



APR 10 2018

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U. S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, DC 20555

Re: St. Lucie Units 1 and 2  
Docket Nos. 50-335 and 50-389  
2017 Annual Environmental Operating Report

In accordance with Section 5.4.1.2 of the St. Lucie Units 1 and 2 Environmental Protection Plans (EPP), attached is the Annual Environmental Operating Report for calendar year 2017.

Sincerely,

A handwritten signature in black ink, appearing to read 'Michael J. Snyder', is written over a faint, larger version of the same signature.

Michael J. Snyder  
Licensing Manager  
St. Lucie Plant

MJS/spt

Attachment: Florida Power & Light Company - St. Lucie Plant - Annual Environmental Operating Report 2017 (50 pages)

cc: FDEP Siting Office

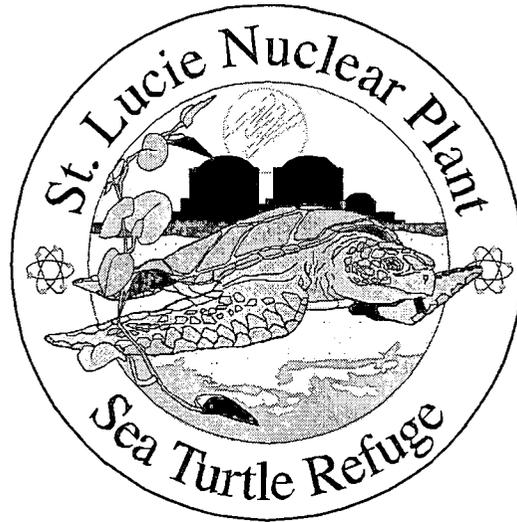
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**FLORIDA POWER & LIGHT COMPANY**

**ST. LUCIE PLANT**

**ANNUAL ENVIRONMENTAL**

**OPERATING REPORT**



**2017**

**FLORIDA POWER & LIGHT COMPANY**

**JUNO BEACH, FLORIDA**

**&**

**INWATER RESEARCH GROUP, INC.**

**JENSEN BEACH, FLORIDA**

# Environmental Operating Report

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## Acronyms

ABI	Applied Biology, Inc.
BO	Biological Opinion
EAI	Ecological Associates, Inc.
ESA	Endangered Species Act
EPP	Environmental Protection Plan
FWC	Florida Fish and Wildlife Conservation Commission
FWRI	Florida Fish and Wildlife Research Institute
FPL	Florida Power & Light
HBOI	Harbor Branch Oceanographic Institute
IRG	Inwater Research Group, Inc.
NMFS	National Marine Fisheries Service
NRC	Nuclear Regulatory Commission
PIT	Passive Integrated Transponder
SSCL	Straight Standard Carapace Length
STSSN	Sea Turtle Stranding and Salvage Network
USFW	U.S. Fish and Wildlife Service
UESI	Underwater Engineering Services, Inc.
UIDS	Underwater Intrusion Detection System

## Executive Summary

Florida Power & Light's (FPL) St. Lucie Plant, located on South Hutchinson Island, consists of two 1000 MWe nuclear-fueled electric generating units that use nearshore ocean water for the plant's once-through condenser cooling system. Water for this system enters through three submerged intake structures located 365 m offshore. Water passes through the structures and into submerged pipes (two 3.7 m and one 4.9 m in diameter) running under the beach. It then passes into a 1500 m long intake canal, which transports water to the plant. Turtles entering the ocean intake structures are entrained with cooling water and rapidly transported through the intake pipes into the enclosed canal system where they must be manually captured and returned to the ocean.

South Hutchinson Island is also an important rookery for loggerhead (*Caretta caretta*), green (*Chelonia mydas*), and leatherback (*Dermochelys coriacea*) turtles. Under the Endangered Species Act (ESA), the federal government has classified loggerhead and green turtles as threatened species while leatherbacks are classified as endangered. One of FPL's primary environmental concerns is to ensure that the operation of the St. Lucie Plant does not adversely affect sea turtle nesting. To monitor nesting trends, they have sponsored nesting surveys on the island since 1971. Biologists use all-terrain vehicles to survey the island each morning during nesting season. New nests, non-nesting emergences (false crawls), and nests negatively affected by predators are recorded. Data collected from beach nesting surveys are reported to the Florida Fish and Wildlife Conservation Commission (FWC) as part of a statewide survey program. In 2017, 7818 loggerhead, 1084 green, and 142 leatherback nests were recorded on South Hutchinson Island.

Since the plant became operational in 1976, turtles entrained in the intake canal have been systematically captured, measured, weighed, tagged, and released. During 2017, 435 sea turtles were removed from the intake canal, including 250 loggerheads, 182 greens, 2 hawksbills, and 1 Kemp's ridley. The majority of these turtles (94.0%) were captured alive and released back to the ocean. Nineteen (4.4%) were taken to rehabilitation facilities for treatment of injuries or disease and seven turtles (1.6%) were recorded as deceased (including one green turtle that died during transit to rehab).

Injuries and mortalities are categorized in two ways - causal to plant operations or non-causal to plant operations. These decisions are made in consultation with FWC and/or a qualified veterinarian. Not all mortalities and injuries are causal to plant operations, as some sea turtles enter the canal in either a moribund state or have pre-existing conditions related to fisheries, boat interactions, or disease. Injuries causal to plant operations are recorded and are applied against the take limit established by

the new 2016 Biological Opinion (BO) set forth by the National Marine Fisheries Service (NMFS). The Incidental Take Statement in the new BO states that FPL would exceed its take limit if: 1) more than 623 loggerheads, 500 green turtles, 7 hawksbills, 8 Kemp's ridleys, or 5 leatherbacks are captured annually; 2) more than 7 green turtles or 3 loggerheads are documented with severe causal injuries annually; 3) more than 5 green turtles or 3 loggerheads are documented as causal mortalities annually; 4) more than one hawksbill, Kemp's ridley, or leatherback is documented with either a severe causal injury or as a causal mortality every two years; 5) more than one smalltooth sawfish is captured every five years or any smalltooth sawfish are ever killed.

During 2017, there were 250 loggerheads, 182 green turtles, 2 hawksbills, and 1 Kemp's ridley captured. One green turtle was sent to rehab for causal injuries. There were three causal green turtle mortalities (including one that died during transit to rehab) and one causal loggerhead mortality. No leatherback, hawksbill or Kemp's ridley turtles were injured or killed due to plant operation. Additionally, two smalltooth sawfish were removed from the intake canal, tagged, and released in good condition. Therefore, FPL exceeded its take limit during 2017 because more smalltooth sawfish were captured than allowable under the latest BO (issued by the NMFS).

Both the primary and the secondary barrier nets were damaged by Hurricane Irma in September 2017. The secondary 8-inch barrier net failed during the storm and was replaced over the next two weeks. Replacement of the primary 5-inch barrier net was completed on February 9, 2018.

The current BO also mandates that FPL participate in the Sea Turtle Stranding and Salvage Network (STSSN) as well as Public Service Turtle Walks. As participants in the STSSN, biologists routinely respond to sea turtle strandings in St. Lucie and Martin Counties. This activity involves the collection of information on turtles that are found dead, debilitated, or that have been impacted by human-related activities. During 2017, Inwater Research Group (IRG) biologists responded to 24 stranding events. Sea turtle nesting walks are conducted by FPL as public service programs during the summer sea turtle nesting season. These turtle walks educate the public about relevant sea turtle protection issues and, in most cases, allow the public to view a nesting loggerhead sea turtle. During 2017, FPL conducted 12 turtle walks attended by 256 people.

The St. Lucie Plant sea turtle program continues to assist other sea turtle researchers, universities, nonprofit organizations, and state and federal agencies by providing data, specimens, and public outreach. Biologists collaborated with researchers on four projects in 2017.

## **1.1 Background**

## **1.2 Area Description**

Florida Power & Light's (FPL) St. Lucie Plant is located on a 457-hectare site on South Hutchinson Island on Florida's east coast (Figures 1 and 2). South Hutchinson Island is a barrier island that extends 36 km between inlets and attains its maximum width of 2 km at the plant site. The plant is approximately midway between Ft. Pierce and St. Lucie Inlets and is bounded on the east by the Atlantic Ocean and on the west by the Indian River Lagoon. Elevations approach five meters atop dunes bordering the beach and decrease to sea level in the mangrove swamps that are common on the western side. The Atlantic shoreline of South Hutchinson Island is composed of sand and shell hash with intermittent rocky promontories protruding through the beach face along the southern end of the island. Submerged coquinoïd rock formations parallel much of the island off the ocean beaches. The ocean bottom immediately offshore from the plant site consists primarily of sand and shell sediments. The Gulf Stream (Florida Current), which flows parallel to the continental shelf margin, begins to diverge from the coastline at West Palm Beach. At South Hutchinson Island, the current is approximately 33 km offshore. Oceanic waters associated with the western boundary of the current periodically meander over the inner shelf, especially during summer months.

## **1.3 Plant Description**

The St. Lucie Plant consists of two 1000 MWe nuclear-fueled electric generating units that use nearshore ocean waters for the plant's once-through condenser cooling system. Unit 1 was placed on-line in March 1976 and Unit 2 was placed on-line in April 1983. Water for this system enters through three submerged intake structures located 365 m offshore (Figure 2). The intake structures are equipped with a velocity cap to minimize entrainment of marine life. Water passes through these structures and into submerged pipes (two 3.7 m and one 4.9 m in diameter) running under the beach. It then passes into a 1500 m long intake canal, which transports it to the plant. After passing through the plant, the heated water is discharged into a 670 m long canal that leads to two buried discharge pipelines. These pass underneath the dunes and along the ocean floor to the submerged discharges, the first of which is 730 m north of the intake and extends approximately 365 m offshore. The second pipeline is located just to the south of the first and is nearly twice as long.

## **1.4 Environmental Reporting**

St. Lucie Units 1 and 2 use the Atlantic Ocean as a source of water for once through condenser cooling. Since 1971, the potential environmental effects resulting from the intake and discharge of this water have been the subject of FPL sponsored biotic

studies at the site (Applied Biology, Inc. [ABI] 1978, 1980, 1986-1989, 1994). Jurisdiction for sea turtle studies lies with the Nuclear Regulatory Commission (NRC), which is considered to be the lead federal agency relative to consultation under the Endangered Species Act (ESA). This document has been prepared to satisfy the requirements contained in Appendix B, Environmental Protection Plan (EPP); St. Lucie Units 1 and 2 Facility Operating License Nos. DPR-67 and NPF-16. Previous results dealing with sea turtle studies are contained in 34 annual environmental operating reports covering the period from 1983 through 2016 (ABI 1984-1994; Quantum Resources, Inc. 1995-2009; Inwater Research Group, Inc. 2010-2017). This report describes the 2017 environmental protection activities related to sea turtles as required by Subsection 4.2 of the St. Lucie Units 1 and 2 EPP. Other routine annual reporting requirements are addressed in Section 7.

## **2.0 Sea Turtle Nest Monitoring**

Sea turtle nesting typically occurs along Florida's Atlantic coast from March through September. Furthermore, South Hutchinson Island is an important rookery for loggerhead (*Caretta caretta*), green (*Chelonia mydas*), and leatherback (*Dermochelys coriacea*) turtles (Meylan, Schroeder, & Mosier, 1995). Under the ESA, the federal government has classified loggerhead and green turtles as a threatened species while leatherbacks are classified as endangered. One of FPL's primary environmental concerns is to ensure the operation of the St. Lucie Plant does not adversely affect sea turtle nesting and they have sponsored monitoring of nesting activity on the island since 1971.

### **2.1 Methodology**

#### **2.1.1 Previous Methods and Projects**

Daytime nesting surveys and nighttime turtle tagging programs were conducted in odd numbered years from 1971 through 1979. During daytime nesting surveys, nine 1.25 km-long survey areas were monitored five days per week (Figure 3). The St. Lucie Plant began operation in 1976; therefore, the first three survey years (1971, 1973, and 1975) provided baseline data for nesting activity on South Hutchinson Island. Though the plant was not operating during 1975, the St. Lucie Plant Unit 1 ocean intake and discharge structures were installed during that year. Installation of these structures included nighttime construction activities conducted offshore from and perpendicular to the beach. The plant was in full operation during the 1977 and 1979 surveys.

A modified daytime nesting survey was conducted in 1980 during the preliminary construction of the ocean discharge structure for St. Lucie Plant Unit 2. Four of the previously established 1.25 km-long survey areas were monitored. To mitigate any

adverse effects associated with construction activities, turtle nests proximal to the construction area were relocated.

The St. Lucie Plant Unit 2 discharge structure was installed during the 1981 nesting season. Construction of the Unit 2 intake structure proceeded throughout the 1982 nesting season and was completed near the end of the 1983 season. Mitigation activities associated with installation of both structures were similar to those conducted when the Unit 1 intake and discharge structures were installed. Analysis demonstrated that the construction of the plant's offshore intake and discharge structures significantly reduced nesting at the plant site during construction years – 1975, 1981, 1982, and 1983 (ABI, 1987). However, nesting at the plant consistently returned to levels similar to or greater than those at a control site in years following the construction.

During 1991, a major offshore construction project was undertaken to replace damaged velocity caps on the three intake structures. A large elevated platform, from which repair activities were conducted, was erected around the three structures. Construction occurred throughout the nesting season. Work was restricted almost entirely to daylight hours, nighttime lighting of the work area was minimal, and no equipment or materials were used on the beach. A sea turtle protection plan was implemented to mitigate any negative effects resulting from the required safety and navigational lighting on and near the platform. The plan included caging nests along a 1500 m section of beach west of the platform and the release of hatchlings to unaffected areas to the north and south. During this period, nests were more abundant at the construction site than at the control site.

Reconstruction of the primary dune in front of the plant was completed by FPL prior to the beginning of the 2005 sea turtle nesting season. This project was required due to the widespread obliteration of the primary dune during the 2004 hurricane season. Despite the compact material and erosion problems associated with the reconstructed dune, nesting success was not noticeably different from nesting success in unaffected survey zones to the north and south of the project area.

In 2012, FPL implemented a construction project at the discharge canal headwall where a retaining wall was added landward of the beach-facing dune. Construction activities took place on a 100 m section on the crest of the primary dune line at the eastern end of the discharge canal. Daily sea turtle nesting surveys were performed as required by the construction permit. From the beginning of nesting season until May 21, nests were left in situ. Beginning on May 22, nests that could have been impacted by construction activities were relocated to a hatchery area approximately 1 km north of the construction site.

