

Marine Turtle Monitoring Report

Gulf Islands National Seashore Florida Unit

2020



Staff Training of Nest Inventory Procedures. NPS Photo: K Dudus.

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Abstract

Gulf Islands National Seashore (GUIS) had an average marine turtle nesting season in 2020, with 59 total nests. Data from the last 11 years has provided an average nesting year to contain 63 nests per season, with the median at 60 and standard error at 9.5 nests. Surveys for turtle nests began May 15, with the first nest documented on May 22 and the last one occurring August 17. The last survey of the season was scheduled to be October 15 but ended up occurring early (Sept 12) due to Hurricane Sally closures and road damage. The majority (95%) of all nests this season were from loggerhead turtles (56 nests) and 5% were laid by green turtles (3 nests). No evidence of Kemp's Ridley turtles were suspected this year and no leatherbacks were documented.

Tropical storms negatively impacted 38 nests (64%) with entire nests being lost to erosion, buried under multiple feet of sand due to accretion, or washed over repeatedly impacting egg development. Of the 59 nests documented this year, 22 were located for a nest assessment either 72 hours after the first sign of emergence, or 70 days after the nest was laid. Those 22 assessments provided evidence of a 60% hatch success rate and a 59% emergence success rate. Nests that could not be located for inventory were not used in the calculations for hatchling or emergence success.

Unlike previous years where mammalian predation impacted over 10% of all nests within the park, nests deposited this season were mostly spared from coyote, raccoon and/or armadillo predation. During 2020, 8% of nests were impacted by predation with 3 nests dug into by coyotes after hatching, and 2 additional nests impacted by ghost crabs during incubation. Florida Fish and Wildlife Conservation Commission (FWC) has determined that nest predation under 10% of the total survey area is acceptable and natural.

Besides tropical storms ravaging the coast this year, the other main impact to marine turtle nesting at GUIS pertained to disorientations. In total, 2 adults were determined to be disoriented while attempting to nest, and 5 nests had documented hatchling disorientations.

Introduction

Gulf Islands National Seashore (GUIS) Science and Resource Stewardship (SRS) Division has primary responsibility for the conservation, protection and documentation of nesting and hatchling marine turtles within the delegated boundaries of the seashore. The GUIS SRS Marine Turtle Program, comprised each year of staff, interns and volunteers, has tracked and documented marine turtle nesting beginning in the mid-1980s and attempts at systematic daily nesting season surveys began in 1994. In Florida, the Florida Fish and Wildlife Conservation Commission (FWC) issues permits for activities involving interactions or research with marine turtles, their nests, eggs hatchlings, or parts under the Marine Turtle Protection Act, Florida Statute 379.2431 (1). FWC also has authority granted to the state through a Cooperative Agreement with the U.S. Fish and Wildlife Service (USFWS) under Section 6 of the U.S. Endangered Species Act (ESA) for such authorizations. The conservation activities specified within this manual have been authorized under Marine Turtle Permit (MTP) MTP-240.

There are four ESA listed marine turtle species that occur in northwest Florida. While all four may be present within the waters at any given time of the year, historically, the majority of nests laid at GUIS are loggerhead turtles (*Caretta caretta*), although green turtles (*Chelonia mydas*), and Kemp's ridleys (*Lepidochelys kempii*) have regularly been documented nesting in lower numbers. Since surveys began in the mid-1980s, two leatherback (*Dermochelys coriacea*) nests have been documented. Currently, the loggerhead turtle and green turtle are federally-designated as threatened under the ESA, while the other two species are federally-designated as endangered. Nesting generally occurs from May 1 through the end of August. Hatchlings are possible and nests need to be protected until October 31.

Methods

GUIS conducted authorized marine turtle activities along approximately 35.7 kilometers (22.2 miles) of shoreline within the Florida Unit of the park. The Florida Unit is located near Pensacola Beach, Florida along the northeast Gulf of Mexico and is comprised of three distinct study areas; Perdido Key (PK), Fort Pickens (FP), and Santa Rosa (SR) (Figure 1).

The PK area is approximately 11.2 kilometers (7 miles), the SR area is approximately 12.2 kilometers (7.6 miles), and the FP area is approximately 12.3 kilometers (7.6 miles) in length.

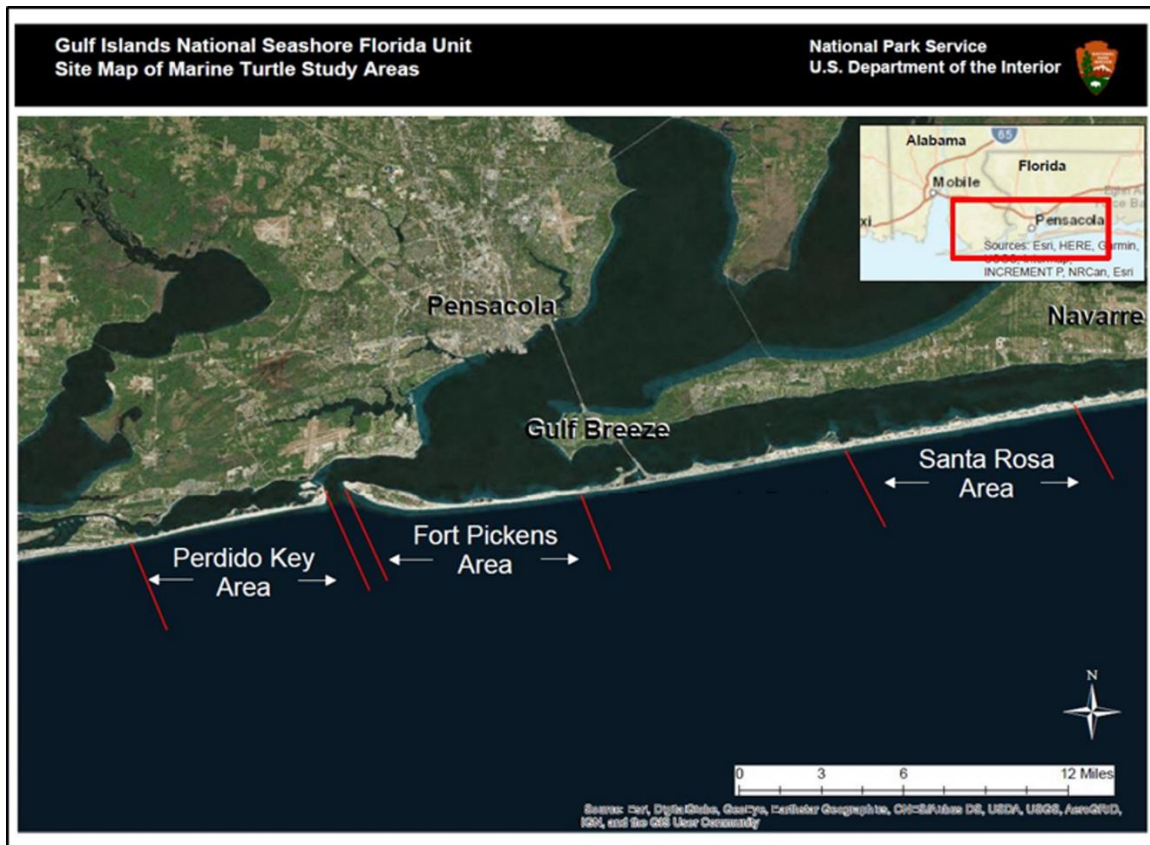


Figure 1: Site Map of Marine Turtle Study Areas.

