Florida Power & Light Company, 6501 S. Ocean Drive, Jensen Beach, FL 34957

FPL

April 27, 2006

L-2006-103
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
2005 Annual Environmental Operating Report

In accordance with Section 5.4.1.2 of the St. Lucie Units 1 and 2 Environmental Protection Plans (EPP), enclosed is the Annual Environmental Operating Report for the calendar year 2005.

Very truly yours,

Gordon L. Johnston
Acting Vice President
St. Lucie Plant

GLJ/KEF

Enclosure

IE25

FLORIDA POWER & LIGHT COMPANY

ST. LUCIE PLANT

ANNUAL ENVIRONMENTAL

OPERATING REPORT

2005

FPL

Nuclear Division

FLORIDA POWER & LIGHT COMPANY

JUNO BEACH, FLORIDA

QUANTUM RESOURCES, INC.

PALM BEACH GARDENS, FLORIDA

ENVIRONMENTAL OPERATING REPORT
TABLE OF CONTENTS

PART I

PART II

1.0 EXECUTIVE SUMMARY

1.1 INTRODUCTION

The St. Lucie Plant is an electric generating station on Hutchinson Island in St. Lucie County, Florida. The plant consists of two nuclear-fueled 850 net MWe units; Unit 1 was placed on-line in March 1976 and Unit 2 in April 1983. 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. This report primarily discusses environmental protection activities related to sea turtles as required by Subsection 4.2 of the EPP. Other routine annual reporting requirements are addressed in Part II.

1.2 TURTLE NESTING SURVEY

Since monitoring began in 1971, there have been considerable year-to-year fluctuations in sea turtle nesting activity on Hutchinson Island. However, data collected through 2005 have shown no long-term reductions in nesting on the island and power plant operation has had no significant effect on nesting near the plant. Low loggerhead nesting numbers for 2005 were possibly attributed to the cyclic nature of nesting observed over time. Low nesting activity in 1975 and again in 1981-1983 in the vicinity of the plant was attributed to nighttime construction activities associated with installation of plant intake and discharge structures. Nesting returned to normal or above normal levels following both periods of construction. During 1991, daytime construction activities associated with velocity cap repairs had no apparent effect on nesting. Formal requirements to conduct nesting surveys expired in 1986, but this program was continued through 1998 with agreement from federal and state agencies. In 1998, the continuation of the nesting survey program, as well as several other sea turtle protection activities, was mandated as part of the biological opinion and incidental take statement issued by the National Marine Fisheries Service (NMFS). An amendment to the Environmental Protection Plan was approved in 1999, which also included this

requirement. This requirement remained in place in accordance with the most recent biological opinion issued by NMFS in May 2001.

1.3 INTAKE CANAL MONITORING

Since plant operation began in 1976, 11283 sea turtles (including recaptures) representing five different species have been removed from the intake canal. The majority of the turtles captured (57.4%) were loggerheads. Variation in the number of turtles found during different months and years, including dramatic increases in green turtle captures in recent years, have been attributed primarily to natural variations in the abundance of turtles in the vicinity of the plant, rather than to operational influences of the plant itself. The majority of turtles removed from the intake canal (about 95%) were captured alive and released back into the ocean. Ongoing evaluations and improvements to the canal capture program have substantially reduced mortalities of entrapped sea turtles during recent years. Turtles confined between the barrier net and intake headwalls typically reside in the canal for a relatively short period prior to capture, and most are in good to excellent condition when caught. However, in recent years, fresh scrapes have been observed on over 70% of the sea turtles captured at the intake canal. These scrapes occur during transport into the canal system and are likely due to biofouling inside the intake pipe. In 2005, four green turtles and one loggerhead turtle sustained severe scrapes during transit through the pipes and were sent to rehabilitation facilities for treatment. Four of these turtles were treated and released, but one green turtle died at the rehabilitation facility as a direct result of injuries sustained during entrainment into the canal system. These five incidents were all considered causal to power plant operation and went against the take limit established by NMFS in the most recent Biological Opinion. Plans to inspect and clean the intake pipes are currently being evaluated by the power plant and are expected to be conducted in 2007.

A 5-inch mesh barrier net completed in January 1996 substantially reduced sea turtle residence times in the intake canal. However, during major influxes of seaweed and

jellyfish this net experienced design failure and caused mortalities. To prevent this problem, FPL constructed a new improved barrier net with additional structural support. Construction of this net was completed in November 2002. This improved design and new net material have withstood the seaweed and jellyfish events that caused previous design failure of the old barrier net. Additionally, dredging of the intake canal (completed in 2005) has reduced current velocities around the new barrier net. These actions have significantly reduced the potential for sea turtle mortalities in the plant's intake canal.

In correspondence relevant to the Incidental Take Statement of the May 2001 Biological Opinion there is language that turtle injuries or mortalities in the canal shall be counted against the take limit if they were causal to power plant operation. In response to this requirement, a qualified veterinarian is utilized to determine cause of death or injury in cases that are not readily apparent.

In 2005 there were four mortalities at the intake canal. One of these events was considered causal to power plant operation as a result of blunt trauma during transport through the intake pipe. The increased vigilance of the biological staff and the continued performance of the primary barrier net were directly responsible for a mortality rate of 0.44% in 2005; the fourth lowest in the program's history.

1.4 OTHER SEA TURTLE PROTECTION ACTIVITIES

As participants in the Sea Turtle Stranding and Salvage Network (STSSN), the biologist routinely respond to sea turtle strandings in St. Lucie and Martin Counties. During 2005, biologists responded to 15 sea turtle strandings. All stranding reports were sent to Florida Fish and Wildlife Conservation Commission (FFWCC).

In addition, FPL conducted 15 public service turtle walks during the 2005 nesting season. This program allowed 549 members of the public to be exposed to relevant

sea turtle protection issues and, in most cases, to actually view a nesting loggerhead sea turtle.

Collaborative efforts in 2005 included blood work analysis of turtles captured at the canal as part of a project with University of Florida to establish baseline blood parameters of sea turtles captured in the wild. Also in 2005, satellite tags were attached to large subadult green turtles as part of a project with University of Central Florida to track the movements of this rare size class of green turtle.

1.5 SECTION 7 CONSULTATION AND BIOLOGICAL OPINION

In 1999, FPL exceeded their anticipated incidental take limit established by the 1997 Biological Opinion (BO) set forth by NMFS. This required reinitiation of consultation under Section 7 of the Endangered Species Act. As part of this consultation, FPL, through Ecological Associates Inc., submitted a report entitled "Physical and Ecological Factors Influencing Sea Turtle Entrainment Levels at the St. Lucie Nuclear Power Plant: 1976-1998." NMFS received the report in March of 2000 and considered this new information when developing the new opinion. On May 4, 2001, NMFS issued its BO as part of the reinitiation of consultation subsequent to the 1997 BO.

In the new Opinion there were a number of changes, most importantly in the Incidental Take Statement. This, in summary, states that FPL will exceed their take limits for a calendar year if: more than 1000 sea turtles are captured, or more than 1% of the total number of loggerhead and green turtles (combined) are injured/killed causal to plant operation, or more than two Kemp's ridley sea turtles are injured/killed causal to plant operation, or if any hawksbill or leatherback sea turtles are injured/killed causal to plant operation. In a 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). If any of these events occur, reinitiation of a Section 7 consultation will be required.

2.0 INTRODUCTION

2.1 BACKGROUND

This document has been prepared to satisfy the requirements contained in Appendix B, Environmental Protection Plan for St. Lucie Unit 1 and 2 Facility Operating License No. DPR-67 and NPF-16, respectively.

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. Jurisdiction for sea turtle studies is with the NRC, which is considered to be the lead federal agency relative to consultation under the Endangered Species Act. Previous results dealing with sea turtle studies are contained in twenty two annual environmental operating reports covering the period from 1983 through 2004. This report describes the 2005 environmental protection activities related to sea turtles, as required by Subsection 4.2 of the St. Lucie Units 1 and 2 Environmental Protection Plans.

2.2 AREA DESCRIPTION

The St. Lucie Plant is located on a 457-hectare site on Hutchinson Island on Florida's East Coast (Figures 1 and 2). The plant is approximately midway between Ft. Pierce and St. Lucie Inlets. It is bounded on the East Side by the Atlantic Ocean and on the West Side by the Indian River Lagoon. Hutchinson Island is a barrier island that extends 36 km between inlets and attains its maximum width of 2 km at the plant site. 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 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 Florida Current, which flows parallel to the continental shelf margin, begins to diverge from the coastline at West Palm Beach. At Hutchinson Island, the current is approximately 33 km offshore. Oceanic water associated with the western boundary of the current periodically meanders over the inner shelf, especially during summer months.

2.3 PLANT DESCRIPTION

The St. Lucie Plant consists of two 850 net 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 (Figure 2). The intake structures are equipped with a velocity cap to minimize fish entrainment. 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 approximately 365 m offshore and 730 m north of the intake.

3.0 SEA TURTLE PROGRAM

3.1 INTRODUCTION

Hutchinson Island, Florida, is an important rookery for the loggerhead turtle, Caretta caretta, and also supports nesting of the green turtle, Chelonia mydas, and the leatherback turtle, Dermochelys coriacea. All three species are protected by state and

federal statutes. The federal government has classified the loggerhead turtle as a threatened species. The leatherback turtle and the Florida nesting population of the green turtle are listed by the federal government as endangered species. It has been a prime concern of FPL that the St. Lucie Plant would not adversely affect the Hutchinson Island rookery. Because of this concern, FPL has sponsored monitoring of marine turtle nesting activity on the island since 1971.

Daytime surveys to quantify nesting, as well as 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) were pre-operational. Though the power plant was not operating during 1975, St. Lucie Plant Unit No. 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. Construction had been completed and 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. During this study, four of the previously established 1.25 km-long survey areas were monitored. Additionally, eggs from turtle nests potentially endangered by construction activities were relocated.

Every year from 1981 through 2005, 36 one-km-long survey areas comprising the entire island were monitored seven days a week during the nesting season (Figure 3). Since the 1994 nesting season, the southern half of the island has been surveyed by Ecological Associates of Jensen Beach, Florida, and their data are included in this report. The St. Lucie Plant Unit 2 discharge structure was installed during the 1981 nesting season. Offshore and beach construction of the Unit 2 intake structure

proceeded throughout the 1982 nesting season and was completed near the end of the 1983 nesting season. Construction activities associated with installation of both structures were similar to those conducted when Unit 1 intake and discharge structures were installed. Eggs from turtle nests potentially threatened by construction activities were relocated.

During 1991, another 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. However, in contrast to previous offshore projects, 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 implemented in support of the project included caging of nests along a 1,500 m section of beach west of the platform and release of hatchlings to unaffected areas to the north and south. This plan was intended to mitigate any negative effects potentially resulting from required safety and navigational lighting on and near the platform.

Requirement 4.2.1 of the St. Lucie Unit 2 operating license Appendix B, Environmental Protection Plan, was complete with submission of the 1986 nesting survey data (ABI, 1987). The nesting survey was continued voluntarily through 1998 with agreement from federal and state agencies. In 1998, the continuation of the nesting survey program, as well as the participation in the Sea Turtle Stranding and Salvage Network and Public Service Turtle Walks were mandated as part of the Biological Opinion and Incidental Take Statement issued by the National Marine Fisheries Service. An amendment to the Environmental Protection Plan was approved in 1999, which included these requirements. Results of the 2005 nesting survey are presented in this report and discussed in relation to previous findings.

In addition to monitoring sea turtle nesting activities and relocating nests away from plant construction areas, removal of turtles from the intake canal has been an integral part of the St. Lucie Plant environmental monitoring program. 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 entrapped in the intake canal have been systematically captured, measured, weighed, tagged, and released.

Previous publications and technical reports have presented findings of the nesting surveys, nest relocation activities and canal capture program (ABI, 1994)(Quantum, 1995 - 2005). Results of studies to assess the effects of thermal discharges on hatchling swimming speed have also been reported (ABI, 1978). In July of 1994, responsibility for sea turtle research and conservation activities was transferred from Applied Biology, Inc. to Quantum Resources, Inc. Methodologies employed in both the nesting surveys and canal capture operations remained essentially unchanged so that data collected in 1994 through the present are directly comparable to previous year's data. The purpose of this report is to: 1) present 2005 sea turtle nesting survey data and summarize observed spatial and temporal nesting patterns since 1971, 2) document and summarize predation on turtle nests since 1971, and 3) present 2005 canal capture data and summarize comparable data collected since 1976.

3.2 MATERIALS AND METHODS

3.2.1 Nesting Survey

Methodologies used during turtle nesting surveys on Hutchinson Island are described in earlier reports (ABI 1994). In 2005, similar methods were used and surveys were designed to allow comparisons with these previous studies.

In 2005, only areas C-S were surveyed by the power plant sea turtle research group (Figure 3). Ecological Associates, Inc. surveyed areas A-C as part of a beach renourishment project south of Ft. Pierce inlet. Data from those areas as well as the south end of Hutchinson Island were supplied by Ecological Associates, Inc. and were used to provide whole island nesting totals in Figures 6, 8, and 9.

From mid-March 2005 through April 14, 2005, several preliminary nest surveys were conducted along Hutchinson Island in areas C-S. Seven leatherback nests were recorded in areas C-S prior to the beginning of formal nesting surveys on April 15, 2005. From April 15, 2005 through September 15, 2005, nest surveys were typically conducted on a daily basis. Biologists used all terrain vehicles to survey the island each morning. New nests, non-nesting emergences (false crawls), and nests destroyed by predators were recorded for each of the 1-km-long survey areas A - S (Figure 3).

Data collected from beach nesting surveys were reported to the Florida Fish and Wildlife Conservation Commission (FFWCC) as part of the FFWCC Index Nesting Beach Survey and the Statewide Nesting Beach Survey. In a cooperative effort, data from stranded turtles found during beach surveys were routinely provided to the FFWCC and the National Marine Fisheries Service (NMFS) through the Sea Turtle Stranding and Salvage Network.

3.2.2 Intake Canal Monitoring

Most turtles entrapped in the St. Lucie Plant intake canal were removed by means of large-mesh tangle nets fished near the intake canal headwalls at the extreme eastern end of the intake canal (Figure 2). Nets used during 2005 were from 30 to 40 m in length, 3 to 4 meters 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. Since its inception in 1976, the canal capture program has been under

continual review and refinement in an attempt to minimize both entrapment time and injuries/mortalities to entrapped sea turtles. Prior to April 1990, turtle 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). Additionally, 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 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 from nets and provided an opportunity to improve daily assessments of turtle levels within the canal. Records of daily canal observations were compared with capture data to assess capture efficiencies.

