NRC FORM 464 Part I (03-2017)

U.S. NUCLEAR REGULATORY COMMISSION

RESPONSE TO FREEDOM OF INFORMATION ACT (FOIA) REQUEST

FOIA: 2017-0644

RESPONSE NUMBER: 1

RESPONSE TYPE: ☐ INTERIM ☑ FINAL

REQUESTER: Julian Tarver

DATE: 08/10/2017

DESCRIPTION OF REQUESTED RECORDS:

ML060580303, ML071700161, ML071240097, ML07170011

PART I. – INFORMATION RELEASED

You have the right to seek assistance from the NRC's FOIA Public Liaison. Contact information for the NRC's FOIA Public Liaison is available at https://www.nrc.gov/reading-rm/foia/contact-foia.html

☑ Agency records subject to the request are already available on the Public NRC Website, in Public ADAMS or on microfiche in the NRC Public Document Room.

☑ Agency records subject to the request are enclosed.

☐ Records subject to the request that contain information originated by or of interest to another Federal agency have been referred to that agency (see comments section) for a disclosure determination and direct response to you.

☐ We are continuing to process your request.

☑ See Comments.

PART I.A -- FEES

AMOUNT*

$0.00

*See Comments for details

☐ You will be billed by NRC for the amount listed.

☐ You will receive a refund for the amount listed.

☐ Fees waived.

NO FEES

☑ Minimum fee threshold not met.

☐ Due to our delayed response, you will not be charged fees.

PART I.B -- INFORMATION NOT LOCATED OR WITHHELD FROM DISCLOSURE

☐ We did not locate any agency records responsive to your request. *Note*: Agencies may treat three discrete categories of law enforcement and national security records as not subject to the FOIA ("exclusions"). 5 U.S.C. 552(c). This is a standard notification given to all requesters; it should not be taken to mean that any excluded records do, or do not, exist.

☐ We have withheld certain information pursuant to the FOIA exemptions described, and for the reasons stated, in Part II.

☐ Because this is an interim response to your request, you may not appeal at this time. We will notify you of your right to appeal any of the responses we have issued in response to your request when we issue our final determination.

☐ You may appeal this final determination within 90 calendar days of the date of this response by sending a letter or e-mail to the FOIA Officer, at U.S. Nuclear Regulatory Commission, Washington, D.C. 20555-0001, or FOIA.Resource@nrc.gov. Please be sure to include on your letter or email that it is a "FOIA Appeal." You have the right to seek dispute resolution services from the NRC's Public Liaison, or the Office of Government Information Services (OGIS). Contact information for OGIS is available at https://ogis.archives.gov/about-ogis/contact-information.htm

PART I.C COMMENTS (Use attached Comments continuation page if required)

We acknowledge receipt of your FOIA request. Please note that we were not able to locate ML07170011 as it appears to be missing a digit.

Signature - Freedom of Information Act Officer or Designee

Stephanie A. Blaney

Digitally signed by Stephanie A. Blaney
DN: c=US, o=U.S. Government, ou=U.S. Nuclear Regulatory Commission, ou=NRC-PIV, cn=Stephanie A. Blaney, 0.9.2342.19200300.100.1.1=200001697
Date: 2017.08.10 07:09:11 -04'00'

February 24, 2006

Mr. David Bernhart
Assistant Regional Administrator
for Protected Resources
NOAA's National Marine Fisheries Service
Southeast Regional Office
263 13th Avenue, South
St. Petersburg, FL 33701

SUBJECT: BIOLOGICAL ASSESSMENT FOR THE REINITIATION OF A FORMAL CONSULTATION FOR CONTINUED OPERATION OF THE ST. LUCIE NUCLEAR POWER PLANT (TAC NOS. MC7266 AND MC7267)

Dear Mr. Bernhart:

