April 15, 2020

L-2020-068
10 CFR 50.4

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
2019 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 2019.

Sincerely,

Wyatt Godes
Licensing Manager
St. Lucie Plant

WG/rcs

Attachment: Florida Power & Light Company - St. Lucie Plant - Annual Environmental Operating Report 2019 (52 pages)

cc: FDEP Siting Office

FLORIDA POWER & LIGHT COMPANY

ST. LUCIE PLANT

ANNUAL ENVIRONMENTAL

OPERATING REPORT

2019

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 1,000 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 1,500 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 2019, 9,472 loggerhead, 1,398 green, and 181 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 2019, 508 sea turtles were removed from the intake canal, including 234 loggerheads, 260 greens, 13 Kemp's ridleys, and one olive ridley. This is the first time an olive ridley has been captured at the St. Lucie Power Plant. The majority of these turtles (95.1%) were captured alive and released back to the ocean. Twenty (3.9%) were taken to rehabilitation facilities for treatment of injuries or disease and five turtles (1.0%) were recorded as deceased.

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 disease, fisheries interactions, boat strikes, or shark

attacks. Injuries causal to plant operations are recorded and are applied against the take limit established by the 2016 Biological Opinion (BO) set forth by the National Marine Fisheries Service (NMFS). The Incidental Take Statement in the 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 2019, there were 234 loggerheads, 260 green turtles, 13 Kemp's ridleys, and one olive ridley captured. There were two causal loggerhead mortalities and two causal green turtle mortalities. No leatherback, hawksbill, olive or Kemp's ridley turtles were injured or killed due to plant operation. One smalltooth sawfish was released from the St. Lucie Power Plant in 2019. FPL exceeded its take limit during 2019 because more Kemp's ridleys were captured than allowable under the latest BO issued by NMFS. In addition, FPL also exceeded its take limit for the capture of too many smalltooth sawfish within a five-year period.

One loggerhead nested on the canal banks during the 2019 sea turtle nesting season. The nest was relocated and later excavated in order to determine hatch success in accordance with FWC protocols.

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 about turtles that are found dead, debilitated, or that have been impacted by human-related activities. During 2019, Inwater Research Group (IRG) biologists responded to 25 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 2019, FPL conducted 11 turtle walks attended by 198 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 three projects in 2019.

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 coquinoid 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 1,000 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 1,500 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 35 annual environmental operating reports covering the period from 1983 through 2018 (ABI 1984-1994; Quantum Resources, Inc. 1995-2009; Inwater Research Group, Inc. 2010-2019). This report describes the 2019 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 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, as such, 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 1,500 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 that of the 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.

Dune restoration activities were repeated in 2019 precipitated by damage from Hurricane Irma (2017). Dune planting was completed in front of the power plant in April and daily sea turtle nesting surveys were performed to ensure that nests were protected. Subsequently, the beach in front of the discharge canal was renourished after the completion of the 2019 sea turtle nesting season in December. There were no remaining nests in the project area at that time.

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 2019, 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 were then 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 2019

In 2019, 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).

Nesting surveys were conducted every other day in March for zones A-S in South Hutchinson Island. Two leatherback sea turtle nests and one false crawl 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 daily.

Not all ventures onto the beach by a female turtle result in a successful nest. 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.

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, prolonged periods of drought, 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 northernmost 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 4,000 and 10,000 loggerhead nests have been deposited annually on South Hutchinson Island during the last 30 years.

In 2019, 9,472 loggerhead nests were recorded on South Hutchison Island (Figure 4). In Zones A-S (the north end of the island) biologists observed 4,122 nests (Figure 8). The first recorded nest was on April 15 and the last loggerhead nest was recorded on August 31. There were 5,804 loggerhead false crawls observed in Zones A-S.

Ninety-nine of the 4,122 loggerhead nests were marked to assess nest productivity. Fifty-five nests were successfully inventoried, 28 washed out, nine were completely

predated, and six could not be located again due to stake loss. The 55 inventoried nests contained a cumulative total of 5,845 eggs. Of these, 2,938 successfully hatched and emerged from the marked nests. This represents an emergence success rate of 50.3%. There were also 91 live loggerhead hatchlings found during nest excavations. However, 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 2019, 1,398 green turtle nests were recorded on South Hutchison Island (Figure 5). Biologists observed a total of 576 green turtle nests in Zones A-S (Figure 8). The first recorded nest of the season was on May 12 and the last green turtle nest was noted on September 23. There were 1,187 green turtle false crawls observed in Zones A-S.

Eighty of the 576 green turtle nests were marked to assess nest productivity. Thirty-one nests were successfully inventoried, 35 nests washed out, seven were completely predated, and seven were missing their marking stakes and could not be inventoried. The 31 inventoried nests contained a cumulative total of 3,624 eggs. Of these, 2,083 successfully hatched and emerged from the marked nests. This represents an emergence success rate of 57.5%. In addition, there were 13 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 2019, 181 leatherback sea turtle nests were recorded on South Hutchison Island (Figure 6). Biologists observed a total of 60 leatherback nests in Zones A-S (Figure 8). The first recorded nest was on March 27 and the last leatherback nest was recorded on July 10. There were 14 leatherback sea turtle false crawls observed in the surveyed areas A-S.

Fourteen of the 60 leatherback turtle nests were marked to assess nest productivity. Twelve nests were successfully inventoried, one washed out, and one could not be inventoried due to stake loss. The 12 nests that were inventoried contained a cumulative total of 954 eggs. Of these, 326 successfully hatched and emerged from the marked nests unaided. This represents an emergence success rate of 34.2%. There were also three 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 of 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 314 predation events for South Hutchinson Island in 2019 within beach Sections D-S (Figure 9). Sea turtle nests on South Hutchinson Island were depredated by raccoons, ghost crabs, fire ants, and a fox. The most abundant predators were raccoons, which accounted for 183 individual predation events. Ghost crabs were the second most abundant predator accounting for 56 events. Another 70

predation events consisted of a combination of raccoon and ghost crab predation. Other predators (fire ants and fox) accounted for five 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 55.1% of nests (54 out of 98) where hatch success could be evaluated. Sixteen additional marked nests were completely predated prior to inventory.

2.2.5 Poaching

EAI documented one poaching incident in 2019 just south of the Fort Pierce Inlet (zones A-D). On August 16, someone dug into a nest the day after it had hatched and removed three eggs. FWC law enforcement was contacted about the incident.

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) with 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.

In September 2017, Hurricane Irma led to the failure of both the primary and secondary barrier nets. The heavily damaged 8-inch A-1-A net was replaced immediately after the storm and the primary 5-inch net was replaced on February 9, 2018.

In April 2019, Ballard Marine Construction began dredging the intake canal to remove sediment buildup and ensure proper flow rates in the intake canal system. The

secondary 8-inch barrier net was temporarily removed to facilitate this process prior to its successful completion in August 2019.

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 is warranted, turtles are 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 2019

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 2019, a total of 508 sea turtles were removed from the intake canal, including 234 loggerheads, 260 green turtles, 13 Kemp's ridleys, and one olive ridley (Figures 10 and 11; Table 1). The majority of these turtles (95.1%) were captured alive and released back to the ocean. Twenty (3.9%) were taken to rehabilitation facilities for treatment of injuries or disease and five (1.0%) turtles were found dead. Specifically, 14 loggerheads, four green turtles, and two Kemp's ridleys were sent to rehabilitation facilities for non-causal injuries and there were four causal mortalities (two loggerhead and two green turtles) and one non-causal loggerhead mortality.

In 2019, one turtle was captured between the primary and A1A barrier nets and three turtles removed from the intake wells. The remaining 504 turtles were captured east of the primary barrier net - 326 by tangle nets, 105 by dip net, 41 by hand capture, and 32 off of the primary barrier net. Proactive captures (hand capture and dip net) accounted for 28.7% of the turtles removed from the intake canal.

One loggerhead nested on the canal banks during the 2019 sea turtle nesting season. The nest was relocated and later excavated in order to determine hatch success in accordance with FWC protocols. The last intake canal nest was documented in 2006.

Decreased water flow during power plant outages likely reduces the number of turtles entrained into the intake canal. An outage occurs when the power generating unit is

offline. There were three outages in 2019. Unit 1 was in an outage from April 25 until June 22, September 7 until September 23, and October 14 until November 20.

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 2019, monthly captures of loggerheads ranged from four in November to 38 in February (Table 2), with a monthly mean of 20. 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 predominantly juvenile to sub-adult animals, with mature adult animals captured mainly during the nesting season of April through September (Figure 12).

Of the 234 loggerheads captured, 111 were juveniles (SSCL < 70 cm), 64 were transitional (SSCL 70-84.9 cm), and 59 were adults (SSCL $\geq$ 85 cm; Hirth, 1980, Figure 12). The intermediate group probably includes both mature and immature individuals. Of the 59 turtles classified as adults, 47 were females and 12 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 2019, monthly green turtle captures ranged from zero in January to 123 in September (Table 2) with a monthly mean of 22. Of the 260 green turtles captured in 2019, there were 243 juveniles or sub-adults (SSCL < 85 cm) and 17 adults (Witherington and Ehrhart, 1989, Figure 13). Of the 17 turtles classified as adults, ten were females and seven were males.

3.2.3 Leatherback, Hawksbill, Kemp's, and Olive 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 2019, there were 13 Kemp's ridleys and one olive ridley captured in the intake canal of the St. Lucie Plant (Table 1). The Kemp's ridleys included 11 subadults and two adult females (SSCL ranged from 46.8 cm to 64.0 cm). The olive ridley was an adult male with an SCL of 63.6 cm (Zug, Chaloupka, & Balazs, 2006). This is the only olive ridley ever captured at the St. Lucie Power Plant.

3.2.4 Recaptures

Since plant operation began in 1976, a total of 18,342 sea turtles (including recaptures) have been captured, including 10,518 loggerheads, 7,662 green, 94 Kemp's ridley, 71 hawksbills, 43 leatherback turtles, and one olive ridley (Table 1).

