HABITAT CONSERVATION PLAN

A PLAN FOR THE PROTECTION OF SEA TURTLES ON THE ERODING BEACHES OF INDIAN RIVER COUNTY, FLORIDA

2016 ANNUAL REPORT

Prepared in Support of Indian River County’s Incidental Take Permit (TE057875-0) for the Take of Sea Turtles Causally Related to Emergency Shoreline Protection Activities

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2016 EXECUTIVE SUMMARY

In 2004 Indian River County received an Incidental Take Permit (ITP) from the U.S. Fish and Wildlife Service, which authorized the “take” of five species of threatened and endangered sea turtles causally related to shoreline protection projects initiated under the county’s emergency authorization to protect coastal properties. As a requirement for the ITP, the county developed a Habitat Conservation Plan for Sea Turtles (HCP). Among other things, the HCP describes measures that will be undertaken to minimize impacts to sea turtles during emergency shoreline protection projects and implements a series of conservation programs to offset unavoidable take.

The county authorized no emergency shoreline protection projects under HCP authorization in 2016, however damage from Hurricane Matthew in early October initiated a FDEP executive final order for emergency repairs and a total of 29 permits were signed at citizen request to repair crossovers and protect the dune. During the nesting season most of the effort was focused on the nest monitoring, predator control, lighting, and education programs. Standard Operating Procedures remained essentially the same and monitoring personnel were provided with training to improve data collection. Nesting activity was summarized within six survey zones and the methodology adhered closely to Florida Fish and Wildlife Conservation Commission (FWC) Marine Turtle Guidelines.

A total of 17,161 sea turtle emergences were recorded above the mean high tide line during the 2016 nesting season. It was the most productive season since the inception of the HCP with a total of 7,496 nests, with a record number belonging to loggerheads (7,197). The county experienced an expected low year of nesting for green turtles with 265 nests and another expected low year for leatherback with 34 nests. Nesting began on March 11 and ended on October 26. Nesting success was 43.9% for loggerheads, 35.4% for green turtles and 61.8% for leatherbacks. Permit holder groups marked 968 nests for reproductive success (12.9% of the total). The mean emerging success was lower than previous years for loggerheads at 43.5% and about average for green turtles at 67.4%, however, when tidal wash-outs and nest predations were included the rate dropped to 40.6% and 42.4%, respectively. Leatherback emerging success was lower at 42.8% but only fell to 41.3% when wash-outs and predations were included. The largest impact to reproductive success for Loggerheads may have been climate, as it was the hottest summer on record and the area experienced very little rain. As for Green Turtles, the largest impact to reproductive success was most definitely Hurricane Matthew which washed away 31.8% of the marked nests.
Potentially disruptive human activities including beach fires, unauthorized vehicles, canopy tents, illegal construction projects and deep holes were recorded. Fortunately, there were no direct impacts (i.e. dead eggs or turtles) from these activities. Raccoon predation was relatively low (<0.1% overall, 0.1% in ACNWR), but canine predation (mostly coyote, 0.5%), which was only found around the ACNWR, was higher than the level of raccoon impacts, but lower than in previous years due to the removal of a pack that was denning nearby. and luckily poaching was not a problem this year. Beachfront lighting continued to be the largest observed impact on nesting. Artificial lights disoriented 48 nests across the county’s coastline, 55.5% decrease from 2015. As seen in many years, the majority of disorientations occurred in the southern part of the county inside the City of Vero Beach where high levels of development have occurred.

In the past education was done primarily through brochures, newspaper articles, news radio, beach signs and direct discussions with beachgoers. However, the 2016 nesting season brought with it many changes to the education program as there was still a general lack of knowledge regarding sea turtle biology and conservation in local residents, business owners, and guests to the area. The new educational opportunities available in 2016 include the turtle friendly business program, turtle digs or public nest excavations, and adapted school presentations for 5th graders. All of these were designed to increasing public awareness and involvement from the community.

Since there were no temporary or permanent armoring structures authorized by the county during 2016, there remains a balance of 2,676 linear feet of armoring remaining for the life of the permit. The HCP programs have largely been effective through collaborations with government agencies, beachfront stakeholders, non-profits and volunteers. Because staff and funding deficits are ongoing, future efforts will rely heavily on help from these groups and donations.
INTRODUCTION

Barrier islands in the southeastern United States are frequently battered and rearranged. Geologists describe this process as “shoreface retreat”, but in the context of coastal development, it is commonly called erosion. Approximately 70 percent of Indian River County’s coastline is classified by the State of Florida as “critically eroded.” As structures close to the beach become increasingly vulnerable to physical damage, property owners are seeking ways to protect their homes. Indian River County was the first in Florida to implement local emergency permitting authority under Section 161, Florida Statutes (FS) and Chapter 62B-33, Florida Administrative Code (FAC). The county issued its first Emergency Permit in 1996.

Each year threatened and endangered sea turtles deposit thousands of nests on the beaches of Indian River County. The nesting season, which officially starts on March 1st and ends on October 31st, lasts eight months in this part of Florida. Local beaches provide nesting habitat for at least three species and are significant on a global scale. The construction of seawalls, revetments and other erosion control devices during the nesting season will likely cause harm or harassment of these federally protected animals. The result is a prohibited “take” as defined under the Endangered Species Act (ESA) of 1973. Federal authorization for take resulting from an otherwise lawful activity can only be granted through an Incidental Take Permit (ITP) pursuant to Section 10(a)(1)(B) of the ESA and issued by the governing agency, which in this case is the United States Fish and Wildlife Service (USFWS).

In an effort to settle a disputed "take" of nesting sea turtles, Indian River County obtained an ITP on December 1, 2004 along with developing a required Habitat Conservation Plan (HCP). The Permit is effective for 30 years and is conditioned upon minimization, mitigation, and other measures described in the HCP and ITP. Condition 11.J of the ITP requires the county to submit an annual report describing efforts undertaken to implement the HCP and identifying any areas of material non-compliance with the Permit. The following report addresses the activities conducted in 2016.

MITIGATION LANDS

STATUS OF CONSERVATION AREA AND RECREATION LAND PROPERTIES

Between 1996 and 1998 Indian River County cost-shared in the purchase of several beachfront properties, collectively referred to as the Jungle Trail Conservation Area (JTCA), which is 110 acres of barrier island coastal habitat. The properties were purchased and managed for conservation and passive recreation. The preservation of these properties as sea turtle habitat was offered as partial mitigation for unavoidable impacts to sea turtles resulting from shoreline protection measures.
Condition 11.G.11.f of the ITP requires the county to manage these parcels in their current state and describes the allowable modifications or improvements to the parcels. In 2015, all activities in the JTCA were conducted in accordance with the ITP.

HCP ADMINISTRATION

Conditions 11.G.1 and 11.G.2 of the ITP require the county to establish and fund the positions of an HCP Coordinator and Coastal Engineer to oversee implementation of the HCP. The HCP coordinator is responsible for oversight of all of the activities identified within the HCP. Oversight of coastal construction activities is performed by the county’s Coastal Engineer, whose primary tasks are implementing the county’s Beach Management Plan, overseeing other shoreline stabilization projects and administering the artificial reef program. Currently, both of these individuals are employees of Indian River County.

In the absence of emergency shoreline protection projects, the administration of the HCP principally involves management of the county's nest monitoring program, beachfront lighting program, education program and predator control program. Section 11.2.7 of the HCP mandates that the county is responsible for obtaining permitted personnel, if necessary, to fulfill the requirements of the nest monitoring program. Since 2005, the HCP Coordinator has held Marine Turtle Permit (#166 and #227) issued by the Florida Fish and Wildlife Conservation Commission (FWC) to conduct nesting surveys and nest evaluations that cover roughly half of the county's beaches, and respond to live and dead stranded sea turtles. (Figure 1; Appendix A).

ANNUAL HCP WORKSHOP

An annual presentation and workshop has been held each year to discuss the results, requirements and status of the HCP. This year the public workshop was hosted by the HCP Coordinator on February 3, 2016. The meeting was attended by 13 people, including all of the Principal Permit Holder’s in the county, town code enforcement, Coastal Division staff and representatives from the community. This year no representatives from municipalities, law enforcement, FWC or USFWS were present. The workshop provided a review of the 2016 nesting season, a review of the basic nest monitoring protocol, a discussion of direct and indirect impacts to nesting, an update on county beach restoration projects and status of the education, predator control and lighting programs. An emphasis was placed on providing accurate and timely data, coordinating needs and encouraging permit holders to seek help from the HCP Coordinator, if necessary.
EMERGENCY SHORELINE PROTECTION PROJECTS

COUNTY-AUTHORIZED EMERGENCY SHORELINE PROTECTION PROJECTS

On October 7, 2016, the western eyewall of Hurricane Matthew passed approximately 3-5 miles east of Indian River County. Hurricane Matthew had maximum sustained winds of approximately 40-50 MPH, gusts of up to 74 MPH, and generated 15-20 foot breaking waves along the coast and 35-40 foot waves offshore. As a result of the high surf, approximately 15-20 feet of dune retreat was observed throughout the County (Appendix C).

Pursuant to FDEP Emergency Final Order – OGC No. 16-1319, Indian River County Coastal Engineering staff responded to citizens requesting emergency permits. Between October 11, 2016 and November 21, 2016 staff issued 16 crosswalk repair and fill permits, 11 fill only permits, and 2 crosswalk only repair permits. All fill permits authorized modest placements of approved beach compatible fill to shore up damaged dunes. Although authorized fill quantities differed from site to site, the majority of the issued fill permits provided enough fill to construct a protective wedge of sand along the damaged dunes. All permitted areas were determined to be clear of sea turtle nests prior construction. All permits had an expiration date of February 28, 2017.

No authorized emergency shoreline protection projects were initiated under the Incidental Take Permit.

UNFORESEEN AND CHANGED CIRCUMSTANCES

As defined in Section 11.K of the ITP, unforeseen circumstances are changes in circumstances affecting a species or geographic area covered by the HCP that could not reasonably be anticipated by the county or the USFWS at the time of HCP development, and that result in a substantial and adverse change in the status of the covered species. There were no unforeseen circumstances in 2016.
CHAPTER 1: INTRODUCTION TO SEA TURTLE NEST MONITORING

STANDARD OPERATING PROCEDURES FOR PERMIT HOLDERS

After the initiation of the HCP, the county developed a set of Standard Operating Procedures (SOP) pursuant to Condition 11.G.10.a of the ITP and in accordance with FWC’s Marine Turtle Conservation Guidelines. The SOP has essentially remained unchanged through the 2016 nesting season. The focus was on obtaining accurate, complete and timely nesting data from each survey area. A description of basic monitoring procedures was extracted from the SOP and given to all Permit Holders (PH), which were encouraged to use standardized data collection forms.

SURVEY AREAS

Sea turtle monitoring in Indian River County was divided into six survey areas based on PH jurisdictions and local municipalities (Figure 1). There are three PH's in the county and most have one or two discrete survey areas. Prior to the 2005 nesting season, the county placed zone markers at one kilometer intervals throughout the 36 kilometer (22.5 mile) coastline. These were used for sections of beach not previously surveyed or areas where old markers had not been maintained. They have also been used in data analysis to examine spatial trends. Historical zone markers have remained in place to maintain consistency in reporting.

A brief description of each area from north to south follows:

Sebastian Inlet State Park (SISP) – SISP occupies the northernmost 3.2 kilometers (2 miles), or 8.9%, of the county’s coastline. This survey area was monitored by biologists from EAI as part of inlet nourishment projects and in an effort to assist the state park rangers with required monitoring.

Archie Carr National Wildlife Refuge (ACNWR) – The ACNWR survey area comprises about 22.3% of the county’s coastline or 8.0 kilometers (5 miles). This area was monitored by biologists from EAI as part of a county beach nourishment project.

Disney Vero Beach Resort (Disney) – This area is referred to as the core Disney area and covers a distance of approximately 2.1 kilometers (1.3 miles), which is 5.8% of the county’s coastline. Monitoring was performed by Disney Animal Kingdom staff.

Indian River Shores (IRS) – The Indian River Shores survey area extends for a distance of approximately 8.9 kilometers (5.5 miles) or 24.6% of the county’s coastline. The northern half of this area was surveyed by Disney Animal Kingdom Staff and the southern half was surveyed by the HCP Coordinator and...
the volunteers on his team. The break in the two areas occurs at the kilometer 18 marker just south of the John's Island Beach Club.

City of Vero Beach (Vero) – This survey area covers a distance of approximately 6.3 kilometers (3.9 miles) comprising 17.4% of the county's coastline. Surveys in this area were conducted by the HCP Coordinator and his team.

South Indian River County (SIRC) – South Indian River County extends to the St. Lucie County Line for a distance of approximately 7.6 kilometers (4.7 miles) or 21.0% of the county's coastline. Surveys in this area were conducted by the HCP Coordinator and his team.

SURVEY METHODOLOGY

Monitoring Procedures

Nesting surveys were conducted each morning on all beaches from March 1 to September 30, 2016. Nest monitoring continued periodically after September 30 at the discretion of each PH. During the surveys, all nesting and non-nesting emergences (false crawls) visible from the previous night were recorded by species and survey zone. A GPS location was collected at every nest and at the landward apex of every false crawl. iPads and handheld Garmin units were used for obtaining location data. The precision ranged from less than a meter to approximately 6 meters (depending on the equipment and satellite geometry).

Crawls were classified as either above or below the most recent high tide line from the previous night. False crawls were determined to be either continuous, abandoned body pits and/or abandoned egg cavities. Obstacles (e.g., scarps, seawalls, beach furniture) that were less than a meter from nests or false crawls and, based on track changes, clearly affected the animals behavior were recorded. Disturbances by predators or potential human impacts were also recorded.

Nest Marking Schemes

Nest Marking Technique- Prior to marking nests, an attempt was made by the surveyor to carefully locate the topmost eggs in order to help the surveyor locate the eggs again at the end of the incubation period for nest evaluation. Once the location of eggs had been identified, the most common technique used to mark off the clutch of eggs was a combination of three stakes surrounding the nest with flagging tape, and up to two more stakes placed in the dune. The stakes were secured 1-2ft in the sand so they would not be easily removed by tides or vandals, but could be recovered by survey personnel. All marked nests were monitored daily for signs of hatchling emergence, tidal over-wash, nest predation, vandals, and other signs of disturbance. Nests were presumed to be washed out if all the markers surrounding the nest were washed away and field personnel found nothing when they excavated the area.
**Nests Marked for Reproductive Success** – In all county survey areas, a representative sample of nests was marked and monitored daily to allow for an evaluation of reproductive success. The sample marked for each species and within each survey area was at the discretion of the PH. The representative sample was chosen based on species type, nesting density, and proximity to a beach nourishment project. For example, nests marked in the southern half of the county where there are no beach nourishment projects were done so based on the following marking scheme in 2016:
- Leatherbacks – ALL nests
- Green Turtles – ALL nest
- Loggerheads – every 15th nest

**Nests Marked for Educational Activities** – Education nests were marked in a high traffic area within the City of Vero Beach and around the Disney Vero Beach Resort to impart information to beachgoers and were used for a new public education activity called “Turtle Digs” (i.e., public nest hatching success evaluations) which occur in July and August three days after these nests hatch. Once marked off with stakes, these nests received an extra educational sign describing the species of sea turtle which laid the nest and facts about that species’ life history. Turtle dig evaluation data were not combined with data used for reproductive success reporting.