In 1978, a barrier net at the A1A bridge was constructed to confine turtles to the eastern most 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 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). There they were 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 during 1990 had effectively confined all turtles larger than 32.5 cm carapace length (28.7 cm carapace width) to the eastern end of the canal.

In response to the large numbers of small green turtles entrained at the intake canal in the 1990s, an improved design, small mesh barrier net was erected 150 meters east of the A1A barrier net in January 1996. This 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 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.

Formal daily inspections of the intake canal were made to determine the numbers, locations and species of turtles present. Surface observations were augmented with periodic underwater inspections, particularly in and around the barrier nets.

In 2005, methods to remove sea turtles from the intake canal included the use of tangle nets, dip nets and hand capture by free diving. 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 30 cm or less. Divers were employed to hand capture turtles whenever underwater visibility permitted. This technique has proven highly effective in the capture of turtles of all sizes, particularly less active individuals often found partially buried in the sediment in the vicinity of the barrier net. Hand capture efforts have had a significant impact in reducing entrapment times for turtles in the intake canal.

Regardless of capture method, all turtles removed from the canal were identified to species, measured, weighed, tagged and examined for overall condition (wounds, abnormalities, parasites, etc.). Beginning in July 1994, all turtles captured have been photographed dorsally and ventrally prior to release, and the photographs retained for future reference. Additionally, beginning in July 2001, Passive Integrated Transponder tags (PIT tags) were injected subcutaneously into the right front flipper of all captured turtles as outlined in the Biological Opinion issued by NMFS in May 2001. Healthy turtles were released into the ocean the same day of capture. Sick or injured turtles were treated and occasionally held for observation prior to release. When treatment was warranted, turtles were transported to an approved rehabilitation facility after consultation with FFWCC. Beginning in 1982, necropsies were conducted on all dead turtles found in fresh condition. Currently, all fresh dead turtles are held on ice for inspection and a necropsy is performed by a qualified veterinarian.

Beginning in July 2004, blood was drawn from all turtles captured at the canal as part of a collaborative effort with the University of Florida, the Marinelife Center of Juno Beach and the Clearwater Aquarium to catalog biochemical blood parameters for wild captured sea turtles. Due to the potential sample size collected at the power plant, this will be the largest database of sea turtle blood profiles ever compiled. These blood profiles are posted monthly on a website designed for this project by the University of Florida and will aid researchers, veterinarians and rehabilitation facilities.

Florida Power & Light Company and Quantum Resources, Inc., continued to assist other sea turtle researchers in 2005. Since the program began, data, specimens and/or assistance have been given to the FFWCC, National Marine Fisheries Service, US Fish and Wildlife Service, Marine Turtle Specialist Group, US Army Corps of Engineers, Smithsonian Institution, South Carolina Wildlife and Marine Resources Division, Center for Sea Turtle Research (University of Florida), Florida Atlantic University, University of Central Florida, Texas A & M University, University of Rhode Island, University of South Carolina, University of Illinois, University of Georgia, Virginia Institute of Marine Science, Duke University Marine Lab, Western Atlantic Turtle Symposium, South Atlantic Fishery Management Council, Florida Marine Fisheries Commission, Harbor Branch Oceanographic Institution and the National Research Council.

3.3 RESULTS AND DISCUSSION

3.3.1 Nesting Survey

Florida experienced the effects of four hurricanes during the 2005 sea turtle nesting season. All storms occurred during the latter part of the season and as a result destroyed many nests from storm surge and beach erosion. Hurricanes Katrina, Ophelia, Rita and Wilma all created conditions detrimental to late season nests and accounted for many of these nests to be lost.

3.3.1.1 2005 Loggerhead Nesting Summary

In 2005, 5291 loggerhead turtle nests were recorded in the 36 one-kilometer segments comprising Hutchinson Island. This figure marks the ninth lowest nest total recorded for Hutchinson Island since whole island surveys began. Despite recent years of below average loggerhead turtle nesting on Hutchinson Island, it is premature to predict whether this drop marks a significant decline in the population. This recent downward

trend in nest numbers may just be a reflection of the cyclic nature of loggerhead nesting observed over time (Figure 4).

3.3.1.2 Spatial Distribution of Loggerhead Turtle Nests

From 1981 through 2005, 36 one-km-long segments comprising the island's coastline have been surveyed. The distribution of nests among these 36 survey areas depicts an increase in nesting from north to south along the northern half of the island (ABI, 1987, 1994). Though beach dynamics may sometimes affect the selection of nesting sites by loggerhead turtles, relationships between spatial nesting patterns and specific environmental conditions are often difficult to establish.

Not all ventures onto the beach by a female turtle culminate 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) suggested that relatively high percentages of false crawls may reflect disturbances or unsatisfactory nesting beach characteristics. Therefore, certain factors may affect a turtle's preference to emerge on a beach, while other factors may affect a turtle's tendency to nest after it has emerged. An index that relates the number of nests to the number of false crawls in an area is useful in estimating the post-emergence suitability of a beach for nesting. In the present study this index is termed "nesting success" and is defined as the percentage of total emergences that result in nests (Figure 5).

Historically, the distribution of loggerhead emergences on the island has been consistent with the distribution of nests (ABI, 1987, 1994), with no difference in nesting success among areas. However, in recent years zones A through C have experienced lower nesting success due to beach renourishment activities conducted just south of Ft. Pierce Inlet. This temporary drop in nesting success has been reported at other renourished beaches throughout Florida (Steinite et al. 1998; Herren, 1999).

Reconstruction of the primary dune in survey zone "O" was completed by the power plant prior to the beginning of the 2005 sea turtle nesting season. Dune restoration projects such as this one were conducted in St. Lucie and Martin counties due to the widespread obliteration of primary dunes during the 2004 hurricane season. Some of these projects were more successful than others and despite the compact material and erosion problems associated with the FPL dune, nesting success was not noticeably different than unaffected survey zones to the north and south of the project area.

A variety of environmental factors (i.e., offshore bottom contours, distribution of reefs, type and extent of dune vegetation, and human activity on the beach at night) may affect loggerhead turtle emergence patterns and several have been reported to affect emergence patterns on Hutchinson Island (ABI, 1988, 1989). Undoubtedly, a combination of factors accounts for the overall distribution of emergences and therefore, the overall nesting pattern on the island.

Nesting surveys on Hutchinson Island were initiated in response to concerns that the operation of the St. Lucie Plant might negatively impact the local sea turtle rookery. Previous analysis, using log-likelihood tests of independence (G-test; Sokal and Rohlf, 1981) 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 construction. During 1991 when offshore construction was restricted almost entirely to daylight hours, nests were more abundant at the plant site than at the control site. Data collected through 2005 have shown that power plant operation exclusive of nighttime intake/discharge construction has had no apparent effect on nesting.

3.3.1.3 Long-Term Trends in Loggerhead Turtle Nesting

Various methods were used during surveys prior to 1981 to estimate the total number of loggerhead nests on Hutchinson Island based on the number of nests found in the nine 1.25 km-long survey areas (ABI, 1980a). Each of these methods was subsequently found to consistently overestimate island totals (ABI, 1987). Since whole-island surveys began in 1981, it has been possible to determine the actual proportion of total nests deposited in the nine areas. This has allowed extrapolation from the nine survey areas to the entire island for years 1981 to 2000. In 2001, these nine 1.25 km sections were abandoned and whole island surveys were conducted in the existing 36 one-kilometer segments.

From 1981 through 1993, the total number of nests in the nine areas ranged from 32.5 to 35.6 percent of the total number of nests on the island. This is slightly higher than the 31.3 percent that would be expected based strictly on the proportion of linear coastline comprised by the nine areas. Using the 13-year mean of 33.81 percent, estimates of the total number of nests on Hutchinson Island can be calculated by multiplying the number of nests in the nine areas by 2.958. This technique, when applied to the nine survey areas during the 13 years in which the entire island was surveyed, produced whole-island estimates within 5.3 percent of the actual number of nests counted. Since the proportion of nests recorded in the nine survey areas remained relatively constant over the last 13 years, this extrapolation procedure provides a fairly accurate estimate of total loggerhead nesting for years prior to 1981, and is used to generate data points for 1971 through 1979 in Figure 6.

It is clear that loggerhead nesting activity on 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. No relationships between annual fluctuations in nesting activity and power plant operation or intake/discharge construction were found.

3.3.1.4 Seasonal Patterns of Loggerhead Turtle Nesting

The loggerhead turtle nesting season usually begins between mid-April and early May, attains a maximum during June or July, and ends by mid-September (ABI, 1987). Nesting activity during 2005 followed this same pattern.

Cool water intrusions frequently occur over the continental shelf of southeast Florida during the summer (Smith, 1982). Typically these cold water upwelling events last less than a week and have little affect on overall nest numbers for the season. While these natural fluctuations in temperature have been shown to affect nesting patterns on Hutchinson Island, there has been no indication that power plant operation has had any affect on these temporal patterns (ABI, 1988).

3.3.1.5 Predation on Loggerhead Turtle Nests

Since nest surveys began in 1971, raccoon predation has been the leading cause of turtle nest destruction on Hutchinson Island. Researchers at other locations have reported raccoon predation levels as high as 70 to nearly 100 percent (Hopkins et al., 1979). Raccoon predation of loggerhead turtle nests on Hutchinson Island has not approached this level during any study year, though levels for individual 1.25 km-long areas have been as high as 80 percent. Overall predation rates for survey years 1971 through 1977 were between 21 and 44 percent, with a high of 44 percent recorded in 1973. A pronounced decrease in raccoon predation occurred after 1977, and overall predation rates for the nine areas have not exceeded 10 percent since 1979. A decline in predation rates on Hutchinson Island may be attributable to trapping programs, construction activities, habitat loss, and disease.

When compared to the previous two years, raccoon predation of loggerhead nests decreased in zones A through S in 2005 with a total of 50 nests depredated (Figure 7). The bulk of these raccoon predations occurred in areas O-Q and are thought to be

caused by a small number of animals. As in previous years (ABI, 1994), the predation of turtle nests was primarily restricted to the more undeveloped portions of the island.

Ghost crabs have been reported by numerous researchers as important predators of sea turtle nests (Hopkins et al, 1979; Stancyk, 1982). Though turtle nests on Hutchinson Island probably have been depredated by ghost crabs since nesting surveys began in 1971, quantification of ghost crab predation did not begin until 1983.

Overall predation rates by ghost crabs have varied from 0.1 to 2.1 percent from 1983-2005. During 2005, five loggerhead nests in areas A-S were depredated by ghost crabs (Figure 7). Nests destroyed by a combination of raccoon and ghost crab predation have been included as raccoon predations in previous discussions. When these combination predations are included as crab predations, the overall predation rates by ghost crabs range from 0.1 to 4.7 percent. During 2005, there were no such combination predations recorded. However, due to the cryptic nature of these predators, ghost crab predation in areas A-S is potentially much greater than what has been presented here.

3.3.1.6 <u>2005 Green and Leatherback Nesting Summary</u>

In 2005, 420 green turtle and 172 leatherback turtle nests were recorded in the 36 one-km segments comprising Hutchinson Island. On Hutchinson Island, green turtles have had alternating years of nesting; a high nesting year followed by a low nesting year (Figures 8). This bimodal pattern is also seen at other green turtle rookeries throughout their nesting range. The nesting total for green turtles in 2005 was the third highest since whole island surveys began and it could mark a shift from the alternating pattern seen in the past; odd years now becoming the higher nesting years. Leatherback nesting in 2005 was also the third highest since whole island surveys began and remains consistent with an overall increase in nesting activity seen by this species over the past 10 years (Figure 9). Although year to year fluctuations are common, the

general trend since 1971 reflects an increase in the number of nesting females of both species in the Hutchinson Island area.

3.3.1.7 Trends in Green and Leatherback Turtle Nesting

Green and leatherback turtles nest on Hutchinson Island, but in fewer numbers than loggerhead turtles. Prior to 1981, both survey (nine 1.25 km-long sections) and inter-survey areas were monitored for the presence of green and leatherback nests. Thirty-one kilometers of beach from area 1 south to the St. Lucie Inlet were included in that effort. During whole-island surveys from 1981 through 1993, only 2.6 percent (7) of the leatherback nests (n=266) and only 1.4 percent (12) of the green turtle nests (n=831) were recorded on the five kilometers of beach north of area 1. Therefore, previous counts of green and leatherback nests within the 31 kilometers surveyed probably were not appreciably different from total densities for the entire island. Based on this assumption, green and leatherback nest densities may be compared among all survey years, except 1980, when less than 15 kilometers of beach were surveyed.

Since surveys began in 1971, the number of nests observed on the island has ranged from five to 502 for green turtles and from one to 232 for leatherbacks (Figures 8 and 9). Temporal nesting patterns for these species differ from the pattern for loggerhead turtles. Green turtles typically nest on Hutchinson Island from mid-June through the first or second week of September. Leatherback turtles usually begin nesting in March or April and continue to nest through early to mid-July. Considerable fluctuations in green turtle nesting on the island have occurred among survey years (Figure 8). This is not unusual since there are drastic year-to-year fluctuations in the numbers of green turtles nesting at other breeding grounds (Carr et al., 1982). Despite these fluctuations, data collected through 2005 suggest an overall increase in nesting since 1971 and may reflect an increase in the number of nesting females in the Hutchinson Island area. Previous surveys have shown that green turtles nested in greater numbers along the southern half of the island, however this was not the case during the 2005 nesting

season in which there were a greater number of nests found along the northern half of Hutchinson Island.

Leatherback turtle nest numbers for 2005 represent another above average year and are consistent with an increase in nesting densities on Hutchinson Island during recent years (Figure 9). This increase in leatherback nesting has not only been reported for Hutchinson Island, but for nesting beaches to the north and south and may reflect an overall increase in the number of nesting females on the Atlantic coast of Florida.

3.3.2 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 (ABI, 1980b and 1986). 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 pipes before they encounter current velocities sufficiently strong enough to entrain them. Consequently, a turtle's entrapment relates primarily to the probability that it will detect and subsequently enter one of the intake structures.

3.3.2.1 <u>2005 Canal Capture Summary</u>

In 2005, 917 sea turtles were captured in the intake canal of the St. Lucie Plant. Captures included 426 green turtles, 486 loggerheads, two hawksbills, and three Kemp's ridley's (Table 1).

3.3.2.2 Relative Abundance and Temporal Distribution

Since intake canal monitoring began in May 1976, 6482 loggerhead (including 483 recaptures), 4686 green (including 1469 recaptures), 30 leatherback, 42 Kemp's Ridley and 43 hawksbill turtle captures have taken place at the St. Lucie Plant. Annual catches for all species combined ranged from a low of 33 in 1976 (partial year of plant operation and monitoring) to 944 in 2003.