Study methods, protocols and specific guidance used during implementation are outlined in the 2018 GUIS Marine Turtle Training and Protocol Manual and were in accordance with the FWC Marine Turtle Conservation Handbook which provides instruction on research and conservation techniques for all authorized activities. In addition, all study areas are part of the FWC Fish and Wildlife Research Institute (FWRI) Statewide Nesting Beach Survey program (SNBS) and SR is also part of the Index Nesting Beach Survey (INBS) program. Each program has specific training, guidance, and reporting requirements from the FWC's Marine Turtle Protection Program. SNBS and INBS surveys have different goals and different approaches as specified.

A remote training class was held immediately prior to the season and methodologies were reviewed through a PowerPoint slide show and team discussion. An updated field guide was also provided as a reference for volunteers and staff members to have in hand while on survey (Gulf Islands National Seashore, Marine Turtle Monitoring Field Guide, 2020). Most of the 2020 volunteers were returning experienced individuals and have been assisting with this turtle program for many seasons. New volunteers received additional one on one training by SRS staff in the field at nest sites throughout the season. Due to COVID, no large group trainings were conducted.

COVID-19 impacted nesting surveys and inventories by preventing large in-person gatherings. Trainings where all volunteers and staff can implement hands on experience at the survey site were avoided to maintain the safety of personnel. Online trainings were

provided on multiple occasions to accommodate staff and volunteers, and one-on-one trainings were held when appropriate. To further comply with COVID protocols, all surveyors were required to use face coverings, utilize hand sanitizer, and follow UTV cleaning protocols to lessen exposure risks while conducting surveys.

Daily morning surveys were conducted in all study areas, seven days a week with the exception of official park closures due to hurricane impacts, and normally lasted 2-4 hours. On occasion, weather conditions including rough surf and high tides prevented surveyors from completing portions of their route, or the entire survey itself. Missed days were documented with FWC at the end of the season for SNBS, and monthly for INBS protocols. Proper INBS protocols were followed to compensate for missed survey data.

In 2020, surveys to document nests and false crawls began May 15. In the past surveys historically began May 1, but COVID caused the park to be closed for field work an additional two weeks. Starting mid-July, hatchling tracks, or evidence of nest hatching events were documented. These efforts represent a substantial amount of time, on average approximately 1200 hours are required for morning surveys over roughly 140 days. In 2020, VIPs logged 1700 hours with a majority of that time spent on surveys, inventories and training but does not account for drive time to the study areas.

Data this season was collected using Samsung tablets and the program Survey 123 through ArcGIS Online (AGOL) for each nest, false crawl, and nest inventory that was conducted. Information collected for each emergence included species, incident type (nest or false crawl), crawl width, and location defined as 1) proximity to beach markers and 2) GPS positioning of all nests at the clutch location using an R1 Trimble receiver. GPS positions were also recorded for unusually long, obstructed or disoriented crawls through the Collector App. All Survey 123 and Collector data was populated on AGOL weekly so biologists could see what nests or false crawls happened where in relative real time.

In order to reduce time, effort and reduce entanglement concerns, twine was not used to enclose the nest area this year.

Results and Discussion

Compared to other nesting beaches in the state of Florida, GIS documents relatively low numbers of marine turtle nests. While small, the panhandle nesting marine turtles have been identified as a distinct genetic population that is vital in maintaining resiliency needed for species recovery (Shamblin et. al, 2010). Small nesting numbers documented at the park cannot be used to determine overall population trends of the species, but trends within the park's boundaries are analyzed each year.

It should also be noted that protocols for marine turtle management and documentation has changed over the years. Gulf Islands NS has followed FWC recommendations on survey techniques and data collection needs as research informs this adaptive management process. Activities such as nest sitting, relocations, and night surveys have

been discouraged throughout the state as studies show their potential impact to natural processes. Because of these potential negative impacts to nesting turtles, GUIS no longer conducts night surveys, and nest relocations have been reserved for extreme, case-by-case circumstances. Due to these changes, data should be viewed with the knowledge that management and documentation techniques have not remained constant through time.

Patrols for the 2020 season began May 15 and ended September 12 providing a total of 59 documented nests within the GUIS boundary. For loggerhead nesting, PK recorded 22, FP recorded 16 and SR recorded 18 nests. Green turtle nests were recorded at FP (1 nest) and SR (2 nests) as seen on Table 1. All nests recorded were left in their original locations, and no nest relocations were conducted in 2020.

The average number of nests for GUIS since daily surveys began in 1994 is 43.8 nests per season ($SD \pm 27.4\%$). A positive linear trendline indicates that the amount of nesting at GUIS is predicted to increase over time, but the low R^2 value shows little confidence in that trendline fit. A polynomial trend line (order 2) fits slightly better (R^2 value = 0.43) and looks to predict increased nesting as well (Figure 2). As these species continue to recover, it is assumed that nesting numbers will increase over time at all Florida beaches.

Table 1. 2020 nesting numbers by species at each GUIS study area in FL. In total, 59 nests were documented during the 2020 season.

Species	Study Area			Total
	PK	FP	SR	
Loggerhead Nests	22	16	18	56
Green Nests	0	1	2	3
Kemp's Ridley Nests	0	0	0	0
Leatherback Nests	0	0	0	0
Total	22	17	20	59