Most turtles removed from the intake canal have been tagged and released into the ocean at various locations along South Hutchinson Island. Individual turtles can be identified as long as they retain their tags. Over the history of the program at the St. Lucie Plant, 3,305 recapture events (790 loggerheads, 2,514 green turtles, and one Kemp's ridley) have occurred. The recapture rate in 2019 was 9.4% for loggerheads, 21.5% for greens, and 7.7% for Kemp's ridleys.

Occasionally, turtles are captured that have been tagged by other researchers; there were seven such captures in 2019. Five subadult loggerheads, one adult female loggerhead, and one subadult green turtle were captured this year baring tags placed by other researchers. The female loggerhead was observed nesting this past year by University of Central Florida (UCF) biologists at the Archie Carr National Wildlife Refuge in Brevard County. A subadult loggerhead was also tagged by UCF in 2013 in the Indian River Lagoon. Another subadult loggerhead was a stranding in Cape Canaveral in 2004 for chronic debilitation (underweight and lethargic). Original tagging information for the remaining four turtles was not yet available through the Archie Carr Center for Sea Turtle Research at the University of Florida, Gainesville.

3.2.5 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 2019, of the 234 loggerheads captured, 88.5% (219) were alive and in good condition. Only 10.7% (19) of all loggerheads were individuals in fair or poor condition and 0.9% (2) were recovered postmortem. Of the 260 green turtles removed from the intake canal, 96.5% (251) were in good condition, 2.3% (6) were in fair or poor condition and 1.2% (3) were found dead.

According to the 2016 Biological Opinion, FPL is required to record the number of captured turtles with fresh causal scrapes and categorize them as minor, moderate, or severe. If the number of turtles with severe fresh scrapes reaches 0.5% of the number of captured turtles or if the number of turtles with moderate or severe fresh scrapes reaches 15% of the number of captured turtles during two consecutive years, FPL shall start the process for inspecting the intake pipes and evaluate and initiate corrective action within one month.

Of the 508 turtles removed from the intake canal during the year, 460 were observed with fresh cuts or scrapes that may have been incurred during transit through the intake pipes. Although these scrapes varied in degree of severity, most turtles were classified as having either none or only minor fresh scrapes (96.7%). However, some turtles (3.3%) had moderate scrapes. No turtles had fresh scrapes that could be categorized as severe, or that would have warranted the turtle being sent to a rehabilitation facility.

3.2.6 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 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 1.4% for the period 1985 to present (Table 1). Over the entire monitoring program's history (1976-2019), 186 (1.8%, including hatchlings from 2006) loggerheads and 132 (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 2019, five sea turtle mortalities were recorded at the St. Lucie plant intake canal. Four of the mortalities were considered causal to plant operations (discussed below) and there were no causal injuries.

There were two causal green turtle mortalities in February. On February 4th, a juvenile green turtle was recovered by UESI divers while inspecting the primary 5-inch barrier net. The turtle was found against the bottom of the barrier net and was moderately decomposed (slippage of scales and foul smell). The turtle was only slightly underweight and there were no wounds or abnormalities that could explain the animal's death. On February 11th, a second fresh dead juvenile green turtle was found below the surface on the primary 5-inch barrier net by UESI divers (during net cleaning). This turtle was underweight and missing half of its right rear flipper from an old healed injury. Both turtles were held on ice and taken to Dr. Nancy Mettee, DVM for necropsy and causality determination. Although the second turtle exhibited signs of nutritional compromise (likely a contributory factory in the death of the animal), both turtles were ultimately deemed causal.

On May 13th, a moderately decomposed subadult loggerhead was found suctioned onto the grate covering the water intake pipe for the mangrove impoundment pump. The mangrove pump had to be turned off to remove the turtle and red tinged fluid was seen draining from its mouth upon recovery. The turtle was bloated and had skin/scale sloughage due to decomposition. Nevertheless, it was saved on ice and transported to Dr. Nancy Mettee, DVM for necropsy and final causality determination (causality confirmed by necropsy). In order to prevent this from happening again, the flat grating on the mangrove intake pipe was replaced with a rounded cage that turtles could neither pass through nor get stuck against.

On October 13th, a fresh dead subadult loggerhead was removed from the permanent 5-inch barrier net. The turtle was emaciated with heavy barnacle and epibiont coverage. The turtle was placed on ice and taken to Dr. Nancy Mettee, DVM for necropsy and causality determination. Although the turtle was in very poor condition prior to being encountered at the power plant, it most likely drowned during entrainment and was therefore deemed causal.

3.2.7 Intake Canal Nesting

On the morning of July 8th, a loggerhead nest was discovered in the gravel in the southeast corner of the intake canal. FWC was promptly notified and the nest was relocated to the beach. This nest was marked and inventoried to determine hatch success in accordance with FWC protocols.

When the nest on the canal banks was exhumed, one egg was found damaged at the bottom. The remaining 61 eggs were relocated to the beach adjacent to the intake canal. Three days after the nest hatched out, the nest was inventoried. Of the 61 relocated eggs, 12 hatched and successfully emerged from the nest. This represents an emergence success rate of 19.7%. There was also one live loggerhead hatchling found during nest excavation which was not considered to have successfully emerged from the nest. Ghost crab predation was documented to have negatively impacted this nest with 11 damaged eggs.

FWC was furnished with an official Relocated Nest Success Report as well as a Statewide Nesting Beach Survey for this nest after the completion of the 2019 sea turtle nesting season.

3.2.8 Smalltooth Sawfish Captures

One smalltooth sawfish (*Pristis pectinata*) was removed from the St. Lucie Plant intake canal in 2019. Additional resources from IRG, FPL, and Harbor Branch Oceanographic Institute (HBOI) were called in to assist. Release was 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 and tags applied by HBOI biologists under NMFS permit 21043.

This capture occurred on September 7, 2019. The sawfish was in good condition with only minor fresh scrapes. The fish was a 3.1 m immature male weighing approximately 125 kg. It was 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 for any possible delayed impacts on the

captured smalltooth sawfish for seven days. There was no indication that the animal stranded and it is 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 this is the third smalltooth sawfish that has been encountered in the intake canal since the BO was issued, FPL has already exceeded its take limit and a Section 7 consultation is still ongoing with NMFS.

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 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 information when developing the new BO that was issued on May 4, 2001.

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 responded by cleaning the intake pipes and other compensatory measures.

The St. Lucie Plant continued to operate under the 2001 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, seven hawksbills, eight Kemp's ridleys, or five leatherbacks are captured annually; 2) more than seven green turtles or three loggerheads are documented with severe causal injuries annually; 3) more than five green turtles or three loggerhead are documented as causal mortalities annually; 4) more than one 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 2019, there were 234 loggerheads, 260 green turtles, 13 Kemp's ridleys, and one olive ridley captured. There were four causal mortalities (two loggerheads and two green turtles) but no causal injuries. Furthermore, no leatherback, hawksbill or Kemp's ridley turtles were injured or killed due to plant operations. Also, one smalltooth sawfish was encountered in the intake canal. FPL exceeded its take limit during 2019 because more Kemp's ridleys were captured than allowable under the latest BO issued by NMFS. In addition, FPL also exceeded its take with regard to the capture of more than one sawfish every five years as stipulated in the Incidental Take Statement. FPL and the NRC have already reinitiated Section 7 consultations with 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 2019

During 2019, IRG biologists responded to 25 (15 green, eight loggerheads, one Kemp's ridley, and one unidentified species) stranding events in Saint Lucie County. Eight live turtles were transported to rehabilitation facilities and one turtle died during transport to rehab. The remaining 16 dead turtles were found in various stages of decomposition. The probable cause of stranding included seven boat strikes, six with chronic debilitation syndrome, four shark attacks, one turtle with severe papillomatosis, and one weather related stranding. 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 11 turtle walks between June 7 and July 13, 2019. During these programs, a total of 198 people attended and on nine out of the 11 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 three research projects in 2019.

Unhatched eggs from loggerhead nests were collected for stable isotope analysis by the Florida Fish and Wildlife Research Institute. Blood from juvenile green turtles was provided to a Florida Atlantic University (FAU) Master's student studying the role of immunosuppression in papillomatosis. FAU/HBOI researchers were also able to collect baseline health information on green turtles as part of an Indian River Lagoon health assessment.

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. Periodic inspections of the barrier nets, as well as cleaning debris when warranted, are 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 nets to fail. Net failures increase both the risk of sea turtle mortalities and overall 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 capture 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.

The 5-inch and 8-inch barrier nets are inspected quarterly and the 10-inch UIDS net is inspected semiannually. No holes were found in any of the barrier nets during 2019. However, on February 3rd, three juvenile green turtles were removed from the intake wells. All were in good condition and released the same day of capture. The following day, UESI inspected the primary 5-inch barrier net and discovered that there were gaps along the bottom of the net. The uneven accumulation of sediment along the base of the barrier net had exerted significant pressure on the net and altered its configuration. In the short-term, rocks were used to fill in any gaps near the bottom of the net and any uneven areas of mesh were patched. Then, under the direction of FPL, UESI retensioned the primary barrier net over the following months in order to improve its overall performance.

In April 2019, Ballard Marine Construction began dredging the intake canal to remove sediment buildup and ensure proper flow rates in the intake canal system. They began east of the primary 5-inch barrier net and completed this portion of the dredging project by the end of June. The bathymetric survey results for the project were favorable and Ballard moved on to dredge west of the primary 5-inch barrier net in early July. The 8-inch A-1-A barrier net was temporarily removed mid-July to facilitate this process. Finally, the secondary barrier net was replaced after the successful completion of the dredging project in August.

The high winds and storm surge during Hurricane Dorian significantly restricted access to the intake canal from September 1st through the 3rd. However, in cooperation with FPL, three juvenile green turtles were recovered from the 5-inch barrier net and released into the Indian River Lagoon. In spite of the challenges inherent in monitoring the intake canal and capturing and assessing turtles during the storm, these actions likely prevented storm-related mortalities. Although water did not come over the top of the 5-inch barrier net during the storm, one small juvenile green turtle did make it past the first barrier net. This turtle was promptly hand-captured in good condition, tagged and released. Weighing only 1.9 kg, it was similar in size to other turtles which have been encountered beyond the primary barrier net in the past.

