



April 23, 2000

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

Re: St. Lucie Units 1 and 2
Docket Nos. 50-335 and 50-389
1999 Annual Environmental Operating Report

In accordance with Section 5.4.1.2 of the St. Lucie Unit 1 and Unit 2 Environmental Protection Plans (EPP), enclosed is the St. Lucie Plant Annual Environmental Operating Report for calendar year 1999.

As required by EPP Section 4.2.2.2 (10)(b), this report includes discussions of the 5-inch barrier net maintenance and Taprogge condenser tube cleaning system ball loss for 1999. In addition, copies of the report are being furnished to the Florida Fish and Wildlife Conservation Commission, Tequesta Office, and the National Marine Fisheries Service, Southeast Region.

Should there be any questions on this information, please contact us.

Very truly yours,

Rajiv S. Kundalkar
Vice President
St. Lucie Plant

RSK/GRM

Enclosure

cc: Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, St. Lucie Plant
Florida Fish and Wildlife Conservation Commission, Tequesta Office
National Marine Fisheries Service, Southeast Region

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FLORIDA POWER & LIGHT COMPANY
ST. LUCIE PLANT
ANNUAL ENVIRONMENTAL
OPERATING REPORT
1999



FLORIDA POWER & LIGHT COMPANY
JUNO BEACH, FLORIDA
QUANTUM RESOURCES, INC.
PALM BEACH GARDENS, FLORIDA

ENVIRONMENTAL OPERATING REPORT

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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), to 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 1999 have shown no long-term reductions in nesting on the island. Relatively high nesting during recent years may actually reflect an increase in the number of nesting females in the study area. On a smaller scale, power plant operation has had no significant effect on nesting near the plant. 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 has been continued through 1998 with agreement from federal and state agencies. In 1998, the continuation of the nesting survey program was 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 this requirement.

1.3 INTAKE CANAL MONITORING

Since plant operation began in 1976, 6580 sea turtles (including recaptures) representing five different species have been removed from the intake canal. The majority of the turtles captured (59 percent) were loggerheads. Differences in the numbers of turtles found during different months and years, including dramatic increases in green turtle captures in recent years, have been attributed primarily to natural variation in the occurrences 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 97 percent) 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. An improved design barrier net completed in January 1996 is expected to further reduce the residence times and potential for mortalities to sea turtles in the intake canal system.

2.0 INTRODUCTION

2.1 BACKGROUND

This document has been prepared to satisfy the requirements contained in Appendix B, Environmental Protection Plan, to St. Lucie Units 1 and 2 Facility Operating Licenses DPR-67 and NPF-16.

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 fourteen annual environmental operating reports covering the period from 1983 through 1998. This report describes the 1999 environmental protection activities related to sea turtles, as required by Subsection 4.2 of the St. Lucie Unit 1 and 2 Environmental Protection Plan.

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 the 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 5-m atop dunes bordering the beach and decrease to sea level in the mangrove swamps that are common on much of 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 coquinooid 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 flow parallel to the continental shelf margin, but 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 water system.

Water for the plant enters through three submerged intake structures located about 365 meters offshore (Figure 2). Each of the intake structures is equipped with a velocity cap to minimize fish entrainment. From the intake structures, the water passes through submerged pipes (two 3.7-m and one 4.9-m in diameter) under the beach and dunes that lead to a 1,500 m long intake canal, which transports water 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

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underneath the dunes and beach 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 TURTLES

3.1 INTRODUCTION

Hutchinson Island, Florida, is an important rookery for the loggerhead turtle, Caretta caretta, and also supports some 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 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 1999, 36 one-km-long survey areas comprising the entire island were monitored seven days a week during the nesting season (Figure 3). Beginning in 1994, the southern half of the island has been surveyed by Ecological Associates of Jensen Beach, Florida, and their data is 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 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 NRC St. Lucie Unit 2 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 was 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 this requirement. Results 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 through 1999). 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 Ecological Associates, Inc. (formerly 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 1999 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 1999 canal capture data and summarize comparable data collected since 1976.

3.2 MATERIALS AND METHODS

3.2.1 Nesting Survey

Methodologies used during previous turtle nesting surveys on Hutchinson Island were described in earlier reports (ABI 1994). Methods used during the 1999 survey were designed to allow comparisons with these previous studies.

In 1999, only areas A-S were surveyed by Quantum Resources biologists (Figure 3). Data supplied by Ecological Associates, Inc. are used to provide whole-island-nesting totals in Figures 6, 8, and 9.

From mid-March, 1999 through April 14, 1999, several preliminary nest surveys were conducted along Hutchinson Island in areas A-S. Five leatherback nests were recorded in areas A-S prior to the beginning of formal nesting surveys on April 15, 1999. From April 15, 1999 through September 10, 1999, nest surveys were conducted on a daily basis. The last nest recorded in area A-S was on September 5, 1999. Biologists used small off-road motorcycles 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). The 1.25 km-long survey areas that were established in earlier studies also were monitored so comparisons could be made with previous studies.

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. In a cooperative effort, data from stranded turtles found during beach surveys were routinely provided to the Florida Department of Environmental Protection 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 1999 were from 30 to 40 meters 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 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 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 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, all but the smallest individuals were unable to reach the intake wells. Improvements made to the A1A barrier net during 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 response to the large numbers of small turtles encountered in the intake canal in recent years, an improved design, small mesh barrier net was erected east of the A1A barrier net. Construction was complete in January 1996. This improved barrier net is designed to confine all turtles with a carapace width greater than 18 cm to the extreme eastern portion of the intake canal.

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 addition to the use of tangle nets, dip nets and hand captures using snorkel and SCUBA were also employed. 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 permits, and 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 nets. 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. 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.

Resuscitation techniques were used if a turtle was found that appeared to have died recently. Beginning in 1982, necropsies were conducted on dead turtles found in fresh condition.

Florida Power & Light Company and Quantum Resources, Inc., continued to assist other sea turtle researchers in 1999. Since the program began, data, specimens and/or assistance have

been given to the Florida Department of Environmental Protection, National Marine Fisheries Service, US Fish and Wildlife Service, 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, 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

3.3.1.1 1999 Loggerhead Nesting Summary

In 1999, 7260 Loggerhead turtle nests were recorded in the 36 one-kilometer segments comprising Hutchinson Island. This figure is in accordance with a general increase in loggerhead turtle nesting on Hutchinson Island since surveys began in 1971, although significant year to year fluctuations are evident. Loggerhead nests and emergences for survey areas A-S is presented in Figure 4.

3.3.1.2 Spatial Distribution of Loggerhead Turtle Nests

From 1981 through 1999, 36 one-km-long segments comprising the island's coastline have been surveyed. The distribution of nests among these 36 survey areas has shown an increase in nesting from north to south along the northern half of the island (ABI, 1987, 1994). Along the southern half of the island there has either been no gradient or a gradient of decreasing nesting from north to south. 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 because of the interrelationship of the factors involved.

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, which 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. Loggerhead nesting success for areas A - S in 1999 is presented in Figure 5.

Historically, the pattern of loggerhead emergences on the island has generally paralleled the distribution of nests (ABI, 1987, 1994). In contrast, nesting success by loggerheads along the island has typically lacked gradients (ABI, 1987, 1994). Thus, the relatively high numbers of

loggerhead nests observed in certain areas are usually a result of more turtles coming ashore in those areas rather than of more preferable nesting conditions being encountered by the turtles after they emerged. 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 effect 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, 1983 (ABI, 1987). However, nesting at the plant consistently returned to levels similar to or greater than 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 1999 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 prior to 1981.

From 1981 through 1993 the total number of nests in the nine areas varied 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, which would be expected, based strictly on the proportion of linear coastline comprised by the nine areas. Using the thirteen-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 thirteen years in which the entire island was surveyed, produced whole-island estimates within 5.3 percent of the actual number of nests counted. Because the proportion of nests recorded in the nine survey areas remained relatively constant over the last thirteen 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 also are common at other rookeries, and may result from non-annual reproductive behavior. Despite high variability, data collected through 1999 suggest an overall increase in nesting on Hutchinson Island since surveys began in 1971. Total nesting activity was greatest during 1995 when 8184 loggerhead nests were

recorded. No relationships between total nesting activity and power plant operation or intake/discharge construction were indicated by year-to-year variations in total nesting on Hutchinson Island.

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 1999 followed this same pattern.

Cool water intrusions frequently occur over the continental shelf of southeast Florida during the summer (Smith, 1982). These intrusions may have been responsible for the temporary declines in loggerhead turtle nesting activity previously observed on Hutchinson Island (ABI, 1994). Though natural fluctuations in temperature have been shown to affect temporal nesting patterns on Hutchinson Island, there has been no indication that power plant operation has affected these temporal patterns (ABI, 1988).

3.3.1.5 Predation on Loggerhead Turtle Nests

Since nest surveys began in 1971, raccoon predation has been a major 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.

During 1999, raccoon predation levels were extremely low, with only one loggerhead nest in areas A-S depredated by raccoons (Figure 7). In previous years (ABI, 1994), 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 1983-1999. During 1999, six 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 1999, no such combination predations were recorded.

3.3.1.6 1999 Green and Leatherback Nesting Summary

In 1999, 29 green turtle and 143 leatherback turtle nests were recorded in the 36 one-km segments comprising Hutchinson Island. The green turtle total represents a substantial decrease from last year's record nesting level. 1999 was the second record year in a row for leatherback turtle nesting on Hutchinson Island (Figures 8 and 9). Although strong year to year fluctuations are common, the general trend since 1971 may reflect an increase in the numbers of nesting females 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 ranged from 5 to 258 for green turtles and from 1 to 143 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 1999 suggest an overall increase in nesting since 1971 and may reflect an increase in the number of nesting females in the Hutchinson Island area. During 1999, green turtles nested most frequently along the southern half of the island. This is consistent with results of previous surveys.

Leatherback turtle nest densities have remained low on Hutchinson Island, however, increased nesting during recent years (Figure 9) may reflect an overall increase in the number of nesting females in the Hutchinson Island area.

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 to effect entrainment. 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 1999 Canal Capture Summary

In 1999, 495 sea turtles were captured in the intake canal of the St. Lucie Plant. Captures included 302 loggerheads, 190 green turtles, 1 leatherback, 1 hawksbill, and 1 Kemp's ridley turtle (Table 1). A possible Chelonia x Caretta hybrid turtle captured in 1999 was counted as a green turtle.