Historically loggerheads have been the most abundant species in the canal. Since 1977, the first full year of plant operation, the number of loggerheads captured each year ranged from 62 in 1981 to 624 in 2004 (Figure 10). Numbers have exhibited considerable year-to-year fluctuations, but recent figures show a significant increase in loggerhead capture rates at the intake canal.

The number of green turtles captured each year since 1977 have ranged from 3 in 1979 to a record high of 673 in 1995 (Figure 10). The increasing number of captures over recent years suggests that there has been an increase in the number of turtles inhabiting the shallow coastal reefs adjacent to the power plant's offshore intake structures. Additional years of capture data will be required before any long-term trends can be established, but clearly there has been an increase in green turtle captures over the past 10 years when compared to the previous years of this program.

During 2005, the monthly catch of loggerheads ranged from 5 (November and December) to 124 (July), with a monthly mean of 40.5 (Table 2). Over the entire history of the capture program, monthly catches have ranged from 0 to 133, with the greatest number of captures occurring during March 2004. Overall, a record number of loggerheads were captured during 2004, which exceeded the previous record in 2003 by nearly 100.

During 2005, the monthly catch of green turtles ranged from 16 (December) to 59 (May), with a monthly mean of 35.5 (Table 3). The March 1996 catch of 147 green turtles is the largest number of captures, for any species, for any month on record. In the past, seasonal abundance patterns of green turtles have typically been much more pronounced than for loggerheads, with over 50 percent of all captures occurring between January and March. From 1995 through 2005, this seasonal pattern was less defined, with captures distributed more evenly throughout the year.

Captures of leatherback, hawksbill, and Kemp's Ridley turtles have been infrequent and scattered throughout the years. Each species has shown rather pronounced seasonal occurrences; over 60 percent of all leatherbacks were captured in March and April, over 60 percent of the hawksbills were captured between July and September, and almost 90 percent of the Kemp's Ridley turtles were caught between December and April.

3.3.2.3 Size-Class Distributions

The size class distribution for loggerheads removed from the intake canal in 2005 is presented in Figure 11. The size class distribution for green turtles removed from the intake canal in 2005 are presented in Figure 12. The size of the two hawksbills captured in 2005 were 69.3 and 68.3 cm SCL. The size of the three Kemp's ridley's captured in 2005 ranged between 24.3 and 35.4 cm SCL. .

3.3.2.4 Sex Ratios

Of the 486 loggerheads captured in 2005 for which straight line carapace lengths are available, 266 were juveniles with a straight line carapace length (SLCL) less than or equal to 70 cm, 133 were adults (SLCL $\geq$ 85 cm) and 87 were transitional (SLCL 70-85 cm) (Hirth, 1980). The latter group probably includes both mature and immature individuals. Of the 133 turtles classified as adults for whom sex was recorded, 125 were females and eight were males, with females predominating by a ratio of 16:1.

Of the 426 green turtles captured in 2005 for which straight line carapace lengths are available, 386 were juveniles or sub-adults (SLCL < 83 cm) and 40 were adults (SLCL > 83 cm) (Whitherington and Ehrhart, 1989). Of the 40 individual adult green turtles where sex was noted, 17 were female and 23 were male; a male biased ratio of 1.35:1. The number of adult green turtles captured at the intake canal in 2005 accounts for almost 40% of the total number of adult green turtles captured during the program's history. ABI (1994) discusses sex ratio data for previous years for both species mentioned here.

3.3.2.5 Capture Efficiencies

Netting methodologies have been under continual review and refinement as net materials, configurations, and placement have been varied in an effort to minimize sea turtle entrapment times. Additionally, alternative capture techniques have been evaluated, and potential deterrent systems tested in the laboratory. Current capture procedures have proven to provide a safe, efficient, and cost-effective program for removing entrapped turtles from the intake canal.

Formal daily inspections of the intake canal are conducted every day that capture nets are deployed, and the number, location and relative size of entrapped turtles are recorded on field observation forms. Better utilization of currents and eddies, adjustments to tethering lines, multi-net deployments and increased efforts to hand capture turtles have contributed to reduced entrapment times during recent years.

Entrapment times may be extended for turtles swimming past the A1A barrier net (ABI, 1987). Because capture efforts west of the A1A bridge were generally less effective than those near the intake headwalls, most turtles breaching the A1A barrier net were not caught until they entered the intake wells of Units 1 and 2. The new primary barrier

net, with few exceptions, has performed as designed and effectively confined sea turtles to the eastern 200 meters of canal.

Because of their relatively small sizes, virtually all turtles reaching the intake wells are green turtles. During 2005, seven of the 426 green turtle captures (1.6%) occurred at the intake wells. The substantial decrease in the percentage of captures at the plant intake wells compared to the 1995 figure of 14.5 percent is attributed to the effectiveness of the primary 5-inch barrier net, which was installed in November 2002. This net has better support structures, stronger mesh material and should further reduce the percentage of turtles captured at the intake wells.

During 2005, 99.2 percent of all turtles entrapped in the canal were captured east of the A1A bridge, 847 by tangle nets, 39 by dipnets and 17 by hand capture. The effective confinement of turtles east of A1A has been a major contributor to the high capture efficiency achieved during recent years. The installation of the improved barrier net in November 2002 continues to increase capture efficiency by more effectively confining turtles of all sizes to an even smaller area, closer to the headwalls.

3.3.2.6 Barrier Net Maintenance

Barrier net maintenance is critical in reducing the opportunity for mortalities in the plant intake well area and in reducing residence times for turtles in the intake canal system. Daily inspections are performed from a small boat to remove floating debris and to repair holes near or at the water surface. A formal inspection is conducted quarterly, including hole repair, debris removal, and airlift dredging of accumulated silt if needed. Maintenance conducted in 2005 included the repair of any holes in the mesh discovered during the daily and quarterly inspections and removal of any debris. During 2005, the primary barrier net was not lowered below the surface of the water, thus eliminating the potential for turtles to move further down the canal system.

3.3.2.7 Relative Condition

Turtles captured alive in the intake canal of the St. Lucie Plant were assigned a relative condition based on weight, activity, parasite infestation, barnacle coverage, injuries and any other abnormalities which might affect overall vitality. During 2005, 91.2% (443) of all loggerheads found in the canal were alive and in good condition. Only 8.4% (41) of all loggerheads involved individuals in fair or poor condition and 0.4% (2) were found dead. Of the 426 green turtles removed from the intake canal during 2005, 97.2% (414) were in good condition, 2.6% (11) were in fair or poor condition and 0.2% (1) were found dead. Conditions for all other sea turtles captured at the intake canal in 2005 were categorized as good.

Relative condition ratings can be influenced by a number of factors, some related and others unrelated to entrainment and/or entrapment in the intake canal. A rating of good indicates that turtles have not been negatively impacted by their entrapment in the canal, at least as evidenced by physical appearance. Although ratings of fair or poor imply reduced vitality, the extent to which entrainment and entrapment is responsible is often indeterminable. In some instances, conditions responsible for lower ratings, such as boat collision or fisheries gear entanglement obviously were sustained prior to entrainment. However, in recent years turtles have been found with fresh scrapes and cuts, incurred during entrainment, which in some cases have had a negative effect on their relative condition rating. Of the 917 turtles removed from the intake canal during 2005, 691 (75%) were observed having fresh cuts and scrapes.

Of the 914 live removals during 2005, 885 were released into the ocean on the day of capture. Twenty-one loggerheads and eight green turtles in obvious ill health or suffering serious injuries were transported to either Sea World of Florida, the Marinelife Center of Juno Beach, the Turtle Hospital in Marathon, or to Clearwater Aquarium for treatment and rehabilitation. Fourteen green turtles and two loggerheads with fibropapilloma tumors were captured and released from the canal in 2005.

3.3.2.8 Mortalities and Injuries

Sea turtle mortalities have been closely monitored throughout the life of the canal capture program in an attempt to assign probable causes and take appropriate remedial action to minimize future occurrences. Previous analyses of capture data identified drowning in nets (A1A barrier net, UIDS barrier, and tangle nets), drowning in the intake pipes during periods of reduced intake flow, injuries sustained from dredging operations and injuries sustained from the mechanical rakes used in the intake wells as probable mortality factors (ABI,1987)(FPL, 1995). Although difficult to quantify, the entrapment and subsequent demise of injured or sick turtles has probably accounted for a portion of observed mortalities, yet recent improvements to the primary barrier net have significantly reduced this possibility.

Over the entire monitoring program's history, 144 (2.2%) of the 6482 loggerheads and 69 (1.1%) of the 4686 green turtles entrapped in the canal were found dead. Mortalities spanned the range of size classes for loggerheads (SLCL = 47.5-103.0 cm), while all green turtle mortalities involved juveniles less than 48 cm in length. The four Kemp's Ridley mortalities documented at the plant during 1987 and 1988 were the only deaths for this species to date; no dead leatherback or hawksbill turtles have ever been recovered at the St. Lucie Plant.

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, expressed as the percentage of total captures involving dead animals, declined from 7.8 percent during the period 1976-1984 to 1.8% percent since 1984, and less than 1.0% since 1990 (Table 1).

In 2005, four mortalities were recorded at the St. Lucie power plant intake canal; two loggerheads and two green turtles. One of these mortalities was considered causal to

power plant operation. On July 9, a male green turtle sustained head and eye injuries during transit through the intake pipe. The turtle was transported to a rehabilitation facility by FFWC personnel where it later died on July 10. A necropsy was performed on July 11 by University of Florida (College of Veterinary Medicine) where it was determined that a large subdural hematoma was present over the cerebrum and olfactory region. This finding indicates that traumatic injury to the head sustained during transit through the intake pipe contributed to the turtles demise. Otherwise, this turtle appeared to be in good general health. This mortality was causal to power plant operation and went against the take limit established under the current Section 7 Biological Opinion set forth by NMFS.

There were three mortalities that were considered non-causal to power plant operations. The first event occurred on May 19 where an adult female loggerhead turtle was found moderately decomposed at the top of the primary barrier net. There was no evidence of any injury or abnormality and this turtle was observed by biologists floating down the canal before it was retrieved from the barrier net. This would indicate that the turtle was entrained in the decomposing state in which it was found. A second event occurred on June 9 where a juvenile green turtle was found at the surface of the primary barrier net. The turtle was found to be underweight with no other obvious injury or abnormality. A necropsy was performed and based on forensic evidence, the cause of death was drowning. However, this turtle had a serious underlying disease due to bacterial hepatitis and sepsis which compromised it both in its natural environment and at the power plant. A third event occurred on July 27 where a severely decomposed sub-adult loggerhead was found at the surface of the primary barrier net. The turtle was too decomposed to definitively give an explanation to the cause of death. Despite these mortality incidents, the overall mortality rate for 2005 was 0.44% and the fourth lowest in the program's history.

Injuries causal to power plant operation are recorded and go against the take limit established in the Biological Opinion set forth by NMFS. In 2005 four turtles (one

loggerhead and three green turtles) with injuries causal to power plant operation were recorded. All of these causal injuries were related to transit through the intake pipes. Once again this underscores the need for corrective action to alleviate this recurring problem and to ensure the vitality of sea turtles entrained into the power plant's intake canal system.

In 1999, FPL exceeded their anticipated incidental take limit established by the 1997 Biological Opinion (BO) set forth by NMFS. This required reinitiation of consultation under Section 7 of the Endangered Species Act. As part of this consultation FPL, through Ecological Associates Inc., submitted a report entitled "Physical and Ecological Factors Influencing Sea Turtle Entrainment Levels at the St. Lucie Nuclear Power Plant: 1976-1998." NMFS received the report in March 2000 and considered this new information when developing the new Opinion. On May 4, 2001, NMFS issued it's BO as part of the reinitiation of consultation subsequent to the 1997 BO. In the new Opinion, there were a number of changes, most importantly in the Incidental Take Statement. This in summary, stated that FPL will exceed their take limits for a calendar year if: more than 1000 sea turtles are captured, or 1% or more of the total number of loggerhead and green turtles (combined) are injured or killed causal to plant operation, or more than two Kemp's Ridley sea turtles are injured or killed causal to plant operation, or if any Hawksbill or leatherback sea turtles are injured or killed causal to plant operation. In a case where 1% of the combined loggerhead and green turtle captures are not a whole number, it is rounded up (e.g. 520 combined captures = take limit of 6). If any of these events occur, reinitiation of a Section 7 consultation will be required. In 2005, four injuries and two mortalities were considered causal to power plant operation and went against the take limit described above.

3.3.2.9 Recapture Incidents

Since the St. Lucie Plant capture program began, most turtles removed from the intake canal have been tagged and released into the ocean at various locations along 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, 1952 recapture events (483 loggerheads and 1469 green turtles) have occurred, and a number of turtles have been recaptured more than once. The recapture rate for green turtles in 2005 was 46.5% and the recapture rate for loggerheads was 7.2%. The large number of green turtle recaptures probably reflects the saturation of the local green turtle aggregation by turtles tagged at the St. Lucie Plant. Occasionally, turtles are captured that have been tagged by other researchers. There were seven such captures in 2005 including five loggerheads and two green turtles. A majority of these turtles were originally tagged by the University of Central Florida Marine Turtle Research Team at study sites in the Archie Carr Wildlife Refuge. However, one green turtle captured at the power plant was originally tagged off the West Coast of Bermuda by a joint project between the Bermuda Aquarium, FFWCC and the Caribbean Conservation Corporation (CCC). This turtle was sent to a rehabilitation facility due to rope protruding from the cloaca and upon its return was fitted with a satellite tag and tracked to the Abaco islands in the Bahamas. Another capture involved a loggerhead that was originally tagged by Inwater Research Group in Mooney Harbor in the Marquesas Keys. Additionally, eleven loggerheads and one green turtle originally tagged and released at the power plant were later found by other researchers as far away as Virginia .

3.3.3 OTHER SEA TURTLE PROTECTION ACTIVITIES

As participants in the Sea Turtle Stranding and Salvage Network (STSSN), biologists routinely respond to sea turtle strandings in St. Lucie and Martin Counties. During 2005, biologists responded to 15 sea turtle strandings. All stranding reports were sent to Florida Fish and Wildlife Conservation Commission (FFWCC).

In addition to stranding efforts, FPL conducted 15 public service turtle walks during the 2005 nesting season. This program allowed members of the public to be exposed to relevant sea turtle protection issues and, in most cases, to actually view a nesting loggerhead sea turtle.

3.3.4 SUMMARY

A gradient of increasing loggerhead turtle nest densities from north to south along the northern half of Hutchinson Island has been shown during most survey years. This gradient may result from variations in beach topography, offshore depth contours, distribution of nearshore reefs, onshore artificial lighting, and human activity on the beach at night. Low nesting activity in the vicinity of the power plant during 1975 and from 1981 through 1983 was attributed to nighttime construction activities associated with installation of power plant intake and discharge structures. Nesting returned to normal or above normal levels following both periods of construction. During 1991, daytime construction activities associated with velocity cap repairs had no apparent effect on nesting. Statistical analyses indicate that power plant operation, exclusive of nighttime construction, has had no significant effect on nest densities near the plant.