Another dune restoration project in front of the plant was completed by FPL prior to the beginning of the 2013 sea turtle nesting season. This project was required due to erosion of the previous dune restoration area. Sea turtle nesting surveys were again performed in conjunction with the restoration activities. Sand placement began in January and was completed by mid-February (prior to the start of sea turtle nesting season). The planting of dune vegetation was subsequently completed in March. No nests or false crawls were recorded during the project timeframe.

### **2.1.2 Current Methods**

Nesting surveys to satisfy environmental reporting requirements were completed in 1986 (ABI, 1987) but continued voluntarily through 1998 with agreement from federal and state agencies. In 1998, the continuation of the nesting survey program was mandated as part of the BO and Incidental Take Statement issued by the National Marine Fisheries Service (NMFS). An amendment to the EPP was approved in 1999 to include these requirements.

From 1981 through 2017, 36 one-km-long segments comprising the island's coastline have been surveyed seven days a week during the nesting season (Figure 3). These "zones" are identified starting with Zone A at the northern end of the island and continue through Zone JJ at the southern end. Since the 1994 nesting season, the southern half of the island (Zone T to Zone JJ) has been surveyed by Ecological Associates, Inc. (EAI) and their data are included in this report. Biologists used all-terrain vehicles to survey the island each morning. New nests, non-nesting emergences (false crawls), and nests affected by predators were recorded for each zone. Data collected from beach nesting surveys are reported to the Florida Fish and Wildlife Conservation Commission (FWC) as part of the Index Nesting Beach Survey and the Statewide Nesting Beach Survey.

### **2.2 Results for 2017**

In 2017, Zones E-S were surveyed by Inwater Research Group, Inc. (IRG). EAI surveyed Zones A-D as part of a beach renourishment project south of the Fort Pierce Inlet. Data from those zones, as well as the south end of South Hutchinson Island, were supplied by EAI and were used to provide whole-island nesting totals (Figures 4 – 6).

From March 1 through March 31, nesting surveys were conducted every other day along South Hutchinson Island in areas A-S. Three leatherback sea turtle nests were recorded in Zones A-S prior to the beginning of formal nesting surveys on April 1. From April 1 through September 30, nest surveys were conducted on a daily basis with one exception; the beach was not surveyed from September 8 through the 11 due to Hurricane Irma.

Not all ventures onto the beach by a female turtle end in successful nests. These “false crawls” (non-nesting emergences) may occur for many reasons and are commonly encountered at other rookeries. Davis and Whiting (1977) suggest that relatively high percentages of false crawls may reflect disturbances or unsatisfactory nesting beach characteristics. Nesting success was lower across all zones due to an increase in the number of false crawls. The increase was associated with below average conditions of rainfall during the peak of nesting season (June – August) that created difficult conditions (dry sand) for turtles to dig their nests. Historically, the distribution of loggerhead emergences on the island has been consistent with the distribution of nests, with no difference in nesting success among zones. We can only speculate the current causes for differences in nesting success between zones (Figure 7). Recent beach renourishment, coastal construction projects, formation of large escarpments that prevent turtles from crawling above the high tide line, and light pollution from inland sources may have all contributed to lower nesting success in the northern most zones. Nesting success in the zone that includes the plant (Zone O) was similar to the surrounding zones (Figure 7).

### **2.2.1 Loggerhead Nesting**

Most loggerhead nesting occurs on warm temperate and subtropical beaches (Dodd, 1988). Approximately 42,000 to 74,000 loggerhead turtle nests are deposited annually on Florida beaches (Turtle Expert Working Group [TEWG], 2000), ranking this loggerhead turtle rookery the second largest in the world (NMFS and U.S. Fish and Wildlife Service [USFWS], 1991). The beaches in southeast Florida are especially prolific nesting areas, with South Hutchinson Island being a critically important nesting beach (Meylan, Schroeder, & Mosier, 1995). Between 4000 and 10,000 loggerhead nests have been deposited annually on South Hutchinson Island during the last 30 years.

In 2017, 7818 loggerhead nests were recorded on South Hutchison Island (Figure 4). In Zones A-S (the north end of the island) biologists observed 3959 nests (Figure 8). The first recorded nest was on April 23 and the last loggerhead nest was recorded on September 5. There were 5229 loggerhead false crawls observed in Zones A-S.

Ninety-five of the 3959 loggerhead nests were marked to assess nest productivity. Sixty-five nests were successfully inventoried, eight were completely predated, 19 completely washed out, one had its marking stakes removed by another nesting turtle (preventing the clutch from being located), and two were predated after the first emergence. The 65 inventoried nests contained a cumulative total of 6664 eggs. Of these, 4229 successfully hatched and emerged from the marked nests. This represents an emergence success rate of 63.5%. There were 80 live loggerhead hatchlings found

during nest excavations. These hatchlings were not considered to have successfully emerged from the nest.

Loggerhead nesting activity on South Hutchinson Island fluctuates considerably from year to year (Figure 6). Annual variations in nest densities are also common at other rookeries, and probably result from non-annual reproductive behavior (Heppell, Snover, & Crowder, 2003). No relationships between annual fluctuations in nesting activity and plant operation or intake/discharge construction have been found. However, loggerhead nesting on South Hutchinson Island mirrors trends in nesting statewide.

### **2.2.2 Green Nesting**

The green turtle is the second most common sea turtle on Florida nesting beaches. Approximately 99% of the green turtle nesting in Florida occurs on the Atlantic coast from Brevard through Broward Counties (Witherington, Herren, Bresette, 2006). On South Hutchinson Island, green turtles have had alternating years of nesting: a high nesting year followed by a low nesting year, although this pattern has become less distinct in recent years. This biennial pattern is also seen at other locations throughout their nesting range (Witherington et al., 2006).

In 2017, a record high of 1084 green turtle nests were recorded on South Hutchinson Island (Figure 5). Biologists observed a total of 573 green turtle nests in Zones A-S (Figure 8). The first recorded nest of the season was on June 2 and the last green turtle nest was noted on September 26. There were 1024 green turtle false crawls observed in Zones A-S.

Seventy-seven of the 573 green turtle nests were marked to assess nest productivity. Eight nests were completely predated, 35 were completely washed out, and three nests were missing their marking stakes and could not be inventoried (at least one of which had its stakes removed by another nesting turtle). Thirty-one nests were successfully inventoried and contained a cumulative total of 3542 eggs. Of these, 1807 successfully hatched and emerged from the marked nests. This represents an emergence success rate of 51.0%. In addition, there were 82 live green turtles found during nest excavations. These hatchlings were not considered to have successfully emerged from the nest.

### **2.2.3 Leatherback Nesting**

Leatherback nesting occurs on subtropical and tropical beaches. Leatherbacks inhabit Florida waters primarily during the nesting season (March-June) when they are generally found in higher densities close to shore awaiting nesting forays onto the beach (Schroeder & Thompson, 1987). Outside of nesting season leatherbacks are

often found in pelagic habitats as far north as the Canadian Maritimes where they feed primarily on jellyfish (Fossette et al. 2010).

In 2017, 142 leatherback turtle nests were recorded on South Hutchinson Island (Figure 6). Biologists observed a total of 62 leatherback sea turtle nests in Zones A-S (Figure 8). The first recorded nest was on March 3 and the last leatherback sea turtle nest was recorded on July 19. There were 15 leatherback sea turtle false crawls observed in the surveyed areas A-S.

Seventeen of the 62 leatherback turtle nests were marked to assess nest productivity. Fourteen nests were successfully inventoried and three nests were missing their nesting markers and could not be inventoried (at least one had its stakes disturbed by another nesting turtle). The 14 nests contained a cumulative total of 1038 eggs. Of these, 402 successfully hatched and emerged from the marked nests. This represents an emergence success rate of 38.7%. There were eight live leatherback turtles found during nest excavations. These hatchlings were not considered to have successfully emerged from the nest.

Leatherback nesting on South Hutchinson Island generally mirrors the nesting trend for the entire state Florida. Stewart et al. (2011) demonstrated that the number of leatherback nests in Florida have increased more than 10% per year between 1979 and 2011. However, over the last several years nesting numbers have been on the decline (Figure 6). Biologists will need to continue monitoring leatherback nesting in order to ascertain whether this is a true trend reversal, as we do not yet have enough data to make this determination.

#### **2.2.4 Predation**

Historically, raccoon (*Procyon lotor*) predation has been the leading cause of turtle nest destruction on South Hutchinson Island (ABI, 1989). Though turtle nests on South Hutchinson Island have probably been depredated by ghost crabs (*Ocypode quadrata*) since nesting surveys began, quantification of ghost crab predation did not begin until 1983. Occasionally, sea turtle nests are depredated by other animals such as bobcats (*Lynx rufus*), fire ants (*Solenopsis invicta*), and various species of birds. However, this only accounts for a small portion of the total number of predation events on South Hutchinson Island.

IRG biologists recorded a total of 468 predation events for South Hutchinson Island in 2017 within beach Sections D-S (Figure 9). Sea turtle nests on South Hutchinson Island were depredated by ghost crabs, raccoons, birds, domestic dogs, armadillos and fire ants. The most abundant predators were raccoons, which accounted for 169 individual predation events. Ghost crabs were the second most abundant predator accounting for

146 events. Another 141 predation events consisted of a combination of raccoon and ghost crab predation. Other predators (fire ants, domestic dogs, or birds, for example) accounted for 12 additional predation events.

Nest excavation provides an opportunity to more accurately account for predation activity. For example, fire ant and ghost crab predation are not always evident from a cursory inspection of the sea turtle nest's surface. Predators negatively affected 65.5% of nests (72 out of 110) where hatch success could be evaluated. Seventeen marked nests were completely predated prior to inventory.

### **2.2.5 Poaching**

IRG documented two poaching events in 2017. On May 5, four loggerhead nests were dug into just north of the Blind Creek Boat Ramp in Zone K. Eggs had been removed from two of the nests. FWC also confiscated 445 eggs from poachers in Zone K on May 24. IRG was tasked with reburying the eggs. Five artificial nests were constructed and hatch success was later reported to FWC.

EAI documented two human disturbances in 2017 while surveying INBS zones A thru D for contract work pertaining to beach renourishment. One leatherback nest was dug into on May 2 prior to hatching and one loggerhead nest was dug into on July 10 during an emergence. All suspected poaching events were reported to FWC.

### **3.0 Intake Canal Monitoring**

Entrainment of sea turtles at the St. Lucie Plant has been attributed to the presumed physical attractiveness of the offshore structures housing the intake pipes rather than to plant operating characteristics (Ecological Associates, Inc., 2000). The velocity caps, which are supported above the openings to each intake pipe, eliminate vertical water entrainment and substantially reduce current velocities near the structures by spreading horizontal draw over a wider area. Even when both units are operating at full capacity, turtles must actively swim into the mouth of one of the structures before they encounter current velocities sufficient enough to entrain them. Turtles entering the ocean intake structures are entrained with cooling water and rapidly transported through the intake pipes into an enclosed canal system where they must be manually captured and returned to the ocean. Since the plant became operational in 1976, turtles entrained in the intake canal have been systematically captured, measured, weighed, tagged, and released.

### **3.1 Methodology**

#### **3.1.1 Barrier Nets**

In 1978, a barrier net at the A1A bridge (Figure 2) was constructed to confine turtles to the easternmost section of the intake canal where capture techniques have been most effective. This net is constructed of large diameter polypropylene rope and has a mesh size of 20.3 cm x 20.3 cm. A cable and series of large floats are used to keep the top of the net above the water's surface and the bottom of the net is anchored by a series of concrete blocks. The net is inclined at a slope of 1:1, with the bottom positioned upstream of the surface cable. This reduces bowing in the center and minimizes the risk of a weak or injured turtle being pinned underwater by strong currents.

In the past, the integrity of the barrier net was occasionally compromised, and turtles were able to move west of A1A. These turtles were further constrained downstream by an underwater intrusion detection system (UIDS) consisting, in part, of a large barrier positioned perpendicular to the north-south arm of the canal (Figure 2). The UIDS security barrier has a mesh size of 22.9 cm x 22.9 cm. Prior to completion of the UIDS in December 1986, turtles unconfined by the A1A barrier net were usually removed from the canal at the intake wells of Units 1 and 2 (Figure 2). They were then retrieved by specially designed nets. Following construction of the UIDS barrier, only the smallest individuals were able to reach the intake wells. Improvements made to the A1A barrier net in 1990 have effectively confined all turtles larger than 32.5 cm carapace length (28.7 cm carapace width) to the eastern end of the canal.

In January 1996 (in response to the large numbers of small green turtles entrained in the intake canal in the early 90s), an improved barrier net design involving a smaller 12.7 x 12.7 cm mesh size was erected 150 m east of A1A (Figure 2). This additional "primary barrier net" was designed to confine all turtles with a carapace width greater than 18 cm to the extreme eastern portion of the intake canal. However, the integrity of this net was often compromised by incursions of seaweed, drift algae, jellyfish, and siltation. During these events, water velocities around the net increased dramatically creating an insufficient net slope that caused several sea turtle mortalities. To address this design problem and to further alleviate mortalities, FPL constructed a new net with a stronger mesh and added support structures. Dredging of the canal east of the A1A net was also conducted to minimize water velocities around the new barrier net. Construction was completed in November 2002.

In October 2009, the primary barrier net and support structures failed due to an algae event, submerging the north half of the net 0.6-1.5 m underwater (IRG, 2010). Underwater Engineering Services, Inc. (UESI) installed large floating buoys onto the primary net in order to create a temporary barrier. However, this temporary barrier net

was found to be susceptible to partial submergence or failure due to severe algae/jellyfish events or at extreme high tides. Therefore, construction on a new permanent primary barrier net began in 2014 and was completed in January 2015.

### **3.1.2 Turtle Capture**

Historically, most turtles entrained in the St. Lucie Plant intake canal were removed using large-mesh tangle nets set near the intake canal headwalls at the extreme eastern end of the intake canal (Figure 2). Nets used were from 30 to 40 m in length, 3 to 4 m deep, and composed of 40 cm stretch mesh multifilament nylon. Large floats were attached to the surface and unweighted lines were used along the bottom. Turtles entangled in the nets generally remained at the water's surface until removed. Nets were usually deployed on Monday morning and retrieved on Friday afternoon. During periods of deployment, the nets were inspected for captures at least twice each day (mornings and afternoons). St. Lucie Plant personnel checked the nets periodically and biologists were notified immediately if a capture was observed. Sea turtle specialists were on call 24 hours a day to retrieve captured turtles from the plant intake canal system.