3.3.2.2 Relative Abundance and Temporal Distribution

Since intake canal monitoring began in May 1976, 3880 loggerhead (including 265 recaptures), 2622 green (including 543 recaptures), 22 leatherback, 34 Kemp's ridleys, and 22 hawksbill 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 933 in 1995.

Except for 1993 through 1997, when the green turtle was the most abundant species in the canal, loggerheads have dominated annual captures. Since 1977, the first full year of plant operation, the number of loggerheads captured each year ranged from 62 in 1981 to 393 in 1998 (Figure 10). Numbers have exhibited considerable year-to-year fluctuations with no persistent trends evident, although recent year's data are suggestive of a possible increasing trend.

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). Increasing numbers of captures over recent years may reflect an increase in the number of turtles inhabiting the nearshore coastal area near the plant or may simply represent statistical variation. Green turtle captures have decreased substantially in 1997 through 1999, but were still above the long-term average. Additional years of capture data will be required before any long-term trends can be established.

During 1999, the monthly catch of loggerheads ranged from 11 (October) to 41 (July), with a monthly mean of 25.2 (Table 2). Over the entire history of the capture program, monthly catches have ranged from 0 to 87, with the greatest number of captures occurring during July 1996.

During 1999, the monthly catch of green turtles ranged from 7 (April and June) to 40 (September), with a monthly mean of 15.8 (Table 3). The March 1996 catch of 147 green turtles is the largest number of captures for this species for any month on record. 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. In 1995 through 1999, however, no such seasonal pattern was evident, with captures distributed more or less evenly throughout the year.

Catches of leatherbacks, hawksbills, and Kemp's ridleys 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 ridleys 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 1999 is presented in Figure 11. The size class distribution for green turtles removed from the intake canal in 1999 are presented in Figure 12. ABI (1994) present's size-class data for turtles removed from the intake canal from 1976-1993. The leatherback captured in 1999 was an adult, with a straight line carapace length (SLCL) of over 121 cm (Hirth, 1980). The hawksbill captured in 1999 was a juvenile (SLCL > 63cm) (Witzell, 1983). The Kemp's ridley captured in 1999 was a juvenile SLCL < 60cm) (Hirth, 1980).

3.3.2.4 Sex Ratios

Of the 302 loggerheads captured in 1999 for which straight line carapace lengths are available, 216 were juveniles with a straight line carapace length (SLCL) less than or equal to 70 cm, 43 were adults (SLCL > 85 cm) and 43 were transitional (SLCL 71-85 cm) (Hirth, 1980). The latter group probably includes both mature and immature individuals. Of the 43 individuals classified as adults for whom sex was recorded, 39 were females and 4 were males, with females predominating by a ratio of 9.75:1.

Of the 189 green turtles captured in 1999 for which straight line carapace lengths are available, all were juveniles or sub-adults (SLCL < 83 cm) (Whitherington and Ehrhart, 1989) ABI (1994) discusses sex ratio data for previous years.

3.3.2.5 Capture Efficiencies

Netting methodologies have been under continual review and refinements 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 barrier net were not caught until they entered the intake wells of Units 1 and 2. Because of their relatively small sizes, virtually all the turtles reaching the intake wells are green turtles. During 1999, six of the 189 green turtle captures (3.2 percent) occurred at the intake wells. The substantial decrease in the percentage of captures at the plants intake wells compared to the 1995 figure of 14.5 percent is attributed to the effectiveness of the new small mesh barrier net installed east of A1A in January of 1996.

During 1999, 98.8 percent of all turtles entrapped in the canal were captured east of the A1A Bridge, 423 by tangle nets and 67 by hand or dip net 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 an improved barrier net completed in January 1996 has further increased capture efficiency by more effectively confining turtles of all sizes to a smaller area east to the A1A barrier net.

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. When underwater visibility conditions permit, a weekly underwater inspection is conducted. A formal inspection is conducted monthly, including hole repair, debris removal, and airlift dredging of accumulated silt if needed. Maintenance conducted in 1999 included the repair of any holes in the mesh discovered during the daily, weekly and monthly inspections and extensive debris removal and airlift dredging of accumulated sediment conducted in May and July. Large influxes of drift algae occasionally forced the primary barrier net to be lowered in 1999. The barrier net was lowered for portions of May, July, August, and September. The lowering mechanism functioned as designed, and no damage was sustained. Special netting and hand capture efforts were conducted to capture turtles penetrating the primary barrier net.

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, wounds, injuries and any other abnormalities which might have affected overall vitality. During 1999, 92.7% (281) of all loggerheads found in the canal were alive and in good condition. Only 6.9% (19) loggerhead captures involved individuals in fair or poor condition, and two were dead. Of the 189 green turtles removed from the intake canal during 1999, 183 (96.8 percent) were in good

condition, 2 (1.1 percent) were in fair or poor condition, and four were dead. The hawksbill and Kemp's ridley captured in 1999 were in good condition, and the leatherback was in fair condition.

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 injuries, obviously were sustained prior to entrainment.

During 1999, 37 of the 495 turtles captured (7.5 percent) had notable injuries such as missing appendages, broken or missing pieces of carapace, or deep lacerations. Many of these were old, well-healed wounds, and did not require veterinary attention.

Of the 489 live removals during 1999, 483 were released into the ocean the day of capture. Five turtles (all loggerheads) in obvious ill health or suffering serious injuries were transported to Sea World of Florida or the Marinelife Center of Juno Beach for treatment and rehabilitation. Three were weak, lethargic, and emaciated when captured, one had serious shark bite injuries, and one had a septic amputation of a front flipper and injuries from fishing line entanglement. Six green turtles with fibropapilloma tumors were removed from the canal in 1999. One turtle with extensive tumors was transferred to the Florida DEP for transportation to a rehabilitation facility. Five turtles with minor tumors were tagged and released.

3.3.2.8 Mortalities

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.

Over the entire monitoring program history, 137 (3.5 percent) of the 3880 loggerheads and 56 (2.1 percent) of the 2622 green turtles entrapped in the canal were found dead. Mortalities spanned the range of size classes for loggerheads (SLCL = 47.5-103 cm), while all green turtle mortalities involved juveniles less than 42 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 been recovered at the St. Lucie Plant.

Modifications to capture procedures, improvements to barrier nets and virtual elimination of low flow conditions within the canal 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 2.1 percent since 1984, and 1.0% since 1990 (Table 1).

In 1999, six turtles (four green turtles and two loggerheads) were removed dead from the intake canal, for an overall mortality rate of 1.2%. One fresh dead loggerhead was found floating at the A1A barrier net in July. The turtle was severely emaciated with a heavy infestation of leeches. In November, a slightly decomposed loggerhead was found floating at the primary barrier net. This turtle was underweight, with severe entanglement in fishing line that impeded its swimming ability. In February, a fresh dead green turtle was found tightly entangled in the north capture net, where it was apparently not noticed during regular checks. Resuscitation was attempted without success. It was found that the north capture net had been hanging up on the bottom of the canal due to extensive canal shoaling, possibly contributing to the mortality. The anchor point of the net was moved to allow the net to fish in deeper water. The remaining three green turtle mortalities all occurred in September. A severely decomposed small green turtle was recovered from the plant intake well, and two decomposed green turtles were found floating at the A1A barrier net during a period when the primary barrier net was down due to drift algae accumulation. Since the majority of the 1999 mortalities occurred west of the primary barrier net, Improvements in barrier net maintenance are identified as a goal to reduce the potential for intake canal mortalities.

In response to the 1995 mortalities and the dramatic increase in intake canal captures in 1995, consultation was initiated with FPL, NRC, and the NMFS under Section 7 of the Endangered Species Act. As a result of that consultation, FPL has designed and constructed an improved, smaller mesh barrier net located between the A1A barrier net and the intake canal headwalls (Figure 2). Construction of the net was completed in January 1996. This barrier net prevents turtles from reaching the intake wells or UIDS barrier and increases capture efficiency by confining turtles to a smaller area of the intake canal.

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, 808 recaptures (265 loggerheads and 543 green turtles) have occurred, and a number of turtles have been recaptured more than once. The recapture rate for green turtles in 1999 was 34% and the recapture rate for loggerheads was 16.5%. The large number of green turtle recaptures probably reflects the saturation of local green turtle populations with turtles tagged at the St. Lucie Plant and possibly indicates a difference in site fidelity between green turtles and loggerheads. Several other turtles with tag scars have also been recovered, indicating that the actual number of recaptures may be higher. Occasionally, turtles are captured that have been tagged by other researchers. One such capture (a loggerhead that was originally tagged in Long Island Sound, New York) occurred in 1999. The original tagging agency was contacted and supplied with recapture data.

3.3.3 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 1999, 7260 loggerhead turtle nests were recorded on Hutchinson Island. There have been considerable year-to-year fluctuations in loggerhead nesting activity on Hutchinson Island from 1971 through 1999. Fluctuations are common at other rookeries and may result from non-annual reproductive behavior. Despite these fluctuations, loggerhead-nesting activity has remained high during recent years and may reflect an overall increase in the number of nesting females in the Hutchinson Island area. No relationship between total nesting on the island and power plant operation or intake/discharge construction was indicated.

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 one of the major causes 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 ten percent since 1979. Decreased predation by raccoons probably reflects a decline in the raccoon population. More years of survey data will be required to determine if the extremely low level of raccoon predation in 1996 through 1999 is an isolated occurrence or part of a continuing trend. Ghost crab predation on the turtle nests may be more significant than previously documented but remains relatively minor compared to raccoon predation.

During 1999, 29 green turtle and 143 leatherback turtle nests were recorded on Hutchinson Island, a record high for leatherbacks. 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 1999, 302 loggerheads, 190 green turtles, one hawksbill, one Kemp's ridley, and one leatherback were removed from the St. Lucie Plant intake canal. Since monitoring began in May 1976, 3880 loggerhead, 2622 green, 22 leatherback, 22 hawksbill and 34 Kemp's ridley

turtles 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 393 in 1998. 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 dominated by juveniles between 50 and 70 cm in straight-line carapace length. Over 75 percent of all green turtles entrapped in the canal were juveniles 40 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 or less evenly throughout the year. The sex ratio of loggerheads caught in the canal continued to be biased towards females.

During 1999, about 94 percent of all loggerheads and green turtles removed from the canal were categorized by physical appearance as being in good condition.

About 7 percent of the turtles removed from the intake canal during 1999 had substantial injuries, and the vast majority of those were well healed and apparently sustained prior to entrapment. Once in the canal, turtles confined east of A1A had very brief residency times. Thus the relative condition of most turtles was not affected by their entrapment.