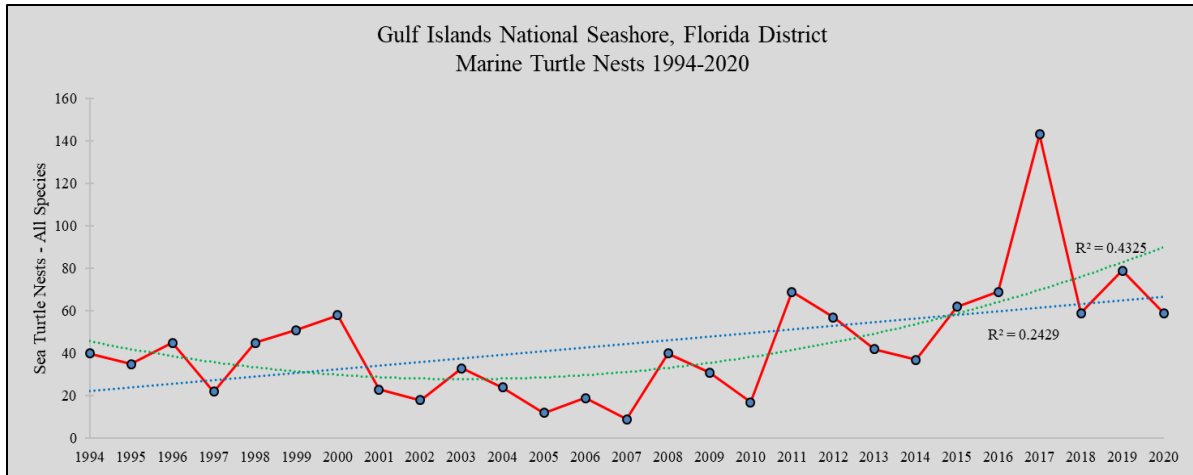


Figure 2. Marine turtle nesting (all species) in FL at GUIS over time starting 1994. Two trendlines, a linear and polynomial, both indicate that nesting will increase over time. With such low numbers of nests each year, this data set cannot be used with confidence to predict future nesting at the park.

Breaking the data down further by species shows that Loggerhead nesting accounts for the vast majority of the nests documented at GUIS since regular surveys began in 1994. Figure 3 shows the proportion of nesting species over time at GUIS separated by species.

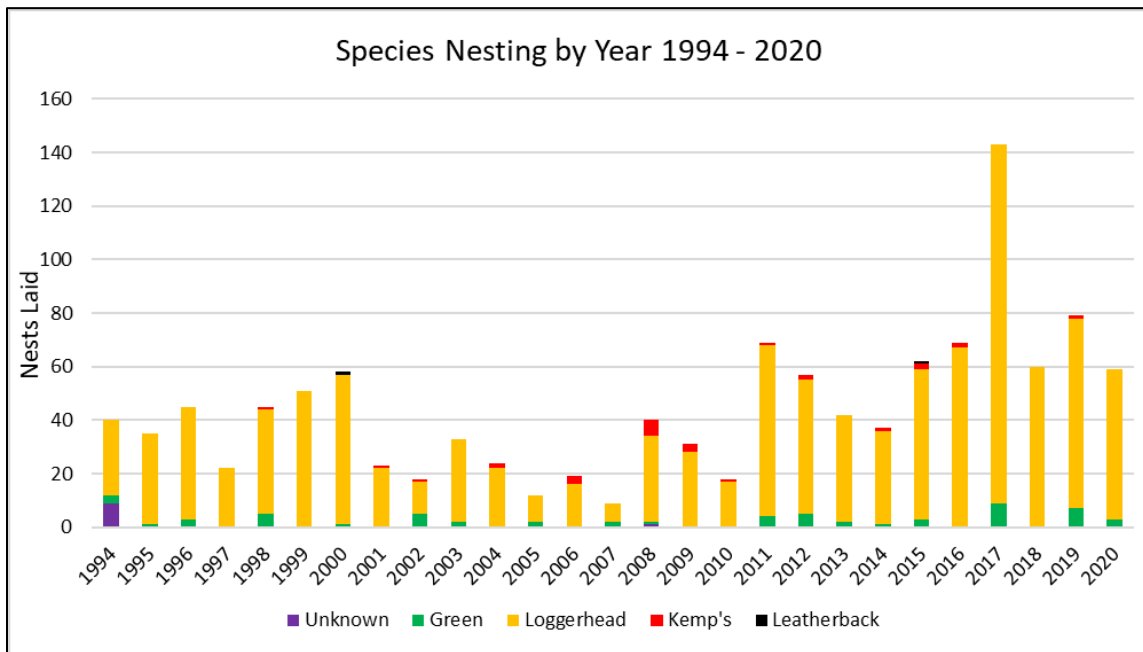


Figure 3. Species nesting by year at GUIS from 1994 to 2020. Loggerheads make up the majority of nesting at the park every year.

A total of 59 nests were documented this season along with 41 false crawls, yielding a beach success of 59% (Figure 4). The beach success average since 2000 is 49.6%, therefore 2020 provided an above average year. False crawls can occur for a variety of

reasons, but ideally when a nesting female expends the energy to come onshore, it is in her best interest to deposit eggs. A high beach success percentage is anticipated for a National Seashore that is maintained to be as natural as possible, therefore a beach success percentage over 50% is ideal for this property.

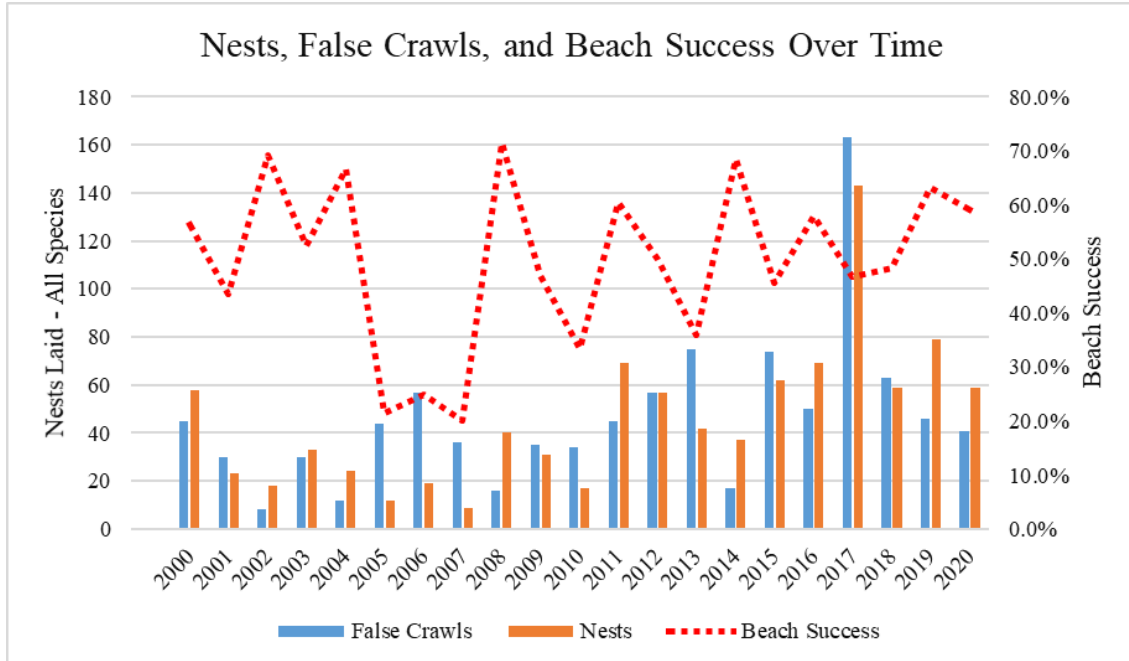


Figure 4. Nests and false crawls over time, with beach success percentages shown with the dotted red line dating back to 2000.

