UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
http://sero.nmfs.noaa.gov

F/SER31: TWD

MAY 16 2017

Chief, Fort Myers Permits Section
Jacksonville District Corps of Engineers
Department of the Army
1520 Royal Palm Square Boulevard, Suite 310
Fort Myers, Florida 33919

Dear Sir or Madam:

The enclosed Biological Opinion ("Opinion") responds to your request for consultation with us, the National Marine Fisheries Service (NMFS), pursuant to Section 7 of the Endangered Species Act (ESA) for the following action.

Permit Number	Applicant	PCTS Number	Project Types
SAJ-2015-00103 (SP-MMB)	Collier County	SER-2016-18168	Jetty Extension; Groin Refurbishment and Construction; Breakwater Construction

The Opinion considers the effects of construction and rehabilitation of erosion control structures by Collier County on the following listed species: green sea turtles, hawksbill sea turtles, Kemp's ridley sea turtles, loggerhead sea turtles, and smalltooth sawfish. NMFS concludes that the proposed action is not likely to adversely affect hawksbill sea turtles, Kemp's ridley sea turtles, or smalltooth sawfish. NMFS also concludes that the proposed action is not likely to jeopardize the continued existence of green or loggerhead sea turtles.

NMFS and the U.S. Fish and Wildlife Service (USFWS) share Federal jurisdiction for sea turtles under the ESA. NMFS has jurisdiction for sea turtles in the marine environment, and USFWS has responsibility for sea turtles on the nesting beach. Our analysis will only address activities that may affect sea turtles in the marine environment and the shoreline updrift and downdrift areas. USFWS will assess and consult with the USACE on activities affecting sea turtle nests and eggs, and hatchlings as they emerge from the nest and crawl to the water.

NMFS is providing an Incidental Take Statement (ITS) with the Opinion. The ITS describes reasonable and prudent measures NMFS considers necessary or appropriate to minimize the impact of incidental take associated with this action. The ITS also specifies nondiscretionary terms and conditions, including monitoring and reporting requirements with which the U.S. Army Corps of Engineers and Collier County must comply to carry out the reasonable and prudent measures. Incidental take from actions described or evaluated in this Opinion that complies with these terms and conditions will be exempt from the ESA's prohibition against the take of listed species.

We look forward to further cooperation with you on other USACE projects to ensure the conservation and recovery of our threatened and endangered marine species. If you have any questions regarding this consultation, please contact Dr. Thomas Dolan, Consultation Biologist, at (727) 551-5741, or by email at thomas.dolan@noaa.gov.

Sincerely,

for Roy E. Crabtree, Ph.D.
Regional Administrator

Enc.: Biological Opinion,
Collier County Sea Turtle Protection Plan as specified by the Collier County Sea Turtle Protection Plan Annual Report – 2015
Sea Turtle and Smalltooth Sawfish Construction Conditions
File: 1514-22.F.4

Endangered Species Act - Section 7 Consultation
Biological Opinion

Action Agency:	United States Army Corps of Engineers, Jacksonville District, Permit SAJ-2015-00103 (SP-MMB)
Applicant:	Collier County
Activity:	Extension of an existing riprap jetty, refurbishment of an existing groin, and construction of a new breakwater with detached groin in Naples, Collier County, Florida
Consulting Agency:	Protected Resources Division Southeast Regional Office National Marine Fisheries Service Consultation Number SER-2016-18168
Approved by:	Roy E. Crabtree, Ph.D., Regional Administrator NMFS, Southeast Regional Office St. Petersburg, Florida
Date Issued:	MAY 16 2017

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Acronyms and Abbreviations

cSEL	cumulative sound exposure level
CFR	Code of Federal Regulations
CPUE	catch per unit effort
DDT	dichlorodiphenyltrichloroethane
DNA	Deoxyribonucleic Acid
DPS	distinct population segment
DTRU	Dry Tortugas Recovery Unit
DWH	Deepwater Horizon
ESA	Endangered Species Act
FP	Fibropapillomatosis
FR	Federal Register
GADNR	Georgia Department of Natural Resources
GCRU	Greater Caribbean Recovery Unit
MHWL	mean high water line
ITS	Incidental Take Statement
NA	North Atlantic
NCWRC	North Carolina Wildlife Resources Commission
NGMRU	Northern Gulf of Mexico Recovery Unit

NMFS	National Marine Fisheries Service
NRU	Northern Recovery Unit
NWA	Northwest Atlantic Ocean (DPS of loggerhead sea turtles)
PCB	polychlorinated biphenyls
PCTS	Public Consultation Tracking System
PFC	perfluorinated chemicals
PFRU	Peninsular Florida Recovery Unit
RPMs	reasonable and prudent measures
SA	South Atlantic
SCDNR	South Carolina Department of Natural Resources
SCL	straight carapace length
STSSN	Sea Turtle Stranding and Salvage Network
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service

Units of Measurement

ac	acre(s)
cm	centimeters
°C	degree(s) Celcius
°F	degree(s) Farenheit
°N	degree(s) north (latitude)
°W	degree(s) west (longitude)
ft	foot/feet
ft^2	square foot/feet
g	gram(s)
in	inch(es)
kg	kilogram(s)
km	kilometer(s)
lb	pound(s)
lin ft	linear foot/feet
m	meter(s)
mi	mile(s)
oz	U.S. ounce
yd^3	cubic yard(s)

Background

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. § 1531 et seq.), requires each federal agency to "insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species." Section 7(a)(2) requires federal agencies to consult with the appropriate Secretary on any such action. National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) share responsibilities for administering the ESA.

Consultation is required when a federal action agency determines that a proposed action "may affect" listed species or designated critical habitat. Consultation is concluded after NMFS determines that the action is not likely to adversely affect listed species or critical habitat or issues a Biological Opinion ("Opinion") that identifies whether a proposed action is likely to jeopardize the continued existence of a listed species, or destroy or adversely modify critical habitat. The Opinion states the amount or extent of incidental take of the listed species that may occur, develops measures (i.e., reasonable and prudent measures - RPMs) to reduce the effect of take, and recommends conservation measures to further the recovery of the species. Notably, no incidental destruction or adverse modification of designated critical habitat can be authorized, and thus there are no RPMs—only reasonable and prudent alternatives that must avoid destruction or adverse modification.

This document represents NMFS's Opinion based on our review of impacts associated with the proposed action to issue a permit within Collier County, Florida. This Opinion analyzes the project's effects on threatened and endangered species and designated critical habitat, in accordance with Section 7 of the ESA. We based it on project information provided by the USACE and other sources of information, including the published literature cited herein.

1 CONSULTATION HISTORY

NMFS received a request for ESA consultation through the National Letter of Concurrence Pilot Program (Pilot) from the U.S. Army Corps of Engineers (USACE) on August 29, 2016. NMFS requested additional information on October 20, 2016. A response was received from the USACE on October 31, 2016. NMFS determined that the consultation request did not qualify for the Pilot and initiated formal consultation on October 31, 2016.

2 DESCRIPTION OF THE PROPOSED ACTION AND ACTION AREA

2.1 Proposed Action

The site of the proposed project consists of the tidal shoreline south of Doctors Pass, extending approximately 500 feet (ft) waterward and 1,000 ft southward, along Naples Beach in Naples, Collier County, Florida (Figure 1). The site is bounded at the northern end by an earthen jetty, approximately 210-ft-long, armored with riprap. To the south it is bounded by a 10-ft-wide by 100-ft-long groin that has partially washed away. Beach renourishment has been conducted at the site since 2006, but the sand eroded too quickly for the effort to be sustained.

To decrease erosion, the applicant proposes to restore the existing 10-ft-wide by 100-ft-long (1,000 square feet [ft^2]) groin and build new erosion control structures at Naples Beach, south of Doctors Pass (Figure 1). The new structures will consist of

1. A 200-linear-foot (lin ft) spur off the south side of the jetty.
2. A 260-lin-ft breakwater.
3. A 200-lin-ft low profile, detached groin.

The spur will be directed approximately southward, and will consist of approximately 962 cubic yards (yd^3) of rock, arranged in a 45-ft-wide mound. Approximately 944 yd^3 of rock will be below the mean high water line (MHWL), and approximately 18 yd^3 will be above the MHLW. The structure will cover an area of approximately 9,000 ft^2 (200 ft × 45 ft).

The breakwater will be located approximately 300 ft waterward of and oriented parallel to the shoreline. It will consist of approximately 1,476 yd^3 of rock, arranged in a 35-ft-wide mound. Approximately 1,348 yd^3 of rock will be below the MHWL, and 128 yd^3 will be above the MHWL. The structure will cover an area of approximately 9,100 ft^2 (260 ft × 35 ft).

The detached groin will extend perpendicularly from the beach toward the center of the breakwater, and will consist of approximately 373 yd^3 of rock, arranged in a 15-ft-wide mound, all of which will be below the MHWL. The structure will cover an area of approximately 3,000 ft^2 (200 ft × 15 ft).

All new construction will include a foundation consisting of geogrid and filter fabric below a bedding stone layer to support the rock structure. Construction of the spur and nearshore breakwater will be accomplished using a long-reach excavator on a barge. Groin construction and rehabilitation will be completed by a land-based excavator. Turbidity will be monitored during construction, but no turbidity controls are proposed.

The applicant will follow NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*, dated March 23, 2006. All construction workers will observe the work area for the presence of these species. All in-water operations will cease if a sea turtle or smalltooth sawfish is observed within 50 ft of construction equipment, and will not resume until the animal leaves of its own accord. Work on the beach will not take place during sea turtle nesting the season. All work will take place during daylight hours only. Completion of the project is expected to require 90 working days.

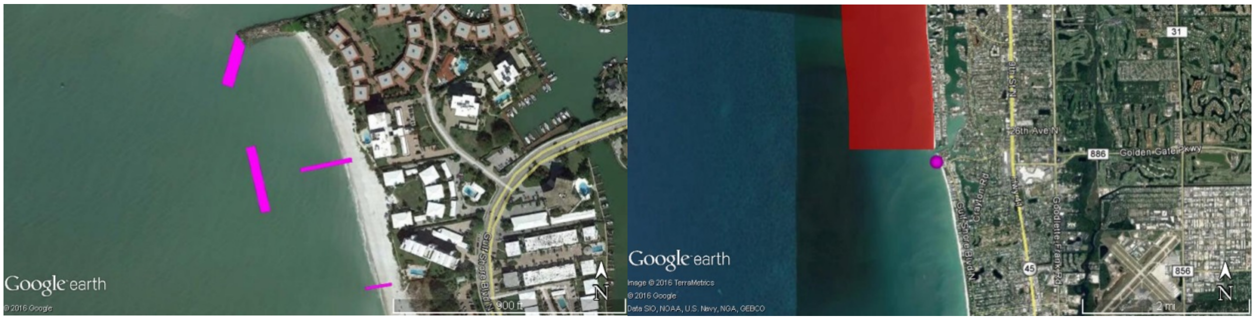

Figure 1. Images of the Doctors Pass erosion control project site showing the approximate configuration of the proposed structures, depicted in pink (left) and the proximity of the site (pink dot) to loggerhead sea turtle critical habitat Units LOGG-N-27 and LOGG-T-FL-27, depicted in red (right). (©2017 Google, TerraMetrics, data SIO, NOAA, U.S. Navy, NGA, GEBCO)

2.2 Action Area

The action area is defined by regulation as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action" (50 CFR 402.02). The project site is located north of latitude 26.170709°N, longitude 81.813364°W (North American Datum 1983). The action area includes the waters and submerged lands within and in the immediate vicinity of the project site and an approximately 100-ft-wide area around the structures to be built. The action area does not contain any critical habitat, but is located within approximately 300 ft of the southern boundaries of loggerhead sea turtle critical habitat units LOGG-N-27 and LOGG-T-FL-27 (Figure 1).

The USACE stated that benthic surveys conducted in June 2015 found that the substrate within the action area consists of unvegetated sand, inhabited by sand dollars and ragged sea hares. Two small hardbottom areas were found within 300 ft of the proposed structures, both colonized by macroalgae, sea whips, and tunicates.

3 STATUS OF LISTED SPECIES AND CRITICAL HABITAT

Table 1 below provides a list of the ESA-listed species that may be affected by the proposed action. The action area is not located in and does not contain any designated critical habitat, and there are no potential routes of effect to any designated critical habitat.

Table 1. Effects Determinations and Status for Species and Critical Habitat in or Near the Action Areas that Either the Action Agency or NMFS Believes May Be Affected by the Proposed Action

Species	ESA Listing Status	Action Agency Effect Determination	NMFS Effect Determination
Sea Turtles			
Green (North Atlantic distinct population segment [DPS])	T	NLAA	LAA/No Jeopardy
Green (South Atlantic DPS)	T	NLAA	NLAA
Hawksbill	E	NLAA	NLAA

Species	ESA Listing Status	Action Agency Effect Determination	NMFS Effect Determination
Kemp's ridley	E	NLAA	NLAA
Loggerhead (Northwest Atlantic Ocean DPS)	T	NLAA	LAA/No Jeopardy
Fish			
Smalltooth sawfish (U.S. DPS)	E	NLAA	NLAA
E = endangered; T = threatened; LAA = likely to adversely affect; NLAA = may affect, not likely to adversely affect			

We believe that smalltooth sawfish and green, hawksbill, Kemp's ridley, and loggerhead sea turtles may be within the action area and may be affected by the project.

3.1 Potential Effects That Are Not Likely to Adversely Affect Species in the Action Area

Adult and juvenile green sea turtles from the North and South Atlantic DPSs, hawksbill sea turtles, Kemp's ridley sea turtles, loggerhead sea turtles from the Northwest Atlantic DPS, and smalltooth sawfish may be found in or near the action area and may be affected by the project. We have identified the following potential effects to these species and concluded that they are not likely to be adversely affected by the proposed action for the reasons described below in Sections 3.1.1-3.1.3. The proposed action is likely to adversely affect green sea turtle hatchlings from the North Atlantic DPS and loggerhead sea turtle hatchlings from the Northwest Atlantic DPS. Therefore, these species and those effects are addressed in the remainder of the Opinion.

3.1.1 Direct Physical Effects

Direct, physical injury to sea turtles and smalltooth sawfish is not expected from construction machinery or materials because we expect sea turtles and smalltooth sawfish to detect and move away from the types of construction activities that are proposed for this project. Additionally, the applicant will implement NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*, dated March 23, 2006 (enclosed), which will provide additional protection by requiring operation of any mechanical construction equipment to immediately cease if a sea turtle or smalltooth sawfish is seen within a 50-ft radius of the equipment, and activities will not resume until the protected species has departed the project area of its own volition. Thus, direct physical impacts are extremely unlikely to occur and adverse effects are therefore discountable.

3.1.2 Foraging and Refuge

Sea turtles and smalltooth sawfish may be temporarily unable to use the project site for forage and shelter habitat due to avoidance of construction activities and related noise. We expect these effects will be temporary and of short duration (total duration of in-water work will be 1 week), intermittent (impact hammering and construction will only occur during daylight hours), and small in nature. Also, because these species are mobile, we expect that they will move away from the construction activities and forage in adjacent areas with similar habitat. Therefore, the effects to sea turtles and smalltooth sawfish from the impacts of temporary loss of foraging and refuge habitat will be insignificant.

In addition, sea turtles and smalltooth sawfish foraging behavior may be affected by the permanent loss of forage habitat. Some of the prey species on which hawksbill sea turtles and smalltooth sawfish feed (echinoderms, mollusks, and arthropods) can be found in areas of open sand. The project will reduce the amount of open sand within the action area by approximately 22,100 ft^2 (1,000-ft^2 groin + 9,000-ft^2 spur + 9,100-ft^2 breakwater + 3,000-ft^2 detached groin). However, the loss of this area of open sand will be insignificant to ESA-listed species to due to the availability of large areas of similar habitat nearby.

3.1.3 Reproduction

Only loggerhead sea turtles in the NWA DPS and green sea turtles from the NA DPS are known to nest in this area. The proposed spur and breakwater may present a physical barrier to individuals of these species seeking to use the beach adjacent to the action area for nesting. However, this effect will be insignificant due to the mobility of both species and their ability to swim around obstacles. In addition, the spur and breakwater will block less than 460 ft of the surface waters approaching the 1,000-lin-ft beach due to the slope of each rock pile, leaving more than half of the waterway open.

3.2 Status of Species Likely to be Adversely Affected

Loggerhead sea turtles in the NWA DPS and green sea turtles in the NA DPS are likely to be adversely affected by the proposed action because they are known to nest in the action area. Section 3.2.1 will address the general threats that confront all sea turtle species. Sections 3.2.2-3.2.3 will address information on the distribution, life history, population structure, abundance, population trends, and unique threats to each species of sea turtle that may be adversely affected by the proposed action.

3.2.1 General Threats Faced by All Sea Turtle Species

Sea turtles face numerous natural and man-made threats that shape their status and affect their ability to recover. Many of the threats are either the same or similar in nature for all listed sea turtle species, those identified in this section are discussed in a general sense for all sea turtles. Threat information specific to a particular species are then discussed in the corresponding status sections where appropriate.

3.2.1.1 Fisheries

Incidental bycatch in commercial fisheries is identified as a major contributor to past declines, and threat to future recovery, for all of the sea turtle species (NMFS and USFWS 1991; NMFS and USFWS 1992; NMFS and USFWS 1993; NMFS and USFWS 2008; NMFS et al. 2011). Domestic fisheries often capture, injure, and kill sea turtles at various life stages. Sea turtles in the pelagic environment are exposed to U.S. Atlantic pelagic longline fisheries. Sea turtles in the benthic environment in waters off the coastal United States are exposed to a suite of other fisheries in federal and state waters. These fishing methods include trawls, gillnets, purse seines, hook-and-line gear (including bottom longlines and vertical lines [e.g., bandit gear, handlines, and rod-reel]), pound nets, and trap fisheries. Refer to the Environmental Baseline section of this opinion for more specific information regarding federal and state managed fisheries affecting sea turtles within the action area). The Southeast U.S. shrimp fisheries have historically been the largest fishery threat to benthic sea turtles in the southeastern United States, and continue to interact with and kill large numbers of sea turtles each year.

In addition to domestic fisheries, sea turtles are subject to direct as well as incidental capture in numerous foreign fisheries, further impeding the ability of sea turtles to survive and recover on a global scale. For example, pelagic stage sea turtles, especially loggerheads and leatherbacks, circumnavigating the Atlantic are susceptible to international longline fisheries including the Azorean, Spanish, and various other fleets (Aguilar et al. 1994; Bolten et al. 1994). Bottom longlines and gillnet fishing is known to occur in many foreign waters, including (but not limited to) the northwest Atlantic, western Mediterranean, South America, West Africa, Central America, and the Caribbean. Shrimp trawl fisheries are also occurring off the shores of numerous foreign countries and pose a significant threat to sea turtles similar to the impacts seen in U.S. waters. Many unreported takes or incomplete records by foreign fleets make it difficult to characterize the total impact that international fishing pressure is having on listed sea turtles. Nevertheless, international fisheries represent a continuing threat to sea turtle survival and recovery throughout their respective ranges.

3.2.1.2 Non-Fishery In-Water Activities

There are also many non-fishery impacts affecting the status of sea turtle species, both in the ocean and on land. In nearshore waters of the United States, the construction and maintenance of federal navigation channels has been identified as a source of sea turtle mortality. Hopper dredges, which are frequently used in ocean bar channels and sometimes in harbor channels and offshore borrow areas, move relatively rapidly and can entrain and kill sea turtles (NMFS 1997). Sea turtles entering coastal or inshore areas have also been affected by entrainment in the cooling-water systems of electrical generating plants. Other nearshore threats include harassment and/or injury resulting from private and commercial vessel operations, military detonations and training exercises, in-water construction activities, and scientific research activities.

3.2.1.3 Coastal Development and Erosion Control

Coastal development can deter or interfere with nesting, affect nesting success, and degrade nesting habitats for sea turtles. Structural impacts to nesting habitat include the construction of buildings and pilings, beach armoring and renourishment, and sand extraction (Bouchard et al. 1998; Lutcavage et al. 1997). These factors may decrease the amount of nesting area available to females and change the natural behaviors of both adults and hatchlings, directly or indirectly, through loss of beach habitat or changing thermal profiles and increasing erosion, respectively (Ackerman 1997; Witherington et al. 2003; Witherington et al. 2007). In addition, coastal development is usually accompanied by artificial lighting which can alter the behavior of nesting adults (Witherington 1992) and is often fatal to emerging hatchlings that are drawn away from the water (Witherington and Bjorndal 1991). In-water erosion control structures such as breakwaters, groins, and jetties can impact nesting females and hatchling as they approach and leave the surf zone or head out to sea by creating physical blockage, concentrating predators, creating longshore currents, and disrupting of wave patterns.

3.2.1.4 Environmental Contamination

Multiple municipal, industrial, and household sources, as well as atmospheric transport, introduce various pollutants such as pesticides, hydrocarbons, organochlorides (e.g., dichlorodiphenyltrichloroethane [DDT], polychlorinated biphenyls [PCB], and perfluorinated chemicals [PFC]), and others that may cause adverse health effects to sea turtles (Garrett 2004; Grant and Ross 2002; Hartwell 2004; Iwata et al. 1993). Acute exposure to hydrocarbons from petroleum products released into the environment via oil spills and other discharges may directly injure individuals through skin contact with oils (Geraci 1990), inhalation at the water's surface, and ingesting compounds while feeding (Matkin and Saulitis 1997). Hydrocarbons also have the potential to impact prey populations, and therefore may affect listed species indirectly by reducing food availability in the action area.

The April 20, 2010, explosion of the DEEPWATER HORIZON (DWH) oil rig affected sea turtles in the Gulf of Mexico. An assessment has been completed on the injury to Gulf of Mexico marine life, including sea turtles, resulting from the spill (DWH Trustees 2015). Following the spill, juvenile Kemp's ridley, green, and loggerhead sea turtles were found in *Sargassum* algae mats in the convergence zones, where currents meet and oil collected. Sea turtles found in these areas were often coated in oil and/or had ingested oil. The spill resulted in the direct mortality of many sea turtles and may have had sublethal effects or caused environmental damage that will impact other sea turtles into the future. Information on the spill impacts to individual sea turtle species is presented in the Status of the Species sections for each species.

Marine debris is a continuing problem for sea turtles. Sea turtles living in the pelagic environment commonly eat or become entangled in marine debris (e.g., tar balls, plastic bags/pellets, balloons, and ghost fishing gear) as they feed along oceanographic fronts where debris and their natural food items converge. This is especially problematic for sea turtles that spend all or significant portions of their life cycle in the pelagic environment (i.e., leatherbacks, juvenile loggerheads, and juvenile green turtles).

3.2.1.5 Climate Change

There is a large and growing body of literature on past, present, and future impacts of global climate change, exacerbated and accelerated by human activities. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. NOAA's climate information portal provides basic background information on these and other measured or anticipated effects (see http://www.climate.gov).

Climate change impacts on sea turtles currently cannot be predicted with any degree of certainty; however, significant impacts to the hatchling sex ratios of sea turtles may result (NMFS and USFWS 2007b). In sea turtles, sex is determined by the ambient sand temperature (during the middle third of incubation) with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward higher numbers of females (NMFS and USFWS 2007b).

The effects from increased temperatures may be intensified on developed nesting beaches where shoreline armoring and construction have denuded vegetation. Erosion control structures could potentially result in the permanent loss of nesting beach habitat or deter nesting females (NRC 1990). These impacts will be exacerbated by sea level rise. If females nest on the seaward side of the erosion control structures, nests may be exposed to repeated tidal overwash (NMFS and USFWS 2007c). Sea level rise from global climate change is also a potential problem for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Baker et al. 2006; Daniels et al. 1993; Fish et al. 2005). The loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006; Baker et al. 2006).

Other changes in the marine ecosystem caused by global climate change (e.g., ocean acidification, salinity, oceanic currents, dissolved oxygen levels, nutrient distribution) could influence the distribution and abundance of lower trophic levels (e.g., phytoplankton, zooplankton, submerged aquatic vegetation, crustaceans, mollusks, forage fish) which could ultimately affect the primary foraging areas of sea turtles.

3.2.1.6 Other Threats

Predation by various land predators is a threat to developing nests and emerging hatchlings. The major natural predators of sea turtle nests are mammals, including raccoons, dogs, pigs, skunks, and badgers. Emergent hatchlings are preyed upon by these mammals as well as ghost crabs, laughing gulls, and the exotic South American fire ant (*Solenopsis invicta*). In addition to natural predation, direct harvest of eggs and adults from beaches in foreign countries continues to be a problem for various sea turtle species throughout their ranges (NMFS and USFWS 2008).