During 1999, six mortalities were recorded in the intake canal. 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, although the 1998 mortality rate of 0.15 %, the lowest mortality rate in the program's history, was an outstanding achievement and a hopeful sign for the future.

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6.0 FIGURES

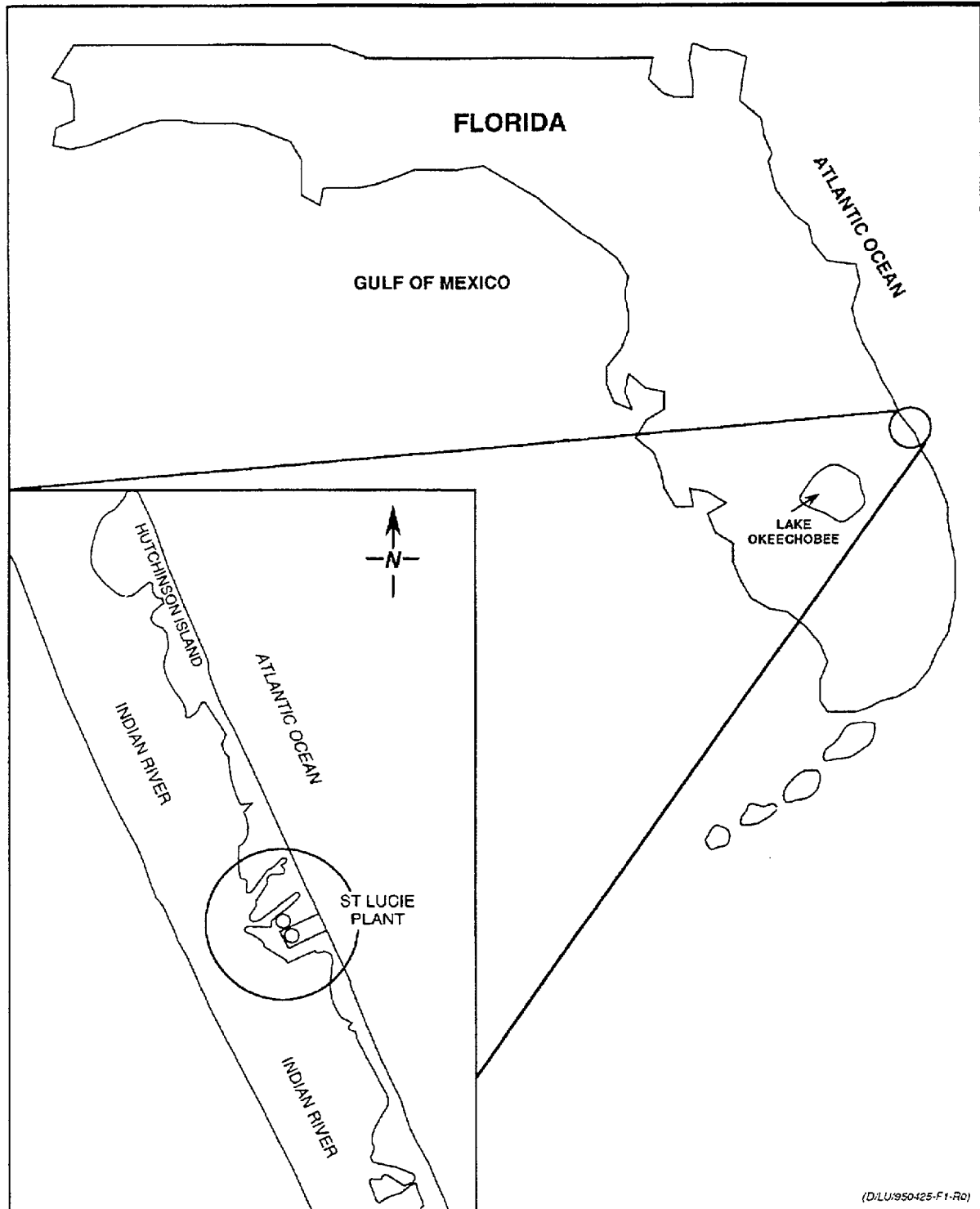


Figure 1. Location of St. Lucie Plant

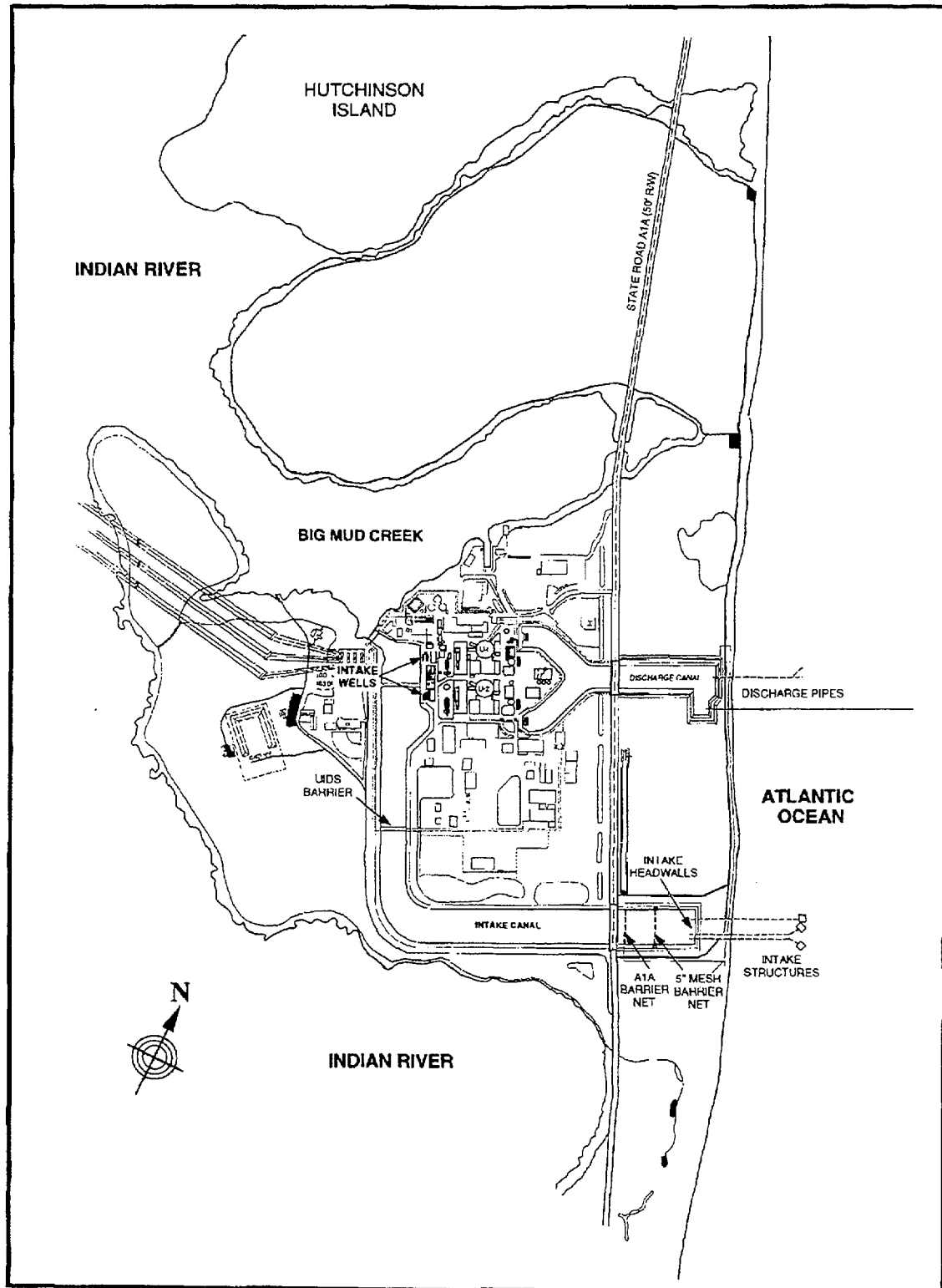


Figure 2. St. Lucie Plant Cooling Water Intake and Discharge System

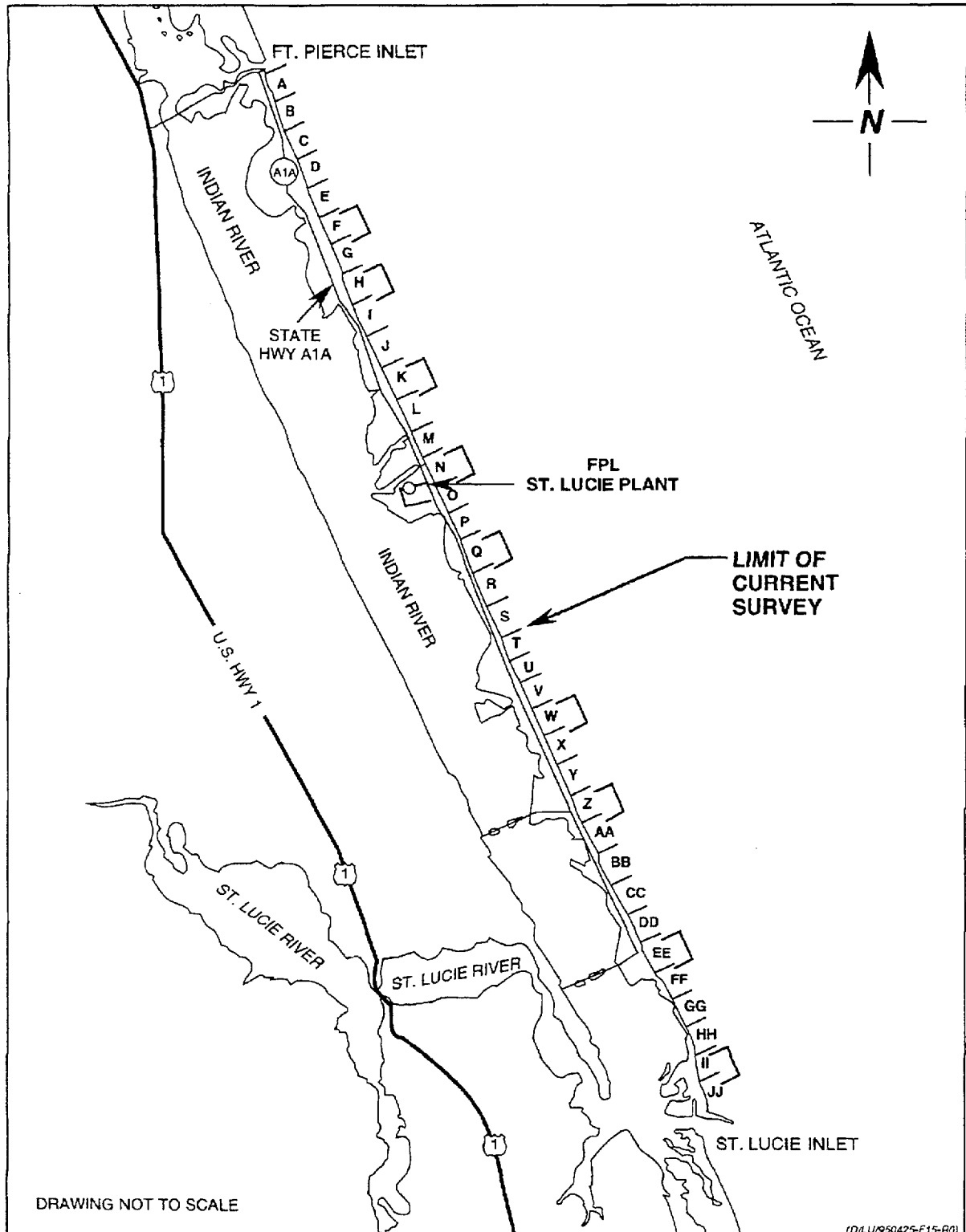


Figure 3. Designation and Location of Nine 1.25-Km Segments and Thirty-Six 1-Km Segments Surveyed for Sea Turtle Nesting, Hutchinson Island. 1971-1999.