The U.S. Nuclear Regulatory Commission (NRC) staff has prepared the enclosed Biological Assessment (BA) to reinitiate formal consultation, under Section 7 of the Endangered Species Act, regarding the continued operation of the St. Lucie Nuclear Power Plant. In your May 4, 2001, Biological Opinion (BO), the current Incidental Take Statement (ITS), as clarified by letter dated July 30, 2002, authorizes the annual take limit for injured and dead (due to plant operations) loggerhead and green turtles by percentage, up to one percent of the annual total loggerhead and green turtles (combined). Additionally, there are limits causally related to plant operations of two lethal takes of Kemp's ridley turtles each year and of one hawksbill or leatherback turtle injured or killed every two years. There is an annual maximum of 1000 takes for all sea turtle species combined, regardless of cause. The take limits for sea turtles have not been met or exceeded. However, a smalltooth sawfish (*Pristis pectinata*) take occurred on May 16, 2005. Because the smalltooth sawfish is listed as Federally endangered and is not addressed in the current ITS, this take triggered reinitiation of a Section 7 consultation. Therefore, the NRC is requesting a reinitiation of formal consultation with the submission of the enclosed BA.

On September 29, 2005, representatives of the NRC, NOAA's National Marine Fisheries Service, and the Florida Power & Light Company (the licensee that maintains and operates the St. Lucie Nuclear Power Plant) met for a site tour and discussion of the smalltooth sawfish take and rescue. The site tour focused on the intake canal and rescue transportation route from the intake canal over the dune to the Atlantic Ocean. At the meeting the specific sequence of events associated with the sawfish sighting and rescue were discussed in addition to potential mitigation measures, which are described in detail in the enclosed BA.

If you have any questions regarding this BA or the staff's request, please contact Ms. Harriet Nash of the Environmental Branch, at 301-415-4100 or by e-mail at hln@nrc.gov.

Sincerely,

/RA Pao-Tsin For/

Frank Gillespie, Director
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos.: 50-335 and 50-389

Enclosure: As stated

cc w/encl.: See next page

If you have any questions regarding this BA or the staff's request, please contact Ms. Harriet Nash of the Environmental Branch, at 301-415-4100 or by e-mail at hln@nrc.gov.

Sincerely,
/RA Pao-Tsin Kuo For/

Frank Gillespie, Director
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos.: 50-335 and 50-389

Enclosure: As stated

cc w/encl.: See next page

DISTRIBUTION:
F. Gillespie
R. Franovich (RidsNrrDlrRebb)
B. Moroney
M. Masnik
H. Nash

Adams accession no.: **ML060580303**

E:\Filenet\ML060580303.wpd

OFFICE	PM:REBB	LA:DLR	PM:REBB	BC:REBB	PM:DORL	D:DLR
NAME	H. Nash	Y. Edmonds	M. Masnik	R. Franovich	B. Moroney	F. Gillespie P.T. (RA Kuo For/
DATE	2/14/06	2/2/06	2/14/06	2/22/06	2/19/06	2/24/06

OFFICIAL RECORD COPY

St. Lucie

cc:

Mr. J.A. Stall
Senior Vice President, Nuclear and Chief Nuclear Officer
Florida Power and Light Company
P.O. Box 14000
Juno Beach, FL 33408-0420

Senior Resident Inspector
St. Lucie Plant
U.S. Nuclear Regulatory Commission
P.O. Box 6090
Jensen Beach, Florida 34957

Craig Fugate, Director
Division of Emergency Preparedness
Department of Community Affairs
2740 Centerview Drive
Tallahassee, Florida 32399-2100

M. S. Ross, Managing Attorney
Florida Power & Light Company
P.O. Box 14000
Juno Beach, FL 33408-0420

Marjan Mashhadi, Senior Attorney
Florida Power & Light Company
801 Pennsylvania Avenue, NW.
Suite 220
Washington, DC 20004

Mr. Douglas Anderson
County Administrator
St. Lucie County
2300 Virginia Avenue
Fort Pierce, Florida 34982