Diseases, toxic blooms from algae and other microorganisms, and cold stunning events are additional sources of mortality that can range from local and limited to wide-scale and impacting hundreds or thousands of animals.

3.2.2 Green Sea Turtles

The green sea turtle was originally listed as threatened under the ESA on July 28, 1978, except for the Florida and Pacific coast of Mexico breeding populations, which were listed as endangered. On April 6, 2016, the original listing was replaced with the listing of 11 DPSs (Figure 2) (81 FR 20057 2016). The Mediterranean, Central West Pacific, and Central South Pacific DPSs were listed as endangered. The North Atlantic, South Atlantic, Southwest Indian, North Indian, East Indian-West Pacific, Southwest Pacific, Central North Pacific, and East Pacific were listed as threatened.

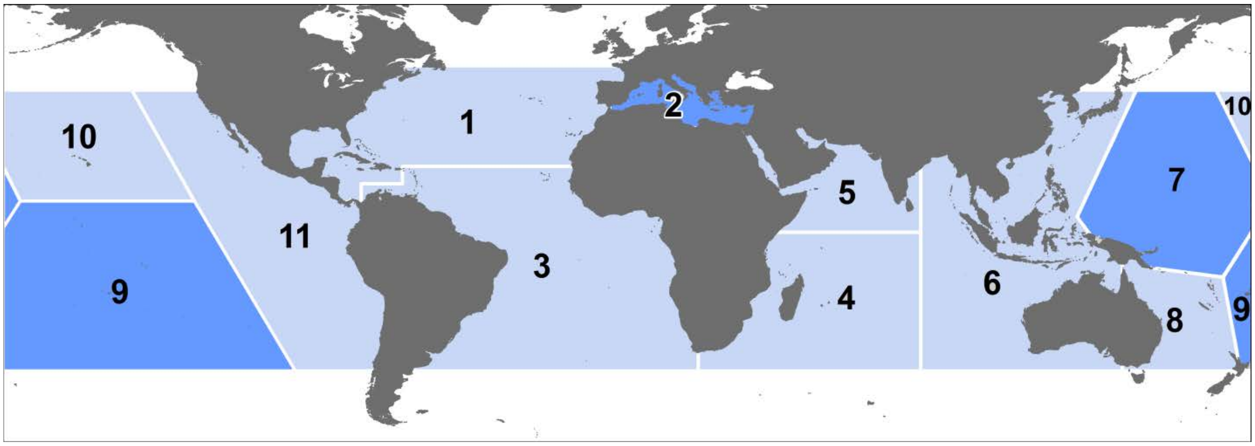

Figure 2. Threatened (light) and endangered (dark) green turtle DPSs: 1. North Atlantic, 2. Mediterranean, 3. South Atlantic, 4. Southwest Indian, 5. North Indian, 6. East Indian-West Pacific, 7. Central West Pacific, 8. Southwest Pacific, 9. Central South Pacific

3.2.2.1 Species Description and Distribution

The green sea turtle is the largest of the hardshell marine turtles, growing to a weight of 350 lb (159 kg) with a straight carapace length of greater than 3.3 ft (1 m). Green sea turtles have a smooth carapace with 4 pairs of lateral (or costal) scutes and a single pair of elongated prefrontal scales between the eyes. They typically have a black dorsal surface and a white ventral surface, although the carapace of green sea turtles in the Atlantic Ocean has been known to change in color from solid black to a variety of shades of grey, green, or brown and black in starburst or irregular patterns (Lagueux 2001).

With the exception of post-hatchlings, green sea turtles live in nearshore tropical and subtropical waters where they generally feed on marine algae and seagrasses. They have specific foraging grounds and may make large migrations between these forage sites and natal beaches for nesting (Hays et al. 2001). Green sea turtles nest on sandy beaches of mainland shores, barrier islands, coral islands, and volcanic islands in more than 80 countries worldwide (Hirth 1997). The 2 largest nesting populations are found at Tortuguero, on the Caribbean coast of Costa Rica (part of the NA DPS), and Raine Island, on the Pacific coast of Australia along the Great Barrier Reef.

Differences in mitochondrial DNA properties of green sea turtles from different nesting regions indicate there are genetic subpopulations (Bowen et al. 1992; FitzSimmons et al. 2006). Despite the genetic differences, sea turtles from separate nesting origins are commonly found mixed together on foraging grounds throughout the species' range. Within U.S. waters individuals from both the NA and SA DPSs can be found on foraging grounds. While there are currently no in-depth studies available to determine the percent of NA and SA DPS individuals in any given location, two small-scale studies provide an insight into the degree of mixing on the foraging grounds. An analysis of cold-stunned green turtles in St. Joseph Bay, Florida (northern Gulf of Mexico) found approximately 4% of individuals came from nesting stocks in the SA DPS (specifically Suriname, Aves Island, Brazil, Ascension Island, and Guinea Bissau) (Foley et al. 2007). On the Atlantic coast of Florida, a study on the foraging grounds off Hutchinson Island found that approximately 5% of the turtles sampled came from the Aves Island/Suriname nesting assemblage, which is part of the SA DPS (Bass and Witzell 2000). All of the individuals in both studies were benthic juveniles. Available information on green turtle migratory behavior indicates that long distance dispersal is only seen for juvenile turtles. This suggests that larger adult-sized turtles return to forage within the region of their natal rookeries, thereby limiting the potential for gene flow across larger scales (Monzón-Argüello et al. 2010). While all of the mainland U.S. nesting individuals are part of the NA DPS, the U.S. Caribbean nesting assemblages are split between the NA and SA DPS. Nesters in Puerto Rico are part of the NA DPS, while those in the U.S. Virgin Islands are part of the SA DPS. We do not currently have information on what percent of individuals on the U.S. Caribbean foraging grounds come from which DPS.

North Atlantic DPS Distribution

The NA DPS boundary is illustrated in Figure 2. Four regions support nesting concentrations of particular interest in the NA DPS: Costa Rica (Tortuguero), Mexico (Campeche, Yucatan, and Quintana Roo), U.S. (Florida), and Cuba. By far the most important nesting concentration for green turtles in this DPS is Tortuguero, Costa Rica. Nesting also occurs in the Bahamas, Belize, Cayman Islands, Dominican Republic, Haiti, Honduras, Jamaica, Nicaragua, Panama, Puerto Rico, Turks and Caicos Islands, and North Carolina, South Carolina, Georgia, and Texas, U.S.A. In the eastern North Atlantic, nesting has been reported in Mauritania (Fretey 2001).

The complete nesting range of NA DPS green sea turtles within the southeastern United States includes sandy beaches between Texas and North Carolina, as well as Puerto Rico (Dow et al. 2007; NMFS and USFWS 1991). The vast majority of green sea turtle nesting within the southeastern United States occurs in Florida (Johnson and Ehrhart 1994; Meylan et al. 1995). Principal U.S. nesting areas for green sea turtles are in eastern Florida, predominantly Brevard south through Broward counties.

In U.S. Atlantic and Gulf of Mexico waters, green sea turtles are distributed throughout inshore and nearshore waters from Texas to Massachusetts. Principal benthic foraging areas in the southeastern United States include Aransas Bay, Matagorda Bay, Laguna Madre, and the Gulf inlets of Texas (Doughty 1984; Hildebrand 1982; Shaver 1994), the Gulf of Mexico off Florida from Yankeetown to Tarpon Springs (Caldwell and Carr 1957), Florida Bay and the Florida Keys (Schroeder and Foley 1995), the Indian River Lagoon system in Florida (Ehrhart 1983), and the Atlantic Ocean off Florida from Brevard through Broward Counties (Guseman and Ehrhart 1992; Wershoven and Wershoven 1992). The summer developmental habitat for green sea turtles also encompasses estuarine and coastal waters from North Carolina to as far north as Long Island Sound (Musick and Limpus 1997). Additional important foraging areas in the western Atlantic include the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Mosquito Coast of Nicaragua, the Caribbean coast of Panama, scattered areas along Colombia and Brazil (Hirth 1971), and the northwestern coast of the Yucatán Peninsula.

3.2.2.2 Life History Information

Green sea turtles reproduce sexually, and mating occurs in the waters off nesting beaches and along migratory routes. Mature females return to their natal beaches (i.e., the same beaches where they were born) to lay eggs (Balazs 1982; Frazer and Ehrhart 1985) every 2-4 years while males are known to reproduce every year (Balazs 1983). In the southeastern United States, females generally nest between June and September, and peak nesting occurs in June and July

(Witherington and Ehrhart 1989b). During the nesting season, females nest at approximately 2-week intervals, laying an average of 3-4 clutches (Johnson and Ehrhart 1996). Clutch size often varies among subpopulations, but mean clutch size is approximately 110-115 eggs. In Florida, green sea turtle nests contain an average of 136 eggs (Witherington and Ehrhart 1989b). Eggs incubate for approximately 2 months before hatching. Hatchling green sea turtles are approximately 2 inches (5 cm) in length and weigh approximately 0.9 ounces (25 grams). Survivorship at any particular nesting site is greatly influenced by the level of man-made stressors, with the more pristine and less disturbed nesting sites (e.g., along the Great Barrier Reef in Australia) showing higher survivorship values than nesting sites known to be highly disturbed (e.g., Nicaragua) (Campell and Lagueux 2005; Chaloupka and Limpus 2005).

After emerging from the nest, hatchlings swim to offshore areas and go through a post-hatchling pelagic stage where they are believed to live for several years. During this life stage, green sea turtles feed close to the surface on a variety of marine algae and other life associated with drift lines and debris. This early oceanic phase remains one of the most poorly understood aspects of green sea turtle life history (NMFS and USFWS 2007a). Green sea turtles exhibit particularly slow growth rates of about 0.4-2 inches (1-5 cm) per year (Green 1993), which may be attributed to their largely herbivorous, low-net energy diet (Bjorndal 1982). At approximately 8-10 inches (20-25 cm) carapace length, juveniles leave the pelagic environment and enter nearshore developmental habitats such as protected lagoons and open coastal areas rich in sea grass and marine algae. Growth studies using skeletochronology indicate that green sea turtles in the western Atlantic shift from the oceanic phase to nearshore developmental habitats after approximately 5-6 years (Bresette et al. 2006; Zug and Glor 1998). Within the developmental habitats, juveniles begin the switch to a more herbivorous diet, and by adulthood feed almost exclusively on seagrasses and algae (Rebel 1974), although some populations are known to also feed heavily on invertebrates (Carballo et al. 2002). Green sea turtles mature slowly, requiring 20-50 years to reach sexual maturity (Chaloupka and Musick 1997; Hirth 1997).

While in coastal habitats, green sea turtles exhibit site fidelity to specific foraging and nesting grounds, and it is clear they are capable of “homing in” on these sites if displaced (McMichael et al. 2003). Reproductive migrations of Florida green sea turtles have been identified through flipper tagging and/or satellite telemetry. Based on these studies, the majority of adult female Florida green sea turtles are believed to reside in nearshore foraging areas throughout the Florida Keys and in the waters southwest of Cape Sable, and some post-nesting turtles also reside in Bahamian waters as well (NMFS and USFWS 2007a).

3.2.2.3 North Atlantic DPS Status and Population Dynamics

Accurate population estimates for marine turtles do not exist because of the difficulty in sampling turtles over their geographic ranges and within their marine environments. Nonetheless, researchers have used nesting data to study trends in reproducing sea turtles over time. A summary of nesting trends and nester abundance is provided in the most recent status review for the species (Seminoff et al. 2015), with information for the North Atlantic DPS.

The NA DPS is the largest of the 11 green turtle DPSs, with an estimated nester abundance of over 167,000 adult females from 73 nesting sites. Overall this DPS is also the most data rich. Eight of the sites have high levels of abundance (i.e., >1000 nesters), located in Costa Rica, Cuba, Mexico, and Florida. All major nesting populations demonstrate long-term increases in abundance (Seminoff et al. 2015).

Tortuguero, Costa Rica is by far the predominant nesting site, accounting for an estimated 79% of nesting for the DPS (Seminoff et al. 2015). Nesting at Tortuguero appears to have been increasing since the 1970's, when monitoring began. For instance, from 1971-1975 there were approximately 41,250 average annual emergences documented and this number increased to an average of 72,200 emergences from 1992-1996 (Bjorndal et al. 1999). Troëng and Rankin (2005) collected nest counts from 1999-2003 and also reported increasing trends in the population consistent with the earlier studies, with nest count data suggesting 17,402-37,290 nesting females per year (NMFS and USFWS 2007a). Modeling by Chaloupka et al. (2008) using data sets of 25 years or more resulted in an estimate of the Tortuguero, Costa Rica population's growing at 4.9% annually.

In the continental United States, green sea turtle nesting occurs along the Atlantic coast, primarily along the central and southeast coast of Florida where an estimated 200-1,100 females nest each year (Meylan et al. 1994; Weishampel et al. 2003). Occasional nesting has also been documented along the Gulf Coast of Florida (Meylan et al. 1995). Green sea turtle nesting is documented annually on beaches of North Carolina, South Carolina, and Georgia, though nesting is found in low quantities (nesting databases maintained on www.seaturtle.org).

In Florida, index beaches were established to standardize data collection methods and effort on key nesting beaches. Since establishment of the index beaches in 1989, the pattern of green sea turtle nesting has generally shown biennial peaks in abundance with a positive trend during the 10 years of regular monitoring (Figure 3). According to data collected from Florida's index nesting beach survey from 1989-2015, green sea turtle nest counts across Florida have increased approximately ten-fold from a low of 267 in the early 1990s to a high of 27,975 in 2015. Two consecutive years of nesting declines in 2008 and 2009 caused some concern, but this was followed by increases in 2010 and 2011, and a return to the trend of biennial peaks in abundance thereafter (Figure 3). Modeling by Chaloupka et al. (2008) using data sets of 25 years or more has resulted in an estimate of the Florida nesting stock at the Archie Carr National Wildlife Refuge growing at an annual rate of 13.9%.

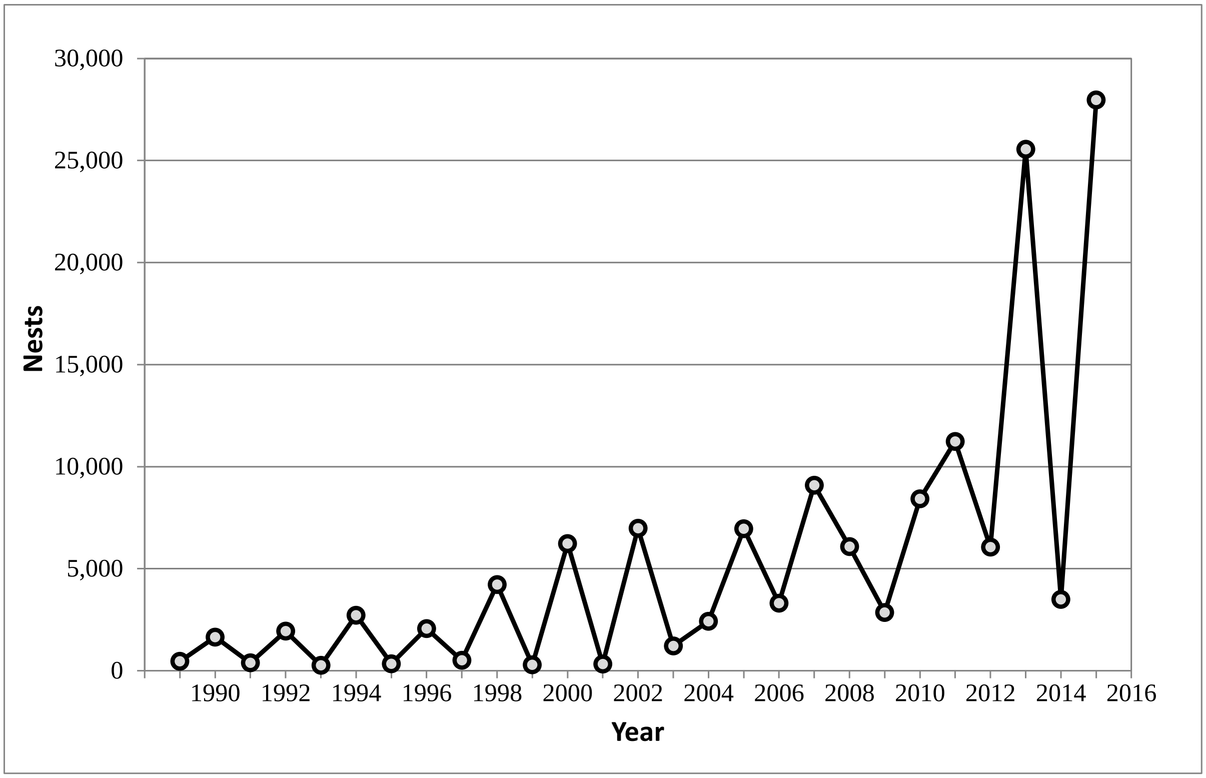

Figure 3. Green sea turtle nesting at Florida index beaches since 1989

Similar to the nesting trend found in Florida, in-water studies in Florida have also recorded increases in green turtle captures at the Indian River Lagoon site, with a 661 percent increase over 24 years (Ehrhart et al. 2007), and the St Lucie Power Plant site, with a significant increase in the annual rate of capture of immature green turtles (SCL<90 cm) from 1977 to 2002 or 26 years (3,557 green turtles total; M. Bressette, Inwater Research Group, unpubl. data; (Witherington et al. 2006).

3.2.2.4 Threats

The principal cause of past declines and extirpations of green sea turtle assemblages has been the overexploitation of the species for food and other products. Although intentional take of green sea turtles and their eggs is not extensive within the southeastern United States, green sea turtles that nest and forage in the region may spend large portions of their life history outside the region and outside U.S. jurisdiction, where exploitation is still a threat. Green sea turtles also face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, oceanic events such as cold-stunning, pollution (e.g., plastics, petroleum products, petrochemicals), ecosystem alterations (e.g., nesting beach development, beach nourishment and shoreline stabilization, vegetation changes), poaching, global climate change, fisheries interactions, natural predation, and disease. A discussion on general sea turtle threats can be found in Section 3.2.1.

In addition to general threats, green sea turtles are susceptible to natural mortality from Fibropapillomatosis (FP) disease. FP results in the growth of tumors on soft external tissues (flippers, neck, tail, etc.), the carapace, the eyes, the mouth, and internal organs (gastrointestinal tract, heart, lungs, etc.) of turtles (Aguirre et al. 2002; Herbst 1994; Jacobson et al. 1989). These tumors range in size from 0.04 inches (0.1 cm) to greater than 11.81 inches (30 cm) in diameter and may affect swimming, vision, feeding, and organ function (Aguirre et al. 2002; Herbst 1994; Jacobson et al. 1989). Presently, scientists are unsure of the exact mechanism causing this disease, though it is believed to be related to both an infectious agent, such as a virus (Herbst et al. 1995), and environmental conditions (e.g., habitat degradation, pollution, low wave energy, and shallow water (Foley et al. 2005). FP is cosmopolitan, but it has been found to affect large numbers of animals in specific areas, including Hawaii and Florida (Herbst 1994; Jacobson 1990; Jacobson et al. 1991).

Cold-stunning is another natural threat to green sea turtles. Although it is not considered a major source of mortality in most cases, as temperatures fall below 46.4°-50°F (8°-10°C) turtles may lose their ability to swim and dive, often floating to the surface. The rate of cooling that precipitates cold-stunning appears to be the primary threat, rather than the water temperature itself (Milton and Lutz 2003). Sea turtles that overwinter in inshore waters are most susceptible to cold-stunning because temperature changes are most rapid in shallow water (Witherington and Ehrhart 1989a). During January 2010, an unusually large cold-stunning event in the southeastern United States resulted in around 4,600 sea turtles, mostly greens, found cold-stunned, and hundreds found dead or dying. A large cold-stunning event occurred in the western Gulf of Mexico in February 2011, resulting in approximately 1,650 green sea turtles found cold-stunned in Texas. Of these, approximately 620 were found dead or died after stranding, while approximately 1,030 turtles were rehabilitated and released. During this same time frame, approximately 340 green sea turtles were found cold-stunned in Mexico, though approximately 300 of those were subsequently rehabilitated and released.

Whereas oil spill impacts are discussed generally for all species in Section 3.2.1, specific impacts of the DWH spill on green sea turtles are considered here. Impacts to green sea turtles occurred to offshore small juveniles only. A total of 154,000 small juvenile greens (36.6% of the total small juvenile sea turtle exposures to oil from the spill) were estimated to have been exposed to oil. A large number of small juveniles were removed from the population, as 57,300 small juveniles greens are estimated to have died as a result of the exposure. A total of 4 nests (580 eggs) were also translocated during response efforts, with 455 hatchlings released (the fate of which is unknown) (DWH Trustees 2015). Additional unquantified effects may have included inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources which could lead to compromised growth and/or reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred.

While green turtles regularly use the northern Gulf of Mexico, they have a widespread distribution throughout the entire Gulf of Mexico, Caribbean, and Atlantic, and the proportion of the population using the northern Gulf of Mexico at any given time is relatively low. Although it is known that adverse impacts occurred and numbers of animals in the Gulf of Mexico were reduced as a result of the Deepwater Horizon oil spill of 2010 (DWH), the relative proportion of the population that is expected to have been exposed to and directly impacted by the DWH event, as well as the impacts being primarily to smaller juveniles (lower reproductive value than adults and large juveniles), reduces the impact to the overall population. It is unclear what impact these losses may have caused on a population level, but it is not expected to have had a large impact on the population trajectory moving forward. However, recovery of green turtle numbers equivalent to what was lost in the northern Gulf of Mexico as a result of the spill will likely take decades of sustained efforts to reduce the existing threats and enhance survivorship of multiple life stages (DWH Trustees 2015).

3.2.3 Loggerhead Sea Turtles

The loggerhead sea turtle was listed as a threatened species throughout its global range on July 28, 1978. NMFS and USFWS published a Final Rule which designated 9 DPSs for loggerhead sea turtles (76 FR 58868, September 22, 2011, and effective October 24, 2011). This rule listed the following DPSs: (1) Northwest Atlantic Ocean (threatened), (2) Northeast Atlantic Ocean (endangered), (3) South Atlantic Ocean (threatened), (4) Mediterranean Sea (endangered), (5) North Pacific Ocean (endangered), (6) South Pacific Ocean (endangered), (7) North Indian Ocean (endangered), (8) Southeast Indo-Pacific Ocean (endangered), and (9) Southwest Indian Ocean (threatened). The Northwest Atlantic Ocean (NWA) DPS is the only one that occurs within the action area, and therefore it is the only one considered in this Opinion.

3.2.3.1 Species Description and Distribution

Loggerheads are large sea turtles. Adults in the southeast United States average about 3 ft (92 cm) long, measured as a straight carapace length (SCL), and weigh approximately 255 lb (116 kg) (Ehrhart and Yoder 1978). Adult and subadult loggerhead sea turtles typically have a light yellow plastron and a reddish brown carapace covered by non-overlapping scutes that meet along seam lines. They typically have 11 or 12 pairs of marginal scutes, 5 pairs of costals, 5 vertebrals, and a nuchal (precentral) scute that is in contact with the first pair of costal scutes (Dodd Jr. 1988).

The loggerhead sea turtle inhabits continental shelf and estuarine environments throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans (Dodd Jr. 1988). Habitat uses within these areas vary by life stage. Juveniles are omnivorous and forage on crabs, mollusks, jellyfish, and vegetation at or near the surface (Dodd Jr. 1988). Subadult and adult loggerheads are primarily found in coastal waters and eat benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats.

The majority of loggerhead nesting occurs at the western rims of the Atlantic and Indian Oceans concentrated in the north and south temperate zones and subtropics (NRC 1990). For the NWA DPS, most nesting occurs along the coast of the United States, from southern Virginia to Alabama. Additional nesting beaches for this DPS are found along the northern and western Gulf of Mexico, eastern Yucatán Peninsula, at Cay Sal Bank in the eastern Bahamas (Addison 1997; Addison and Morford 1996), off the southwestern coast of Cuba (Moncada Gavilan 2001), and along the coasts of Central America, Colombia, Venezuela, and the eastern Caribbean Islands.

Non-nesting, adult female loggerheads are reported throughout the U.S. Atlantic, Gulf of Mexico, and Caribbean Sea. Little is known about the distribution of adult males who are seasonally abundant near nesting beaches. Aerial surveys suggest that loggerheads as a whole are distributed in U.S. waters as follows: 54% off the southeast U.S. coast, 29% off the northeast U.S. coast, 12% in the eastern Gulf of Mexico, and 5% in the western Gulf of Mexico (TEWG 1998).