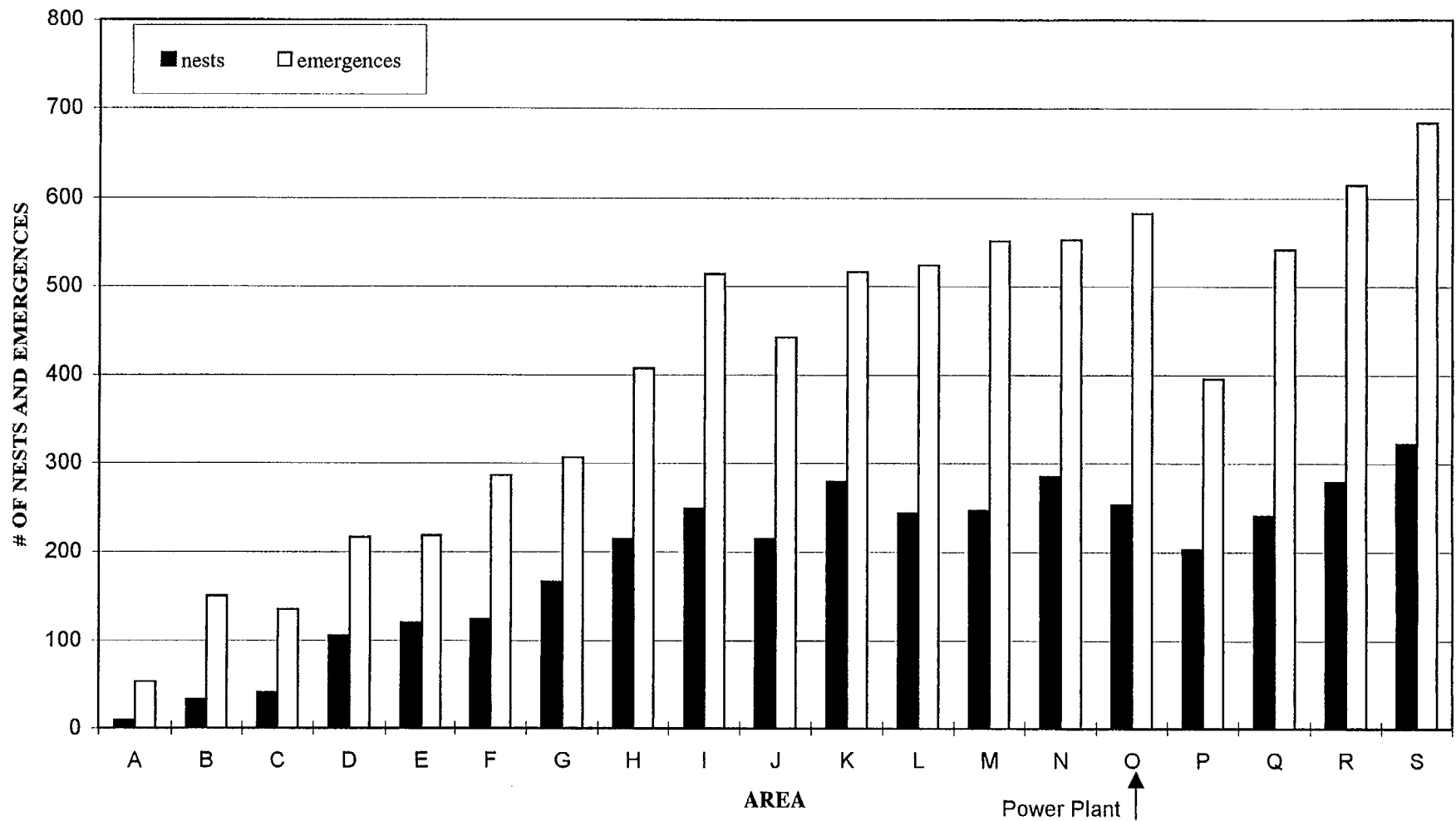


Figure 4. Number of Loggerhead Turtle Nests and Emergences from Area A Through S, Hutchinson Island, April Through September 1999.

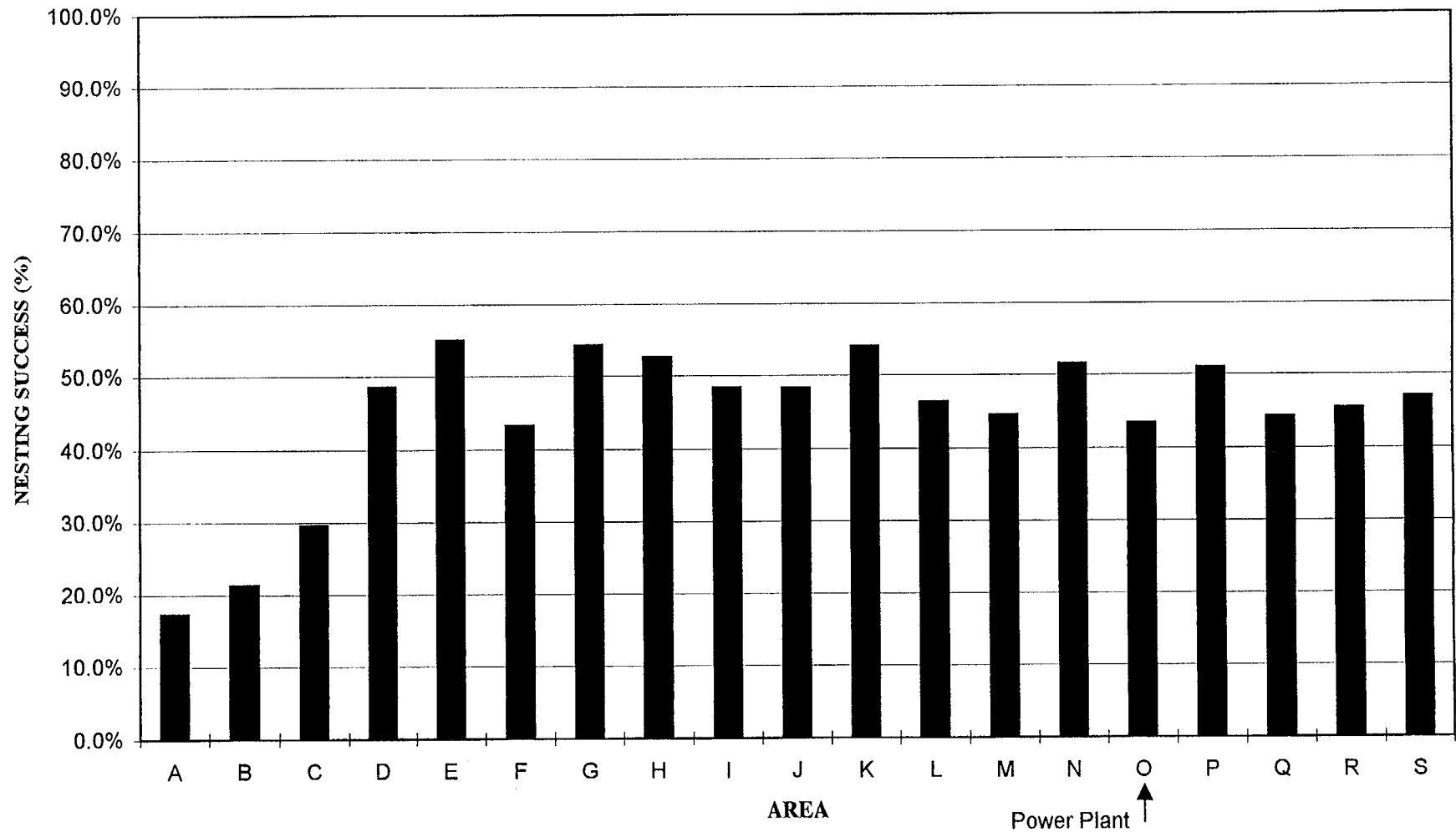


Figure 5. Loggerhead Turtle Nesting Success (Percentage of Emergences Resulting in Nests) for Areas A Through S, Hutchinson Island, April Through September 1999.

