, William, Carroll L. Cordes. "Habitat Suitability Index Models: Diamondback Terrapin (nesting)- Atlantic Coast." *USFWS National Digital Library* (1988).

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Successes and Challenges

Terrapin trapping was one of the most successful portions of the project. We had a high catch per unit (CPU) rate and through discussions with outside researchers, the CPU is generally much lower. Trapping will be continued annually with two to three stents per year per site to establish populations. The suitable habitat model is another success of the project where future directions and decisions can be made with stronger data to suggest terrapin occurrence in a habitat area. Comparing the known nesting locations to the model further supports the success of the model as majority of sites are within suitable habitat ranges. The education portion of the project was a huge success. We reached almost 19,000 people through in-person and digital methods. Digital methods include articles and social media posts (Escambia Extension and Escambia County NRM pages). In-person methods include tabling at events, presentations with high school and college students, or through presentations and meetings.

We faced numerous challenges with the changing of the administration contributing to the pausing of in-kind funds and delays with shipping & customs. We learned that it is better to order supplies earlier in the process for use later, rather than waiting until closer to needing them (i.e. acoustics). The challenges were largely due to administration, funds, and regulation changes that could not have been predicted. However, I believe we worked around many of the

challenges and still had a successful project. Trapping stents were delayed but not cancelled, other sources for supplies were found through donations or additional in-kind support from Escambia County and Sea Grant. Diligent planning and communications between the collaborators were critical in the success of this project. While work was delayed and is still ongoing, it will be implemented in the 2025 season and data can be presented in September and provided by the deadline in May 2026. Otherwise, we enjoyed the work and loved watching the program grow beyond its previous capacity and hope to continue that growth.

Lessons Learned

While data has not be analyzed or completed, the results have shown a need for fine-scale movement studies and population assessments. The wide variety of morphological characteristics between the two subspecies indicates that a change in the habitat range for the protected Mississippi terrapin may be needed in the future. The movement and distribution of terrapins within the western Panhandle has already proven to be unique through large movements of tagged terrapins and through the observations of Tiger Point trapping. The distribution of males versus adult females in this area was unique and indicate that they may be occupying separate areas of the marsh, at least earlier in the season. Further studies will continue so management methods can be established. We, the collaborators, have distributed work amongst ourselves. This change had to be made as the program is continuing to grow both in volunteers and in research areas. Trapping stents are managed by Kindall, volunteers by Rick, and data through Daniel. However, with the uncertain future for federal employees, backup plans for data management and supplies are being explored and implemented as needed.

This report is submitted in accordance with the reporting requirements of Agreement No. FY2425-05 and accurately reflects the activities associated with the project.

Kindall Butler

6/12/2025

Signature of Grantee's Representative

Date

Kindall Butler/ Environmental Specialist

Print Name and Title