In 2005, conditions generated by four hurricanes in Florida directly and negatively affected late season nests on Hutchinson Island. During the 2005 nesting season 5291 loggerhead turtle nests were recorded on Hutchinson Island. This marks the ninth lowest number of nests ever recorded since whole island surveys began. There have been considerable year-to-year fluctuations in loggerhead nesting activity on Hutchinson Island from 1971 through 2005. These fluctuations are common at other rookeries and may result from non-annual reproductive behavior. However, no relationship between total nesting on the island and power plant operation or intake/discharge construction has been indicated by past studies.

Temporal nesting patterns of the Hutchinson Island population may be influenced by natural, large scale fluctuations in water temperature, such as those produced by the cool water intrusions that frequently occur over the continental shelf of southeast Florida during the nesting season. However, localized fluctuations in water temperature associated with power plant operation have had no apparent effect on nesting.

Since nesting surveys began in 1971, raccoon predation has been the leading cause of turtle nest destruction on Hutchinson Island. From 1971 through 1977, overall predation rates in the nine survey areas were between 21 and 44 percent. However, a pronounced decrease in raccoon predation occurred after 1977, and overall predation rates in the nine survey areas have not exceeded 10 percent since 1979. In 2005, raccoon predation was predominantly found in areas O-Q and overall predation rates for areas A-S were still well below 10 percent. Ghost crab predation of turtle nests on Hutchinson Island remained low in 2005, however due to their cryptic nature, ghost crab predation may be more significant than previously documented.

During 2005, 420 green turtle and 172 leatherback turtle nests were recorded on Hutchinson Island. Nesting activity by these two species has exhibited considerable annual fluctuations, as has been recorded at other rookeries, but has remained relatively high during recent years. This may reflect an overall increase in the number of nesting green and leatherback turtles in the Hutchinson Island area.

During 2005, 486 loggerheads, 426 green turtles, three Kemp's Ridley and two hawksbills were removed from the St. Lucie Plant intake canal. Since monitoring began in May 1976, 6482 loggerheads, 4686 greens, 30 leatherbacks, 43 hawksbills and 42 Kemp's ridley's have been captured and tagged. Over the life of the monitoring program, annual catches for loggerhead turtles have ranged from 33 in 1976 (partial year of plant operation and monitoring) to a high of 624 in 2004. Yearly catches of green turtles have ranged from 0 in 1976 to 673 in 1995. Differences in the number of turtles entrapped during different years and months are attributed primarily to natural

variation in the occurrence of turtles in the vicinity of the offshore intake structures, rather than to plant operation characteristics.

Size-class distributions of loggerhead turtles removed each year from the canal have consistently been predominated by juveniles between 50 and 70 cm in straight line carapace length. Over 65 percent of all green turtles entrapped in the canal were juveniles 45 cm or less in length. For both species, the largest number of captures for all years combined occurred during winter. These seasonal peaks have generally been more pronounced for green turtles, but since 1995, green turtle captures have tended to be distributed more evenly throughout the year. The sex ratio of adult loggerheads caught in the canal continued to be biased towards females.

During 2005, over 93 percent of all loggerheads and green turtles removed from the canal were categorized by physical appearance as being in good condition. However, fresh scrapes incurred during transport through the intake pipe have increasingly been noted on the carapace and soft tissue of captured sea turtles. Some these injuries are severe and have resulted in causal events reportable to the NRC. Once in the canal, turtles confined east of the new barrier net had very brief residency times. Thus, the relative condition of most turtles was not affected by their entrapment.

During 2005, four mortalities were recorded in the intake canal. Two of these mortalities and four injuries sustained by turtles during entrainment were determined to be causal to power plant operation. Given the regulations outlined in the current Biological Opinion, the take level in 2005 fell short of the established limits and reinitiation of a Section 7 Consultation was not warranted. Program modifications, including continual surveillance of tangle nets during periods of deployment, improvements to the integrity of the barrier net system and greater effort to hand capture turtles have contributed to a substantial decline in sea turtle mortalities during recent years. The design and construction of an improved barrier net completed in January 1996 was expected to reduce mortalities and entrapment times for turtles in the intake canal. Data since then

indicate that the new barrier net configuration has been highly effective in excluding turtles from the plant intake wells, but has not been as effective in reducing the overall mortality rate as anticipated. Improvements to the barrier net design, including stronger mesh material, additional support structures, and dredging of the canal east of A1A were completed in November 2002. Additional dredging associated with the aftermath of the 2004 hurricane season was completed in 2005. These improvements and modifications have significantly reduced the potential for sea turtle mortality.

4.0 LITERATURE CITED

ABI (Applied Biology, Inc.), 1978, Ecological monitoring at the Florida Power & Light Co. St. Lucie Plant, annual report 1977, Volumes I and II, AB-101, Prepared by Applied Biology, Inc. for Florida Power & Light Co., Miami.

1980a, Florida Power & Light Company, St. Lucie Plant annual non-radiological environmental monitoring report 1979, Volumes II and III, Biotic monitoring, AB-244, Prepared by Applied Biology, Inc. for Florida Power & Light Co., Miami.

1980b, Turtle entrainment deterrent study, AB-290, Prepared by AppliedBiology, Inc. for Florida Power & Light Co., Miami.

1986, Florida Power & Light Company, St. Lucie Unit 2 annual environmental operating report 1985, AB-563, Prepared by Applied Biology, Inc. for Florida Power & Light Co., Juno Beach.

1987, Florida Power and Light Company, St. Lucie Unit 2 annual environmental operating report 1986, AB-579, Prepared by Applied Biology, Inc. for Florida Power & Light Co., Juno Beach.

1988. Florida Power & Light Company, St. Lucie Unit 2 annual environmental operating report 1987, AB-595, Prepared by Applied Biology, Inc. for Florida Power & Light Co., Juno Beach.

1989, Florida Power & Light Company, St. Lucie Unit 2 annual environmental operating report 1988. AB-596. Prepared by Applied Biology, Inc. for Florida Power & Light co., Juno Beach.

1994, Florida Power & Light Company, St. Lucie Unit 2 annual environmental monitoring report, AB-631, Prepared by Applied Biology, Inc., for Florida Power & Light Co., Juno Beach.

Carr, A., A. Meylan, J. Mortimer, K. Bjorndal and T. Carr, 1982, Surveys of sea turtle populations and habitats in the Western Atlantic, NOAA Technical Memorandum NMFS-SEFC-91:1-82.

Davis, G.E., and M.C. Whiting, 1977, Loggerhead sea turtle nesting in Everglades National Park, Florida, USA, Herpetologica 33:18-28.

Ecological Associates Inc. 2000, Physical and Ecological Factors influencing Sea Turtle Entrainment Levels at the St. Lucie Power Plant 1976-1998, Submitted to FPL.

FPL, 1995, Assessment of the impacts of the St. Lucie Nuclear Generating plant on sea turtle species found in the inshore waters of Florida, Florida Power and Light Co., Juno Beach, FL.

Herren, R. M., 1999, The effect of beach renourishment on loggerhead (Caretta caretta) nesting and reproductive success at Sebastian Inlet, Florida, M.S. thesis University of Central Florida. 148pp.

Hirth, H.F., 1980, Some aspects of the nesting behavior and reproductive biology of sea turtles, American Zoologist 20:507-523.

Hopkins, S.R., T.M. Murphy, Jr., K.B. Stansell and P.M. Wilkinson, 1979, Biotic and abiotic factors affecting nest mortality in the Atlantic loggerhead turtle, Proceeding Annual Conference of Southeastern Fish and Wildlife Agencies 32:213-223.

Quantum Resources Inc., 1995, Florida Power and Light Co., St. Lucie Unit 2 Annual Environmental Operating Report 1994, Prepared by Quantum Resources Inc. for Florida Power and Light Company, Juno Beach, FL.

1996, Florida Power and Light Co., St. Lucie Unit 2 Annual Environmental Operating Report 1995, Prepared by Quantum Resources Inc, For Florida Power and Light Company, Juno Beach, FL.

1997. Florida Power and Light Co., St. Lucie Unit 2 Annual Environmental Operating Report 1996, Prepared by Quantum Resources Inc., For Florida Power and Light Company, Juno Beach, FL.

1998. Florida Power and Light Co., St. Lucie Unit 2 Annual Environmental Operating Report 1997, Prepared by Quantum Resources Inc.for Florida Power and Light Company, Juno Beach, FL.

1999. Florida Power and Light Co., St. Lucie Unit 2 Annual Environmental Operating Report 1998, Prepared by Quantum Resources Inc. for Florida Power and Light Company, Juno Beach, FL.

2000. Florida Power and Light Co., St. Lucie Unit 2 Annual Environmental Operating Report 1998, Prepared by Quantum Resources Inc. for Florida Power and Light Company, Juno Beach, FL.

2001. Florida Power and Light Co., St. Lucie Unit 2 Annual Environmental Operating Report 1998, Prepared by Quantum Resources Inc. for Florida Power and Light Company, Juno Beach, FL.

2002. Florida Power and Light Co., St. Lucie Unit 2 Annual Environmental Operating Report 1998, Prepared by Quantum Resources Inc. for Florida Power and Light Company, Juno Beach, FL.

2003. Florida Power and Light Co., St. Lucie Unit 2 Annual Environmental Operating Report 1998, Prepared by Quantum Resources Inc. for Florida Power and Light Company, Juno Beach, FL.

2004. Florida Power and Light Co., St. Lucie Unit 2 Annual Environmental Operating Report 1998, Prepared by Quantum Resources Inc. for Florida Power and Light Company, Juno Beach, FL.

Smith, N.P., 1982, Upwelling in Atlantic shelf waters of south Florida, Florida Scientist 45(2):125-138.

Sokal, R.R. and F.J. Rohlf, 1981, Biometry, The principles and practice of statistics in biological research, S.H. Freeman and Company, San Francisco, 859 pp.

Stancyk, S.E., 1982. Non-human predators of sea turtle and their control, Pages 139-152 in Bjorndal, K.A., ed. Biology and Conservation of Sea Turtles. Smithsonian Institution Press, Washington, D.C.

Steinite, M. J., M. Salmon and J. Wyneken. 1998. Beach renourishment and loggerhead turtle reproduction: A seven year study of Jupiter Island, Florida. Journal of Coastal Research. 14(3):1000-1013.

Witherington, B.E. and L.M. Ehrhart, 1989. Status and reproductive characteristics of green turtles (Chelonia mydas) nesting in Florida. Pages 351-352 in Ogren, L., F. Berry, K. Bjorndal, H. Kumpf, R. Mast, G. Medina, H. Reichart and R. Witham, editors. Proceeding of the Second Western Atlantic Turtle Symposium, Mayaguez, Puerto Rico, 12-16 October 1987. NOAA Technical Memorandum NMFS-SEFC-226.

Witzell, W.N. 1983. Synopsis of Biological Data on the Hawksbill Turtle Eretmochelys imbricata (Linnaeus, 1766). FAO Fisheries Synopsis, 137: 1-78.

5.0 FIGURES

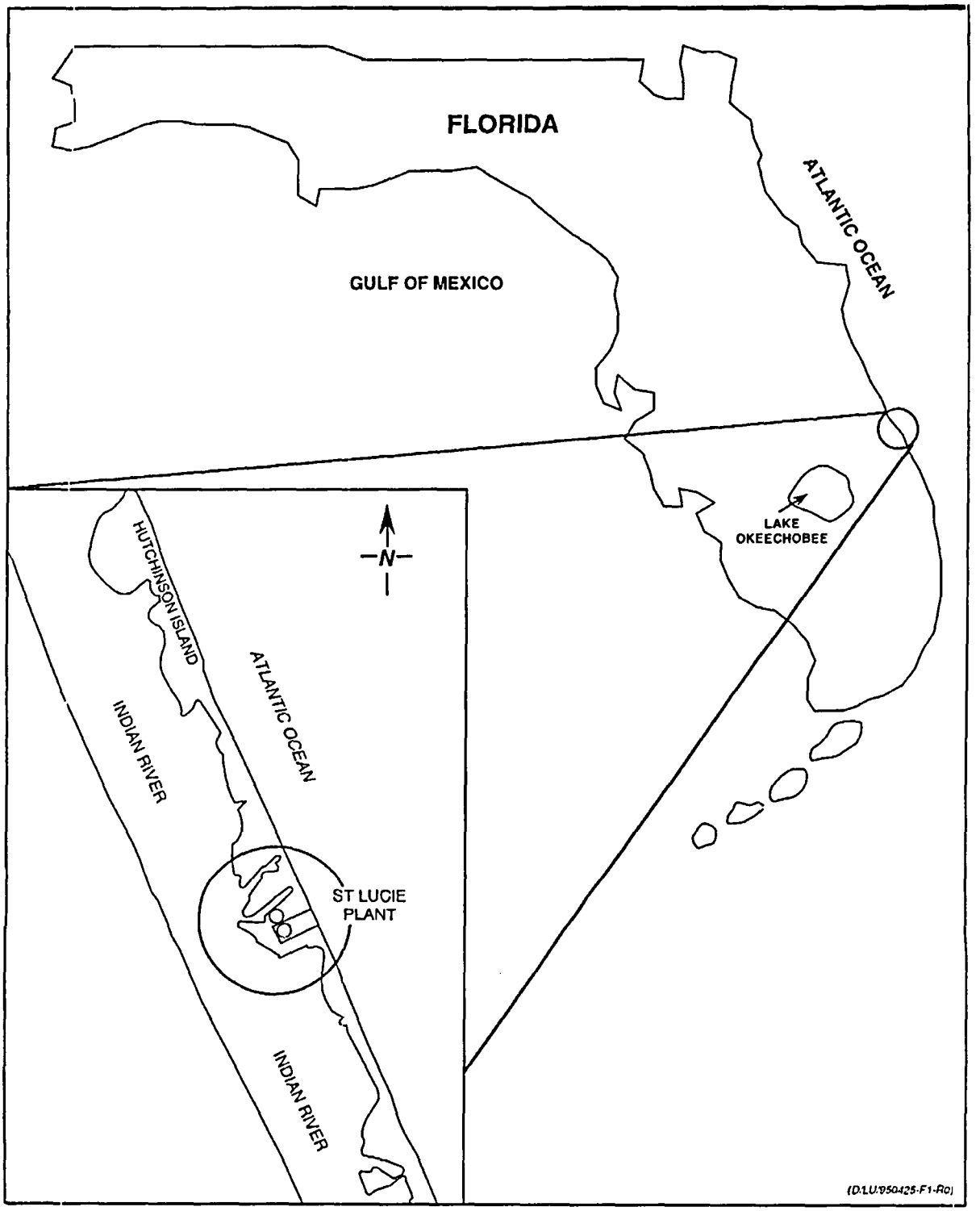

Figure 1. Location of St. Lucie Plant on Hutchinson Island, Florida.