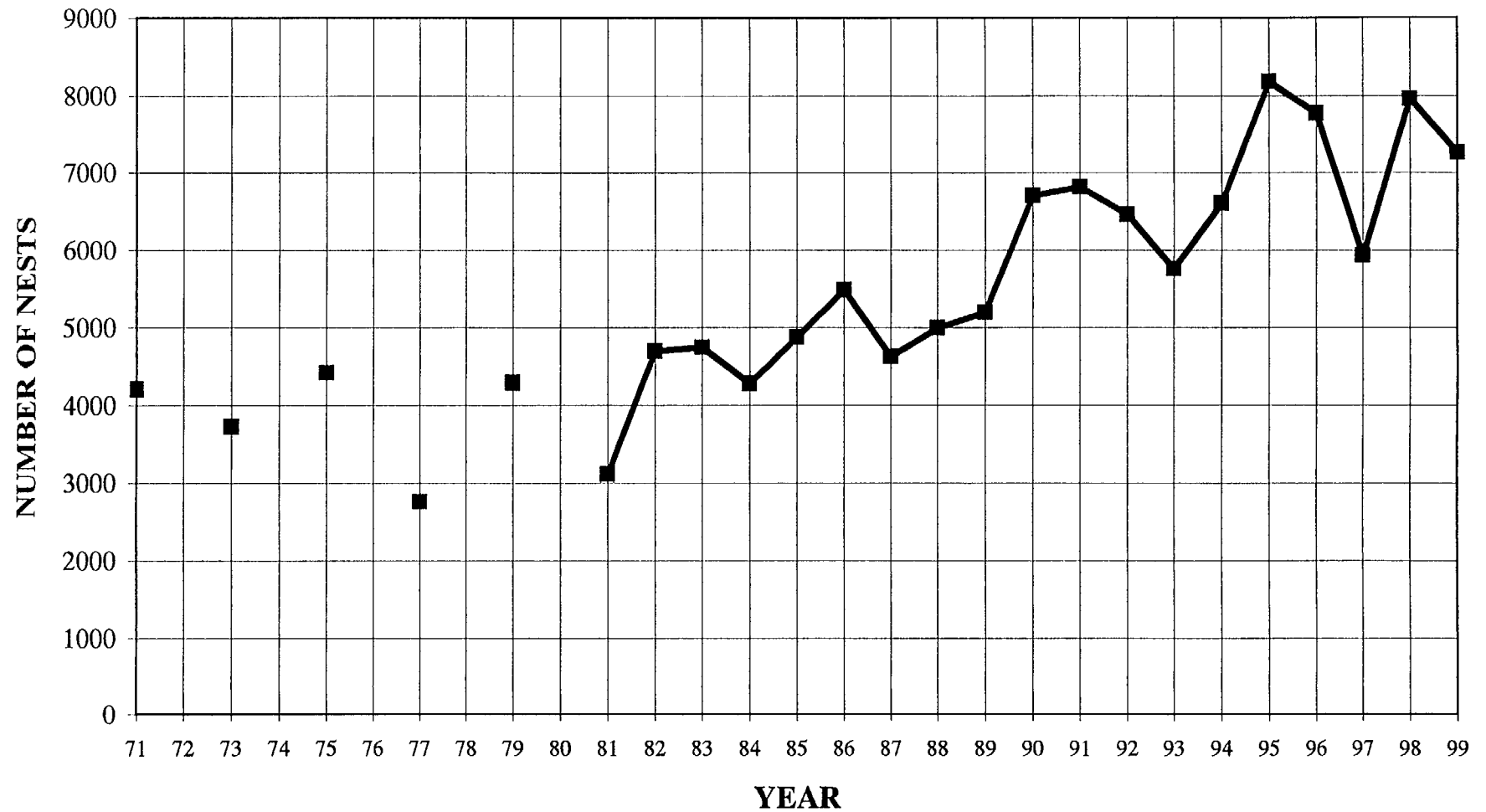


Figure 6. Number of Loggerhead Turtle Nests, Hutchinson Island 1971 Through 1999. Values for 1971 Through 1979 Are Estimates (See Text). Values for 1981 Through 1998 Are From Whole Island Surveys.

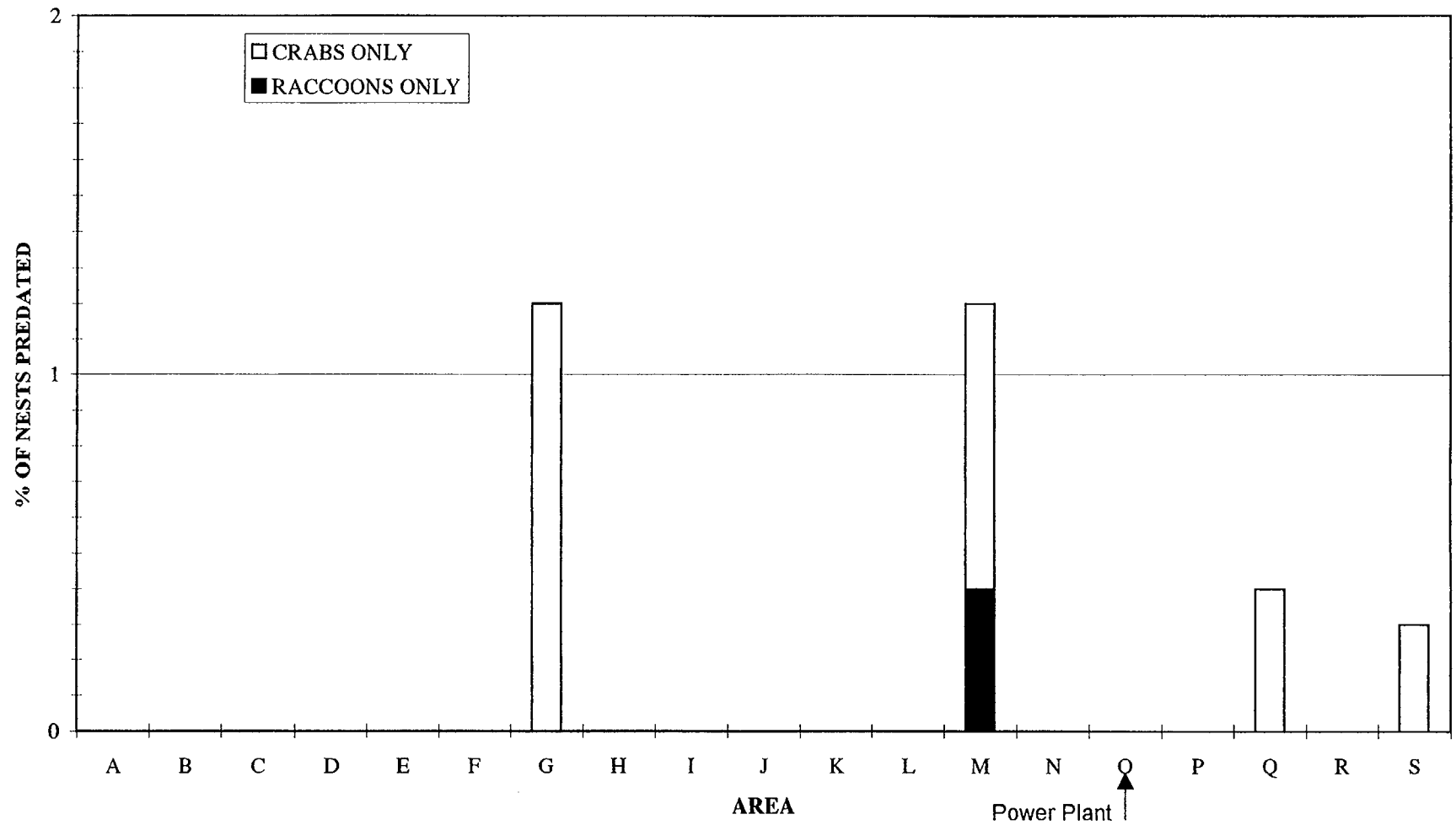


Figure 7. Percentage of Loggerhead Turtle Nests Predated by Raccoons and/or Ghost Crabs in Areas A Through S, Hutchinson Island, April Through September 1999.

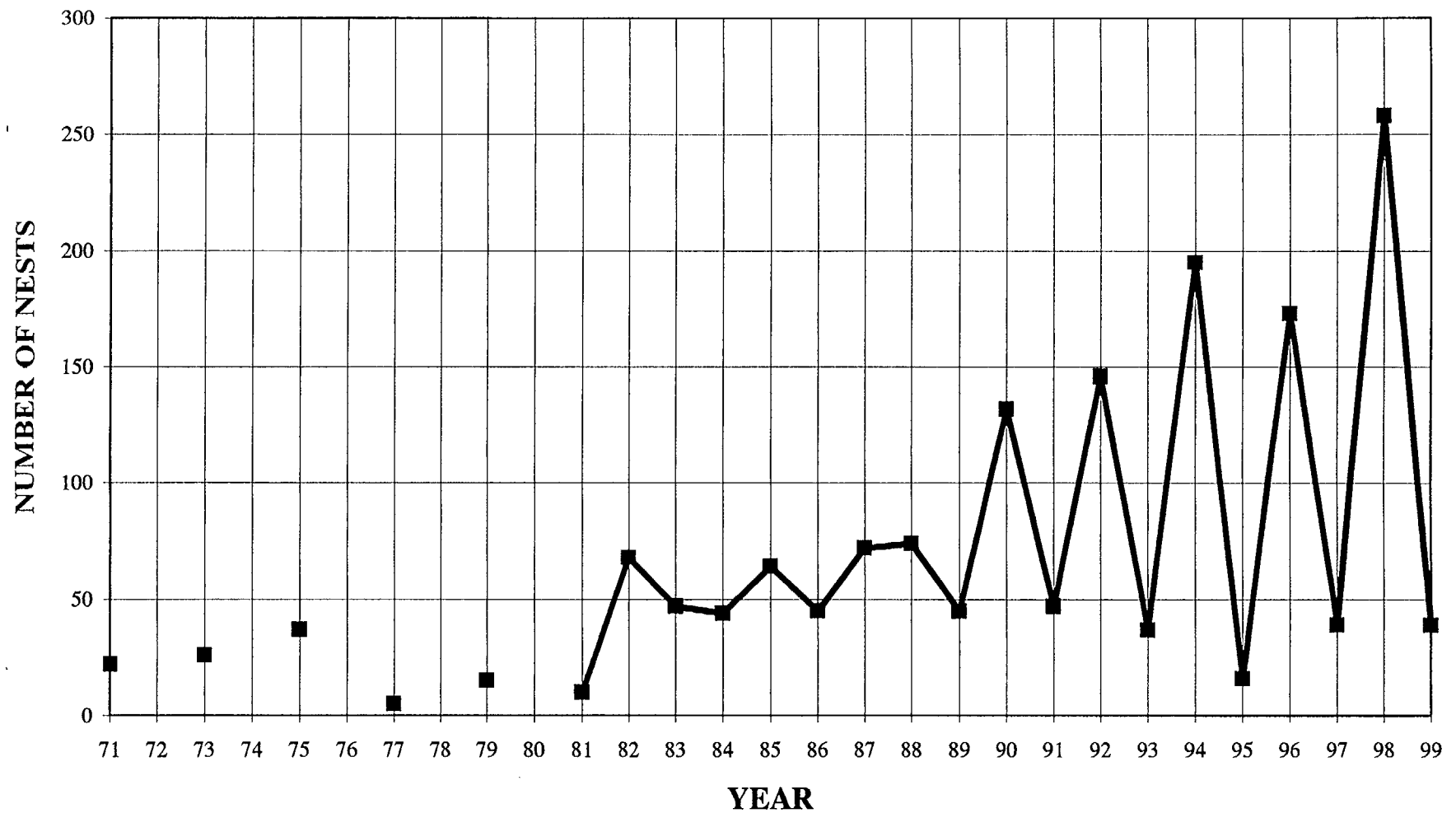


Figure 8. Number of Green Sea Turtle Nests, Hutchinson Island, 1971 Through 1999. Values for 1971 Through 1979 Are Estimates (See Text). Values for 1981 Through 1999 Are From Whole Island Surveys.