Mr. William A. Passetti, Chief
Department of Health
Bureau of Radiation Control
2020 Capital Circle, SE, Bin #C21
Tallahassee, Florida 32399-1741

Mr. Gordon L. Johnston
Acting Site Vice President
St. Lucie Nuclear Plant
6351 South Ocean Drive
Jensen Beach, Florida 34957-2000

Mr. Christopher R. Costanzo
Acting Plant General Manager
St. Lucie Nuclear Plant
6351 South Ocean Drive
Jensen Beach, Florida 34957-2000

Mr. Terry L. Patterson
Licensing Manager
St. Lucie Nuclear Plant
6351 South Ocean Drive
Jensen Beach, Florida 34957-2000

Mark Warner, Vice President
Nuclear Operations Support
Florida Power and Light Company
P.O. Box 14000
Juno Beach, FL 33408-0420

Mr. Rajiv S. Kundalkar
Vice President - Nuclear Engineering
Florida Power & Light Company
P.O. Box 14000
Juno Beach, FL 33408-0420

Mr. J. Kammel
Radiological Emergency
Planning Administrator
Department of Public Safety
6000 Southeast Tower Drive
Stuart, Florida 34997

Mr. James Ross
Nuclear Energy Institute
1776 I Street, NW, Suite 400
Washington, DC 20006-3708

Mr. Bill Parks
Acting Operations Manager
St. Lucie Nuclear Plant
6351 South Ocean Drive
Jensen Beach, FL 34957-2000

Biological Assessment

St. Lucie Units 1 and 2
Reinitiation of Section 7 Consultation

St. Lucie County, Florida

February 2006

Docket Nos. 50-335 and 50-389

U.S. Nuclear Regulatory Commission
Rockville, Maryland

1.0 Introduction and Summary of Conclusions

This Biological Assessment (BA) was prepared in support of reinitiating a formal consultation between the U.S. Nuclear Regulatory Commission (NRC) and National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) in compliance with Section 7 of the Endangered Species Act of 1973, as amended (ESA). The purpose of this BA is to examine the potential impacts on ESA-listed species associated with the continued operation of the St. Lucie Nuclear Power Plant's circulating seawater cooling system, and to support the NRC's July 8, 2005, request to NMFS for reinitiation of formal Section 7 consultation regarding the St. Lucie Nuclear Power Plant. The NRC has been consulting with NMFS regarding sea turtle takes at the St. Lucie Nuclear Power Plant since 1982; several BAs and Biological Opinions (BOs) have been issued since 1982 resulting in periodic revisions to the Incidental Take Statement (ITS), as appropriate. All previous consultations with NMFS have addressed sea turtle takes; however, this reinitiation of formal consultation was triggered by a take of a smalltooth sawfish (*Pristis pectinata*) on May 16, 2005.

Florida Power and Light Company (FPL) is the licensee that operates the St. Lucie Nuclear Power Plant and conducts an ongoing turtle capture-and-release program in the station's intake canal. There have been no procedural changes in the operation of the St. Lucie Nuclear Power Plant's circulating seawater cooling system since the last BO, dated May 4, 2001, which was clarified by letter dated July 30, 2002. Therefore, the NRC staff suggests maintaining the 2001 ITS for sea turtles with an addendum for the smalltooth sawfish. The 2001 BO analyzed the effects of operation of the St. Lucie Nuclear Power Plant's circulating seawater cooling system on loggerhead turtles (*Caretta caretta*), green turtles (*Chelonia mydas*), Kemp's ridley turtles (*Lepidochelys kempi*), leatherback turtles (*Dermochelys coriacea*), and hawksbill turtles (*Eretmochelys imbricata*). This BA provides a brief update of information regarding interactions of the cooling system with these sea turtle species. However, the central focus of this BA is to identify potential impacts of cooling system operation on the smalltooth sawfish, which was listed as endangered on November 16, 2005, based on NMFS's final determination dated April 1, 2003.

