April 17, 2014

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U. S. Nuclear Regulatory Commission
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Re: St. Lucie Units 1 and 2
Docket Nos. 50-335 and 50-389
2013 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 2013.

Sincerely,

Eric S. Katzman
Licensing Manager
St. Lucie Plant

ESK/tlt

Attachment: Florida Power & Light Company St. Lucie Plant Annual Environmental Operating Report 2013 (52 pages)

cc: FDEP Siting Office

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NRR

FLORIDA POWER & LIGHT COMPANY

ST. LUCIE PLANT

ANNUAL ENVIRONMENTAL

OPERATING REPORT

2013

FLORIDA POWER & LIGHT COMPANY

JUNO BEACH, FLORIDA

&

INWATER RESEARCH GROUP, INC.

JENSEN BEACH, FLORIDA

**Environmental Operating Report**

**Table of Contents**

**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 |
| FPL | Florida Power & Light |
| 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 near shore ocean waters for the plant's once-through condenser cooling system. Water for this system enters through three submerged intake structures located about 365 m offshore. 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 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 the loggerhead turtle as a threatened species and leatherbacks and the Florida nesting population of green turtles 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; they have sponsored monitoring of nesting activity 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 2013, 6,783 loggerhead, 787 green, and 186 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 2013, 503 sea turtles were removed from the intake canal, including 303 loggerheads, 196 greens, two leatherbacks, and two hawksbills. The majority of these turtles (96.4 %) were captured alive and released back to the ocean. Thirteen (2.6%) were taken to rehabilitation facilities for treatment of injuries or disease and five turtles (1.0%) were found dead.

Injuries and mortalities are categorized in two ways—causal to power plant operations or non-causal to power plant operations. These decisions are made in consultation with FWC and/or a qualified veterinarian. Not all mortalities and injuries are causal to power 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 power plant operations are recorded and are applied against the take limit established by the most recent Biological Opinion (BO) set forth by the National Marine Fisheries Service (NMFS). The Incidental Take Statement in the most recent BO states that FPL will exceed their take limits for a calendar year if any of the following occur: 1) more than 1,000 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 ESA, a new consultation with NMFS is required If FPL meets or exceeds the take limits specified in the Incidental Take Statement.

During 2013, there were two sea turtle mortalities and one injury that were causal to power plant operations. No leatherback, hawksbill or Kemp's ridley turtles were injured or killed. Based on the latest BO issued by NMFS, FPL did not exceed its take limit during 2013. However, FPL did exceed their sea turtle take limit at the St. Lucie power plant in 2006 and reinitiating a Section 7 consultation was required. This consultation is currently ongoing between NMFS and the Nuclear Regulatory Commission (NRC). A new BO is expected in 2014. FPL has identified and responded to correct the contributing factors that led to exceeding the take limit in 2006.

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 2013, IRG biologists responded to 28 stranding events. Additionally, IRG biologists responded to four strandings at other FPL facilities. 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 2013, FPL conducted 12 turtle walks attended by 386 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 2013.

## 1.0 Background

### 1.1 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.

### 1.2 Power Plant Description

The St. Lucie Power Plant consists of two 1,000 MWe nuclear-fueled electric generating units that use near shore ocean waters for the plant's once-through condenser cooling system. Unit 1 was placed on-line in March 1976 and Unit 2 in April 1983. Water for this system enters through three submerged intake structures located about 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 are 730 m north of the intake and extend approximately 365 m offshore. The second pipeline is located just to the south of the first and is nearly twice as long.

### 1.3 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, 1987, 1988, 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 Licenses No. DPR-67 and No. NPF-16. Previous results dealing with sea turtle studies are contained in thirty annual environmental operating reports covering the period from 1983 through 2012 (ABI 1983-1994; Quantum Resources, Inc. 1995-2009; Inwater Research Group, Inc. [IRG] 2010-2012). This report describes the 2013 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 the loggerhead turtle as a threatened species and leatherbacks and the Florida nesting population of green turtles 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 has 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 power 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 power 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$^{st}$, nests were left in situ. Beginning on May 22$^{nd}$, 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 power 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 2013, 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 2013

In 2013, 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 4th through March 29th, several preliminary nesting surveys were conducted 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 1st. From April 1st through September 30th, nest surveys were conducted on a daily basis.

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. 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. Nest success in the zone that includes the power plant (zone O) was lower than the nesting success in the surrounding zones (Figure 7). A dune restoration project completed prior to the beginning of the nesting season likely contributed to this phenomenon. Storms and heavy wave action subsequently caused the formation of escarpments in portions of the project area and this may have deterred some turtles from crawling above the high tide line to nest.

### 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 (National Marine Fisheries Service [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 8,000 loggerhead nests have been deposited annually on South Hutchinson Island during the last thirty years.

In 2013, 6,783 loggerhead nests were recorded on South Hutchison Island (Figure 4). In zones A-S (the north end of the island) biologists observed 3,762 nests (Figure 8). The first recorded nest was on April 26th and the last loggerhead nest was recorded on September 24th. There were 3,251 loggerhead false crawls observed in zones A-S.

Eighty-eight of the 3,762 loggerhead nests were marked to assess nest productivity: 52 nests were successfully inventoried, 23 were completely predated, nine washed out, two had their marking stakes removed/vandalized preventing the clutch from being located, one was predated after the first emergence and one was not inventoried because another turtle had nested on top of the marked nest. The 52 inventoried nests contained a cumulative total of 5,720 eggs. Of these, 4,012 successfully hatched and emerged from the marked nests. This represents an emergence success rate of 69.1%. There were 84 live loggerhead turtles found in the nests, which were released and not accounted for in the emergence success rate.

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 power 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 with little fluctuation, 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 2013, 787 green turtle nests were recorded on Hutchison Island (Figure 5). Biologists observed a total of 413 green turtle nests in zones A-S (Figure 8). This was the highest number of nests ever recorded on Hutchinson Island. The first recorded nest of the season was on May 23rd and the last green turtle nest was noted on October 1st. There were 517 green turtle false crawls observed in zones A-S.

Forty-seven of the 413 green turtle nests were marked to assess nest productivity: 35 nests were successfully inventoried; six were completely predated, three washed out, and three had their marking stakes removed/vandalized preventing the clutch from being located. The 35 inventoried nests contained a cumulative total of 4,494 eggs. Of these, 2,937 successfully hatched and emerged from the marked nests. This represents an emergence success rate of 64.0%. In addition, there were 78 live green turtles found in the nests which were released and not accounted for in the emergence success rate.

### 2.2.3 Leatherback Nesting

Leatherback nesting occurs on subtropical and tropical beaches. Leatherbacks inhabit Florida waters primarily during the nesting season (March-June) and are generally found in higher densities close to shore, rather than offshore (Schroeder & Thompson, 1987).

In 2013, 186 leatherback turtle nests were recorded on Hutchison Island (Figure 6). Biologists observed a total of 66 leatherback sea turtle nests in zones A-S (Figure 8). The first recorded nest was on March 18$^{th}$ and the last leatherback sea turtle nest was recorded on July 25$^{th}$. There were 11 leatherback sea turtle false crawls observed in the surveyed areas A-S.

Eight of the 66 leatherback turtle nests were marked to assess nest productivity: 6 nests were successfully inventoried, one was completely predated, and one had its marking stakes removed/vandalized preventing the clutch from being located. The 6 nests contained a cumulative total of 541 eggs. Of these, 130 successfully hatched and emerged from the marked nests. This represents an emergence success rate of 24.0%. There were seven live leatherback turtles found in the nests, which were released and not accounted for in the emergence success rate.

The increase in leatherback nesting on South Hutchinson Island mirrors the nesting trend for the entire state Florida. The number of leatherback nests in Florida has increased more than 10% per year since 1979 (Stewart et al., 2011), but it is unknown whether the increase is from new recruits to the population or if it represents migrants from other Caribbean nesting beaches.

### 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 856 predation events for South Hutchinson Island in 2013 within beach sections E-S; EAI did not report predation events in zones A-D (Figure 9). Sea turtle nests on South Hutchinson Island were depredated by ghost crabs, raccoons, birds, and fire ants. The most abundant predators were raccoons, which accounted for 306 individual predation events. Ghost grabs were the second most abundant predator accounting for 249 events. Another 273 predation events consisted of a combination of raccoon and ghost crab predation. Other predators (fire ants, domestic dogs or birds for example) accounted for 28 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 74.2% of nests (69 out of 93) where hatch success could be evaluated. Thirty one marked nests were completely predated prior to inventory. Thirty eight additional nests were noted to have been partially depredated.

## 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 means of large mechanical rakes or 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. These improvements have enabled the new net to withstand events that caused design failure of the old barrier net, thus reducing the potential for sea turtle mortalities.

### 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, all captured turtles have been photographed dorsally and ventrally prior to release. Additionally, as of July 2001, Passive Integrated Transponder (PIT) tags were injected subcutaneously into the right front flipper of all turtles as outlined in the BO issued by NMFS in May 2001. Healthy turtles were 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. As of 1982, necropsies were conducted on all dead turtles found in fresh condition. Currently, all fresh dead turtles are held on ice and taken to a qualified veterinarian for necropsy. Methodologies employed in 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 2013

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 about 40 cm or less. Divers 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 2013, 503 sea turtles were removed from the intake canal, including 303 loggerheads, 196 green turtles, two leatherbacks, and two hawksbills (Figures 10 and 11; Table 1). The majority of these turtles (96.4%) were captured alive and released back to the ocean. Thirteen (2.6%) were taken to rehabilitation facilities for treatment of injuries or disease and five (1.0%) turtles were found dead. One of the turtles taken to rehab facilities had injuries causal to power plant operations. Only two of the five turtles found dead were causal to power plant operations. Mortalities and injuries are discussed in Section 3.2.6.

In 2013, 99.8% (502) of all turtles entrained in the canal were captured east of the primary barrier net—294 by tangle nets, 19 off of the primary barrier net, 32 by dip net, and 157 by hand capture. Proactive captures (hand capture and dip net) accounted for 37.8% of the turtles removed from the intake canal. One turtle was removed from the intake well. It was originally spotted west of the primary barrier net after the net failed.

Decreased water flow during plant outages likely reduces the number of turtles entrained into the intake canal. In 2013, Unit 1 was in an outage from September 30$^{th}$ to November 9$^{th}$.