**Nests Marked for Conservation Purposes** – Conservation nests were barricaded off in high traffic areas along the county’s beaches. This was done to avoid excessive disturbance to the nests (e.g., base of dune crossover).

**Nests Marked in Sentinel Areas** – Sentinel nests were marked in accordance with Condition 11.G.10.d (1) of the ITP to note the location of nests high on the beach in critically eroded areas. This provided a means of assessing nests should an emergency shoreline protection project be initiated at that location. Prior to the 2015 season, the coastal engineer provided maps to permit holders showing the properties in critically-eroded areas that may be eligible for a county emergency permit (Appendix B). Monitoring personnel were asked to mark any nest deposited landward of the toe of the dune in these designated areas.

**Nests at Emergency Shoreline Protection Project Sites** – Survey personnel were required to monitor emergency shoreline protection project sites and implement appropriate measures to protect nests from construction impacts.

**Nests Marked for Research** – Research nests were marked specifically to collect data for projects conducted by the Disney conservation team. These projects have been permitted by FWC and only occur within the Disney survey area.
DATA MANAGEMENT AND ORGANIZATION

Nesting success, defined as the percentage of total emergences on the beach that result in a nest, was used to assess the post-emergence suitability of an area. Nesting success was calculated by dividing the number of nests by the number of emergences above the high tide line and multiplying by 100.

The fate of each marked nest was assigned to one of the following categories:

- **Buried** – heavy accretion occurred over clutch. No signs of emergence observed and clutch could not be found.
- **Clutch no Located** – could not located clutch at initial time of nest marking and no signs of emergence observed.
- **Completely Vandalized** – Stakes used to mark nest were stolen or destroyed and cannot located clutch.
- **Could Not Evaluate** – hatchlings emerged, but nest contents not evaluated due to being washed out or otherwise severely impacted.
- **Depredated Partial** – clutch partially destroyed by predators
- **Depredated Complete** – clutch completely destroyed by predators
- **Hatched** – signs of hatchling tracks observed and, upon excavation, turtles clearly hatched and emerged.
- **Hatched, no signs of emergence** – no signs of hatchling tracks observed but, upon excavation, turtles clearly hatched and emerged.
- **Hatched Clutch Not Located** – signs of hatchling tracks observed but, upon excavation, the clutch could not be located.
- **Hatched Did Not Emerge** – hatchling tracks were not observed and, upon excavation, no turtles hatched or emerged.
- **Hatched Not Analyzed** – Another clutch is too close and nests cannot be separated for analysis.
- **Nested On By Another** – clutch mixed, scattered or otherwise nested on by another turtle.
- **Poached** – the clutch was partially disturbed or completely removed by non-permitted humans.
- **Scavenged** – signs of hatchling emergence observed but eggs dug into prior to inventory.
- **Unreliable Data** – Signs of emergence no seen, nest dug into at 70 days or later and eggs are decomposed and uncountable.
- **Washed Out partial** – clutch partially washed away during incubation by waves or tides.
- **Washed Out Complete** – clutch completely washed away during incubation by waves or tides.

Mean clutch size, hatching success, emerging success, and mean incubation period were determined for excavated nests by the following formulae:
- **Clutch size** (total number of eggs in a nest) = number of hatched eggs + number of unhatched eggs.
- **Hatching success** (turtles completely removed from their eggshells) = (number of hatched eggs / clutch size) \times 100.
- **Emerging success** (turtles that hatched and successfully emerged) = \{(number of hatched eggs minus the number of live and dead hatchlings in the nest) / (clutch size)\} \times 100.
- **Incubation period** = inclusive period from the date of egg deposition until the first sign of hatchling emergence.

Depredated and washed out nests were separated into partial and complete failures for purposes of reproductive success. All partially impacted nests were still evaluated following nest inventory protocol. Predation and scavenged were defined as follows:

- **Predation** – means that viable eggs, embryos or hatchlings were consumed during incubation or at the time of emergence.
- **Scavenged** – refers to non-viable eggs, embryos or hatchlings consumed after a major disturbance (i.e. storm, predation event, etc.).
CHAPTER 2: RESULTS OF SEA TURTLE NESTING SEASON

The nest monitoring program requires the most time and effort, covering approximately half the county’s beaches. One reason for this is simply the high density nesting that occurs in Indian River County. Improvements in this program have been made over the years in terms of the collection of quality data from individual permit holder groups. For example, there continue to be improvements in GPS locations, reporting of crawl obstructions, human disturbances and predation events and the types of descriptive data collected. More importantly, nesting data received from permit holders has closely matched the format used by the HCP coordinator, and all PH have begun collecting data electronically using the same data collection app for iPads. This has meant less post-processing, more consistency, and the ability to convert the data for geographical representation.

In 2016, the Sector 3 Beach Nourishment Project continued to be monitored by Ecological Associates, Inc., who conducted surveys in the central and north county beaches. However, this year there were no permitted projects in the northern portion of the refuge or in Sebastian Inlet State Park. All of the individuals involved in surveys attended a workshop held by the HCP Coordinator to familiarize themselves with HCP monitoring and nesting protocols. Permit holders and volunteers have worked hard to provide HCP nesting data to the county.

NEST TOTALS, TRENDS AND CRAWL CHARACTERISTICS

The following totals do not include crawls recorded below the most recent high tide due to observation bias. The total number of crawls below high tide observed in 2016 was 1,270. The vast majority of which were false crawls (97.2%).

Nesting and Nesting Success

There were a record 17,161 sea turtle emergences recorded above high tide during the 2016 nesting season (Table 1). The vast majority of sea turtle emergences were loggerheads, *Caretta caretta*, (95.4%), while green turtles, *Chelonia mydas*, and leatherbacks, *Dermochelys coriacea*, accounted for 4.3% and 0.3% of the crawls, respectively. Of the total number of crawls, 7,496 resulted in a nest, yielding an overall nesting success of 43.7% for all species and areas combined. Loggerhead and green turtle nesting success was 43.9% and 35.4%, respectively. Leatherback nesting success was average at 87.2%. Nesting success averages were slightly lower than many previous years and mimic the 2015 season due to lack of rain during the first half of the nesting season.

Loggerhead nesting set a new record high with 7,197 nests, 63.9% higher than the long-term average (2005 – 2016). Green turtle nesting experienced an expected low year with 265 nests, following 2015’s record high nesting year for green turtles. The county also experience an expected low leatherback season with 34 nests following an
average year in 2015. Leatherbacks are known to have a semi bi-annual pattern similar to green turtles. Green turtle and leatherback nesting has been exponentially increasing in Florida since the 1980's (Witherington et al. 2006; Stewart et al. 2011) possibly making nesting patterns for leatherbacks harder to recognize. Nesting seems to have become more stable over the last five years in Indian River County (see previous annual reports).

Temporal Patterns

The first recorded sea turtle emergence and nest in the county was from a leatherback on March 11, 2016 (Table 1). The first loggerhead nest was deposited on April 23, 2016 and nesting increased rapidly in May, stabilized nesting throughout June and July, peaking at the end of June, and slowly decreased throughout August and the rest of the season, depositing the last nest September 21 (Figure 2). In contrast, green turtle nesting steadily increased in June and plateaued throughout July and August and then slowly decreased during the month of September, with the last nest deposited on October 26 (Figure 2). A graph of long-term nesting across the whole county was updated throughout the 2016 nesting season and added to the county’s coastal website at www.ircgov.com/coastal.

Spatial Patterns

Loggerheads nested in high densities throughout the county, and as expected the highest nesting density occurred in the ACNWR survey area and the lowest nesting densities occurred on South Indian River County beaches (Table 2; Figure 3). As in previous years (see previous reports) nesting densities for loggerheads generally decrease from north to south. The City of Vero Beach’s nesting density was very similar to that of South Indian River County beaches (SIRC), while SISP and Disney had similar nesting densities. Loggerhead nesting success experienced a reverse in location where the rate of success was highest on South Indian River County beaches (52.8%) and lowest in the Disney area (Table 2). A spatial analysis by kilometer (km) zone revealed steadily high nesting numbers on the ACNWR beach, with the greatest peak of 352 nests within kilometer zones 5 and other peaks in zone 6, 7, and 9 (Figure 3). There were two other nesting peaks found in the southern half of the county in zones 26 and 31.

Green turtles nested throughout the county, but nesting was far more abundant in the ACNWR than any other survey area (Figure 4). A spatial analysis by km zone revealed dramatic peaks in nesting in zone 9, 10, and 11, which after nesting numbers dropped significantly (Figure 4). The average crawl density was 95% higher in the ACNWR (169 nests) than on SIRC beaches (8 nests), and 71% higher than IRS (54 nests), the second highest nesting density area in the county (Table 3). Nesting success rates were quite opposite where highest nesting success was on SIRC beaches and the lowest success rate was on Disney beaches. These results are strongly associated with disruptions such as seawalls, dune scarps, and people in the lower success rate areas.
and single family homes that are vacant throughout the nesting season in the higher success rate areas. (Table 3).

Leatherback nesting occurred in all survey areas (Table 4; Figure 5). Nesting densities are much lower for leatherbacks than any other species, as Indian River County is part of their northern most consistent nesting range in Florida. The highest density of nesting was on Disney beaches which experienced leatherback nesting in all of its km zones instead of other areas which had spatial gaps in nesting. However, as in the past, some km zones located in South County beaches experience higher nesting densities than any other zone in the county. This is expected since the majority of leatherbacks in Florida nest a couple counties south of Indian River. Nesting peaks for leatherbacks occurred in zone 29 and within the ACNWR in zone 7 (Figure 5). Nesting success rates, however, were 100% from Disney south through SIRC beaches and were the lowest on SISP beaches.

Overall nesting success was at or above the 50% baseline in 9 of the 36 kilometer zones (Figure 6), which is 3 more zone than in 2015. The overall lowest nesting success occurred in zone 12 (31.6%) and this is due in part to a large dune escarpment formed by excessive erosional stress in that area and possibly from numerous beachgoers who use the popular public beach access and are guests of nearby rental properties and the hotel. The highest nesting success occurred in zone 31 (59.7%) and this is due in part to the season residents not being home during this time reducing the number of beach goers and the number of external lights being turned on (Figure 6). Each species had different level of nesting success across the county. Leatherbacks had the highest nesting success rate (87.2%) which is expected since they hardly ever false crawl, and loggerheads and green turtle has much lower nesting success rates, 43.9% and 35.4% respectively, and part of this is due to the dry hot sand from lack of rain during May and June. Every year green turtle nesting success is the lowest and this is likely due to green turtles being much pickier in their location to create a nest and being more cautious of potential predators or movements on the beach (Figure 6).

Non-nesting Emergences and Obstructions

Turtles coming ashore go through distinct nesting phases and at any time prior to dropping eggs they may abandon their nesting attempt. In 2016, the average proportion of loggerhead false crawls over all study sites was 72.2% continuous, 25.0% abandoned body pits and 4.7% abandoned egg chambers (Table 5). The latter two categories were not mutually exclusive since some turtles constructed both abandoned body pits and abandoned egg chambers. Loggerhead false crawls with abandoned body pits were highest in Sebastian Inlet State Park, and in contrast, the Disney area had the highest proportion of continuous crawls and, conversely, the lowest proportion of abandoned body pits and egg chambers (Table 5). Seawalls are common in the Disney area, as well as a lasting dune scarp that can often deter turtles prior to digging or nest preparation activity, while the inlet has wide natural beaches giving turtles a greater opportunity to continue forward with her nesting attempts.
As with loggerheads, most green turtles that did not nest continuously turned around and went back into the water (Table 6). There were more continuous false crawls in Disney than the rest of the county. Followed by the city of Vero Beach. Both of these locations have seawalls or a large dune escarpment that can often deter turtles prior to digging or nest preparation activity. The spatial distribution of abandoned nesting attempts varied across kilometer zones (Figure 7). The top five zones with the highest number of abandoned body pits were located in the northern portion of the county within the ACNWR (which has significantly more crawls than other areas of the county) including 4, 5, 6, 7, and 8. Interestingly, three of these zones also included the highest number of false crawls with abandoned egg chambers, zone 5, 6 and 7 respectively.

Overall, 82% of the loggerhead false crawls had no obstructions associated with them (Table 5). However, on average, 10% were associated with scarps, 3% with seawalls, 2% with dune cross-overs and 3% with 'other' obstructions (either beach furniture, boats or debris). Among study sites, the proportion of loggerhead scarp obstructions was much higher in the Disney and IRS study area. This is the Sector 3 beach nourishment area which experiences high rates of erosion increasing the likelihood of permanent escarpments. The Disney area also had the highest proportion of seawall, dune cross-over and 'other' obstructions. The green turtle obstruction data were similar (Table 6). Green turtle false crawls had an average of 79% associated with no obstructions, 11% were scarps, 7% were seawalls, 1% were dune cross-overs and 3% were in the 'other' category. As in previous years, most green turtles attempted to nest closer to the dune which meant they were more likely to encounter dune escarpments, seawalls and dune cross-overs.