Beginning in April 1990, after consultation with NMFS, net deployment was scaled back to daylight hours only. Concurrently, surveillance of the intake canal was increased and biologists remained on site for the duration of each day's netting activities. This measure decreased response time for removal of entangled turtles and provided an opportunity to improve daily assessments of turtle abundance within the canal.

During each day's directed capture efforts, formal inspections of the intake canal were made to determine the number, location, and species of turtles present. Surface observations were augmented with periodic underwater inspections, particularly in and around the barrier nets. These observations allowed for a rough estimate of how many sea turtles were in each section of the canal on a given day.

The canal capture program has been under continual review and refinement in an attempt to minimize both entanglement time and injuries/mortalities to sea turtles. Better utilization of currents and eddies, adjustments to tethering lines, multi-net deployments and increased efforts to hand capture and dip net turtles have contributed to reduced residency times in recent years.

### **3.1.3 Data Collection**

Regardless of capture method, all turtles removed from the canal are identified to species, measured, weighed, tagged, and examined for overall condition (wounds, abnormalities, parasites, etc.). Since 1994, captured turtles have been photographed

dorsally and ventrally prior to release. Additionally, as of July 2001, Passive Integrated Transponder (PIT) tags are injected subcutaneously into the right front flipper of all turtles as outlined in the BO issued by NMFS in May 2001. Healthy turtles are released into the ocean the same day of capture. When treatment was warranted, turtles were transported to an approved rehabilitation facility after consultation with FWC. Beginning in 1982, necropsies were conducted on dead turtles found in fresh condition. Currently, fresh dead turtles are held on ice and taken to a qualified veterinarian for necropsy. Methodologies associated with the canal capture program have remained essentially unchanged since 1994, making data comparable from that year through the current reporting period.

### **3.2 Results for 2017**

Methods to remove sea turtles from the intake canal included the use of tangle nets, dip nets, and hand capture. Long handled dip nets employed from small boats, the canal banks, and headwall structures were moderately effective in capturing turtles with carapace lengths of 40 cm or less. Snorkelers were employed to hand capture turtles whenever water visibility permitted. This technique has proven highly effective in the capture of turtles of all sizes, particularly less active individuals that are often found partially buried in the sediment near the primary barrier net. Hand capture efforts have successfully reduced residency times for turtles in the intake canal.

During 2017, a total of 435 sea turtles were removed from the intake canal, including 250 loggerheads, 182 green turtles, 2 hawksbills, and 1 Kemp's ridley (Figures 10 and 11; Table 1). The majority of these turtles (94.0%) were captured alive and released back to the ocean. Nineteen (4.4%) were taken to rehabilitation facilities for treatment of injuries or disease and seven (1.6%) turtles were found dead. Two green turtles were taken to rehab facilities with injuries causal to plant operations. One of the green turtles was dead upon arrival at rehabilitation and was reported as a causal mortality. Mortalities and injuries are discussed in Section 3.2.6.

In 2017, six turtles were captured in the intake wells and one turtle was captured between the primary barrier and A1A barrier nets. The remaining 428 turtles were captured east of the primary barrier net - 309 by tangle nets, 19 off of the primary barrier net, 18 by dip net, and 82 by hand capture. Proactive captures (hand capture and dip net) accounted for 23.0% of the turtles removed from the intake canal.

Decreased water flow during plant outages likely reduces the number of turtles entrained into the intake canal. An outage occurs when the power generating unit is offline. In 2017, Unit 2 was in outage from February 20 until March 24. Unit 1 also underwent a forced outage from September 11 to the 12 due to Hurricane Irma.

### **3.2.1 Loggerhead Captures**

Historically, loggerheads have been the most abundant species entrained into the canal. The number of loggerheads captured each year ranged from 62 in 1981 to 623 in 2004. During 2017, monthly captures of loggerheads ranged from eight in March to 41 in June (Table 2), with a monthly mean of 21. Loggerhead capture rates have exhibited considerable year-to-year fluctuation, but have shown an overall increasing trend since the plant started operation (Figure 10; Table 1). The size frequency of loggerheads captured at the intake canal of the plant ranges from predominately juvenile to sub-adult animals, with mature adult animals captured mainly during the nesting season of April through September (Figure 12).

Of the 250 loggerheads captured, 21 were juveniles (SSCL  $\leq$  70 cm), 61 were adults (SSCL  $\geq$  85 cm), and 168 were transitional (SSCL 70-85 cm; Hirth, 1980, Figure 12). The latter group probably includes both mature and immature individuals. Of the 61 turtles classified as adults, 58 were females and 3 were males. Two additional loggerheads were recorded as males, even though their SSCL was less than 85 cm, because sex was apparent from the animal's tail length.

### **3.2.2 Green Captures**

The number of green turtles captured each year has ranged from three in 1979 to a record high of 673 in 1995 (Figure 10; Table 1). A spike in green turtle captures, driven mainly by small juveniles (Bresette, Gorham, & Peery, 1998), during the mid-1990s has leveled off to a capture rate consistently greater than numbers recorded prior to 1994. Size class frequencies of green turtles at the intake canal are dominated by juvenile animals with adults captured in relatively small numbers during the nesting season of May through October (Figure 13).

During 2017, monthly green turtle captures ranged from zero in August to 77 in October (Table 2) with a monthly mean of 15. Of the 182 green turtles captured in 2017, there were 154 juveniles or sub-adults (SSCL  $<$  85 cm), 6 adult males, and 13 adult females (Witherington and Ehrhart, 1989, Figure 13).

### **3.2.3 Leatherback, Hawksbill, and Kemp's ridley Captures**

Captures of leatherback, hawksbill, and Kemp's ridley turtles have been infrequent and scattered throughout the years (Figure 11 and Table 1). However, each species has shown rather pronounced seasonal occurrences (Table 3). Leatherbacks are typically captured in March and April, hawksbills are captured between July and September, and Kemp's ridleys are caught between December and April.

In 2017, there were two hawksbills and one Kemp's ridley captured in the intake canal of the St. Lucie Plant (Table 1). The hawksbills ranged in SSCL from 62.5 cm (subadult) to 72.7 cm (adult female). The Kemp's ridley sea turtle was a subadult and with an SSCL of 58.2 cm.

#### **3.2.4 Smalltooth Sawfish Captures**

Two smalltooth sawfish (*Pristis pectinata*) were removed from the St. Lucie Plant intake canal in 2017. Each time, additional resources from IRG, FPL, and Harbor Branch Oceanographic Institute (HBOI) were called in to assist. Releases were performed according to the Smalltooth Sawfish Handling, Transportation, and Release Protocols (FPL 2007) and recent smalltooth sawfish on-site training (2016). Tissue samples were collected each time and tags were applied by HBOI biologists under National Marine Fisheries Service permit 21043.

The captures occurred on September 17 and November 2, 2017. Both smalltooth sawfish were in good condition with only minor fresh scrapes. The first fish was an 11-foot, 4-inch male weighing approximately 300 pounds and the second was a 12-foot, 2-inch female estimated to weigh over 400 pounds. Both fish were successfully released into the ocean adjacent to the intake canal beach access. IRG biologists continued to monitor the three-mile stretch of beach along Hutchinson Island following the release of each individual for any possible delayed impacts on the captured smalltooth sawfish for seven days. There was no indication that either animal stranded and they are presumed to still be living offshore.

The Incidental Take Limit established by the 2016 Biological Opinion set forth by NMFS is one non-lethal capture (take) of U.S. Distinct Population Segment smalltooth sawfish every five years. Therefore, since two smalltooth sawfish were encountered in the intake canal this year, FPL has exceeded its take limit and must reinstate a Section 7 consultation with NMFS.

#### **3.2.5 Recaptures**

Since plant operation began in 1976, a total of 17,384 sea turtles (including recaptures) have been captured, including 10,046 loggerhead, 7156 green, 70 hawksbill, 70 Kemp's ridley, and 42 leatherback turtles (Table 1).

Most turtles removed from the intake canal have been tagged and released into the ocean at various locations along South Hutchinson Island. Consequently, individual turtles can be identified as long as they retain their tags. Over the history of the program at the St. Lucie Plant, 3188 recapture events (756 loggerheads and 2432 green turtles)

have occurred. The recapture rate in 2017 was 11.6% for loggerheads and 35.2% for greens.

Occasionally, turtles are captured that have been tagged by other researchers; there were four such captures in 2017. One green turtle was originally tagged in 1993 by University of Central Florida biologists at the Trident Submarine Basin, Port Canaveral. An adult female loggerhead was captured by South Carolina Department of Natural Resources researchers off Cape Canaveral. A subadult loggerhead was tagged by IRG during a research trip to the Key West National Wildlife Refuge in 2006. Lastly, another subadult loggerhead was rehabbed at Sea Turtle Recovery in New Jersey after a 2016 cold-stun event in Virginia.

### **3.2.6 Relative Condition**

Turtles captured alive in the intake canal of the St. Lucie Plant are assigned a relative condition based on weight, activity, parasite infestation, epibiont coverage, injuries, and any other abnormalities that might affect overall vitality. Relative condition ratings can be influenced by a number of factors, some related and others unrelated to entrainment into the intake canal. A rating of good indicates that turtles have not been negatively impacted by their entrapment in the canal, as evidenced by physical appearance. Although ratings of fair or poor imply reduced vitality, the extent to which entrainment and entrapment are responsible is often indeterminable. In some instances, acute injuries responsible for lower overall condition ratings, such as boat collision, fisheries gear entanglement, or disease were obviously sustained prior to entrainment. However, in recent years, turtles have been found with fresh scrapes and cuts incurred during the entrainment process. Some of these incidents have had a negative effect on a sea turtle's overall condition and have been categorized as directly causal to plant operation. Causal determinations are made by consultation with personnel from FWC and/or a qualified veterinarian.

During 2017, of the 250 loggerheads captured, 88.8% (222) were alive and in good condition. Only 10.0% (25) of all loggerheads were individuals in fair or poor condition and 1.2% (3) were recorded as mortalities. Of the 182 green turtles removed from the intake canal 94.0% (171) were in good condition, 3.3% (6) were in fair or poor condition and 2.7% (5) were found dead. One green turtle died while in transit to rehab in 2017 and was, therefore, counted as a mortality.

Of the 435 turtles removed from the intake canal during the year, 376 (86.4%) were observed with fresh cuts and scrapes that may have been incurred during transit through the intake pipes. The scrapes varied in degree of severity, although most (93.9%) of the scrapes were classified as minor. However, some of the scrapes (6.1%)

were moderate. No turtle had a fresh scrape categorized as severe and warranted the turtle being sent to a rehabilitation facility.

### **3.2.7 Mortalities and Injuries**

Injuries and mortalities are categorized in two ways - causal to plant operation or non-causal to plant operation. These decisions are made in consultation with FWC and/or a qualified veterinarian. Not all mortalities and injuries are causal to plant operation, as some sea turtles enter the canal in either a moribund state or have had pre-existing conditions related to fisheries, boat interactions or disease. Injuries and mortalities causal to plant operation are recorded and are applied against the take limit established by the most recent BO set forth by NMFS.

Sea turtle mortalities have been closely monitored throughout the history of the capture program in an attempt to assign probable cause and take remedial action to minimize future occurrences. Modifications to capture procedures, improvements to barrier nets, and virtual elimination of low flow conditions within the intake pipes have resulted in a substantial reduction in sea turtle mortalities over the life of the canal capture program. Mortality rate declined from 7.9% during the period 1976-1984 to 1.3% for the period 1985 to present (Table 1). Over the entire monitoring program's history (1976-2017), 183 (1.8%; including hatchlings from 2006) loggerheads and 119 (1.7%) green turtles entrained in the canal were found dead. Only four Kemp's ridley mortalities have been documented at the St. Lucie Plant during 1987 and 1988. The only hawksbill mortality was recorded in 2014. There have been no leatherback mortalities in the history of the project.

In 2017, five green turtle and three loggerhead mortalities were recorded at the St. Lucie plant intake canal. Three green turtle and one loggerhead mortalities were considered causal to plant operations. There was also one green turtle with a causal injury.

On September 11, a dead juvenile green turtle was found impinged on the primary barrier net. The turtle was retrieved when biologists resumed monitoring after Hurricane Irma. The turtle could not be preserved for necropsy due to the lack of electricity and resources after the storm. The mortality was considered causal.

On September 11, a subadult loggerhead was found impinged against the primary barrier net. The turtle was retrieved when biologists resumed monitoring after Hurricane Irma. The turtle had a deep partially healed boat propeller wound along the length of its skull and onto the nuchal notch of the carapace. There was also a partially healed laceration on its mouth. The turtle could not be preserved for necropsy due to the lack of

electricity and resources after the storm. The mortality was considered a causal mortality.

On October 3, a live juvenile green turtle was retrieved in poor condition from the intake wells. It was unresponsive and bleeding from its mouth. The turtle died en route to a rehabilitation facility. The necropsy revealed that blunt force trauma caused the animal to bleed-out internally. Therefore, this was considered a causal mortality.

On October 7, a dead juvenile green turtle was retrieved from the intake wells. There was a large fresh abrasion on the left side of the throat and right axillary region. There were also impact wounds in the carapace. The necropsy findings were consistent with the preliminary determination and this was deemed a causal mortality.

On October 7, a live juvenile green turtle in poor condition was retrieved from the intake wells. It had a 3 x 6 x 1.5 cm puncture through the right anterior region of the carapace. The puncture was caused by the traveling screens and/or rake at the intake wells. It was considered a causal injury.

#### **4.0 Sea Turtle Protective Activities**

##### **4.1 NMFS Section 7 Consultations**

In accordance with Section 7 of the ESA, FPL must submit a Biological Assessment to NMFS for review if FPL exceeds the Incidental Take Limit established by the most recent BO. The BO is an analytical document that looks at the effects of a federal action on endangered and threatened species.

Section 7(b) (4) of the ESA refers to the incidental take of listed species. It sets forth the requirements when a proposed agency action is found to be consistent with Section 7(a) (2) of the ESA and the proposed action may incidentally take listed species. NMFS is responsible for issuing a statement that specifies the impact of any incidental take of endangered or threatened species. It also states that reasonable and prudent measures, and terms and conditions to implement the measures, be provided to minimize such impacts.

In 1999, FPL exceeded their anticipated incidental take limit established by the 1997 BO set forth by NMFS. This required reinitiating of consultation under Section 7 of the ESA. As part of this consultation, FPL conducted a study on the factors influencing sea turtle entrainment (EAI, 2000). NMFS considered this new information when developing the new opinion. On May 4, 2001, NMFS issued its BO as part of the reinitiating of consultation subsequent to the 1997 BO.