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

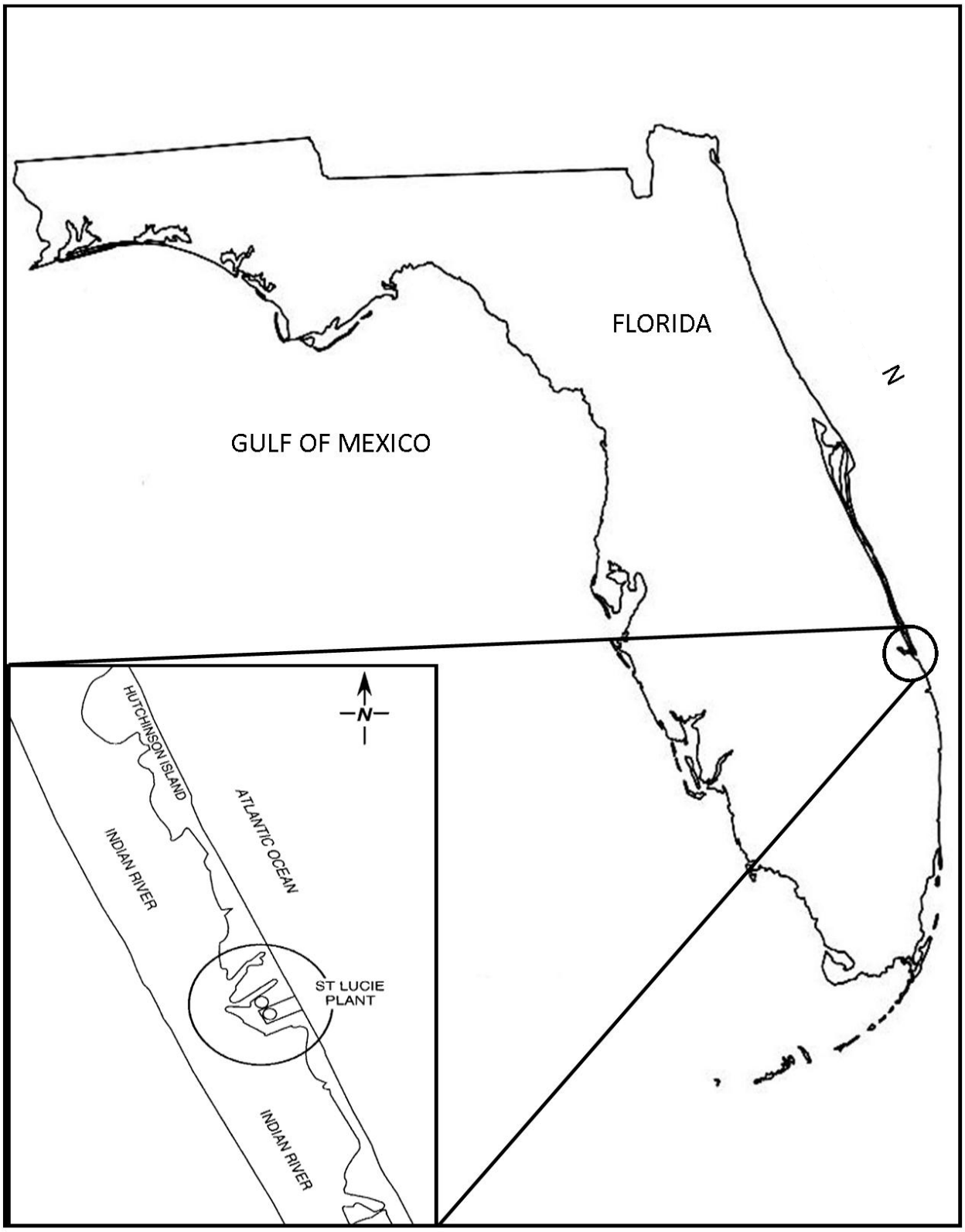

Figure 1. Location of St. Lucie Plant on South Hutchinson Island, Florida.

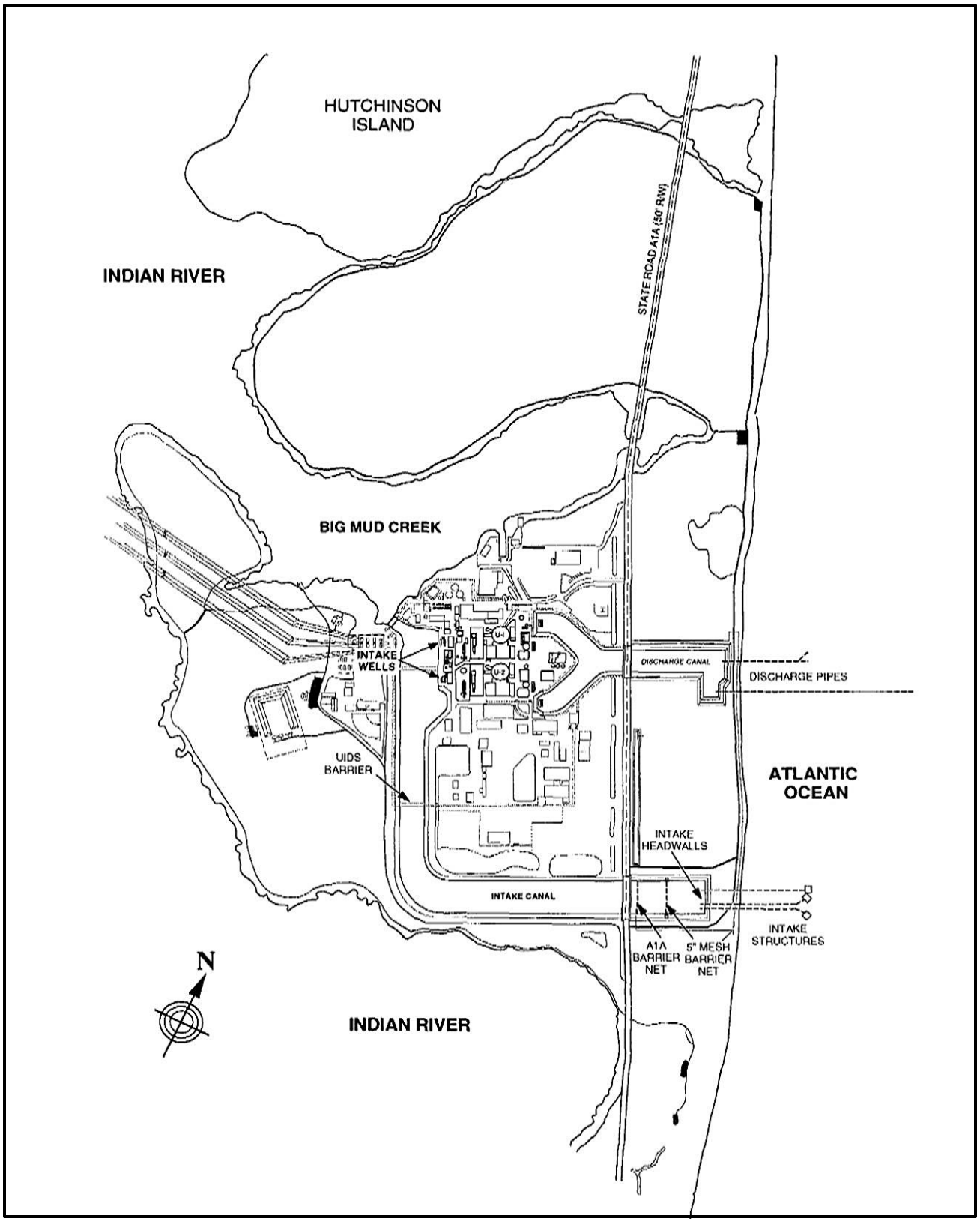

Figure 2. St. Lucie Plant cooling water intake and discharge system.

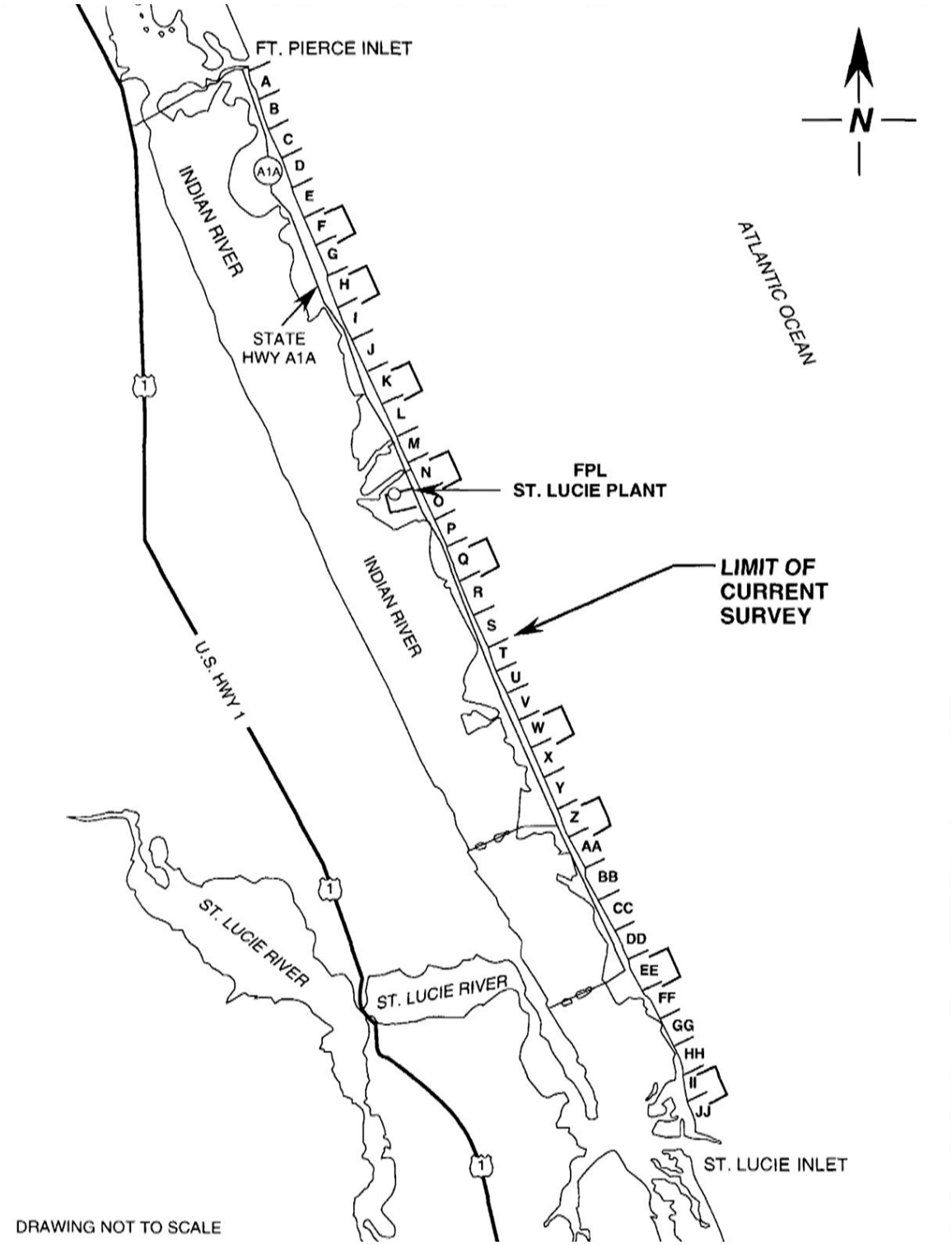

Figure 3. Designation and location of nine 1.25 km segments (in brackets) and 36 one km segments surveyed for sea turtle nesting on South Hutchinson Island (1971-2019).