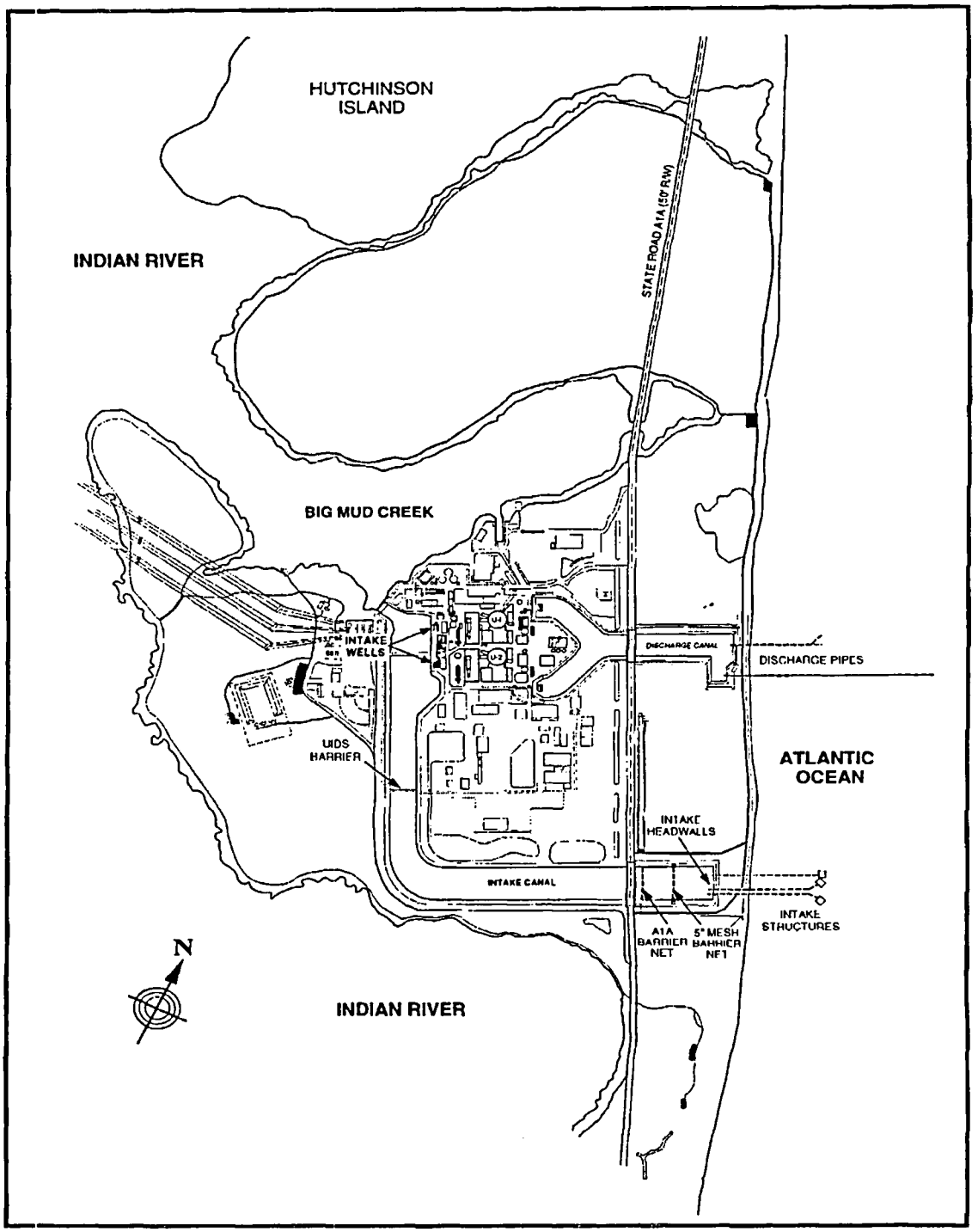

Figure 2. St. Lucie Plant Cooling Water Intake and Discharge System

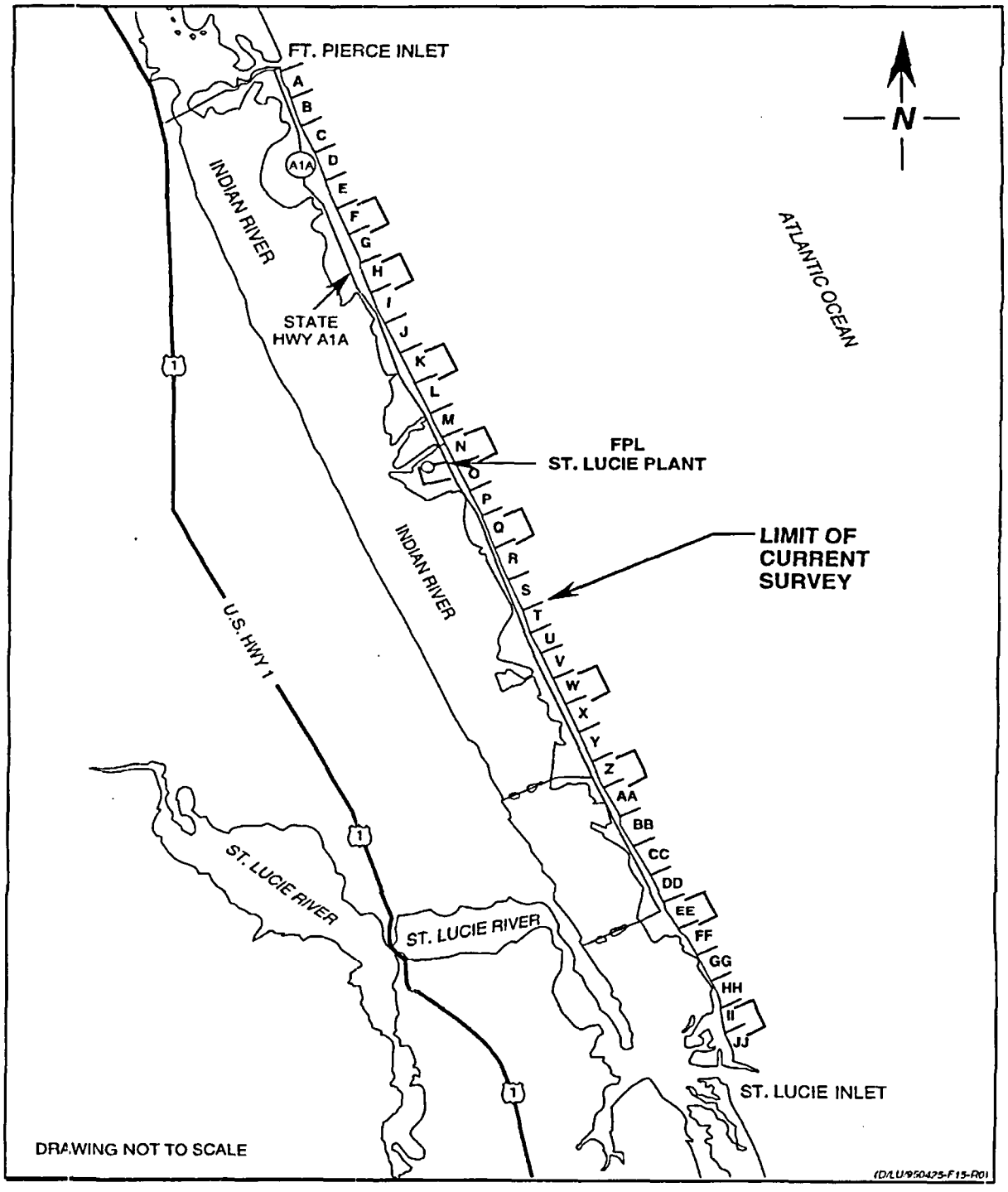

Figure 3. Designation and Location of Nine 1.25-Km Segments and thirty-six 1-Km Segments Surveyed for Sea Turtle Nesting, Hutchinson Island. 1971-2005.

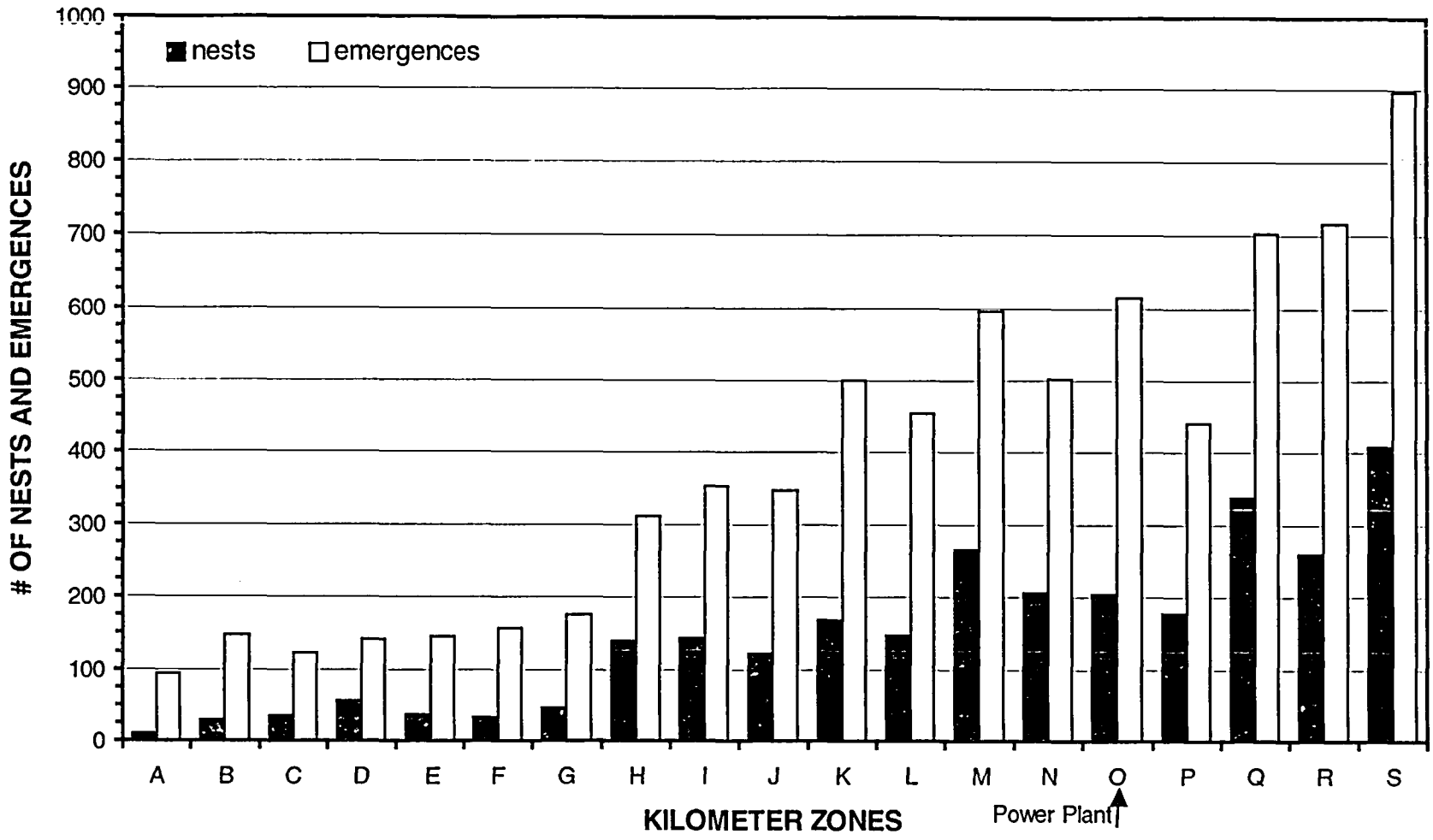

Figure 4. Number of loggerhead turtle nests and emergences for kilometer zones A through S (North to South), Hutchinson Island, April through September 2005.

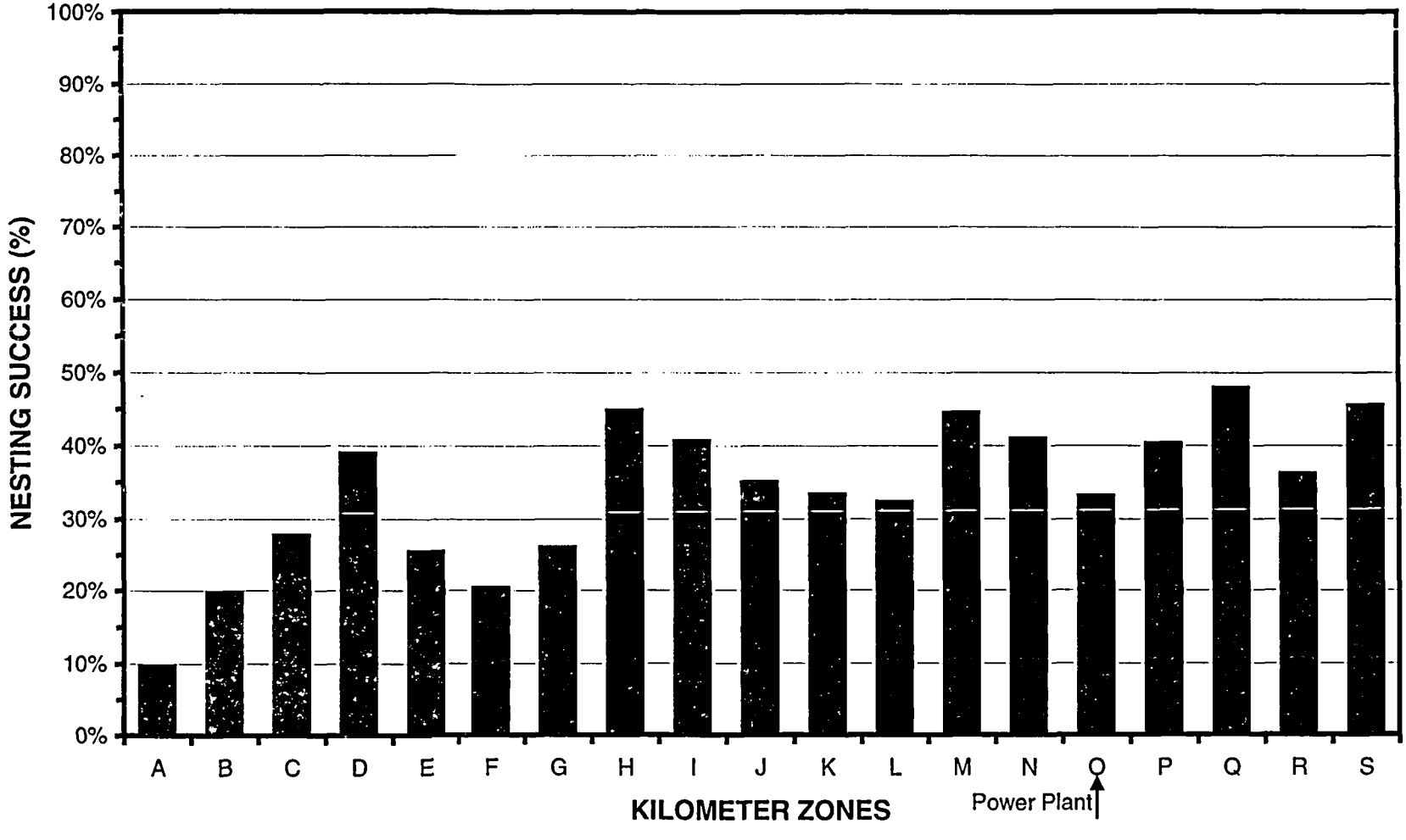

Figure 5. Loggerhead turtle nesting success (percentage of emergences resulting in nests) for kilometer zones A through S (North to South), Hutchinson Island, April through September 2005.