The distribution of crawl obstructions by kilometer zone highlights problem areas for nesting sea turtles (Figure 8). Crawl obstructions codes were decided upon by all permit holders prior to the nesting season and were summarized in Figure (8) for both nests and false crawls; since there were instances where turtles collided with a barrier which restricted them from going further up the beach and still decided to nest. As in years past, scarps were more of a problem on the eroded beaches in northern km zones, specifically the sector 3 nourishment area (zones 9-12 respectively), and contributed to the vast majority of obstructed nesting attempts (56.5%). Previously marked nests were the second highest recorded nesting obstruction which were more of a problem on Disney area beaches mainly because they mark every single nest surrounding the resort, while other areas only have a subsample marked off. The majority of the time a marked nest doesn't not prevent a turtle from finishing her nesting attempt. Seawall obstructions were the third largest recorded problem accounting for 13.9% of recorded obstructions. Over time the number of walled linear footage within the county is increasing, ultimately reducing the area of available dune for turtle attempting to nest. It is possible this obstruction percentage may increase through the lifetime of the HCP. Areas with significant seawall footage include the Summerplace community located just north of the core Disney beaches, the City of Vero Beach and South County beaches in zones 31 and 32. The remaining codes made up 13.7% of recorded obstructed nesting attempts which occurred all along the county’s beaches.
NEST FATE AND REPRODUCTIVE SUCCESS

Nest evaluations adhered closely to FWC Marine Turtle Guidelines. Three days after the first hatchling emergence or after 70 days incubation, marked nests were excavated by hand to determine reproductive success. The numbers of hatched eggs, unhatched eggs, and live and dead hatchlings were recorded. Unhatched eggs consisted of live and dead pipped embryos, whole eggs and damaged eggs. After an inventory, nest contents were re-buried in the egg cavity and marking stakes were removed from the beach (see definitions below).

Overall Nest Fate

Countywide, there were 968 sea turtle nests marked for reproductive success (Table 7). The total number of marked nests represented 12% of all the nests recorded in the county. Out of the total marked nests, 84 (8%) were marked without the clutch being found at day of deposition. As mentioned in previous reports, this kind of marking effort is difficult to avoid (particularly for leatherbacks and green turtles), but may introduces a bias in the data if too many nests are marked where the clutch is not found. For the 2016 nesting season there was no statistical difference in nest productivity when marked nests without the clutch being found until an emergence was observed (42 nests) were included in these analysis. Therefore, the following results pertain to all marked nests.

Of the marked nests, 784 (80%) were excavated to determine reproductive success (Table 7). The remaining nests that were not evaluated fell into the following categories: 114 (11%) were washed out by Hurricane Matthew (Appendix C) or an offshore tropical wave; 22 (2%) were destroyed by predators; 20 (2%) could not be evaluated due to logistical problems or data was unreliable; 6 (<1%) were nested on by another turtle; 23 (2%) could not be found either due to heavy accretion burying the clutch too deep, an emergence was never observed on a nest where the clutch was not initially found or the clutch could not be found after emergence was seen.

Loggerhead Reproductive Success

There were 576 loggerhead nests excavated for reproductive success (Table 7). Of these, 49 (8.5%) did not hatch (0% success rate). A total of 40 loggerhead nests which could not be evaluated were washed out by Hurricane Matthew or extreme high tides and another 19 nests were depredated causing a 0% success rate. The mean clutch size across the six study areas ranged from 99.0 to 107.2 eggs and the mean incubation period ranged from 49.8 to 51 days (Table 8). Hatching success was highest in the city of Vero with 74.9% (70 nests excavated) and the lowest in the ACNWR with 55.5% (255 nests excavated). The difference between hatching success and emerging success ranged from 1.6%-5.7% across all six survey areas, where the greatest difference was found in the City of Vero Beach, however the Vero area still had the highest emerging success rate. When predation and wash out events were included (assuming 0% success) was lowest emerging success the highest success rate was
found in the Disney area (67.2%) and the lowest in the ACNWR (49.8%). The ACNWR is less developed and houses many common mammalian predators of sea turtle nests. Predation impacts to nests are discussed in a later chapter of this report. Based on the combined county-wide loggerhead data, the mean clutch size was 102.0 eggs per nest, with a range of 37 to 68 eggs (Table 11a). The mean hatching success for all inventoried loggerhead nests was lower than last year at 45.4% and the mean emerging success was 43.5%. Emerging success stayed relatively similar (40.6%) when predation events and washed-out nests were included. The mean incubation period was 50.2 days and ranged from 44 to 67 days.

**Green Turtle Reproductive Success**

There were 126 marked green turtle nests whose clutch contents successfully hatched and 4 nests that were excavated and were found to be complete failures (Table 7). Most (73%) of the green turtle nests that were not excavated were due to tidal wash-outs from Hurricane Matthew or various “King” tides throughout the nesting season. The mean clutch size across study areas ranged from 97.0 to 124.0 eggs and the mean incubation period ranged from 49.0 to 52.0 days. The mean inventoried hatching success ranged from 64.0% in Indian River Shores (31 excavated nests) to 94.8% in the Disney area (7 excavated nests) with the second highest hatching success rate being 85.7 in Sebastian Inlet State Park (8 excavated nests) (Table 9). When predations and washed out nests were included, green turtle emerging success in the Disney area dropped dramatically to 13.5% which was the lowest in any area, most likely due to the erosive nature of the area and because the area is heavily armored. Based on the combined county-wide green turtle data, nests had a mean clutch size of 115.1 eggs, with a range of 35 to 167 eggs (Table 11b). Mean hatching success was 69.6% and the mean emerging success was 67.4%. When predations and wash-outs were included in the data, emerging success dropped to 42.4%. The mean incubation period was 51.0 days. Green turtle reproductive success is similar to rates determined in previous years, but unlike previous years, green turtle reproductive success was higher than that of loggerheads. Continued monitoring is of utmost importance to determine if this is just a random low year for loggerheads or if there measurable reasons for these results.

**Leatherback Reproductive Success**

There were 34 marked leatherback nests of which 18 (53%) were found at original deposition (Table 7). Across the six study areas there was a low nesting density, and this has been seen throughout the long-term data. This year all study areas contained at least one marked nests which had reproductive data collected from them. The area with only one excavated nest was the Disney area (Table 10). Based on data from across the study areas (excluding the Disney area), hatching success was highest on South IRC beaches and lowest within the ACNWR. Mean emerging success was the lowest in the City of Vero Beach, however South IRC beaches had the largest drop from hatching to emerging success (22.6%) mainly due to one nest which hatched but all hatchlings were stuck in plant roots and never emerged. Overall, leatherback mean clutch size
was 68.3 eggs with a range of 25 to 103 eggs (Table 11c). The mean hatching success was 45.6% and emerging success was 42.8%. Emerging success only dropped slightly to 41.3% when wash-outs and predations were included. The incubation period ranged from 58 to 90 days with a mean of 67.7 days.

**Educational Nests**

The 2016 nesting season was the first in which nests were marked off specifically for educational usages i.e. Turtle Digs. A total of 31 loggerhead nests were marked inside survey zone 24 around the Sexton Beach Plaza area inside the City of Vero Beach. Of the 31 marked nests, 3 were washed out by high tide and a heavy swell which occurred on June 6th, 9 were not evaluated for the public because another nests hatched the same day, and 4 showed no signs of emergence during daily survey. The remaining 14 nests (45%) were evaluated for the public at 8am three days after signs of hatchling emergence were initially observed. Around the Disney Vero Beach Resort a total of 72 nests were marked for educational presentation. Of these, 3 were washed out by Hurricane Matthew and the remaining 69 nests (95%) were evaluated at 8am for hotel guests and beach goers.

**Conservation Nests**

There were 82 nests barricaded off for conservational purposes along the Indian River County beaches. None of these nests were used for reproductive success sampling. When hatchlings successfully emerged, or at 70 days post-deposition.

**Sentinel Nests**

No sentinel nests were marked during the 2016 nesting season.

**Research Nests**

During the 2016 nesting season two concurrent research projects were being conducted by the Disney conservation team within the Disney survey area. The first was a project involving an egg-finding detection dog. Preliminary testing and use of a detection dog allowed relatively precise location of eggs within sea turtle nests of two species (loggerhead and green), which could aid in the protection of nests that are challenging to find for human surveyors. The second was an experiment documenting water stress effects on loggerhead nests. The purpose of this study is to gain a larger understanding of which developmental stage of sea turtle embryos are most susceptible to developmental arrest from water stress events. We are comparing stage-specific mortality with the timing and frequency of water stress events (e.g. excessive rainfall, tidal inundation). For these two projects a total of 39 nests were marked. These nests
had an average hatching success of 63.8% and an average emerging success of 58.0%.

**NESTS AT EMERGENCY SHORELINE PROTECTION PROJECT SITES**

Since there were no emergency shoreline protection projects initiated by the county during 2016, no nests were marked for this purpose.

**NEST MONITORING PROGRAM SUMMARY**

The 2016 nesting season was the highest on record since county-wide surveys began for loggerheads turtles, the most common species. This was an expected low year for green turtles after their record high year in 2015, following the bi-annual pattern they have exhibited over the last 10 years. And lastly, for leatherbacks it was another low nesting season, which complements their stable nesting pattern. We will need more data to truly know if there is any new trend relative to leatherback nesting in IRC, as the northern (Brevard County) stretch of the ACNWR which borders IRC experienced record nesting for leatherbacks in 2016. As in previous years, there were more nests deposited in the northern portion of the county than in the southern portion. The Vero Beach area contains more people, buildings and lights and these are all potential nesting disruptions. Nesting success was above average for loggerheads, but much lower for green turtles. The lower nesting success for green turtles occurred in the northern part of the county which had a mixture of scarps, seawalls and dune restoration projects.

Unlike last year or other previous years, emerging success was highest for green turtles and lowest for leatherbacks with loggerheads falling in between. This was an extremely hot nesting season with very little rain. Temperatures are known to speed up incubation period but can also effect the reproductive success of indvidual clutches. More years of monitoring will be needed to determine if the low emerging success was climate related or if it was a random low year. The largest direct impact to hatching and emerging success came from Hurricane Matthew (Appendix C) which came 6 miles offshore of Vero Beach in on October 6-7, 2016. This storm event cause up to 15 feet of dune retreat in northern areas of the county and up to 6 feet of beach profile lowering in many areas across the county. In total this storm event washed away 118 marked nests and up to 484 un-marked nests accounting for a possible 8% of total nests laid throughout the nesting season. It should be emphasized that these are natural typical conditions which largely affect nests, primarily green turtle, in the latter half of the season as seen with this event.

This year represented the twelfth year of complete county-wide nesting surveys and the first year of a uniform methodology and protocol for data collection between all permit holders. The detail and accuracy of these data remains at a fairly high level, however, many human activities still occur which have the potential to impact nests and individual
turtles. Some of these are illegal under local ordinances and are being monitored closely by state and local enforcement. Unfortunately, many beachgoers mistakenly believe that all nests are physically protected with barriers or stakes, which is not true for this area. The ongoing efforts to inform the public about the density of nesting on IRC beaches and to generate interest in sea turtle conservation (see Education and Community Involvement) will continue to help reduce these potential impacts and make IRC a safer nesting ground for these protected species.
CHAPTER 3: CUMULATIVE SEA TURTLE TAKE AND IMPACTS TO NESTING SUCCESS

HUMAN-BASED – BEACH ARMORING

The current amount of armoring in Indian River County has increased to 10,138 linear feet or approximately 8.58% of the shoreline. Of that total, only 520 feet or 5.1% of total armored footage falls under the County’s HCP (Table 14). The remaining structures were either permitted through the State of Florida (FDEP) or they were older structures that did not pass through a formal permitting process. Pursuant to Condition 11.E of the ITP, the county is authorized to “take” the covered sea turtle species incidental to authorizing construction and maintenance of armoring structures encompassing no more than 3,196 linear feet of coastline in the Plan Area over the 30-year life of the ITP (Table 14). This cumulative total represents the estimated amount of frontage of eligible and vulnerable properties along critically eroded beaches that may be in need of shoreline protection prior to construction of a beach nourishment project at their respective locations.

There were no temporary or permanent armoring structures authorized by the county in 2016. In accordance with an Interim Agreement between the FDEP, Indian River County, the Sea Turtle Conservancy, and two private petitioners, FDEP allowed two (2) temporary structures previously installed under the county’s emergency authorization to remain in place (Table 14). Condition 11.G.9 of the ITP authorized permanent seawalls at these properties. However, shoreline protection projects authorized by the FDEP through Florida’s standard permitting process are not included as cumulative take under the ITP. Nonetheless, construction and placement of these continues, which could potentially harm sea turtles or their nesting habitat. In response FDEP, in cooperation with FWC, began developing a comprehensive state-wide HCP for its coastal program in 2008. Among other things, this HCP would encompass take from CCCL shoreline projects.

HUMAN-BASED – NEST POACHING

Despite the fact that sea turtles have been protected by state and federal laws since the early 1970’s, there remains some human egg poaching every year. Fortunately, in 2016, we only recorded two nests with human digging, but 0 nests verified as poached within the county. This has not been the case in past years. We are lucky to not have damage to these nests during the 2016 nesting season. All disturbances within the county and other cases of egg poaching outside the county were turned over to wildlife law enforcement officials at the state and federal level.
**HUMAN-BASED – DISRUPTIVE BEACHFRONT ACTIVITIES**

The three most commonly reported activities were beach bonfires, recreational equipment and large holes. There were 14 recorded bonfires, most of which were within close proximity of neighborhood beach access points. There have been documented cases in Florida of fires killing hatchling sea turtles. Although one beach bonfire was created only one foot away from a newly laid loggerhead nests, no impacts to hatchlings or nests were reported in 2016. While the city has an ordinance prohibiting fires the county does not. Large holes were however a large problem during the 2016 nesting season. Beachgoers dug in the sand above the high tide line with shovels to create bunkers, sand furniture, or just a very large hole. The most dangerous ones were an estimated radius of 10 feet wide and four feet deep. They were deep enough to potentially excavate an unmarked nest, ensnare a sea turtle, or injure a person. As a result, lifeguards and city and town public works personnel were made aware and filled in holes when possible. Though no injuries or deaths were reported, it is worth noting that an adult loggerhead was killed when it fell into a large hole in Palm Beach County in 2009, and up to six hatchlings were found in a large hole on city beaches during the 2016 season.

Other potential problems included boats part of a race docked on beach overnight, loose dogs and Treasure Salvor anchors buried on the beach. Luckily this season these instances were not problematic. Vehicle tracks from unauthorized motorcycles, ATV's and trucks were not observed on the beach during the 2016 nesting season, however this has not been the case in past years and disruptive activities like these will continue to be monitored in the future. FWC Law Enforcement and the sheriff’s office are always notified of these instances once they occur and will continue to be notified if future incidents occur. Many beachgoers mistakenly believe that all sea turtle nests on our beaches are physically protected with stakes and warning tape. Because of the area’s high density of nesting, this has never been the case. Marking all nests would be impracticable, extremely expensive and create numerous barriers on the beach, and for these reasons the county will continue to only mark off a sub-sample of nests for various reasons explained in previous sections.