The St. Lucie Nuclear Power Plant is located on Hutchinson Island in St. Lucie County, Florida. The island is a barrier island bounded by the Atlantic Ocean to the east and the Indian River Lagoon to the west. The cooling system withdraws water from the Atlantic Ocean to cool the condensers of the two operating reactors, St. Lucie Units 1 and 2, which began operating in 1976 and 1983, respectively. The intake portion of the cooling system consists of three intake structures with velocity caps in the ocean, three buried pipelines, a common intake canal, and two intake well structures (one for each unit). In the intake canal is a series of nets, trash bars, and screens to prevent debris and organisms from being impinged on the intake screens.

Animals occasionally enter the canal system of the St. Lucie Nuclear Power Plant along with seawater that is withdrawn from the Atlantic Ocean for condenser cooling. The intake structures and velocity caps for the plant are located about 365 meters (m) (1200 feet [ft]) offshore where they also serve as artificial reefs. As such, these structures attract turtles and other marine life by providing food and shelter. If an animal passes through the vertical plane of the velocity cap, the animal would enter the intake pipeline, which travels under the ocean floor and barrier island and debouches in the intake canal on the western side of the beach dunes.

Once in the intake canal, the animals cannot escape due to the high flow rates in the intake pipes and must be rescued and returned to the ocean. Therefore, FPL has a capture-and-release program to retrieve sea turtles and return them to the ocean. The capture program includes conservation efforts and collaboration with research organizations, sea turtle stranding programs, and Federal and State agencies. FPL has an existing agreement with Florida Fish and Wildlife Conservation Commission (FFWCC) regarding case-specific decisions on how and where to treat injured turtles that are not healthy enough to be returned immediately to the ocean. The FFWCC is also consulted to conduct turtle necropsies when needed. NRC's long history of consultations with NMFS regarding the St. Lucie Nuclear Power Plant and FPL's commitment to minimize sea turtle injury and mortality have resulted in the modification and addition of barrier nets over time.

According to FPL, the smalltooth sawfish take on May 16, 2005, is the only known occurrence of the species in the St. Lucie Nuclear Power Plant intake canal since the cooling system began operating in 1976. Although the smalltooth sawfish was not listed under the ESA until 2005, the NRC staff believes that a sighting of this species most likely would have been reported given the unusual morphology of the rostrum. Once in the intake canal, the smalltooth sawfish was ensnared in a tangle net used to retrieve turtles. FPL biologists acted quickly to retrieve the specimen, take measurements and photographs, and return the animal to the ocean using the turtle stretcher and cart. The animal appeared healthy and immediately swam away upon release. On September 29, 2005, representatives of NMFS, NRC, and FPL met at the St. Lucie Nuclear Power Plant to discuss the smalltooth sawfish take. The meeting included a tour of the intake canal and the beach. Discussions focused on the series of events immediately following the take and on possible rescue strategies in the event of a future smalltooth sawfish take. Because the occurrence of the smalltooth sawfish at St. Lucie Nuclear Power Plant is rare (one take since 1976), because the FPL biologists acted with vigilance to rescue the animal successfully, and because FPL committed to put proper procedures in place to deal with any future smalltooth sawfish takes, the NRC staff believes that the continued operation of the St. Lucie Nuclear Power Plant's cooling system would not jeopardize the continued existence of the smalltooth sawfish.

2.0 Purpose

This BA is submitted to NMFS in compliance with Section 7 of the ESA, and in support of the NRC's July 8, 2005, request to NMFS for reinitiation of formal Section 7 consultation on ESA-listed species at the St. Lucie Nuclear Power Plant, which is licensed to FPL.