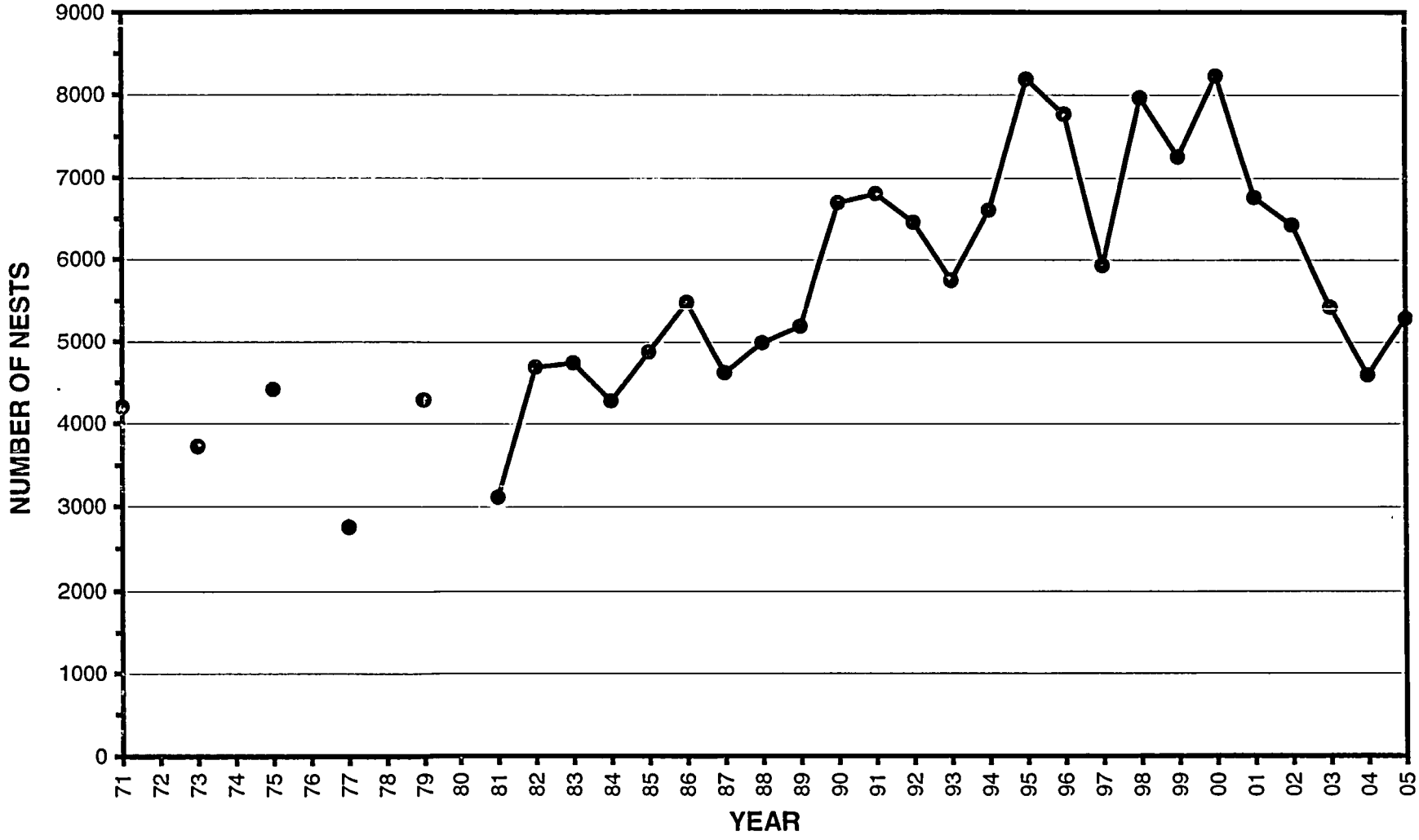

Figure 6. Number of loggerhead turtle nests, Hutchinson Island 1971 through 2005. Values for 1971 through 1979 are estimates (see text), values for 1981 through 2005 are from whole island surveys.

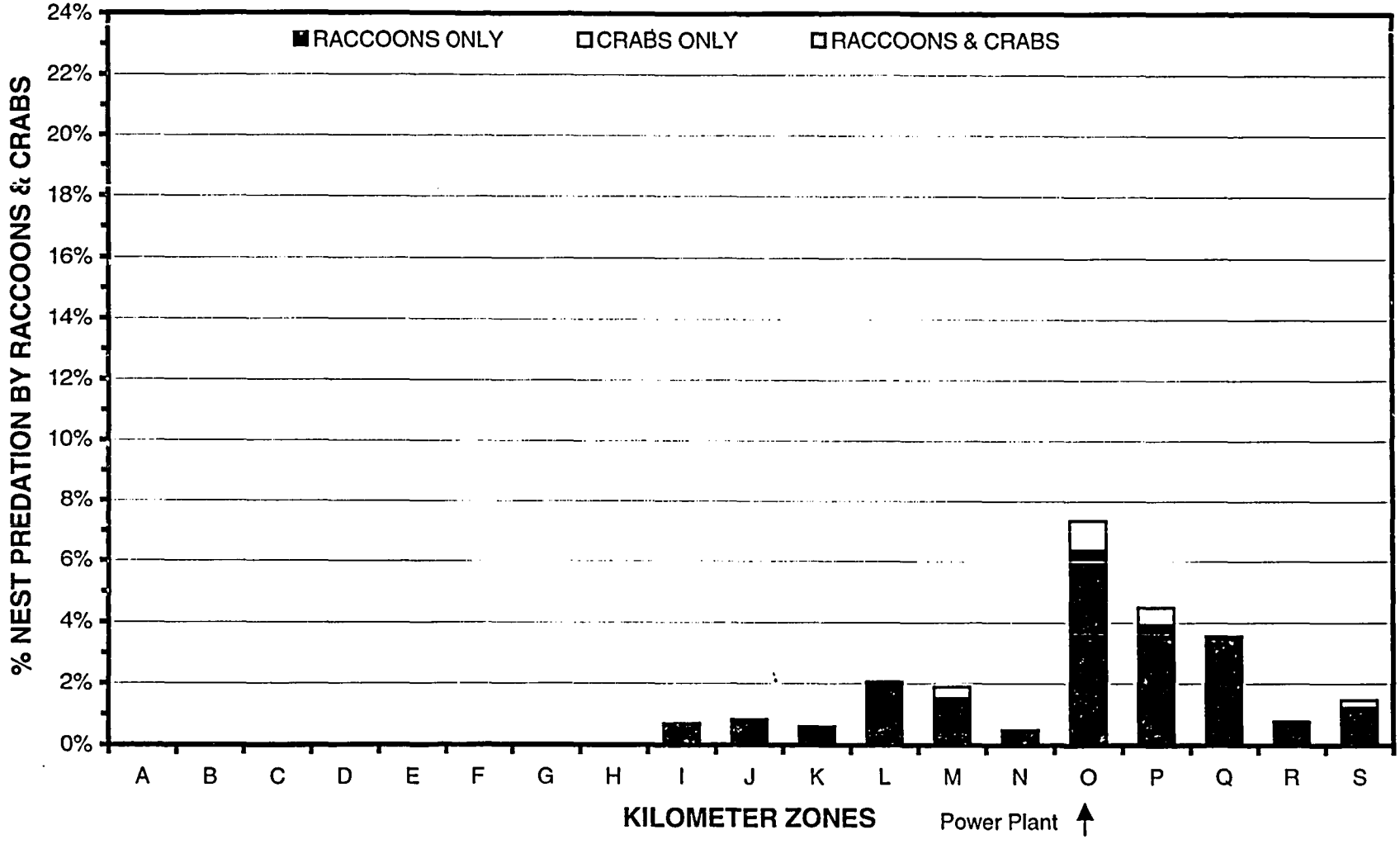

Figure 7. Percentage of loggerhead turtle nests depredated by raccoons and/or ghost crabs in kilometer zones A through S (North to South), Hutchinson Island, April through September 2005.

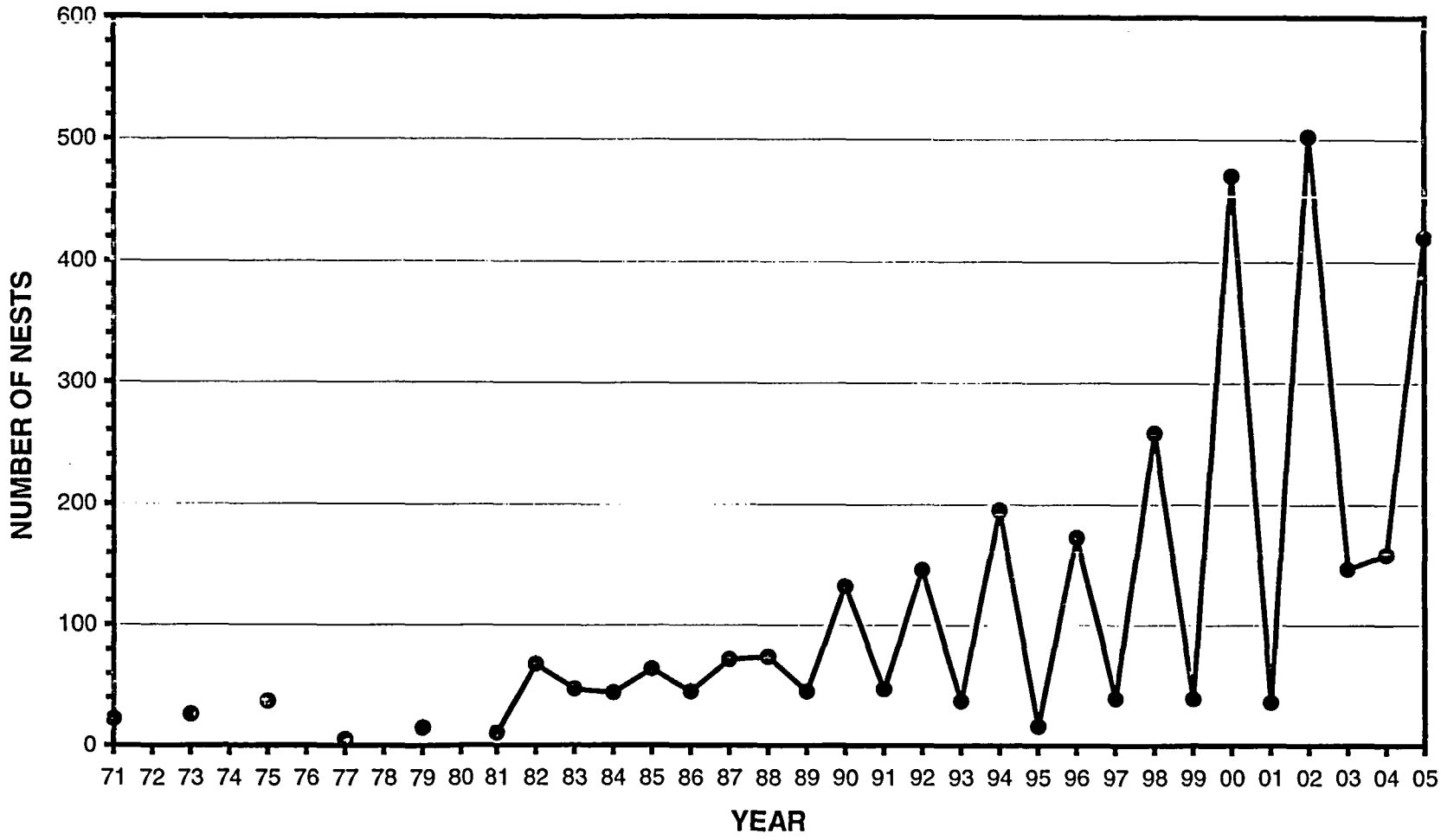

Figure 8. Number of green turtle nests, Hutchinson Island, 1971 through 2005. Values for 1971 through 1979 are estimates (see text). Values for 1981 through 2005 are from whole island surveys.