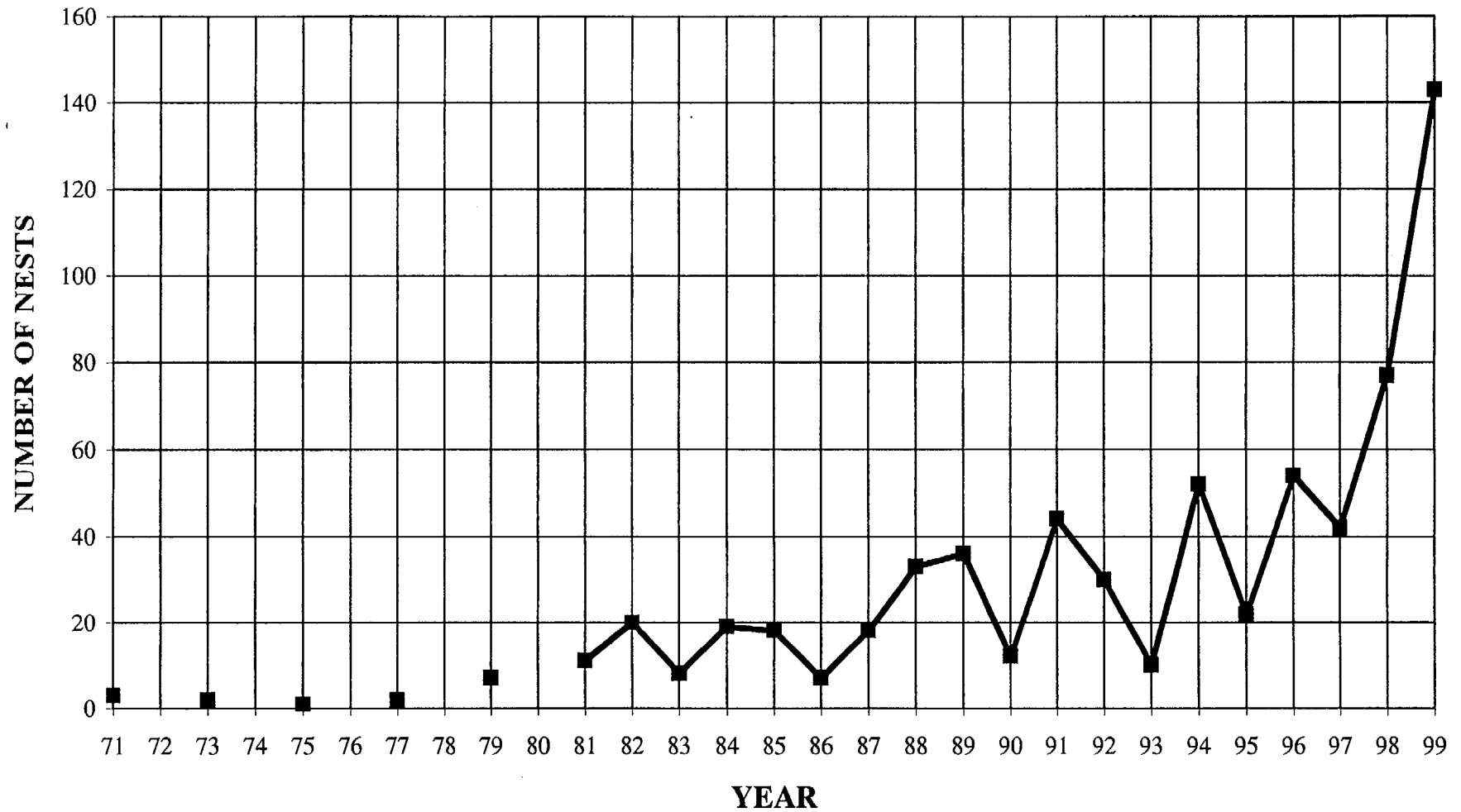


Figure 9. Number of Leatherback Turtle Nests, Hutchinson Island, 1971 Through 1999. Values for 1971 Through 1979 Are Estimates (See Text). Values for 1981 Through 1999 Are From Whole Island Surveys.

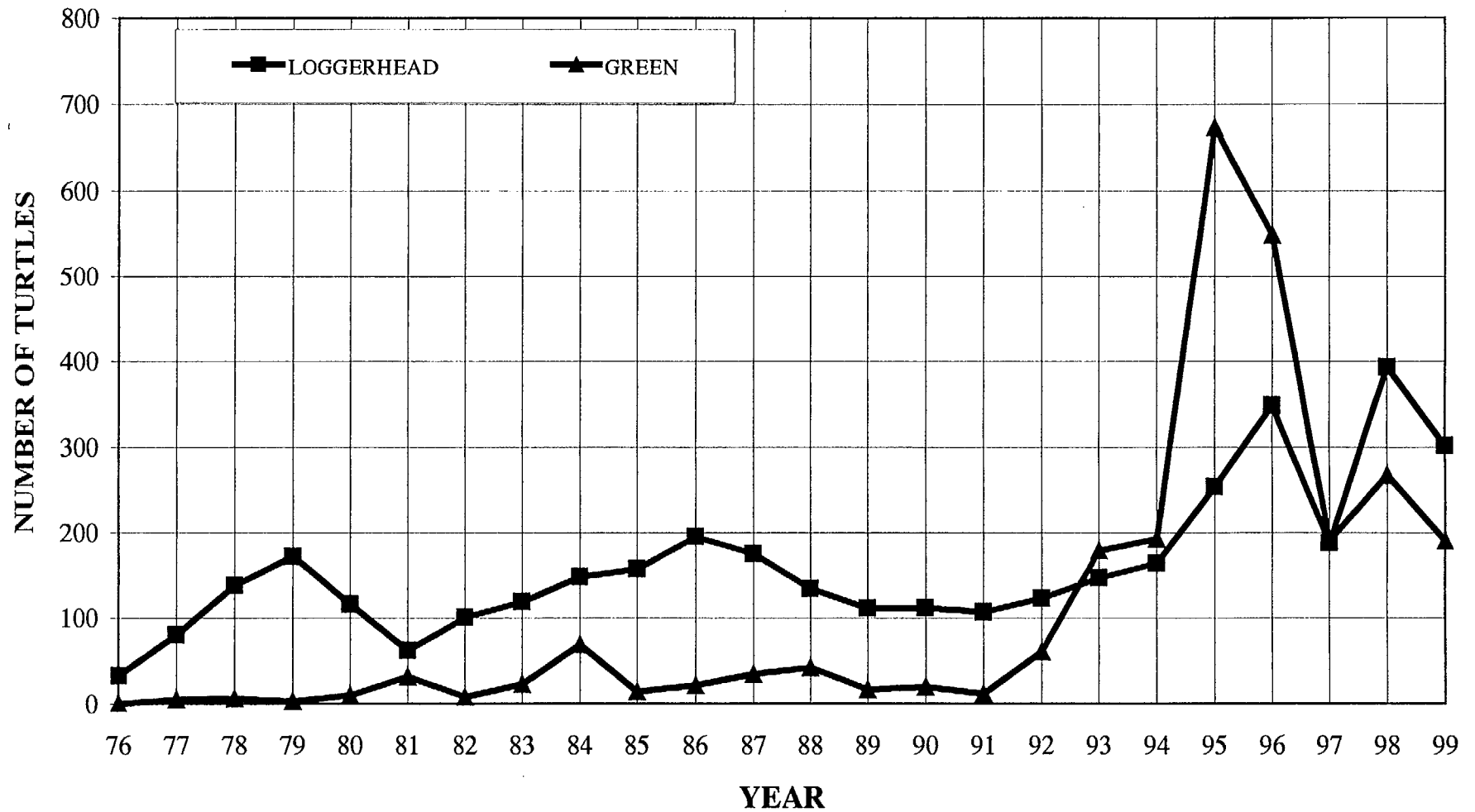


Figure 10. Number of Loggerhead and Green Turtles Removed Each Year from the Intake Canal, St. Lucie Plant, 1976 Through 1999.