**HUMAN-BASED – NIGHTTIME BEACHGOERS AND PETS**

Since 2006, the presence of people and dog tracks on new crawls has been recorded in the southern half of the county. These can range from severe disruptions to just a few tracks recording the presence of people and animals. As in years past, most of these were in zones 29 and 30 (south of South Beach Park). Neighborhoods with heavily used beach access points had the highest levels of these interactions (e.g. Castaway Cove).
**NATURE-BASED – RACCOON PREDATION**

The Predator Control Plan (PCP) outlined in Section 11.4 of the county’s HCP constituted mitigation for the take of sea turtles causally related to shoreline protection. The overall goal was to increase hatchling productivity by reducing predation rates by 40% over a period of five years within non-Federal lands of the ACNWR. The assumed level of raccoon (*Procyon lotor*) predation in this area was 15% of all nests. However, since the inception of the HCP raccoon predation has turned out to be far lower than this. As a result, even though condition 11.G.11.e of the ITP required the county to develop and submit a PCP to the Service within six months of the effective date of the ITP, the draft plan has never been approved. It is not known if predator control efforts by the refuge have reduced raccoon predation or the assumed historical level of predation was incorrect.

The number of nests depredated by raccoons in 2016 was a total of 4. As in years past, most raccoon predations occurred in the northern portion of the county, specifically the SISP and the ACNWR. Raccoon predation events represented <0.1% of all the nests deposited in the county and 0.1% of the nests deposited in the ACNWR. Raccoon predations have remained at an extremely low level since 2005. The ACNWR implemented a predator control program in 2009, 2010, 2012, and 2016. However, almost all of the effort was focused on trapping in the Brevard County portion of the refuge because of the larger number of predations in that area. The object of the plan was to focus on raccoons, however, in 2008 it became clear that canine predation, specifically coyote, was becoming a problem in Indian River County.

**NATURE-BASED – CANINE PREDATION**

Unlike the 2015 nesting season, there were a minimal number domestic canine nest predations in the county in 2016. Nest predation by domestic dogs (*Canis familiaris*) has been occurring at low levels for many years, primarily in the southern portion of the county. In 2016, only one unmarked nest predation from a domestic canine was observed, and nevertheless, the owner denied the action. Multiple other dogs were seen digging off leash but not effecting turtle nests. If owners did not control the dog’s habits after being approached by a surveyor then animal control was called to report the dog and owner. Almost all of these instances occurred on south county beaches. Education and enforcement of animal control laws has largely been effective at deterring most of the dog predations over the years. For example, there were many dog prints around marked nests and on newly deposited unmarked nests in 2016, yet it appeared that most owners kept their animals from digging in the sand and ultimately digging up nests. Domestic dog predation will continue to be monitored closely to determine their impact on incubating nests.

Coyotes (*Canis latrans*) were assumed to be part of depredations in the ACNWR in 2008 and were then observed in 2009 west of highway A1A inside refuge borders. That year almost all of the canine predations in the northern part of the county were thought
to be coyote. The refuge then began a coyote capture program in 2009 and 2010 to help reduce predation levels on sea turtle nests below the 5% threshold set by the refuge’s comprehensive conservation plan (CCP), however, none were caught during those years. In 2015, there were 31 predations attributed to coyotes located in the refuge survey area (see previous report). However, the refuge was able to fund the coyote capture program again in 2016 where USDA Animal Control Services successfully caught and removed 2 adult males, 1 adult female and one juvenile female which were suspected to be denning on across highway A1A on Pelican Island NWR. This family of coyotes are the suspected culprits of the 2015 predation events, as the number of nests depredated by coyotes in 2016 was reduced by 54.8% to only 14 nests. The refuge plans to continue curtailing coyote predation using the USDA Animal Control Services removal program and the county has pledged to support the effort with maps of past canine predations and the location of predation "hot spots."

In summary, the county never met the original intent of the PCP due to the unexpected low level of raccoon predation. It is the intent of the HCP Coordinator, in conjunction with animal control enforcement, the ACNWR, and public education about nest predators, to continue in efforts to control raccoon predation levels and reduce coyote and domestic dog predation as a part of the PCP. In the future, the HCP coordinator will work to refine the PCP to better reflect the refuge’s CCP threshold of a 5% maximum predation rate county-wide, and will use information collected about predation hot spots to focus management efforts. The issue of canine predation has always been difficult to solve because coyotes are not easily trapped and there exists strong sentiments regarding the issue of curtailing the behavior of domestic dogs. Despite this, the recent focus (since 2009) on canine predation has met the current intent of the predator control program. Overall predation rates are still fairly low and with the limited financial resources of the county and its’ partners (The City of Vero Beach Police Department, FWC Law Enforcement, USFWS personnel, USDA Animal Control Services and Indian River County Animal Control), predator control is currently focused on education, wildlife law enforcement and limited trapping. Ultimately, help is needed from the public to report digging dogs or coyotes and be willing to speak up about the negative impacts these animals can have on the reproductive success of federally protected sea turtles.
CHAPTER 4: LIGHT MANAGEMENT PROGRAM

During the sea turtle nesting season (March 1-October 31), beachfront lighting in unincorporated areas of Indian River County is regulated by county ordinance (Section 932.09 of County Codes). Additionally, the town of Indian River Shores and the City of Vero Beach have their own lighting ordinances (Article IV Sec. 91.40 – 91.50 of IRS code of Ordinance; Division 2 Sec. 46-106 -- 46-117 of City Code of Ordinances), which regulate beachfront lighting within their jurisdiction. Initiation of a pro-active light management program is intended as compensatory mitigation for the take of sea turtles associated with shoreline protection measures. The county’s light management program is outlined in section 11.5 of the HCP and is stipulated in Conditions 11.G.11.a-c of the ITP. This section describes the key items associated with the light management program and the actions undertaken in 2016.

The county's Light Management Program (LMP) has been slow to improve largely due to lack of personnel, however 2016 consisted of many improvements. In addition to lighting violations and nest disorientations being more adequately reported each year, the county hired a new environmental planner to handle lighting violations in unincorporated county areas, the HCP coordinator was able to issue a follow-up lighting survey during the middle of the nesting season after initial enforcement letters and citations were distributed in unincorporated areas, and collaborative lighting surveys were conducted inside municipalities using similar methodology, ultimately filing the data gap which previously existed. Additionally, the updated county sea turtle protection lighting ordinance, which better reflects the state model ordinance and includes specifics pertinent to the county HCP, became effective on March 1st (Appendix E).

Unfortunately, even with city and county staff working hard to notify property owners about sea turtle season beginning, violations of the lighting ordinance, and consequences of their actions, a handful of properties are repeat offenders who have refuse to fix problem areas or fight their case in front of the code board. To accentuate the seriousness of this issue, the city of Vero Beach sent out citations where fines increase as the number of repeat violations per property occurred. For incidences related to areas outside municipalities, HCP and county code enforcement staff created a new sea turtle lighting protocol in line with new survey technology and the updated ordinance, where fines accumulated if not paid or brought to code board. This new protocol is as follows:

- Two surveys will be conducted each nesting season. The first between March and May as stipulated in Conditions 11.G.11.a-c of the ITP. The second a follow-up conducted in July marking the beginning of nest hatching.
- The county environmental planner will use the 1st survey report to issue warning letters to property owners
- If violation is recorded again during follow-up survey or is reported directly to enforcement by an individual then a citation of $50 per light per day observed will be issued.
- Violators will have ability to present rebuttal case at next code board meeting.
**PRE-SEASON LIGHTING LETTERS**

Prior to March 1\textsuperscript{st} of each year, the county is required to mail written notices to property owners in unincorporated areas of Indian River County notifying them of the upcoming sea turtle nesting season and their lighting obligations associated with the county ordinance (ITP Condition 11.G.11.a). In 2016, the county’s Environmental Planning and Code Enforcement Office mailed the lighting information letters (Appendix D), a copy of the updated lighting ordinance, and a sea turtle information card to all beachfront property owners on February 15. The letter describes the parameters associated with the updated county code, methods for assessing beachfront lighting for compliance, methods for achieving compliance, and a general discussion of the problems caused by artificial light with regard to sea turtles.

**NIGHT-TIME LIGHTING EVALUATIONS**

Condition 11.G.11.b of the ITP stipulates that the county shall conduct inspections of beachfront lighting within unincorporated areas each year between March 1 and May 31 to document compliance with the county’s lighting ordinance. According to the code, exterior lights visible from the beach between 9:00 pm and sunrise during the sea turtle nesting season are deemed non-compliant. Interior lights on single and multi-story structures are also non-compliant if they illuminate the beach during the nesting season.

The initial night-time lighting evaluation was performed by the Ecological Associates Inc. and HCP coordinator on the evenings of May 2 and May 3. Non-compliant and other potentially disruptive lights were identified during the inspection, and each non-compliant exterior light was given a rating with respect to its potential effect on sea turtles (ratings ranged from 1 to 5, from least disruptive to most disruptive based on the light intensity and the area illuminated). For each non-compliant light source, recommendations were made for corrective measures to bring problematic lights into compliance.

A follow-up night-time lighting evaluation was performed by the Ecological Associates Inc. and HCP coordinator on the evenings of July 21 and July 22. As in the initial survey, non-compliant and other potentially disruptive lights were identified during the inspection, and each non-compliant exterior light was given a rating with respect to its potential effect on sea turtles (ratings ranged from 1 to 5, from least disruptive to most disruptive based on the light intensity and the area illuminated). For each non-compliant light source, recommendations were made for corrective measures to bring problematic lights into compliance.

The most problematic lights observed during both lighting surveys were wall-mounted lights and floodlights. A few streetlights remained a problem, but many of them, particularly in the south part of the county, were improved through a NFWF grant completed in 2009 (see the 2009 Annual HCP Report). As in years past, private single-family residences accounted for the highest number of non-compliant and/or potentially
disruptive light sources in both the initial and follow-up surveys (Table 12-13). This was followed in order of decreasing frequency by condominiums, streetlights, hotels, dune corssovers and "other types" (e.g. resorts). Although there were more private homes with lighting problems, condominiums had a higher number of disruptive lights. Problematic external lights were a problem in all areas of the county except the ACNWR and SISP. However, proportion of external to interior violations was greater in Southern unincorporated county beaches while more internal lighting violations were noted in the northern part of the county (Figure 9).

During the initial unincorporated county lighting survey there were more exterior lighting violations (69%) than interior (31%; Table 12a). Then during the follow-up survey, within the same area, the observed number of exterior lighting violations decreased by 56% (Table 12b). Interior lighting tends to be less of a problem than exterior lights, based on the area illuminated, the intensity of the light, and being easily covered by window screens or shades, so the county will continue its efforts focus on decreasing the impacts of exterior lighting fixtures and will use education to encourage people to close blinds or window fixtures to block interior light from escaping onto the beach. Properties with lighting problems tend to fluctuate from year to year, but there remain a "core group" of the same lighting offenders every nesting season. Through education and code enforcement action this group has slowly been diminishing. In 2016 the peak in the number of violations per kilometer was in zone 34, just as previous years. This stretch of beach includes the neighborhood, the Moorings, and multiple private residences.

The 2016 nest season was the first year lighting surveys occurred uniformly using the same methodology as unincorporated county lighting surveys inside the jurisdictional area of the City of Vero Beach and the Town of Indian River Shores. This eliminated the previous gap in lighting survey data for the first time since lighting surveys began in 2005. Initial and follow-up surveys indicated there are more external violations than internal in these areas and more violations occurred in the City are than the Town (Figure 9). This is most likely due beachfront businesses that are open after 9pm within the City, while the town is strictly residential (seasonal) along the beachfront area.

**SEA TURTLE DISORIENTATIONS**

When hatchlings emerged from marked and unmarked nests, the paths of the hatchlings were examined to determine if they were oriented toward the water. Sea turtle disorientation reports were provided to the FWC Tequesta Field Laboratory, Imperiled Species Program and copies were sent to Code Enforcement offices in the county and municipalities as required by Condition 11.J.2.i of the ITP.

Through the years there has been increasing education about lighting impacts on sea turtles and reporting effort has increased due to comprehensive training and an increased surveyor awareness of marked and unmarked nest impacts. Conversely during the 2016 season, there were only 48 disoriented nests observed in the county, a
55.5% decrease from the previous year (Figure 9). This was the lowest number of recorded disorientations ever documented since the inception of the HCP. The Turtle Friendly Business (TFB) Program influenced beachfront businesses in the City of Vero Beach to conduct turtle friendly practices (i.e. focusing on reducing the amount of light observed from the beach and educated their guests on impacts to nesting adults and hatchlings). The combination of this new program and the county hiring new staff to enforce lighting violations in unincorporated areas may have contributed to this record low number of reported disorientations. Loggerhead nests amounted to 93.7% of reports (Table 13). The City of Vero Beach had the most documented cases (60.4%) caused primarily by exterior and interior condo lights located in km zone 28 which includes the South Beach Park area (Figure 9). All other areas experienced 12% or less of the reported disorientation events. There was not a one-to-one relationship between lighting violations and disorientations partly because one disruptive light can lead to many disorientations (Figure 9).

**CODE ENFORCEMENT ACTION**

Under the provisions of the light management program, the county is required to enforce the lighting ordinance within unincorporated areas through code enforcement action, if necessary. To make the most of limited resources and make it easier for code enforcement, violations were grouped from the least to most problematic. Exterior lights with codes 5 through 3 were given the highest priority and processed using the new sea turtle lighting protocol. The county environmental planner sent warning letters to property owners with high priority problematic exterior lighting violations asking them to voluntarily address the issues. In the past these letters often had an effect but many of these changes were short-term fixes and not designed to last. However in 2016 code enforcement action had a great affect with a 47% reduction in lighting between the initial and follow surveys. The HCP coordinator and environmental planner also made individual property visits to examine the lights and recommend specific changes, many times where property owners made long-term fixes. An example of this was seen with the 1150 Sabal Reef Rd. Condos in the Moorings Community. In 2015 they retrofitted all lights in stairwells and at doors. However their property was documented for having visible white lights at the bottom of the condo buildings. After a site visit was made it was determined that the visible lights were above the garages and were being used to illuminate the driveways. The maintenance staff quickly replaced all bulbs the following morning and the property was not recorded as a violator during the follow-up survey.

The HCP Coordinator was notified about 10 properties outside of municipalities receiving citations for being repeat offenders, only two of which brought their case to the code enforcement board for further discussion, and 26 properties were given written warnings from the environmental planner and code enforcement office in 2016.