The first nests of the season were laid at SR and FP on May 22. The final documented nest of the season was laid on August 17 at FP. Based on historical data seen in Figure 5, to capture the majority (85%) of the earliest and latest marine turtle nests at the park, daily surveys should begin May 15 and end August 31. To capture 93% of the historical first and last nests laid, surveys would need to begin May 9 and end Sept. 3. Lastly, to record 100% of all historical nests documented at the park starting in 1994, surveys would need to begin May 3 and end Sept. 6.

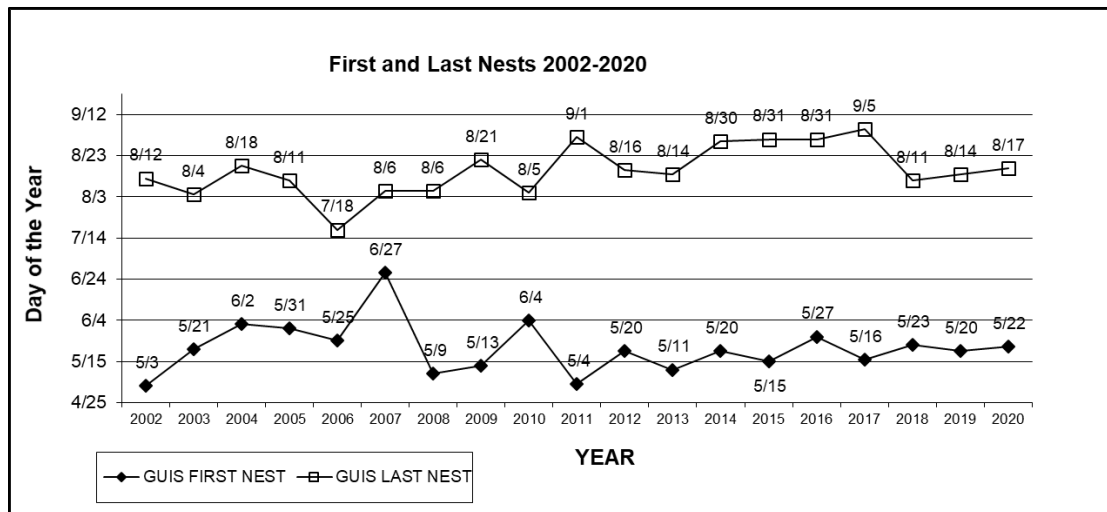


Figure 5. Historical nesting dates from 2002 to 2020. The data set goes back to 1994 but is best visualized with under 20 years of data.

The average clutch size of assessed nests (22 total) was 102 eggs, ranging from 52 – 142 per nest. This clutch size range and average egg number is typical for these species in Florida and is not expected to change much from year to year.

The mean incubation rate is of more interest, especially in the context of global climate change. In 2020, staff were able to record the incubation time of 15 nests and documented an average incubation of 60.5 days. This did not include nests that were left until the 70-day mark for inventory. This subset only includes known hatch days where staff could accurately determine total incubation time for a nest, meaning they recorded a hatching event and knew when the nest was laid. As seen in Figure 6, incubation times for nests laid at GUIS have fluctuated over time. Because incubation times are directly related to temperature, it is assumed that increased air temperatures will lessen incubation times. An order 3 polynomial trendline fits this data best with an R² value of 0.55. With a small dataset, it's difficult to determine future incubation rates based solely on GUIS nesting, but it is generally thought that incubation times will decrease as air temperatures increase. Because marine turtles have temperature-dependent sex determination (TSD), it is possible that more female hatchlings will be present as air temperatures rise globally.

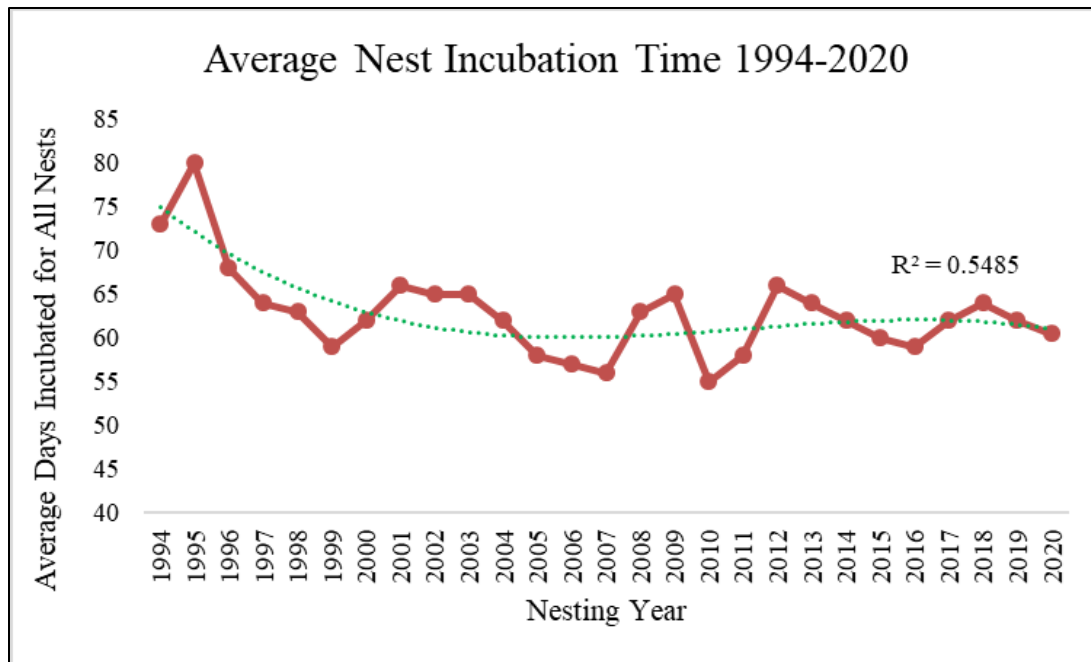


Figure 6. Average incubation times for all species at all locations at GUIS. Each year provided between 6 to 102 nests to calculate averages from. An order 3 polynomial trendline fits best with the somewhat fluctuating and limited data set.

The mean hatch success rate of inventoried nests was 60% for 2020 (Figure 7). This annual hatch rate is the GUIS average stretching back to 1996 (60%). While fewer nests were inventoried due to storm washouts, the nests that made it through all 4 tropical storms had a generally good success rate. The emergence success rate was similar at 59%, meaning almost all of the eggs that hatched had turtles that were able to leave the nest cavity on their own. Overall, the 60% average hatch success is ideal for the National Seashore standard.