### 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 2013, monthly captures of loggerheads ranged from five in September to 47 in May and July (Table 2), with a monthly mean of 25.3. 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 power 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 301 loggerheads captured where standard straight carapace length (SSCL) is available, 141 were juveniles (SSCL $\leq$ 70 cm), 93 were adults (SSCL $\geq$ 85 cm), and 67 were transitional (SSCL 70-85 cm; Hirth, 1980, Figure 12). The latter group probably includes both mature and immature individuals. Of the 93 turtles classified as adults, 88 were females and 5 were males. One additional loggerhead was recorded as a male even though its 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 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 2013, monthly green turtle captures ranged from five in October to 31 in May (Table 2) with a monthly mean of 16.3. Of the 196 green turtles captured in 2013, there were 179 juveniles or sub-adults (SSCL < 83cm) and 17 adults (SSCL $\geq$ 83 cm; Witherington and Ehrhart, 1989, Figure 13), of which 10 were males and 7 were females.

### 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 2013, there were two leatherbacks and two hawksbills captured in the intake canal of the St. Lucie Plant (Table 1). A female leatherback was captured on April 8$^{th}$ and had a SSCL of 135.0 cm. A male leatherback was captured on August 30$^{th}$ and had a SSCL of 140.3 cm. A female hawksbill was captured on April 30$^{th}$ and had a SSCL of 76.5 cm. A subadult hawksbill was captured on May 10$^{th}$ and had a SSCL of 50.9 cm.

### 3.2.4 Recaptures

Since plant operation began in 1976, a total of 15,584 sea turtles (including recaptures) have been captured, including 8,931 loggerhead, 6,500 green, 60 hawksbill, 54 Kemp's ridley, and 39 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, 2,848 recapture events (670 loggerheads and 2,178 green turtles) have occurred. The recapture rate in 2013 was 5.6% for loggerheads and 42.9% for greens. Occasionally, turtles are captured that have been tagged by other researchers. There were six such captures in 2013 (five loggerheads and one green turtle). The green turtle and one loggerhead were originally tagged by University of Central Florida in Melbourne Beach, FL. Two loggerheads were originally tagged in North Carolina. One loggerhead was released from Loggerhead Marinelife Center in Juno Beach, FL (turtle originally stranded in Cape Cod, MA during a cold stun event) after rehabilitation. The last loggerhead was tagged in the Azores, but the original tagging data were lost. In 2013, there were 6 incidences of turtles tagged at the intake canal that were subsequently observed by other research groups. Four turtles were spotted by UCF researchers monitoring sea turtle nesting in Melbourne Beach, FL. One loggerhead turtle was captured in a shrimp net in the Gulf of Mexico and documented by the NMFS Shrimp Fishery Observer Program. The last turtle, a loggerhead, was seen by IRG biologists nesting during a public sea turtle walk in front of the St. Lucie Power Plant.

### 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 power plant operation. Causal determinations are made by consultation with personnel from FWC and/or a qualified veterinarian.

During 2013, 92.7% (281) of all loggerheads found in the canal were alive and in good condition. Only 6.6% (20) of all loggerheads were individuals in fair or poor condition, and 0.7% (2) were found dead. Of the 196 green turtles removed from the intake canal in 2013, 93.4% (183) were in good condition, 5.1% (10) were in fair or poor condition and 1.5% (3) were found dead.

Of the 503 turtles removed from the intake canal during 2013, 409 (81.3%) 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 (88.3%) of the scrapes were classified as minor. However, some of the scrapes (11.5%) were moderate. Only one turtle (0.2%) had a fresh scrape categorized as severe that 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 power plant operation or non-causal to power plant operation. These decisions are made in consultation with FWC and/or a qualified veterinarian. Not all mortalities and injuries are causal to power 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 causal to power 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 7.8% during the period 1976-1984 to 1.3% for the period 1985 to present (Table 1). Over the entire monitoring program's history (1976-2013), 178 (2.0%; including hatchlings from 2006) loggerheads and 97 (1.5%) 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. No dead leatherback or hawksbill turtles have ever been recorded.

In 2013, five mortalities were recorded at the St. Lucie power plant intake canal: two loggerhead and three green turtles. Two green turtle mortalities were considered causal to power plant operations. Additionally, one loggerhead sustained injuries that were considered casual to plant operations.

On August 5th an adult loggerhead was captured in the intake canal. The turtle had a 3 cm X 3.5 cm puncture through the carapace. After consultation with FWC, it was determined that the injury sustained was causal to plant operation and the turtle was sent to the Loggerhead Marinelife Center for rehabilitation. It was successfully treated and released on August 14th.

On November 26th a dead juvenile green turtle was found submerged below the water on the primary barrier net. A necropsy found no evidence of life threatening disease or compromise and the veterinarian determined that forced submergence was the likely cause of death.

On December 27th a juvenile green turtle was found dead, pinned against the primary barrier net by a buoy. The turtle was underweight and had an old rusted hook in the right corner of its mouth. The necropsy noted the turtle's compromised health and determined forced submergence was the likely cause of death

## 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 new BO there were a number of changes, most importantly in the Incidental Take Statement. This states that FPL will 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.

During 2013, there were two sea turtle mortalities and one injury that were causal to power plant operations. No leatherback, hawksbill or Kemp's ridley turtles were injured or killed. A total of 503 turtles were captured in the FPL intake canal for the year. Based on the latest BO issued by NMFS, FPL did not exceed its take limit during 2013. However, FPL did exceed their sea turtle take limit at the St. Lucie power plant in 2006 and reinitiating a Section 7 consultation was required. This consultation is currently ongoing between NMFS and the NRC. A new BO is expected in 2014. FPL has identified the contributing factors that led to exceeding the take limit in 2006. The company has responded by cleaning the intake pipes and developing a plan to install turtle excluder grating on the offshore intake structures.

### 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 2013

During 2013, IRG biologists responded to 29 (12 loggerhead, 17 green) stranding events in Martin and St. Lucie Counties. The turtles were found in various stages of decomposition. Of these 29 turtles, the probable cause of stranding included three boat strikes, two entanglement, two shark attacks, one trauma by a rock, and one spear fishing mortality. The remaining 20 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.

IRG biologists also responded to strandings at two other FPL facilities. A live green turtle was documented at the Cape Canaveral Clean Energy Center. Two live green turtles and a live loggerhead turtle were documented at the Riviera Beach Clean Energy Center.

FPL conducted 12 turtle walks between June 7th and July 13th, 2013. During these programs, a total of 386 people attended and on eight of the 12 turtle walks they 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 power plant continued to collaborate with other researchers on three research projects in 2013.

IRG biologists collected blood samples and biopsies from two loggerheads to assist with a project conducted by University of Central Florida researchers looking at stable isotope analysis in sub-adult and adult loggerheads. Blood was taken from five loggerheads captured in the canal to assist in a project conducted by Florida Atlantic University researchers investigating the immune response in marine turtles with fibropapilloma tumors. IRG biologists also took front flipper measurements for a professor from Embry-Riddle Aeronautical University studying propulsion dynamics.

### 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 Underwater Engineering Services, Inc. (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 new primary barrier net, with few exceptions, has performed as designed and has effectively confined sea turtles to the eastern 200 meters of the intake canal.

In October 2009 the primary barrier net failed due to an algae event, submerging the north half of the net 0.6-1.5 m underwater (IRG, 2010). 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. A permanent fix to the primary net is scheduled in 2014.

During 2013, there were two net failures. On October 7th, the north and south ends of the A1A net, each approximately 3-5 m long, fell below the water level. The failure was due to high water levels in the canal caused by the combined effects of power plant outage and unusually high tides. On the same day, UESI added buoys to raise the net height. On November 26th the 5" primary net failed. Eighty percent of the net was submerged below the water line for approximately 3.5 hours. The failure was due to a severe algae build-up on the net. UESI worked throughout the day to remove the algae and restore the net height. One juvenile green turtle was spotted west of the 5" after the failure and attempts to capture the turtle were unsuccessful. It was subsequently captured in good condition at the intake wells. In 2013, routine quarterly inspections of the temporary primary barrier net and the A1A net were completed. During these inspections, debris was removed from both nets and two holes were repaired in the primary barrier net. There were no holes found in the A1A barrier net.

### 4.5 Intake Pipe Cleaning and Maintenance

Since 2002 there had been a steady increase in the number of sea turtles incurring scrapes during transit through the power plant intake pipes. These scrapes varied in degree of severity, with most being minor and similar to those found on sea turtles that inhabit near shore 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 of 2007 and was completed in February 2011. Additionally, two openings that extended from the top of the two 12' intake pipes were also sealed off during this time.