Within the NWA DPS, most loggerhead sea turtles nest from North Carolina to Florida and along the Gulf Coast of Florida. Previous Section 7 analyses have recognized at least 5 western Atlantic subpopulations, divided geographically as follows: (1) a Northern nesting subpopulation, occurring from North Carolina to northeast Florida at about 29ºN; (2) a South Florida nesting subpopulation, occurring from 29°N on the east coast of the state to Sarasota on the west coast; (3) a Florida Panhandle nesting subpopulation, occurring at Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán nesting subpopulation, occurring on the eastern Yucatán Peninsula, Mexico (Márquez M. 1990; TEWG 2000); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (NMFS 2001).

The recovery plan for the Northwest Atlantic population of loggerhead sea turtles concluded that there is no genetic distinction between loggerheads nesting on adjacent beaches along the Florida Peninsula. It also concluded that specific boundaries for subpopulations could not be designated based on genetic differences alone. Thus, the recovery plan uses a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries, in addition to genetic differences, to identify recovery units. The recovery units are as follows: (1) the Northern Recovery Unit (Florida/Georgia border north through southern Virginia), (2) the Peninsular Florida Recovery Unit (Florida/Georgia border through Pinellas County, Florida), (3) the Dry Tortugas Recovery Unit (islands located west of Key West, Florida), (4) the Northern Gulf of Mexico Recovery Unit (Franklin County, Florida, through Texas), and (5) the Greater Caribbean Recovery Unit (Mexico through French Guiana, the Bahamas, Lesser Antilles, and Greater Antilles) (NMFS and USFWS 2008). The recovery plan concluded that all recovery units are essential to the recovery of the species. Although the recovery plan was written prior to the listing of the NWA DPS, the recovery units for what was then termed the Northwest Atlantic population apply to the NWA DPS.

3.2.3.2 Life History Information

The Northwest Atlantic Loggerhead Recovery Team defined the following 8 life stages for the loggerhead life cycle, which include the ecosystems those stages generally use: (1) egg (terrestrial zone), (2) hatchling stage (terrestrial zone), (3) hatchling swim frenzy and transitional stage (neritic zone[1]), (4) juvenile stage (oceanic zone), (5) juvenile stage (neritic zone), (6) adult stage (oceanic zone), (7) adult stage (neritic zone), and (8) nesting female (terrestrial zone) (NMFS and USFWS 2008). Loggerheads are long-lived animals. They reach sexual maturity between 20-38 years of age, although age of maturity varies widely among populations (Frazer and Ehrhart 1985; NMFS 2001). The annual mating season occurs from late March to early

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[1] Neritic refers to the nearshore marine environment from the surface to the sea floor where water depths do not exceed 200 meters.

June, and female turtles lay eggs throughout the summer months. Females deposit an average of 4.1 nests within a nesting season (Murphy and Hopkins 1984), but an individual female only nests every 3.7 years on average (Tucker 2010). Each nest contains an average of 100-126 eggs (Dodd Jr. 1988) which incubate for 42-75 days before hatching (NMFS and USFWS 2008). Loggerhead hatchlings are 1.5-2 inches long and weigh about 0.7 oz. (20 g).

As post-hatchlings, loggerheads hatched on U.S. beaches enter the "oceanic juvenile" life stage, migrating offshore and becoming associated with *Sargassum* habitats, driftlines, and other convergence zones (Carr 1986; Conant et al. 2009; Witherington 2002). Oceanic juveniles grow at rates of 1-2 inches (2.9-5.4 cm) per year (Bjorndal et al. 2003; Snover 2002) over a period as long as 7-12 years (Bolten et al. 1998) before moving to more coastal habitats. Studies have suggested that not all loggerhead sea turtles follow the model of circumnavigating the North Atlantic Gyre as pelagic juveniles, followed by permanent settlement into benthic environments (Bolten and Witherington 2003; Laurent et al. 1998). These studies suggest some turtles may either remain in the oceanic habitat in the North Atlantic longer than hypothesized, or they move back and forth between oceanic and coastal habitats interchangeably (Witzell 2002). Stranding records indicate that when immature loggerheads reach 15-24 in (40-60 cm) SCL, they begin to reside in coastal inshore waters of the continental shelf throughout the U.S. Atlantic and Gulf of Mexico (Witzell 2002).

After departing the oceanic zone, neritic juvenile loggerheads in the Northwest Atlantic inhabit continental shelf waters from Cape Cod Bay, Massachusetts, south through Florida, The Bahamas, Cuba, and the Gulf of Mexico. Estuarine waters of the United States, including areas such as Long Island Sound, Chesapeake Bay, Pamlico and Core Sounds, Mosquito and Indian River Lagoons, Biscayne Bay, Florida Bay, as well as numerous embayments fringing the Gulf of Mexico, comprise important inshore habitat. Along the Atlantic and Gulf of Mexico shoreline, essentially all shelf waters are inhabited by loggerheads (Conant et al. 2009).

Like juveniles, non-nesting adult loggerheads also use the neritic zone. However, these adult loggerheads do not use the relatively enclosed shallow-water estuarine habitats with limited ocean access as frequently as juveniles. Areas such as Pamlico Sound, North Carolina, and the Indian River Lagoon, Florida, are regularly used by juveniles but not by adult loggerheads. Adult loggerheads do tend to use estuarine areas with more open ocean access, such as the Chesapeake Bay in the U.S. mid-Atlantic. Shallow-water habitats with large expanses of open ocean access, such as Florida Bay, provide year-round resident foraging areas for significant numbers of male and female adult loggerheads (Conant et al. 2009).

Offshore, adults primarily inhabit continental shelf waters, from New York south through Florida, The Bahamas, Cuba, and the Gulf of Mexico. Seasonal use of mid-Atlantic shelf waters, especially offshore New Jersey, Delaware, and Virginia during summer months, and offshore shelf waters, such as Onslow Bay (off the North Carolina coast), during winter months has also been documented (Hawkes et al. 2007) Georgia Department of Natural Resources, unpublished data; South Carolina Department of Natural Resources, unpublished data). Satellite telemetry has identified the shelf waters along the west Florida coast, The Bahamas, Cuba, and the Yucatán Peninsula as important resident areas for adult female loggerheads that nest in Florida (Foley et al. 2008; Girard et al. 2009; Hart et al. 2012). The southern edge of the Grand Bahama Bank is important habitat for loggerheads nesting on the Cay Sal Bank in The Bahamas, but nesting females are also resident in the bights of Eleuthera, Long Island, and Ragged Islands. They also reside in Florida Bay in the United States, and along the north coast of Cuba (A. Bolten and K. Bjorndal, University of Florida, unpublished data). Moncada et al. (2010) report the recapture of 5 adult female loggerheads in Cuban waters originally flipper-tagged in Quintana Roo, Mexico, which indicates that Cuban shelf waters likely also provide foraging habitat for adult females that nest in Mexico.

3.2.3.3 Status and Population Dynamics

A number of stock assessments and similar reviews (Conant et al. 2009; Heppell et al. 2003; NMFS-SEFSC 2009; NMFS 2001; NMFS and USFWS 2008; TEWG 1998; TEWG 2000; TEWG 2009) have examined the stock status of loggerheads in the Atlantic Ocean, but none have been able to develop a reliable estimate of absolute population size.

Numbers of nests and nesting females can vary widely from year to year. Nesting beach surveys, though, can provide a reliable assessment of trends in the adult female population, due to the strong nest site fidelity of female loggerhead sea turtles, as long as such studies are sufficiently long and survey effort and methods are standardized (e.g., (NMFS and USFWS 2008). NMFS and USFWS (2008) concluded that the lack of change in 2 important demographic parameters of loggerheads, remigration interval and clutch frequency, indicate that time series on numbers of nests can provide reliable information on trends in the female population.

Peninsular Florida Recovery Unit

The Peninsular Florida Recovery Unit (PFRU) is the largest loggerhead nesting assemblage in the Northwest Atlantic. A near-complete nest census (all beaches including index nesting beaches) undertaken from 1989 to 2007 showed an average of 64,513 loggerhead nests per year, representing approximately 15,735 nesting females per year (NMFS and USFWS 2008). The statewide estimated total for 2015 was 89,295 nests (FWRI nesting database).

In addition to the total nest count estimates, the Florida Fish and Wildlife Research Institute (FWRI) uses an index nesting beach survey method. The index survey uses standardized data-collection criteria to measure seasonal nesting and allow accurate comparisons between beaches and between years. This provides a better tool for understanding the nesting trends (Figure 4). FWRI performed a detailed analysis of the long-term (1989-2016) loggerhead index nesting data (FWRI 2016). Over that time period, 3 distinct trends were identified. From 1989-1998, there was a 24% increase that was followed by a sharp decline over the subsequent 9 years. A large increase in loggerhead nesting has occurred since, as indicated by the 71% increase in nesting over the 10-year period from 2007-2016. Nesting in 2016 also represents a new record for loggerheads on the core index beaches. FWRI examined the trend from the 1998 nesting high through 2016 and found that the decade-long post-1998 decline was replaced with a slight but nonsignificant increasing trend. Based on the data from 1989 through 2016, FWRI concluded that there was an overall positive change in the nest counts although it was not statistically significant due to the wide variability during 2012-2016, resulting in widening confidence intervals.

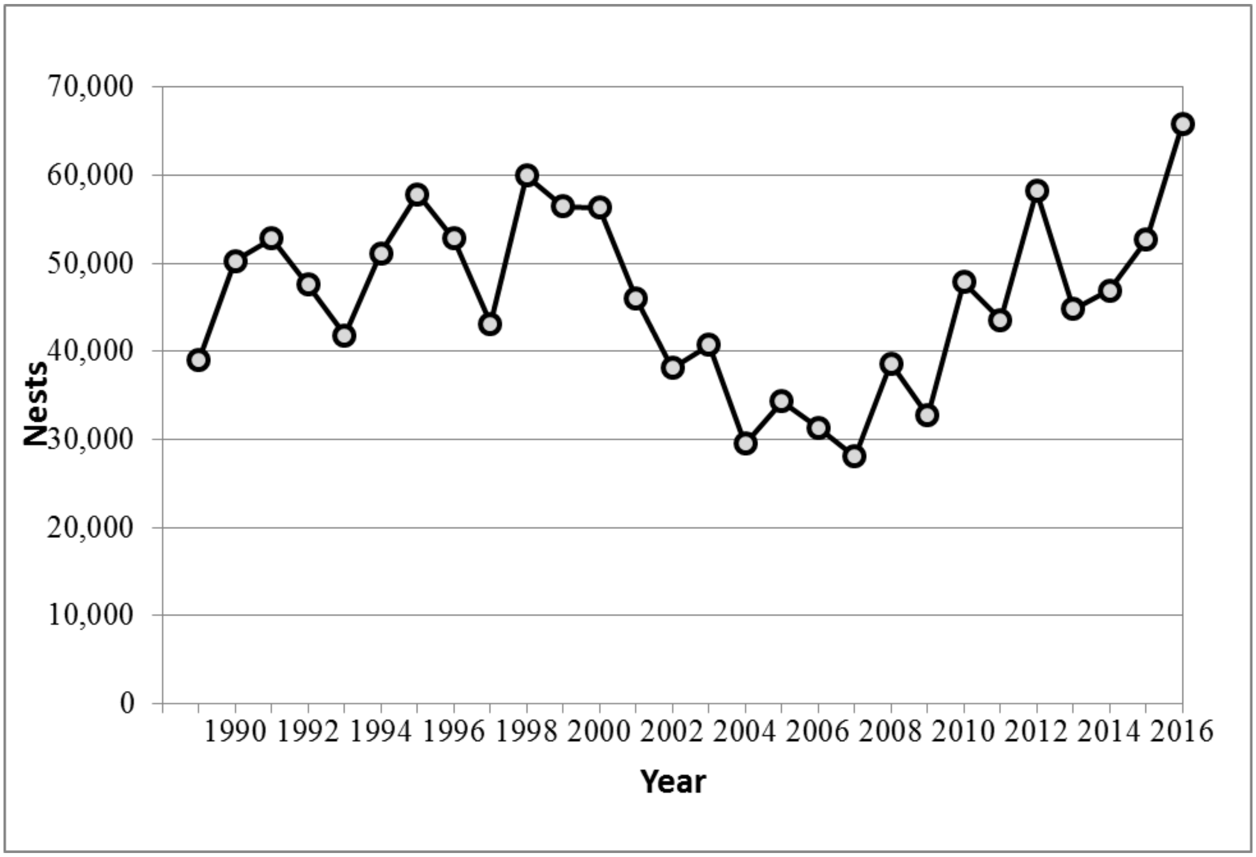

Figure 4. Loggerhead sea turtle nesting at Florida index beaches since 1989

Northern Recovery Unit

Annual nest totals from beaches within the Northern Recovery Unit (NRU) averaged 5,215 nests from 1989-2008, a period of near-complete surveys of NRU nesting beaches (Georgia Department of Natural Resources [GADNR] unpublished data, North Carolina Wildlife Resources Commission [NCWRC] unpublished data, South Carolina Department of Natural Resources [SCDNR] unpublished data), and represent approximately 1,272 nesting females per year, assuming 4.1 nests per female (Murphy and Hopkins 1984). The loggerhead nesting trend from daily beach surveys showed a significant decline of 1.3% annually from 1989-2008. Nest totals from aerial surveys conducted by SCDNR showed a 1.9% annual decline in nesting in South Carolina from 1980-2008. Overall, there are strong statistical data to suggest the NRU had experienced a long-term decline over that period of time.

Data since that analysis (Table 2) are showing improved nesting numbers and a departure from the declining trend. Georgia nesting has rebounded to show the first statistically significant increasing trend since comprehensive nesting surveys began in 1989 (GADNR 2015; GADNR 2016). South Carolina and North Carolina nesting have also begun to shift away from the previous declining trend. Loggerhead nesting in Georgia, South Carolina, and North Carolina all broke records in 2015 and then topped those records again in 2016.

Table 2. Total Number of NRU Loggerhead Nests (GADNR, SCDNR, and NCWRC nesting datasets compiled at Seaturtle.org)

Nests Recorded	2008	2009	2010	2011	2012	2013	2014	2015	2016
Georgia	1,649	998	1,760	1,992	2,241	2,289	1,196	2,319	3,265
South Carolina	4,500	2,182	3,141	4,015	4,615	5,193	2,083	5,104	6,443
North Carolina	841	302	856	950	1,074	1,260	542	1,254	1,612
Total	**6,990**	**3,472**	**5,757**	**6,957**	**7,930**	**8,742**	**3,821**	**8,677**	**11,320**

South Carolina also conducts an index beach nesting survey similar to the one described for Florida (SCDNR 2013). Although the survey only includes a subset of nesting, the standardized effort and locations allow for a better representation of the nesting trend over time. Increases in nesting were seen for the period from 2009-2012, and 2012 shows the highest index nesting total since the start of the program (Figure 5).

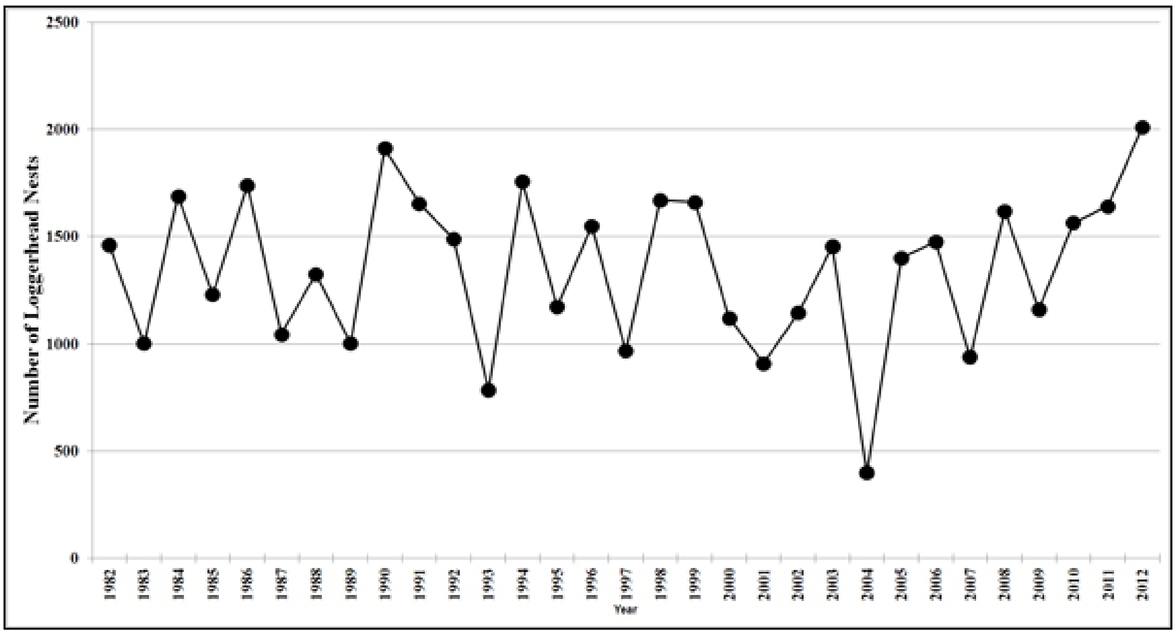

Figure 5. South Carolina index nesting beach counts for loggerhead sea turtles, reproduced from (SCDNR 2013)

<u>Other Northwest Atlantic DPS Recovery Units</u>

The remaining 3 recovery units—Dry Tortugas (DTRU), Northern Gulf of Mexico (NGMRU), and Greater Caribbean (GCRU)—are much smaller nesting assemblages, but they are still considered essential to the continued existence of the species. Nesting surveys for the DTRU are conducted as part of Florida's statewide survey program. Survey effort was relatively stable during the 9-year period from 1995-2004, although the 2002 year was missed. Nest counts ranged from 168-270, with a mean of 246, but there was no detectable trend during this period (NMFS and USFWS 2008). Nest counts for the NGMRU are focused on index beaches rather than all beaches where nesting occurs. Analysis of the 12-year dataset (1997-2008) of index nesting beaches in the area shows a statistically significant declining trend of 4.7% annually. Nesting on the Florida Panhandle index beaches, which represents the majority of NGMRU nesting, had shown a large increase in 2008, but then declined again in 2009 and 2010 before rising back to a level similar to the 2003-2007 average in 2011. Nesting survey effort has been inconsistent among the GCRU nesting beaches, and no trend can be determined for this subpopulation (NMFS and USFWS 2008). Zurita et al. (2003) found a statistically significant increase in the number of nests on 7 of the beaches on Quintana Roo, Mexico, from 1987-2001, where survey effort was consistent during the period. Nonetheless, nesting has declined since 2001, and the previously reported increasing trend appears to not have been sustained (NMFS and USFWS 2008).

In-water Trends

Nesting data are the best current indicator of sea turtle population trends, but in-water data also provide some insight. In-water research suggests the abundance of neritic juvenile loggerheads is steady or increasing. Although Ehrhart et al. (2007) found no significant regression-line trend in a long-term dataset, researchers have observed notable increases in catch per unit effort (CPUE) (Arendt et al. 2009; Ehrhart et al. 2007; Epperly et al. 2007). Researchers believe that this increase in CPUE is likely linked to an increase in juvenile abundance, although it is unclear whether this increase in abundance represents a true population increase among juveniles or merely a shift in spatial occurrence. Bjorndal et al. (2005), cited in NMFS and USFWS (2008), caution about extrapolating localized in-water trends to the broader population and relating localized trends in neritic sites to population trends at nesting beaches. The apparent overall increase in the abundance of neritic loggerheads in the southeastern United States may be due to increased abundance of the largest oceanic/neritic juveniles (historically referred to as small benthic juveniles), which could indicate a relatively large number of individuals around the same age may mature in the near future (TEWG 2009). In-water studies throughout the eastern United States, however, indicate a substantial decrease in the abundance of the smallest oceanic/neritic juvenile loggerheads, a pattern corroborated by stranding data (TEWG 2009).

Population Estimate

The NMFS Southeast Fisheries Science Center developed a preliminary stage/age demographic model to help determine the estimated impacts of mortality reductions on loggerhead sea turtle population dynamics (NMFS-SEFSC 2009). The model uses the range of published information for the various parameters including mortality by stage, stage duration (years in a stage), and fecundity parameters such as eggs per nest, nests per nesting female, hatchling emergence success, sex ratio, and remigration interval. Resulting trajectories of model runs for each individual recovery unit, and the western North Atlantic population as a whole, were found to be very similar. The model run estimates from the adult female population size for the western North Atlantic (from the 2004-2008 time frame), suggest the adult female population size is approximately 20,000-40,000 individuals, with a low likelihood of females' numbering up to 70,000 (NMFS-SEFSC 2009). A less robust estimate for total benthic females in the western North Atlantic was also obtained, yielding approximately 30,000-300,000 individuals, up to less than 1 million (NMFS-SEFSC 2009). A preliminary regional abundance survey of loggerheads within the northwestern Atlantic continental shelf for positively identified loggerhead in all strata estimated about 588,000 loggerheads (interquartile range of 382,000-817,000). When correcting for unidentified turtles in proportion to the ratio of identified turtles, the estimate increased to about 801,000 loggerheads (interquartile range of 521,000-1,111,000) (NMFS-NEFSC 2011).

3.2.3.4 Threats (Specific to Loggerhead Sea Turtles)

The threats faced by loggerhead sea turtles are well summarized in the general discussion of threats in Section 3.2.1. Yet the impact of fishery interactions is a point of further emphasis for this species. The joint NMFS and USFWS Loggerhead Biological Review Team determined that the greatest threats to the NWA DPS of loggerheads result from cumulative fishery bycatch in neritic and oceanic habitats (Conant et al. 2009).

Regarding the impacts of pollution, loggerheads may be particularly affected by organochlorine contaminants; they have the highest organochlorine concentrations (Storelli et al. 2008) and metal loads (D'Ilio et al. 2011) in sampled tissues among the sea turtle species. It is thought that dietary preferences were likely to be the main differentiating factor among sea turtle species. Storelli et al. (2008) analyzed tissues from stranded loggerhead sea turtles and found that mercury accumulates in sea turtle livers while cadmium accumulates in their kidneys, as has been reported for other marine organisms like dolphins, seals, and porpoises (Law et al. 1991).

While oil spill impacts are discussed generally for all species in Section 3.2.1, specific impacts of the DWH oil spill event on loggerhead sea turtles are considered here. Impacts to loggerhead sea turtles occurred to offshore small juveniles as well as large juveniles and adults. A total of 30,800 small juvenile loggerheads (7.3% of the total small juvenile sea turtle exposures to oil from the spill) were estimated to have been exposed to oil. Of those exposed, 10,700 small juveniles are estimated to have died as a result of the exposure. In contrast to small juveniles, loggerheads represented a large proportion of the adults and large juveniles exposed to and killed by the oil. There were 30,000 exposures (almost 52% of all exposures for those age/size classes) and 3,600 estimated mortalities. A total of 265 nests (27,618 eggs) were also translocated during response efforts, with 14,216 hatchlings released, the fate of which is unknown (DWH Trustees 2015). Additional unquantified effects may have included inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources which could lead to compromised growth and/or reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred.

Unlike Kemp's ridleys, the majority of nesting for the Northwest Atlantic Ocean loggerhead DPS occurs on the Atlantic coast, and thus loggerheads were impacted to a relatively lesser degree. However, it is likely that impacts to the NGMRU of the NWA loggerhead DPS would be proportionally much greater than the impacts occurring to other recovery units. Impacts to nesting and oiling effects on a large proportion of the NGMRU recovery unit, especially mating and nesting adults likely had an impact on the NGMRU. Based on the response injury evaluations for Florida Panhandle and Alabama nesting beaches (which fall under the NGMRU), the Trustees estimated that approximately 20,000 loggerhead hatchlings were lost due to DWH oil spill response activities on nesting beaches. Although the long-term effects remain unknown, the DWH oil spill event impacts to the Northern Gulf of Mexico Recovery Unit may result in some nesting declines in the future due to a large reduction of oceanic age classes during the DWH oil spill event. Although adverse impacts occurred to loggerheads, the proportion of the population that is expected to have been exposed to and directly impacted by the DWH oil spill event is relatively low. Thus we do not believe a population-level impact occurred due to the widespread distribution and nesting location outside of the Gulf of Mexico for this species.