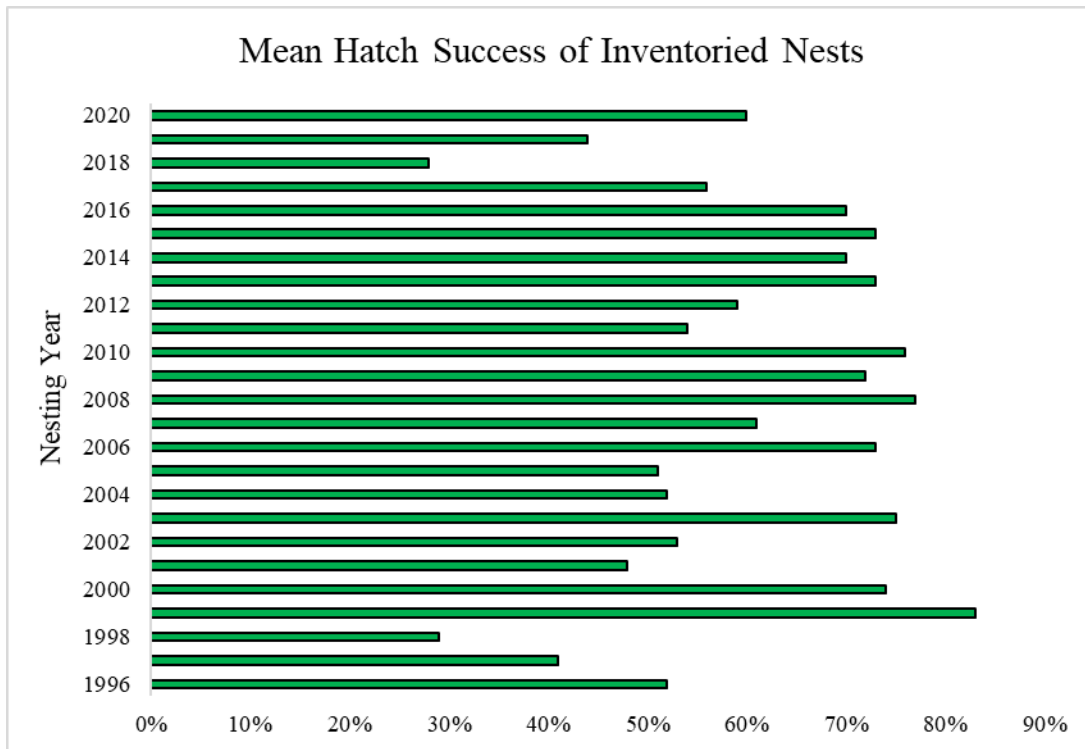


Figure 7. Hatch success percentages of nesting turtles over time.

Tropical Weather

This season, the main impact to nests was attributed to tropical storm events. Erosion, washouts, and sediment accretion impacted 64% of the nests laid at the park.

Four tropical events impacted nesting turtles this season. Tropical Storm Cristobal occurred early in the year and impacted nests on June 7, 8 and 9. FP lost 3 nests to this storm, while SR lost 2 and PK lost only 1 nest. The next major storm systems to impact the area were Tropical Storm Marco and Hurricane Laura (Aug. 24– 27). These storms were in the Gulf of Mexico simultaneously, and while we didn’t have a direct hit from either, the sustained storm surge and wave energy caused multiple nests to be impacted. PK lost 1 nest, FP lost 1 nest, and multiple other nests were washed over at all 3 units for extended periods of time. By far the most impactful storm this season was Hurricane Sally, who came ashore just west of Perdido Key at an average speed of 2 mph from Sept 14 – 17. Hitting the coast as a Category 2, this storm caused extensive damage to the habitat and imbedded infrastructure. SR lost 8 nests, FP lost 8 and PK lost 6. Most of these nests were in the later stages of their incubation process as the nesting season was winding down.

As climate change continues, experts are warning that tropical storms will be coming more frequently and with greater intensity. 2020 is currently one of the most active hurricane seasons on record, just beating out the similarly insane summer of 2005. Staff should prepare to manage the upcoming turtle seasons with the expectation that multiple storms can occur, and negative impacts to nesting turtles will continue to increase.

Predation

Only minimal predation on nests was documented this season. In the past, predation from coyotes has been substantial, and self-releasing screens were utilized to protect eggs under the sand by placing 2-inch by 4-inch chicken wire on the surface over the clutch. The park also previously contracted predation management out to USDA, who was successful at removing coyotes from the landscape. This year's Marine Turtle Permit from FWC included the use of self-releasing screens, but we agreed to only use them when predation became a documented impact on the nests. With no substantial predation observed this season, screens were not implemented.

In total, both SR and FP recorded one nest with negative impacts from ghost crabs prior to hatching. PK had 3 nests dug into by coyotes after they hatched, which was evident from the condition of the egg fragments.

Predation management was employed this year at FP, and it is not clear how these actions impacted nesting success at this area. We do know that the FWC predation management biologist was active at properties surrounding GUIS. Therefore, it is a possibility that nests at PK and SR fared well due to this active management of mesopredators.

Human Disturbance and Disorientation

Numerous human footprints were documented walking through nesting sites since enclosures were not established with twine. Twine enclosures will be re-implemented in 2021 with daily monitoring to mitigate for entanglement concerns. We did not observe impacts to nests or the incubation as a result of these walk over events.

Hatchling disorientation was defined as > 5 hatchlings from a given nest orienting $> 45^\circ$ from the most direct path to the Gulf post-emergence (FWC 2016). One of the negative anthropogenic impacts to nesting marine turtles is artificial light sources. Lights can be seen directly or indirectly from all park beaches as point light sources (Pensacola Naval Air Station lighthouse, gas dock) or as urban sky glow (cumulative lights from cityscapes). While sand dunes and vegetation can block out some of the direct light sources, the sky glow is visible from all areas of the seashore.

In 2020, adult turtle disorientations occurred again as they have in previous years. Two nesting adults disoriented this season, with one female turtle needing assistance back to the Gulf of Mexico by morning patroller, Tom Anderson, to avoid a vehicular collision on SR 399. The other adult female ended up on the road at FP for a short period of time before eventually making her way back to the water unassisted.

Of the 14 nests that hatched with directional data of hatchlings, disorientation was noted for 5 (36%) of the nests (Figure 8). Disorientations have been an ongoing negative impact to marine turtle reproduction at GUIS, as the historical average of disorientations since 1996 sits at 51%. The park has taken action to retrofit all NPS structures with wildlife

friendly lighting to lessen the impact to nesting turtles but making large changes to the Naval Air Station and surrounding cityscapes is a challenge.

Changes in protocols could also have an impact on the amount of disorientations documented at the park. Prior to 2018, volunteers were allowed and encouraged to perform an activity know as “nest sitting.” This activity required a surveyor be at the nest site during night/early morning hours to witness the hatching event. By having people at the nest site during hatching there is a potential to skew disorientation data. Volunteers being at a large proportion of the hatching events increases the documentation of hatchings and could alter how the animals react or orient as they exited the nest cavity. There is also a potential that volunteers intervened earlier than necessary, and hatchlings would have eventually oriented in the correct direction towards the Gulf of Mexico. This last scenario would result in an overestimation of disorientation events.