In the 2001 BO, there were a number of changes, most importantly in the Incidental Take Statement. It stated that FPL would exceed their take limits for a calendar year if any of the following occur: 1) more than 1000 sea turtles are captured, 2) more than 1% of the total number of loggerhead and green turtles (combined) are injured/killed due to plant operation, 3) more than two Kemp's ridley sea turtles are injured/killed due to plant operation, or 4) if any hawksbill or leatherback sea turtles are injured/killed due to plant operation. In the case where 1% of the combined loggerhead and green turtle captures is not a whole number, it is rounded up (e.g. 520 combined captures = take limit of 6). Under Section 7 of the Endangered Species Act, a new consultation with NMFS is required if FPL meets or exceeds the take limits specified in the Incidental Take Statement.

In 2006, FPL exceeded their sea turtle take limit at the St. Lucie Plant and reinitiating a Section 7 consultation was required. FPL identified the contributing factors that led to exceeding the take limit in 2006 and the company responded by cleaning the intake pipes and developing a plan to install turtle excluder panels on the offshore intake structures. These grated panels would exclude almost all reproductively active sea turtles from being entrained into the plant's intake canal.

The St. Lucie Plant continued to operate under the 2006 BO until NMFS issued a new BO in March 2016. The most significant change in the new BO is to the Incidental Take Statement. It states that FPL would exceed its take limit if: 1) more than 623 loggerheads, 500 green turtle, 7 hawksbills, 8 Kemp's ridleys, or 5 leatherbacks are captured annually; 2) more than 7 green turtles or 3 loggerheads are documented with severe causal injuries annually; 3) more than 5 green turtles or 3 loggerhead are documented as causal mortalities annually; 4) more than 1 hawksbill, Kemp's ridley, or leatherback are documented with either a severe causal injury or is a causal mortality every two years; 5) more than one smalltooth sawfish is captured every five years or any smalltooth sawfish are ever killed.

During 2017, there were 250 loggerheads, 182 green turtles, 2 hawksbills, and 1 Kemp's ridley captured. There were three causal green turtle mortalities as well as one green turtle with causal injuries. One loggerhead mortality was also causal to plant operations. No leatherback, hawksbill or Kemp's ridley turtles were injured or killed due to plant operations. However, two smalltooth sawfish were removed from the intake canal, tagged, and released in good condition. Consequently, FPL exceeded its take limit during 2017 because more smalltooth sawfish were captured than allowable under the latest BO (issued by the NMFS).

## **4.2 Sea Turtle Stranding and Salvage Network and Turtle Walks**

An amendment to the EPP, Requirement 4.2.1 of the St. Lucie Unit 2 operating license Appendix B, was approved in 1999. This mandated that participation in the Sea Turtle Stranding and Salvage Network (STSSN) and Public Service Turtle Walks was to become part of the BO and Incidental Take Statement issued by NMFS.

As participants in the STSSN, IRG's sea turtle biologists routinely respond to sea turtle strandings in St. Lucie and Martin Counties. This activity involves the collection of information on turtles that are found dead, debilitated, or that have been impacted by human-related activities. All permit holders participating in this program are required to complete a STSSN stranding report for each dead or debilitated turtle encountered. Completed stranding reports are then sent to FWC.

Sea turtle nesting walks are conducted by FPL as part of their public outreach programs during the summer sea turtle nesting season. These turtle walks educate the public about relevant sea turtle protection issues and, in most cases, allow the public to view a nesting loggerhead sea turtle.

### **4.2.1 Results for 2017**

During 2017, IRG biologists responded to 24 (6 loggerhead, 17 green, and 1 Kemp's ridley species) stranding events between St. Lucie and Martin Counties. Six live turtles were transported to rehabilitation facilities. The 18 dead turtles were found in various stages of decomposition. The probable cause of stranding included two boat strikes, three in an emaciated body condition, one fishing line/trap entanglement, one shark attack, and five turtles with sever papillomatosis. The remaining six turtles were either too decomposed, had injuries of an unknown origin, or otherwise lacked any salient wounds or abnormalities to indicate a probable cause of death.

FPL conducted 12 turtle walks between June 2 and July 8, 2017. During these programs, a total of 256 people attended and on 9 of the 12 turtle walks participants were able to view a nesting female loggerhead turtle.

## **4.3 Collaborative Efforts**

IRG biologists continue to assist other sea turtle researchers, universities, nonprofit organizations, and state and federal agencies by providing data, specimens, and public outreach. IRG biologists at the St. Lucie Plant continued to collaborate with other researchers on four research projects in 2017.

IRG biologists collaborated with Dr. Duncan Irschick, an integrative biologist from the University of Massachusetts Amherst, on his Digital Life Project to make accurate 3-D

images of sea turtles to benefit science, conservation, and education. Additional photos were taken of juvenile green turtles for Dr. Michael Salmon of FAU (studying ontogenetic/ morphometric shifts in this species. Unhatched eggs from loggerhead nests were also collected for stable isotope analysis conducted by Florida Fish and Wildlife Research Institute (FWRI). Measurements of hatchlings orientation direction were also collected for a separate study by FWRI.

#### **4.4 Barrier Net Maintenance**

Maintaining the integrity of the barrier nets is essential to reducing mortality rates and residency times of entrained sea turtles and is mandated by the most recent BO issued by NMFS. Daily inspections are performed from a small boat to remove floating debris and to repair holes at or near the water's surface. Quarterly inspections and cleaning debris from the net when warranted was conducted by UESI. In addition to scheduled inspections and cleaning of the nets, divers are deployed when the integrity of the nets are threatened by algae events. These algae events can cause undue stress to the net structures and may cause the net to fail. Net failures increase both the risk of sea turtle mortalities and residency times. Turtles can become tangled in or pinned under a failed barrier net, leading to a causal drowning mortality. Furthermore, if turtles have access to larger portions of the intake canal, then it becomes more challenging to quickly entrap and release these animals back into their natural environment. The primary barrier net, with few exceptions, has effectively confined sea turtles to the eastern 200 meters of the intake canal.

UESI discovered two medium-sized holes in the 8-inch A1A net during the first quarterly inspection; the holes were promptly repaired. However, the overall condition of this net was considered poor and replacement was planned. No other holes were found in any of the remaining barrier nets during 2017.

Hurricane Irma significantly impacted the barrier nets within the FPL intake canal. UESI personnel were on site immediately after the storm on September 11 to remove debris, inspect and clean the 5-inch net. The hurricane ultimately caused the failure of the secondary 8-inch A1A barrier net, which UESI removed and replaced over the following two weeks. On October 8, UESI determined that the primary 5-inch barrier net had been impacted by Hurricane Irma as well, allowing larger than normal turtles to pass through the net. After consultation with FWC, FPL directed UESI to fasten a 5-inch mesh net atop the existing 8-inch A1A net in order to prevent turtles from moving further down the canal until the primary 5-inch net could be replaced. Replacement of the primary barrier net was completed on February 9, 2018.

After Hurricane Irma, additional effort was made to proactively capture turtles east of the primary barrier net. IRG personnel also inspected the entire length of the intake canal

(up to the security barrier) at least twice daily for turtles that may have made it past the primary or secondary barrier nets. Later, a small john boat was deployed between the 5-inch and 8-inch nets resulting in the dip net capture of one juvenile green turtle.

Altogether, seven juvenile green turtles were encountered west of the primary barrier net, including the one turtle that was dip netted between the first two barrier nets and six turtles that were recovered from the intake wells (three released in good condition, two causal mortalities, and one causal injury).

#### **4.5 Intake Pipe Cleaning and Maintenance**

Beginning in 2002, there was a steady increase in the number of sea turtles incurring scrapes during transit through the plant intake pipes. These scrapes varied in degree of severity, with most being minor and similar to those found on sea turtles that inhabit nearshore reefs. However, some scrapes were moderate or severe, causing some turtles to be sent to rehabilitation facilities for treatment. This prompted FPL to inspect the intake pipes in 2006 and schedule cleaning of bio-fouling and marine debris that were thought to be causing the scrapes to entrained sea turtles.

Cleaning and removal of debris from the intake pipes and offshore intake structures began in October 2007 and was completed in February 2011. Additionally, two openings that extended from the top of the two 12-foot intake pipes were also sealed off during this time.

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6.0 Figures and Tables

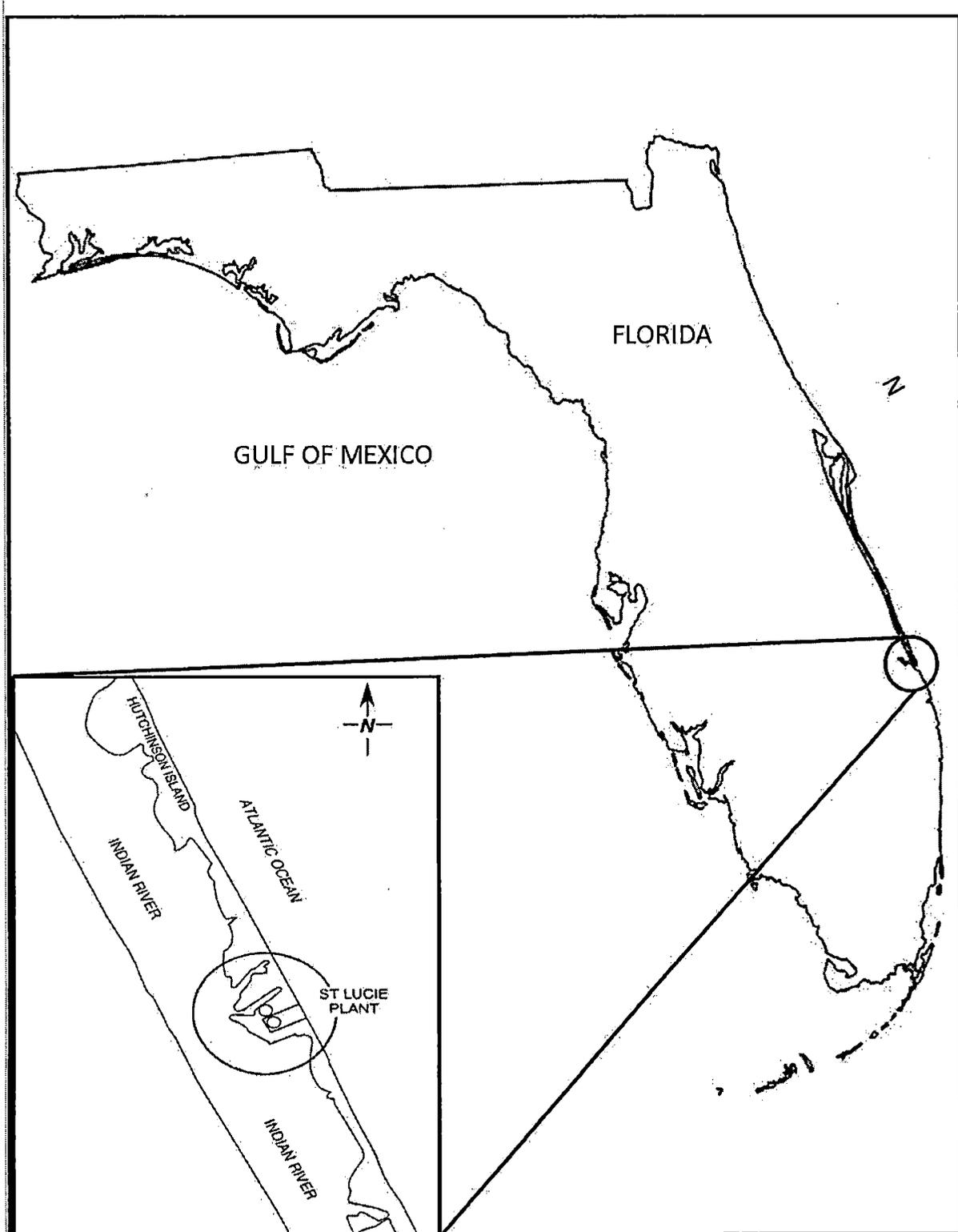


Figure 1. Location of St. Lucie Plant on South Hutchinson Island, Florida.