The purpose of this BA is to examine the potential impacts of continued operation of the St. Lucie Nuclear Power Plant's cooling system on ESA-listed species. Since 1982, the NRC has been consulting with NMFS regarding sea turtle takes at St. Lucie Nuclear Power Plant. Historically, the operation of the plant's cooling system has resulted in takes of several sea turtle species: loggerhead turtle (*Caretta caretta*), Kemp's ridley turtle (*Lepidochelys kempii*), green turtle (*Chelonia mydas*), leatherback turtle (*Dermochelys coriacea*), and hawksbill turtle (*Eretmochelys imbricata*). FPL has a program in place to retrieve entrapped turtles and return them to the ocean if they are in healthy condition. If the turtle is injured or dead, FPL coordinates treatment or necropsy with FFWCC. If the turtle is unharmed, it is measured, tagged, and returned to the ocean.

The incidental take limits for turtles have not been exceeded, and FPL's specific protocols designed to retrieve and rescue turtles are in place and followed regularly. This Section 7 consultation reinitiation is in response to a take of smalltooth sawfish (*Pristis pectinata*) that occurred on May 16, 2005. The smalltooth sawfish was measured, photographed, and rescued successfully by FPL biologists. It swam away freely upon release into the Atlantic Ocean. This BA will focus on the smalltooth sawfish.

3.0 Site Description

The St. Lucie Nuclear Power Plant is located on a 457-hectare (1130-acre) site on Hutchinson Island on Florida's east coast (see Figures 1 and 2). The plant is approximately midway between the Ft. Pierce and St. Lucie Inlets. It is bounded on the eastern side by the Atlantic Ocean and on the western side by the Indian River Lagoon, which is a long, shallow estuary. Hutchinson Island is a barrier island that extends 36 kilometers (km) (22.4 miles [mi]) between inlets and attains its maximum width of 2 km (1.2 mi) at the plant site. Elevations approach 5 m (16.4 ft) atop dunes bordering the beach on the eastern side of the island 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 (20.5 mi) offshore. Oceanic water associated with the western boundary of the current periodically meanders over the inner shelf, especially during summer months.

4.0 Description of the St. Lucie Nuclear Power Plant

St. Lucie Units 1 and 2 consist of two 839-net megawatt-electric (MWe) nuclear-fueled generating units that use nearshore waters from the Atlantic Ocean for the plant's once-through condenser cooling system. The cooling water system removes heat from the condensers and other auxiliary equipment. Eight pumps (four per unit) located at the intake wells circulate water through the system. The pumping capacity ranges from 50,470 to 70,660 liters per second (800,000 to 1,120,000 gallons per minute) (NRC 2003).

Water for this system enters through three submerged intake structures located about 365 m (1200 ft) offshore at a depth of about 7 m (23 ft) (Figure 2). The intake structures have vertical cylindrical openings and are equipped with concrete velocity caps supported by columns extending about 1.8 m (6 ft) from the intake openings. The velocity caps minimize entrainment of fish and other organisms by eliminating vertical flow and slowing horizontal flow. Water passes through these structures and into submerged pipes (two 3.7 m [12 ft] and one 4.9 m [16 ft] in diameter) running under the beach. Flow velocities in the pipes range from 0.11 to 2.1 m/s (0.37 to 6.8 ft/s), depending on the pipe's orientation and size. The three pipes all deliver water into a 1500-m (4921-ft) long intake canal, which transports the water to the plant. The intake canal is a trapezoidal channel about 55 m (180 ft) wide and 9.1 m (30 ft) deep under normal conditions. FPL occasionally dredges the intake canal to remove accumulated sediments and maintain proper flow conditions; most recently, the canal was dredged in 2002 and 2005.