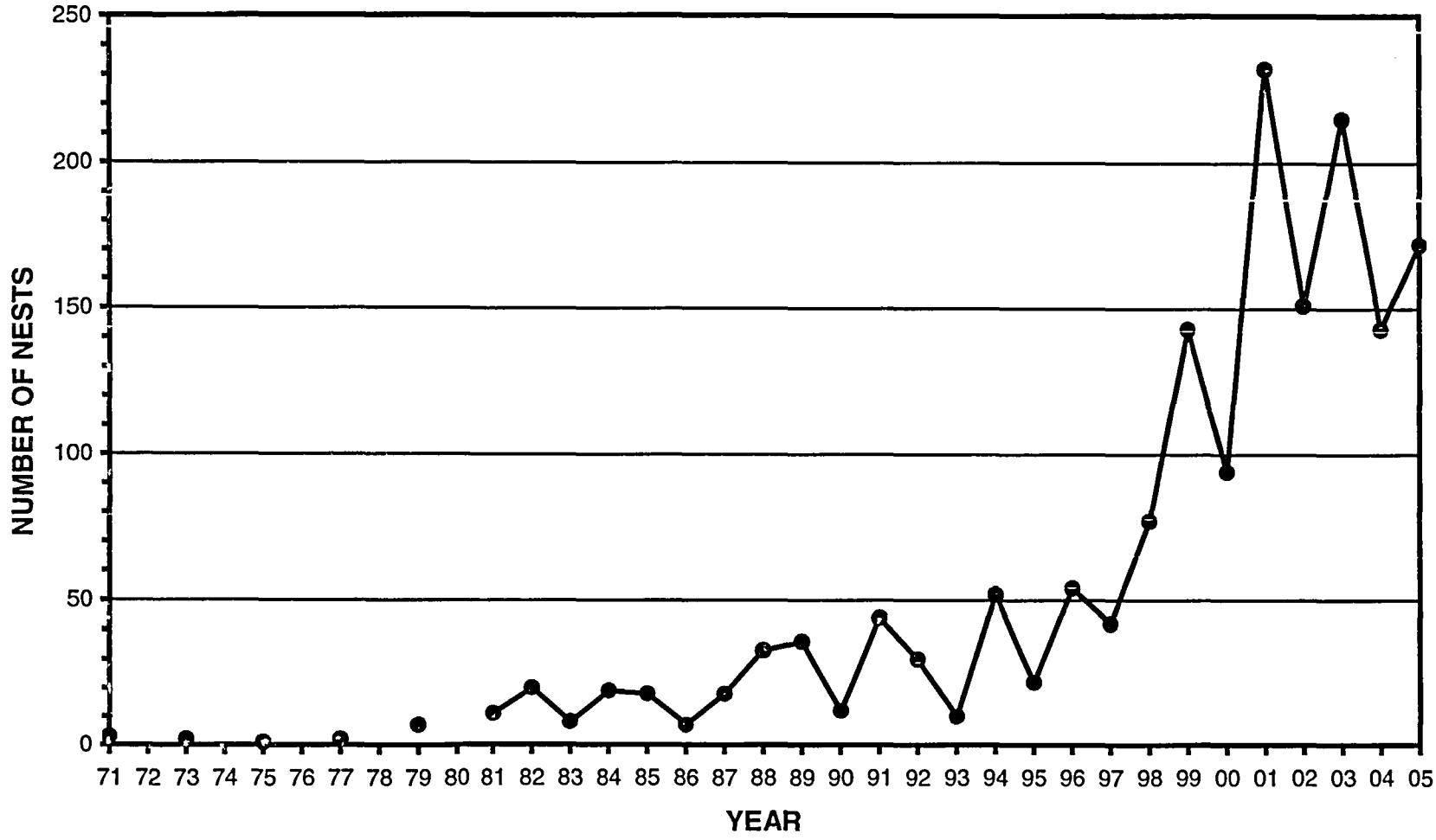

Figure 9. Number of leatherback turtle nests, Hutchinson Island, 1971 through 2005. Values for 1971 through 1979 are estimates (see text). Values for 1981 through 2005 are from whole island surveys.

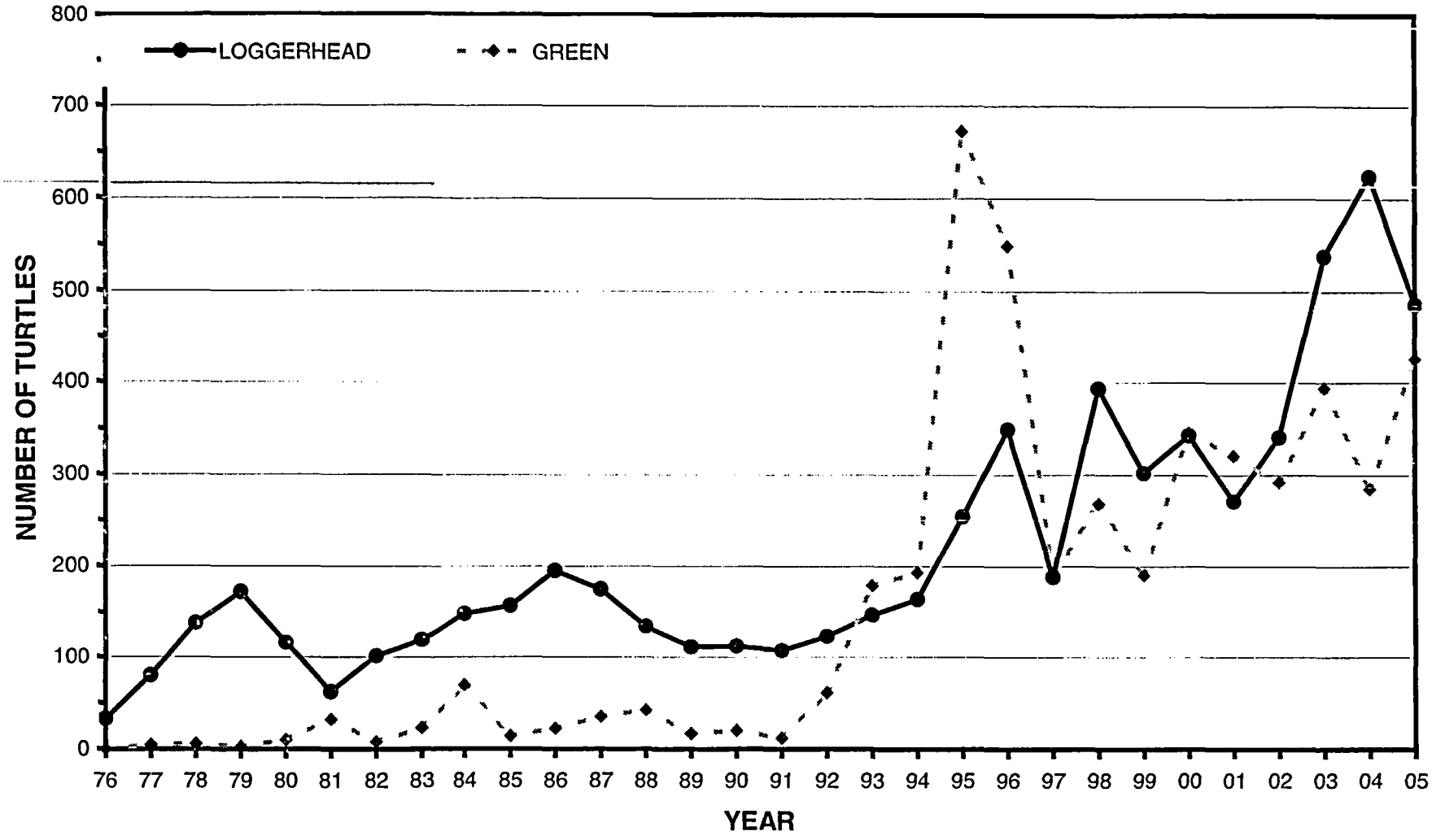

Figure 10. Number of loggerhead and green turtles removed each year from the intake canal at the St. Lucie Power Plant, 1976 through 2005.

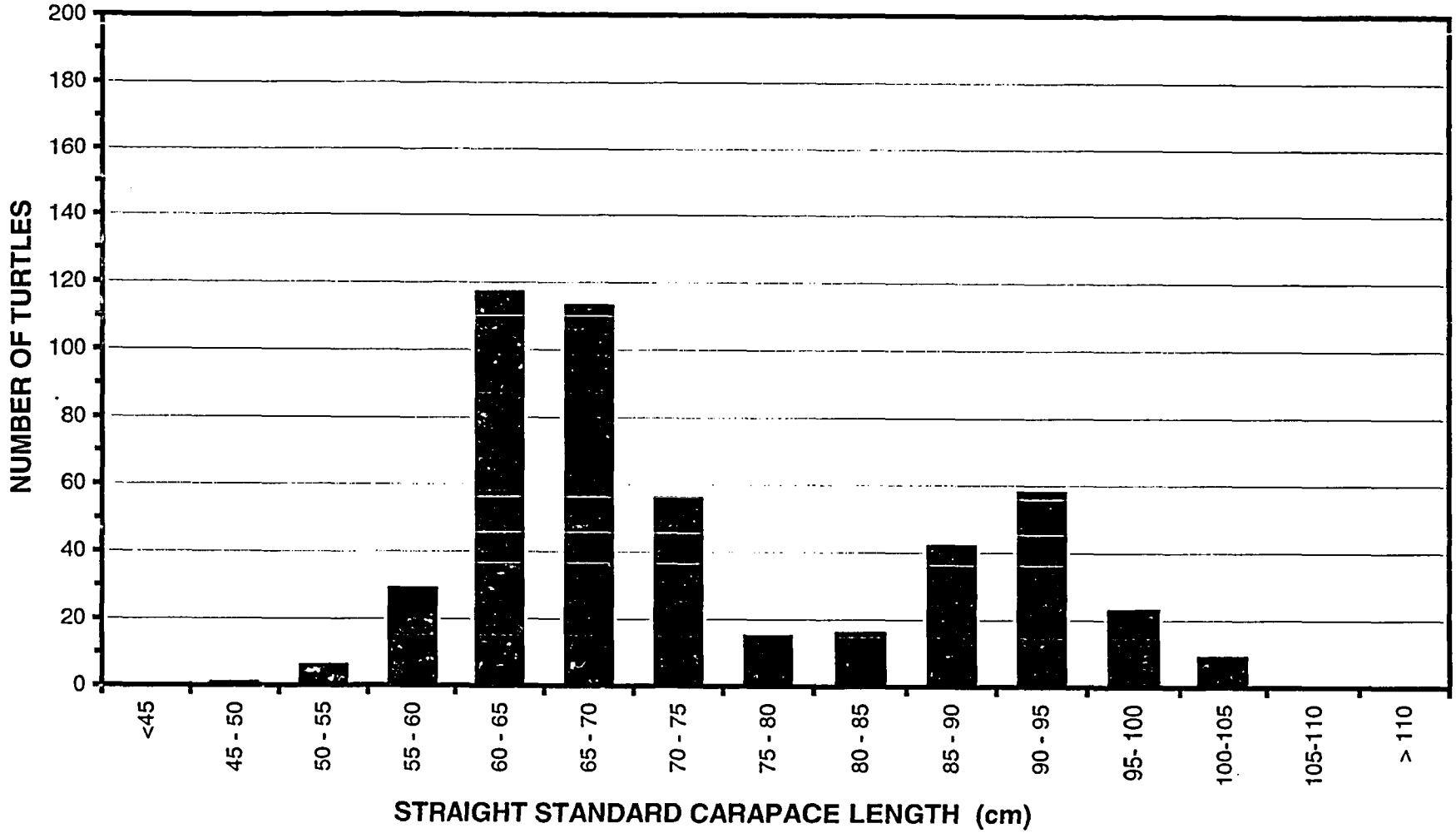

Figure 11. Size distribution (SSCL) of loggerhead turtles (n = 486) removed from the intake canal, St. Lucie Plant, 2005.

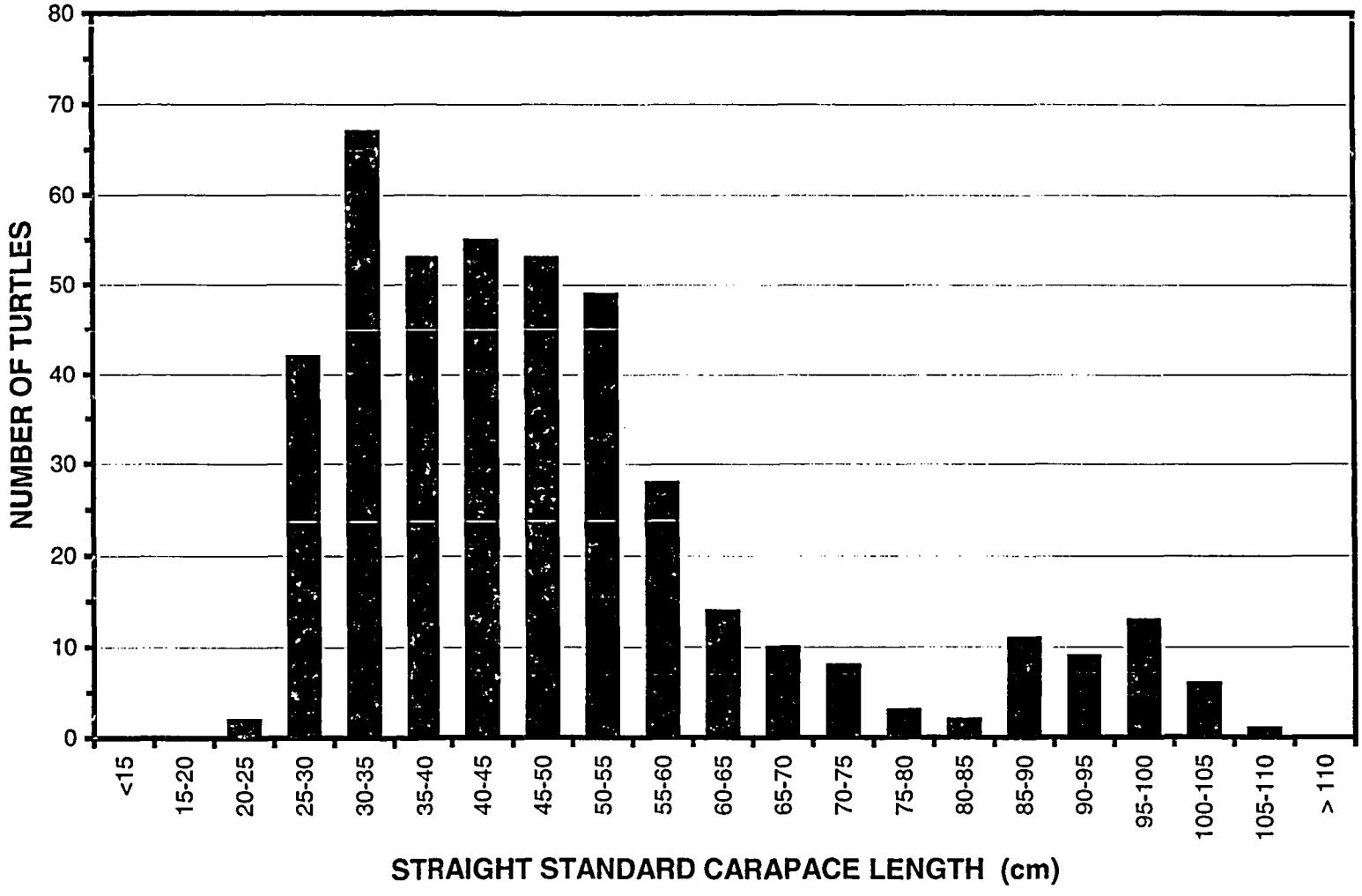

Figure 12. Size distribution (SSCL) of green turtles (n = 426) removed from the intake canal, St. Lucie Plant, 2005.