The HCP Coordinator collaborated with code enforcement officials in the municipalities if the City of Vero Beach and the Town of Indian River Shores and also worked closely with a small number of property owners. During phone calls and site visits, property
owners were reminded that the HCP Coordinator could only act as an informational resource and staff expert but did not act as certifying authority. A disorientation hotspot was located in the southern limits of Vero Beach and through collaborative meetings and a group of interested volunteers and a lighting team was created and will begin conducting bi-monthly lighting surveys inside the municipalities in 2017. These volunteer lighting surveys will be conducted similarly to HCP contracted lighting surveys and will follow the same methodology and protocols. These data will then be available for code enforcement in the municipalities so proper actions can be taken.
CHAPTER 5: EDUCATION AND COMMUNITY INVOLVEMENT

SEA TURTLE STRANDING AND SALVAGE NETWORK

Every year, dead, sick or injured sea turtles are found washed up on the shore of our beaches, bays and lagoons. The Sea Turtle Stranding and Salvage Network (STSSN) was initiated by the National Marine Fisheries Service (NMFS) in 1980 to document these events. The HCP Coordinator has permits to collect these data and, along with the stranding team, responds to calls from FWC, local enforcement, lifeguards and the public regarding sea turtles in distress. In 2016, the stranding team recorded 76 sea turtle strandings in Indian River County. In addition there were a total of 33 washback loggerhead, green, and hawksbill post-hatchlings rescued by beachgoers who found them stuck in the wrack line following Hurricane Matthew and post-storm swell. All live strandings were taken to permitted rehabilitation facilities north and south of the county and all post-hatchling washbacks were transported to the closest rehabilitation facility, the Brevard Zoo Sea Turtle Healing Center. Stranding data are valuable because they provide a relative measure of sea turtle impacts along our coast and in our waterways. Stranding reports and photos are sent to FWC’s Tequesta Field Station. A few dead animals are stored in freezers for further examination, but most turtles are buried on the beach or relocated to remote wooded areas to be recycled into the environment out of courtesy to beach residents and visitors. There were two strandings in particular that were transported to Sea World in 2016 that were selected to have their rescue stories appear on a popular TV show called Sea Rescue. HCP coordinator is working with the production company to supply pictures and footage of each rescue event and their releases for these special TV segments.

Indian River County hosts a portion of the ACNWR, a protected area for the highest density nesting beach for loggerheads in the western hemisphere. County-wide the beaches incubate extremely high numbers of sea turtle nests every year. These high numbers of nests also mean an extremely high number of hatchlings making their way to the ocean and a great probability of finding hatchings disoriented crawling along the beaches or in the dunes, as many beach goers have found in the past and reported to various entities including animal control, lifeguards, FWC, and the local police. In 2016 the HCP coordinator created a new protocol to rescue these tired disoriented hatchlings and release them once they are more energized and less susceptible to predation. This new program is called the hatchling dropbox and it includes a small cooler located at the front door of the Indian River Shores Public Safety office and a sign-in book to record the number of rescued hatchlings. Lifeguards and animal control were trained by the HCP coordinator to recover hatchlings found by beachgoers and to transport them to the drop box location. Surveyors may also find and deliver stragglers which need to be kept until dark to ensure a more natural release in the ocean. During the 2016 nesting season 222 hatchlings were recovered and released by permitted team members. As awareness of this program increases, the number of rescued hatchlings found on personal property, in the dunes or wondering down the beach may increase.
EDUCATION AND OUTREACH ACTIVITIES

For years now, the education program has gotten significant help from partners in other agencies and non-profits. Under Condition 11.G.11.d of the ITP, the county developed written literature intended to enhance public awareness of coastal erosion and the HCP. In a collaborative effort, the brochure was created in 2006 by the Sea Turtle Conservancy (formerly the Caribbean Conservation Corporation) and Ecological Associates, Inc. Out of the original 6,400 brochures, approximately 200 remained at the end of 2016. In addition to the HCP brochure, other sea turtle informational brochures were obtained from the Ocean Conservancy, Disney, Caribbean Conservation Corporation, UF / St. Lucie County Cooperative Extension Office, Florida Power and Light and the Friends of the Carr Refuge. For years, educational brochures have been passed out through partners in other agencies and non-profits, have been placed in a large acrylic display cases around the City of Vero Beach and distributed in mail outs by Alex MacWilliams Reality. In addition, a watertight Pelican case was filled with brochures and business cards so they could be taken on the beach and handed out during nesting surveys. In 2016, the HCP coordinator and volunteer survey team members spent between 45-60 minutes on each nesting survey speaking to visiting and local beachgoers about sea turtle nesting and conservation activities.

With the help of many volunteers new education and outreach activities were able to be developed and managed by the environmental specialist in 2016. Staff was able to create a new informational picture card which offered basic tips about what to do during nesting season to protect sea turtles and identifying pictures of the three nesting species in IRC. An order of 15,000 cards was made prior to nesting season and approximately 6,000 have been distributed by staff at local meetings, partnering agencies, city and county lifeguards and turtle friendly businesses throughout 2016. Lifeguards have also been trained by staff to collect sick or injured sea turtles found by beach goers and transport them to the new hatching drop box cooler to enhance the stranding program at public beaches.

The turtle friendly business program is an incentivizing program which was piloted in the City limits of Vero Beach during 2016. Beach front businesses like hotels, recreational companies and restaurants, volunteered to comply with the local lighting ordinance, provide educational materials about sea turtles to guests, promote local sea turtle conservation activities, and maintain a clean and natural-like beach safe for adult and hatchling sea turtles. During the 2016 pilot year, six businesses volunteered for this program and passed inspections. All six were recognized in November for their efforts to be turtle friendly.

The last new activity that was developed in 2016 were Turtle Digs, or public educational nest excavations. Volunteers set up an educational venue at the Sexton Plaza Beach Access which displayed educational materials on the local IRC sea turtle program and long-term data collected by the program. Then guests where then taken on the beach to a nearby nests marked specifically for educational purposes which hatched three days prior to the activity and watched the nest be evaluated while listening to a short
presentation including all FWC standards for public education programs. A total of 14 turtle digs were conducted during July and August with a total attendance 626, many of which came because of the neighboring turtle friendly businesses (Appendix F).

There was one article in in the Vero Beach Press Journal with contributions from the HCP Coordinator in 2016, along with one article in Newsweekly and front page column in 32963 news and a full page inside the local tourist guide book – Inside Track Almanac. It has been one full year since Vero Beach Portfolio Magazine began including a sea turtle news update page in every bi-monthly issue. Topics covered in this local magazine include the impacts of dogs on turtle nests, lighting impacts to hatchlings, nesting reminders, and a season summary. In addition to the written press, the HCP Coordinator was on public news radio (1490 AM) two times in 2016 answering questions regarding sea turtle nesting, lights and nest predators and also on local talk radio show. The HCP Coordinator also gave several public presentations year round to county commissioners, city council members, non-profit groups like the Vero Garden club, and continued classroom presentations about marine conservation and animal adaptations to public 5th grade science classes. Pre and post test data were collected from this presentation and these data show a significant increase in learning after the presentation. The county was awarded a grant from Inwater Research group to expand the education program even more in 2017 by providing a traveling turtle trunk which provides 4 pre-made lessons on sea turtle biology for free to 5th grade science classes. A total of six schools will be utilizing this program during the 2016/2017 school year.

**FLORIDA LICENSE PLATE GRANT – DATA MANAGEMENT NEEDS**

The HCP Coordinator applied for and received a mini-grant in the amount of $1,000 for the 2007, 2010, 2016, and 2017 nesting seasons. The grant was through the Florida Sea Turtle License Plate Grants Program in support of Marine Turtle Permit Activities (Permit #166). Previously the nesting program was in need of educational materials. Past rewarded money was spent creating durable signs that were weather-resistant, contained education information and were designed to be specific to each turtle species. Copies of the signs have been disseminated to several other marine turtle permit holders in the state for use as templates. The signs were recycled and carried over for use in the 2015 and 2016 seasons on nests marked for educational programs. Additional applied funding, if received for the 2017 season, will be used to purchase iPads for county-wide electronic data collection and restructuring of county-wide sea turtle database.
LITERATURE CITED


ACKNOWLEDGMENTS

The HCP Coordinator would like to acknowledge the cooperation of the FWC Marine Turtle Permit Holders and their crew who provided data for this report, especially Anibal Vasquez, Terry O'Toole, Blair Witherington, Rachel Smith, Emily Neidhardt, Rebekah Lindborg, Joe Scarola, Niki Desjardin, Samantha Pessolano, Deanna DeRosia, Cassidy Killinger, and Brandon Bell. Assistance on beachfront lighting issues and code enforcement came from Steven Hitt, Melody Sanderson, Tom Ramsey, and Barb Grass. Most importantly, Indian River County is indebted to the volunteers and interns who donated their time conducting nesting surveys and helping orchestrate education programs for the county in 2016: Melisa Blasky, Zak Grant, Barbara Grass, Sherri Davis, Matthew Ritcher, Kate Hoffman, Stacey Kalwies, Chris Walker, Penny Tranchilla, Fenia Hiaasen, Andrea Court, Paul Lins, Ann Lins, Nancy Pham, Tim Adams, and Bob Mallory. Much of this work would not have been possible without their help.
TABLES
Table 1. Total nesting activity for Indian River County in 2016. This table includes only crawls above the most recent high tide line (1270 crawls below high tide were recorded).

<table>
<thead>
<tr>
<th>Nesting Activity</th>
<th>Loggerhead</th>
<th>Green</th>
<th>Leatherback</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of Last Nest</td>
<td>9/21/2016</td>
<td>10/26/2016</td>
<td>7/1/2016</td>
<td>10/26/2016</td>
</tr>
<tr>
<td>Total Nests</td>
<td>7,197</td>
<td>265</td>
<td>34</td>
<td>7,496</td>
</tr>
<tr>
<td>Total False Crawls</td>
<td>9,179</td>
<td>483</td>
<td>3</td>
<td>9,665</td>
</tr>
<tr>
<td>Total Emergences</td>
<td>16,376</td>
<td>748</td>
<td>55</td>
<td>17,161</td>
</tr>
<tr>
<td>Nesting Success</td>
<td>43.9%</td>
<td>35.4%</td>
<td>61.8%</td>
<td>43.7%</td>
</tr>
</tbody>
</table>
Table 2. Loggerhead nesting activity, nesting success and crawl density by survey area in 2016. This includes only crawls above the most recent high tide line. SISP = Sebastian Inlet State Park, ACNWR = Archie Carr National Wildlife Refuge.

<table>
<thead>
<tr>
<th>Survey Area</th>
<th>Nests</th>
<th>False Crawls</th>
<th>Total Emergences</th>
<th>Nesting Success (%)</th>
<th>Avg. Crawl Density ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>SISP</td>
<td>643</td>
<td>843</td>
<td>1,486</td>
<td>43.3%</td>
<td>464.4</td>
</tr>
<tr>
<td>ACNWR</td>
<td>2,243</td>
<td>3,365</td>
<td>5,608</td>
<td>40.0%</td>
<td>701.0</td>
</tr>
<tr>
<td>Disney</td>
<td>407</td>
<td>700</td>
<td>1,107</td>
<td>36.8%</td>
<td>527.1</td>
</tr>
<tr>
<td>IR Shores</td>
<td>1,578</td>
<td>1,895</td>
<td>3,473</td>
<td>45.4%</td>
<td>390.2</td>
</tr>
<tr>
<td>Vero Beach</td>
<td>1,062</td>
<td>1,248</td>
<td>2,310</td>
<td>46.0%</td>
<td>366.7</td>
</tr>
<tr>
<td>South IRC Beaches</td>
<td>1,264</td>
<td>1,128</td>
<td>2,392</td>
<td>52.8%</td>
<td>314.7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7,197</strong></td>
<td><strong>9,179</strong></td>
<td><strong>16,376</strong></td>
<td><strong>44.0%</strong></td>
<td><strong>241.1</strong></td>
</tr>
</tbody>
</table>

¹ Expressed as the number of emergences (nests and false crawls) per kilometer of beach.
Table 3. Green turtle nesting activity, nesting success and crawl density by survey area in 2016. This includes only crawls above the most recent high tide line. SISP = Sebastian Inlet State Park, ACNWR = Archie Carr National Wildlife Refuge.

<table>
<thead>
<tr>
<th>Survey Area</th>
<th>Nests</th>
<th>False Crawls</th>
<th>Total Emergences</th>
<th>Nesting Success (%)</th>
<th>Avg. Crawl Density ¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>SISP</td>
<td>11</td>
<td>20</td>
<td>31</td>
<td>35.5%</td>
<td>9.7</td>
</tr>
<tr>
<td>ACNWR</td>
<td>169</td>
<td>332</td>
<td>500</td>
<td>33.8%</td>
<td>62.5</td>
</tr>
<tr>
<td>Disney</td>
<td>11</td>
<td>38</td>
<td>49</td>
<td>22.4%</td>
<td>23.3</td>
</tr>
<tr>
<td>IR Shores</td>
<td>54</td>
<td>85</td>
<td>139</td>
<td>38.8%</td>
<td>15.6</td>
</tr>
<tr>
<td>Vero Beach</td>
<td>12</td>
<td>6</td>
<td>18</td>
<td>66.7%</td>
<td>2.9</td>
</tr>
<tr>
<td>South IRC Beaches</td>
<td>8</td>
<td>2</td>
<td>10</td>
<td>80.0%</td>
<td>1.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>265</strong></td>
<td><strong>483</strong></td>
<td><strong>747</strong></td>
<td><strong>46.2%</strong></td>
<td><strong>241.1</strong></td>
</tr>
</tbody>
</table>

¹ Expressed as the number of emergences (nests and false crawls) per kilometer of beach.
Table 4. Leatherback nesting activity, nesting success and crawl density by survey area in 2016. This includes only crawls above the most recent high tide line. SISP = Sebastian Inlet State Park, ACNWR = Archie Carr National Wildlife Refuge.