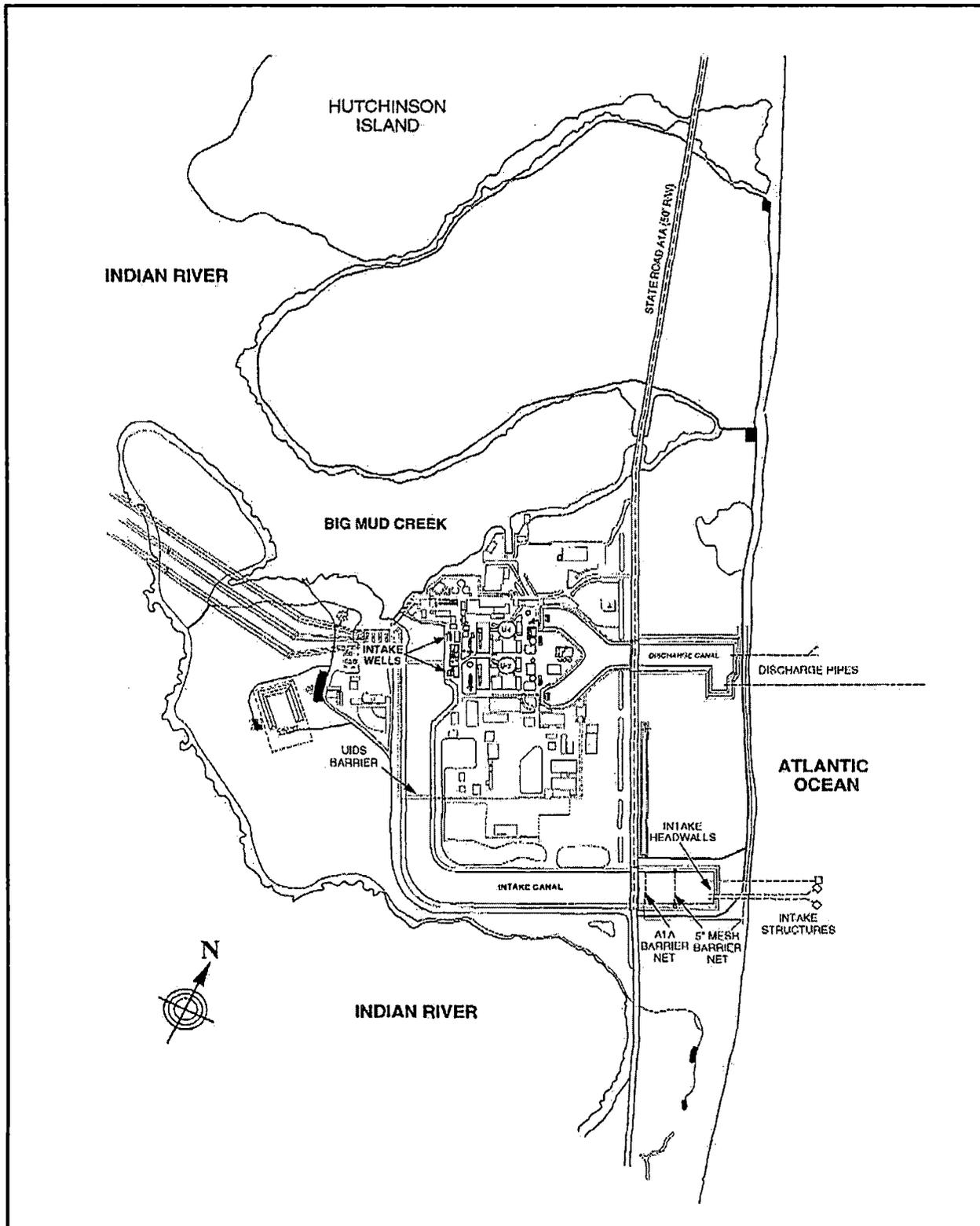
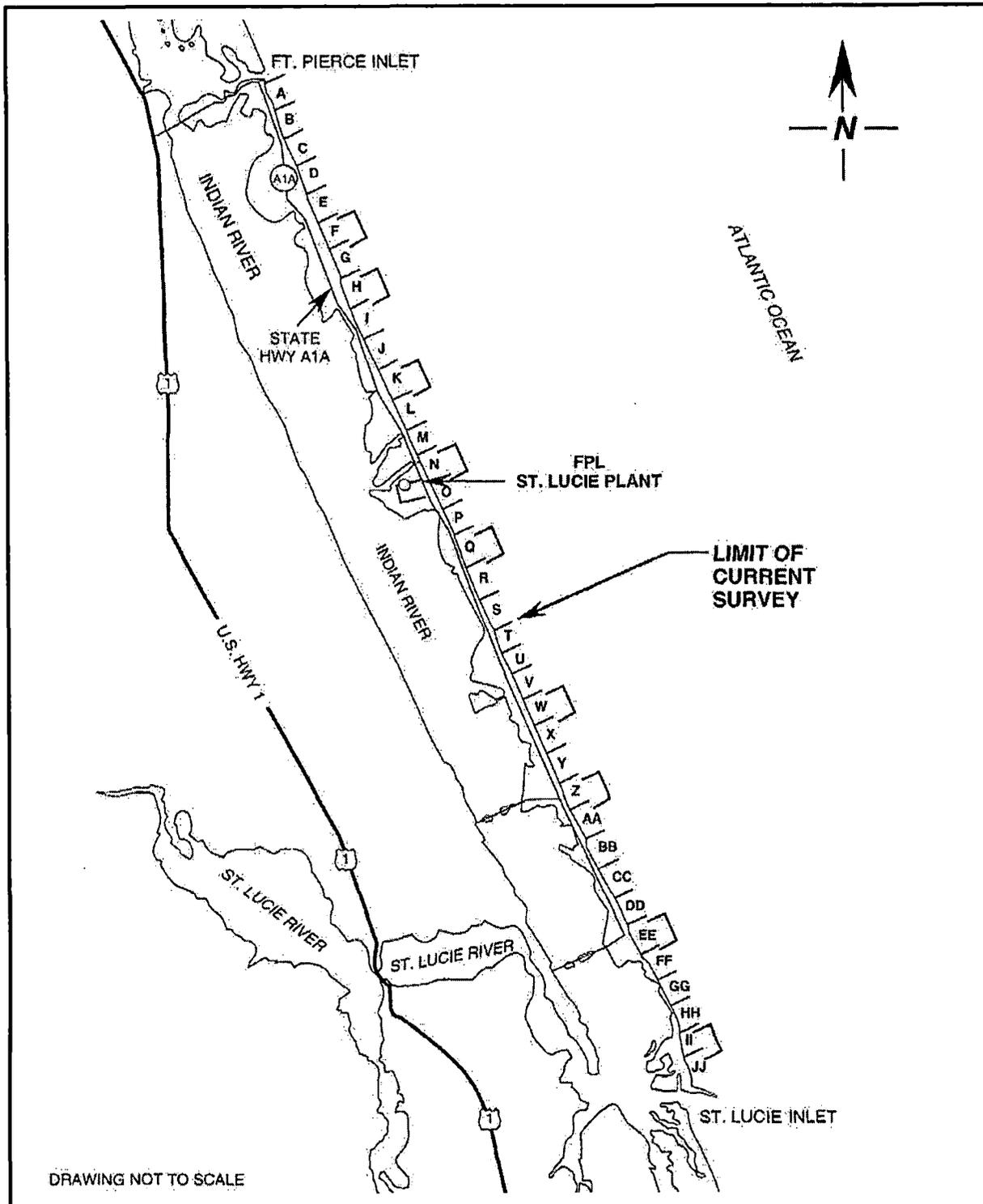
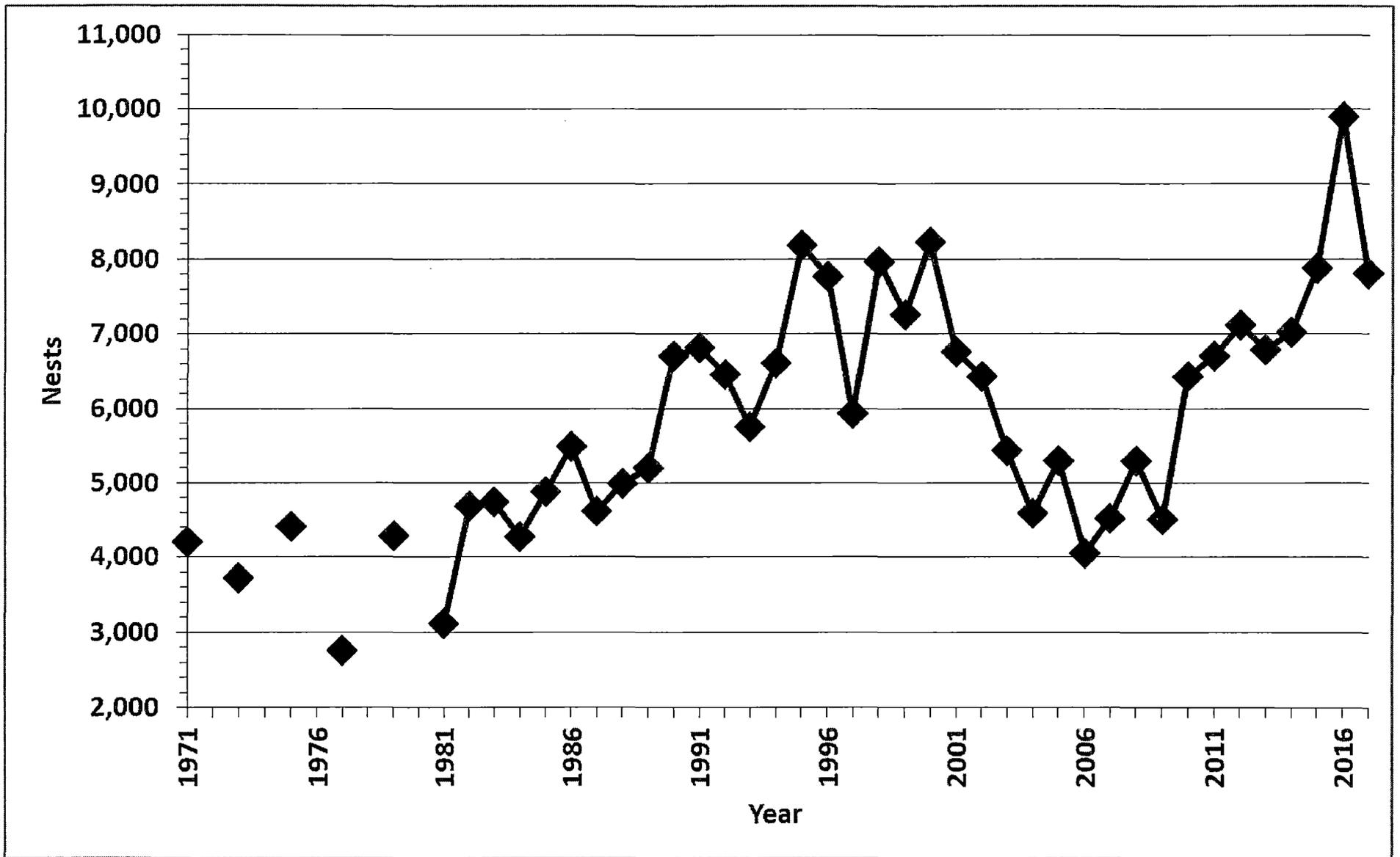


Figure 2. St. Lucie Plant cooling water intake and discharge system.



**Figure 3.** Designation and location of nine 1.25 km segments (in brackets) and 36 one km segments surveyed for sea turtle nesting on South Hutchinson Island (1971-2017).



**Figure 4.** Number of loggerhead turtle nests on South Hutchinson Island from 1971 through 2017. Values for 1971 through 1979 are estimates (Section 2.1.1); values for 1981 through 2017 are from whole island surveys.