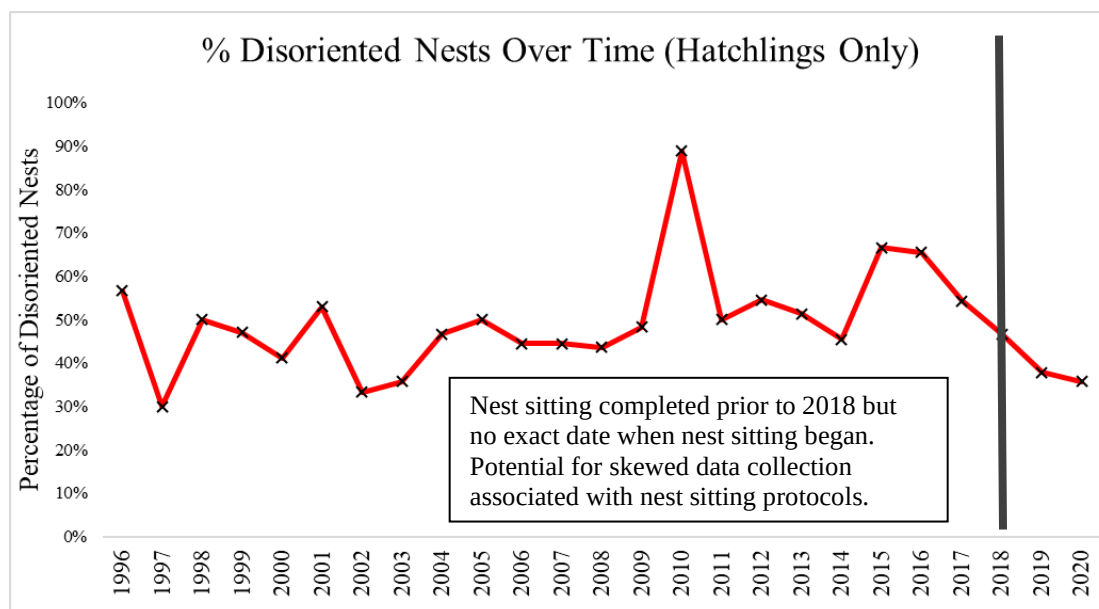


Figure 8. Percent of disoriented nests over time. This number is derived from total hatched nests where orientation could be determined divided by how many became disoriented. The park average from 1996 to 2020 is 51%. A black bar has been placed at 2018 to demarcate when the protocol for nest sitting changed.

We find that FP has some of the worst disorientation issues with 3 of the 4 (75%) nests becoming disoriented once hatching begins. FP has a history of hatchling disorientations, with years such as 2018, where 100% of nests became disoriented. This trend is expected to continue as Hurricane Sally destroyed over 70% of the dune structures at this unit and removed over 100 feet of shoreline in many areas.

Recommendations

There are 3 main recommendations to management based on information gathered in the 2020 season in order from lowest to highest priority:

- 1) Be cautious of low predation numbers and prepare for rebounds.
- 2) Prepare for continued extreme storm events.
- 3) Create action plan for disorientations and road mortality due to a flat landscape.

Predation levels were incredibly low this year, and multiple confounding factors do not allow us to tease out which of these factors played the largest role. Major tropical storm events paired with different nest marking techniques (no digging into the nest) and predation management in the form of coyote removal all played some role in the lack of egg predation. This is great news, and minimizes the effort needed to protect each nest. It also lessens how much material is placed on the beach (no metal screens) and allows the National Seashore to keep its mission of letting nature be nature.

The main recommendation here is to maintain our vigilance to this issue, and ensure we have the appropriate tools in the toolbox for when predation increases (Figure 9). Predation that impacts over 10% of the nests warrants further investigation and management. Right now, GUIS is in good standing regarding marine turtle predation.

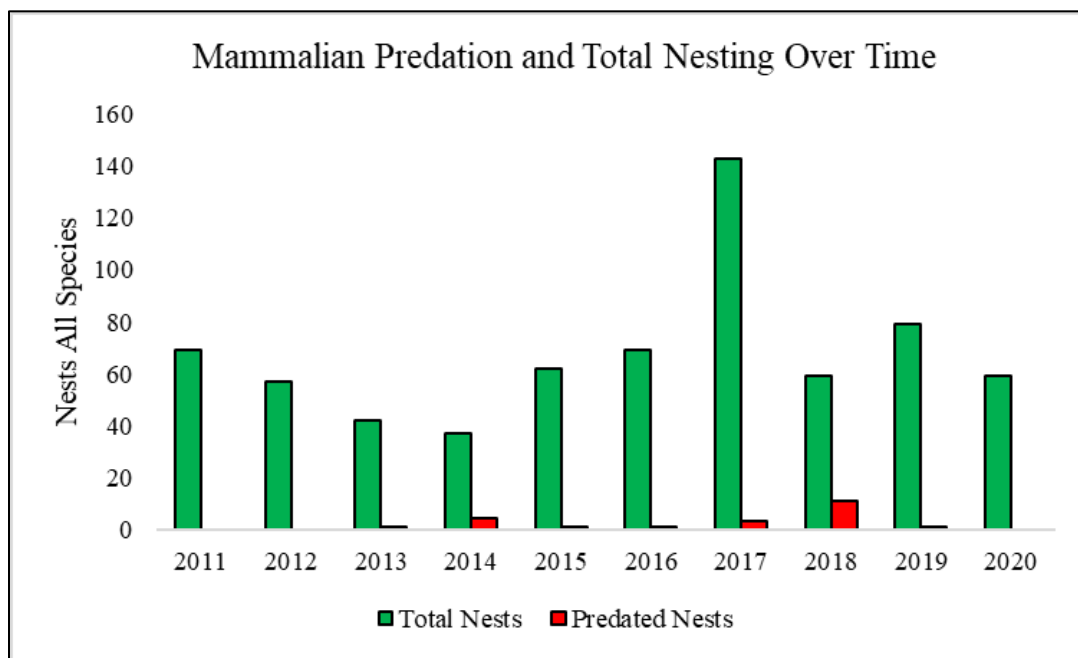


Figure 9. Total nesting numbers and total mammalian predation events over time. The park started keeping track of predation at PK, SR, and FP in 2011, but has a longer data set for PK.

With increasing ocean temperatures, meteorologists generally agree that tropical storms will be more frequent and more intense as global climate change occurs. With this knowledge, the park needs to prepare for more frequent catastrophic losses to the barrier island shorelines. One issue that park biologists are concerned about is the lack of beach between the frontal dune system and park structures (Figure 10). Infrastructure such as roads, parking lots and beach crossovers are incredibly close to the nesting habitat of

these turtles at GUIS. Barrier islands are designed to shift over time, but hard structures pinch off Gulf facing habitat as the sand moves northward towards the mainland.