Specific information regarding potential climate change impacts on loggerheads is also available. Modeling suggests an increase of 2°C in air temperature would result in a sex ratio of over 80% female offspring for loggerheads nesting near Southport, North Carolina. The same increase in air temperatures at nesting beaches in Cape Canaveral, Florida, would result in close to 100% female offspring. Such highly skewed sex ratios could undermine the reproductive capacity of the species. More ominously, an air temperature increase of 3°C is likely to exceed the thermal threshold of most nests, leading to egg mortality (Hawkes et al. 2007). Warmer sea surface temperatures have also been correlated with an earlier onset of loggerhead nesting in the spring (Hawkes et al. 2007; Weishampel et al. 2004), short inter-nesting intervals (Hays et al. 2002), and shorter nesting seasons (Pike et al. 2006).

4 ENVIRONMENTAL BASELINE

This section is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat), and the ecosystem, within the action area. The environmental baseline is a “snapshot” of a species’ health at a specified point in time. It does not include the effects of the action under review in this consultation.

By regulation, environmental baselines for Biological Opinions include the past and present impacts of all state, federal, or private actions and other human activities in the action area. We identify the anticipated impacts of all proposed federal projects in the specific action area of the consultation at issue, that have already undergone formal or early Section 7 consultation as well as the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

Focusing on the impacts of the activities in the action area specifically, allows us to assess the prior experience and state (or condition) of the endangered and threatened individuals, and areas of designated critical habitat that occur in an action area, and that will be exposed to effects from the actions under consultation. This is important because, in some phenotypic states or life history stages, listed individuals will commonly exhibit, or be more susceptible to, adverse responses to stressors than they would be in other states, stages, or areas within their distributions. The same is true for localized populations of endangered and threatened species: the consequences of changes in the fitness or performance of individuals on a population's status depends on the prior state of the population. Designated critical habitat is not different: under some ecological conditions, the physical and biotic features of critical habitat will exhibit responses that they would not exhibit in other conditions.

4.1 Status of green and loggerhead sea turtles within the Action Area

Due to the large geographic ranges of adult and juvenile sea turtles, coupled with overlapping ranges of some DPSs, direct estimates of population levels and mortality rates are not available. Instead, reproductive activity, as reflected in counts of sea turtle nests, is typically used to estimate sea turtle abundances. Therefore, this section focuses on nesting activity on the beach adjacent to the action area as an indirect measure of the status of green and loggerhead sea turtle hatchlings, juveniles, and adults within the action area. The status and effects of the proposed action on green and loggerhead sea turtle nests and eggs are addressed separately in consultation number 04EF2000-2016-F-0529 by the USFWS.

4.1.1 Green sea turtles

Turtle nesting surveys were conducted as part of the Florida Fish and Wildlife Conservation Commission's Statewide Nesting Beach Survey Program from 1994-2016, along Naples Beach, a 5.6 mile (mi) stretch of beach that, in part, includes the beach adjacent to the action area (Kraus et al. 2017; Kraus et al. 2007). Two green sea turtle nests were found during the 22-year period (Kraus and Addison 2017). This indicates that, on average, 1 adult green sea turtle every 11 years is expected to emerge on Naples Beach. Because green sea turtles typically swim alongshore to find an appropriate emergence location, it is possible that this individual may transit through the action area during the reproductive season. Because adult males move to nearshore reproductive habitat to engage the females in reproductive behavior, it is likely that a similar number of adult male green sea turtles may be in the action area at the same time. In addition, a small number of hatchling green sea turtles may transit through the action area upon hatching, if a nest is laid on the adjacent beach. Juvenile and adult green sea turtles may also transit though the action area on their way to more suitable habitat, but there is no data available on which a quantitative estimate of this activity can be based. The lack of seagrasses or other suitable food sources and the lack of suitable structure with large crevices suggest that green sea turtles would not use the action area for foraging or for shelter.

4.1.2 Loggerhead sea turtles

Turtle nesting surveys were conducted as part of the Florida Fish and Wildlife Conservation Commission's Statewide Nesting Beach Survey Program from 1994-2016, along Naples Beach (Kraus et al. 2017; Kraus et al. 2007). Nesting activity on Naples Beach was relatively stable from 1994-2011 at 55±15 nests (mean±standard deviation). After 2011, activity generally increased, and in 2016 reached an historic high of 268 nests (Kraus et al. 2017), 63% higher than any previously recorded number of nests. The cause of this increase is currently unknown, but it mirrors the trend for nesting in Collier County as a whole. Given the high amount of variation from year to year, we do not believe that the highest recorded level of nesting is a reasonable approximation for the expected level of nesting in the future. However, the six-year increasing trend at Naples Beach suggests that the overall average, which is the mathematical definition of the expected value, may significantly underestimate future nesting. Therefore, we have chosen to use data from 2011-2016 (Table 3), resulting in a mean of 144 nests per year at Naples Beach. Because loggerhead sea turtles tend to use the same nesting beaches and produce an average of 4.1 clutches of eggs in any year that they are reproductively active, approximately 35 adult females may nest on Naples Beach in any given year (144 nests per year / 4.1 nests per female = 35.122 females per year). Because loggerhead sea turtles typically swim alongshore to find an appropriate emergence location, it is possible that that these individuals may transit through the action area during the reproductive season. Because adult males move to nearshore reproductive habitat to engage the females in reproductive behavior, it is likely that a similar number of adult male green sea turtles may be in the action area at the same time. Hatchling loggerhead sea turtles from any nests laid on the beach adjacent to the action area would also transit through the action area upon emergence from their nests. In addition, although open sand is not the preferred foraging habitat for loggerhead sea turtles, suitable prey species, including jellyfish, mollusks, and decapods, are likely present, so juvenile and adult loggerhead sea turtles may forage in the area. The lack of suitable structures with large crevices suggests that loggerhead sea turtles would not use the action area for shelter.

Table 3. Observed Numbers of Loggerhead Sea Turtle Nests at Naples Beach (reproduced from Kraus et. al, 2017)

Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**Mean**
Number of Nests	67	148	92	164	125	268	144

4.2 Factors affecting green and loggerhead sea turtles within the Action Area

4.2.1 Federal Actions

A wide range of activities funded, authorized, or carried out by federal agencies may affect loggerhead sea turtles. These include actions permitted or implemented by the USACE such as dredging; dock/marina construction; fishing pier construction; bridge/highway construction; residential construction; shoreline stabilization; breakwater construction; and the installation of subaqueous lines or pipelines. Other federal activities that may affect Johnson's seagrass critical habitat include actions by the Environmental Protection Agency and the USACE to manage freshwater discharges into waterways; management of National Parks; regulation of vessel traffic to minimize propeller dredging and turbidity; and other activities by the U.S. Coast Guard and U.S. Navy.

According to NMFS's Public Consultation Tracking System database, there have been 2 ESA Section 7 consultations completed on activities in or near the action area:

1. USACE Permit SAJ-2003-12405 for beach renourishment carried out by Collier County on three beaches in Collier County, Florida, including Naples Beach. The County would place up to 978,000 cubic yards (yd^3) of sand over the 15-year period covered by the permit. This would compensate for losses due to erosion, estimated at 51.240 yd^3 per year, and storm damage causing removal of up to 210,000 yd^3. Borrow areas for the renourishment include Doctors Pass. The consultation request for this action was withdrawn by the USACE upon determination that the activities were addressed in the Gulf of Mexico Regional Biological Opinion (NMFS 2007). Although NMFS examined the USACE permitting program as applied throughout the Gulf of Mexico, take (combined lethal and non-lethal) was separately authorized within the West Florida Coastal Area, from the Aucilla River Basin to, but not including, Key West. Of the species considered in this Opinion, the incidental take resulting from this program is expected to consist of 3 green sea turtles and 5 loggerhead sea turtles per year in this area.

2. USACE Permit SAJ-2015-00103 for reconstruction of the jetty south of Doctors Pass. The work consisted of placement of 1,620 yd^3 of rock below the MHWL over an area measuring

approximately 0.05 ac, and placement of approximately 1,900 yd^3 of rock above the MHWL in an area of approximately 0.25 ac. NMFS concurred with the USACE determination that the action may affect, but was not likely to adversely affect smalltooth sawfish or green, Kemp's ridley, or loggerhead sea turtles.

4.2.2 State or Private Actions

4.2.2.1 Development and Urbanization

Although Naples Beach is fully developed by private residences and the Gulf View Beach Club of Naples, redevelopment and lighting are ongoing activities that potentially reduce or degrade sea turtle nesting habitats or interfere with hatchling movement to sea. Nocturnal human activities along nesting beaches may also discourage sea turtles from nesting sites. The extent to which these activities reduce sea turtle nesting and hatchling production is unknown. Still, an increasing number of coastal counties are adopting stringent protective measures to protect hatchling sea turtles from the disorienting effects of beach lighting.

4.2.2.2 Recreational Fishing

Recreational fishing as regulated by the state of Florida can affect sea turtles or their habitats within the action area. Pressure from recreational fishing in and adjacent to the action area is likely to continue and will increase with the construction and operation of the proposed fishing pier. Recreational fishing pressure via small vessels and from shore is difficult to quantify given the lack of reporting at Naples Beach.

Recreational fishing from private vessels may occur in the action area. Observations of state recreational fisheries have shown that loggerhead sea turtles are known to bite baited hooks and frequently ingest the hooks. Hooked turtles have been reported by the public fishing from boats, piers, and beach, banks, and jetties and from commercial anglers fishing for reef fish and for sharks with both single rigs and bottom longlines. Additionally, lost fishing gear such as line cut after snagging on rocks, or discarded hooks and line, can also pose an entanglement threat to sea turtles in the area. A detailed summary of the known impacts of hook-and-line incidental captures to loggerhead sea turtles can be found in the Southeast Fisheries Science Center Turtle Expert Working Group (TEWG) reports (TEWG 1998; TEWG 2000).

4.2.3 Other Potential Sources of Impacts to the Environmental Baseline

Stochastic (i.e., random) events, such as hurricanes, fluctuation in water temperature, and red tides, occur in Southwest Florida and may affect the action area. The occurrence of these events is, by nature, unpredictable, as is their effect on the species; but, they have the potential to directly impede recovery if animals die as a result of the event, or indirectly if important habitats are damaged. For example, storm surge can result in beach inundation which often results in higher mortality of eggs. Storm surge can also result in washout of a beach, both destroying nests and altering the beach habitat. Between 1916 and 2015, 35 hurricanes have approached Southwest Florida closely enough to affect Naples Beach (Gamio 2016). Deepwater upwelling can result in rapidly cooling coastal waters, as occurred in January 2010 along Florida's Gulf Coast, which can kill sea turtles (Foley et al. 2007). Harmful algal blooms consisting of the toxic dinoflagellate *Karenia brevis*, occur in the area, and may have sublethal effects on sea turtles, including disorientation, lack of coordination, and extreme lethargy, and can result in sea turtle mortality. Harmful algal blooms, defined cell counts higher than ~2,642 cells per gallon (10,000 cells per liter), occurred 8 times from 2007-2013 in the region between Bonita Beach and Marco Island (FWRI 2015a).

4.2.4 Conservation and Recovery Actions Shaping the Environmental Baseline

The National Oceanic and Atmospheric Association's Southeast Fisheries Science Center in cooperation with states, including Florida, established the Sea Turtle Stranding and Salvage Network (STSSN) in 1980 to collect information on and document strandings (death or injury) of marine turtles along the U.S. Gulf of Mexico and Atlantic coasts. The STSSN not only collects data, but also attempts to rescue and rehabilitate any live stranded sea turtles.

Collier County Parks & Recreation Department is responsible for surveying 23.7 miles of beach for sea turtle activities. The Sea Turtle Protection Program monitors nests and helps rescue stranded sea turtles. Parks & Recreation monitors 18.1 miles of shoreline on Barefoot, Vanderbilt, Parkshore, and Marco Island Beaches. The remaining 5.6 miles of beach in the City of Naples is subcontracted by the County to the Conservancy of Southwest Florida. A key part of this program is public education to ensure residents and visitors are aware of issues related to sea turtles and how they can help in conservation efforts. In addition to providing educational information on their website, Collier County posts informational and warning signs regarding sea turtles and use of the beaches (Kraus et al. 2017). The City of Naples also provides educational material on their website (City of Naples 2012) regarding sea turtle behavior and use of the area, and the consequences of human interactions with them.

5 EFFECTS OF THE ACTION

5.1 Direct and Indirect Effects of the Action

Effects of the action include direct and indirect effects of the action under consultation. Indirect effects are those that result from the proposed action, occur later in time (i.e., after the proposed action is complete), but are still reasonably certain to occur. The analysis in this section forms the foundation for our jeopardy analysis in Section 7. The analyses in this section are based on the best available commercial and scientific data on species biology and the potential effects of the action. Data are limited, and, in some cases highly variable, and estimates of parameter values like mortality rates are accordingly uncertain. In those cases, the uncertainty is resolved in favor of the species (House of Representatives Conference Report No. 697, 96th Congress, Second Session, 12 [1979]). To resolve the uncertainty in favor of the species, the value that would lead to conclusions of higher, rather than lower, risk to the species is used in the analysis.

As noted in Section 3.2.1.3, establishment of in-water erosion control structures can affect nesting and hatchling sea turtles by blocking ingress and egress from shallow nearshore waters. As discussed in Section 3.1.3, we expect this effect of the action on adult nesting sea turtles to be insignificant. However, hatchling sea turtles are especially vulnerable to predation when impeded by in-water structures. Migration to the open sea incorporates frenzied activity by sea turtle hatchlings, which is known to be energetically demanding (Clusella-Trullas et al. 2006). Also, the swim frenzy is based upon an internal clock that determines when the hatchlings switch from frenzy to post-frenzy swimming (Wyneken 2000; Wyneken and Salmon 1992). Whereas hatchling sea turtles may cross emergent sand banks during swim frenzy, riprap boulders are likely to present an impassable barrier, concentrating sea turtle hatchlings on the landward side, and forcing them to traverse the length of the breakwater. Disorientation and prolongation of the time in which hatchlings attempt to reach deeper, open waters can be expected to have a significant, though un-quantifiable, impact on the hatchlings, such as excess resource expenditures resulting in physiological effects reducing later fitness.

The proposed in-water erosion control structures are likely to result in increased predation on hatchling sea turtles. These structures will be formed from boulders of various sizes and irregular shapes resulting in high-relief, complex forms. It has long been understood and is well documented that fish, including large predatory fish, are attracted to high-relief, complex structures to a much greater extent than sand bottom or low-relief hardbottom such as naturally occurs at the project site. In fact such structures are often used as fish aggregating devices. Hatchling sea turtles are preyed upon by large, predatory fishes such as jacks, tarpon, barracuda, and grouper as they attempt to reach the open ocean (Stewart and Wyneken 2004; Whelan and Wyneken 2007). Studies on hatchling predation have resulted in various conclusions on the extent of predation on hatchlings in nearshore areas, and how nearshore habitats impact those predation rates. Stewart and Wyneken (2004) found no significant difference in predation between sand, transitional, and reef sites off Juno Beach, although the raw numbers showed an increase from sand to transitional to reef. The data were pooled and an approximately 5% predation rate in the nearshore zone was calculated. Witherington and Salmon (1992) showed that predation on hatchling sea turtles was substantially higher in the vicinity of reef structure, even patchy, low-relief reefs, than over open sand (9% vs. 0%). Other studies have found higher predation rates, especially over reef systems. Gyuris (1994) found predation rates of 0-85% with a mean of 31%. In that study, the greatest predation occurred during low tide, close to the reef system (and predators). Whelan and Wyneken (2007) found a predation rate of approximately 9% off Boca Raton in limited sampling. They speculated that one of the main differences between their findings and studies that found higher predation rates, such as Gyuris (1994), is that in the area of the Gyuris (1994) study the hatchlings must cross the reef, and the reef is likely closer to the surface than it is off Boca Raton. These studies indicate that predation on hatchling sea turtles is likely to increase near structures with high relief, but the amount of increase is highly uncertain. In addition, none of these studies included structures that were also barriers to swimming or that could trap hatchling sea turtles within their structure. This introduces an unknown additional mortality rate, and more uncertainty in the resulting estimate. Given that the mortality rate may be as high as 85% due to predation, alone, we resolve the uncertainty in favor of the species by assuming that any nesting activity within or adjacent to the action area will fail throughout the functional lifespan of the proposed structures. Although many factors are involved in determining the lifespan of a breakwater, including storm activity, it is generally thought that rock mound breakwaters have a lifespan between 30 and 50 years (CLIMATE-ADAPT 2017).

5.1.1 Green Sea Turtle Hatchlings

Based on the best available estimates of nesting density, approximately 0.003 green sea turtle nests per year (2 nests / 5.6 lin mi / 22 years nests per lin mi × 0.19 lin mi = 0.00301 nests per year), and a total of 0.15 nests over the lifespan of the proposed erosion control structures (0.003 nests per year × 50 years) would be expected in this area if the numbers of nesting females does not change. However, due to the trend of increasing nesting locally and throughout the NA DPS, we believe that this may significantly underestimate future nesting. Therefore, we estimate the total lethal take will be 1 nest within the lifespan of the proposed erosion control structures, which would accommodate population growth an order of magnitude greater than the current level. There are approximately 136 eggs per nest (Witherington and Ehrhart 1989b). Hatch rates are location specific and can be highly variable even in the same location. Therefore, being conservative, we will assume all eggs will hatch. Therefore, this would result in the lethal take of up to 136 green sea turtle hatchlings (136 eggs per nest × 1 nest) due to entrapment and predation.

5.1.2 Loggerhead Sea Turtle Hatchlings

Based on the best available estimates of nesting density, discussed in Section 4.1.2, approximately 5 loggerhead sea turtle nests per year (144 nests per year / 5.6 mi × 0.19 miles = 4.87 nests per year) would be expected in this area if the numbers of nesting females of each species do not change. There are approximately 126 eggs per loggerhead nest (Dodd Jr. 1988); therefore, we estimate that the proposed action will result in the lethal take of 31,500 hatchlings over the lifespan of the proposed structures due to entrapment and predation (5 nests per year × 126 hatchlings per nest × 50 year life span of the proposed structures).

5.2 Interrelated and Interdependent Actions

Effects of the proposed action also include effects of other activities that are interrelated or interdependent with the proposed action. Interrelated actions are those that are part of a larger action and depend on that larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Thus these actions are also described and their effects on listed species and critical habitat are evaluated as effects of the proposed action. To date, we have identified no interrelated or interdependent activities relative to the proposed action.

6 CUMULATIVE EFFECTS

Cumulative effects include the effects of future state, tribal, local or private actions that are reasonably certain to occur in the action area considered in this Biological Opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA. Within the action area, no major changes are anticipated in the ongoing human activities described in the environmental baseline. The present, main human uses of the action area such as commercial fishing, recreational fishing, and recreational boating, are expected to continue at the present levels of intensity as are the associated risks.

7 JEOPARDY ANALYSIS

The analyses conducted in the previous sections of this Opinion serve to provide a basis to determine whether the proposed actions would be likely to jeopardize the continued existence of green or loggerhead sea turtles. In Section 5, we outlined how the proposed actions can affect these species. Now we turn to an assessment of the species response to these impacts, in terms of overall population effects, and whether those effects of the proposed actions, when considered in the context of the status of the species (Section 3), the environmental baseline (Section 4), and the cumulative effects (Section 6), will jeopardize the continued existence of the affected species.

This section evaluates whether the proposed actions are likely to jeopardize the continued existence of green and loggerhead sea turtles in the wild. To *jeopardize the continued existence of* is defined as "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Thus, in making this determination, NMFS must look at whether the proposed actions directly or indirectly reduce the reproduction, numbers, or distribution of a listed species. Then, if there is a reduction in one or more of these elements, we evaluate whether it would be expected to cause an appreciable reduction in the likelihood of both the survival and the recovery of the species. Section 5 ("Effects of the Action") describes the effects of the proposed actions on these species, and the extent of those effects in terms of an estimate of the number of impacts.

All life stages are important to the survival and recovery of a species; however, it is important to note that individuals of one life stage are not equivalent to those of other life stages. For example, the take of male juveniles may affect survivorship and recruitment rates into the reproductive population in any given year, and yet not significantly reduce the reproductive potential of the population. Yet, the death of mature, breeding females can have an immediate effect on the reproductive rate of a species. Different age classes may be subject to relative rates of mortality, resilience, and overall effects of population dynamics. For the proposed action, we would not expect juvenile or adult stage sea turtles of any species to be subject to take from any aspect of the in-water construction or use of the proposed erosion control structures. However, green and loggerhead sea turtle hatchlings are likely to be subject to incidental take as a result of being entrapped by or diverted along the in-water structures during their transit from the beach to open water, and the increased predation that is expected to result from the proposed project. Sea turtles are also subject to many sources of mortality in the nest and in transit from the nest to the water. In addition, it is not possible to accurately determine the number of hatchling sea turtles that reach the water without using intrusive methods that may result in even higher mortality. Therefore, in the following discussions we focus on the number of sea turtles projected from the number of nests that would be expected in the action area over the 50-year lifespan of the proposed erosion control structures. Due to these sources of uncertainty, we use those projected values as estimates of the levels of take of hatchlings due to entrapment and increased predation caused by the presence of the proposed structures.

7.1 Green Sea Turtle North Atlantic DPS

Because green sea turtle hatchlings are likely to be subject to incidental take as a result of the proposed action, as discussed in Section 3.2, above, and juveniles and adults are not, as discussed in Section 3.1, above, the effects of the project will be limited to the DPS that uses the action area for nesting, i.e., the North Atlantic DPS. The proposed project is anticipated to result in the mortality of all green sea turtle hatchlings produced within the 1,000-lin-ft of beach bounded by the proposed erosion control structures. Over the 50-year lifespan of the structures, this is expected to result in the mortality of 136 individual green sea turtle hatchlings, ignoring natural mortality in the nest and during transit from the nest to the water. The effect of this lethal take on distribution, numbers, and reproduction, and the concomitant effects on the survival and recovery of the species depend on the life history and reproductive dynamics of the species.

As discussed in Section 3.2.2.1, above, the green sea turtle population appears to have a genetic substructure that is suggestive of reproductively isolated subpopulations. This is likely due to the majority of reproductive activity taking place near the nesting beaches, coupled with the tendency of nesting females to return to the same nesting beaches throughout their lifetime. However, green sea turtles also tend to use specific foraging grounds that may be large distances from their nesting beaches. The groups of green sea turtles using any given foraging ground are genetically mixed, and may even include individuals from other DPSs. This indicates that individuals from each of the reproductive subpopulations tend to be widely distributed; therefore, we do not expect that the lethal take of 136 hatchlings, over 50 years, from a single beach will affect the distribution of the species.

As noted in Section 3.2.2.3, above, approximately 167,000 female green turtles comprise the nesting population of the NA DPS. This does not account for the number of adult males or the number of juveniles of either sex, which cannot be accurately estimated. Assuming that all of the 136 hatchlings that are anticipated to be lethally taken as a result of the proposed action are female, and they would all have reached reproductive age, but for the proposed action, the anticipated lethal take would result in a loss of 0.08% of the reproductive female population, which would, therefore be a small reduction in both numbers and reproductive potential of the species. As discussed in Section 3.2.2.3, nesting and, presumably, population levels of green sea turtles have been increasing for the past decade throughout the range of the NA DPS. In Florida, nesting has generally increased over the last 20 years and peaked in 2015 with 27,975 nests statewide in 2015 (FWRI 2015b). In-water studies conducted over 24 years in the Indian River Lagoon, Florida, suggest similar increasing trends, with green sea turtle captures up 661% (Ehrhart et al. 2007). Similar in-water work at the St. Lucie Power Plant site revealed a significant increase in the annual rate of capture of immature green sea turtles over 26 years (Witherington et al. 2006). Seminoff et al. (2015) conducted a population viability analysis for the Florida nesting sites that evaluated the probabilities of nesting populations declining to 2 separate biological thresholds after 100 years: (1) a 50% decline in population growth and (2) a reduction in the total number of adult females to 300 or fewer. The analysis was based solely on nesting data and did not fully incorporate spatial structure or threats. It also assumed that all environmental and man-made pressures will remain constant over the forecast period. The results indicated a 0.3% probability that the population would fall below the 50% decline threshold within100 years, and a 0% probability that it would fall below the absolute abundance threshold of 100 nesting females per year in that time. This suggests that the positive growth trend of the green sea turtle population is robust, that is, not likely to be affected by small changes.