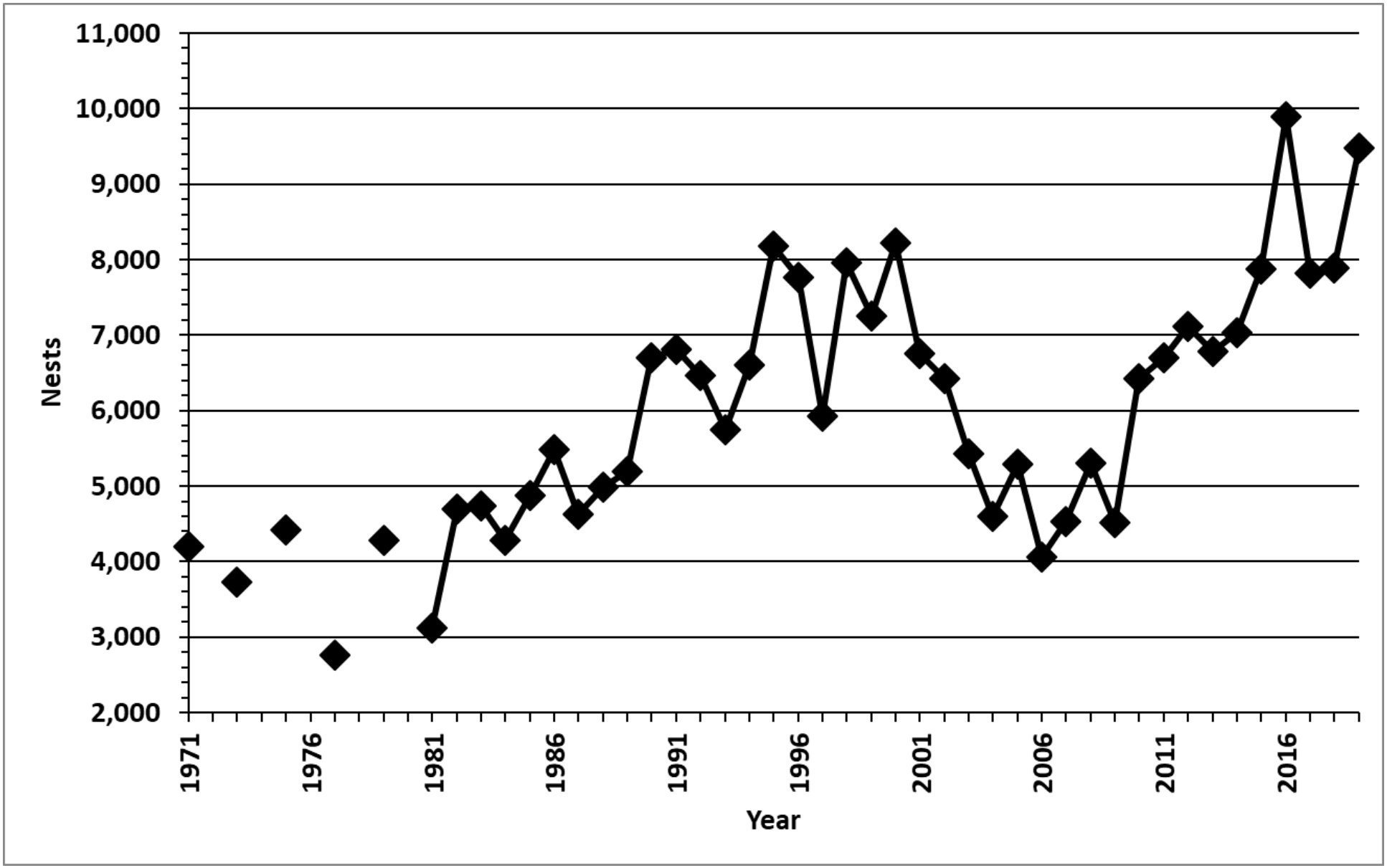

Figure 4. Number of loggerhead turtle nests on South Hutchinson Island from 1971 through 2019. Values for 1971 through 1979 are estimates (Section 2.1.1); values for 1981 through 2019 are from whole island surveys.

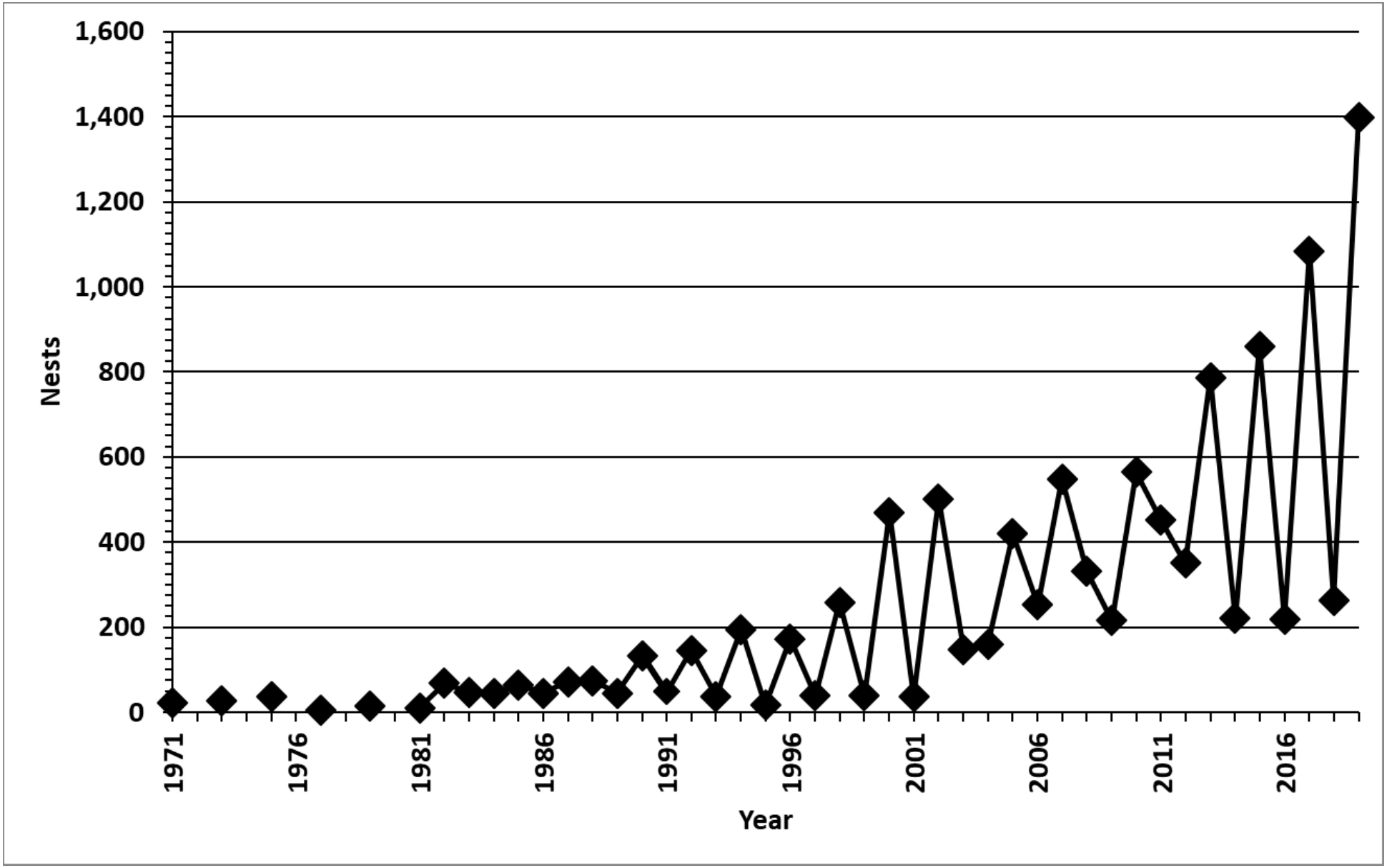

Figure 5. Number of green turtle nests on South Hutchinson Island from 1971 through 2019. Values for 1971 through 1979 are estimates (Section 2.1.1); values for 1981 through 2019 are from whole island surveys.