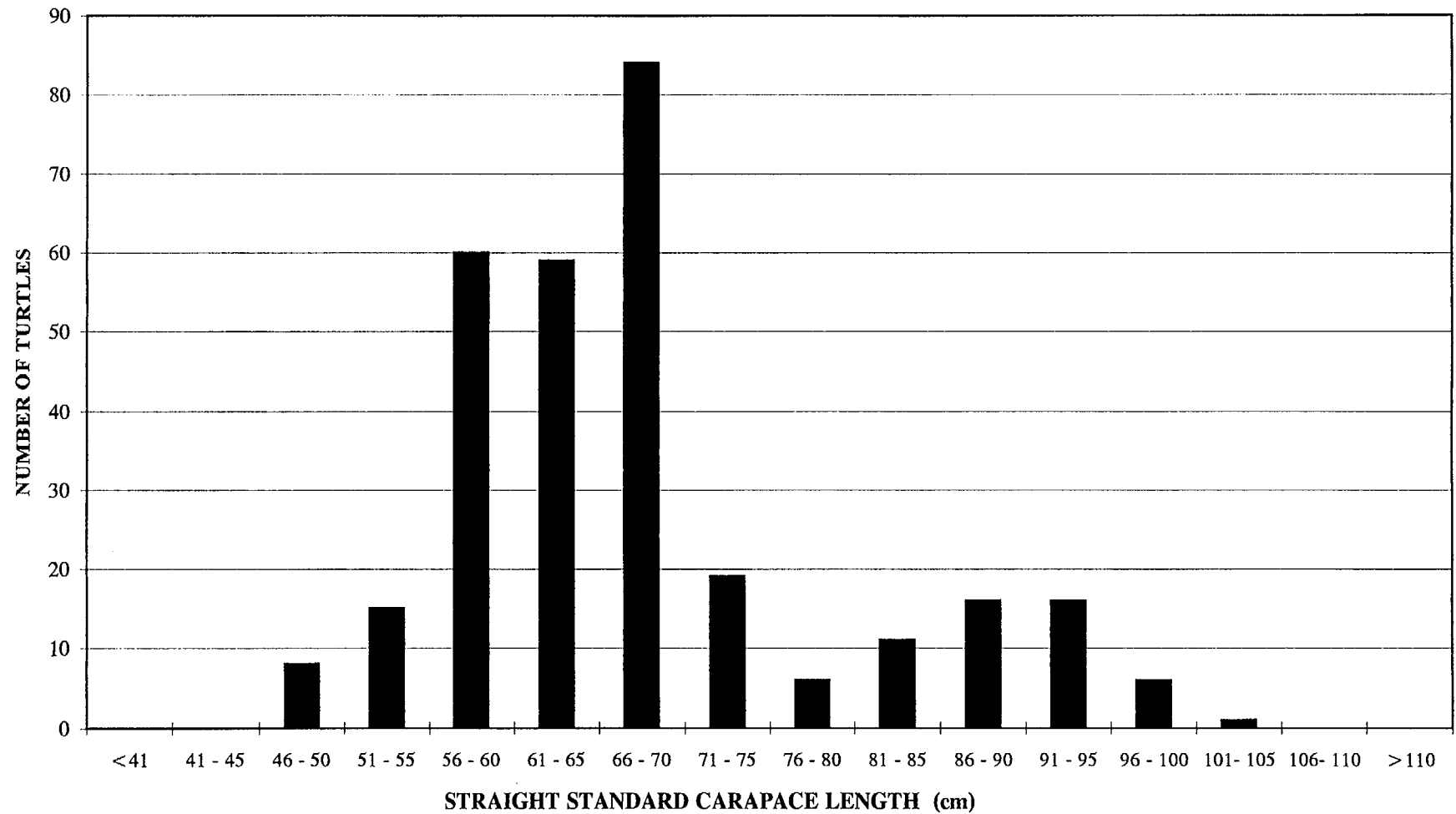


Figure 11. Size Distribution (SSCL) of Loggerhead Turtles (N= 301) Removed from the Intake Canal, St. Lucie Plant, 1999.

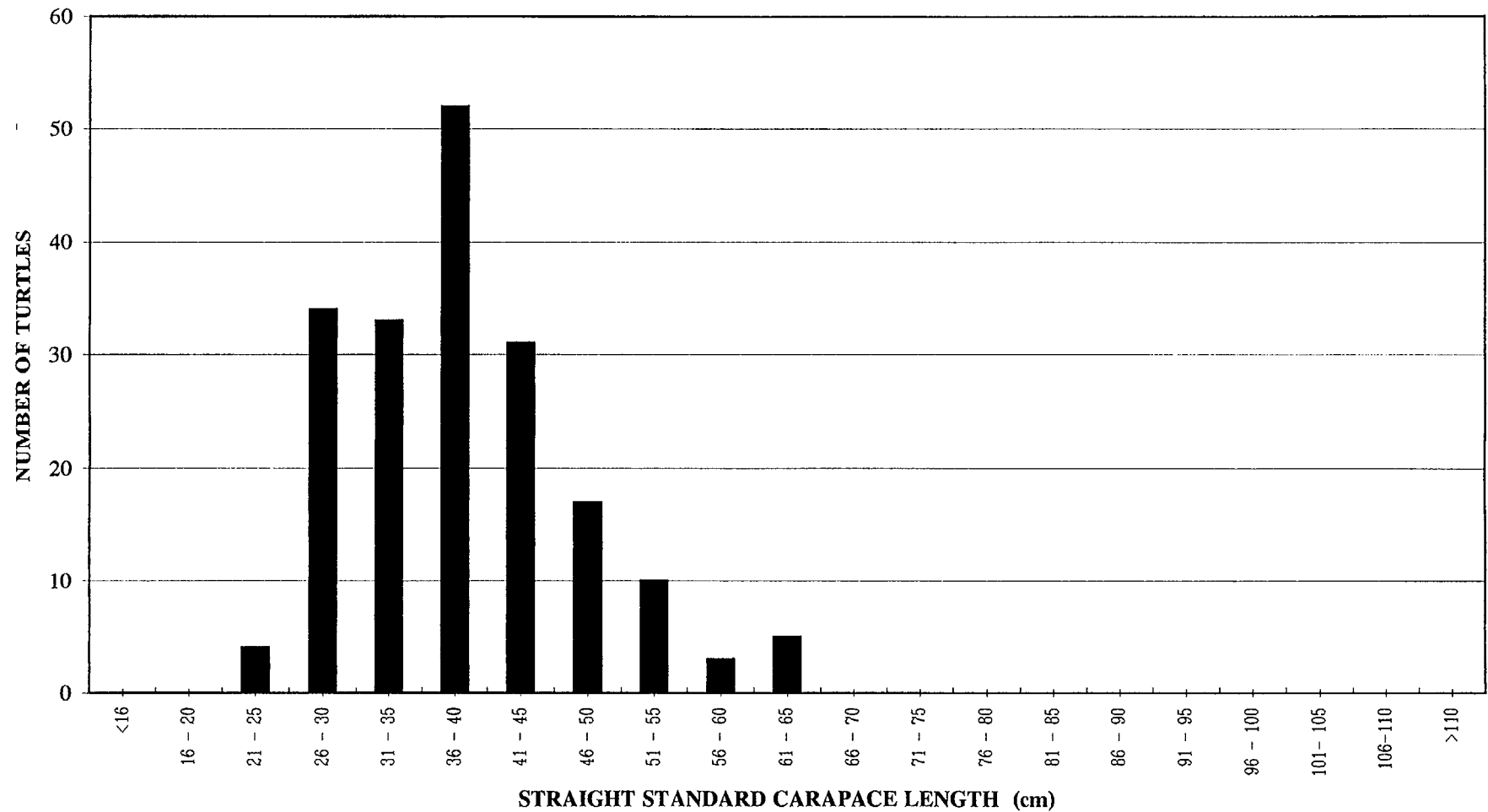


Figure 12. Size Distribution (SSCL) of Green Turtles (N=189) Removed from the Intake Canal, St. Lucie Plant, 1999.

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6.0 TABLES

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YEAR	Species					Total
	Loggerhead	Green	Leatherback	Hawksbill	Kemp's Ridley	
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)
Total	3880 (137)	2622 (56)	22	22	35 (4)	6581 (197)
Annual Mean*	176.4	114.0	1.0	1.0	1.5	284.7

* Excludes 1976 (partial year of plant operation).

Table 1. Total Number of Captures and (Number Dead) Turtles Removed from the Intake Canal.

Month	Number of Captures	Percent of All Captures	Minimum	Maximum	Mean	Standard Deviation	1999
January	459	11.9%	6	39	20.0	10.7	38
February	359	9.3%	5	34	15.6	8.4	24
March	368	9.6%	1	60	16.0	14.4	14
April	390	10.1%	0	47	17.0	12.5	26
May	343	8.9%	0	40	14.9	11.4	39
June	393	10.2%	3	42	17.1	11.1	29
July	446	11.6%	0	87	19.4	20.2	41
August	349	9.1%	2	43	15.2	12.1	25
September	222	5.8%	1	19	9.7	6.5	28
October	204	5.3%	0	27	8.9	6.2	11
November	138	3.6%	0	15	6.0	4.1	13
December	176	4.6%	1	14	7.7	4.2	14
Total**	3847		0	87			302
Mean	320.6				13.9		25.2
Std. Deviation	107.7				4.7		10.6
* First full year of plant operation							
** 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 -1999.

Month	Number of Captures	Percent of All Captures	Minimum	Maximum	Mean	Standard Deviation	1999
January	301	11.5 %	0	59	13.1	15.2	17
February	301	11.5 %	0	64	13.1	17.9	12
March	378	14.4 %	0	147	16.4	34.8	8
April	217	8.3 %	0	64	9.4	17	7
May	192	7.3 %	0	91	8.3	19.8	12
June	144	5.5 %	0	52	6.3	12.3	7
July	135	5.1 %	0	61	5.9	13.8	10
August	166	6.3 %	0	64	7.2	15	15
September	188	7.2 %	0	77	8.2	18.7	40
October	219	8.4 %	0	54	9.5	15.2	21
November	167	6.4 %	0	42	7.3	10.7	17
December	214	8.2 %	0	68	9.3	15.7	24
Total	2622		0	147			190
Mean	218.5				9.5		15.8
Std. Deviation	73.0				3.2		9.4

* First full year of plant operation.

Table 3. Total Number of Green Turtles Removed Each Month from the Intake Canal, St. Lucie Plant, 1977-1999.

ANNUAL ENVIRONMENTAL OPERATING REPORT

PART II

1.0 INTRODUCTION

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

2.0 SEA TURTLE MONITORING AND ASSOCIATED ACTIVITIES

Surveillance and maintenance of the light screen to minimize sea turtle disorientation as required by Section 4.2.4 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 24 mm in diameter, to clean the condenser tubes through which seawater flows to cool steam after its pass through the plant's turbines. This system improves plant performance while reducing the need for chemical treatments such as biocides or chlorine to control biofouling.

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

Sponge ball inventories and estimates of sponge ball loss to the environment have been performed since system start-up on both units. Number of ball strainer back flushes has also been tracked. In addition, daily beach surveys have been performed on plant property (approximately 2.5 miles) to note any sponge balls that may occur as a result of loss from the plant. This survey area has been extended during the turtle-nesting season to almost 12 miles.

The results of the program for 1999 are presented in Table 1. Larger sponge ball losses occurred on Unit 1 for the year. Increased macrofouling, prior to coating the water box internals on Unit 1, was responsible for somewhat higher ball losses during the first part of the year. A strainer misalignment appears to have increased losses in November of 1999. A similar incident occurred on Unit 2 in August of 1999. Ninety-eight sponge balls were found whole in the environment near the plant. This is an increase over previous years, but the number indicates that few balls actually reach the environment whole. The strainer alignment problem on Unit 2 may have attributed to the increased number of sponge balls found on the beach in August and September of 1999. These strainer alignment issues have since been corrected.

Figure 1 indicates that estimated sponge ball loss for both units generally remained low through the year, with the previously discussed peaks in January, August, and November. Average daily ball loss in 1999 decreased from 1998 but is higher than the 1996 and 1997 totals (Figure 2). Estimated sponge ball loss from both units was 17.4 balls per day for 1999. This reflects a decrease of about three balls per day from 1998.