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## 6.0 Figures and Tables

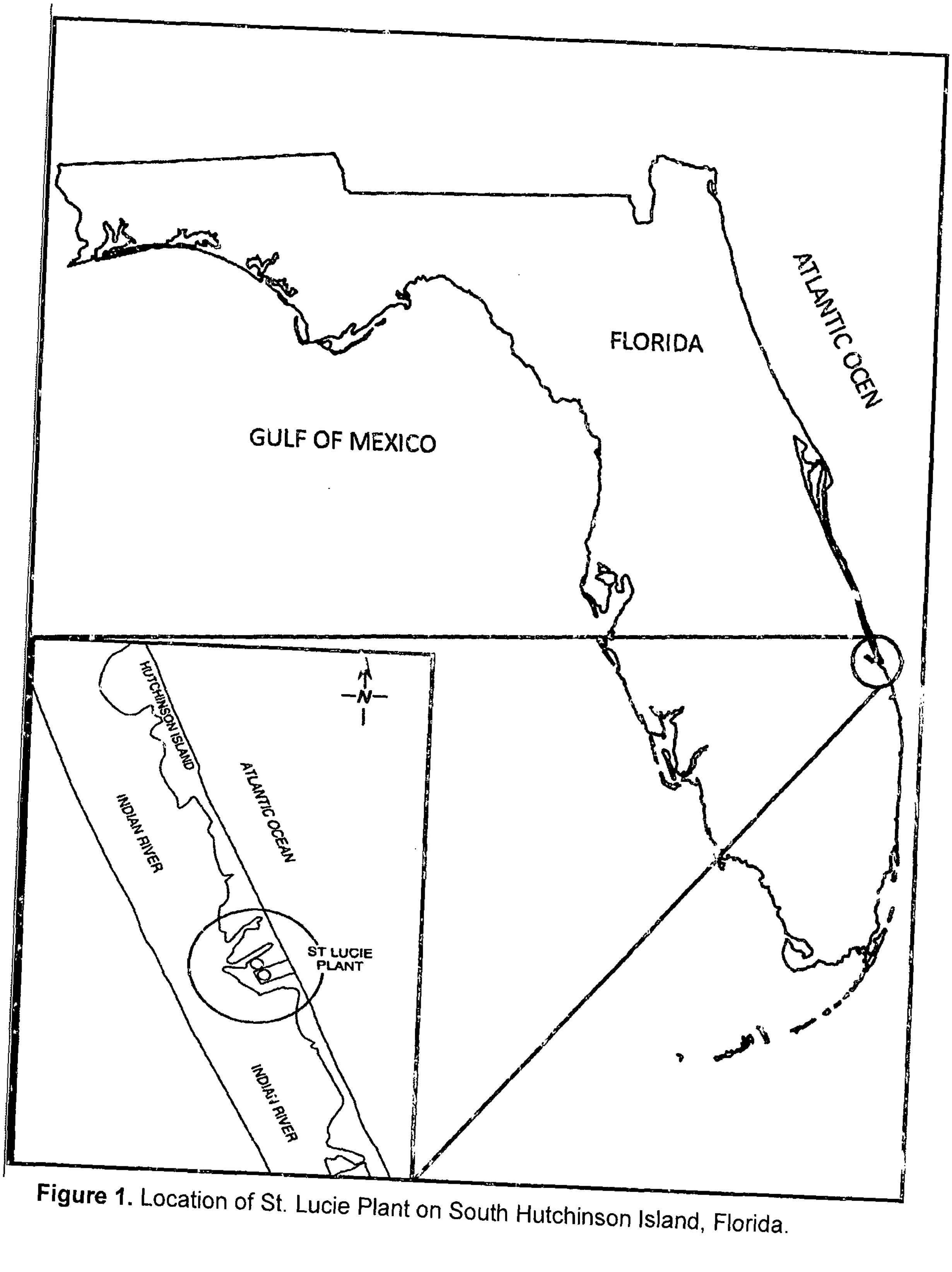


**Figure 1.** Location of St. Lucie Plant on South Hutchinson Island, Florida.

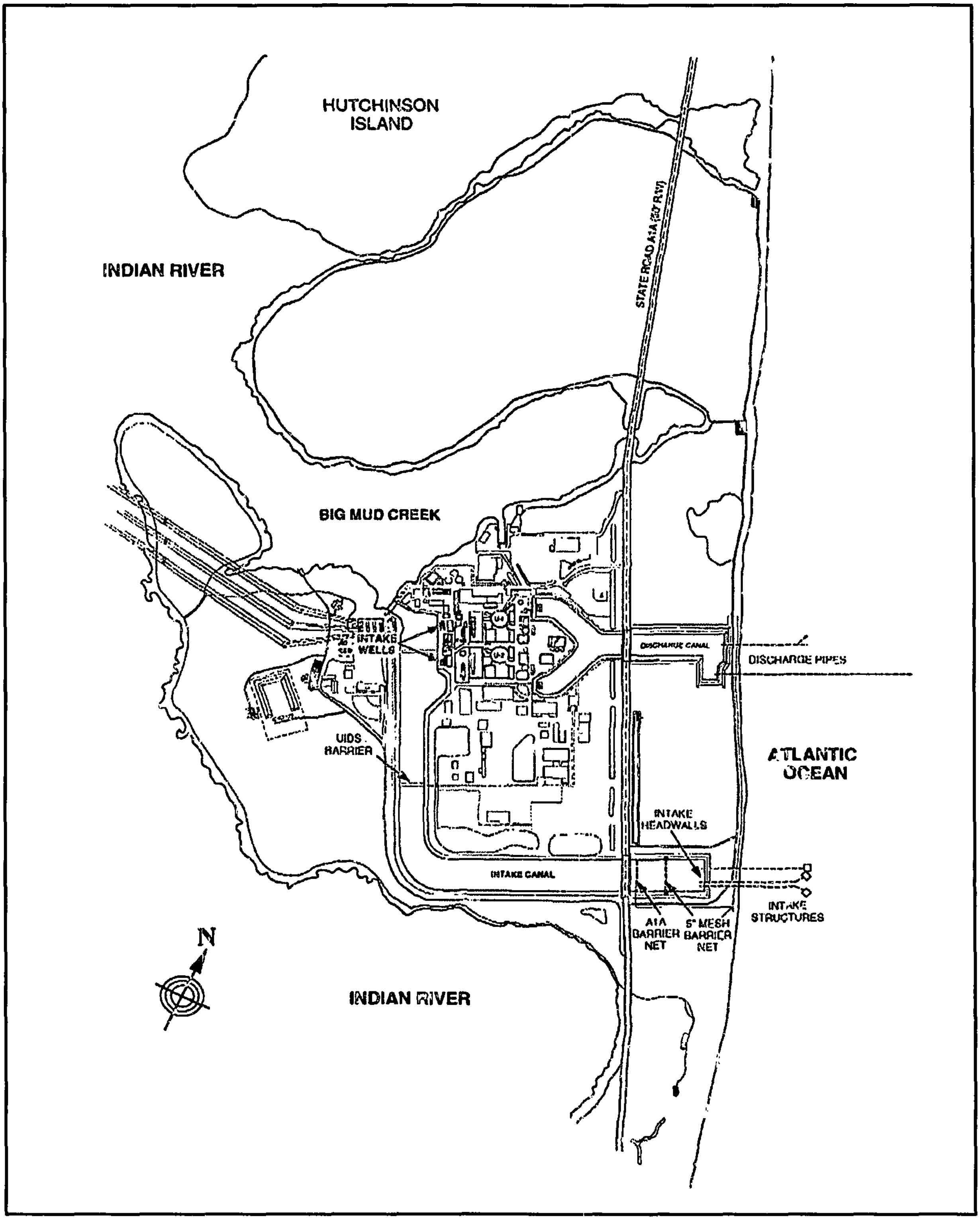


**Figure 2.** St. Lucie Plant cooling water intake and discharge system.

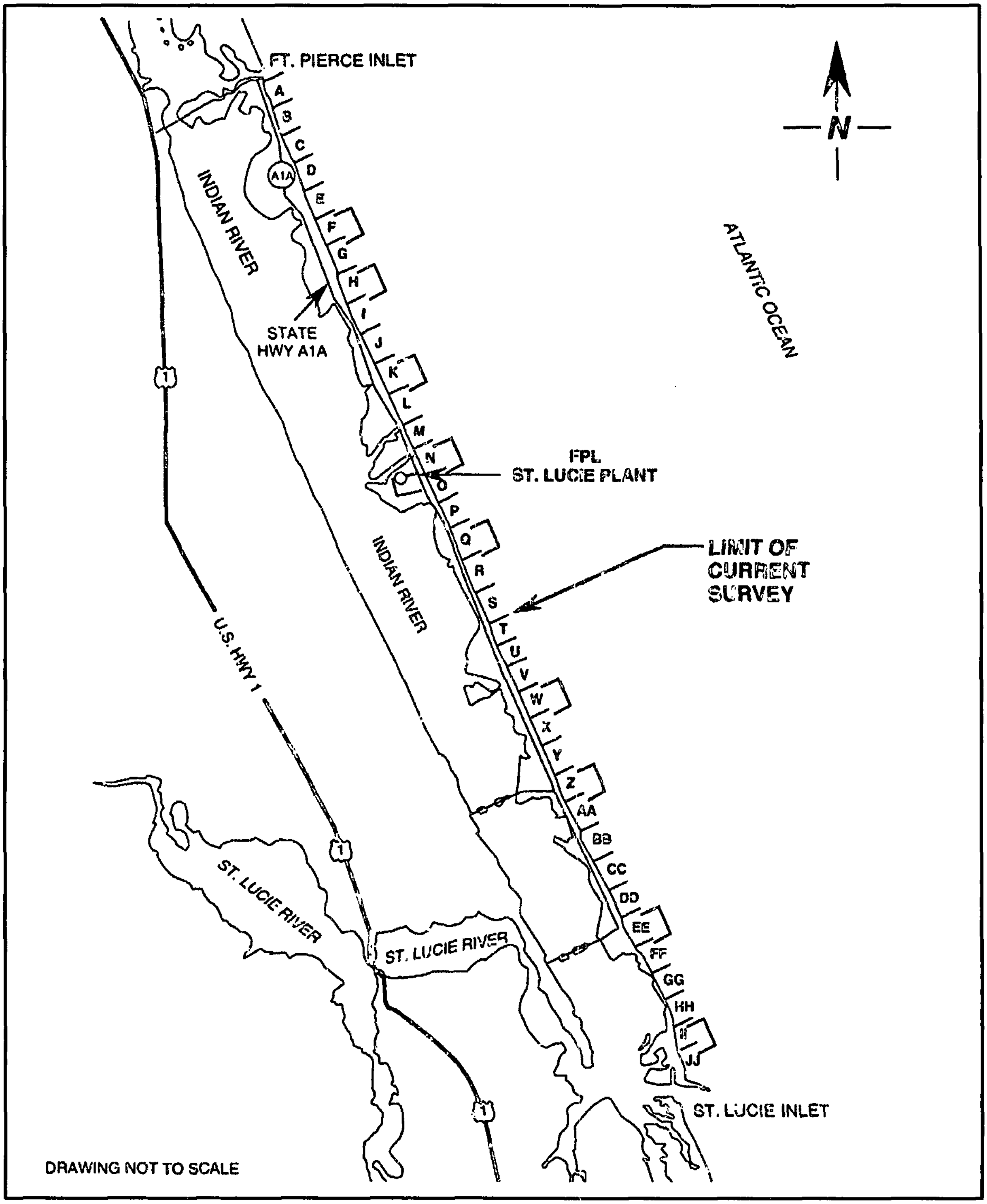


**Figure 3.** Designation and location of nine 1.25 km segments (in brackets) and thirty-six 1 km segments surveyed for sea turtle nesting on South Hutchinson Island (1971-2013).