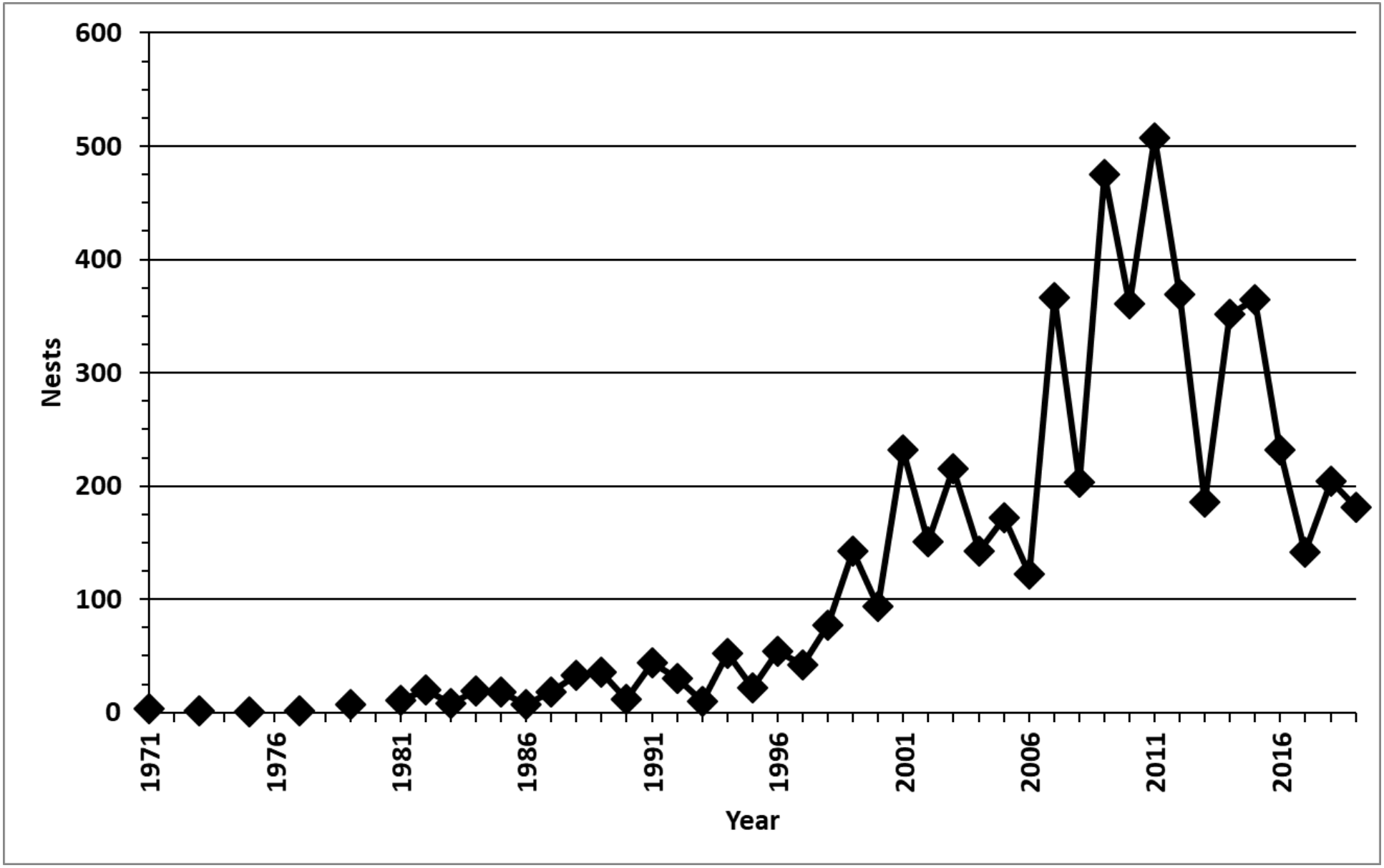

Figure 6. Number of leatherback turtle nests on South Hutchinson Island from 1971 through 2019. Values for 1971 through 1979 are estimates (Section 2.1.1); values for 1981 through 2019 are from whole island surveys.

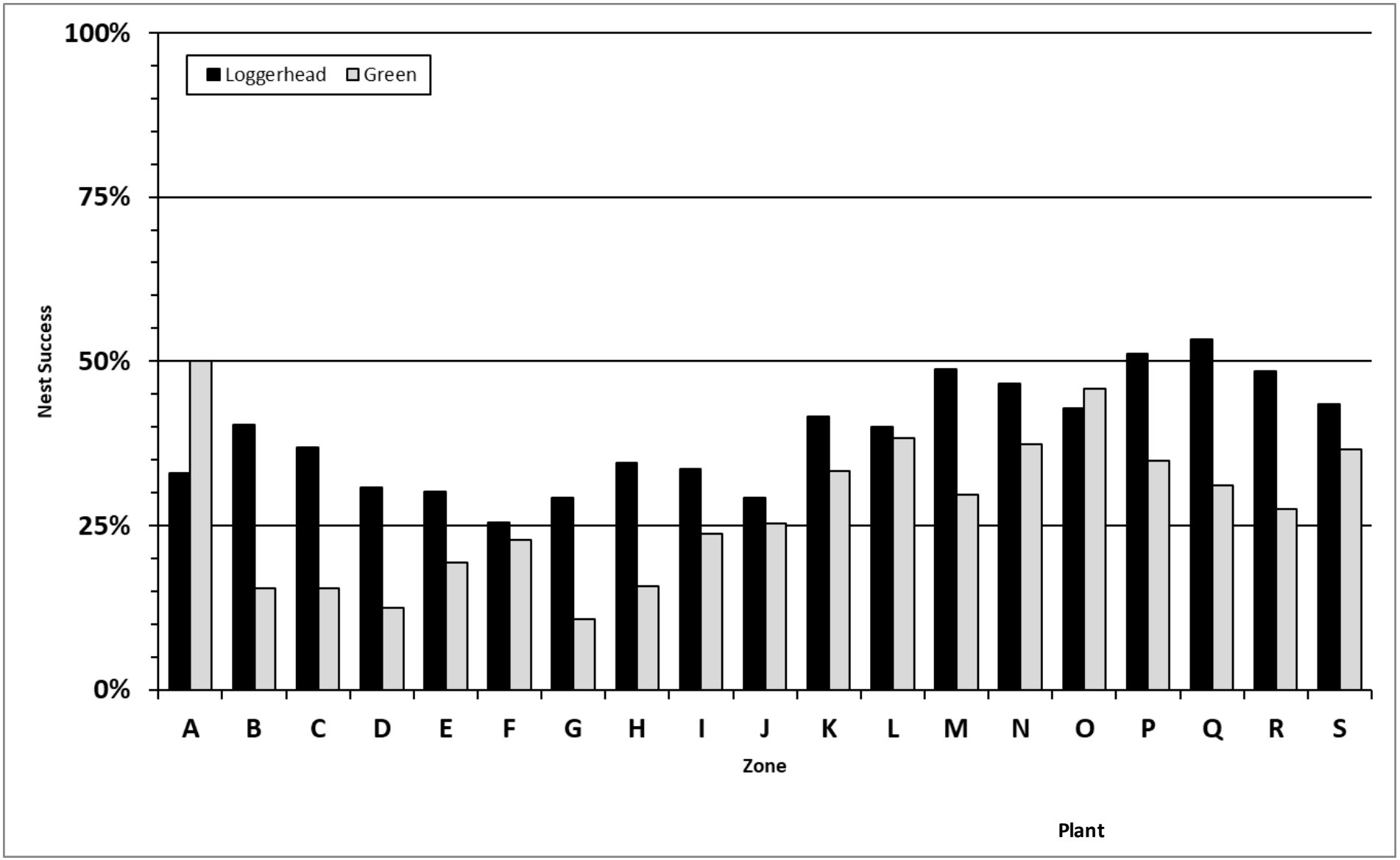

Figure 7. Loggerhead and green turtle nesting success (percentage of emergences resulting in nests) for each of the 1 km Zones A through S (North to South) on South Hutchinson Island for the 2019 nesting season.

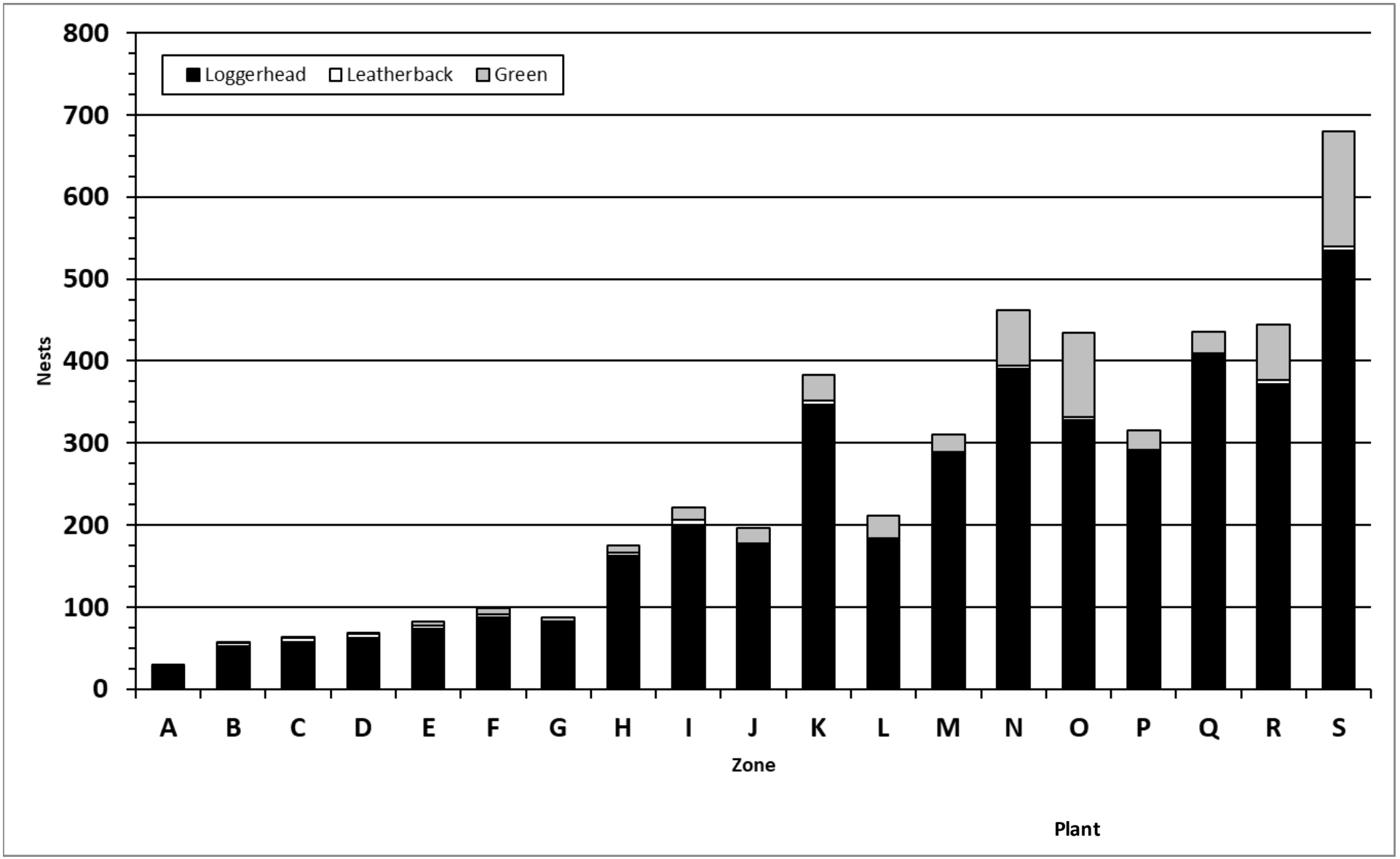

Figure 8. Number of turtle nests by species for each of the 1 km Zones A through S (North to South) on South Hutchinson Island for the 2019 nesting season (N=4,759 nests).