The park management team needs to seriously look at beach nourishment and/or moving infrastructure northward to avoid being washed away. Our management recommendation would be starting the conversation for all mitigating actions by starting the permitting process for both. It may be easier in the short-term to place more sand on the beach, but long-term survival of the park's property relies on moving inland.



Figure 10. Fort Pickens road after Hurricane Sally removed over 100 feet of Gulf facing shoreline. This is the most egregious section at GUIS regarding shoreline erosion threatening infrastructure.

Paired with increased tropical storm activities, our main concern for upcoming turtle seasons pertains to disorientations from adult nesting females and hatchlings. With the loss of our dune system from multiple tropical storm events, the beach is flat. Without dune structures blocking point source lights and sky glow from the mainland, we expect a high amount of disorientation events in 2021. Without action, we will be dealing with additional road mortalities to these federally protected species (Figure 11a and 11b).

The current management recommendation is to create a plan to how the park wants to deal with these events. For hatchlings we have options: Non-releasing screens, relocations, and black silt screens around nests about to hatch. All three options require a

permit from FWC, and approval from the park management team. For adults we have less options. One that could work at PK and FP are to close the road at night, and educate staff living at FP to be on the lookout for adult turtles in the road. With those measures in place, we would only have to determine a plan for SR 399.

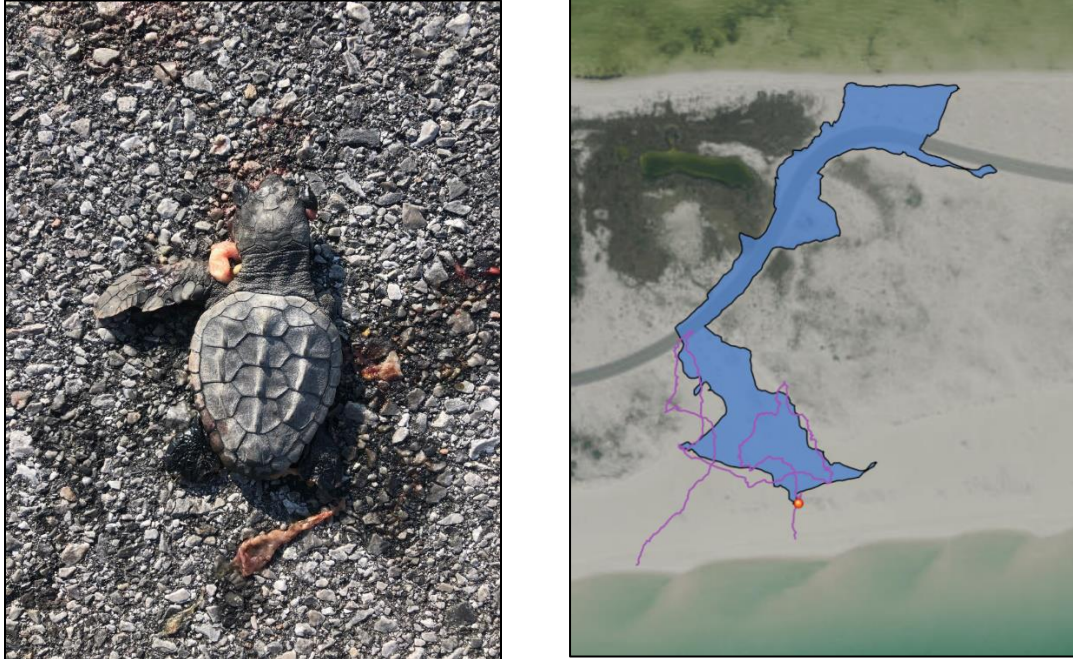


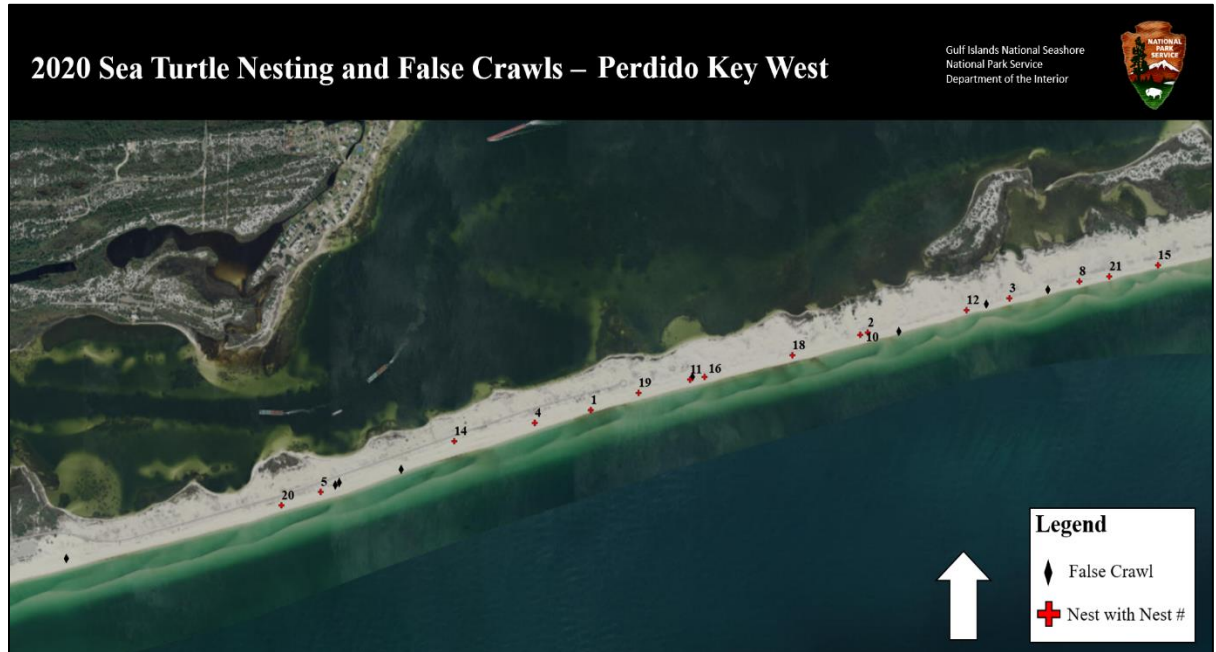
Figure 11a. Dead marine turtle hatchling on Fort Pickens Road (right) and map of the adult disorientation (line data) and hatchling disorientation data (polygon). Three hatchlings were found dead on the road when staff arrived, and multiple individuals were found in the wetland adjacent to the road.