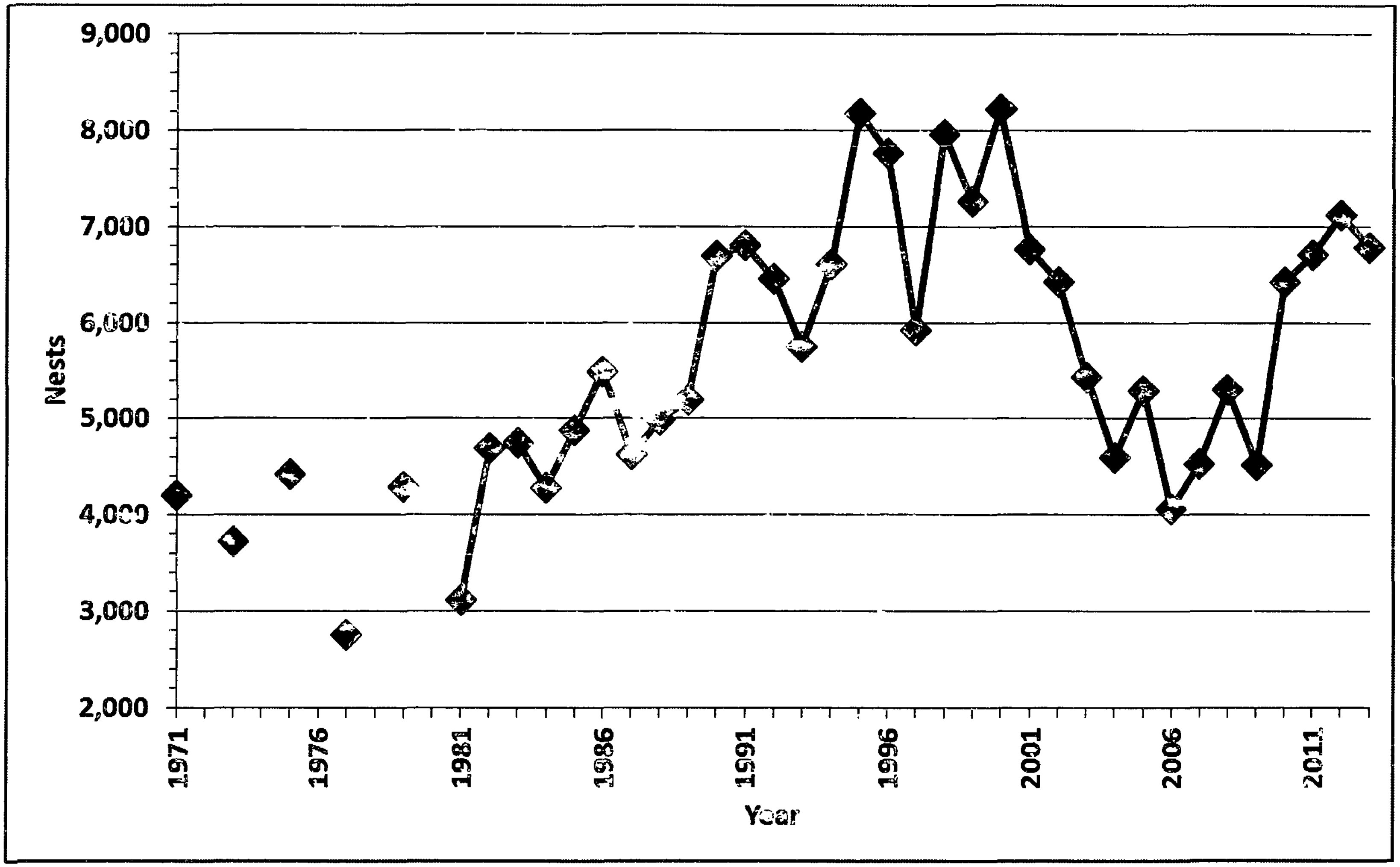


**Figure 4.** Number of loggerhead turtle nests on South Hutchinson Island from 1971 through 2013. Values for 1971 through 1979 are estimates (see section 2.1.1); values for 1981 through 2013 are from whole island surveys.

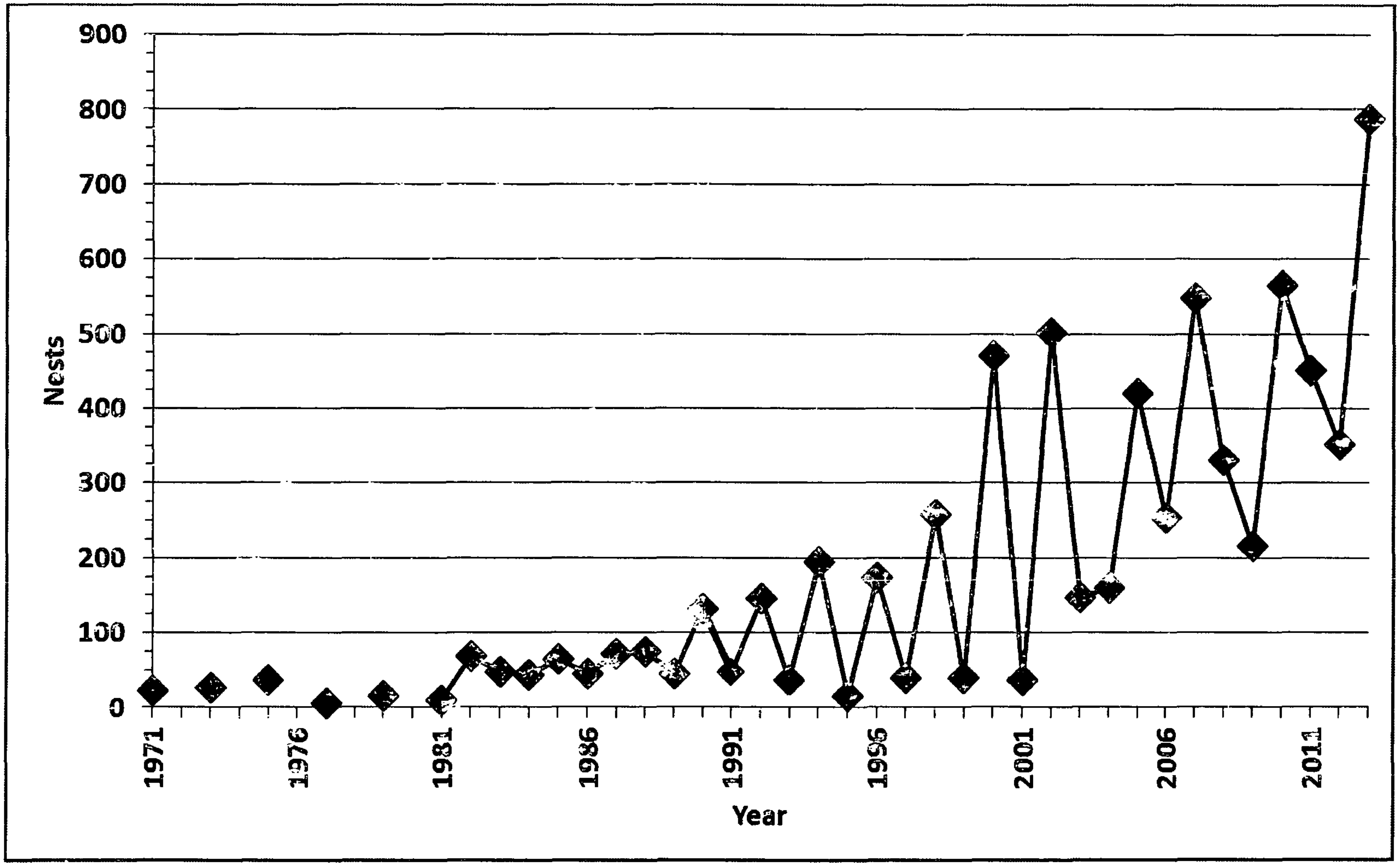


**Figure 5.** Number of green turtle nests on South Hutchinson Island from 1971 through 2013. Values for 1971 through 1979 are estimates (see section 2.1.1); values for 1981 through 2013 are from whole island surveys.

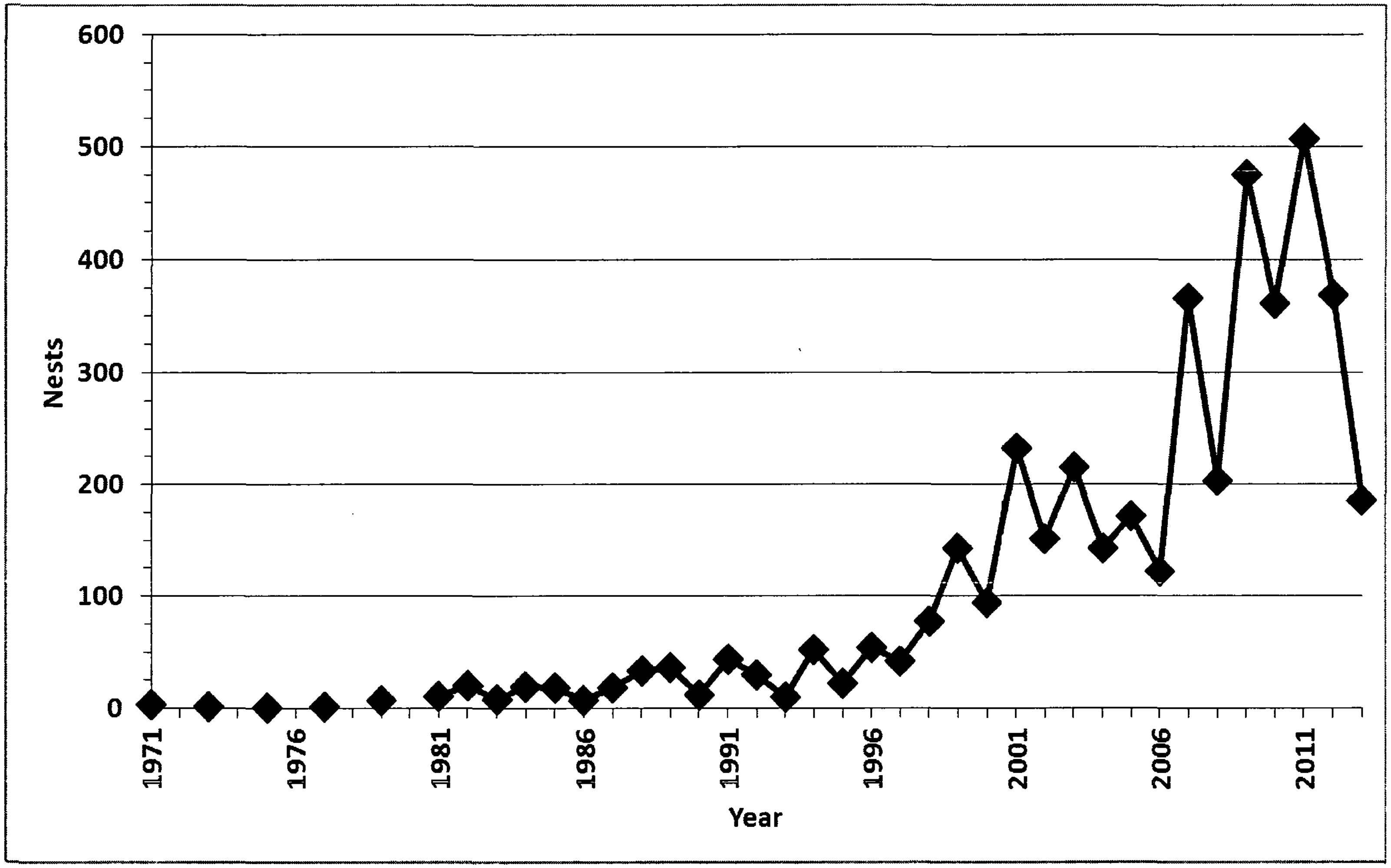


**Figure 6.** Number of leatherback turtle nests on South Hutchinson Island from 1971 through 2013. Values for 1971 through 1979 are estimates (see section 2.1.1); values for 1981 through 2013 are from whole island surveys.