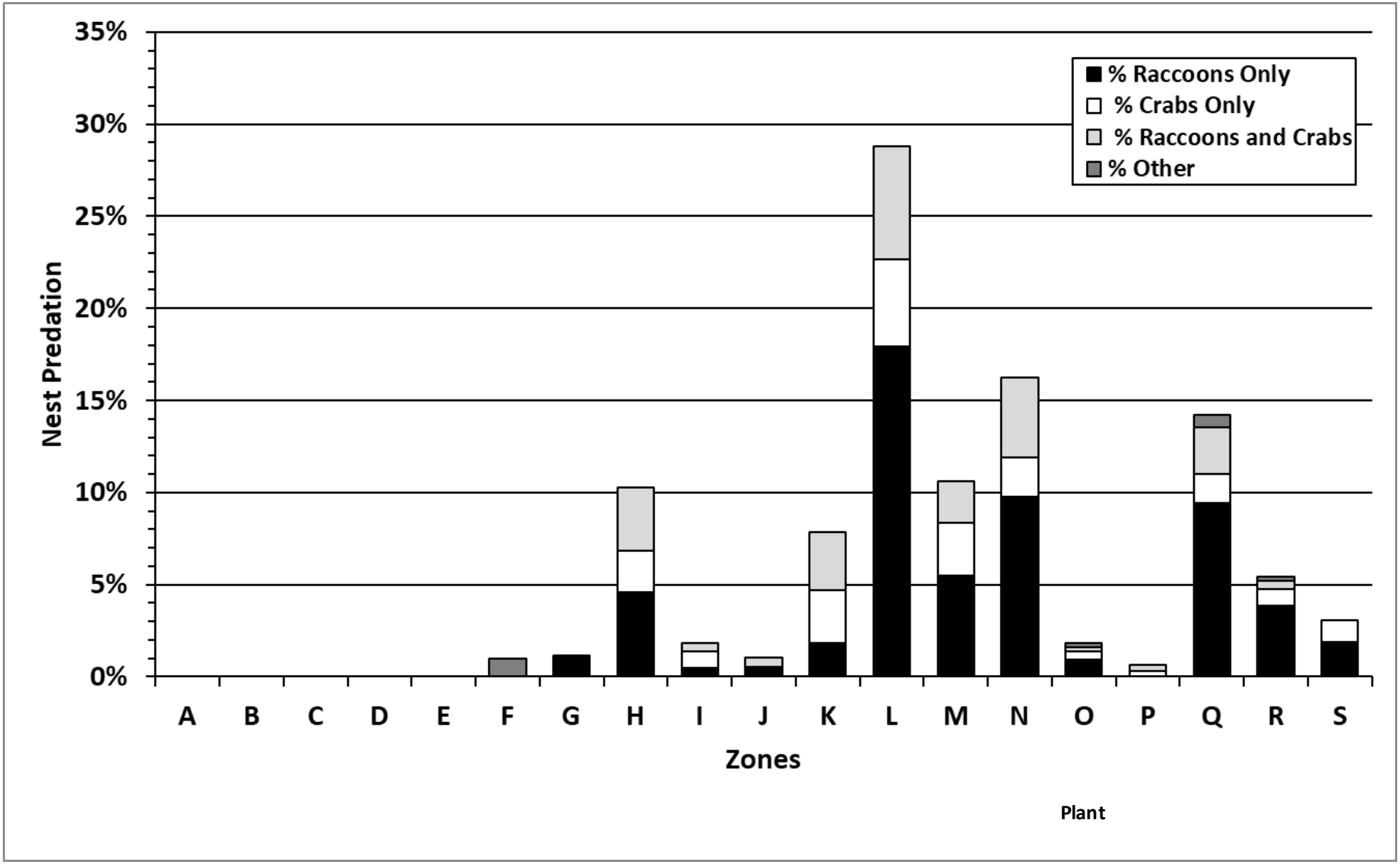

Figure 9. Percentage of sea turtle nests depredated by 1 km Zones A through S (North to South) on South Hutchinson Island for the 2019 nesting season.

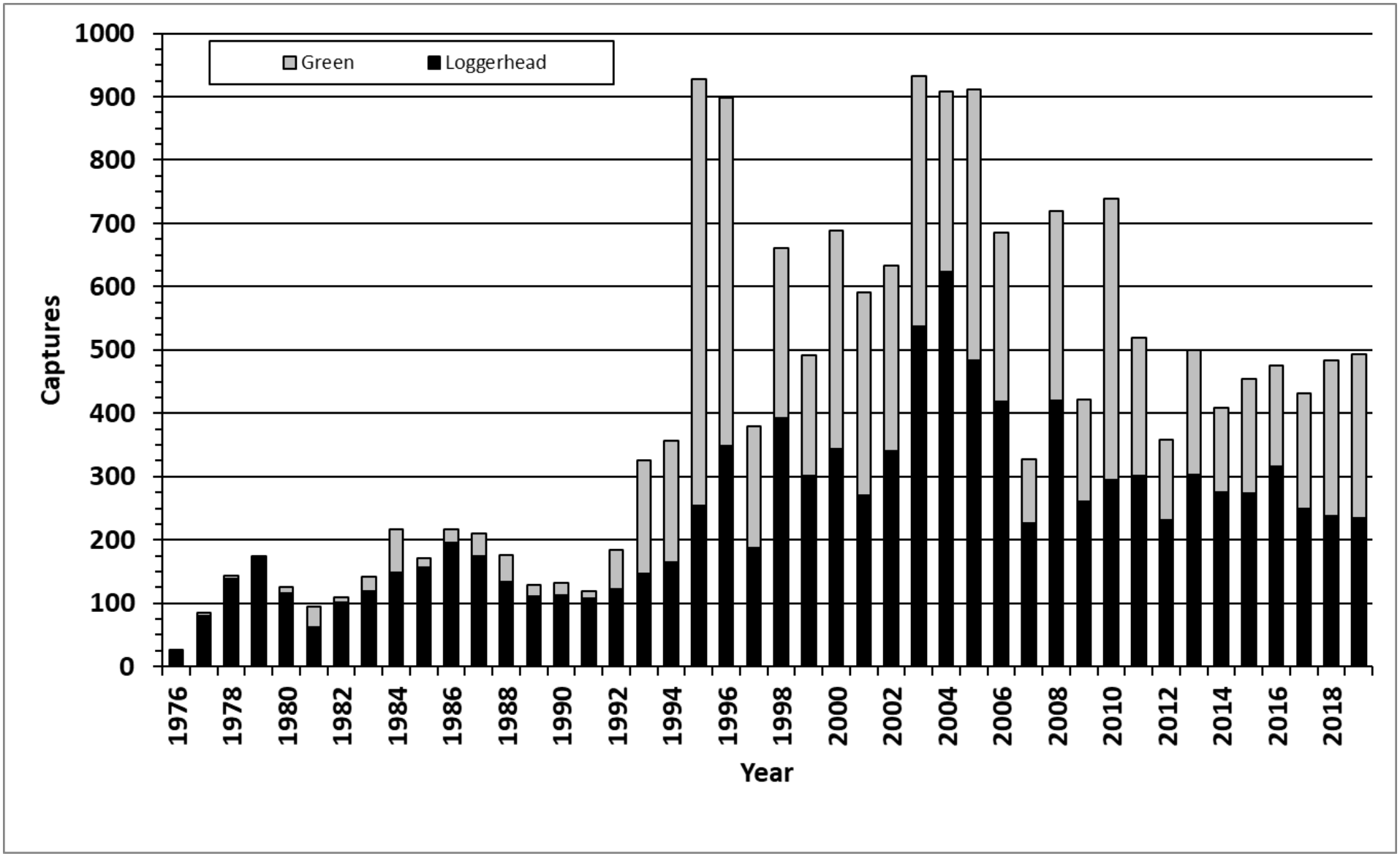

Figure 10. Number of loggerhead and green turtles captured and removed each year from the intake canal at the St. Lucie Plant, 1976 through 2019.