Seminoff et al. (2015) estimate there are more than 167,000 nesting females in the NA DPS. Nesting in Florida comprises 5% of the total, or approximately 8,400 nesting females. Assuming the unlikely case that all of the 136 hatchlings anticipated to be lethally taken are female, that the take occurs in the first year of the project, and that all of the hatchlings would have survived to reproductive age, but for the proposed action, this equates to a loss of 1.6% of the reproductive potential of the Florida subpopulation, and 0.08% of the reproductive potential of the NA DPS. Given the positive growth trend discussed above, we would not expect the reduction in numbers or reproduction resulting from the lethal take of 136 green sea turtle hatchlings over 50 years to cause an appreciable reduction in the likelihood of survival of the species.

As discussed above, the lethal take of the hatchlings from 1 green sea turtle nest over 50 years is not expected to affect the distribution of the NA DPS and is expected to reduce numbers and reproduction by at most 0.08%. Therefore, we do not believe the proposed action will cause reductions in the distribution, numbers, or reproduction of the NA DPS of green sea turtles sufficient to appreciably reduce the likelihood of survival of the NA DPS of green sea turtles.

The NA DPS of green sea turtles did not have a recovery plan in place at the time of listing. However, an Atlantic Recovery Plan for the population of Atlantic green sea turtles (NMFS and USFWS 1991) does exist. Since the animals within the NA DPS all occur in the Atlantic Ocean and would have been subject to the recovery actions described in that plan, we believe it is appropriate to continue using that Recovery Plan as a guide until a new plan, specific to the NA DPS, is developed. The Atlantic Recovery Plan lists the following relevant recovery objectives over a period of 25 continuous years:

> *Objective: The level of nesting in Florida has increased to an average of 5,000 nests per year for at least 6 years.*
>
> *Objective: A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.*

Sea turtle nesting in Florida is increasing. An average of 5,039 green turtle nests were laid annually in Florida between 2001 and 2006 with a low of 581 in 2001 and a high of 9,644 in 2005 (NMFS and USFWS 2007a). Across the entire state, nesting increased from 2008-2012. An average of 10,377 green sea turtle nests were laid annually in Florida during the period with a low of 4,462 in 2009 and a high of 15,352 in 2011 (FWRI 2013). Since 2011 the average has been more than 16,600 nests per year (FWRI 2015b), thus the first recovery objective has been met. Further, the lethal take of 136 hatchlings would reduce the number of nests by a maximum of 544 (136 individuals × 4 nests per individual) which would not reduce the six-year average from more than16,600 to fewer than 5,000 nests per year.

There are currently no estimates available specifically addressing changes in abundance of individuals on foraging grounds. Given the clear increases in the abundance of nesting females, and the fact that all adult green sea turtles tend to move to their foraging grounds outside of the reproductive season, it is likely that numbers green sea turtles on foraging grounds have also increased. Therefore, we do not expect the lethal take of 136 hatchlings over 50 years to have any measureable influence on the recovery objective and trends noted above.

The lethal take of up to 136 green sea turtles hatchlings from the NA DPS over the next 50 years will result in a reduction in numbers and reproduction, but is not expected to cause an appreciable reduction in the likelihood of survival of the species. Similarly, the lethal take of 136 green sea turtles hatchlings by the proposed action will not impede achievement of the recovery objectives for the Atlantic DPSs, and, therefore, will not result in an appreciable reduction in the likelihood of recovery of the species.

7.2 Loggerhead Sea Turtle Northwest Atlantic DPS

Because loggerhead sea turtle hatchlings are likely to be subject to incidental take as a result of the proposed project, and juveniles and adults are not, the effects of the project will be limited to the PFRU within the NWA DPS. The proposed project is anticipated to result in the mortality of all loggerhead sea turtle hatchlings produced within the 1,000-lin-ft of beach bounded by the proposed erosion control structures, which we estimate to be 250 nests, or approximately 31,500 hatchlings, over the 50-year lifespan of the proposed structures. The effect of this lethal take on distribution, numbers, and reproduction, and the concomitant effects on the survival and recovery of the species depend on the life history and reproductive dynamics of the species.

As discussed in Sections 3.2.3.1-3.2.3.3, above, the NWA DPS appears to have a genetic substructure that is suggestive of reproductively isolated subpopulations. This is likely due to the majority of reproductive activity taking place near the nesting beaches, coupled with the tendency of nesting females to return to the same nesting beaches throughout their lifetime. However, loggerhead sea turtles are known to move large distances between their nesting beaches and foraging grounds. This suggests that individuals from different recovery units likely intermix on their foraging grounds; therefore, we do not expect the lethal take of 250 nests over 50 years from a single beach to affect the distribution of the species.

As discussed in Section 3.2.3.3, index nesting beach surveys indicate that nesting in the PFRU has increased by 71% over the past decade, with an estimated statewide total of 89,295 nests in Florida in 2015, based on observation of 52,647 nests at the index beaches. The anticipated lethal take caused by the proposed action would be 0.0056% (100% × 5 nests / 89,295 nests) of production in the PFRU in any given year. It would be an even smaller percentage of the NWA DPS. This reduction in numbers would also result in the loss of reproductive potential. The maximum loss of reproductive potential would also be 0.0056% per year, which would only be realized if all of the individuals lost are female. This annual rate of loss would amount to approximately 0.3% over the 50 year lifespan of the proposed structures ($[1 – 0.0056 / 100\%]^{50} \approx 0.9972$; $[1- 0.9972] \times 100\% \approx 0.28\%$).

As discussed above, the lethal take of 250 loggerhead sea turtle nests over 50 years is not expected to affect the distribution of the NWA DPS and is expected to reduce numbers and reproduction by at most 0.0056% per year. Therefore, we do not believe the proposed action will cause reductions in the distribution, numbers, or reproduction sufficient to appreciably reduce the likelihood of survival of the NWA DPS of loggerhead sea turtles.

With respect to whether the proposed action would appreciably reduce the likelihood of recovery of the species, we evaluated the Services' recovery plan for the Northwest Atlantic population of the loggerhead sea turtle (NMFS and USFWS 2008a), which is the same population as the NWA DPS. The recovery plan anticipates that, with implementation of the plan, the Northwest Atlantic population will recover within 50-150 years, but notes that reaching recovery in only 50 years would require a rapid reversal of the then declining trends of the Northern, Peninsular Florida, and Northern Gulf of Mexico Recovery Units.

The objectives of the recovery plan most pertinent to the threats posed by the proposed actions are Objectives 1 and 2:

1. *Ensure that the numbers of nests in each recovery unit are increasing and that this increase corresponds to an increase in the number of nesting females.*

2. *Ensure the in-water abundance of juveniles in both neritic and oceanic habitats is increasing and is increasing at a greater rate than strandings of similar age classes.*

Unfortunately, estimates of the numbers of nesting females in the PFRU are currently based on nest counts due to a lack of studies capable of directly determining their abundance, so the second part of Objective 1 cannot be independently verified. Similarly, there are no studies, at present, that estimate the in-water abundance of juvenile loggerhead sea turtles in neritic and oceanic habitats independently of nest counts. Therefore, the only criterion on which the effect of the proposed action can be evaluated relative to the recovery plan is the change in the rate of increase in the number of nests. As discussed above, the recovery plan was implemented at the beginning of a decade-long increase in nesting in the PFRU of 71%, which amounts to an increase of 5.5% per year over 10 years[2]. A reduction of 0.0056% of nests per year would result in an annual rate of change in nesting of 5.4944%, which is still an increase. Therefore, based on the best available scientific and commercial data, we do not believe the proposed action will appreciably reduce the likelihood of recovery of the species.

8 CONCLUSION

We have analyzed the best available scientific and commercial data, the current status of the species, environmental baseline, effects of the proposed actions, and cumulative effects to determine whether the proposed action is likely to jeopardize the continued existence of green

[2] To calculate population level using a constant rate of increase over a discrete interval, like a year, the population level is multiplied by 1 (100%) + the rate of increase. So, a population of 100 individuals with a 10% increase per year results in 110 individuals after 1 year (100 individuals × 1.1). After a second year, the population would be 121 individuals (110 individuals × 1.1). This is the same as 100 individuals × 1.1 × 1.1), or 100 individuals × 1.1^2. That pattern holds no matter how many years are considered, so after 50 years, the population would be 11,739 individuals (100 individuals × 1.1^{50}). Therefore, the annual rate of increase of a population, given the rate of increase over 10 years, is calculated as the 10th root of the decadal rate of increase. For the loggerhead sea turtle PFRU, with a 10-year increase of 71%, the corresponding annual multiplier is 1.055 (10 √ 1.71), or an annual rate of increase of 5.5%.

sea turtles and loggerhead sea turtles. Because the proposed action will not appreciably reduce the likelihood of survival and recovery of these species, it is our Opinion that the proposed action is likely to adversely affect, but not likely to jeopardize the green sea turtle NA DPS or loggerhead sea turtle NWA DPS.

9 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and federal regulations issued pursuant to Section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively. Section 7(b)(4) and Section 7(o)(2) provide that take that is incidental to an otherwise lawful agency action is not considered to be prohibited take under the ESA if that action is performed in compliance with the terms and conditions of this Incidental Take Statement.

9.1 Amount and Extent of Take

NMFS anticipates incidental take of sea turtles will be difficult to detect and quantify for the following reasons: (1) an unknown number of eggs may be subject to mortality in the nest; (2) an unknown number of hatchlings may be subject to predation during transit from the nest to the water; (3) an unknown number of hatchlings may be subject to mortality caused by entrapment by the proposed erosion control structures; and (4) an unknown number of hatchlings may be subject to increased predation due to concentration of predators on the erosion control structures. However, Collier County maintains a beach survey program that consists of daily surveys of sea turtle nesting beaches during the reproductive season. Therefore, NMFS has chosen to use sea turtle nests as a surrogate for incidental take.

NMFS has determined that the proposed action is expected to result in lethal take of all hatchlings from 1 green sea turtle nest and 250 loggerhead sea turtle nests over a 50-year time period due to entrapment and increased predation caused by the presence of the proposed erosion control structures. Therefore, the lethal take of 1 green sea turtle nest is authorized within the 50-year lifespan of the proposed erosion control structures. Similarly, the lethal take of 250 loggerhead sea turtle nests is authorized over the 50-year lifespan of the proposed erosion control structures, but no more than 5 loggerhead sea turtle nests may be taken in any given year. The 50-year time period will begin upon commencement of the proposed construction activities.

If any take of species under NMFS's purview occurs during in-water construction authorized using this Opinion as the Section 7 consultation, it shall be immediately reported to takereport.nmfsser@noaa.gov (refer to "Doctors Pass Erosion Control," the issue date of this Opinion, and the NMFS Public Consultation Tracking System identifier number [SER-2016-18168]).

9.2 Effect(s) of the Take

NMFS has determined the anticipated level of incidental take specified in Section 9.1 is not likely to jeopardize the continued existence of the green sea turtle NA DPS or the loggerhead sea turtle NWA DPS.

9.3 Reasonable and Prudent Measures

Section 7(b)(4) of the ESA requires NMFS to issue a statement specifying the impact of any incidental take on listed species, which results from an agency action otherwise found to comply with Section 7(a)(2) of the ESA. It also states that the RPMs necessary to minimize the impacts of take and the terms and conditions to implement those measures must be provided and must be followed to minimize those impacts. Only incidental taking by the federal agency or applicant that complies with the specified terms and conditions is authorized.

The RPMs and terms and conditions are specified as required by 50 CFR 402.14 (i)(1)(ii) and (iv) to document the incidental take by the proposed action and to minimize the impact of that take on sea turtles. These measures and terms and conditions are nondiscretionary, and must be implemented by USACE or the applicants in order for the protection of Section 7(o)(2) to apply. USACE has a continuing duty to regulate the activity covered by this Incidental Take Statement (ITS). If USACE or the applicants fail to adhere to the terms and conditions of the ITS through enforceable terms, and/or fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of Section 7(o)(2) may lapse. To monitor the impact of the incidental take, USACE or the applicant must report the progress of the action and its impact on the species to NMFS as specified in the ITS [50 CFR 402.14(i)(3)].

NMFS has determined that the following RPMs are necessary and appropriate to minimize impacts of the incidental take of sea turtles related to the proposed action. The following RPMs and associated terms and conditions are established to implement these measures, and to document incidental takes. Only incidental takes that occur while these measures are in full implementation are authorized. These restrictions remain valid until reinitiation and conclusion of any subsequent Section 7 consultation.

9.3.1. Monitoring of sea turtle nesting activity on the beach adjacent to the proposed construction through the life of the proposed erosion control structures must be performed to determine the impact of the project, and reports submitted to NMFS annually.

9.3.2 All erosion control structures created or modified by this action shall be monitored to ensure that deterioration and damage do not result in effects outside of the action area.

9.4 Terms and Conditions

In order to be exempt from liability for take prohibited by Section 9 of the ESA, the USACE and their applicants must comply with the following terms and conditions, which implement the RPMs described above. These terms and conditions are nondiscretionary.

9.4.1 The following terms and conditions implement RPM 9.3.1.

9.4.1.1 Collier County must promptly (within 2 days of the take) notify NMFS Southeast Regional Office at takereport.nmfsser@noaa.gov regarding the lethal take or injury of sea turtles resulting from construction activities. The report shall refer to "Doctors Pass

Erosion Control," the issue date of this Opinion, and the NMFS Public Consultation Tracking System identifier number (SER-2016-18168).

9.4.1.2 Collier County must, at minimum, and throughout the lifespan of the proposed erosion control structures (i.e., 50 years or until the structures are removed, whichever occurs first), adhere to the *Collier County Sea Turtle Protection Plan as specified by the Collier County Sea Turtle Protection Plan Annual Report – 2015*, attached, including maintaining and keeping current all permits necessary to lawfully carry out the plan.

9.4.1.3 Monitoring reports shall be sent to the National Marine Fisheries Service Southeast Regional Office, Protected Resources Division, 263 13th Avenue South, St. Petersburg, Florida 33701-5505.

9.4.2 The following terms and conditions implement RPM 9.3.2.

9.4.2.1 The erosion control structures shall be inspected within 30 days of any storm or other disturbance (e.g., vessel grounding) with the potential to displace material from the structure to determine whether material from the structure has been moved into any area outside of the proposed action area.

9.4.2.2 A report summarizing the results of any inspection carried out under Term 9.4.2.1 shall be sent to the NMFS Southeast Regional Office at takereport.nmfsser@noaa.gov within 15 days of the inspection. The report shall refer to "Doctors Pass Erosion Control," the issue date of this Opinion, and the NMFS Public Consultation Tracking System identifier number (SER-2016-18168).

10 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

NMFS believes the following conservation recommendations are reasonable, necessary, and appropriate to conserve and recover green and loggerhead sea turtles. NMFS strongly recommends that these measures be considered and adopted.

1. Collier County should consider obtaining the necessary permits, staff, and training to perform sea turtle nest relocations, and should, in consultation with the U.S. Fish and Wildlife Service, relocate any nests found on the beach adjacent to the project area to a more appropriate site south of the project area. Although relocation efforts may increase mortality of eggs and hatchlings in the nest above natural levels, the surviving eggs and hatchlings would be subject to sublethal take in the form of collection, rather than the lethal take expected from the proposed action.

Please notify NMFS if the federal action agency carries out any of these recommendations so that we will be kept informed of actions that are intended to improve the conservation of listed species or their designated critical habitats.

11 REINITIATION OF CONSULTATION

This concludes NMFS's formal consultation on the proposed actions. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal action agency involvement or control over the action has been retained, or is authorized by law, and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action on listed species or designated critical habitat in a manner or to an extent not considered in this Opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat not considered in this Opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

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SEA TURTLE PROTECTION PLAN
ANNUAL REPORT – 2015

Principal Investigators

Maura C. Kraus, Principal Environmental Specialist

Mary K. Toro, Environmental Specialist

Markus Hennig, Environmental Specialist

Prepared by
Parks and Recreation Department

Naples, Florida
January, 2016

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Barry Williams
PARKS AND RECREATION DIVISION DIRECTOR

Period of Investigation

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In addition to fulltime staff, the following part-time staff members provided invaluable field assistance:

Mary Nelson
Beverly Ann Shipe
Dana Dettmar
Ashley Girt

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For additional information email: MauraKraus@colliergov.net

ABSTRACT

Collier County was responsible for the daily survey of 23.7 miles (38.1 km) of beach for sea turtle activities during the 2015 sea turtle season (May through October). The Collier County Parks and Recreation Department surveyed 16.9 miles (27.2 km) of beach including Barefoot, Vanderbilt, Park Shore, and Marco Island beaches. Staff documented 881 nests in 2015, an increase from the 800 nests in 2015. Under contract to Collier County, the Conservancy of Southwest Florida documented 125 nests on the 5.6 mile (9.0 km) City of Naples beach. Fifty-eight nests were documented on the 1.2 mile (1.9 km) beach along Delnor-Wiggins Pass State Park. During the 2015 nesting season, 1% (9) of the documented nests disoriented. One hundred sixteen nests (13.1%) of the 881 were depredated, which is an increase from the 59 (7.4%) in 2014. A total of 43,513 hatchlings were estimated to have reached the Gulf of Mexico. The number of successfully emerged hatchlings represents a significant decrease compared to 57,718 hatchlings that reached the Gulf of Mexico in 2014. There were 29 recovered sea turtle strandings (dead or injured) in Collier County in 2015.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
ATV	All Terrain Vehicle
BG	Bonita Grande – Upland Sand Source
BI	Big Island – Upland Sand Source
CCCL	State Coastal Construction Control Line
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CCPRD	Collier County Parks and Recreation Department
CROW	Clinic for the Rehabilitation of Wildlife
CSWF	The Conservancy of Southwest Florida
DNR	Florida Department of Natural Resources (now called FWC)
DNWSP	Delnor Wiggins State Park
ERJ	E.R. Jahna – Upland Sand Source
ESD	Collier County Environmental Services Department

FDACS	Florida Department of Agriculture and Consumer Services
FWC	Florida Fish and Wildlife Conservation Commission
GPS	Global Positioning System
HWL	High Water Line
IUCN	International Union for the Conservation of Nature and Natural Resources
NAD	North American Datum
NERR	National Estuarine Research Reserve
NMFS	National Marine Fisheries Service
NOV	Notice of Violation
STSSN	Sea Turtle Stranding and Salvage Network
TED	Turtle Excluder Device
USFWS	United States Fish and Wildlife Service

SECTION 1

INTRODUCTION

Sea turtles have inhabited the earth for millions of years. They are believed to have evolved from marsh dwelling species that existed between the Upper Triassic and the Jurassic periods (190 –135 million years ago). Fossil records indicate an early transition from the marsh into the marine environment. By the Cretaceous period (65 million years ago) four families of sea turtles were distributed throughout the oceans of the world (Pritchard, 1979). Today marine turtles are limited to two families: Cheloniidae (six species) and Dermochelyidae (one species) (National Research Council, 1990).

Sea turtles are air-breathing reptiles that emerge from the sea and deposit their eggs on tropical and subtropical beaches around the world. The loggerhead sea turtle (*Caretta caretta*) is the most abundant nesting sea turtle species in Collier County. Loggerheads, named for their disproportionately large head, emerge on Florida's beaches from May through August to lay their eggs. Clutches, containing an average of 100 eggs, incubate for approximately two months before hatchlings, less than two inches in length, emerge and head to the water. Within 12 to 30 years, loggerhead turtles reach sexual maturity and return to the beach to lay eggs every two to four years. It is estimated that only one hatchling in 1,000 will survive to repeat this cycle.

All but one species of sea turtle [Australian flatback (*Natator depressus*)] is listed as endangered and/or threatened by one or more of the following agencies: U.S. Fish and Wildlife Service (USFWS), Florida Fish and Wildlife Conservation Commission (FWC), and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Furthermore, the loggerhead sea turtle is classified by the International Union for the Conservation of Nature and Natural Resources [IUCN (although without statutory authority)], as a 'vulnerable' species (Groombridge, 1982). Extensive exploitation by man for food, leather, decorative pieces, cosmetics and other uses, as well as incidental catch by commercial fisheries have drastically decreased populations of all remaining sea turtle species.

Coastal development and natural erosion have significantly reduced the number of suitable nesting beaches. Developed beaches used by nesting sea turtles can become hazardous to emerging hatchlings. Human disturbances on nesting beaches include: human activity, artificial lighting, erosion induced by shoreline hardening with seawalls, rock revetment, beach renourishment, vehicular traffic on or near the beach, beach raking, pollution, shading of beaches by large buildings and exotic vegetation, beach furniture and recreational accessories, as well as egg and hatchling predation associated with human activities (Carr and Ogren, 1960; Daniel and Smith, 1947; Dickerson and Nelson, 1989; Mann, 1978; Mortimer, 1987; Mortimer and Portier, 1989; Moulding and Nelson, 1988; National Research Council, 1990; Nelson, 1988; Nelson, 1991; Nelson and Dickerson, 1989; Nelson *et al*, 1987; Raymond, 1984b; Salmon and Wynekin, 1990; Schmeltz and Mezich, 1988; Witherington, 1990; Witherington, 1991; Witherington and Bjorndal, 1991). Sea turtles have encountered some or all of these problems on many of Florida's beaches, including Collier County. As human activity and development on nesting beaches increases, a more complete understanding of the plight of the sea turtle must be developed so that remedial actions can be taken.

Collier County is responsible for surveying 23.7 miles (38.1 km) of beach for sea turtle activities. The Sea Turtle Protection Program within the Collier County Parks and Recreation Department (CCPRD) monitored 16.9 miles (27.2 km) of shoreline on Barefoot, Vanderbilt, Park Shore, and Marco Island beaches. The remaining 5.6 miles (9.0 km) of beach in the City of Naples is subcontracted to the Conservancy of Southwest Florida (CSWF). Delnor-Wiggins

Pass SRA survey 1.2 miles (1.9 km) of beach within the park boundary. The surveyed beaches not included in this report are Keewaydin Island (monitored by the CSWF), Cape Romano Complex (monitored by the CCPRD and Rookery Bay NERR), and Coconut and Sea Oat Islands (monitored by Rookery Bay NERR).

The purpose of the Collier County Sea Turtle Protection Program is to protect nests and collect data on sea turtle nesting and hatching activities, in order to fulfill permit requirements for beach raking and beach renourishment. Protecting sea turtle nests also allows beachfront property owners to obtain permits for certain activities seaward of the State Coastal Construction Control Line (CCCL).

This report details the methods established by the CCPRD with updates based on the Florida Fish and Wildlife Conservation Commission Sea Turtle Conservation Guidelines (FWC, 2007). The report includes an analysis of sea turtle emergences, effects of beach renourishment, historical trends, nesting and hatching, depredation, storm effects, strandings, beach lighting, and public awareness. Program research and management recommendations are also provided.