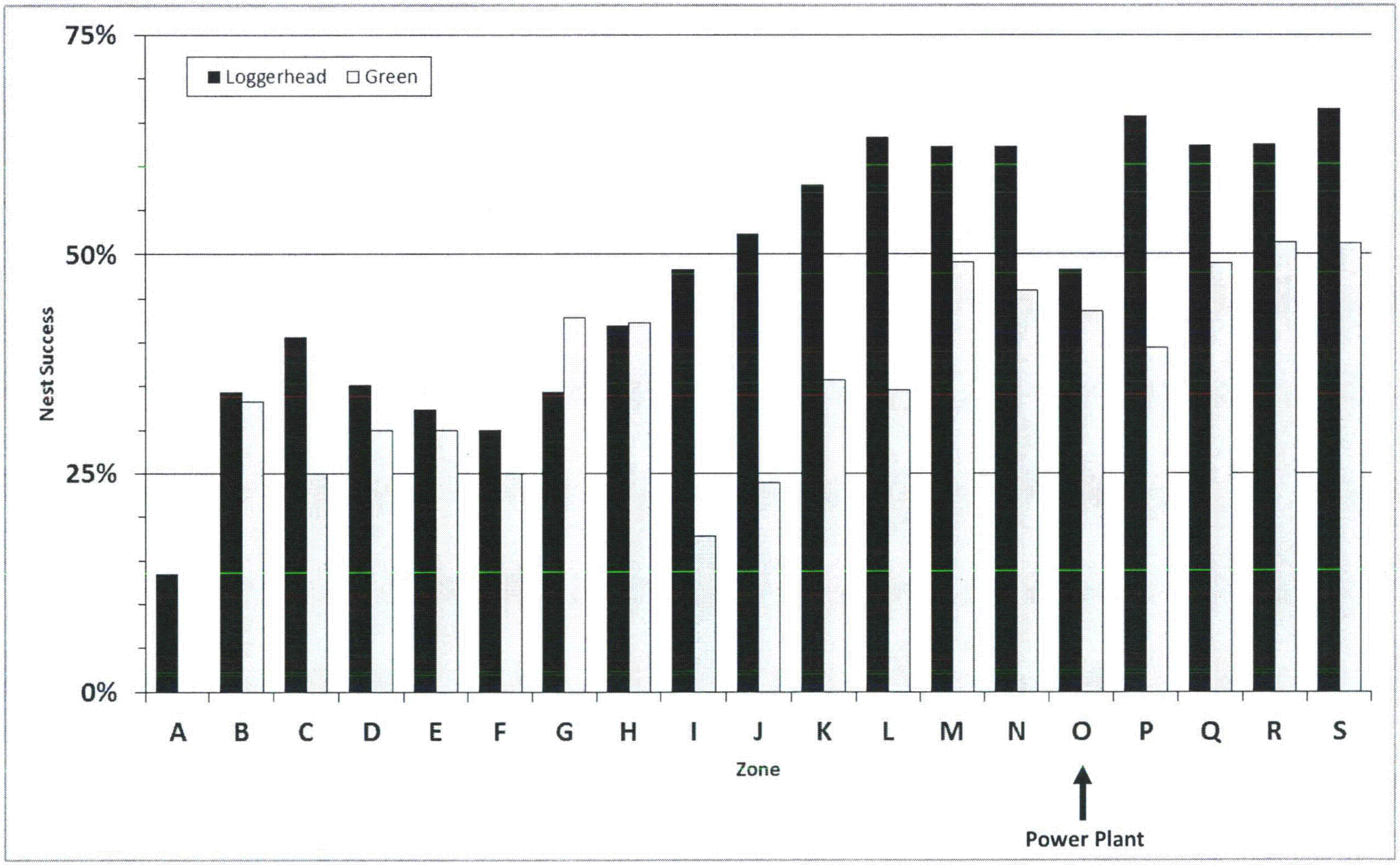


**Figure 7.** Loggerhead and green turtle nesting success (percentage of emergences resulting in nests) for each of the 1 km zones A through S (North to South) on South Hutchinson Island for the 2013 nesting season.

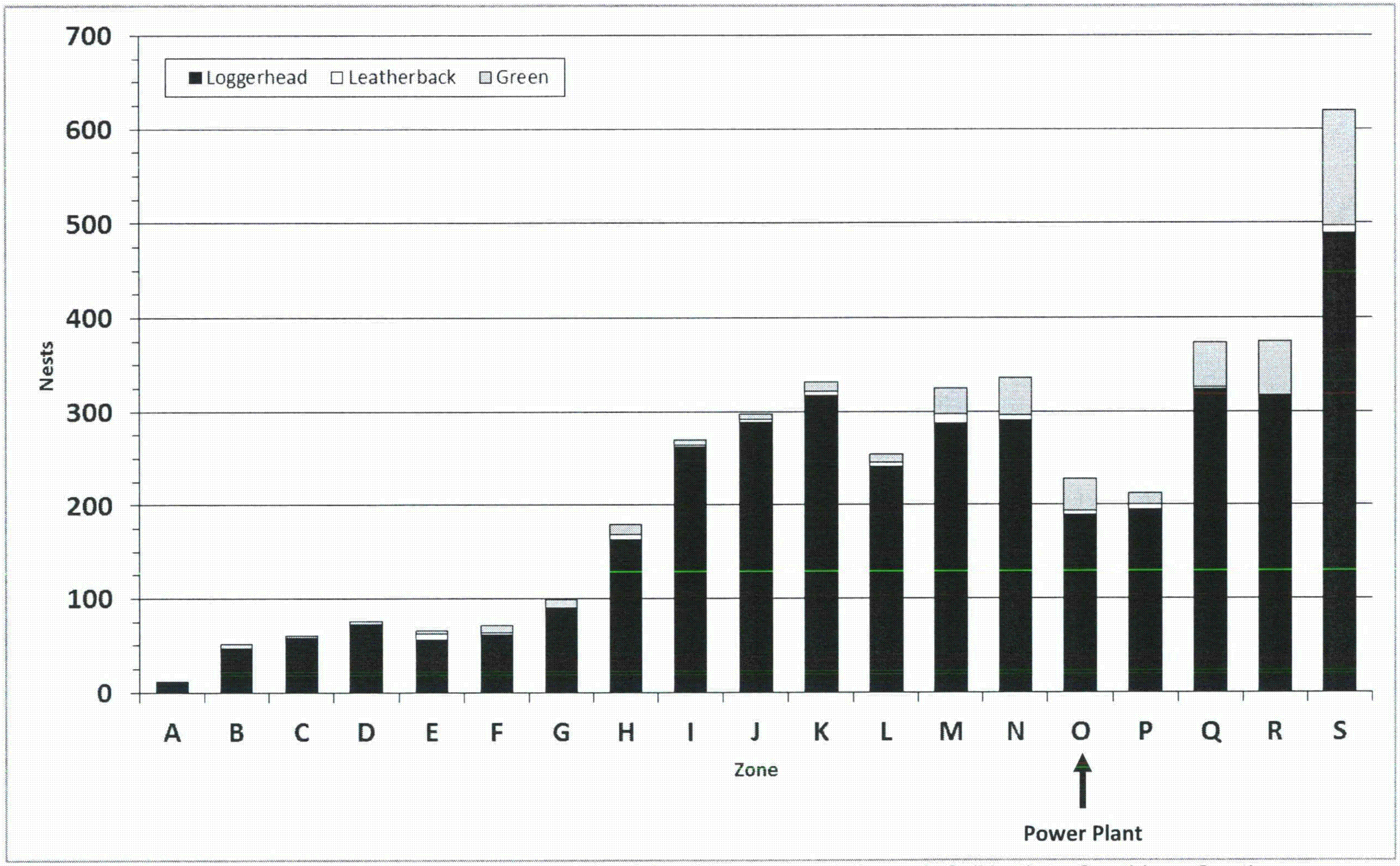

**Figure 8.** Number of turtle nests by species for each of the 1 km zones A through S (North to South) on South Hutchinson Island for the 2013 nesting season.

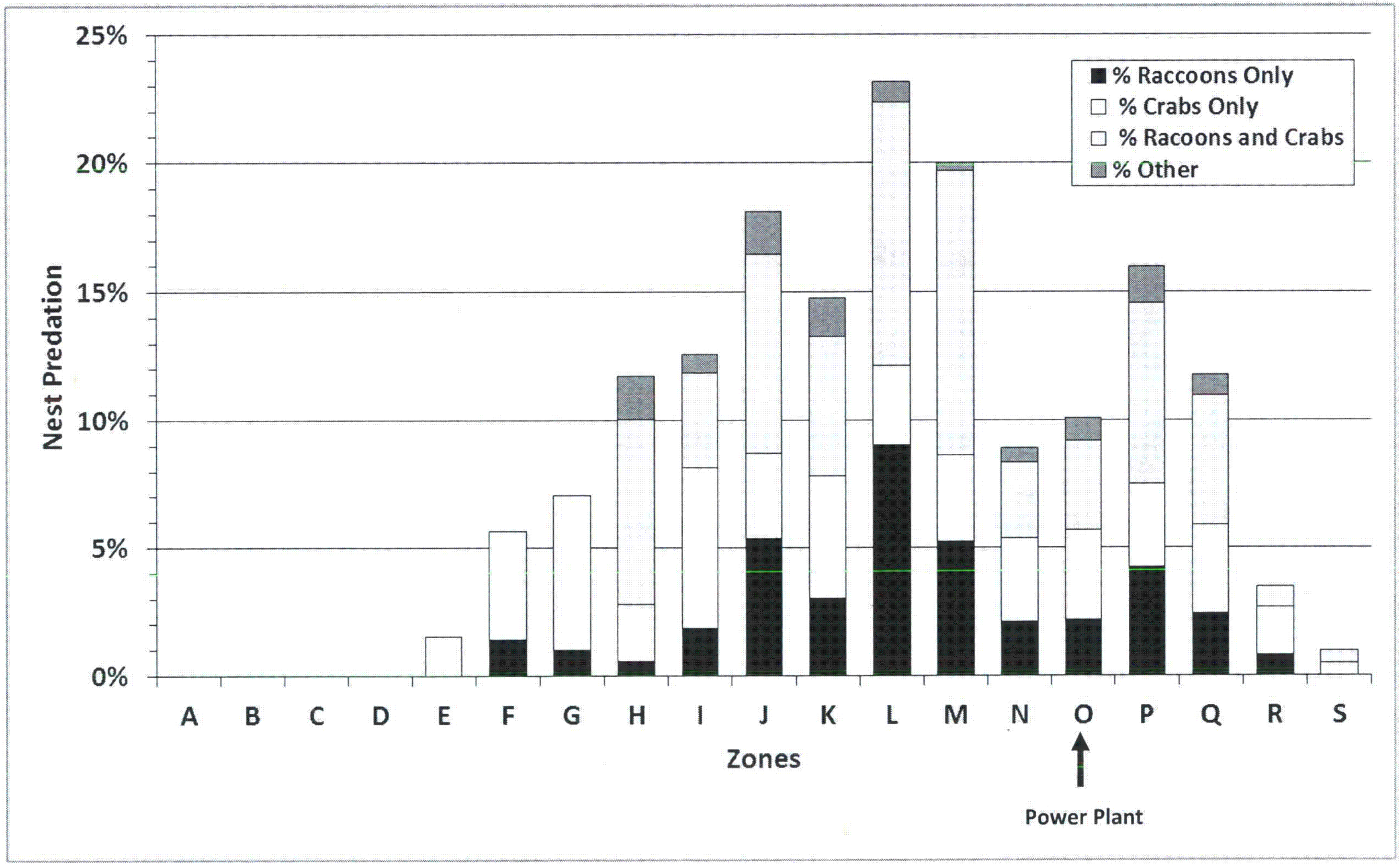


**Figure 9.** Percentage of sea turtle nests depredated by1 km zones E through S (North to South) on South Hutchinson Island for the 2013 nesting season. Nest predation data from zones A-D were not reported by EAI.