<table>
<thead>
<tr>
<th>Survey Area</th>
<th>Nests</th>
<th>False Crawls</th>
<th>Total Emergences</th>
<th>Nesting Success (%)</th>
<th>Avg. Crawl Density&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>SISP</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>75.0%</td>
<td>1.3</td>
</tr>
<tr>
<td>ACNWR</td>
<td>11</td>
<td>2</td>
<td>13</td>
<td>84.6%</td>
<td>1.6</td>
</tr>
<tr>
<td>Disney</td>
<td>7</td>
<td>0</td>
<td>7</td>
<td>100.0%</td>
<td>3.3</td>
</tr>
<tr>
<td>IR Shores</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>100.0%</td>
<td>0.2</td>
</tr>
<tr>
<td>Vero Beach</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>100.0%</td>
<td>0.8</td>
</tr>
<tr>
<td>South IRC Beaches</td>
<td>6</td>
<td>0</td>
<td>6</td>
<td>100.0%</td>
<td>0.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>34</strong></td>
<td><strong>3</strong></td>
<td><strong>37</strong></td>
<td><strong>93.3%</strong></td>
<td><strong>241.1</strong></td>
</tr>
</tbody>
</table>

<sup>1</sup> Expressed as the number of emergences (nests and false crawls) per kilometer of beach.
Table 5. Summary of loggerhead false crawl characteristics and obstructions by survey area for Indian River County in 2016. This includes only crawls above the most recent high tide line. SISP = Sebastian Inlet State Park, ACNWR = Archie Carr National Wildlife Refuge, IRS = Indian River Shores, SIRC = South Indian River County.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>SISP</th>
<th>ACNWR</th>
<th>Disney</th>
<th>IRS</th>
<th>Vero</th>
<th>SIRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of False Crawls</td>
<td>843</td>
<td>3,365</td>
<td>700</td>
<td>1,895</td>
<td>1,248</td>
<td>1,128</td>
</tr>
<tr>
<td>Continuous Crawls (%)</td>
<td>65.5%</td>
<td>70.9%</td>
<td>81.7%</td>
<td>72.8%</td>
<td>72.6%</td>
<td>69.8%</td>
</tr>
<tr>
<td>Abandoned Body Pits (%)</td>
<td>31.6%</td>
<td>26.1%</td>
<td>17.1%</td>
<td>23.5%</td>
<td>24.5%</td>
<td>27.0%</td>
</tr>
<tr>
<td>Abandoned Egg Chambers (%)</td>
<td>5.6%</td>
<td>5.2%</td>
<td>2.1%</td>
<td>5.8%</td>
<td>4.6%</td>
<td>5.1%</td>
</tr>
</tbody>
</table>

Obstructions

<table>
<thead>
<tr>
<th>Obstructions</th>
<th>SISP</th>
<th>ACNWR</th>
<th>Disney</th>
<th>IRS</th>
<th>Vero</th>
<th>SIRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Obstructions Recorded (%)</td>
<td>95.0%</td>
<td>80.5%</td>
<td>59.3%</td>
<td>77.3%</td>
<td>86.6%</td>
<td>93.6%</td>
</tr>
<tr>
<td>Scarps (%)</td>
<td>2.8%</td>
<td>13.1%</td>
<td>18.9%</td>
<td>18.5%</td>
<td>5.7%</td>
<td>0.8%</td>
</tr>
<tr>
<td>Seawalls (%)</td>
<td>0.0%</td>
<td>1.8%</td>
<td>11.4%</td>
<td>0.1%</td>
<td>3.4%</td>
<td>3.2%</td>
</tr>
<tr>
<td>Dune Cross-Overs (%)</td>
<td>0.0%</td>
<td>1.6%</td>
<td>3.6%</td>
<td>1.7%</td>
<td>1.8%</td>
<td>0.6%</td>
</tr>
<tr>
<td>Other Obstructions (%)</td>
<td>2.1%</td>
<td>3.0%</td>
<td>6.9%</td>
<td>2.5%</td>
<td>2.4%</td>
<td>1.8%</td>
</tr>
</tbody>
</table>
Table 6. Summary of green turtle false crawl characteristics and obstructions by survey area for Indian River County in 2016. SISP = Sebastian Inlet State Park, ACNWR = Archie Carr National Wildlife Refuge, IRS = Indian River Shores, SIRC = South Indian River County.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>SISP</th>
<th>ACNWR</th>
<th>Disney</th>
<th>IRS</th>
<th>Vero</th>
<th>SIRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of False Crawls</td>
<td>20</td>
<td>332</td>
<td>37</td>
<td>55</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Continuous Crawls (%)</td>
<td>55.0%</td>
<td>59.3%</td>
<td>83.8%</td>
<td>47.3%</td>
<td>66.7%</td>
<td>50.0%</td>
</tr>
<tr>
<td>Abandoned Body Pits (%)</td>
<td>35.0%</td>
<td>37.3%</td>
<td>16.2%</td>
<td>43.6%</td>
<td>33.3%</td>
<td>50.0%</td>
</tr>
<tr>
<td>Abandoned Egg Chambers (%)</td>
<td>10.0%</td>
<td>5.4%</td>
<td>0.0%</td>
<td>9.1%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

**Obstructions**

<table>
<thead>
<tr>
<th>Obstructions</th>
<th>SISP</th>
<th>ACNWR</th>
<th>Disney</th>
<th>IRS</th>
<th>Vero</th>
<th>SIRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Obstructions Recorded (%)</td>
<td>100.0%</td>
<td>62.7%</td>
<td>43.2%</td>
<td>70.9%</td>
<td>100.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Scarps (%)</td>
<td>0.0%</td>
<td>25.9%</td>
<td>13.5%</td>
<td>23.6%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Seawalls (%)</td>
<td>0.0%</td>
<td>4.2%</td>
<td>35.1%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Dune Cross-Overs (%)</td>
<td>0.0%</td>
<td>1.8%</td>
<td>5.4%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>Other Obstructions (%)</td>
<td>0.0%</td>
<td>7.2%</td>
<td>5.4%</td>
<td>5.5%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>
Table 7. Summary of the fate of all marked nests by species where the clutch was found the morning after deposition in Indian River County in 2016.

<table>
<thead>
<tr>
<th>Fate</th>
<th>Loggerhead</th>
<th>Green Turtle</th>
<th>Leatherback</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Excavated</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emerged</td>
<td>587</td>
<td>405</td>
<td>33</td>
<td>1,025</td>
</tr>
<tr>
<td>Did not emerge</td>
<td>18</td>
<td>22</td>
<td>4</td>
<td>44</td>
</tr>
<tr>
<td><strong>Total Excavated</strong></td>
<td>605</td>
<td>425</td>
<td>37</td>
<td>1,067</td>
</tr>
<tr>
<td><strong>Not Excavated</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Washed out</td>
<td>36</td>
<td>64</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Completely Depredated</td>
<td>17</td>
<td>24</td>
<td>1</td>
<td>42</td>
</tr>
<tr>
<td>Completely Vandalized</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Nested on by another</td>
<td>2</td>
<td>9</td>
<td>0</td>
<td>11</td>
</tr>
<tr>
<td>Emerged Not Excavated</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>Could Not Evaluate</td>
<td>10</td>
<td>21</td>
<td>0</td>
<td>31</td>
</tr>
<tr>
<td>Did Not Find</td>
<td>1</td>
<td>41</td>
<td>6</td>
<td>48</td>
</tr>
<tr>
<td><strong>Total Not Excavated</strong></td>
<td>71</td>
<td>164</td>
<td>9</td>
<td>244</td>
</tr>
<tr>
<td><strong>Total Marked</strong></td>
<td>676</td>
<td>589</td>
<td>46</td>
<td>1,311</td>
</tr>
</tbody>
</table>
Table 8. Summary of reproductive success for loggerhead nests by study area in Indian River County, 2016. Includes only nests where the clutch was found the morning after deposition. SISP = Sebastian Inlet State Park, ACNWR = Archie Carr National Wildlife Refuge.

<table>
<thead>
<tr>
<th></th>
<th>SISP</th>
<th>ACNWR</th>
<th>Disney</th>
<th>IR Shores</th>
<th>Vero Beach</th>
<th>South IRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nests Excavated</td>
<td>87</td>
<td>300</td>
<td>68</td>
<td>118</td>
<td>43</td>
<td>60</td>
</tr>
<tr>
<td>Mean Clutch Size</td>
<td>110.4</td>
<td>104.9</td>
<td>106.6</td>
<td>106.0</td>
<td>103.4</td>
<td>110.3</td>
</tr>
<tr>
<td>Inventoried Hatching Success (%)</td>
<td>82.7</td>
<td>83.0</td>
<td>70.8</td>
<td>72.2</td>
<td>89.4</td>
<td>79.8</td>
</tr>
<tr>
<td>Inventoried Emerging Success (%)</td>
<td>81.5</td>
<td>81.2</td>
<td>68.3</td>
<td>70.9</td>
<td>88.9</td>
<td>78.9</td>
</tr>
<tr>
<td>Emerging Success, including Predation and Wash Outs (%)</td>
<td>76.5</td>
<td>73.2</td>
<td>64.2</td>
<td>67.9</td>
<td>78.3</td>
<td>73.6</td>
</tr>
<tr>
<td>Mean Incubation Period (days)</td>
<td>50.6</td>
<td>50.7</td>
<td>51.1</td>
<td>51.1</td>
<td>52.9</td>
<td>51.7</td>
</tr>
</tbody>
</table>
Table 9. Summary of reproductive success for green turtle nests by study area in Indian River County, 2016. Includes only nests where the clutch was found the morning after deposition. SISP = Sebastian Inlet State Park, ACNWR = Archie Carr National Wildlife Refuge.

<table>
<thead>
<tr>
<th></th>
<th>SISP</th>
<th>ACNWR</th>
<th>Disney</th>
<th>IR Shores</th>
<th>Vero Beach</th>
<th>South IRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nests Excavated</td>
<td>20</td>
<td>286</td>
<td>98</td>
<td>154</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>Mean Clutch Size</td>
<td>125.9</td>
<td>114.7</td>
<td>121.7</td>
<td>116.7</td>
<td>128.4</td>
<td>141.0</td>
</tr>
<tr>
<td>Inventoried Hatching Success (%)</td>
<td>94.6</td>
<td>75.8</td>
<td>73.8</td>
<td>54.5</td>
<td>95.3</td>
<td>60.9</td>
</tr>
<tr>
<td>Inventoried Emerging Success (%)</td>
<td>89.2</td>
<td>74.2</td>
<td>72.3</td>
<td>52.3</td>
<td>94.5</td>
<td>59.8</td>
</tr>
<tr>
<td>Emerging Success, including Predation and Wash Outs (%)</td>
<td>81.0</td>
<td>55.9</td>
<td>62.6</td>
<td>49.4</td>
<td>78.7</td>
<td>52.7</td>
</tr>
<tr>
<td>Mean Incubation Period (days)</td>
<td>52.2</td>
<td>53.0</td>
<td>54.3</td>
<td>53.8</td>
<td>53.5</td>
<td>54.0</td>
</tr>
</tbody>
</table>
Table 10. Summary of reproductive success for leatherback nests by study area in Indian River County, 2016. Includes only nests where the clutch was found the morning after deposition. SISP = Sebastian Inlet State Park, ACNWR = Archie Carr National Wildlife Refuge.

<table>
<thead>
<tr>
<th></th>
<th>SISP</th>
<th>ACNWR</th>
<th>Disney</th>
<th>IR Shores</th>
<th>Vero Beach</th>
<th>South IRC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nests Excavated</td>
<td>3</td>
<td>7</td>
<td>2</td>
<td>6</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Mean Clutch Size</td>
<td>96.5</td>
<td>78.7</td>
<td>75</td>
<td>70.6</td>
<td>74.7</td>
<td>68.2</td>
</tr>
<tr>
<td>Inventoried Hatching Success (%)</td>
<td>74.1</td>
<td>62.6</td>
<td>45.0</td>
<td>54.0</td>
<td>79.5</td>
<td>57.4</td>
</tr>
<tr>
<td>Inventoried Emerging Success (%)</td>
<td>54.7</td>
<td>59.2</td>
<td>45.0</td>
<td>46.0</td>
<td>75.3</td>
<td>55.5</td>
</tr>
<tr>
<td>Emerging Success, including Predation and Wash Outs (%)</td>
<td>54.7</td>
<td>51.8</td>
<td>45.0</td>
<td>46.0</td>
<td>75.3</td>
<td>55.5</td>
</tr>
<tr>
<td>Mean Incubation Period (days)</td>
<td>67.0</td>
<td>60.8</td>
<td>61.0</td>
<td>61.4</td>
<td>64.0</td>
<td>59.7</td>
</tr>
</tbody>
</table>
Table 11. Descriptive statistics for all inventoried nests in Indian River County in 2016. Includes only nests where the clutch was found the morning after deposition.

(a) *Loggerhead.*

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Stand. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clutch Size</td>
<td>607</td>
<td>39</td>
<td>175</td>
<td>106.6</td>
<td>23.5</td>
</tr>
<tr>
<td>Inventoried Hatching Success (%)</td>
<td>606</td>
<td>0</td>
<td>100</td>
<td>79.8</td>
<td>23.2</td>
</tr>
<tr>
<td>Inventoried Emerging Success (%)</td>
<td>605</td>
<td>0</td>
<td>100</td>
<td>78.1</td>
<td>23.8</td>
</tr>
<tr>
<td>Emerging Success, including Predation and Wash Outs (%)</td>
<td>657</td>
<td>0</td>
<td>100</td>
<td>72.1</td>
<td>30.9</td>
</tr>
<tr>
<td>Incubation Period (days)</td>
<td>520</td>
<td>44</td>
<td>63</td>
<td>51.0</td>
<td>2.3</td>
</tr>
</tbody>
</table>

(b) *Green Turtle.*

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Stand. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clutch Size</td>
<td>428</td>
<td>51</td>
<td>191</td>
<td>118.4</td>
<td>23.0</td>
</tr>
<tr>
<td>Inventoried Hatching Success (%)</td>
<td>426</td>
<td>0</td>
<td>100</td>
<td>69.9</td>
<td>31.1</td>
</tr>
<tr>
<td>Inventoried Emerging Success (%)</td>
<td>426</td>
<td>0</td>
<td>100</td>
<td>68.1</td>
<td>31.3</td>
</tr>
<tr>
<td>Emerging Success, including Predation and Wash Outs (%)</td>
<td>514</td>
<td>0</td>
<td>100</td>
<td>56.4</td>
<td>38.4</td>
</tr>
<tr>
<td>Incubation Period (days)</td>
<td>326</td>
<td>43</td>
<td>70</td>
<td>53.4</td>
<td>3.7</td>
</tr>
</tbody>
</table>

(c) *Leatherback.*

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Stand. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clutch Size</td>
<td>38</td>
<td>33</td>
<td>101</td>
<td>74.1</td>
<td>16.5</td>
</tr>
<tr>
<td>Inventoried Hatching Success (%)</td>
<td>38</td>
<td>0</td>
<td>95</td>
<td>63.9</td>
<td>32.7</td>
</tr>
<tr>
<td>Inventoried Emerging Success (%)</td>
<td>38</td>
<td>0</td>
<td>92</td>
<td>59.3</td>
<td>33.4</td>
</tr>
<tr>
<td>Emerging Success, including Predation and Wash Outs (%)</td>
<td>39</td>
<td>0</td>
<td>92</td>
<td>57.8</td>
<td>34.3</td>
</tr>
<tr>
<td>Incubation Period (days)</td>
<td>30</td>
<td>58</td>
<td>78</td>
<td>62.0</td>
<td>4.1</td>
</tr>
</tbody>
</table>
Table 12. Results of night-time lighting inspections conducted in May 2016 in unincorporated areas of Indian River County. These results summarize the number of properties with exterior and interior lighting violations in six property types from the initial and follow-up lighting surveys. Exterior lights were given a problem code based on the intensity and the scope of the light. See text for further explanation.