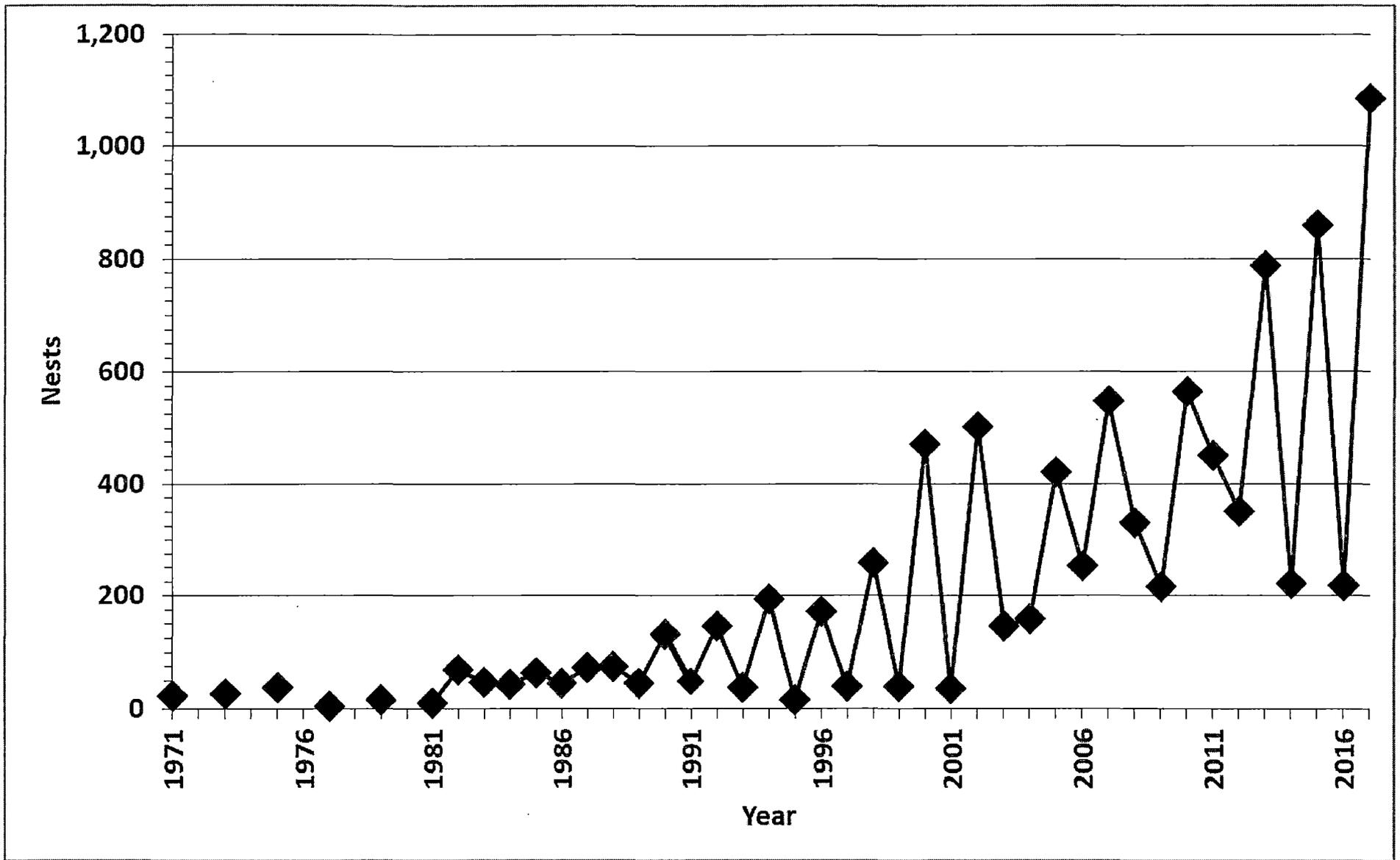
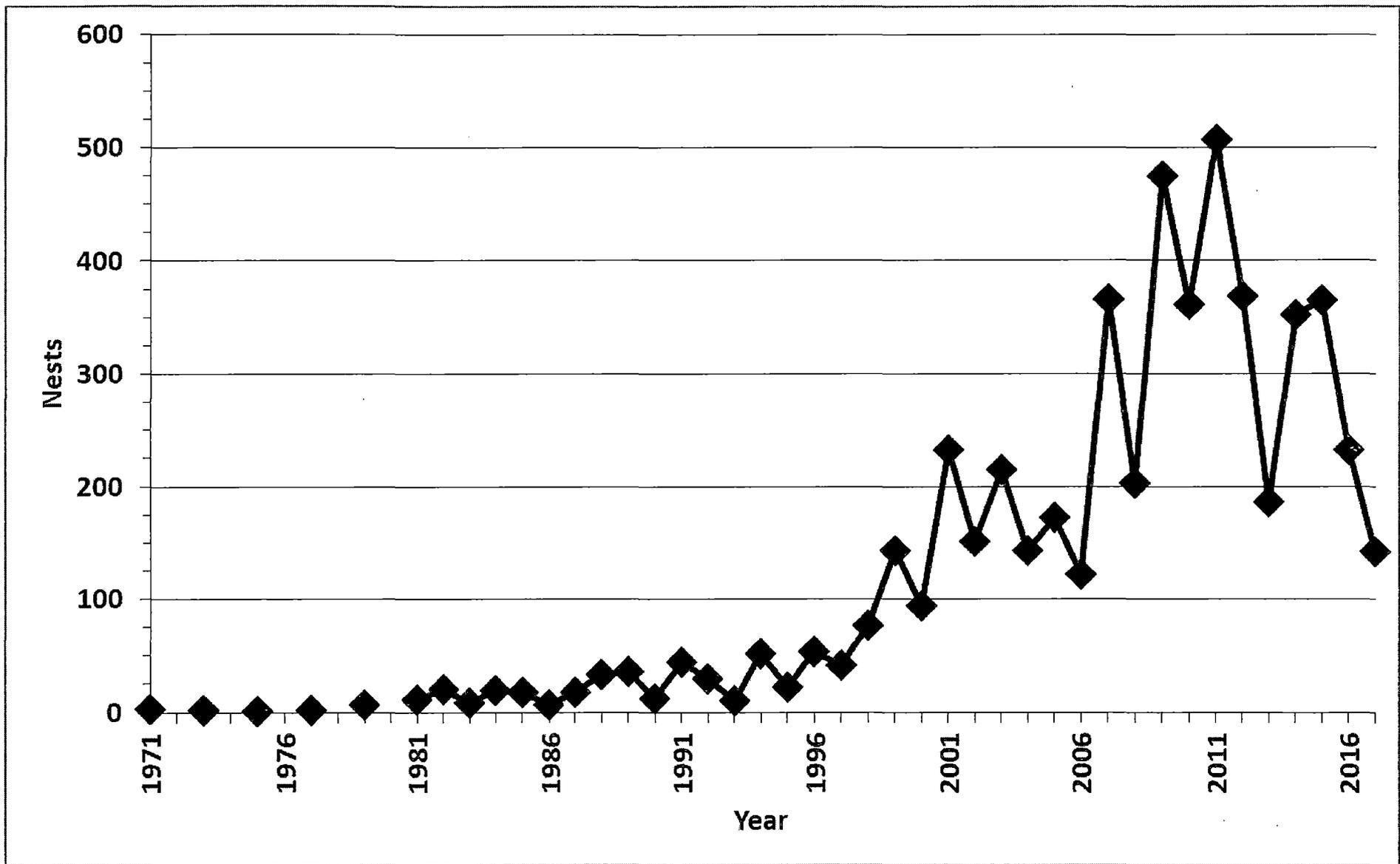
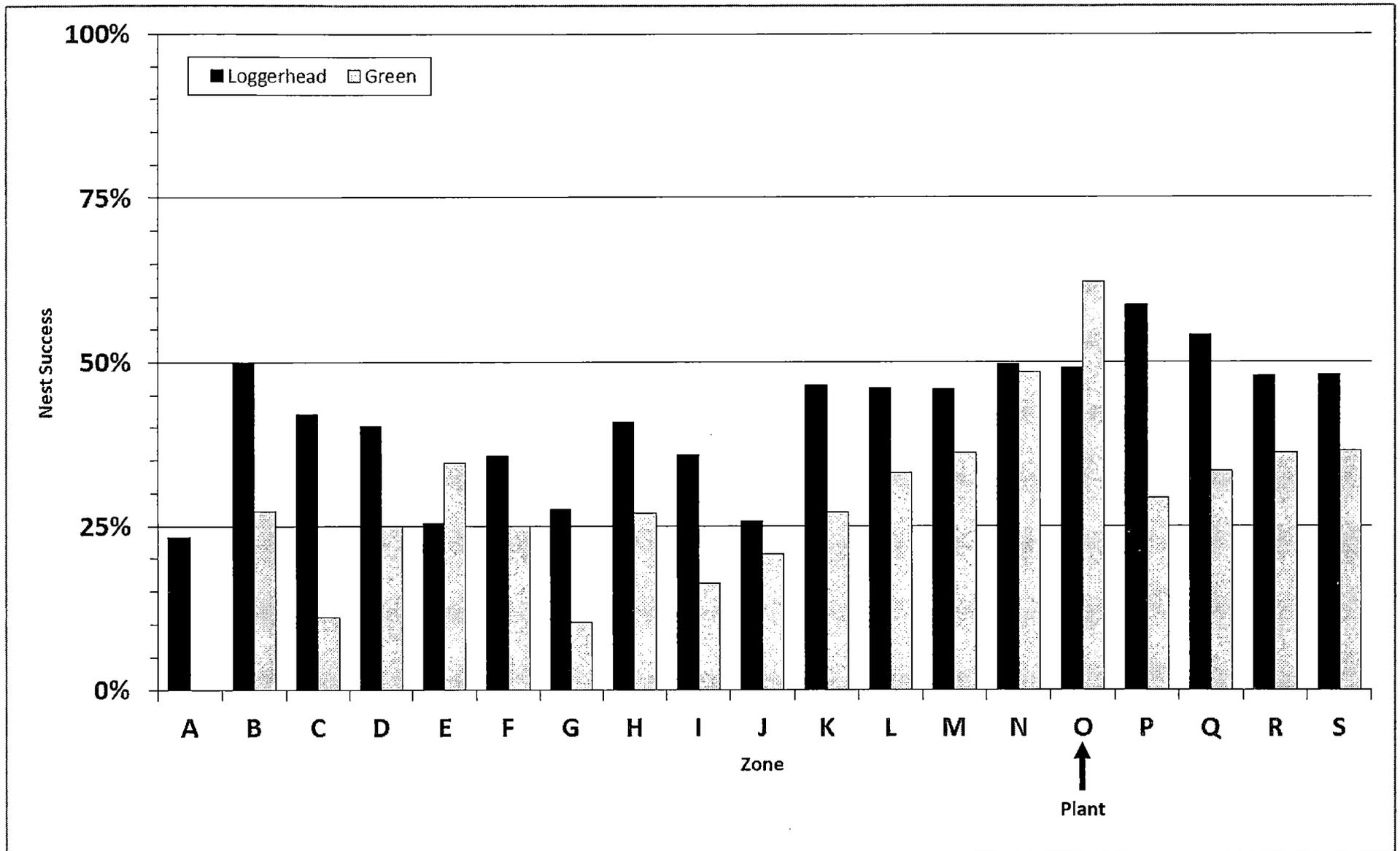


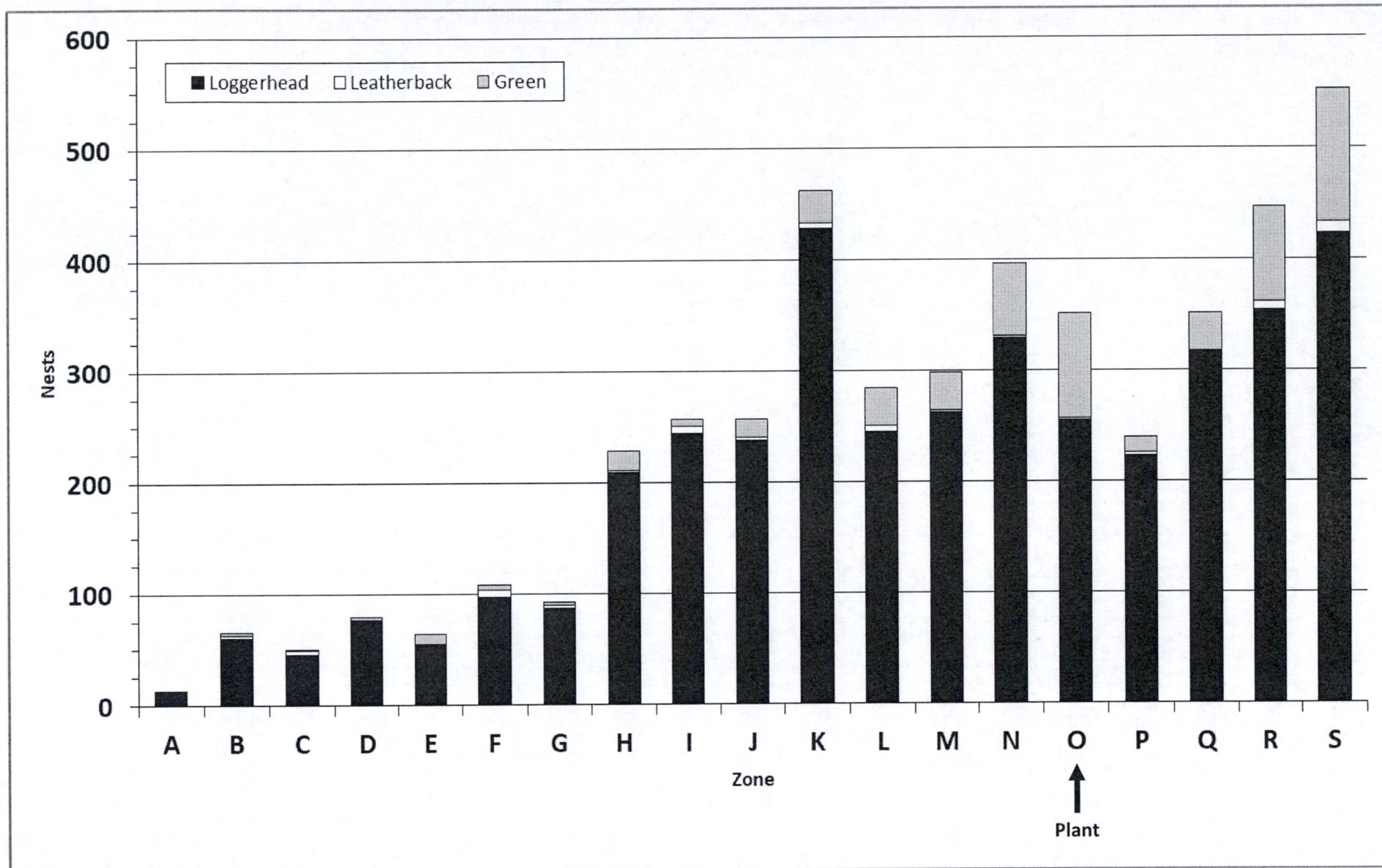
Figure 5. Number of green turtle nests on South Hutchinson Island from 1971 through 2017. Values for 1971 through 1979 are estimates (Section 2.1.1); values for 1981 through 2017 are from whole island surveys.



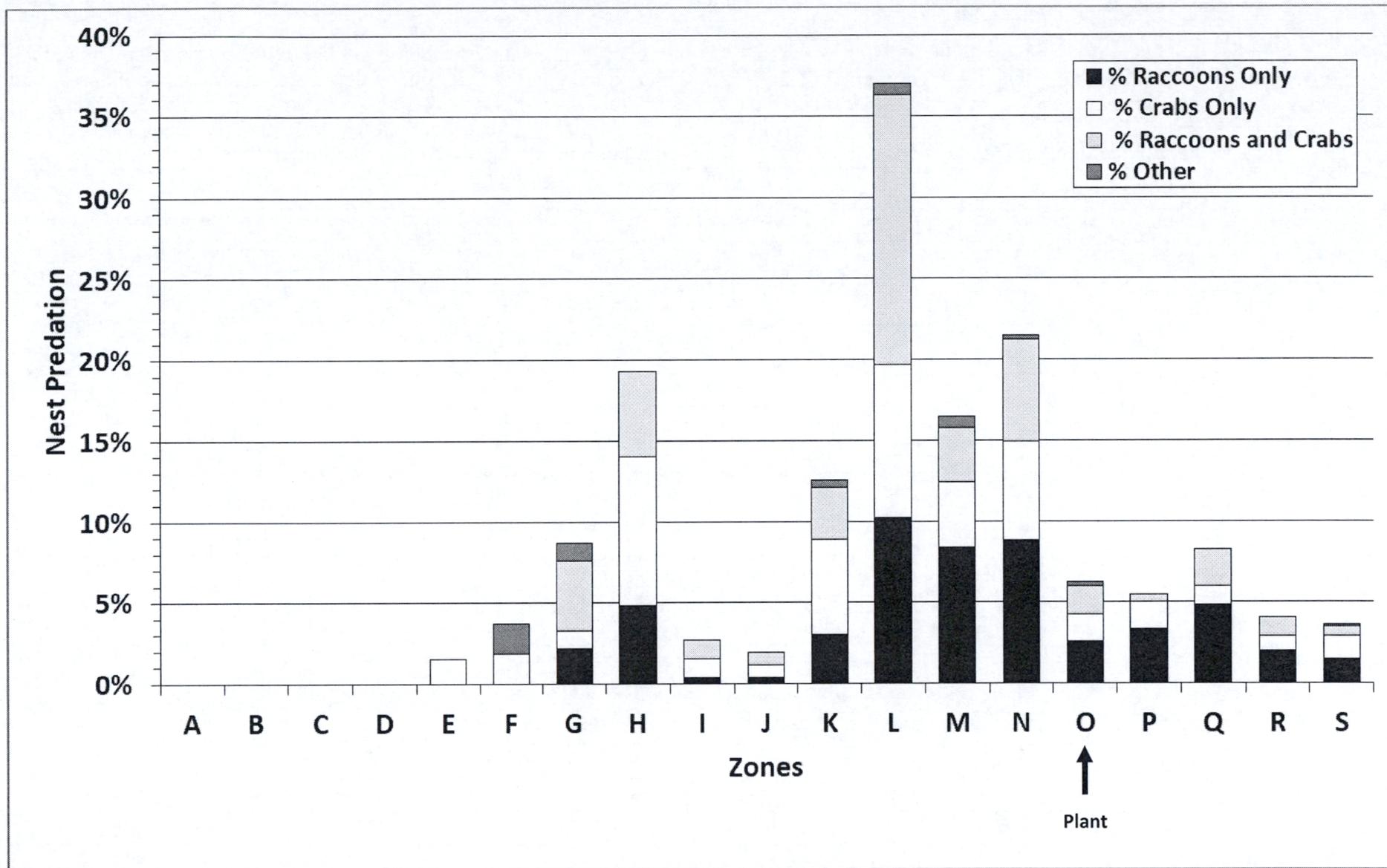
**Figure 6.** Number of leatherback turtle nests on South Hutchinson Island from 1971 through 2017. Values for 1971 through 1979 are estimates (Section 2.1.1); values for 1981 through 2017 are from whole island surveys.



**Figure 7.** Loggerhead and green turtle nesting success (percentage of emergences resulting in nests) for each of the 1 km Zones A through S (North to South) on South Hutchinson Island for the 2017 nesting season.



**Figure 8.** Number of turtle nests by species for each of the 1 km Zones A through S (North to South) on South Hutchinson Island for the 2017 nesting season (N=4,594 nests).



**Figure 9.** Percentage of sea turtle nests depredated by 1 km Zones A through S (North to South) on South Hutchinson Island for the 2017 nesting season.