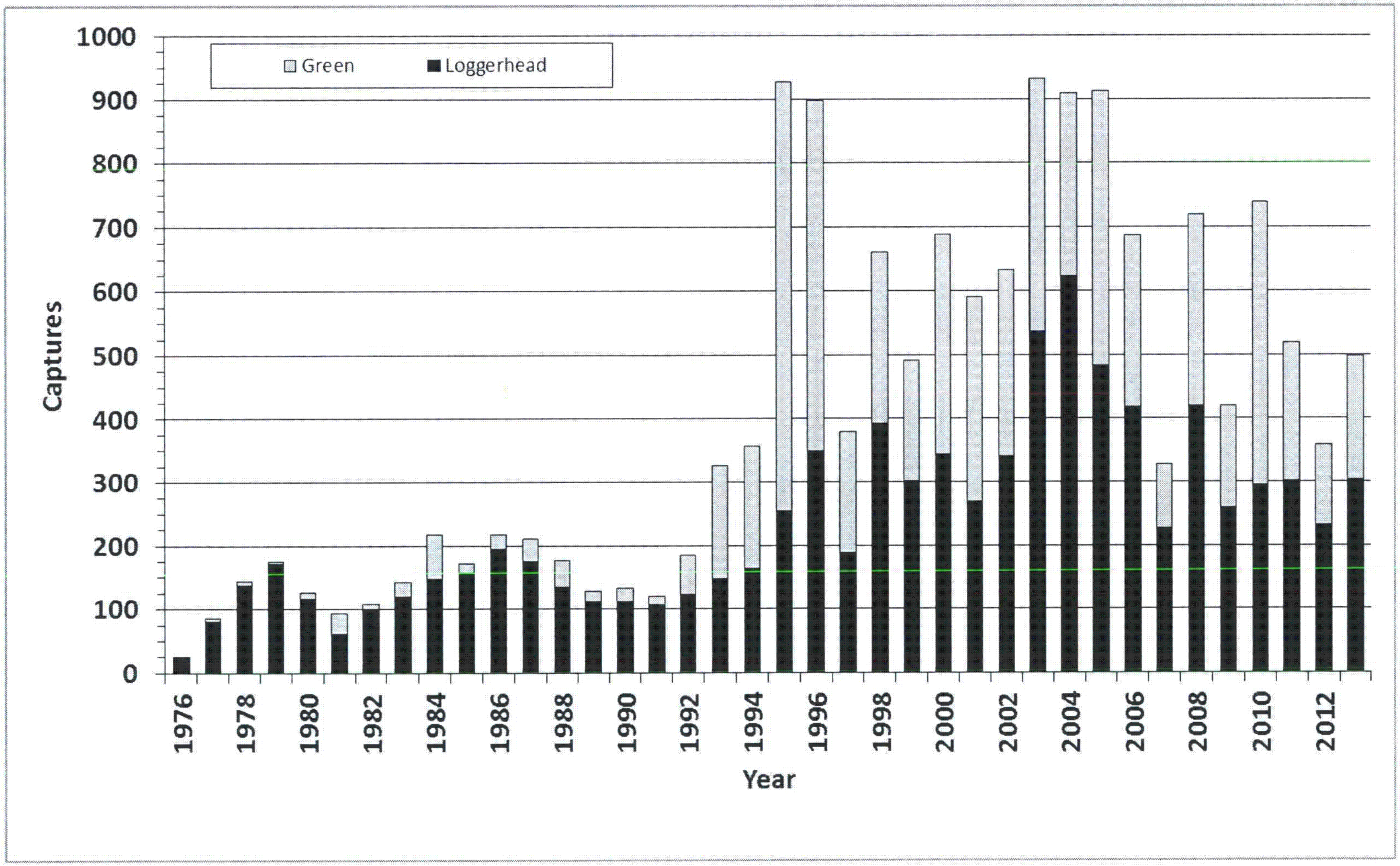


**Figure 10.** Number of loggerhead and green turtles captured and removed each year from the intake canal at the St. Lucie Power Plant, 1976 through 2013.

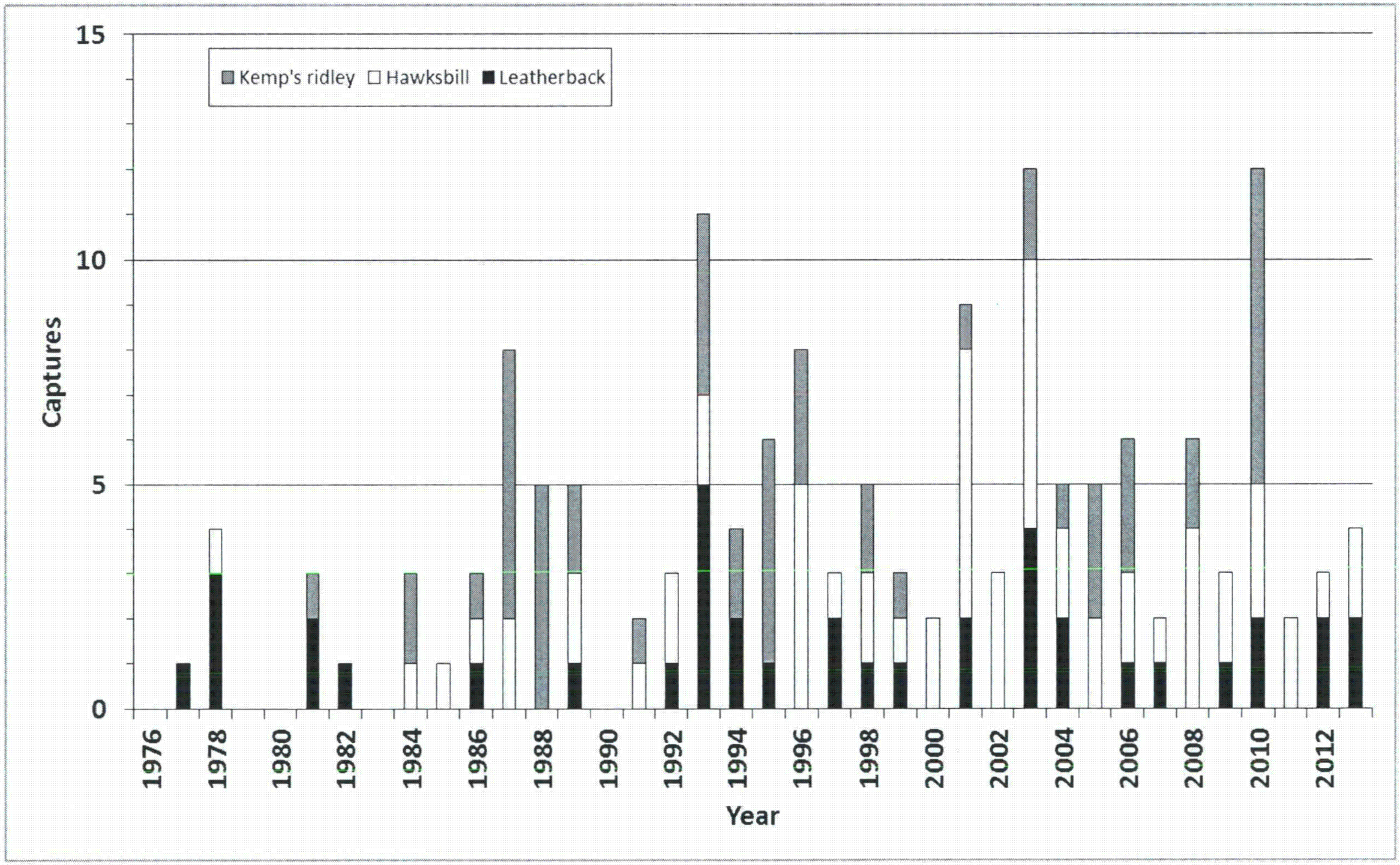


**Figure 11.** Number of Kemp's ridley, Hawksbill, and Leatherback turtles captured and removed each year from the intake canal at the St. Lucie Power Plant, 1976 through 2013.