(a) Initial night-time lighting survey

<table>
<thead>
<tr>
<th>Property Type</th>
<th>Exterior Lighting</th>
<th>Interior Lighting</th>
<th>Total Lighting Violations</th>
<th>Average Problem Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condominium</td>
<td>14</td>
<td>10</td>
<td>24</td>
<td>2.2</td>
</tr>
<tr>
<td>Hotel</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>3.3</td>
</tr>
<tr>
<td>House</td>
<td>28</td>
<td>11</td>
<td>39</td>
<td>3.2</td>
</tr>
<tr>
<td>Streetlight</td>
<td>5</td>
<td>0</td>
<td>5</td>
<td>2.6</td>
</tr>
<tr>
<td>Walkover</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>3.0</td>
</tr>
<tr>
<td>Other Types</td>
<td>5</td>
<td>2</td>
<td>7</td>
<td>2.4</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>58</strong></td>
<td><strong>26</strong></td>
<td><strong>84</strong></td>
<td></td>
</tr>
</tbody>
</table>

1 Averages include exterior lights only. Problem codes for exterior lighting range from 1 to 5, from least disruptive to most disruptive, respectively.

(b) Follow-up night-time lighting survey

<table>
<thead>
<tr>
<th>Property Type</th>
<th>Exterior Lighting</th>
<th>Interior Lighting</th>
<th>Total Lighting Violations</th>
<th>Average Problem Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condominium</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>3.0 ²</td>
</tr>
<tr>
<td>Hotel</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>4.0</td>
</tr>
<tr>
<td>House</td>
<td>16</td>
<td>13</td>
<td>29</td>
<td>4.0</td>
</tr>
<tr>
<td>Streetlight</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>3.5</td>
</tr>
<tr>
<td>Walkover</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>3.0 ²</td>
</tr>
<tr>
<td>Other Types</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3.0 ²</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>25</strong></td>
<td><strong>19</strong></td>
<td><strong>44</strong></td>
<td></td>
</tr>
</tbody>
</table>

1 Averages include exterior lights only. Problem codes for exterior lighting range from 1 to 5, from least disruptive to most disruptive, respectively. ² Sample size = 1 violation
Table 13. Summary of sea turtle disorientation events by study area, 2016. Qualitative data were based on a range. MANY disoriented > 50, SOME disoriented = 11 – 50, FEW disoriented = 2 – 10. See text for further explanation of this table.

<table>
<thead>
<tr>
<th>Disoriented Nests</th>
<th>SISP</th>
<th>ACNWR</th>
<th>Disney</th>
<th>IR Shores</th>
<th>Vero Beach</th>
<th>South IRC</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loggerhead</td>
<td>4</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>29</td>
<td>6</td>
<td>48</td>
</tr>
<tr>
<td>Green Turtle</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Leatherback</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Nests w/ MANY disoriented hatchlings</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>14</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>Nests w/ SOME disoriented hatchlings</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>10</td>
<td>4</td>
<td>18</td>
</tr>
<tr>
<td>Nests w/ FEW disoriented hatchlings</td>
<td>2</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>All Reached Water</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Some Reached Water</td>
<td>4</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>24</td>
<td>6</td>
<td>40</td>
</tr>
<tr>
<td>Few to None Reached Water</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Nests w/ Turtles Found Dead</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Most Common Light Source</td>
<td>SKY GLOW</td>
<td>HOME</td>
<td>CONDO</td>
<td>CONDO/ SKY GLOW</td>
<td>CONDO</td>
<td>HOME</td>
<td>CONDO</td>
</tr>
</tbody>
</table>
Table 14. Cumulative take since date of issuance of the Indian River County ITP (December 1, 2004). No armoring under the HCP occurred in 2016.

<table>
<thead>
<tr>
<th>Applicant Name</th>
<th>Survey Area</th>
<th>Jurisdiction</th>
<th>FDEP Permit No.</th>
<th>Type of Armoring</th>
<th>Take (Linear Ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summerplace¹</td>
<td>Disney</td>
<td>Unincorporated</td>
<td>IR-512 ATF</td>
<td>Seawall</td>
<td>420</td>
</tr>
<tr>
<td>Gerstner, Larry &amp; Cheryl</td>
<td>South County</td>
<td>Unincorporated</td>
<td>IR-511 M1 ATF</td>
<td>Seawall</td>
<td>100</td>
</tr>
</tbody>
</table>

|                      |             | Dec 1, 2004 – Dec 31, 2005 | 520 |
|                      |             |                            |     |
|                      |              | 2016                       | 0   |
|                      |              | Cumulative Take            | 520 |
|                      |              | Take Authorized Under ITP  | 3,196 |
|                      |              | Balance                    | 2,676 |

¹ Parvus, Dirk & Brenda; Strand, Anne E.; Trimarche, Peter J.; King, Bruce, E.; Simpson, Patricia N.; and McCoy, Richard & Louise.
FIGURES
Indian River County, Vero Beach, Florida

Map Date: 2/1/2017

Map of Nesting Survey Areas and permit holders in Indian River County.

Figure 1: Map of Indian River County showing survey areas and the marine turtle permit holders responsible for collecting nesting data within each area and coordinating with the HCP Coordinator. Indian River County’s coastline spans approximately 36 kilometers from Sebastian Inlet south to the St. Lucie County line. Kilometer markers indicate each 1km section of coastline, which divide Indian River County’s beach into 36 individual kilometer zones.
Temporal distribution of all nesting by species in 2016.

Figure 2: The temporal pattern of all nesting by species above the high tide line (HTL) in 2016. Peak numbers are indicated on graph. A long-term nesting trend figure for each species is available at www.ircgov.com/coastal.
Spatial distribution of loggerhead (CC) nests in Indian River County in 2016.

Figure 3: The number of loggerhead nests above the high tide line (HTL) per county km in 2016. Data for this type of distribution was compiled by GPS location, which may have a small degree of error.
Green Turtle Nest Distribution
*Chelonia mydas*, 2016 Summary

Spatial distribution of green (CM) turtle nests in Indian River County in 2016

Figure 4: The number of green turtle nests above the high tide line (HTL) per county km in 2016.

Note: One (1) nest above the HTL had incorrect or missing spatial information. Two (2) nests occurred below the HTL. These data are not included in the chart.

**TOTAL NESTS**

CM (2016) 265
Spatial distribution of leatherback (DC) nests in Indian River County in 2016
Figure 5: The number of leatherback nests above the high tide line (HTL) per county km in 2016
Nesting Success
2016 Summary

Figure 6: The center dashed line represents 50% nesting success, which is used as a baseline. The figures were calculated using nests recorded above the high tide line (HTL).

Spatial distribution of Loggerhead (CC), Green (CM), and Leatherback (DC) Turtle nesting success (%) in 2016.

Note: Eight (8) nests above the HTL which included six (6) nests, had erroneous or missing spatial information; thus, are not spatially represented in bar chart. Thirty-five (35) nests and (1,235) false crawls excluded from all figures in this map were recorded below the HTL.
False Crawl Distribution
2016 Summary

Spatial Distribution of false crawls in 2015
Figure 7: The number of loggerhead, green, and leatherback turtle false crawls above the high tide line per county km in 2016. Abandoned body pits and abandoned egg chambers are not mutually exclusive.
Spatial Distribution of obstructed nesting attempts in 2016

Figure 8: The number of crawls above the high tide line (HTL) per county km associated with an obstruction.
Lighting Violations and Disorientations
2016 Summary

Spatial Distribution of disorientations and unincorporated county lighting violations in 2016
Figure 9: The number of disoriented nests vs. the number of properties with exterior and interior lighting violations per county km.

Note: The lighting violation figures are a cumulative result of two different survey teams conducting both initial and follow-up assignments over several dates in May, July, and August.

Two (2) lighting survey records were omitted due to incomplete information regarding the source and type of illegal fixture.

TOTAL DISORIENTATIONS 48

DISORIENTATIONS INTERIOR LIGHTING VIOLATIONS EXTERIOR LIGHTING VIOLATIONS

Note: The lighting violation figures are a cumulative result of two different survey teams conducting both initial and follow-up assignments over several dates in May, July, and August.

Two (2) lighting survey records were omitted due to incomplete information regarding the source and type of illegal fixture.

TOTAL DISORIENTATIONS 48
APPENDIX A – MARINE TURTLE PERMIT #166
Marine Turtle Permit
Florida Fish and Wildlife Conservation Commission
Imperiled Species Management Section-Tequesta Field Lab, 19100 SE Federal Highway
Tequesta, FL 33469
(561) 882-5964

Permittee: Kendra Cope
INDIAN RIVER COUNTY PUBLIC WORKS/COASTAL DIVISION
1801 27TH STREET BUILDING A
VERO BEACH, FLORIDA 32960
UNITED STATES

Permit#: MTP-16-166
Effective Date: 01/01/2016
Expiration Date: 12/31/2016

Is Authorized to:
1. conduct nesting surveys;
2. conduct stranding/salvage activities;
3. relocate nests for conservation purposes;
4. collect hatched nest contents (including unhatched eggs) on behalf of collaborators - see Conditions;
5. maintain & display preserved specimens; and
6. conduct public hatch success evaluations.

Authorized Nesting Survey Area:
1. Indian River Shores (including Baytree);
2. Vero Beach; and
3. South Indian River County Beaches.

Permittee Signature: Kendra Cope 01/01/2016
Date:

Not valid unless signed. By signature, the permittee confirms that all information provided to issue the permit is accurate and complete, and indicates acceptance and understanding of the provisions and conditions listed below. Any false statements or misrepresentations when applying for this permit may result in felony charges and will result in revocation of this permit.

By signature, I acknowledge that I have read and understand this permit. Signature of this permit indicates that I and all authorized personnel listed below have read and agree to abide by all Florida Fish and Wildlife Conservation Commission (FWC) 'Sea Turtle Conservation Guidelines' that pertain to the authorized activity(ies) listed on this marine turtle permit. I understand that it is my responsibility to transmit all future information updates to all authorized personnel listed on my permit. Permittee must provide a signed copy of this permit to the FWC address above to activate this permit.

 Authorized By: ROBBIN TRINDELL
Authorized for: Nick Wiley, Executive Director

Authorizing Signature: __________________________ Date: 12/17/2015

PERMIT NO. MTP-16-166
**Authorized Research Projects**: None.
**Authorized Monitoring Projects**: None.

**Authorized Personnel**:
James Gray; Nancy Pham; Paul Lins; Anne Lins; Barbara Griss; Sherri Davis; Antoinette Miller; Kevin Walker; Penny Tranchila; Kate Hoffman; Denise Kristansen; Heather Stapleton; Christine Walker; Matthew Ritcher.

**PERMIT CONDITIONS AND PROVISIONS**:
1. Permitted individuals must adhere to the FWC marine turtle permit guidelines developed under a Section 6 Cooperative Agreement between FWC and the U.S. Fish and Wildlife Service.
2. All transfers of marine turtles or specimens into or out of the State of Florida must be accompanied by a specific consent permit from FWC.
3. Permittee shall coordinate with Indian River County in implementing the Indian River County Habitat Conservation Plan.
4. Sample collection for collaborators is authorized as follows:
   1. Dr. Simona Ceriani - Florida Fish & Wildlife Conservation Commission:
      1. Hatched nest contents (including unhatched eggs) from green turtle nests.
   2. Dr. Brian Shamblin - Authorized Research Projects listed on Marine Turtle Permit #130:
      1. Hatched nest contents (including unhatched eggs) from green turtle nests.

A person whose substantial interests are affected by FWC's action may petition for an administrative proceeding (hearing) under sections 120.569 and 120.57 of the Florida Statutes. A person seeking a hearing on FWC's action shall file a petition for hearing with the agency within 21 days of receipt of written notice of the decision. The petition must contain the information and otherwise comply with section 120.569, Florida Statutes, and the uniform rules of the Florida Division of Administration, chapter 28-106, Florida Administrative Code. If the FWC receives a petition, FWC will notify the Permittee. Upon such notification, the Permittee shall cease all work authorized by this permit until the petition is resolved. The enclosed Explanation of Rights statement provides additional information as to the rights of parties whose substantial interests are or may be affected by this action.
APPENDIX B – MAPS OF SENTINEL AREAS
Sentinel Nest Marking Locations
INDIAN RIVER COUNTY, FLORIDA

- Golden Sands Beach Park
- Wabasso Beach Park
- Seagrape Trail Beach Access
- Turtle Trail Beach Access
- Tracking Station Beach Park
- Ocean Club I, II, & III
- Jaycee Beach Park
- Conn Beach Park
- Humiston Beach Park

Map Date: 2/12/2016

2016 Sentinel Locations

Map of sentinel nest marking locations in Indian River County, Florida, including locations such as Golden Sands Beach Park, Wabasso Beach Park, Seagrape Trail Beach Access, Turtle Trail Beach Access, Tracking Station Beach Park, Ocean Club I, II, & III, Jaycee Beach Park, Conn Beach Park, and Humiston Beach Park.
APPENDIX C – HURRICANE MATTHEW DAMAGE REPORT
PRELIMINARY BEACH DAMAGE ASSESSMENT
HURRICANE MATTHEW

INDIAN RIVER COUNTY
COASTAL ENGINEERING DIVISION

OCTOBER 10, 2016
REVISED OCTOBER 11, 2016
**Introduction**

The western eyewall of Hurricane Matthew passed approximately 3-5 miles east of Indian River County on October 7, 2016, with maximum sustained winds of approximately 45-55 mph and maximum recorded gusts of up to 74 mph producing 15-20 foot breaking waves along the coast and 35 to 40 feet waves offshore. This preliminary beach damage report is based on pre and post storm field surveys performed October 3, 2016 thru October 9, 2016 by the Indian River County Coastal Engineering Division. This report is based on visual inspection only – no topographic surveys were used to determine erosion estimates. Some general comments on the County beaches as a whole are provided, followed by a segment by segment review of beach conditions and damage observed. Segments are divided based on FDEP Reference Monuments (R-1 – R-119) and the County designated beach sectors 1-8.