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(a) EPP NONCOMPLIANCES AND CORRECTIVE ACTIONS TAKEN

No noncompliances under EPP Section 5.4.1(a) were determined to have occurred during 1999.

5.4.1(b) CHANGES IN STATION DESIGN OR OPERATION, TESTS, AND EXPERIMENTS IN ACCORDANCE WITH EPP SUBSECTION 3.1

FPL letter L-99-051 transmitted the request for modification of Wastewater Permit Application to FDEP. The modification involves the replacing of the demineralizer portion of the make-up system with a water softener/reverse osmosis treatment system followed by demineralizer polishing. This letter was transmitted to NRC March 1, 1999.

FPL letter L-99-153 transmitted the modification of the site Wastewater Permit, which as issued by the Florida Department of Environmental Protection on June 4, 1999. This letter was transmitted to NRC June 30, 1999.

5.4.1(c) NONROUTINE REPORTS SUBMITTED TO THE NRC FOR THE YEAR 1999 IN ACCORDANCE WITH EPP SUBSECTION 5.4.2

1. Report concerning the mortality of a 7.5-pound Green Sea Turtle in an intake canal capture net. Event was reported to NRC by FPL letter L-99-045 on March 1, 1999.

2. Report concerning the mortality of a 67-pound Loggerhead Sea Turtle in the intake canal. Event was reported to NRC by FPL letter L-99-183 on August 13, 1999.
3. Report concerning the mortalities of three juvenile Green Sea Turtles in the intake canal, thereby exceeding the Incidental Take Statement Limit for the Green Sea Turtle at the Plant. FPL therefore requested that NRC begin the necessary steps to reinitiate formal consultation under Section 7 of the Endangered Species Act. Events were reported to NRC by FPL letter L-99-214 on October 1, 1999.

TABLE 1

**1999 ST. LUCIE PLANT CONDENSER TUBE CLEANING
SYSTEM SUMMARY**

MONTH	STRAINER BACK FLUSHES		ESTIMATED BALL LOSS		BALLS FOUND ON BEACH
	UNIT 1	UNIT 2	UNIT 1	UNIT 2	
January	20	16	788***	465	1
February	20	16	+66**/***	105	1
March	27	19	573***	33	0
April	23	17	200	9	3
May	32	15	106	+2**	2
June	22	14	37	440	5
July	19	14	92	486*****	5
August	14	11	+58**	1321*****	56
September	4*	13	43	126	25
October	0*	15	0	+105**	0
November	10	18	1604*****	+46**	0
December	16	17	135	61	0
Total	207	185	3454	2893	98

* Unit 1 system shutdown during refueling, 9/13 to 10/18/99.

** Net gain in inventory.

*** Macrofouling in tubes and on strainers

***** Strainer Misalignment

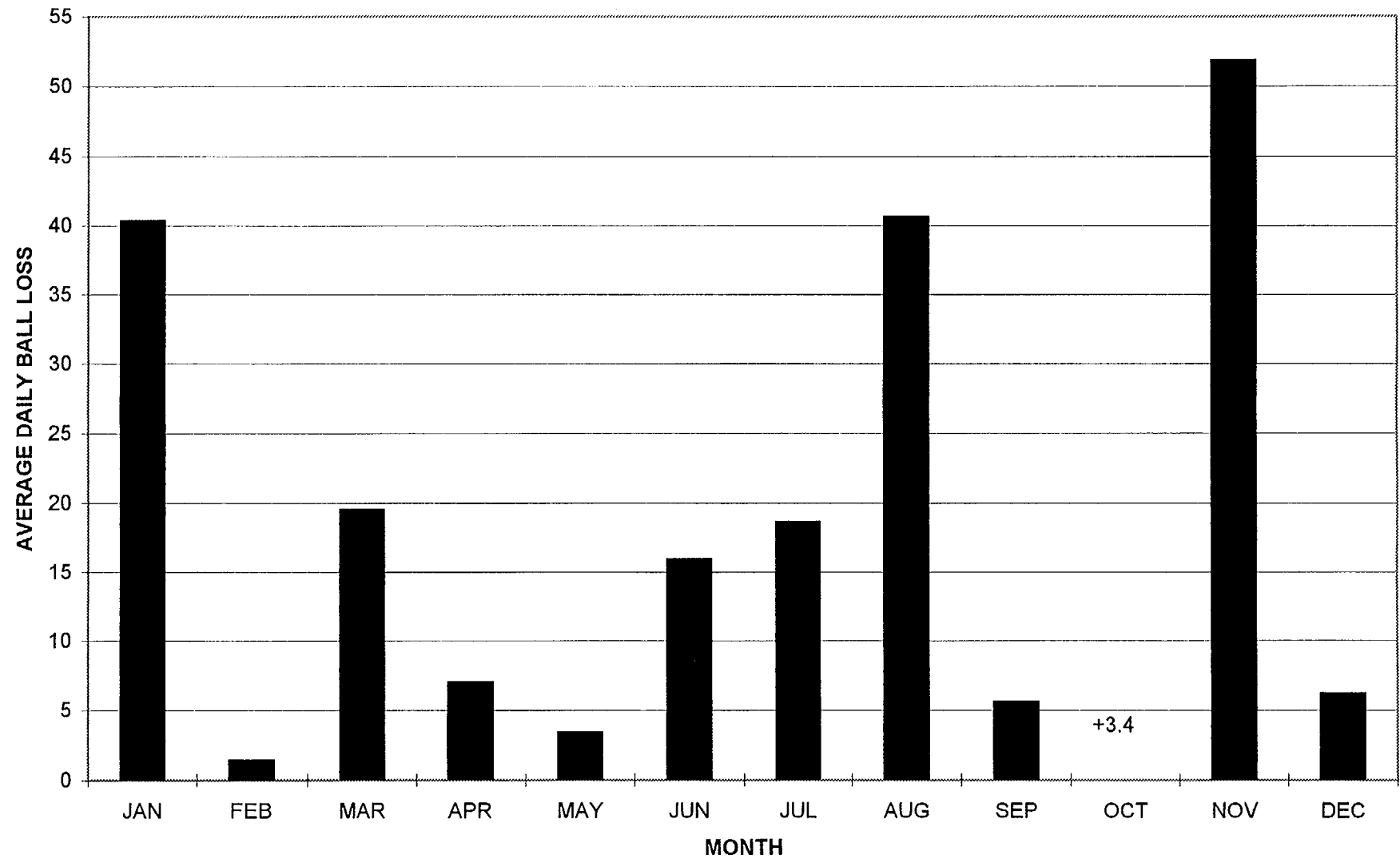


Figure 1. Estimated Average Daily Sponge Ball Loss by Month from St. Lucie Plant (Both Units) for 1999.

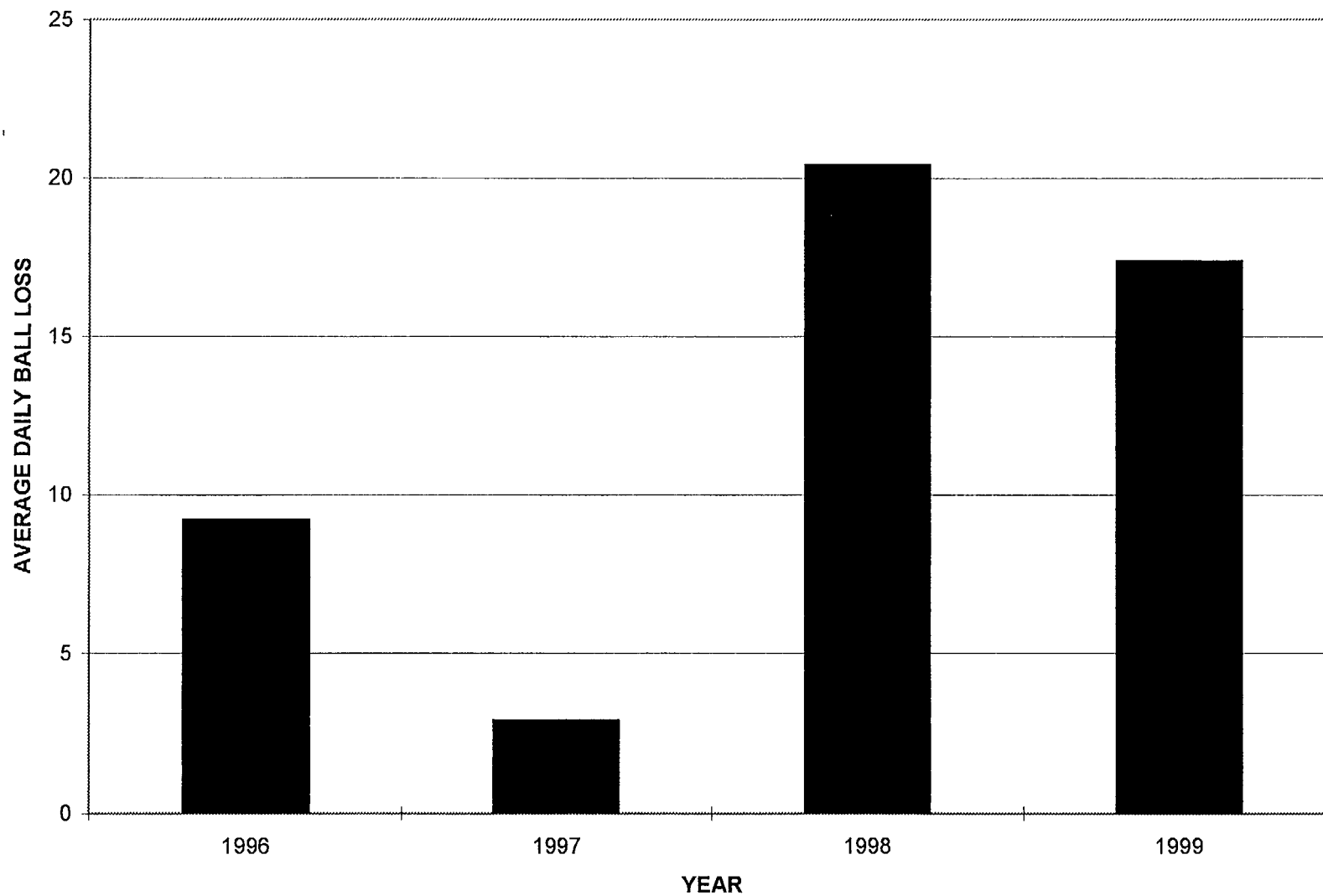


Figure 2. Average Daily Sponge Ball Loss from the St. Lucie Plant (Both Units) Since System Start-Up (January 1996).