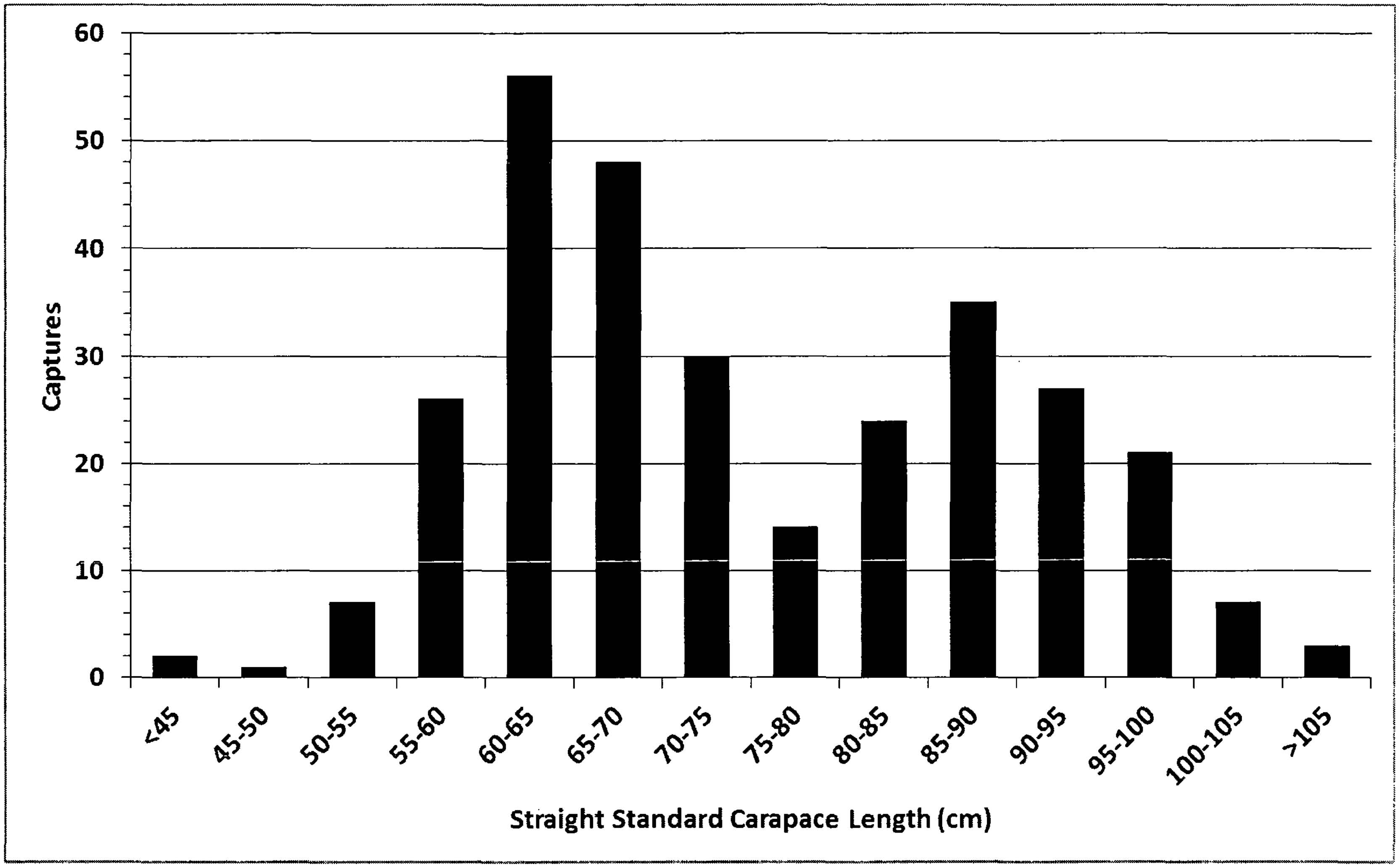


**Figure 12.** Size distribution (Straight Standard Carapace Length; SSCL) of loggerhead turtles (n=301) captured and removed from the intake canal at the St. Lucie Power Plant during 2013.

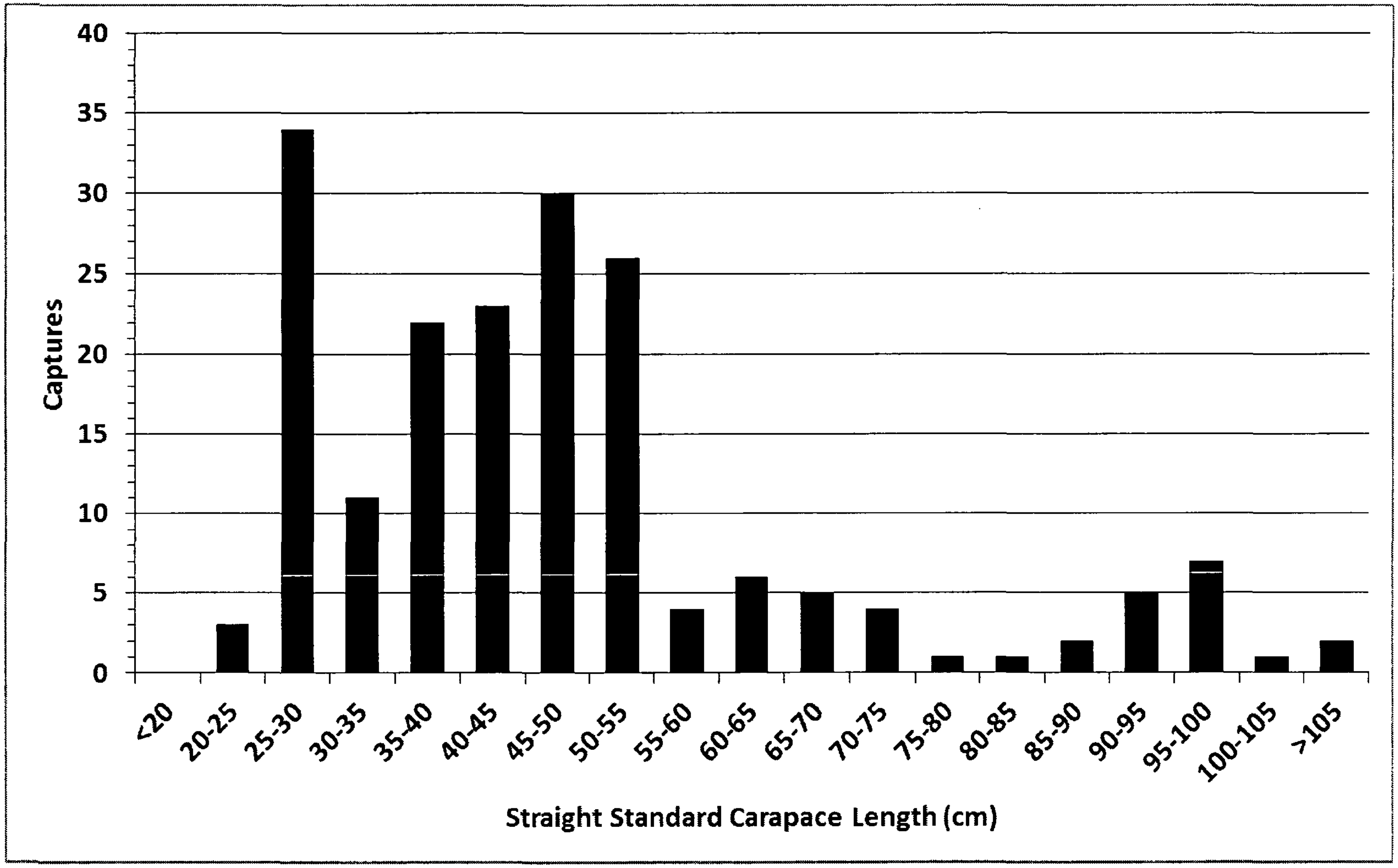


**Figure 13.** Size distribution (Straight Standard Carapace Length; SSCL) of green turtles (n=187) captured and removed from the intake canal at the St. Lucie Power Plant during 2013.

| 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 | 2 | 2 | | 2 | | | | 503 | 5 |
| **Total** | **8931** | **178** | **6500** | **96** | **39** | **0** | **60** | **0** | **54** | **4** | **15584** | **279** |
| Mean* | 241.4 | 4.8 | 175.7 | 2.6 | 1.1 | 0 | 1.6 | 0 | 1.5 | 0.1 | 421.2 | 7.5 |

**Table 1**. Total number of captured turtles removed from the intake canal at the St. Lucie Power Plant from 1976 through 2013. Number of mortalities is highlighted in gray. Mean excludes partial year of 1976 when 33 loggerheads were captured.

| | Loggerhead | | | | Green | | | |
|---|---|---|---|---|---|---|---|---|
| Months | 2013 Captures | Total Captures | Percent of Captures | Mean | 2013 Captures | Total Captures | Percent of Captures | Mean |
| *January* | 18 | 817 | 9.1% | 22.1 | 17 | 783 | 12.0% | 21.2 |
| *February* | 8 | 784 | 8.8% | 21.2 | 8 | 672 | 10.3% | 18.2 |
| *March* | 22 | 944 | 10.6% | 25.5 | 28 | 767 | 11.8% | 20.7 |
| *April* | 35 | 889 | 10.0% | 24.0 | 8 | 472 | 7.3% | 12.8 |
| *May* | 47 | 815 | 9.1% | 22.0 | 31 | 454 | 7.0% | 12.3 |
| *June* | 42 | 939 | 10.5% | 25.4 | 11 | 402 | 6.2% | 10.9 |
| *July* | 47 | 1171 | 13.1% | 31.6 | 12 | 378 | 5.8% | 10.2 |
| *August* | 39 | 785 | 8.8% | 21.2 | 5 | 384 | 5.9% | 10.4 |
| *September* | 5 | 541 | 6.1% | 14.6 | 18 | 496 | 7.6% | 13.4 |
| *October* | 10 | 456 | 5.1% | 12.3 | 5 | 617 | 9.5% | 16.7 |
| *November* | 11 | 346 | 3.9% | 9.4 | 26 | 537 | 8.3% | 14.5 |
| *December* | 19 | 444 | 5.0% | 12.0 | 27 | 538 | 8.3% | 14.5 |
| **Total** | 303 | 8931 | | 241.4 | 196 | 6500 | | 175.7 |

**Table 2.** Total number of loggerhead and green turtles removed each month from the intake canal at the St. Lucie Power Plant from 1977 through 2013. Monthly totals exclude the partial year 1976 when 33 loggerheads were captured.

| | Leatherback | | | | Hawksbill | | | | Kemp's Ridley | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Months | 2013 Captures | Total Captures | Percent of Captures | Mean | 20123 Captures | Total Captures | Percent of Captures | Mean | 2013 Captures | Total Captures | Percent of Captures | Mean |
| *January* | 0 | 5 | 12.8% | 0.1 | 0 | 0 | 0.0% | 0.0 | 0 | 8 | 14.8% | 0.2 |
| *February* | 0 | 4 | 10.3% | 0.1 | 0 | 1 | 1.7% | 0.0 | 0 | 13 | 24.1% | 0.4 |
| *March* | 0 | 12 | 30.8% | 0.3 | 0 | 7 | 11.7% | 0.2 | 0 | 12 | 22.2% | 0.3 |
| *April* | 1 | 7 | 17.9% | 0.2 | 1 | 3 | 5.0% | 0.1 | 0 | 11 | 20.4% | 0.3 |
| *May* | 0 | 4 | 10.3% | 0.1 | 1 | 3 | 5.0% | 0.1 | 0 | 2 | 3.7% | 0.1 |
| *June* | 0 | 2 | 5.1% | 0.1 | 0 | 2 | 3.3% | 0.1 | 0 | 2 | 3.7% | 0.1 |
| *July* | 0 | 0 | 0.0% | 0.0 | 0 | 13 | 21.7% | 0.4 | 0 | 1 | 1.9% | 0.0 |
| *August* | 1 | 1 | 2.6% | 0.0 | 0 | 9 | 15.0% | 0.2 | 0 | 0 | 0.0% | 0.0 |
| *September* | 0 | 2 | 5.1% | 0.1 | 0 | 11 | 18.3% | 0.3 | 0 | 0 | 0.0% | 0.0 |
| *October* | 0 | 0 | 0.0% | 0.0 | 0 | 5 | 8.3% | 0.1 | 0 | 1 | 1.9% | 0.0 |
| *November* | 0 | 1 | 2.6% | 0.0 | 0 | 5 | 8.3% | 0.1 | 0 | 1 | 1.9% | 0.0 |
| *December* | 0 | 1 | 2.6% | 0.0 | 0 | 1 | 1.7% | 0.0 | 0 | 3 | 5.6% | 0.1 |
| **Total** | 2 | 39 | | 1.1 | 1 | 60 | | 1.6 | 0 | 54 | | 1.5 |

**Table 3.** Total number of leatherback, hawksbill, and Kemp's ridley turtles removed each month from the intake canal at the St. Lucie Power Plant from 1977 through 2013. Monthly totals exclude the partial year 1976 when 33 loggerheads were captured.