SECTION 2

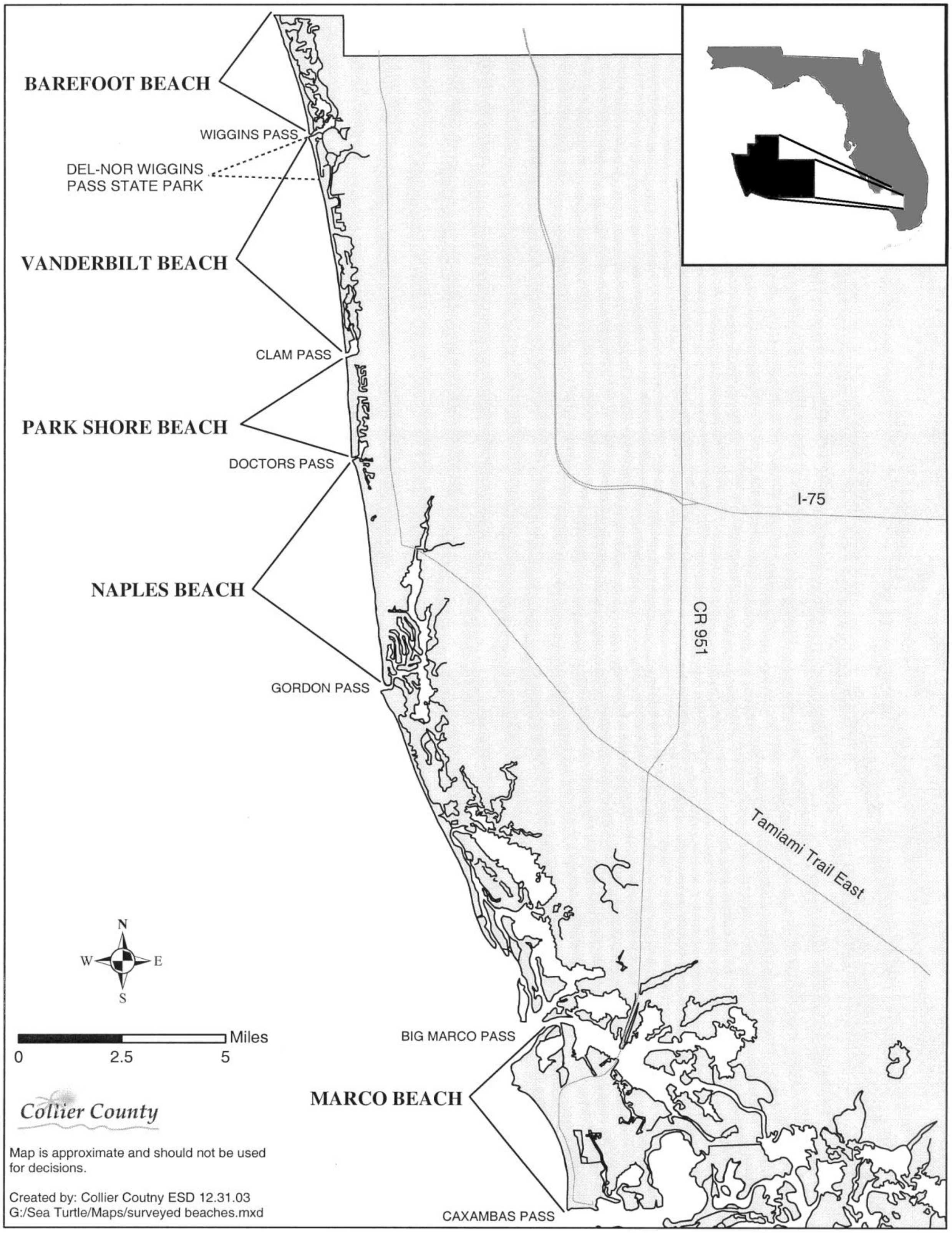
SEA TURTLE MONITORING PROGRAM

2.1. STUDY AREA

Collier County, Florida is the southern terminus of the southwest barrier island chain that begins at Anclote Key in Pasco County, 175 miles (282 km) to the north. The Collier barrier island coastline extends 37 miles (60 km) from the Lee/Collier County line, southward to Cape Romano. The beaches comprise a wide variety of physiographic types including a coastal headland, barrier beach ridge, barrier islands, migrating over-wash ridges, and a coastal cape. Ten major barrier beach units are recognized in the County, separated by nine tidal passes. Five of the ten barrier beach units are surveyed daily (May 01–October 31) for sea turtle activities including Barefoot, Vanderbilt (including Delnor-Wiggins Pass State Park), Park Shore, City of Naples, and City of Marco Island beaches (Figure 2.1.1.).

Since 1990, beach renourishment activities have occurred in Collier County. The following sections outline the years (1990–2015), DNR monument location, and sand source (hydraulic, mechanical, or upland) for each renourishment event. Hydraulic sand is transported by pipe from an offshore sand source or from a pass, with seawater as a transport medium. Mechanical sand is excavated from a pass, stockpiled and placed onto the beach. Upland sand is trucked from an inland quarry source and spread onto the beach.

Figure 2.1.1. Collier County Surveyed Beaches, 2015.



2.1.1. Barefoot Beach

Barefoot Beach is the northern-most beach unit in Collier County, which encompasses 3.1 miles (5.0 km) of barrier beach extending from the County line south to Wiggins Pass (DNR monument R-1 to R-16). The Barefoot Beach unit is surveyed for sea turtle activities to comply with the Wiggins Pass Inlet Management Plan and to assist in the permitting process for the maintenance of Wiggins Pass. Table 2.1.1.1. summarizes the renourishment history of Barefoot Beach since 1990.

Table 2.1.1.1. Barefoot Beach Renourishment History.

Year	DNR Location	Sand Source	Cubic Yards	Linear Feet of Beach
1990	R-13 to R-14	Hydraulic	33,460	1,000
1991	250' North R-13 to 30' North R-15	Hydraulic	34,010	2,264
1998	R-12.5 to R-13.5	Hydraulic	11,980	913
2002	250' North R-8 South 250'	Upland (ERJ) *Dune Only	n/a	ca. 500
2002	250' North R-5.5 South 250'	Upland (ERJ)	n/a	ca. 500
2005	250' South R-5 to 250' South of R-8	Big Island *Dune Only	n/a	3,000
2013	R-12 to R-15.5	Hydraulic	50,000	3,500

ERJ indicates an upland sand source known as E.R. Jahna. * Upland sand placed into dune only, this is not a beach renourishment.

2.1.2. Vanderbilt Beach / Delnor-Wiggins Pass State Park

The Vanderbilt Beach coastal barrier unit includes 4.7 miles (7.6 km) of beach from Wiggins Pass south to Clam Pass (DNR monument R-17 to R-41.5). The northern most mile of the Vanderbilt Beach unit, Delnor-Wiggins Pass State Park (R-17 to R-22.5), is surveyed for sea turtle activities by park staff. The data from Delnor-Wiggins is included in this report. Vanderbilt Beach is surveyed for sea turtle activities to meet the permit requirements for beach restoration and beach raking. Table 2.1.2.1 summarizes the renourishment activity of Vanderbilt Beach and Delnor-Wiggins Pass State Park since 1990.

Table 2.1.2.1. Vanderbilt Beach and Delnor-Wiggins Renourishment History.

Year	DNR Location	Sand Source	Cubic Yards	Linear Feet of Beach
1994	*R-18 to R-19	Hydraulic	35,250	1,000
1995	*R-19 to R-20	Hydraulic	46,580	1,000
1996	100’ North R-22.5 to R-29 R-29 to 50’ South R-30.5 R-40 to R-41 (North of Clam Pass)	Hydraulic Upland Mechanical	322,800 3,000 4,500	7,490 1,588 1,000
1998	*R-19 to R-20	Hydraulic	19,550	1,000
2000	*R-18 South 850’	Hydraulic	16,960	850
2002	*R-18 to 400’ South R-20 500’ South of R-23 to R30 (Dune Protection) 150’ South R-39 415’ South (Dune Protection) 500’ South R-36 to 322’ South R-38 (Dune Protection)	Hydraulic Upland (ERJ) Upland (ERJ) Upland (ERJ)	50,614 22,138 655 4,445	2,400 6,500 265 1,822
2006	R-22 to37	Hydraulic	178,442	14,900
2007	*R-18 south to 19.5	Hydraulic	48,405	1,591
2012	R-26 to R-30	Upland	12,000	4,000
2013	R-39A to R-41	Mechanical	9,626	1,500
2013	R25A to 36.3	Upland	78,752	10,800

* Indicates an area within the Delnor-Wiggins Pass State Park. ERJ is an upland sand source known as E.R Jahna.

2.1.3. Park Shore Beach

The Park Shore coastal barrier unit extends 3.2 miles (5.1 km) south from Clam Pass to Doctors Pass (DNR monument R-41.5 to R-57). Clam Pass County Park extends from Clam Pass southward approximately 2,000ft (640 m) to the Naples Cay development (R-42 to R-44). Park Shore Beach is monitored for sea turtle nesting activities to comply with beach renourishment and beach raking permit requirements. Table 2.1.3.1 summarizes the renourishment history of Park Shore beach.

Table 2.1.3.1. Park Shore Beach Renourishment History.

Year	DNR Monument	Sand Source	Cubic Yards	Linear Feet of Beach
1995	Clam Pass to R-43.5	Mechanical	4,500	2,889
1996	Clam Pass to R-42.5 350' South R-50 to 350' North R-54	Mechanical Hydraulic	6,000 90,700	1,788 3,589
1997	Clam Pass to R-42.5 350' North R-48 to 350' South R-50	Mechanical Mechanical	6,000 8,000	1,788 2,751
1998	Clam Pass to 143' North R-45	Mechanical	8,000	4,208
1999	Clam Pass to 270' North R-42 430' South R-42 to 250' South R-43.5	Mechanical & Hydraulic Hydraulic	3,500 26,500	310 1,365
2000	R-50.5 to 100' South R-53	Upland (ERJ)	35,000	2,600
2001	R-50.5 to R-54	Upland (ERJ)	28,268	3,500
2002	Clam Pass to 40' South R-43 700' South R-49 to 40' South R-54	Hydraulic Upland (ERJ)	11,725 9,067	1,975 4,700
2006	R-45 to R-55	Hydraulic	140,336	10,543
2007	R-42 + 180 South to R-43 +500	Hydraulic	20,603	1,464
2011	R 45 to R 46	Upland (SM)	7,836	1,000
2013	R-42+180' south to R-44+100'	Mechanical	10,877	1,920

ERJ indicates an upland sand source known as E.R. Jahna. SM indicates and upland sand source knows as Stewart Mining.

2.1.4. City of Naples Beach

The City of Naples beach unit encompasses approximately 5.6 miles (9.0 km) of shoreline from Doctors Pass south to Gordon Pass (DNR monument R-57.5 to R-89). The Conservancy of Southwest Florida monitors the City of Naples beach for sea turtle activities, contracted by Collier County, to meet the beach renourishment program permit requirements. Naples beach monitoring results are included in this report as well as in an annual report by the Conservancy of Southwest Florida. Table 2.1.4.1. summarizes the renourishment history of the City of Naples beach.

Table 2.1.4.1. City of Naples Beach Renourishment History.

Year	DNR Location	Sand Source	Cubic Yards	Linear Feet of Beach
1996	Doctors Pass (R-57) to 350' North R-78	Hydraulic	759,150	18,253
	R-69.5 to R-72	Upland/Hydraulic	55,000	2,438
1998	R-69.5 to R-72	Upland (BG)	8,820	2,438
	R-75 to 400' South R-76	Upland (BG)/Hydraulic	6,696	1,213
1999/ 2000	500' North R-63 to R-64 (Naples Beach Club)	Upland (BG)	8,036	1,500
	Doctors Pass (R-57) to R-58	Upland (BG)	6,804	1,000
2000	R-88 to R-89	Upland (BI)	6,000	1,000
2002	Doctors Pass (R-57) to R-68	Upland (ERJ)	45,047	11,000
2006	R-58A to R-77A	Hydraulic	345,307	18,935
2010	R-57 to R57 A +100 ft.	Upland (IM)	3,000	1,000
2011	R-57 to R-58A	Upland (IM)	22,393	2,000

2012	R-61 to R-63A	Upland (SM)	12,000	2,500
2013	R-57 to R-58A	Hydraulic	22,393	1,500
2013	R-58 to R-72.1	Upland (SM)	69,993	8,424

BG indicates an upland sand source known as Bonita Grande. BI indicates an upland sand source known as Big Island. ERJ indicates an upland sand source known as E.R. Jahna. SM indicates an upland sand source known as Stewart Mining

2.1.5. City of Marco Island Beach

The City of Marco Island coastal barrier unit encompasses 7.1 miles (11.4 km) of beach, from inside Big Marco Pass [Hideaway Beach (DNR monument H-16 to H-1)] south to Caxambas Pass (DNR monument R-131 to R-148). The City of Marco Island is a highly developed beach with high-rise condominiums and hotels. This beach has been monitored for sea turtle activities since 1990 comply with the permit requirements for beach renourishment and raking. Table 2.1.5.1. summarizes the renourishment history for the City of Marco Island.

Table 2.1.5.1. City of Marco Island Beach Renourishment History.

Year	DNR Monument	Sand Source	Cubic Yards	Linear Feet of Beach
1990	*H-3 to H-7	Hydraulic	70,000	2,063
	R-136.5 to R-138.5	Hydraulic	284,600	2,189
	R-142.5 to R-148	Hydraulic	715,400	5,533
1997	*130' South H-9 to 45' South H-11	Upland (BG)	1,000	1,345
	*370' South H-1 to 131' South H-3	Upland (BG)	4,000	1,636
	R-145.5 to R-148	Upland (BG)	80,000	1,781
1998	*H-9 to H-11	Upland (BG)	15,000	1,250
	*400' South H-1 to H-2	Upland (BG)	10,000	900
1999	*H-1 to H-3	Upland (BG)	3,528	985
	R-148 South to Caxambas Pass	Upland (BG)	9,000	625
2000	*200' North H-1 to H-3	Upland (BI)	3,600	950
		Hydraulic	2000	
2001	*H-1 to H-4	Upland (ERJ)	15,000	1,500
	*H-9 to H-13.5	Hydraulic	24,078	2,300
2002	R-136 to R-136.5	Upland (ERJ)	148	300
	*140' South H-9 to 140' North	Upland (ERJ)	359	280
2003	*200' South H-1 to 40' North H-4	Upland (ERJ)	11,096	1,740
	*H-9 to H-11	Upland (ERJ)	11,096	1,000
2005	H1 to H-9	Hydraulic	316,770	6,300
2007	R-144 to R-148 +549	Hydraulic	168,431	4,288
2010	H4 to H9	Hydraulic	130,000	2,500
2013	R-144 to R-148 H-12 to H-14	Hydraulic	104,000 25,000	4,730 1,000

* Indicates an area within Hideaway Beach were the H-monuments are numbered consecutively from southwest to northeast. BG indicates an upland sand source known as Bonita Grande. BI indicates an upland sand source known as Big Island. ERJ indicates an upland sand source known as E.R. Jahna

2.2. METHODS AND MATERIALS

2.2.1. Reconnaissance Surveys and Beach Zoning

Pre-season reconnaissance surveys of the monitored beaches were conducted in April, 2014. The objective of the surveys was to develop daily monitoring strategies, note the condition of the beaches, zone the beaches for management purposes, and conduct cone penetrometer readings to determine if the beaches required tilling pre-season.

Metal signs on 6' metal posts were placed within the dune area in approximately 1,000 ft. increments from the Lee/Collier County line south to Marco Island. In addition, wooden stakes were installed 500 ft south of every DNR marker. Beaches were measured along the high tide line using a Rolatape measuring wheel.

2.2.2. Daily Monitoring

Daily surveys for emergence activity were performed along the high water line (HWL) utilizing all-terrain-vehicles (ATVs) equipped with low-pressure tires. Upon discovery of an emergence, staff visually determined if the emergence resulted in a nest or a false crawl (non-nesting emergence). A GPS reading was taken for each emergence location. Nests and false crawls were sequentially numbered and mapped on aerial photographs. Characteristics and measurements of the emergences were recorded on data sheets for evaluation.

All nests were marked with stakes, flagging tape, and a sign to provide protection and facilitate evaluations. Four 36-inch (91 cm) long wooden stakes were placed in the corners of each disturbed area. Yellow ribbon with the word "caution" printed on it, was then placed around the stakes and a Sea Turtle Nest Sign (Figure 2.2.2.1.) was affixed to alert and direct beach rakers and the public away from nests. In addition, the stakes were marked with their direction (SW, NW, SE, NE) to facilitate clutch location if stakes were lost during storms.

Nests laid in areas known for high depredation, such as the undeveloped portions of Barefoot and Vanderbilt, beach were covered with a protective screen. Screening involved securing a four-foot (1.2 m) square wire mesh screen over the clutch with metal tent stakes. The 2 by 4 inch screen openings (5.1 by 10.2 cm) were large enough to allow the natural escape of hatchlings, but were small enough to prevent most mammalian depredation. Screened nests were observed on a daily basis for evidence of predation. If a predator disturbed the sand under the screen, the sand was replaced, the area flattened out, and the event recorded. If fire ants were observed, they were gently swept off the nest.

Figure 2.2.2.1. Sea Turtle Nesting Form 2015

Nesting & Hatchling Data Form 2015

GPS # N. ____________
W. ____________

NEST #______________

Nesting Data

Date__________ Species____________

Did You Verify?: ☐ Map?: ☐ Log?: ☐

DNR Location: ______________________

Establishment: ______________________

Renourished* or Natural

Beach Zone (please circle): A (dune) B (berm) C (mhw)

Distance(ft) from:

MHW_______ Vegetation / Structure________

Structure Type: ______________________

Scarp: No or Yes : Height______ : Sloped or Vertical

Length_____ Crawl over scarp: Yes or No

Nest cover: Full sun Partial shade Total shade

Relocated: Yes or No

If Relocated, Why:___________________

Screened / Caged: No or Yes Date:_______

Investigator______________________

Egg Chamber Data

A. Hatched eggs (1+2+3) ☐

1. Emerged _____2. Alive_____3. Dead______

B. Unhatched eggs (4+5+6) ☐

4. Undeveloped____5.Dead embryo_____

6. Depredated Eggs _____ LOOK on the back.

C. Pipped eggs (7+8) ☐

7. Dead _______ 8. Alive _______

D. Total Eggs (A+B+C) ☐

Nest Material: ____% Sand ____% Shell ____ % Root

Please note anomalies in hatchlings or unhatched eggs

____

____

____

Renourishment Data*

Year of Renourishment: __________

Type of Sand: Upland Hydraulic Mechanical

Eggs deposited in renourished sand: Yes or No

Embryo Stages

30 ______ **29** ______ **28**______

27 ______ **26** ______ **25**______

24 ______ **23** ______ **22**______

21 ______ **< 21** ______

Undetermined ______

Emergence Data

Expected Date________Actual________

Incubation_______Date excavated_______

Clutch Depth(in)_______Width________

Investigator______________________

Crawl Diagram

Draw scarps and obstructed nesting attempts (fill out form).

Disorientation Data

Disoriented Hatchlings: ________ Date: ______

Dead ____ # Alive _____ Source ________

DEP form filled out? Yes or No

Notes

DEPREDATION FORM

*Please record **EACH** occurrence of predator interaction. This includes root invasions and eggs destroyed by other nesting turtles*

Please Note* you may record occurrence of depredation of hatchlings but only those hatchlings that are depredated within the nest. The hatchlings should be recorded as dead hatchlings(#3) on the nesting sheet in the Hatched eggs section (A.).**

Date	Predator Species	Digging or Tracks	Through or Under Screen	Location of Ants / Ghost Crabs 1.beach surface 2.Upper cavity 3. Lower cavity 4. Throughout	# of Eggs Depredated	# of Hatchlings Depredated
				Total :		

INUNDATION LOG

Nest #	Date	Cause of Inundation	Complete or Partial

WASHED OUT LOG

Nest #	Date	Cause of Nest Being Washed Away	Complete or Partial

ACCRETION LOG

Nest #	Date	Cause of Nest Being Affected by accretion	Complete or Partial

Figure 2.2.2.2. Sea Turtle Nesting Area Sign.

2.2.2. Nest Monitoring and Evaluation

Daily monitoring for hatched nests began as the first nest approached its expected hatch date (approximately 60 days). All nests were observed for signs of hatching, such as an obvious depression in the sand or hatchling tracks around the nest. Each nest was excavated for evaluation approximately 72 hours (3 days) following signs of the first emergence, or in the case of unhatched nests, 70 days from deposition or 80 days if the nest was inundated from high surf, excessive rainfall or shading.

Upon excavation, all contents of the egg cavity were removed by hand. The depth and width of the egg cavity was measured and recorded. Data from each nest evaluation was recorded on CCPRD Sea Turtle Nesting Forms. Empty eggshells accounted for live hatchlings that escaped from the nest and/or dead turtles, found within the nest. Unhatched eggs included undeveloped eggs, dead embryos, and eggs depredated prior to hatching. Pipped eggs refer to hatchlings (dead or alive) that puncture the eggshell but did not fully emerge from the shell. Unhatched eggs were opened and inspected to determine the stage of embryonic development at the time of death. If live hatchlings were found in the nest, they were either released immediately or transferred to a bucket of moist sand for night release, depending on the time of the day and the presence or absence of predatory birds in the area. Hatchling releases were conducted according to the Florida Fish and Wildlife Conservation Commission Sea Turtle Conservation Guidelines (FWC, 2007).

Nests were also inspected for evidence of predation. If signs of predation were discovered, the information was recorded. The collection of predator data aids in quantifying and determining the extent of nest predation in Collier County. The data also helps to identify ways to mitigate predation. Washed out nests and inundations were also recorded after storm events and extreme high tides.

2.2.4. Data Analysis

Sea turtle emergence and hatchling data were compiled using the relational database Microsoft Access. Maps were produced using ArcMap and Collier County Property Appraiser's aerial photographs taken in 2015. Shoreline and monument points were based on North American Datum (NAD) 1927 and then converted to NAD 1983, Florida State Plane Coordinate East Zone. Shoreline data and emergence locations were collected with a Garmin GPS 76 marine navigator. Graphs and plots were created using Microsoft Excel. Data was analyzed with personal computers utilizing Microsoft Excel and Microsoft Access.

Data was analyzed at each study area for factors relating to both nest and hatching characteristics. Nesting factors included nests per emergences (nesting success), emergences per mile (e/mi.), and nest placement characteristics. Factors relating to hatching success included cavity depth, incubation duration, egg counts, inundation, and depredation. Linear regression analysis was used to search for any factors directly affecting hatching success. Plots were prepared showing comparisons between and within study areas.

2.3. RESULTS AND DISCUSSION

2.3.1. Emergences

Sea turtles emerged on Collier County beaches from April 23, 2015 through August 13, 2015. A total of 1,690 emergences (881 nests and 809 false crawls) occurred along the 23.7 miles (38.1 km) of the daily surveyed shoreline. A breakdown of emergence activity for each beach is listed in Table 2.3.1.1. Aerial maps showing emergence location by beach are available as an additional appendix separate from this report. A comparison of nests and false crawls for each beach segment is given in Figure 2.3.1.1. A breakdown of emergences per mile on each beach is illustrated in Table 2.3.1.1. Barefoot beach recorded the most sea turtle activity with an average of 135 emergences per mile. The City of Naples beach received the least activity with an average of 34 emergences per mile.

Table 2.3.1.1. Emergences, 2015.

	Barefoot	Delnor Wiggins	Vanderbilt	Park Shore	Naples	Marco	Total
Total Nests	260	58	192	128	125	118	881
Total False Crawls	160	69	227	123	66	164	809
Total Emergences	420	127	419	251	191	282	1,690
Nest / Emergence (%)	61.9	45.7	45.8	51	65.4	41.8	52.1
Beach Length (mi.)	3.1	1.2	3.5	3.2	5.6	7.1	23.7
Emergences / mi.	135	105	119	78	34	39	71
Nests / mi.	83	48	54	40	22	16	37
False Crawls / mi.	51	57	64	38	11	23	34

Figure 2.3.1.1. Sea Turtle Emergences in Collier County, 2015.

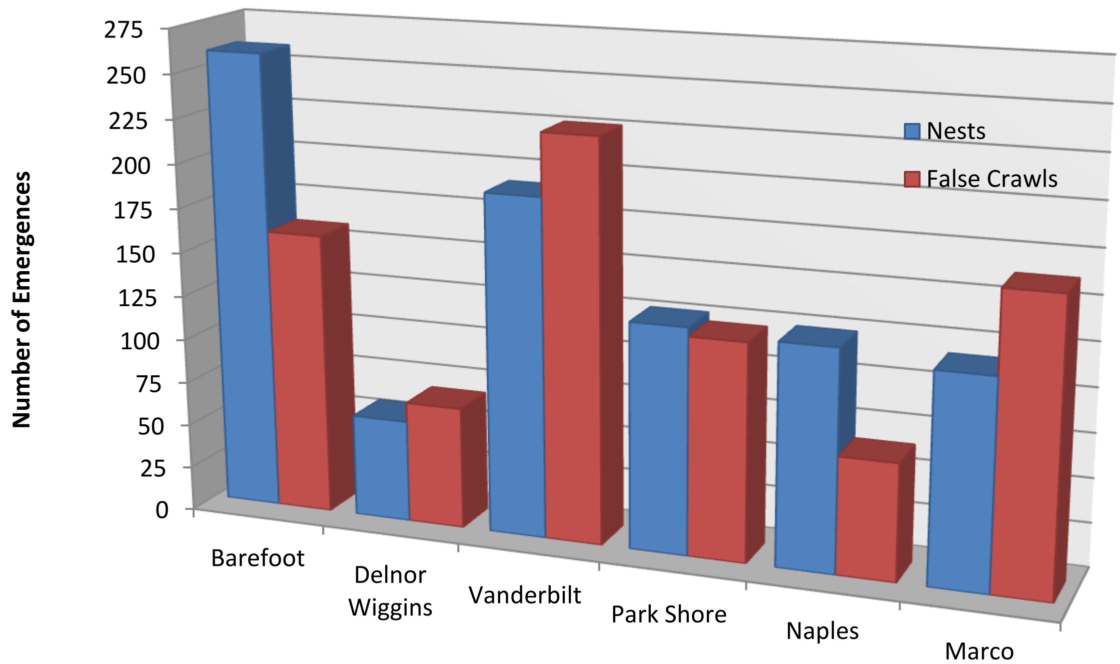


Figure.2.3.1.1. shows some variation in total nests and false crawls between beaches. This variation is difficult to explain since nest-site selection of the female turtle is still poorly understood. Some important factors include, but are not limited to: beach compaction, artificial lighting, human activity, structures on the beach, and scarps.