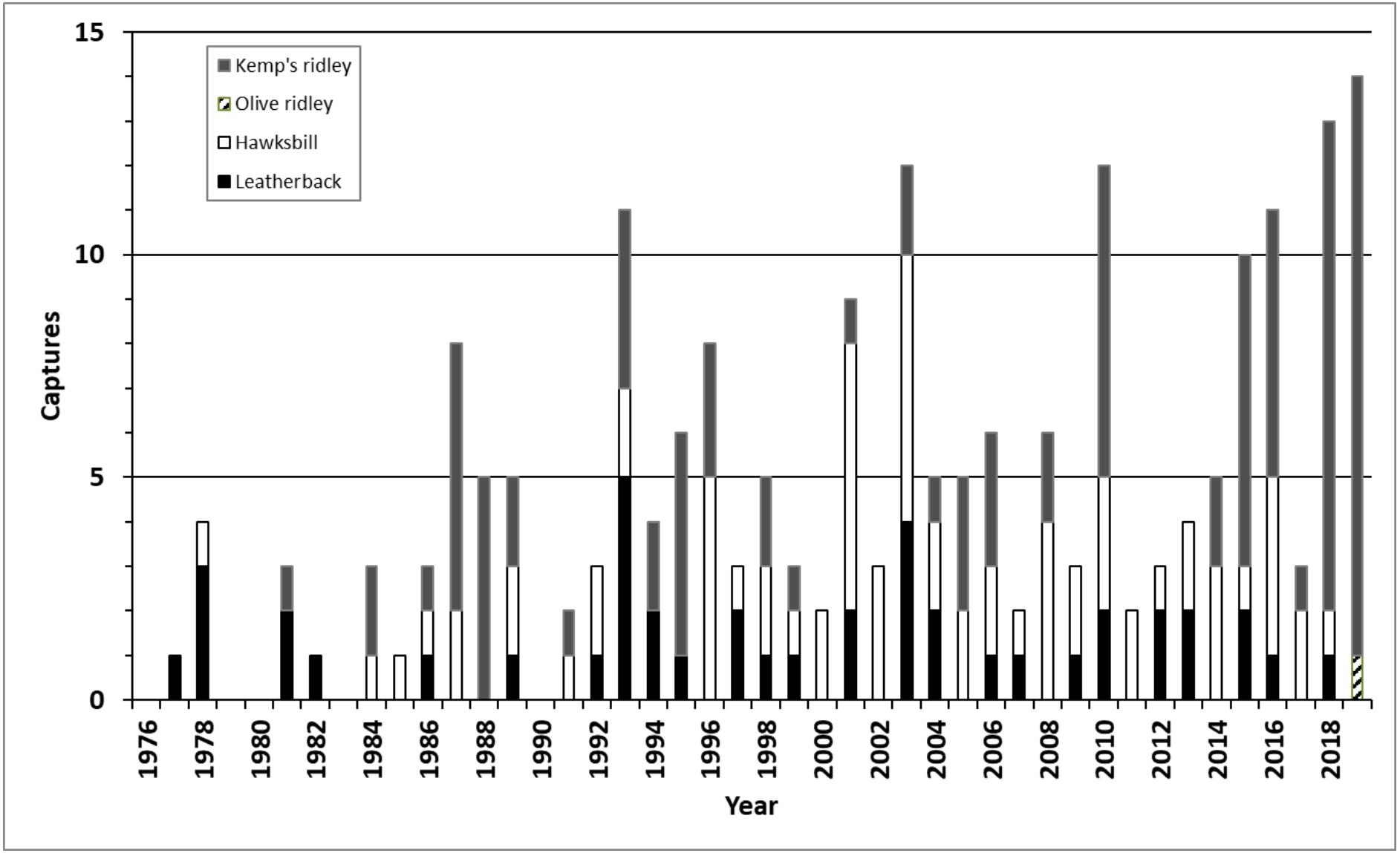

Figure 11. Number of Kemp's ridley, olive ridley, hawksbill, and leatherback turtles captured and removed each year from the intake canal at the St. Lucie Plant, 1976 through 2019.

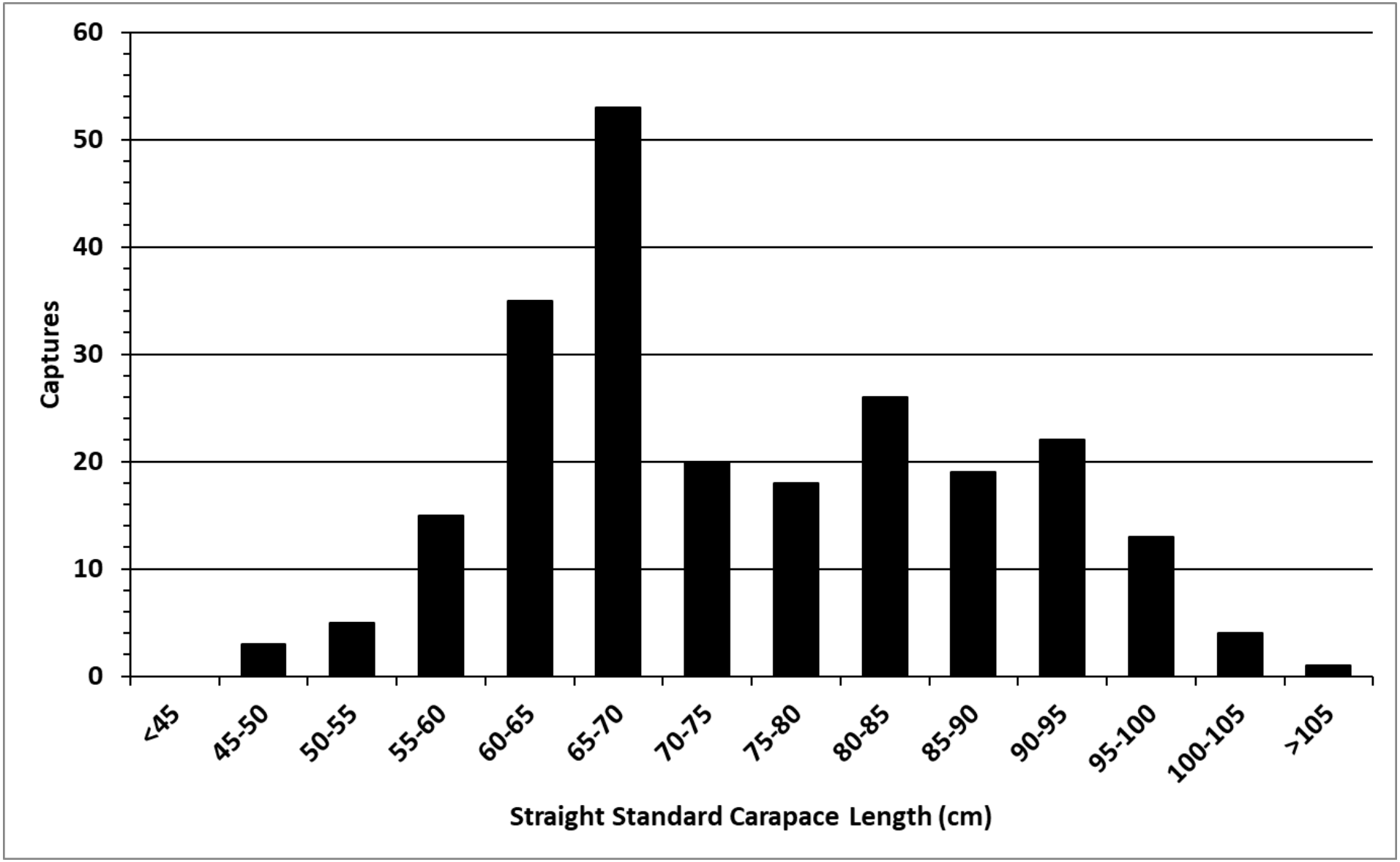

Figure 12. Size distribution (Straight Standard Carapace Length; SSCL) of loggerhead turtles (N=234) captured and removed from the intake canal at the St. Lucie Plant during 2019.

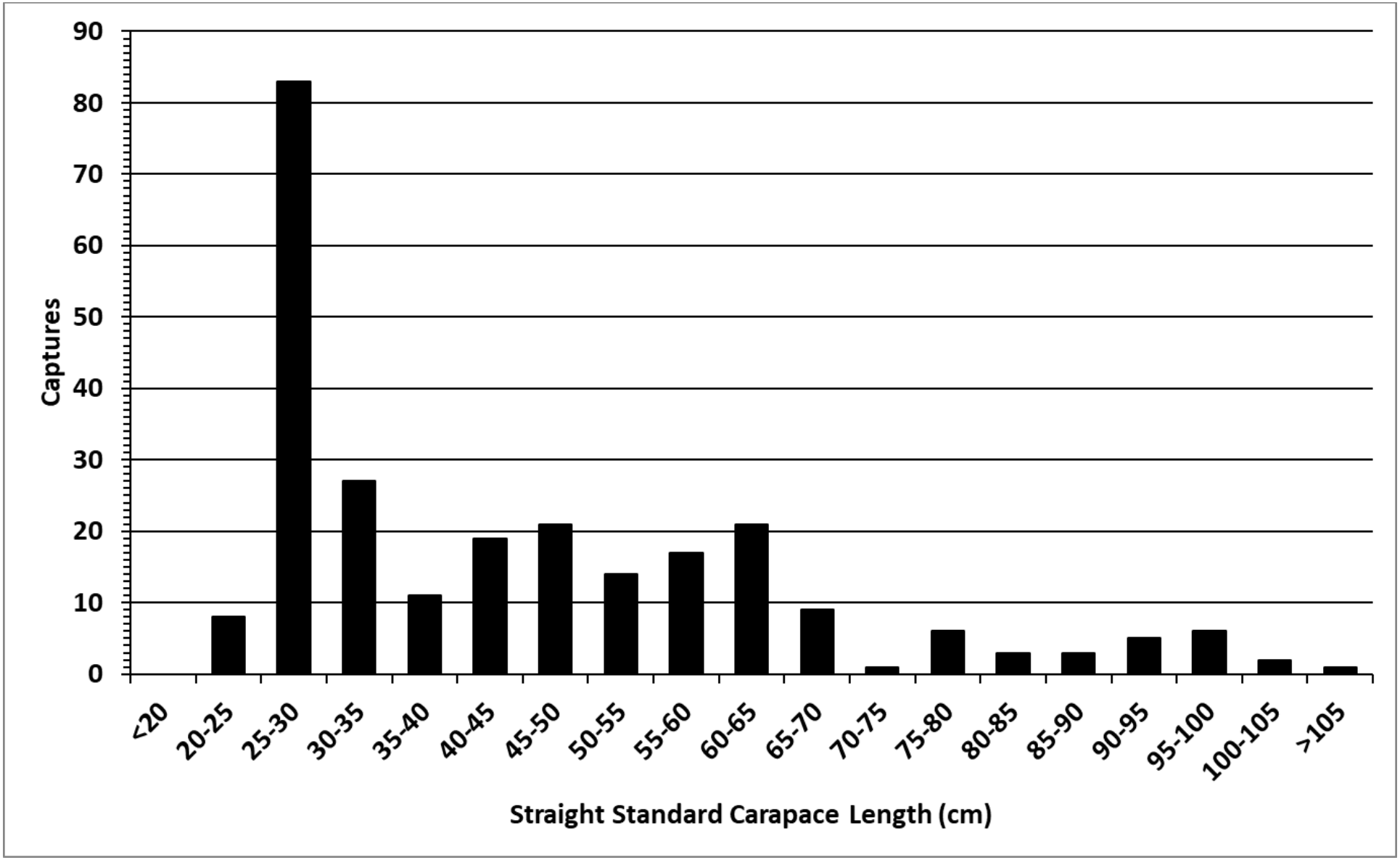

Figure 13. Size distribution (Straight Standard Carapace Length; SSCL) of green turtles (N=260) captured and removed from the intake canal at the St. Lucie Plant during 2019.