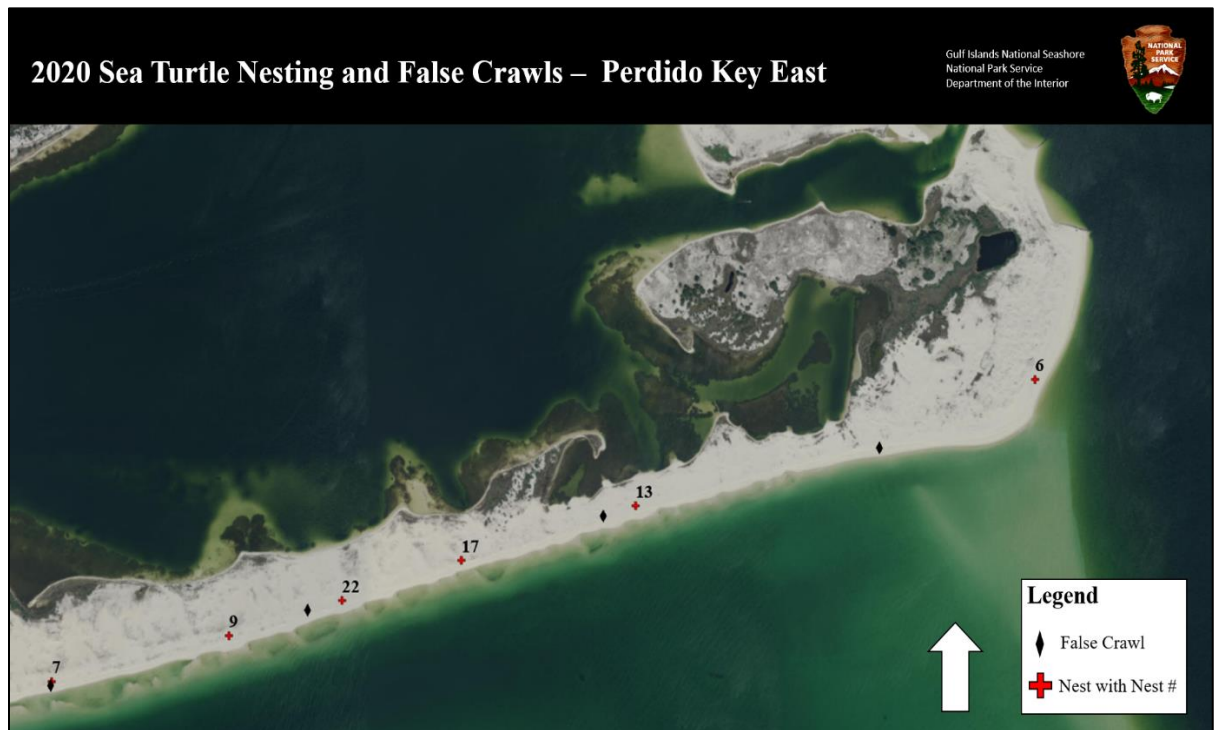
Figure 11b. Adult nesting female struck by a car on Fort Pickens Road 2019. Named ‘Crash,’ this turtle was taken into Gulfarium for treatment. Unfortunately, she succumbed to her injuries after a few months at the facility.

Nesting and False Crawl Locations

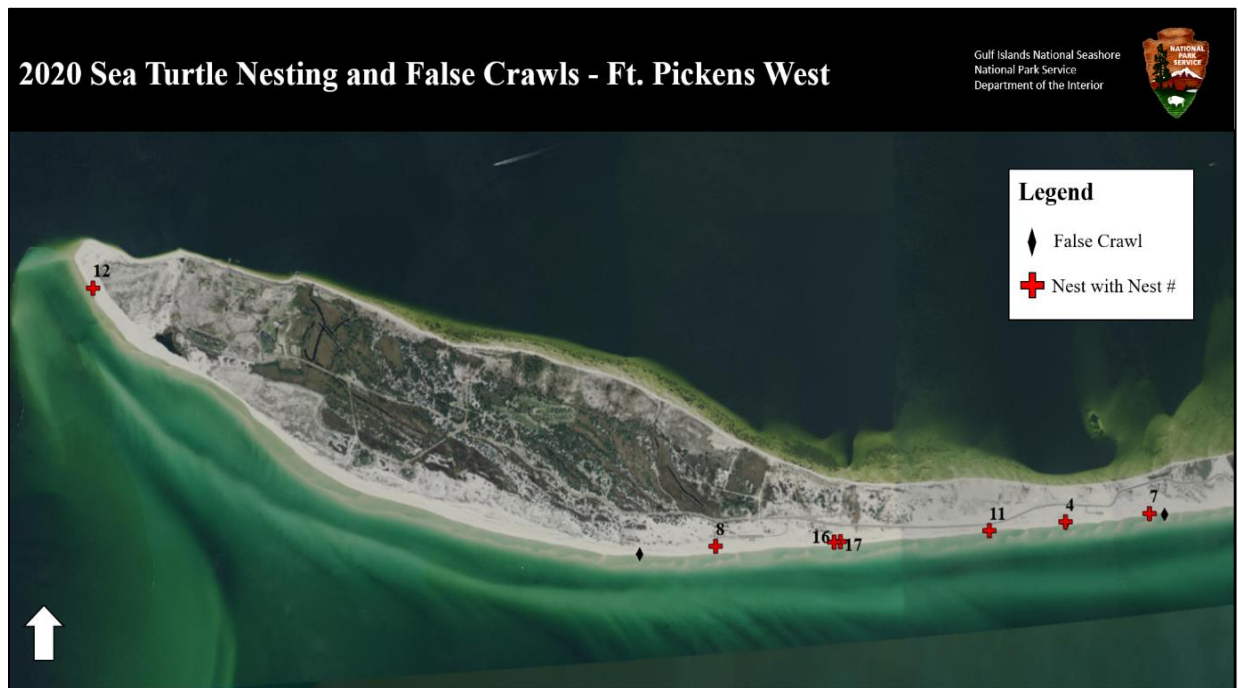
Locations of nests and false crawls were documented with Collector and Survey 123 in coordination with R1 Trimble Receivers. Final maps are created through ArcPro, and all geographic data is archived.



Perdido Key West



Perdido Key East



Fort Pickens West



Fort Pickens East

2020 Sea Turtle Nesting and False Crawls – Santa Rosa West

Gulf Islands National Seashore
National Park Service
Department of the Interior



Santa Rosa West

2020 Sea Turtle Nesting and False Crawls – Santa Rosa East

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National Park Service
Department of the Interior



Santa Rosa East

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B.M. Shamblin, M.G. Dodd, D.A. Bagley, L.M. Ehrhart, A.D. Tucker, C. Johnson, R.R. Carthy, R.A. Scarpino, E. McMichael, D.S. Addison, K.L. Williams, M.G. Frick, S. Ouellette, A.B. Meylan, M.H. Godfrey, S.R. Murphy, C.J. Nairn. *Genetic structure of the southeastern United States loggerhead turtle nesting aggregation: evidence of additional structure within the peninsular Florida recovery unit*. Nov, 2010. Available at http://gtmnerr.org/documents/Research_Publications/2010.Shamblinetal.pdf