Above normal beach compaction can impede nest excavation contributing to the rejection of a nesting site, thus increasing the number of false crawls and aborted egg cavities on renourished beaches (Raymond, 1984a; Nelson, 1991). Witherington (1991) found that the "presence" of lights in beach areas "sharply reduce" the number of sea turtles that emerge to nest. Human activities on the beach can also contribute to the disruption of nest site selection by adult sea turtles (LeBuff, 1990; Kraus, 1992). Obstacles in the paths of emerging turtles may contribute to the failure of a nesting attempt. These obstacles include, but are not limited to: scarps, beach furniture, seawalls, boardwalks, stairs, fences, pilings, groins, sand castles, sand pits, and boats stored on the beach.

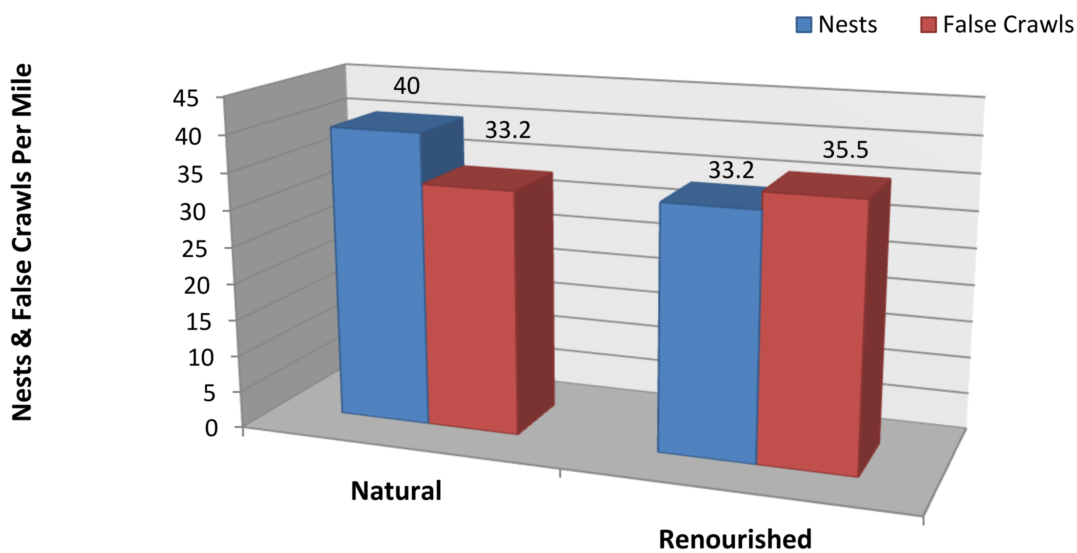
Abandoned nesting attempts (false crawls) are a common occurrence for loggerheads and have been recorded at all nesting beaches (Dodd, 1988). Raymond (1984b) reported that on natural beaches, 46% to 49% of emergences resulted in false crawls. The 809 false crawls in Collier County, represents 47.8% of the total emergences. The reasons for the 2015 false crawl ratio may include: lighting violations, human activity, beach furniture, seawalls, compaction, dense roots, standing water on the beach and scarps.

It is possible that a limited number of false crawls occur from the female's instinctive preferences for a specific site. These are false crawls not provoked by human disturbance and interference; but by physical factors such as temperature, sand composition, and possibly other unknown characteristics.

2.3.2. Effects of Beach Renourishment

Figure 2.3.2.1. compares the 2015 nests and false crawls per mile on natural and renourished beach areas on the combined beaches of Barefoot, Vanderbilt (including Delnor-Wiggins Pass State Park), Park Shore, City of Naples, and City of Marco Island.

Figure 2.3.2.1. Natural vs Renourished Beaches, 2015.



Dodd (1998) reported that loggerhead sea turtle nest site selection might be influenced by “micro-habitat cues” that initiate the nesting process. Microhabitat cues may be significantly different on renourished beaches when compared to natural, non-renourished beaches, and these differences may influence nesting preferences and success. Collier County beaches are continually nourished and renourished therefore, continued research and data collection is imperative. Studying the historical nesting data from different sand types will ensure the best selection of sand to reduce negative impacts of future renourishments.

2.3.3. Historical Trends

Marco Island beach was first surveyed for sea turtle activities in 1990, followed by Barefoot in 1991, and Clam Pass Park (from Clam Pass south to Seagate beach access) in 1992. In 1994, the "Collier County Sea Turtle Protection Program" was developed to survey mainland beaches in response to area-wide beach renourishment. Consecutive years of consistent data collection will assist biologists in detecting local population trends of loggerhead sea turtles, and the local impacts of beach renourishment.

Most loggerhead sea turtles do not nest every year. In the "Synopsis of the Biological Data on the Loggerhead Sea Turtle", Dodd (1988) compiled studies reporting that 90% of loggerhead sea turtles nest on a 2 to 4 year cycle. This factor requires many years of consistent data collection before any trends can be accurately detected. Historical sea turtle emergences are presented in Table 2.3.3.1. and Figures 2.3.3.2. – 2.3.3.6. for all beaches. Figure 2.3.3.1. reflects the overall County beach totals.

Table 2.3.3.1. Historical Trends of Sea Turtle Nests and False Crawls (FCs), 2000–2015.

Beach Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Barefoot Nests	96	104	62	88	84	72	56	40	75	59	87	71	172	121	189	260
Barefoot FCs	85	84	28	66	73	67	55	33	85	50	90	38	209	136	113	160
Delnor Nests	17	23	15	21	11	15	10	18	17	22	20	18	46	30	42	58
Delnor FCs	32	25	22	49	38	46	12	20	33	36	20	15	62	54	35	69
Vanderbilt Nests	167	125	90	159	90	61	78	55	82	62	111	93	212	151	172	192
Vanderbilt FCs	136	118	131	125	45	91	81	69	64	65	88	107	146	194	163	227
Park Shore Nests	154	105	81	122	73	40	68	67	73	50	86	90	188	114	160	128
Park Shore FCs	186	79	75	188	64	58	78	60	52	43	74	69	198	153	113	123
Naples Nests	68	52	31	59	61	31	30	42	50	50	72	67	148	92	164	125
Naples FCs	70	49	49	52	39	55	40	43	38	42	35	51	153	82	136	66
Marco Nests	50	79	28	55	59	39	56	40	34	54	46	65	52	93	73	118
Marco FCs	52	115	54	80	97	75	107	96	52	94	90	124	75	166	107	164
Total Nests	552	488	307	504	378	258	298	262	331	297	422	404	818	601	800	881
Total FCs	541	470	359	560	356	392	373	321	324	330	397	401	843	785	667	809

Figure 2.3.3.1. Collier County Annual Emergences, 2000 – 2015.

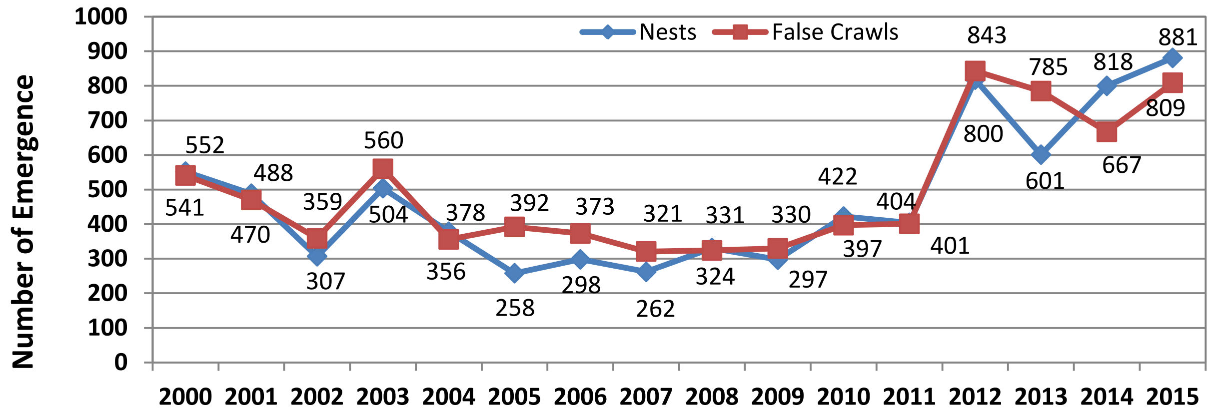


Figure 2.3.3.2. Barefoot Annual Emergences, 2000 – 2015.

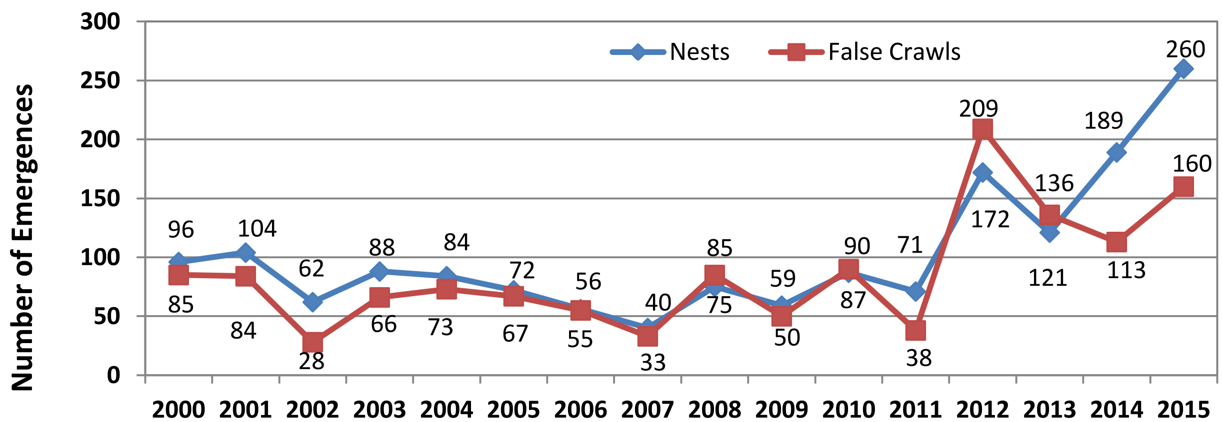


Figure 2.3.3.3. Delnor-Wiggins Pass SRA Annual Emergences, 2000 – 2015.

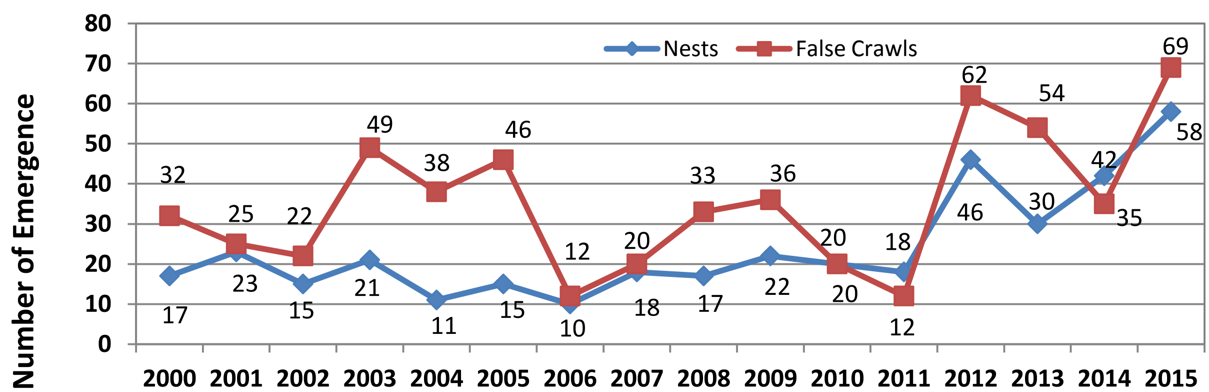


Figure 2.3.3.4. Vanderbilt Beach Annual Emergences, 2000 – 2015.

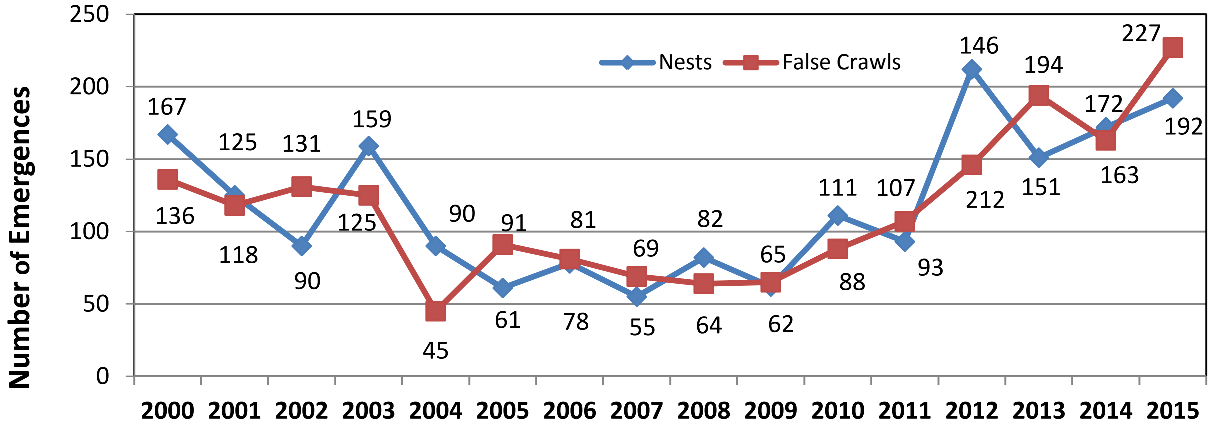


Figure 2.3.3.5. Park Shore Beach Annual Emergences, 2000 – 2015.

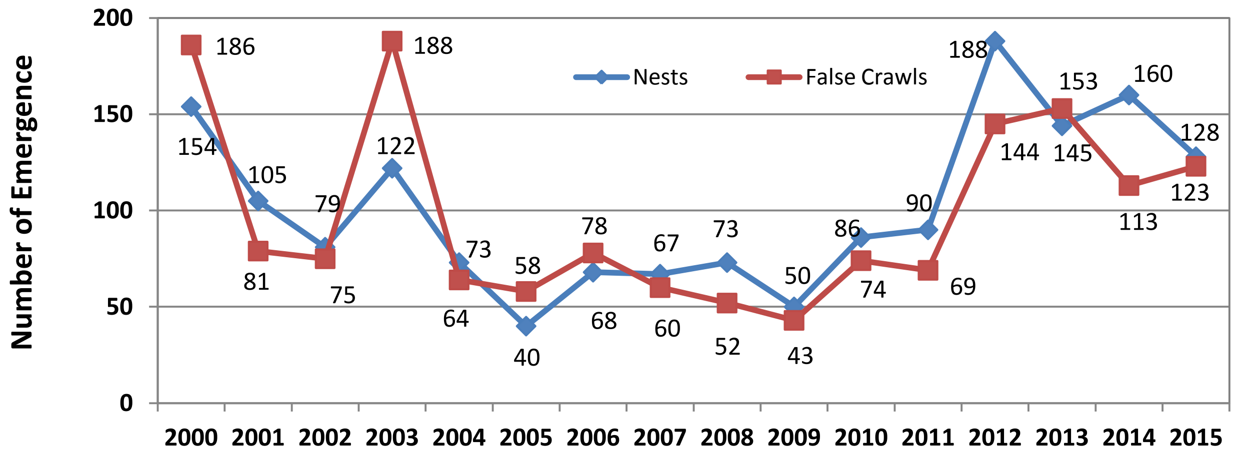


Figure 2.3.3.6. City of Naples Annual Emergences, 2000 – 2015.

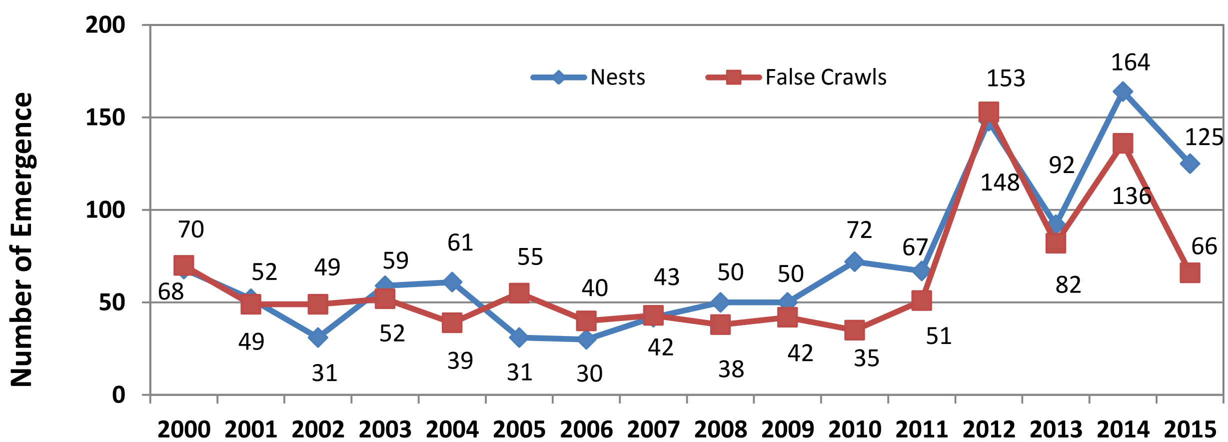
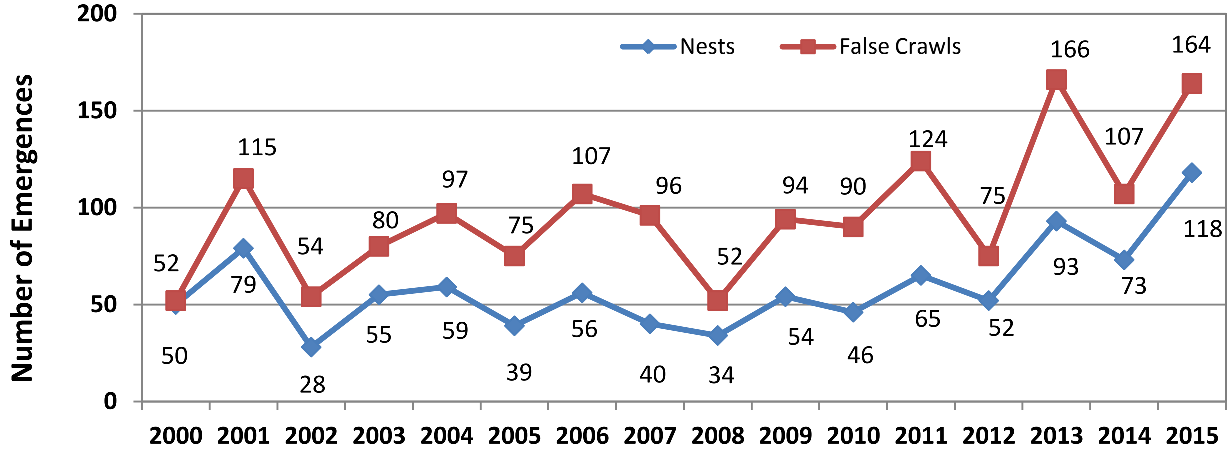


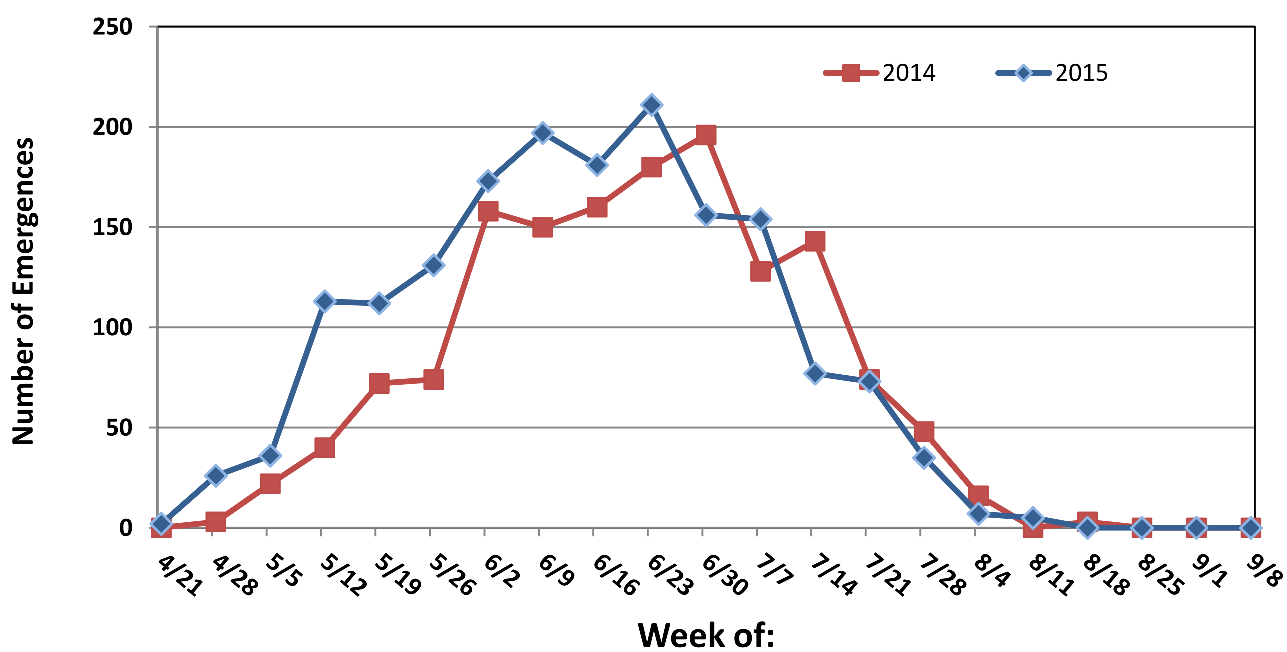
Figure 2.3.3.7. City of Marco Island Annual Emergences, 2000 – 2015.



2.3.4. <u>Weekly Emergence Analysis</u>

Sea turtle weekly emergence (nest and false crawls) trends are depicted in Figure 2.3.4.1. for 2014 and 2015. There are typically two peaks of sea turtle emergences for each season. This season's peaks occurred in the second and fourth week of June.

Figure 2.3.4.1. Collier County Emergences per Week, 2014 –2015.



2.3.5. Clutch Depth

Measurements of the egg cavity were taken for each excavated nest when possible. Clutch depths were recorded from 692 of the 881 nests deposited. The clutch width was measured from the widest portion of the egg cavity and the clutch depth was measured from the sand surface to the firm bottom of the egg cavity. There was a significant difference found when the clutch depths were compared between renourished and non-renourished beaches ($p=0.0009$; $df = 1,690$; $F = 11.17$).

Table 2.3.5.1. Clutch Depth in Renourished Sand Types, 2015.

	Natural	Renourished
Mean Clutch Depth (Inches)	18.26	19.08
Number of Nests	433	259

2.3.5. Hatching Evaluation

In 2015, 881 of the evaluated nests were marked for evaluation. Of these nests, the CCPRD, The Conservancy of Southwest Florida, and Delnor-Wiggins Pass State Park staff evaluated 727. Sixty-seven (7.6%) were lost due to storms during the 2015 season. Tidal flooding inundated 37% (n = 326) of nests. Tidal flooding and washed out nests combined accounted for 46.6% (n=393) of all nests compared to 4.1% (n=33) in 2014.

The average number of eggs per nest (clutch size) was 101 (range = 1–159). Loggerhead sea turtles average 110 to 120 eggs per nest throughout their range, but the clutch size is highly variable (Ernst *et al.*, 1994).

Table 2.3.6.1. Collier County Mean Clutch Size, 2015.

	Barefoot	Delnor Wiggins Pass	Vanderbilt	Park Shore	Naples	Marco
Mean Egg Count / Nest	87	100	95	91	93	103

A total of 68,311 eggs were deposited into the evaluated nests and 43,531 hatchlings entered the Gulf of Mexico (Table 2.3.6.2.). The total number of hatchlings that entered the Gulf of Mexico includes 42,690 that emerged on their own and 841 that were found alive in the nest cavity.

Table 2.3.6.2. Nest / Hatchling Evaluations by Beach Unit, 2015.