Year	Loggerhead		Green		Leatherback		Hawksbill		Kemp's ridley		Olive ridley		Total	
1976 - 1984	962	74	156	15	7		2		3				1127	89
1985	157	4	14				1						172	4
1986	195	27	22	1	1		1		1				219	28
1987	175	11	35				2		6				212	13
1988	134	6	42	2					5	2			176	10
1989	111	4	17	1	1		2		2	2			131	5
1990	112	1	20	2									132	3
1991	107	1	12				1		1				120	1
1992	123	2	61	2	1		2						187	4
1993	147		179	1	5		2		4				333	1
1994	164		193	4	2				2				359	4
1995	254	1	673	15	1				5				928	16
1996	349	3	549	4			5		3				903	7
1997	188		191	5	2		1						382	5
1998	393	1	268		1		2		2				664	1
1999	302	2	190	4	1		1		1				494	6
2000	344	2	345	2			2						691	4
2001	270	1	321	5	2		6		1				599	6
2002	341		292	3			3						636	3
2003	538		394	2	4		6		2				942	2
2004	623	2	286	1	2		2		1				913	3
2005	484	2	428	1			2		3				914	3
2006	419	22	267	2	1		2		3				689	24
2007	227	3	101	1	1		1						330	4
2008	420	2	299	4			4		2				723	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
2018	238		246	9	1		1		11				497	9
2019	234	2	260	3					13		1		508	5
Total	**10518**	**186**	**7662**	**132**	**43**	**0**	**71**	**1**	**94**	**4**	**1**	**0**	**18342**	**323**
Mean*	244.0	4.2	178.2	3.1	1.0	0	1.7	0.02	2.2	0.1	0.0	0.0	426.0	7.4

Table 1. Total number of captured turtles removed from the intake canal at the St. Lucie Plant from 1976 through 2019. Number of mortalities is highlighted in gray. Mean excludes partial year of 1976 when 26 loggerheads were captured.

	Loggerhead				Green			
Months	2019 Captures	Total Captures	Percent of Captures	Annual Mean	2019 Captures	Total Captures	Percent of Captures	Annual Mean
January	12	972	9.3%	22.6	0	1022	13.3%	23.8
February	38	947	9.0%	22.0	29	798	10.4%	18.6
March	22	1069	10.2%	24.9	14	878	11.5%	20.4
April	29	1007	9.6%	23.4	26	535	7.0%	12.4
May	28	963	9.2%	22.4	8	493	6.4%	11.5
June	24	1154	11.0%	26.8	2	438	5.7%	10.2
July	28	1375	13.1%	32.0	1	411	5.4%	9.6
August	16	902	8.6%	21.0	1	401	5.2%	9.3
September	15	631	6.0%	14.7	123	675	8.8%	15.7
October	9	544	5.2%	12.7	28	773	10.1%	18.0
November	4	404	3.9%	9.4	10	609	7.9%	14.2
December	9	524	5.0%	12.2	18	629	8.2%	14.6
Total	234	10492	100.0%	244.0	260	7662	100.0%	178.2

Table 2. Total number of loggerhead and green turtles removed each month from the intake canal at the St. Lucie Plant from 1977 through 2019. Monthly totals exclude the partial year 1976 when 26 loggerheads were captured.

	Leatherback				Hawksbill				Kemp's ridley				Olive ridley			
Months	2019 Captures	Total Captures	Percent of Captures	Annual Mean	2019 Captures	Total Captures	Percent of Captures	Annual Mean	2019 Captures	Total Captures	Percent of Captures	Annual Mean	2019 Captures	Total Captures	Percent of Captures	Annual Mean
January	0	5	11.6%	0.1	0	1	1.4%	0.0	0	20	21.3%	0.5	0	0	0.0%	0.0
February	0	5	11.6%	0.1	0	2	2.8%	0.0	7	27	28.7%	0.6	0	0	0.0%	0.0
March	0	13	30.2%	0.3	0	8	11.3%	0.2	0	16	17.0%	0.4	0	0	0.0%	0.0
April	0	7	16.3%	0.2	0	3	4.2%	0.1	5	17	18.1%	0.4	0	0	0.0%	0.0
May	0	5	11.6%	0.1	0	3	4.2%	0.1	0	2	2.1%	0.0	1	1	100.0%	0.0
June	0	2	4.7%	0.0	0	2	2.8%	0.0	0	2	2.1%	0.0	0	0	0.0%	0.0
July	0	0	0.0%	0.0	0	14	19.7%	0.3	0	3	3.2%	0.1	0	0	0.0%	0.0
August	0	1	2.3%	0.0	0	10	14.1%	0.2	0	0	0.0%	0.0	0	0	0.0%	0.0
September	0	2	4.7%	0.0	0	14	19.7%	0.3	0	0	0.0%	0.0	0	0	0.0%	0.0
October	0	1	2.3%	0.0	0	6	8.5%	0.1	0	1	1.1%	0.0	0	0	0.0%	0.0
November	0	1	2.3%	0.0	0	6	8.5%	0.1	0	1	1.1%	0.0	0	0	0.0%	0.0
December	0	1	2.3%	0.0	0	2	2.8%	0.0	1	5	5.3%	0.1	0	0	0.0%	0.0
Total	0	43	100.0%	1.0	0	71	100.0%	1.7	13	94	100.0%	2.2	1	1	100.0%	0.0

Table 3. Total number of leatherback, hawksbill, Kemp's ridley, and olive ridley turtles removed each month from the intake canal at the St. Lucie Plant from 1977 through 2019. 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 and biocides or chlorine to control biofouling.

Normally, the St. Lucie CTCS utilizes about 1200 sponge balls, which are continually re-circulated 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 2019 are presented in Table 1.

7.4 Non-Routine Reports

On February 4, 2019 and February 11, 2019 a deceased juvenile green sea turtle (Chelonia mydas) was recovered from the St. Lucie Plant Intake Canal. Notification of the mortality to the NRC occurred via FPL letter L-2019-051.

On May 11, 2019 a healthy olive ridley sea turtle (lepidochelys olivacea) was released back into the environment unharmed. This is an unusual event as this species of sea turtle is not found in the North Atlantic. On May 13, 2019 a deceased sub-adult loggerhead sea turtle (Caretta caretta) was recovered near the suction port of the St. Lucie Plant Intake Cooling Canal mangrove irrigation pump. The NRC was notified of the unusual capture of the olive ridley, and the loggerhead mortality via FPL letter L-2019-115.

On October 13, 2019 a deceased sub-adult male loggerhead (Caretta caretta) was recovered from the St. Lucie Plant Intake Canal. Notification of the mortality to the NRC occurred via FPL letter L-2019-199.

7.5 Routine Reports

On March 25, 2019 St. Lucie submitted to the NRC a copy of the 2018 Annual Environmental Operating Report. The report was submitted to the NRC via FPL letter L-2019-066.

On November 25, 2019 St. Lucie submitted to the NRC a copy of a Minor Permit Revision Request for our Wastewater Facility Permit (permit number FL0002208). The request was submitted to the NRC via FPL letter L-2019-206.

7.6 Figures and Tables

Table 1
PSL CTCS Ball Loss 2019 Summary

	1A1		1A2		1B1		1B2		PSL 1 ALL		
	#B/W	LOST	#B/W	LOST	#B/W	LOST	#B/W	LOST	#B/W	LOST	COMMENTS
Jan	2	54	1	63	2	36	2	0	7	153	
Feb	2	67	2	170	2	48	1	0	7	285	
Mar	1	4	1	52	2	20	0	0	4	76	
Apr	3	54	2	100	2	19	0	0	7	173	
May	0	0	0	0	0	0	0	0	0	0	
June	1	0	1	0	0	0	1	0	3	0	
July	2	27	2	289	2	129	4	731	`10	1176	
Aug	1	37	0	0	2	68	2	0	5	105	
Sep	2	59	2	0	1	9	3	0	8	68	
Oct	0	0	0	0	1	0	0	0	1	0	
Nov	0	0	0	0	0	0	0	0	0	0	
Dec	1	27	1	41	0	0	0	0	2	68	
Summary	15	329	12	715	14	329	13	731	54	2104	

	2A1		2A2		2B1		2B2		PSL 2 ALL		
	#B/W	LOST	#B/W	LOST	#B/W	LOST	#B/W	LOST	#B/W	LOST	COMMENTS
Jan	3	35	1	35	1	300	1	0	6	370	
Feb	2	39	1	32	1	233	1	0	5	304	
Mar	5	24	4	151	3	75	0	0	12	250	
Apr	2	0	3	1744	2	32	1	0	8	1776	
May	2	7	2	58	1	1107	1	31	6	1203	
June	2	18	2	249	2	109	2	65	8	441	
July	2	8	3	71	3	233	2	47	10	359	
Aug	2	18	2	49	1	89	3	44	8	200	
Sep	1	0	1	43	2	182	2	17	6	242	
Oct	2	37	2	99	2	158	2	8	8	302	
Nov	2	17	2	48	2	40	2	4	8	109	
Dec	`1	11	2	270	2	112	2	24	7	417	
Summary	26	214	25	2849	22	2670	19	240	92	5973	