6.0 TABLES

	Species					
Year	Loggerhead	Green	Leatherback	Hawksbill	Kemp's ridley	Total
1976	33 (4)					33 (4)
1977	80 (5)	5 (2)	1			86 (7)
1978	138 (19)	6 (1)	3	1		148 (20)
1979	172 (13)	3 (1)				175 (14)
1980	116 (5)	10 (3)				126 (8)
1981	62 (5)	32 (2)	2		1	97 (7)
1982	101 (16)	8	1			110 (16)
1983	119 (4)	23 (4)				142 (8)
1984	148 (3)	69 (2)		1	2	220 (5)
1985	157 (4)	14		1		172 (4)
1986	195 (27)	22 (1)	1	1	1	220 (28)
1987	175 (11)	35		2	6 (2)	218 (13)
1988	134 (6)	42 (2)			5 (2)	181 (10)
1989	111 (4)	17 (1)	1	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	343 (2)	346 (2)		2		691 (4)
2001	270 (1)	321 (5)	2	6	1	600 (6)
2002	341	292 (3)		3		636 (3)
2003	538	394 (3)	4	6	2	944 (3)
2004	624 (2)	285 (1)	2	2	1	914 (3)
2005	486 (2)	426 (2)		2	3	917 (4)
Total	**6482** (144)	**4686** (72)	**30**	**43**	**42** (4)	**11283** (220)
Annual Mean*	222.4	161.6	1.0	1.5	1.4	387.9

* Excludes 1976 (partial year ot plant operation).

Table 1. Total number of captured turtles removed from the intake canal, St. Lucie Plant, 1976 through 2005. Number of dead turtles is in parentheses.

Month	Number of Captures	Percent of All Captures	Minimum	Maximum	Mean	Standard Deviation	2005
January	635	9.8%	6	39	21.9	12.0	**21**
February	618	9.6%	5	38	21.3	17.8	**38**
March	695	10.8%	1	60	24.0	27.9	**30**
April	651	10.1%	0	71	22.4	19.2	**71**
May	588	9.1%	0	61	20.3	16.1	**61**
June	681	10.6%	3	66	23.5	18.7	**66**
July	821	12.7%	0	124	28.3	29.0	**124**
August	571	8.9%	2	43	19.7	14.3	**39**
September	378	5.9%	1	26	13.0	10.9	**18**
October	310	4.8%	0	27	10.7	7.8	**8**
November	243	3.8%	0	18	8.4	7.1	**5**
December	258	4.0%	1	24	8.9	5.7	**5**
Total*	**6449**		**0**	**124**			**486**
Mean	537.4				18.5		40.5
Std. Deviation	190.8				6.6		35.1

* Excludes 33 loggerhead captures from 1976 (partial year)

Table 2. Total number of loggerhead turtles removed each month from the intake canal, St. Lucie Plant 1977 through 2005.

Month	Number of Captures	Percent of All Captures	Minimum	Maximum	Mean	Standard Deviation	2005
January	538	11.5%	0	61	18.6	19.9	22
February	503	10.7%	0	64	17.3	18.6	47
March	539	11.5%	0	147	18.6	31.5	18
April	355	7.6%	0	64	12.2	16.7	40
May	346	7.4%	0	91	11.9	20.6	59
June	333	7.1%	0	55	11.5	17.2	55
July	295	6.3%	0	61	10.2	16.4	49
August	300	6.4%	0	64	10.3	15.1	37
September	341	7.3%	0	77	11.8	18.4	38
October	438	9.3%	0	54	15.1	18.4	26
November	361	7.7%	0	50	12.4	15.0	19
December	337	7.2%	0	68	11.6	14.9	16
Total*	4686		0	147			426
Mean	390.5				13.5		35.5
Std. Deviation	89.8				3.1		15.1

* Excludes 1976 (partial year)

Table 3. Total number of green turtles removed each month from the intake canal, St. Lucie Plant, 1977 through 2005.

ANNUAL ENVIRONMENTAL OPERATING REPORT

PART II

1.0 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.

2.0 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.

3.0 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 2005 are presented in Table 1. Total sponge ball losses were higher from Unit 2 than Unit 1 in 2005. This was due to a peak that occurred in May. The sponge ball loss was potentially due to debris fouling the ball strainer. Only 14 sponge balls were found whole in the environment near the plant in 2005. This number indicates that few balls actually reach the environment whole.

Figure 1 indicates that estimated sponge ball loss for both units generally remained low through the year, with the previously discussed peak in May attributed to Unit 2. Average daily ball loss in 2005 has decreased since 2004, and is below the average since system star-up (Figure 2). Estimated sponge ball loss from both units was 10.7 balls per day for 2005. Average daily sponge ball loss since system start-up has been approximately 13 balls per day.

4.0 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 2005.

5.4.1.2(b) Changes In Station Design or Operation, Tests, and Experiments In Accordance With EPP Subsection 3.1

No plant site activities were determined to be reportable under Section 5.4.1(b) during 2005.

5.4.1.2(c) Non-routine Reports Submitted to the NRC for the Year 2005 in Accordance with EPP Subsection 5.4.2

Biological Assessment Regarding Smalltooth Sawfish Event

By Florida Power and Light Company (FPL) letter L-2005-146 dated July 1, 2005, FPL submitted a report providing description of a reportable capture of a smalltooth sawfish in the intake canal at the St. Lucie Plant.

On May 16, 2005 at 1720 a smalltooth sawfish became entangled in the North capture net in the intake canal. Four biologists successfully disentangled the sawfish from the net, promptly took pictures and measurements, and reintroduced the sawfish to the ocean.

After the safe release of the sawfish by the biologists, FPL contacted NOAA Fisheries to report the incident. NOAA Fisheries requested FPL send photographs and measurement data on the sawfish to Mote Marine

Laboratories as part of Mote's ongoing sawfish research. On June 7, 2005 NOAA Fisheries indicated to FPL that a Section 7 Consultation would need to be initiated between the NRC and NOAA Fisheries concerning the event.

By NRC letter dated July 19, 2005 NRC informed FPL of its plans to prepare a biological assessment for this species. In this letter, NRC requested FPL to provide records of endangered sea turtle captures, details of recent dredging activities in the intake canal, and information on research and conservation efforts.

Report concerning the mortality of a green sea turtle captured on July 9, 2005. The turtle was recovered alive and sent off for rehabilitation and later died. Follow-up notification was made to NRC on July 9, 2005. The event was reported to NRC by FPL letter L-2005-174 on August 9, 2005.

TABLE 1

2005 ST. LUCIE PLANT CONDENSER TUBE CLEANING SYSTEM SUMMARY

	Strainer Back Flushes		Estimated Ball Loss		Balls Found On Beach
Month	Unit 1	Unit 2	Unit 1	Unit 2	
January	17	3#	29	19	2
February	16	5#	278	3	1
March	19	16	1	117	0
April	16	16	47	+306	1
May	18	18	239	1646	2
June	18	19	+12	431	2
July	17	16	80	+88	0
August	18	21	+11	165	1
September	17	17	247	+127	3
October	8##	18	56	366	2
November	0##	18	0	258	0
December	8##	17	31	424	0
Total	172	184	985	2908	9

Unit 2 system shutdown during refueling
Unit 1 system shutdown during refueling
\+ Net gain in inventory.
* Loss of abrasive balls.

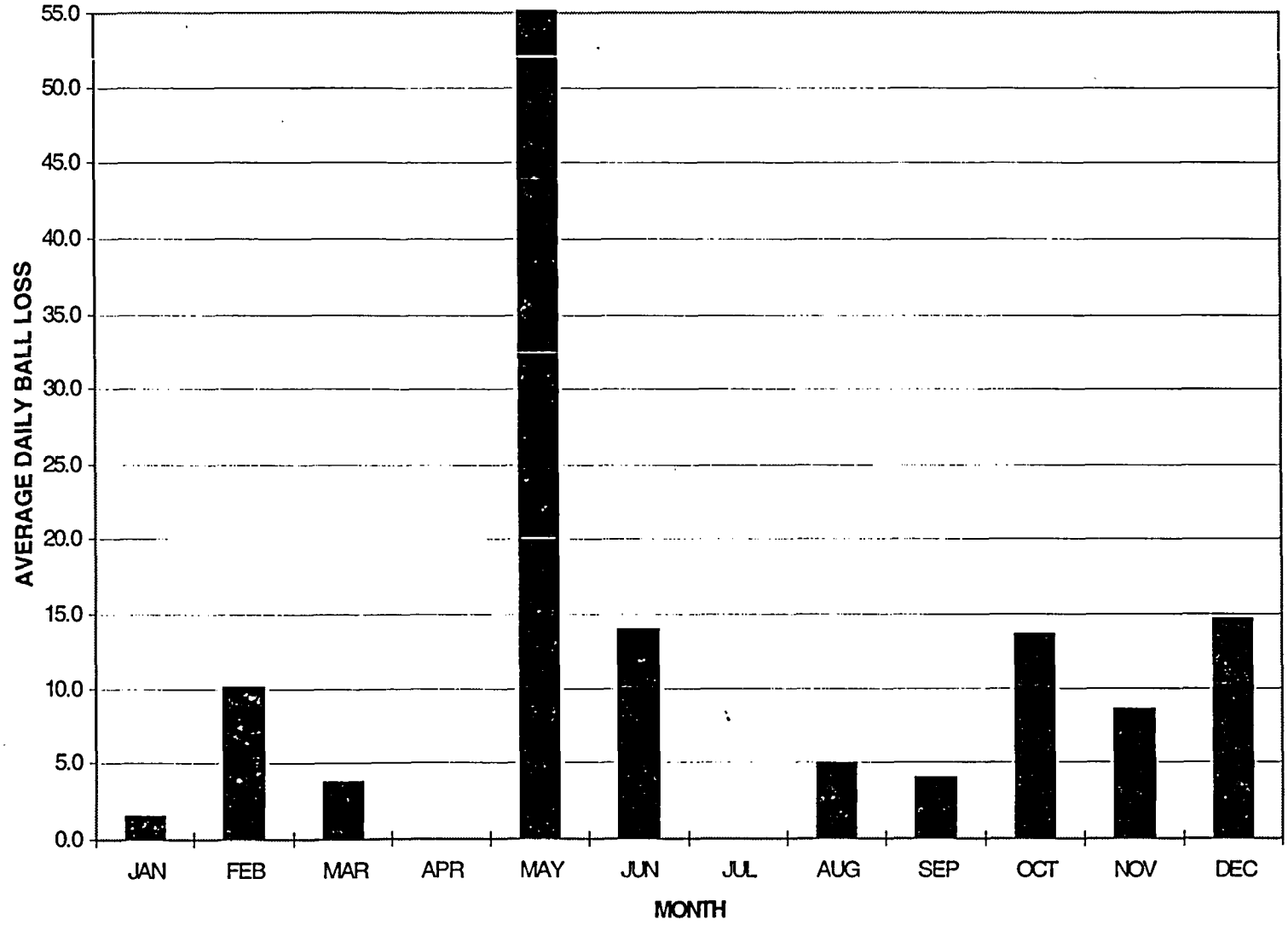

Figure 1. Estimated Average Daily Sponge Ball Loss by Month from St. Lucie Plant (Both Units) for 2005.

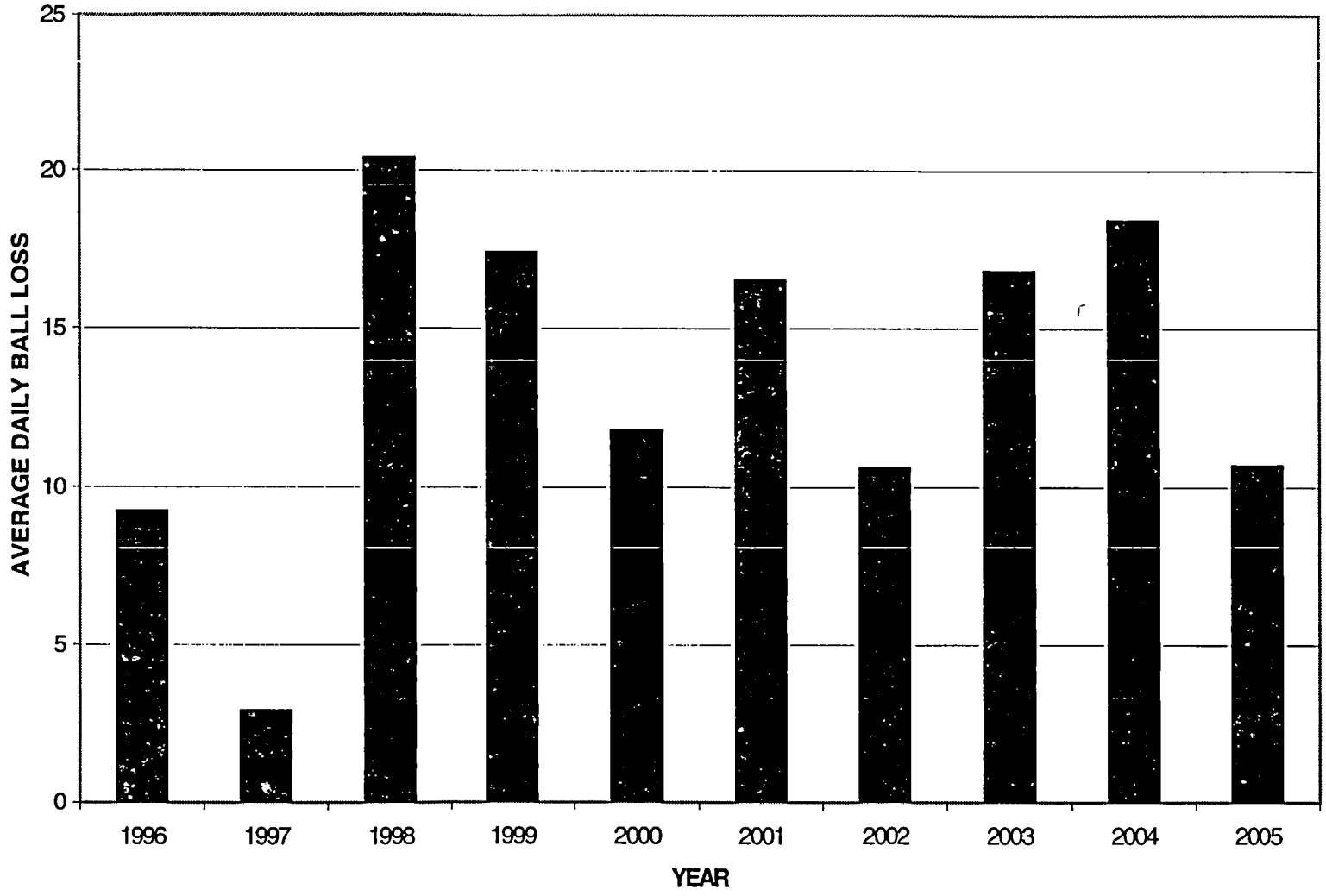

Figure 2. Average Daily Sponge Ball Loss from the St. Lucie Plant (Both Units) Since System Start-Up (January 1996).