	Barefoot	Delnor Wiggins Pass	Vanderbilt	Park Shore	Naples	Marco	Total
Total Nests	260	58	192	128	125	118	881
Lost Nests	6	9	16	11	20	5	67
Total Eggs	18,215	4,941	15,466	10,115	8,830	10,744	68,311
Emerged Hatchlings	11,473	2,747	11,271	6,410	5,577	5,212	42,690
Hatchlings Alive in Nest	82	120	236	40	46	317	841
Hatchlings Dead in Nest	260	143	128	449	215	552	1,747
Undeveloped Eggs	1,653	1,041	2,325	1,698	890	1,925	9,532
Dead Embryos	1,336	715	1,196	1,192	1,802	2,279	8,520
Predated Eggs	3,284	151	214	0	123	67	3,839
Pipped Live Eggs	17	0	2	11	6	15	51
Pipped Dead Eggs	110	24	94	513	171	377	1,091
Total Hatch Success	65%	61%	75%	68%	66%	57%	66.3%
Total Hatchling Emergence Success	63%	56%	73%	63%	63%	49%	62.5%

Unhatched eggs (21,891) were opened to identify fertility and embryonic development. Dead embryos (8,520) comprised 39% of the unhatched eggs, depredated eggs (3,839) made up

17.5%, and the remaining 43.5% were labeled as undeveloped (9,531) due to lack of evidence of advanced embryological development. The undeveloped eggs may be a result of infertility or early embryological death. Each dead embryo was carefully inspected and the developmental stage was determined based on the 30 stages described by Miller (1985). Stages 1 through 20 are difficult to distinguish and were recorded together and labeled as "less than stage 21". Stages 21 through 30 are determined relatively easily with the naked eye and were recorded separately. Embryos too decomposed for identification were labeled as "undetermined".

The mean incubation rate for nests deposited in non-renourished areas was 59.8 days. This rate appears slightly lower than the 60.9 days experienced for nests deposited in renourished sands (hydraulic and upland). There was a significant difference in the mean incubation rates between natural and renourished sands ($p = 0.0009$; df =1,581; $F = 11.05$). There was however, no significant difference in the mean incubation rate when comparing nests that were fully exposed to the sun and nests that were shaded by vegetation or buildings ($p = 0.40$; df =1,582; $F = 3.86$).

Table 2.3.6.3. Mean Incubation Rate in Natural and Renourished Sand Types, 2015.

	Natural	Hydraulic/Mechanical	Upland
Mean Incubation Rate (days)	59.8	61.1	60.9
Number of Nests	353	53	177

The incubation success of a nest was measured by its overall hatching success and emergence success. The hatching success was calculated as the number of hatched eggs including live hatchlings and dead hatchlings found in the nest divided by the total egg count.

The emergence success was calculated as the number of naturally emerged hatchlings divided by the total egg count. The mean emergence success was 61.1% and the mean hatching success was 64.8% for all beaches and sand types (Table 2.3.6.5.). The emergence success of nests found on natural, non-renourished beaches versus renourished beaches was significantly different (p = 0.026; df =1,724; F = 4.83). When comparing the hatching successes on natural non-renourished beaches with those of renourished beaches, there was also a significant difference found (p = 0.027; df =1,724; F = 4.90).

Table 2.3.6.4. Hatching and Emergence Success in Natural and Renourished Sand, 2015.

Natural Sand or Renourishment Type	Natural	Renourished	Overall
Mean Hatching Success	62.5%	68.3%	64.8%
Mean Emergence Success	58.8%	65%	61.1%

2.3.6. Nest Predation

Depredation by raccoons (*Procyon lotor*), fire ants (*Solenopsis invicta*), ghost crabs (*Ocypode quadrata*), feral cats (Felis catus), opossum (Didelphimorphia), roots, armadillos (*Dasypus novemcinctus*), and nesting loggerheads (Caretta caretta) affected 13.1% of all nests (n=116). Most depredations occurred on Barefoot Beach, where 71 nests (27.3%) were depredated. The damage caused by predators to sea turtle eggs was significant. Of the 68,312 eggs deposited in 2015, 3,839 (5.6%) were lost to predators, which represents a significant increase from 1,495 (2.0%) in 2014. A total of 66 raccoons were removed from Barefoot Beach during the nesting season. During the months of March to April, 33 raccoons were removed, and an additional 33 raccoons during months July to August. Different methods of nest protection and increased trapping in specific areas will have to be implemented on Barefoot Beach during future nesting seasons. Table 2.3.7.1 provides a breakdown of egg predation during 2015.

Table 2.3.7.1. Egg Depredation in Collier County, 2015.

Predator(s)	Number of Eggs Taken	Percentage By Predator
Raccoons	3,528	91.9%
Armadillo	87	2.3%
Ants	8	0.2%
Opossum	20	0.5%
Ghost crab and ants	2	0.1%
Cat	2	0.1%
Roots	155	4.0%
Root an ants	18	0.5%
Loggerhead	7	0.2%
Unknown	12	0.3%
Total	3,839	100%

SECTION 3

PUBLIC AWARENESS AND BEACH LIGHTING

Public education plays a vital role in conservation. Many beach goers are unaware of the problems sea turtles encounter. The CCPRD staff provides an important link to knowledge and understanding of the characteristics and natural history of the sea turtles inhabiting our area. In 2015, staff responded to the inquiries of approximately 5,504 people during morning surveys and over 1460 people during educational programs and exhibits. Through public presentations, mail distributions and related local events, the CCPRD staff works to make sea turtle conservation a community challenge which brings to light the importance of our common natural environment. Our local beaches are an important habitat requirement for sea turtles and making homeowners and visitors aware of the possible impact of artificial lighting is also an important aspect of the public education program.

Artificial lighting on nesting beaches, distant sources of illumination ("city glow") and other sources of light pollution can interfere with the normal nesting behavior of sea turtles and cause hatchling orientation problems. Light pollution has been proven to discourage sea turtles from emerging out of the water to nest (Witherington, 1996). The negative effects of artificial lights on hatchling sea turtles are well documented (Danial and Smith, 1947; Dickerson and Nelson, 1989; Witherington, 1990). Artificial lighting interferes with a hatchling sea turtle's ability to correctly orient, causing them to crawl towards sources of the light pollution (disorientations). Disorientations affect sea turtles by leaving them vulnerable to dehydration, exhaustion, and predation (Witherington, 1999). Hatchling loggerhead turtles appear to be more susceptible to disorientation on wider beaches where nests are placed further from the vegetation, implying a protective benefit of the dune vegetation, by shading landward light sources.

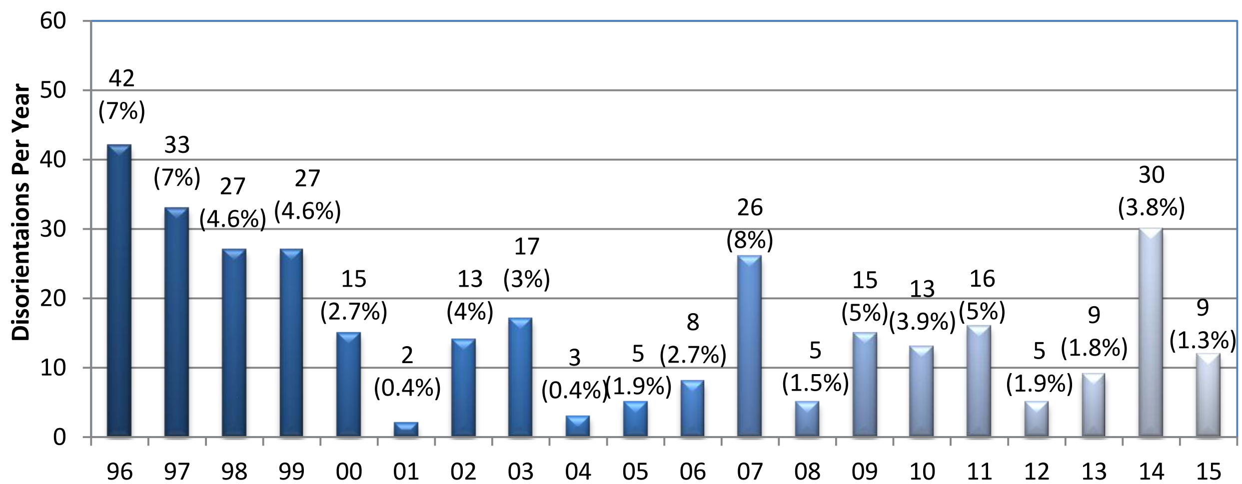
In accordance with the Collier County Land Development Code Sec. 3.04.00 “Protection of Endangered, Threatened or Listed Species”, CCPRD manages a beach lighting compliance program developed to minimize the damages caused by light pollution. The program is composed of two annual mail-outs prior to season, night lighting compliance inspections, violation notices, and code enforcement action. The first annual mail-out is a sea turtle information package sent to beachfront homeowners and establishments. The mail-out illustrates the importance of shielding or turning off lights during sea turtle nesting season and suggests inexpensive methods of reducing and minimizing beach lighting. It also reminds the residents to remove any obstacles to nesting and hatching sea turtles such as beach furniture or recreational accessories, and reminds them to refrain from trimming beachfront vegetation during and prior to season. The 2^{nd} mail out is a post card/sticker and is sent a few days prior to May 1.

Throughout sea turtle nesting season (May 01 – October 31), the CCPRD, Collier County Code Enforcement, City of Naples and Marco Island staff conduct monthly lighting compliance inspections. The monthly inspections are conducted as close to the new moon phase as possible. Light sources that create a visible shadow on the beach are considered a violation. When a violation is identified, efforts are made to work with the property managers and owners to correct the problem. Violations with no attempt to correct are sent to Collier County’s Code Enforcement Department for formal action. If the violation is not corrected when the Code Enforcement Inspector arrives, the establishment receives formal “Notice of Violation” (NOV). Additional violations may result in citations and court actions.

By working with property owners, managers, and renters, the beach lighting program decreased the amount of hatchling sea turtles affected by light pollution. In 1996, ESD staff documented 42 disorientations (7% of the nests), since that time the amount of disorientations has decreased. In 2015, there were 12 disorientations (1.3 % of the nests).

Figure 3.1. shows a yearly decrease in disorientations beginning one year after the initiation of the beach lighting program and continuing through 2015.

Figure 3.1. Disoriented Nests in Collier County, 1996–2015.



In addition to documenting lighting violations, Parks and Recreation staff also recorded objects left on the beach that could be an obstacle to nesting and hatchling sea turtles. The Collier County Land Development Code section 10.02.06 requires that any structure such as beach umbrellas and furniture not requiring a building permit, be removed nightly from the beach. Objects left on the beach over-night were documented and a NOV sticker adhered to the object to inform the owner of the need for furniture or equipment to be removed. Staff hopes to reduce this number by notifying people about the harm furniture and other equipment can cause on nesting or hatchling sea turtles.

SECTION 4

SEA TURTLE STRANDING AND SALVAGE PROGRAM

Stranded sea turtles are those which wash ashore or are found floating, dead or alive in a weakened condition. Collier County has been actively involved in assisting the Florida Fish and Wildlife Conservation Commission's (FWC) Sea Turtle Stranding and Salvage Network (STSSN) with data collection on dead, sick or injured sea turtles since 1994. Prior to 1994, not all strandings in Collier County were reported and many sea turtles were disposed of without notification to staff or the FWC. The FWC is required to send all stranding data to the National Marine Fisheries Service (NMFS) on a weekly basis. The NMFS uses this data to further our knowledge of sea turtle biology, species composition, distribution, seasonality, migratory patterns, habitat use, and sources of mortality.

Sources of sea turtle mortality include, but are not limited to the following: incidental catch by commercial fisheries (trawling gear, gill nets, drift nets, long lines and crab traps), entanglement and ingestion of marine debris, boat strikes, poaching, injury from shark attack, red tide, disease, and natural causes. The cause of mortality is determined when possible and used to identify ways of aiding in population sustainability; although it is estimated that only 27% of the carcasses are detected and therefore reported (Murphy, T.M. and Sally Hopkins Murphy, 1989). The STSSN program is critical to the future conservation and recovery efforts of sea turtles.

In 2015, 29 sea turtles were reported stranded along the Collier County coastline (Figure 4.2). Strandings occurred every month except February, May and December (Figure 4.1).

Figure 4.1. Collier County Monthly Sea Turtle Strandings, 2015

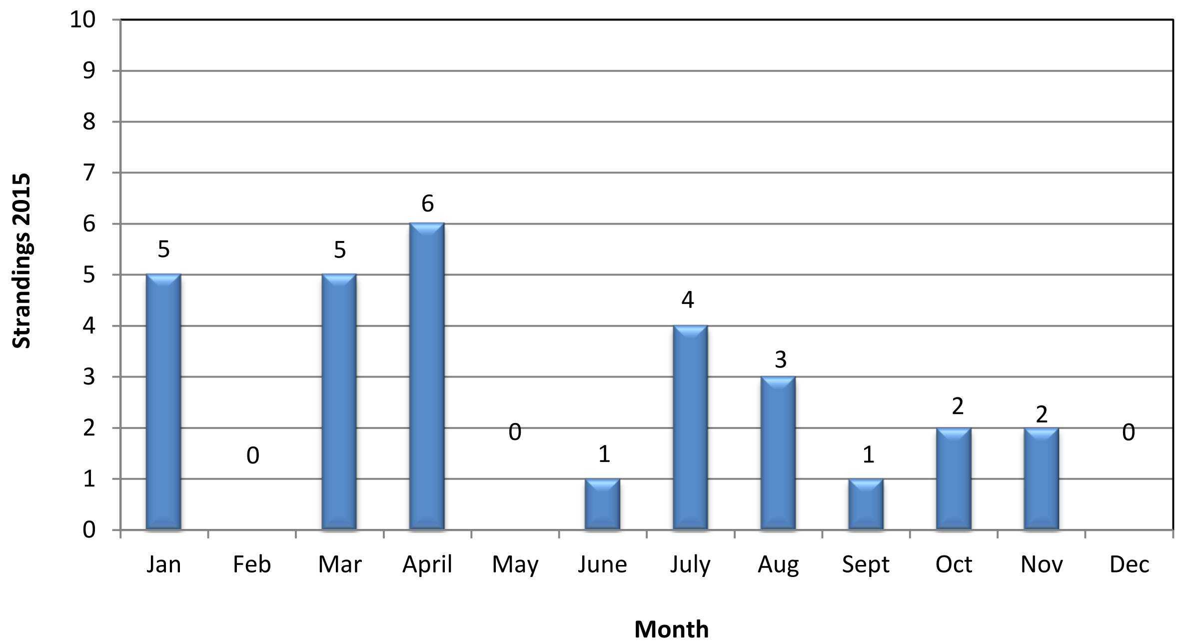
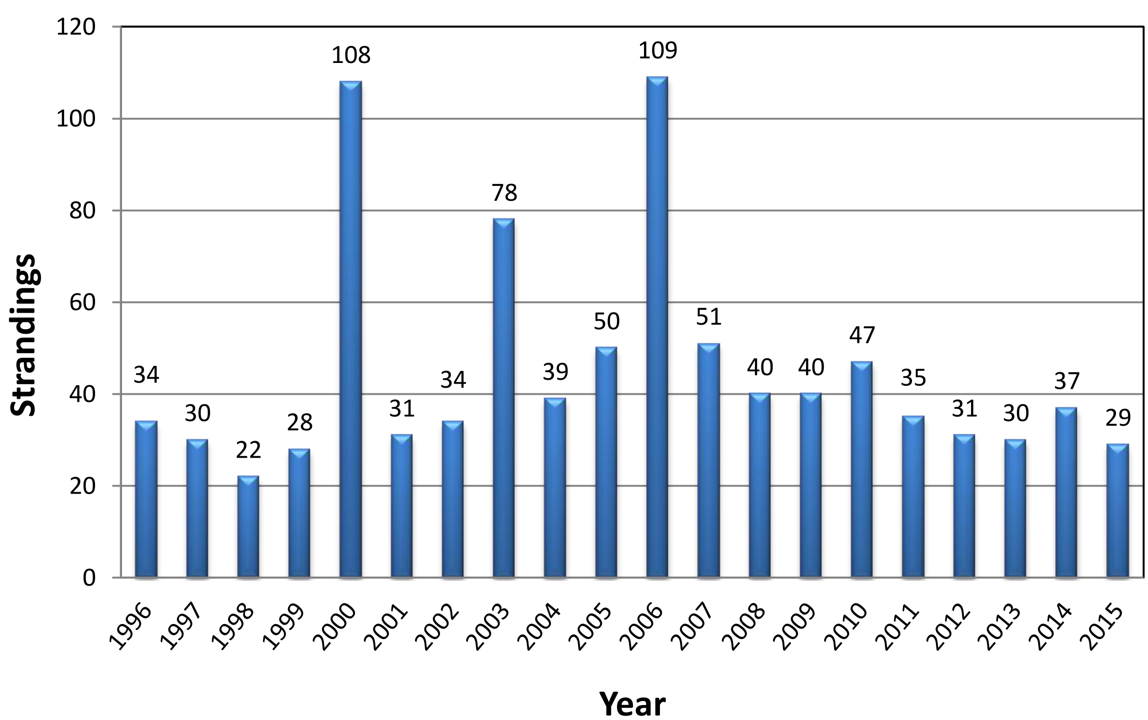


Figure 4.2. Collier County Sea Turtle Strandings, 1996-2015.



Strandings in 2015 included loggerheads (14), Kemp's ridleys' (5), green sea turtles (7), hawksbills (2) and one (1) unknown (bones only). Six sea turtles were alive at the time of stranding. Two died before arriving at a rehabilitation facility and four were euthanized due to severity of their injuries. An additional two sea turtles were reported dead or sick offshore were not recovered or confirmed

Injuries and abnormalities of dead and live sea turtles ranged from boat and/or obvious propeller damage with visible markings or hull paint (8), shark bites (4), fishing line or crab trap entanglement (1) emaciated with much barnacle and algal growth (10), Fibropapilloma virus (4) and one died post nesting having been pinned under a dead mangrove root. The remaining turtles either had no obvious cause of death or were too decomposed to assess. In many cases it is not known if boat damage or shark bites were the cause of death or a post-mortem injury.

Sea turtle strandings occurred throughout coastal Collier County both on beaches and floating in bays or canals. Beach strandings include Barefoot Beach (1), Vanderbilt Beach/ Del nor Wiggins (3), Park Shore/Clam Pass Park (2), City of Naples (4), Marco Island (4), Keewaydin Island (2), Cape Romano Complex (3), Everglades National Park (1) and offshore Marco Island (3). Six bay and canal strandings were recovered from Naples Bay, Venetian Bay and Goodland Bay.

Increased public awareness of the reporting requirements may result in better coverage for the STSSN. Stranding and salvage personnel are not in the field on a daily basis outside of the nesting season and rely on the Florida Marine Patrol and the public for stranding locations. Stranded sea turtles outside the developed beaches may not be found or reported, some are lost at sea, and others buried by persons unfamiliar with the reporting procedures.

The Collier County Parks and Recreation Department responded to 24 of the 29 sea turtle strandings. Rookery Bay NERR responded to three strandings, the Conservancy of Southwest Florida staff responded one stranding and FWC responded to one stranded sea turtle.

SECTION 5

SUMMARY

Adult loggerhead sea turtle emergences were recorded on Collier County beaches from April 23 through August 13, 2015. A total of 881 nests and 809 false crawls were identified on Barefoot, Delnor-Wiggins Pass State Park, Vanderbilt, Park Shore, City of Naples, and City of Marco Island beaches. Weekly emergence data revealed a single peak of increased emergence activity in the last week of June. The summary for each beach is given in Table 5.1.

Table 5.1. Summary of Monitored Beaches, 2015.

	Barefoot	Delnor Wiggins Pass	Vanderbilt	Park Shore	Naples	Marco Island	Total
Beach Length (miles)	3.1	1.2	3.5	3.2	5.6	7.1	23.7
Nests	260	58	192	128	125	118	881
Nests / Mile	83.9	48.3	54.9	40	22.3	13.6	67.2
False Crawls	160	69	227	123	66	164	809
False Crawls/ Mile	51.6	57.5	64.9	38.4	11.8	23.1	34.1
Mean Clutch Size	87.5	100.8	95.4	91.9	93.9	103.3	101.5
Nests Depredated	71	8	7	0	9	21	116
Nests Inundated	75	25	73	44	42	67	326
Nest Washed Out	6	9	16	11	20	5	67
Mean Incubation (days)	60.1	58.7	59.4	61.9	60.2	60.7	60.2
Disoriented Nests	0	0	3	2	3	4	12
Mean Hatching Success	73.8	77.7	80.1	75.4	75.6	64.1	74.5
Mean Emergence Success	71.8	71.5	78.6	72.5	73.6	59.1	71.2
Eggs Deposited	18,215	4,941	15,466	10,115	8,830	10,744	68,311
Hatchlings Emerged	11,473	2,747	11,271	6,410	5,577	5,212	42,690

In natural beach areas, an average of 40 nests per mile was recorded while 33 nests per mile were recorded on renourished beach areas (Table 5.2). There was a significant difference found when the clutch depths were compared between renourished and non-renourished beach areas.

Table 5.2. Summary of Natural Beaches vs Renourished Beach Areas, 2015.

	Natural Beaches	Renourished Beaches	All Beaches
Beach Length (mile)	13.8	9.9	23.7
Nests	552	329	881
Nests Per Mile (mean)	40	33.2	37.2
False Crawls	458	351	809
False Crawls Per Mile (mean)	33.2	35.5	34.1
Mean Clutch Depth (in)	18.2	19.0	18.5
Mean Incubation (days)	59.8	60.9	60.2
Mean Hatching Success	62.5	68.8	64.8

In 2015, 68,312 eggs were deposited and 3,839 (5.6%) were lost to predation. This represents a significant increase from 1,495 (2.0%) in 2014.

Twenty nine sea turtle strandings were responded to in 2015, including 14 loggerheads, sfive Kemp’s ridleys, seven green sea turtles, two hawksbills, and one unknown (bones only). An additional two sea turtles were reported dead or sick offshore however, they were not recovered or confirmed.

SECTION 6
ACKNOWLEDGMENTS

The Collier County Parks and Recreation Department would like to extend our thanks and appreciation to the following persons and organizations for their contributions: Mary and Richard Nelson, Dana Dettmar, Ashley Girt, Beverly Ann Shipe, Scott Aldrich, Dan Flaherty, Marty and Debbie Roddy, Trevor and Rita Whitely, and the countless other volunteers and community service students for their services. We would also like to thank David Addison, Kathy Worley and interns Sara Bolds, Maggie Doolin, Caitlin Jarvis and Sam Ayers of the Conservancy of Southwest Florida; Mark Nikoletti and staff of the Delnor-Wiggins Pass State Park; Robin Trindell, Meghan Koperski, Beth Brost and Rhonda Bailey, FWC; Jill Schmid, Sara Norris, Greg Curry, Rookery Bay NERR; and Roger Jacobsen, Bill Quinsey and the City of Naples Beach Patrol; Dana Dettmar, City of Marco Island; City of Marco Island's and Collier County Sheriff Departments Marine Units; and the FWCC Marine Patrol.

The CCPRD would also like to extend appreciation to the Tourist Development Council, the Collier County Board of County Commissioners, the Coastal Advisory Committee, and all others we may have failed to mention.

SECTION 7

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SEA TURTLE AND SMALLTOOTH SAWFISH CONSTRUCTION CONDITIONS

The permittee shall comply with the following protected species construction conditions:

a. The permittee shall instruct all personnel associated with the project of the potential presence of these species and the need to avoid collisions with sea turtles and smalltooth sawfish. All construction personnel are responsible for observing water-related activities for the presence of these species.

b. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles or smalltooth sawfish, which are protected under the Endangered Species Act of 1973.

c. Siltation barriers shall be made of material in which a sea turtle or smalltooth sawfish cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment. Barriers may not block sea turtle or smalltooth sawfish entry to or exit from designated critical habitat without prior agreement from the National Marine Fisheries Service's Protected Resources Division, St. Petersburg, Florida.

d. All vessels associated with the construction project shall operate at "no wake/idle" speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes (e.g., marked channels) whenever possible.

e. If a sea turtle or smalltooth sawfish is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 50 feet of a sea turtle or smalltooth sawfish. Operation of any mechanical construction equipment shall cease immediately if a sea turtle or smalltooth sawfish is seen within a 50-ft radius of the equipment. Activities may not resume until the protected species has departed the project area of its own volition.

f. Any collision with and/or injury to a sea turtle or smalltooth sawfish shall be reported immediately to the National Marine Fisheries Service's Protected Resources Division (727-824-5312) and the local authorized sea turtle stranding/rescue organization.

g. Any special construction conditions, required of your specific project, outside these general conditions, if applicable, will be addressed in the primary consultation.

Revised: March 23, 2006