**General Comments**

In most beach segments, the erosion was consistent with what the Florida Department of Environmental Protection (FDEP) defines as: “Condition IV: Major Dune Erosion”; dune recession greater than 10 feet. The damage throughout the recently completed Sector 3 Beach and Dune restoration project area and Sector 5 (City of Vero Beach) experienced dune recession greater than 15 feet. FDEP beach condition descriptions can be seen in Appendix A.
Estimated beach sand losses and replacement costs as a result of Hurricane Matthew:

- Sectors 1 and 2 (Managed by the Sebastian Inlet District)
  - Project length 2 miles
  - 40,000 cubic yards - $1.2 Million
- Sector 3 (Managed by Indian River County)
  - Project length 7 miles
  - 200,000 cubic yards - $4.5 Million
- Sector 5 (Managed by Indian River County/City of Vero Beach)
  - Project length 3 miles
  - 90,000 cubic yards - $2.15 Million
- All other Sectors, including Sector 7 (Managed by Indian River County)
  - Shoreline length 10 miles
  - 200,000 cubic yards - $5 Million

It is important to note that beach areas with Beach Nourishment preformed as designed by providing storm protection benefits to public and private infrastructure. The Sectors 1 and 2 Project Area is located between FDEP Reference Monuments R-6-R-17 as was recently completed in 2015. The Sector 3 Project Area is located between FDEP Reference Monuments R-20 – R-55 and was recently completed in 2015. The Sector 7 project area is located between FDEP Reference Monuments R-97 and R-108 and was completed in 2007.

Significant damage to pedestrian crosswalks within County owned Beach Parks was also observed.

- Golden Sands Beach Park
  - Southern 40 feet of ADA ramp damaged
  - Estimated repair cost - $15,000
- Wabasso Beach Park
  - 20 feet of ADA ramp damaged
  - Estimated repair cost - $5,000
- Seagrape Trail
  - Damage the lower 20 feet of crosswalk
  - Estimated repair cost - $5,000
- Tracking Station Park
  - All three crosswalk damaged
  - Estimated repair cost – $25,000

Some natural recovery of the beach is to be expected in the coming months, and profile surveys will be required to refine the estimates of damage, but the economic loss due to the observed countywide coastal erosion, is estimated at 13 million dollars. Beach profile surveys are currently, underway.
SEGMENT 1: SEBASTIAN INLET TO AMBERSAND (R-1 TO R-20)

Dune retreat of approximately 7-10 feet was observed along this segment producing 5-15 foot dune escarpments and 3 foot berm profile lowering. (Sectors 1 and 2)

10-3-16 10-9-16
Looking North R-8 (GPS -80.4377722, 27.8410161)

10-3-16 10-9-16
Looking South R-8

10-3-16 10-9-16
Looking South R-17 (GPS -80.426227, 27.8190075)
SEGMENT 2: AMBERSAND TO WABASSO BEACH PARK (R-20 TO R-40)

Significant dune retreat and berm profile lowering was observed throughout this segment. Approximately 8-10 feet of dune retreat was observed in Golden Sands Park (R-32) and Wabasso Beach Park (R-40). Approximately 10-15 feet of dune retreat was observed along the Orchid beaches (R-34 - R-37). (Sector 3)
SEGMENT 3: WABASSO BEACH PARK TO SEAGRAPE TRAIL (R-40 TO R-50)

Significant dune retreat and berm profile lowering was observed throughout this segment. Approximately 12 feet of dune retreat was observed along the Seagrape Trail beach park area (R-47-R-48). Approximately 5 feet of primary dune retreat was observed within the Baytree Community, exposing their pool foundation (R-46-47). (Sector 3)

Baytree Looking North R-47 (GPS -80.3868557, 27.745548)

SEGMENT 4: SEAGRACE TRAIL BEACH PARK TO TRACKING STATION BEACH PARK (R-50 TO R-72)

Significant dune retreat and berm profile lowering was observed throughout this segment. Approximately 15 feet of dune retreat was observed along the Carlton dunes and at Turtle Trail Beach Park (R-51+300). Approximately 10 feet of dune retreat was observed along the Tracking Station Park (R-73) dunes with significant damages to the beach crosswalks. (Sector 3)

Carlton Community looking North R-51 (GPS -80.3821371, 27.7352967)
SEGMENT 5: TRACKING STATION BEACH PARK TO RIOMAR BEACH PARK (R-72 TO R-86)

Significant dune retreat and berm profile lowering was observed throughout this segment. Approximately 20 feet of dune retreat was observed along the southern 600 feet of Conn Beach Park (R-78) shoreline undermining approximately 200 feet (R-78+800-R-79) of parking spaces (Sector 5).
SEGMENT 6: RIOMAR BEACH PARK TO SURFSIDE TERRACE (R-86 TO R-104)

Approximately 7-10 feet of dune retreat and 2-3 feet of berm profile lowering was observed along this segment.
SEGMEN T S 9-11: SOUTH BEACH PARK TO SOUTH COUNTY LINE (R-104 TO R-119)

Minor dune retreat and berm profile lowering was observed throughout this segment.

Round Island Beach Park Looking North (R-118) (GPS -80.3232023, 27.5610258)
APPENDIX A

Beach and Dune Erosion Conditions
(provides a qualitative means to describe erosion after a storm event)

CONDITION I: MINOR BEACH EROSION

CONDITION II: MINOR DUNE AND BEACH EROSION

CONDITION III: MODERATE DUNE EROSION AND BEACH PROFILE LOWERING

CONDITION IV: MAJOR DUNE EROSION

R. R. CLARK

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APPENDIX D – PRE-SEASON LIGHTING LETTER
February 15, 2016

10480/90 ETON WAY LIMITED PARTNERSHIP
C/O NRAI SERVICES, INC
1200 SOUTH PINE ISLAND ROAD
PLANTATION, FL 33324 US

**RE: COUNTY SEA TURTLE PROTECTION REGULATIONS**

Dear 10480/90 ETON WAY LIMITED PARTNERSHIP,

County records indicate you are the owner of a beachfront property located in unincorporated Indian River County. This letter is part of an annual mailing to all beachfront property owners regarding the county’s sea turtle protection regulations. Please take time to look at the information provided in this letter.

**Background**

In 1987, Indian River County adopted sea turtle protection regulations that restrict beachfront lighting during sea turtle nesting season. Nesting season runs from March 1 to October 31 each year.

Section 932.09 of the Indian River County Code of Ordinances sets forth parameters for artificial lighting, including requirements that:

- Lights illuminating buildings or associated grounds for decorative or recreational purposes shall be shielded or screened such that they are not visible from the beach, or turned off after 9:00pm during the period from March 1st to October 31st of each year.

- Lights illuminating dune crossovers or any areas oceanward of the dune line shall be turned off after 9:00pm during the period from March 1st to October 31st of each year.

- Window treatments in windows visible from the beach on single and multistory structures are required so that interior lights do not illuminate the beach. The use of tint or film on windows or awnings is preferred; however, the use of black-out draperies or shade screens are acceptable.
Beachfront lighting is regulated based on scientific documentation that such lighting can disorient sea turtle hatchlings. Disoriented hatchlings crawl toward artificial lighting instead of the ocean, and are subsequently eaten by predators, such as raccoons or stray cats, or they die from dehydration. In addition, adult turtles will frequently avoid nesting on lighted beaches.

The best way to ensure that your property does not have lights visible from the beach is to view it from various locations on the beach at night. Observations should be made from locations north and south of your property, as well as from directly east. Observations should also be made from locations low (near the water line) and high (near the dune) on the beach. If you are able to see the source of light (e.g., light bulb) within a fixture, that light is likely to cause problems for sea turtles.

Under a 1992 fine schedule approved by county resolution, failure to correct the above referenced violation(s) can result in citations assessed at $50.00 for each day of the violation after a warning notice has been issued with 24 hours to comply. Indian River County can also bring sea turtle lighting violations before the code enforcement board, which can enter an order and fines (usually $100 per day) if compliance is not achieved by a board-established compliance date. **Be advised that property owners are ultimately responsible for the actions of anyone on their property that violates lighting restrictions, including guests and renters, and property owners will be subject to penalties accordingly.**

Indian River County has the privilege of being one of the most important sea turtle nesting areas in the Western Hemisphere. In addition, the county has a federally mandated Habitat Conservation Plan (HCP) for Sea Turtles in accordance with its permit to help protect beachfront homes from storm erosion. The reduction of lighting impacts on nesting turtles is a part of the County's HCP. Therefore, your cooperation in minimizing beachfront lighting is greatly appreciated.

If you have any questions concerning sea turtle regulations, please do not hesitate to call the Indian River County Environmental Planning and Code Enforcement Division at (772) 226-1249.

Sincerely,

Roland M. DeBlois, AICP
Chief, Environmental Planning
APPENDIX E – INDIAN RIVER COUNTY LIGHTING ORDINANCE – REV. 11/15
Section 932.09. - Sea turtle protection.

(1) **Purpose.** The purpose of this section is to protect threatened and endangered sea turtles which nest along the beaches of Indian River County, Florida, by safeguarding adult and hatchling sea turtles from the impacts of light. The regulations of this section also serve as a light management mechanism in furtherance of Indian River County's Sea Turtle Habitat Conservation Plan.

(2) **New development.** It is the policy of the Indian River County board of county commissioners that no light illuminate any area of the beaches of unincorporated Indian River County, Florida, during the period of the year when sea turtles nest (March 1 to October 31). To meet this intent, building and electrical plans for construction of single-family or multifamily dwellings, commercial or other structures, parking lots, dune walkovers, and other outdoor lighting for real property, if lighting associated with such construction or development can be seen from the beach, shall be in compliance with the following:

(a) Floodlights shall be prohibited. All exterior light fixtures on the seaward or shore-perpendicular sides of buildings, or on the landward side of buildings if the fixtures are visible from the beach, shall be fitted with shields and directed downward so that no light directly or indirectly illuminates the beach. Such lighting shall be lamped with a long wavelength light source, such as amber or red light emitting diodes (LED), low pressure sodium, or true red neon. It has been recommended by the Florida Fish and Wildlife Conservation Commission that no such light source emit light below five hundred sixty (560) nanometers (nm).

(b) Pole lights shall be shielded in such a way that light will not illuminate areas other than the specific property boundaries of the subject site and shall not directly or indirectly illuminate the beach or dune area on the seaward side of the pole. Outdoor lighting shall be held to the minimum necessary for security.

(c) Low-profile downward directed luminaries, with shields if necessary, shall be used in parking lots, and such lighting shall be positioned so that no light directly or indirectly illuminates the beach.

(d) Dune crosswalks shall utilize low-profile, shielded downward directed luminaries so that no light directly or indirectly illuminates the beach.

(e) Lights on balconies shall be low-profile, shielded and downward directed so that lights will not directly or indirectly illuminate the beach.

(f) Tinted or filmed glass shall be used in windows and glass doors within line-of-sight of an observer standing anywhere on the beach on single and multistory structures.

(g) Temporary security lights at construction-sites shall not be mounted more than fifteen (15) feet above the ground. Illumination from the lights shall not spread beyond the boundary of the property being developed, and in no case shall those lights directly or indirectly illuminate the beach.

(3) **Beachfront lighting approval.** Prior to the issuance of a certificate of occupancy for any new development within view of the beach, compliance with the beachfront lighting standards set forth in this ordinance shall be approved as follows:

(a) Upon completion of the construction activities, the building contractor shall provide written certification to county staff that the beachfront lighting standards of this section have been met, and county staff shall conduct a site inspection to verify the contractor's certification.

(b) In cases where remedial action is necessary, county staff shall notify the owner or developer of the results of the inspection and shall schedule a date and time for a subsequent inspection to verify that required modifications have been made for compliance with this ordinance.

(4) **Existing development.** To meet the intent of this section, lighting of existing structures which can be seen from the beach shall be in compliance with the following:
(a) Lights illuminating buildings or associated grounds for decorative or recreational purposes shall be shielded or screened such that they do not directly or indirectly illuminate the beach, or turned off after 9:00 p.m. during the period from March 1 to October 31 of each year.

(b) Lights illuminating dune crosswalks or any areas oceanward of the landward side of the dune line shall be turned off after 9:00 p.m. during the period from March 1 to October 31 of each year and shall not directly or indirectly illuminate the beach.

(c) Security lighting shall be permitted throughout the night so long as low-profile luminaries are used and screened in such a way that those lights do not directly or indirectly illuminate the beach. Motion detector switches may be used.

(d) Window treatments in windows within line-of-sight of an observer standing anywhere on the beach on single and multistory structures are required so that interior lights do not illuminate the beach. The use of non-reflective tint or film on windows or awnings is preferred; however, the use of black-out draperies or shade screens will suffice.

(e) All exterior light fixtures on the seaward or shore-perpendicular sides of buildings, or on the landward side of buildings if the fixtures are visible from the beach, shall be lamped with a long wavelength light source, such as amber or red light emitting diodes (LED), low pressure sodium, or true red neon. It has been recommended by the Florida Fish and Wildlife Conservation Commission that no such light source emit light below five hundred sixty (560) nanometers (nm).

(5) Publicly owned lighting. Street lights and lighting at parks and other publicly owned beach access areas shall be subject to the following:

(a) Whenever possible, street lights shall be located so that the bulk of their illumination will travel away from the beach. The lights shall be equipped with shades or shields that will prevent backlighting and render them not visible from the beach.

(b) Lights at parks or other public beach access points shall be shielded or shaded.

(Ord. No. 90-16, § 1, 9-11-90; Ord. No. 94-1, §§ 8B, 8C, 1-5-94; Ord. No. 2015-015, § 2, 10-13-15)
APPENDIX F – TURTLE DIGS
Summary from the 2016 Turtle Digs held at Sexton Beach Plaza in the City of Vero Beach. All digs were held at 8 am in the same location and were performed 3 days after a nest marked for educational purposes successfully hatched. Notification of these events occurred on the Coastal Division Facebook page and through word of mouth. At the beach entrance there was a table and tent set up with display material including: a tri-fold board with updated county-wide data, specimens, framed educational posters, portfolio magazine which promote the turtle program, and educational handouts for interested guests. The activity occurred on the beach surrounding the hatched nest. One volunteer inventoried the nest, one recorded data and helped with showing nest contents to guests, and either the HCP coordinator or nesting team member gave a short presentation about sea turtle nesting in IRC, threats to their survival and ways to get involved and help protect sea turtles. If straggler hatchings were found they were released at the end of the presentation. Guests were asked to fill out a 3-question survey after the event, 14.6% of which did so.

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