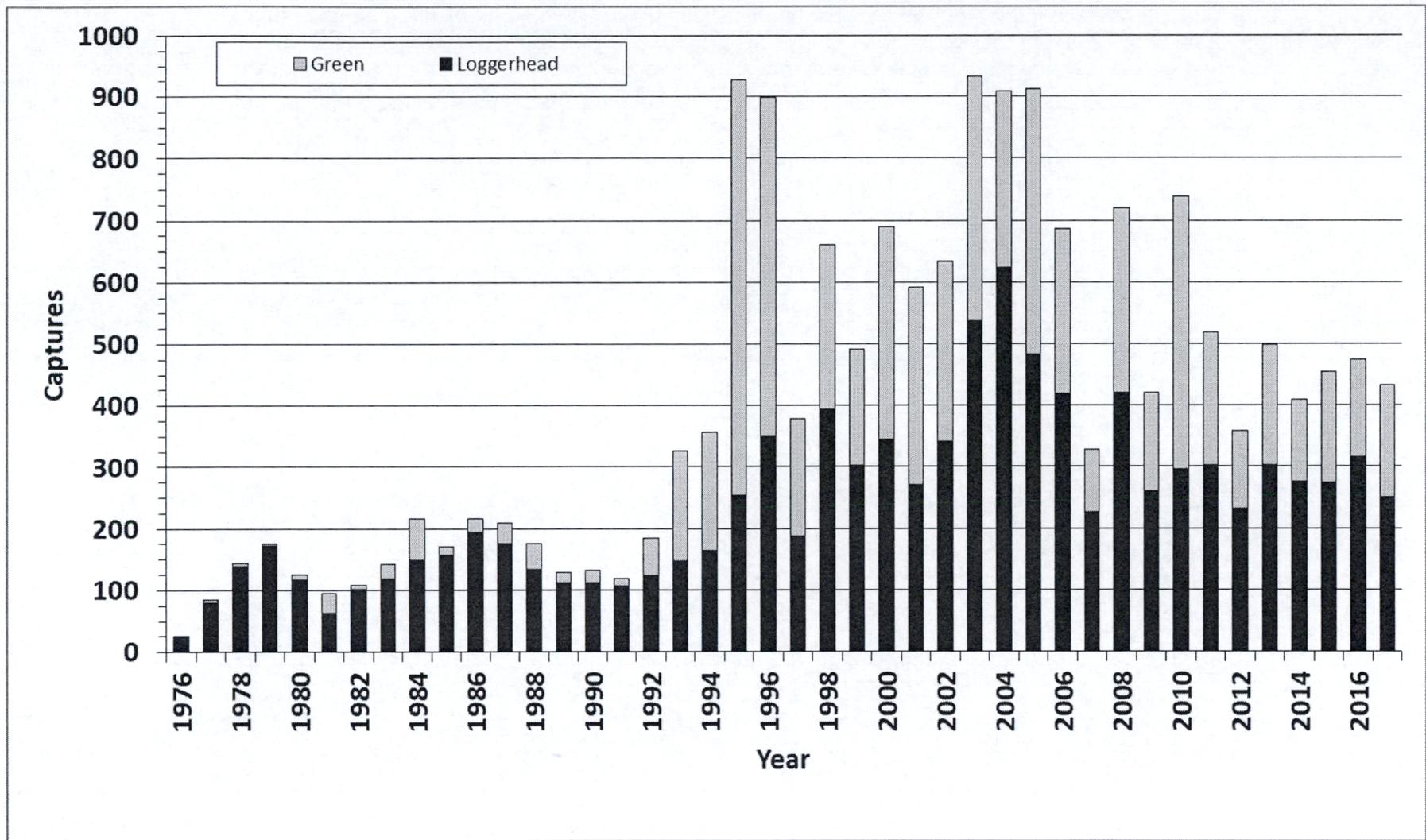


Figure 10. Number of loggerhead and green turtles captured and removed each year from the intake canal at the St. Lucie Plant, 1976 through 2017.

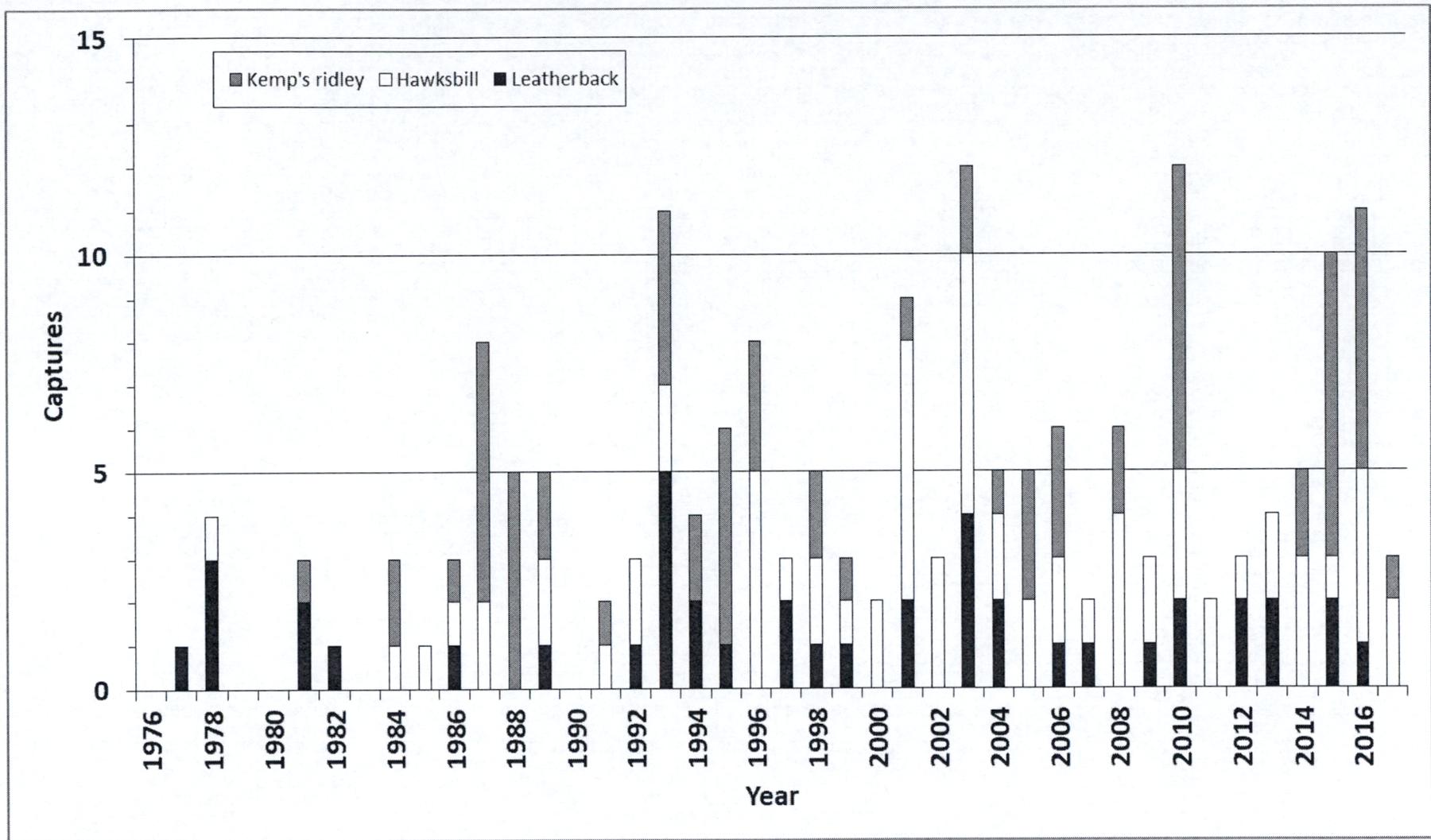
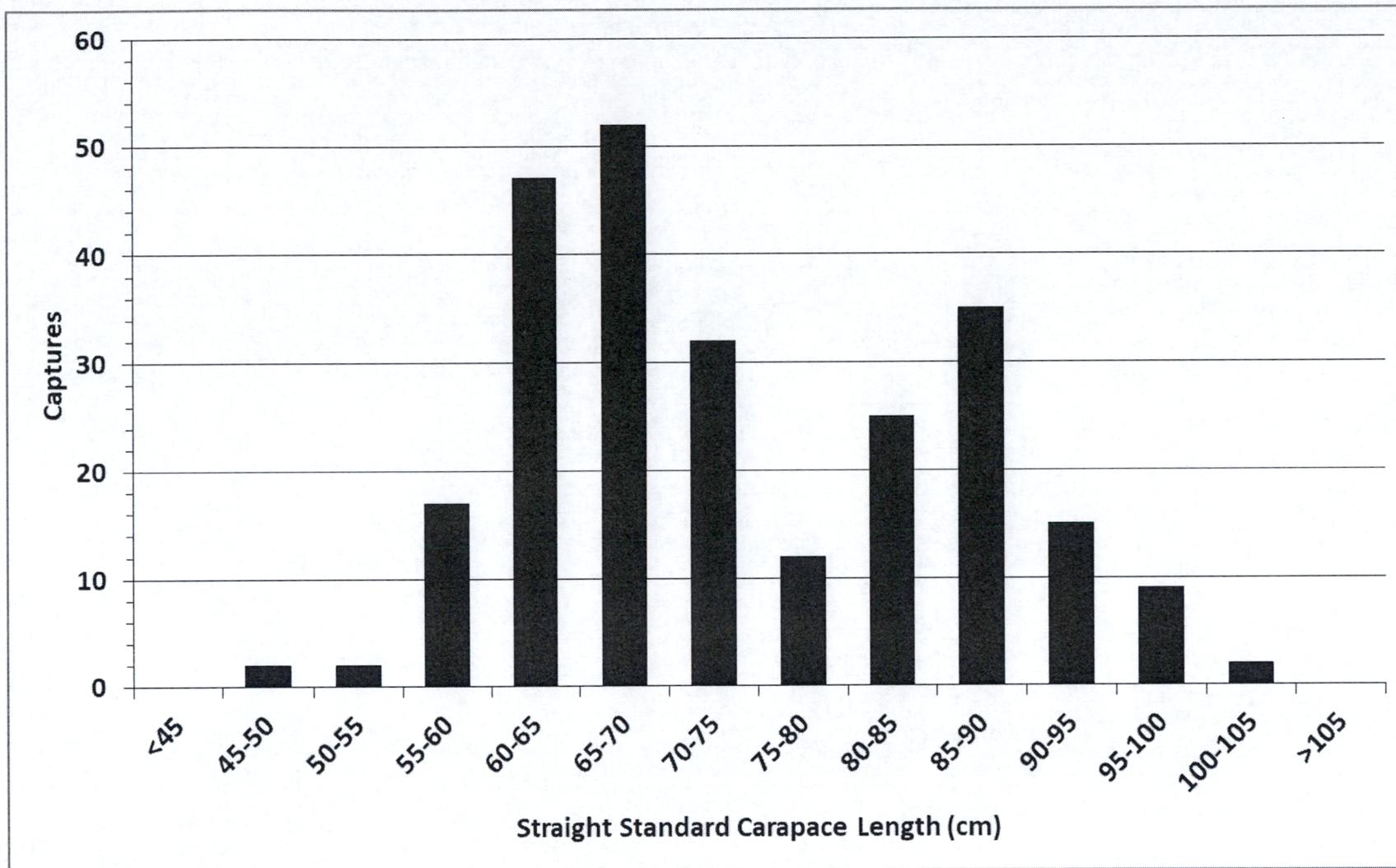
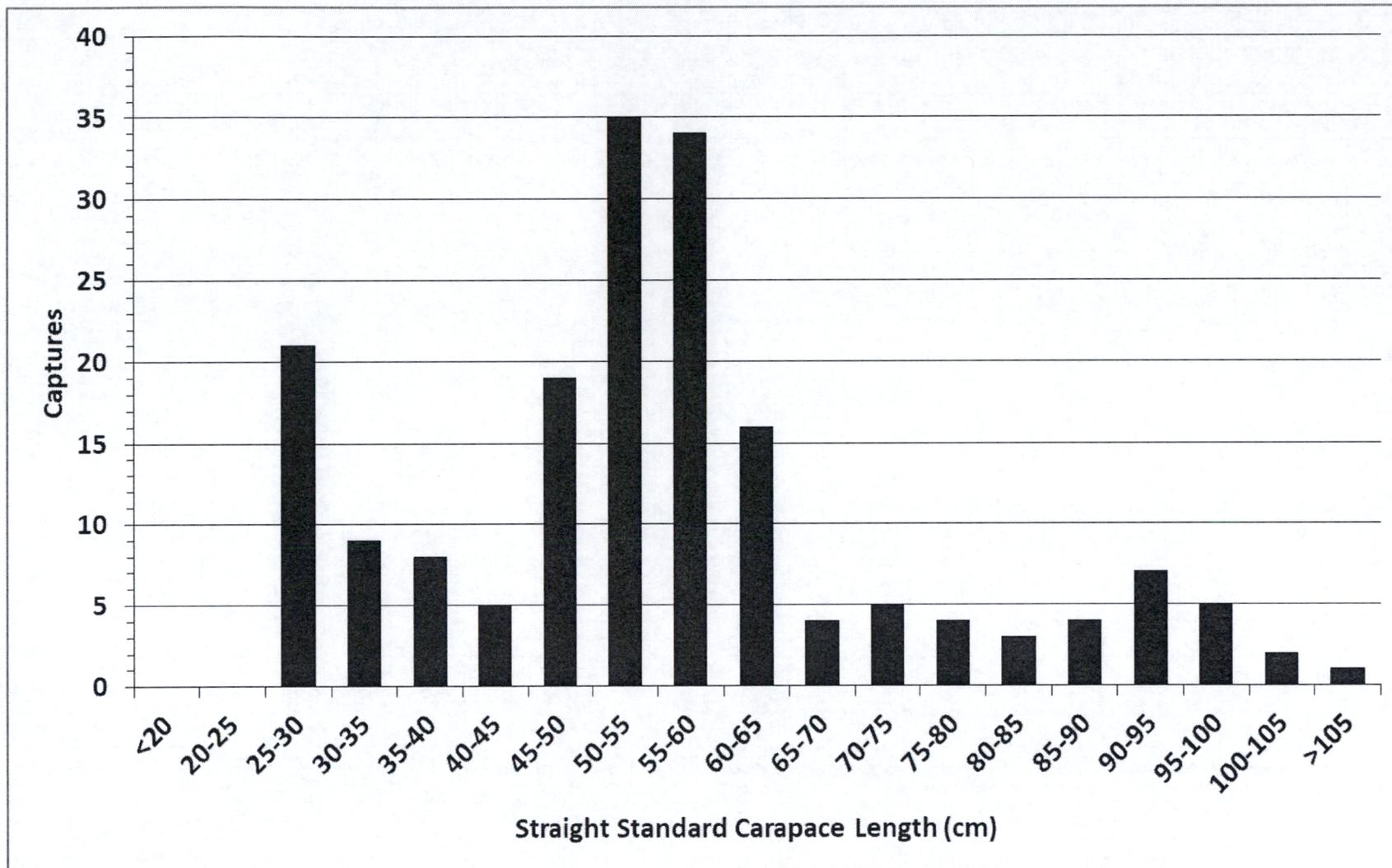


Figure 11. Number of Kemp's ridley, hawksbill, and leatherback turtles captured and removed each year from the intake canal at the St. Lucie Plant, 1976 through 2017.