## 7.0 Annual Environmental Operating Report

### 7.1 Introduction

The St. Lucie Units 1 & 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 power 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 1800 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.

The results of the program for 2013 are presented in Table 1.

During 2013, CTCS ball recoveries were reduced by algae intrusions, biodegraded ball fatigue failures, ruptured filter screen in DFS 1B1, peeling epoxy liners inside condenser tubes 1B1 and 1B2 and by peeling of the epoxy liner in the 2A2 waterbox outlet pipe above the CTCS.

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.

CTCS ball loss was increased by intake debris intrusions. The response to debris such as algae intrusions is to place the CTCS in the "protected configuration", balls in "catch" and CTCS ball strainers placed in backwash if a notable DP increase is indicated. Not having a full time intake monitoring system, in a few cases the intake debris influx can affect the CTCS before Operations is able to respond to the debris intrusion and place the CTCS in the protected" configuration. Reduced recovery of CTCS balls due to fouling from debris is unusual compared to the frequent occurrence of debris intrusion. CTCS ball recovery remains high during most debris intrusion events.

CTCS ball loss was increased by biodegraded ball fatigue failures. Balls are replaced every four to five weeks to avoid ball failure. Ball replacement at five weeks service or less has previously been effective. However, in the summer of 2013 during a period of persistent influx of jellyfish, several CTCS ball loads experienced unusually rapid degradation leading to ball failure. Ball failures occurred at five weeks of service on several waterboxes during this exceptional event, a two month period with continues influx of jellyfish combined with warm ocean temperatures.

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.

CTCS ball loss was increased due to a failed filter screen. Debris Filter System (DFS) 1B1 filter screen ruptured in service before the SL1-25 refueling outage. A large hole in the filter screen allowed macrofoulling to enter condenser tubes, trapping balls, fouling the ball strainer and degrading ball recovery. To prevent the bypass of debris into the CTCS as a result of screen failures, filter screens are being replaced in all the circulating water DFS.

CTCS ball loss was increased by epoxy chips peeling from the epoxy liner in the 2A2 waterbox outlet pipe above the CTCS. Broken chips of epoxy coating larger than a nickel can degrade ball recovery. The chips or any other ~ flat debris like shells can become wedged edgewise in the narrow slots between the bars in the ball recovery strainer. A collection of debris flakes that project more than 1/8" above the plane of the ball recovery strainer panel can initially stop a few balls from rolling towards the ball recirculation chute. Additional balls continue to lodge behind the stopped balls, until many balls are trapped on the strainer panel. The population of balls trapped on the strainer depends on the position of the debris fouled zones. Fouling of the strainer panel zone near a ball recovery chute is more adverse to ball recovery.

The installation of Plastocor epoxy liners inside the condenser waterboxes was expected to prevent low ball recovery events resulting from failed epoxy coating. The effect of unique ocean environment and from the waterbox cathodic protection has resulted in failures of the Plastocor in areas where optimum coatings preparation was difficult to accomplish. Ongoing remediation efforts are conducted each refueling outage to remove loose coatings and repair the coatings as necessary.

Ball recovery was reduced by peeling epoxy due to poor adhesion of the epoxy coatings inside condenser tubes in waterboxes 1B1 and 1B2. This coating application was not replicated in any other waterbox tubes.

Inside the condenser there are about 12,000 tubes per waterbox. In waterboxes 1B1 and 1B2, coatings inside some of the tubes are lifting and curling up along the edges where the remaining epoxy is firmly attached. The epoxy coating is very hard material and peeled up epoxy has sharp edges. The edges snag the balls or other debris and jam the ball in the tubes. The tube can collect up to four balls before the flow into the tube ceases. Over time the balls shrink and may later dislodge from the tube. When the tube is clogged with a ball, the flow is reduced enough for wormrock to grow in and seal off the tube inlet, eventually preventing more balls from entering. Ball losses may vary as these conditions change.

The firmly attached epoxy can't be aggressively removed from these tubes without risk of damaging these thin wall titanium tubes. However, each outage, the site continues to remove the loose coating as it progressively peels from inside the tubes on the outlet ends of waterbox 1B1 and waterbox 1B2. The hydrided condition of 1B1 waterbox tubes causes relatively poor adhesion and the coatings peel up quickly, leading to more frequent ball loss events on this waterbox.

Best management practices continue to be applied to minimize CTCS ball loss.

## 7.4 Other Routine Reports

The following items for which reporting is required are listed by section number from the plant's Environmental Protection Plan:

5.4.1.2(a) EPP Noncompliance Incidents and Corrective Actions Taken

No incidents of noncompliance under EPP Section 5.4.1(a) were determined to have occurred during 2013.

5.4.2(b) Changes in Station Design or Operation, Tests, and Experiments in Accordance with EPP Subsection 3.1

No changes in station design, operation, tests, and experiments were determined to have occurred during 2013.

5.4.1.2(c) Non-routine reports were submitted to the NRC for the year 2013 in accordance with EPP Subsection 5.4.2.

On April 9, 2013, St. Lucie submitted to the NRC the 2012 Annual Environmental Operating Report for the calendar year 2012. Notification to the NRC occurred via FPL letter L-2013-125.

On April 17, 2013, St. Lucie submitted to the NRC a copy of 316(b) related documentation pertaining to the Heated Water Plan of Study as addressed in the St. Lucie Industrial Wastewater Permit No. FL 0002208. Notification to the NRC occurred via FPL letter L-2013-124.

On November 26, 2013, a dead juvenile green sea turtle (Chelonian mydas) was recovered from the east side of the St. Lucie cooling canal five-inch barrier net. A necropsy was performed on November 27, 2014 to determine the cause of mortality. The turtle mortality was determined causal to plant operations due to forced submersion. Notification to the NRC occurred on December 4, 2013, via FPL letter L-2013-328.

## 7.5 Figures and Tables

**Table 1**

PSL CTCS Ball Loss 2013 Summary

| | 1A1 | | 1A2 | | 1B1 | | 1B2 | | PSL 1 ALL | | Probable Causes of Ball Loss |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | # B/W | LOST | # B/W | LOST | # B/W | LOST | # B/W | LOST | # B/W | LOST | COMMENTS |
| | | | | | | | | | | | |
| **Jan-13** | 3 | 58 | 3 | 50 | 0 | -129 | 3 | 939 | 9 | 918 | 1B2 Algae intrusion |
| **Feb-13** | 4 | 29 | 4 | 20 | 4 | 509 | 4 | -396 | 16 | 162 | |
| **Mar-13** | 1 | 134 | 1 | 105 | 2 | 28 | 1 | -118 | 5 | 149 | |
| **Apr-13** | 4 | 59 | 3 | 47 | 5 | 274 | 0 | 0 | 12 | 380 | |
| **May-13** | 4 | 57 | 4 | -315 | 0 | 685 | 4 | 7 | 12 | 434 | 1B1 tube epoxy peel |
| **Jun-13** | 4 | 82 | 3 | 1775 | 2 | 522 | 4 | 22 | 13 | 2401 | 1A2 ball failure, 1B1 tube epoxy peel |
| **Jul-13** | 3 | 443 | 2 | 151 | 5 | 285 | 3 | 226 | 13 | 1105 | 1A1 ball failure,1B1 & 1B2 tube epoxy peel |
| **Aug-13** | 4 | 9 | 4 | 39 | 4 | 2292 | 1 | 339 | 13 | 2679 | High D/P, fouled by DFS 1B1 screen rupture |
| **Sep-13** | 2 | 218 | 2 | 31 | 4 | 292 | 4 | 90 | 12 | 631 | |
| **Oct-13** | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | |
| **Nov-13** | 0 | 0 | 0 | 0 | 2 | 49 | 2 | 9 | 4 | 58 | |
| **Dec-13** | 5 | 11 | 5 | 100 | 0 | 266 | 4 | 36 | 14 | 413 | 1B1 tube epoxy peel |
| | | | | | | | | | | | |
| **SUMMARY** | 34 | 1100 | 31 | 2003 | 28 | 5073 | 31 | 1154 | 124 | 9330 | |

| | 2A1 | | 2A2 | | 2B1 | | 2B2 | | PSL 2 ALL | | Probable Causes of Ball Loss |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | # B/W | LOST | # B/W | LOST | # B/W | LOST | # B/W | LOST | # B/W | LOST | COMMENTS |
| | | | | | | | | | | | |
| **Jan-13** | 0 | -7 | 0 | 4 | 0 | 80 | 0 | 81 | 0 | 158 | |
| **Feb-13** | 2 | 27 | 2 | 113 | 1 | 83 | 2 | 33 | 7 | 256 | |
| **Mar-13** | 3 | -9 | 4 | 23 | 4 | -85 | 1 | 117 | 12 | 46 | |
| **Apr-13** | 3 | 22 | 5 | 40 | 4 | 60 | 1 | 105 | 13 | 227 | |
| **May-13** | 4 | 86 | 4 | -28 | 4 | 18 | 5 | 45 | 17 | 121 | |
| **Jun-13** | 3 | 58 | 4 | -435 | 3 | 6 | 2 | 129 | 12 | -242 | |
| **Jul-13** | 5 | -9 | 3 | 755 | 4 | 13 | 4 | 74 | 16 | 833 | 2A2 Waterbox epoxy peel |
| **Aug-13** | 4 | 701 | 2 | 430 | 4 | 5 | 5 | 32 | 15 | 1168 | 2A1 ball failure, 2A2 Waterbox epoxy peel |
| **Sep-13** | 4 | 101 | 2 | 474 | 4 | 164 | 3 | 1315 | 13 | 2054 | 2A2 epoxy peel, 2B1 ball failure, 2B2 ball failure |
| **Oct-13** | 5 | 4 | 3 | 240 | 5 | 34 | 4 | 98 | 17 | 376 | 2A2 epoxy peel, 2B2 ball failure |
| **Nov-13** | 4 | -8 | 1 | 10 | 1 | -19 | 4 | 37 | 10 | 20 | |
| **Dec-13** | 5 | 151 | 5 | 31 | 0 | 0 | 4 | -13 | 14 | 169 | |
| | | | | | | | | | | | |
| **SUMMARY** | 42 | 1117 | 35 | 1657 | 34 | 359 | 35 | 2053 | 146 | 5186 | |