**Figure 12.** Size distribution (Straight Standard Carapace Length; SSCL) of loggerhead turtles (N=250) captured and removed from the intake canal at the St. Lucie Plant during 2017.



**Figure 13.** Size distribution (Straight Standard Carapace Length; SSCL) of green turtles (N=182) captured and removed from the intake canal at the St. Lucie Plant during 2017.

Year	Loggerhead		Green		Leatherback		Hawksbill		Kemp's ridley		Total	
1976 - 1984	962	74	156	15	7		2		3		1130	89
1985	157	4	14				1				172	4
1986	195	27	22	1	1		1		1		220	28
1987	175	11	35				2		6		218	13
1988	134	6	42	2					5	2	181	10
1989	111	4	17	1	1		2		2	2	133	5
1990	112	1	20	2							132	3
1991	107	1	12				1		1		121	1
1992	123	2	61	2	1		2				187	4
1993	147		179	1	5		2		4		337	1
1994	164		193	4	2				2		361	4
1995	254	1	673	15	1				5		933	16
1996	349	3	549	4			5		3		906	7
1997	188		191	5	2		1				382	5
1998	393	1	268		1		2		2		666	1
1999	302	2	190	4	1		1		1		495	6
2000	344	2	345	2			2				691	4
2001	270	1	321	5	2		6		1		600	6
2002	341		292	3			3				636	3
2003	538		394	2	4		6		2		944	2
2004	623	2	286	1	2		2		1		914	3
2005	484	2	428	1			2		3		917	3
2006	419	22	267	2	1		2		3		692	24
2007	227	3	101	1	1		1				330	4
2008	420	2	299	4			4		2		725	6
2009	260	1	161	1	1		2				424	2
2010	295	2	444	6	2		3		7		751	8
2011	302	1	217	8			2				521	9
2012	232	1	127	2	2		1				362	3
2013	303	2	196	3	2		2				503	5
2014	275	1	134	2			3	1	2		414	4
2015	274	1	181	8	2		1		7		465	9
2016	316	1	159	8	1		4		6		486	9
2017	250	3	182	5			2		1		435	8
<b>Total</b>	<b>10046</b>	<b>184</b>	<b>7156</b>	<b>120</b>	<b>42</b>	<b>0</b>	<b>70</b>	<b>1</b>	<b>70</b>	<b>4</b>	<b>17384</b>	<b>309</b>
<b>Mean*</b>	<b>244.4</b>	<b>1.7</b>	<b>174.5</b>	<b>2.9</b>	<b>1.0</b>	<b>0</b>	<b>1.7</b>	<b>0.02</b>	<b>1.7</b>	<b>0.1</b>	<b>423.4</b>	<b>7.5</b>

**Table 1.** Total number of captured turtles removed from the intake canal at the St. Lucie Plant from 1976 through 2017. Number of mortalities is highlighted in gray. Mean excludes partial year of 1976 when 26 loggerheads were captured.

Months	Loggerhead				Green			
	2017 Captures	Total Captures	Percent of Captures	Mean	2017 Captures	Total Captures	Percent of Captures	Mean
<i>January</i>	14	919	9.2%	22.4	7	880	12.3%	21.5
<i>February</i>	12	889	8.9%	21.7	3	750	10.5%	18.3
<i>March</i>	8	1039	10.4%	25.3	3	824	11.5%	20.1
<i>April</i>	13	972	9.7%	23.7	1	497	6.9%	12.1
<i>May</i>	33	920	9.2%	22.4	7	478	6.7%	11.7
<i>June</i>	41	1093	10.9%	26.7	13	431	6.0%	10.5
<i>July</i>	31	1301	13.0%	31.7	4	408	5.7%	10.0
<i>August</i>	16	858	8.6%	20.9		396	5.5%	9.7
<i>September</i>	20	609	6.1%	14.9	31	552	7.7%	13.5
<i>October</i>	34	529	5.3%	12.9	77	739	10.3%	18.0
<i>November</i>	12	388	3.9%	9.5	22	595	8.3%	14.5
<i>December</i>	16	503	5.0%	12.3	14	606	8.5%	14.8
<b>Total</b>	250	10020		243.8	182	7156		174.5

**Table 2.** Total number of loggerhead and green turtles removed each month from the intake canal at the St. Lucie Plant from 1977 through 2017. Monthly totals exclude the partial year 1976 when 26 loggerheads were captured.

Months	Leatherback				Hawksbill				Kemp's ridley			
	2017 Captures	Total Captures	Percent of Captures	Mean	2017 Captures	Total Captures	Percent of Captures	Mean	2017 Captures	Total Captures	Percent of Captures	Mean
January	0	5	11.9%	0.1	0	1	1.4%	0.0	0	11	15.7%	0.3
February	0	5	11.9%	0.1	0	2	2.9%	0.0	0	19	27.1%	0.5
March	0	13	31.0%	0.3	0	8	11.4%	0.2	0	16	22.9%	0.4
April	0	7	16.7%	0.2	0	3	4.3%	0.1	0	12	17.1%	0.3
May	0	5	11.9%	0.1	0	3	4.3%	0.1	0	2	2.9%	0.0
June	0	2	4.8%	0.0	0	2	2.9%	0.0	0	2	2.9%	0.0
July	0	0	0.0%	0.0	0	14	20.0%	0.3	0	2	2.9%	0.0
August	0	1	2.4%	0.0	0	10	14.3%	0.2	0	0	0.0%	0.0
September	0	2	4.8%	0.0	1	13	18.6%	0.3	0	0	0.0%	0.0
October	0	0	0.0%	0.0	0	6	8.6%	0.1	0	1	1.4%	0.0
November	0	1	2.4%	0.0	0	6	8.6%	0.1	0	1	1.4%	0.0
December	0	1	2.4%	0.0	1	2	2.9%	0.0	1	4	5.7%	0.1
<b>Total</b>	0	42		1.0	2	70		1.7	1	70		1.7

**Table 3.** Total number of leatherback, hawksbill, and Kemp's ridley turtles removed each month from the intake canal at the St. Lucie Plant from 1977 through 2017. Monthly totals exclude the partial year 1976 when 26 loggerheads were captured.

## **7.0 Annual Environmental Operating Report**

### **7.1 Introduction**

The St. Lucie Units 1 and 2 Environmental Protection Plans (EPP) require the submittal of an annual report for various activities at the plant site including the reporting on sea turtle monitoring programs, and other matters related to Federal and State environmental permits and certifications.

### **7.2 Sea Turtle Monitoring and Associated Activities**

Surveillance and maintenance of the light screen to minimize sea turtle disorientation as required by Section 4.2.3 of the EPP is ongoing. The vegetation light screen located on the beach dune between the plant and the ocean is routinely surveyed to determine its overall vitality. Evidence of sea turtle disorientation that occurs would also indicate any significant problems. Trees, vegetation or shade cloth are replaced as necessary to maintain the overall integrity of the light screen. Plant parking lot lighting is also designed and maintained to minimize light levels on the beach.

### **7.3 Taprogge Condenser Tube Cleaning System Operation**

A Taprogge condenser tube cleaning system (CTCS) became operational on St. Lucie Unit 2 in January 1996 and on Unit 1 in July 1996. This system utilizes sponge balls, approximately 23 mm in diameter, to clean the condenser tubes through which seawater flows to cool steam after its pass through the plant's turbines. This system improves plant performance while reducing the need for chemical treatments such as biocides or chlorine to control biofouling.

Normally, the St. Lucie CTCS utilizes about 1800 sponge balls, which are continually recirculated through each of four "water boxes" on each unit. These sponge balls are retained in the system by a ball strainer located on the outlet of each water box. The ball strainers (mesh size 5 mm) are opened routinely to discharge debris, which can decrease flow and obstruct sponge ball movement through the system. The sponge balls are collected prior to opening, or back flushing, the ball strainers. At that time, the sponge balls are examined and replaced if they are worn to the point that they can no longer effectively clean the condenser tubes.

Sponge ball inventories and estimates of sponge ball loss to the environment have been performed since system start-up on both units. Number of ball strainer back flushes has also been tracked. In addition, daily beach surveys have been performed on plant property (approximately 2.5 miles) to note any sponge balls that may occur as a result

of loss from the plant. This survey area has been extended during the turtle nesting season to almost 12 miles.

Ball loss reporting is required in accordance with the St. Lucie site environmental permit, a component of the site license. Best management practices are used to minimize the discharge of CTCS balls to the Atlantic Ocean.

The sponge cleaning balls are made of natural latex which will biodegrade and break down after about two months in a high nutrient seawater environment. Biodegradation can occur while balls are in service and weaken the latex sponge, leading to premature ball fatigue failure from cycle fatigue induced by the CTCS ball circulation impeller. Although blue stripe balls are more resistant to biodegradation compared to orange balls, they are not as effective for tube cleaning during the last two weeks of service. The five week maximum service interval is adequate to prevent most ball failure events.

Best management practices continue to be applied to minimize CTCS ball loss. The results of the program for 2017 are presented in Table 1.

#### **7.4 Nonroutine Reports**

On September 11, 2017, a juvenile green sea turtle (*Chelonia mydas*) and a loggerhead sub-adult (*Caretta caretta*) were recovered from the plant's intake canal 5-inch barrier net post Hurricane Irma. Notification of the mortalities to the NRC occurred via FPL letter L-2017-173.

On October 3, 2017, and again on October 7, 2017, a juvenile green sea turtle (*Chelonia mydas*) was recovered from the St. Lucie Plant intake canal intakes. Notification of the mortalities to the NRC occurred via FPL letter L-2017-189.

On November 2, 2017, St. Lucie captured a smalltooth sawfish (*Pristis pectinate*), the report of an important environmental occurrence. The event is important because this is the second smalltooth sawfish captured in 2017 and exceeds the capture limit of one every five years. Notification to the NRC occurred via FPL letter L-2017-205.

#### **7.5 Routine Reports**

On January 24, 2017, St. Lucie submitted to the NRC a copy of a revised Industrial Wastewater Facility Permit (permit number FL0002208). The report was submitted to the NRC via FPL letter L-2017-012.

On April 26, 2017, St. Lucie submitted to the NRC a copy of the 2016 Annual Environmental Operating Report. The report was submitted via FPL letter L-2017-078.

On September 13, 2017, St. Lucie submitted to the NRC a copy of a revision request to the St. Lucie Industrial Wastewater Permit (permit number FL0002208). The report was submitted to the NRC via FPL letter L-2017-160.

On September 11, 2017, a juvenile green sea turtle (*Chelonia mydas*) and a loggerhead sub-adult (*Caretta caretta*) were recovered from the plant's intake canal 5-inch barrier net post Hurricane Irma. Notification of the mortalities to the NRC occurred via FPL letter L-2017-173.

On October 3, 2017, and again on October 7, 2017, a juvenile green sea turtle (*Chelonia mydas*) was recovered from the St. Lucie Plant intake canal intakes. Notification of the mortalities to the NRC occurred via FPL letter L-2017-189.

On November 3, 2017, St. Lucie submitted to the NRC a copy of a Minor Permit Revision to the Industrial Wastewater Permit (permit number FL0002208). Notification to the NRC occurred via FPL letter L-2017-193.

On November 2, 2017, St. Lucie captured a smalltooth sawfish (*Pristis pectinate*), the report of an important environmental occurrence. The event is important because this is the second smalltooth sawfish captured in 2017 and exceeds the capture limit of one every five years. Notification to the NRC occurred via FPL letter L-2017-205.

## 7.6 Figures and Tables

**Table 1  
PSL CTCS Ball Loss 2017 Summary**

	1A1		1A2		1B1		1B2		PSL 1 ALL		COMMENTS
	#B/W	LOST	#B/W	LOST	#B/W	LOST	#B/W	LOST	#B/W	LOST	
Jan-17	2	0	1	0	2	42	2	33	7	75	
Feb-17	2	37	1	0	1	83	1	72	5	192	
Mar-17	2	10	2	13	2	62	2	76	8	161	
Apr-17	2	57	2	48	1	1	2	0	7	106	
May-17	2	1	2	34	2	132	2	29	8	196	
Jun-17	1	1	1	0	2	93	2	76	6	170	
Jul-17	2	3	1	76	2	59	1	24	6	162	
Aug-17	1	9	2	75	1	59	1	26	5	169	
Sep-17	2	85	2	3	0	0	1	0	5	88	
Oct-17	1	0	1	51	1	89	1	12	4	152	
Nov-17	2	14	2	23	1	2	1	16	6	55	
Dec-17	2	78	2	24	2	44	2	32	8	178	
Summary	21	295	19	347	17	666	18	396	75	1704	

	2A1		2A2		2B1		2B2		PSL 2 ALL		COMMENTS
	#B/W	LOST	#B/W	LOST	#B/W	LOST	#B/W	LOST	#B/W	LOST	
Jan-17	1	69	2	73	0	0	0	0	3	142	
Feb-17	1	89	0	0	1	46	1	15	3	150	
Mar-17	0	0	0	0	0	0	0	0	0	0	
Apr-17	2	60	2	456	1	0	1	0	6	516	
May-17	2	46	2	264	1	2138	2	90	7	2538	
Jun-17	1	55	1	0	2	118	2	70	6	243	
Jul-17	3	175	3	508	2	181	2	115	10	979	
Aug-17	1	127	2	55	3	62	4	165	10	409	
Sep-17	1	0	0	0	1	0	1	0	3	0	
Oct-17	1	52	1	19	1	0	1	72	4	143	
Nov-17	3	197	2	51	3	122	3	10	11	380	
Dec-17	2	10	2	34	1	79	1	21	6	144	
Summary	18	880	17	1460	16	2746	18	558	69	5644	