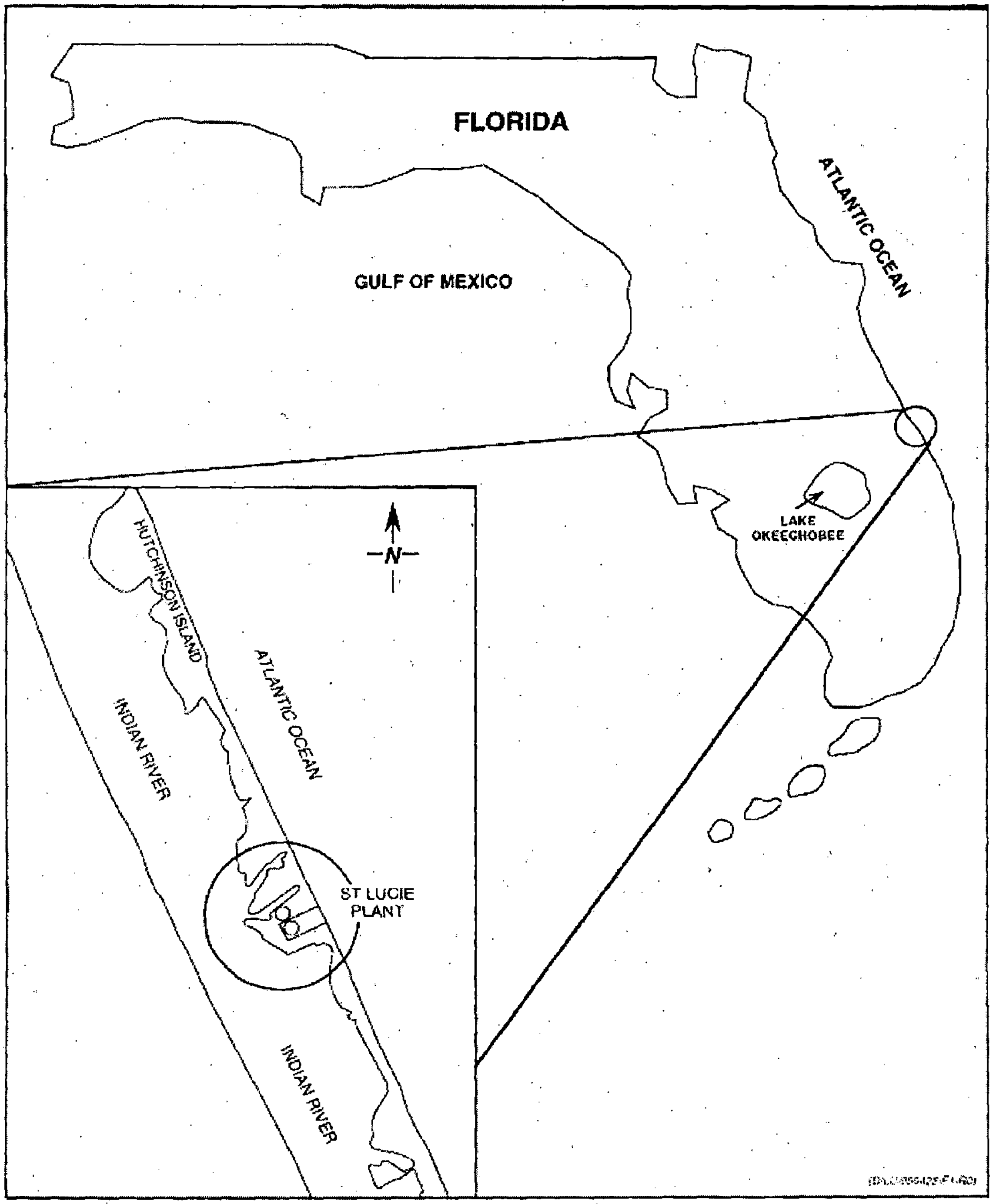

Figure 1. Location of St. Lucie Nuclear Power Plant

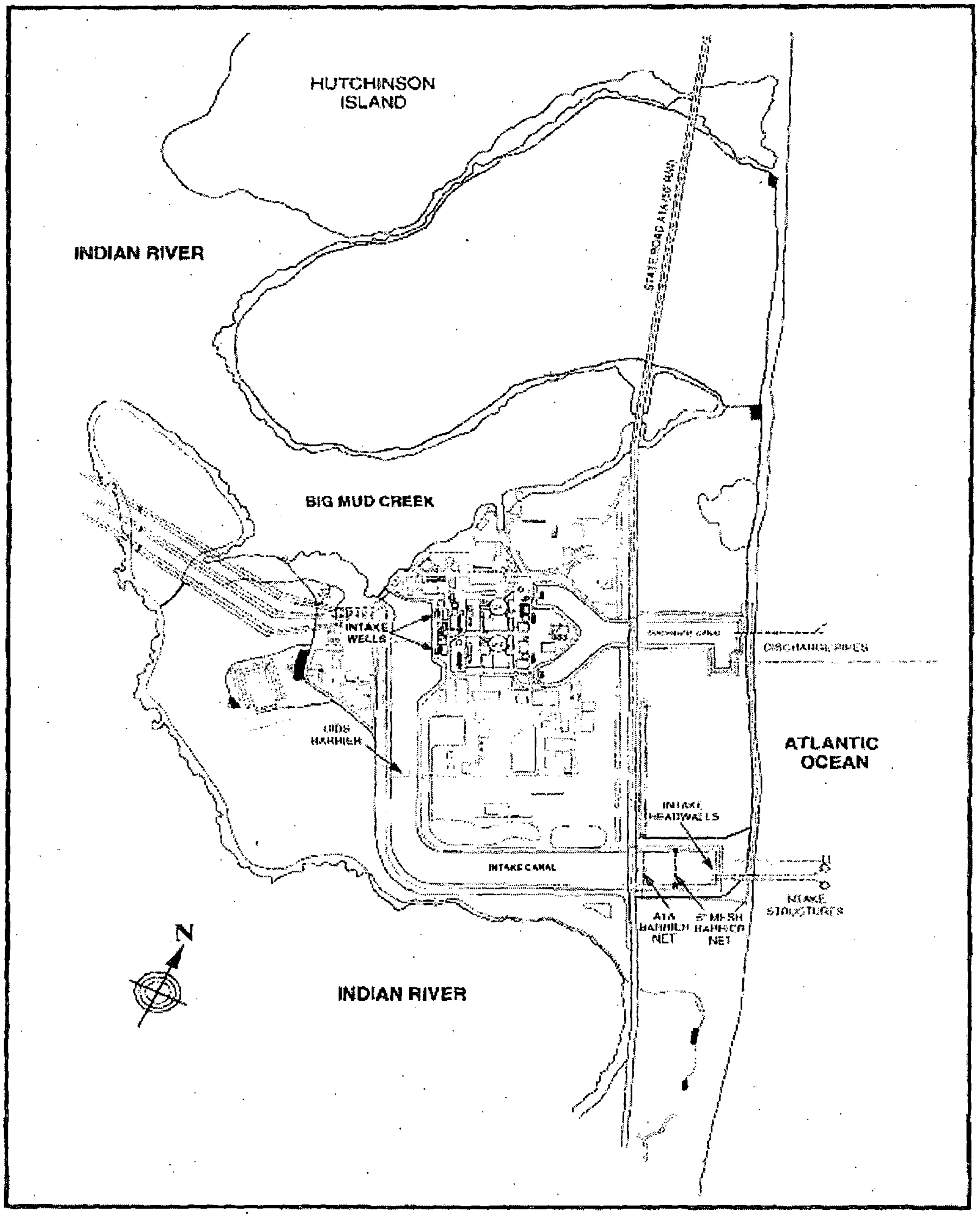

Figure 1. St. Lucie Cooling Water Intake and Discharge System

In addition to the velocity caps on the intake pipes, other measures are in place to minimize impingement of marine biota at the St. Lucie Nuclear Power Plant. In the intake canal, there is a series of barriers to prevent sea turtles and other biota from being impinged on the screens where the water enters the plant. Heading from the intake headwalls toward the intake wells in the intake canal, first there is a 12.7-centimeter (cm) (5-inch [in.]) mesh net that is taut and sloped to prevent turtles from being entangled in the net. The net is monitored hourly by sea turtle biologists who rescue any entrapped turtles. Next, there is a 20-cm (8-in.) mesh barrier net, and finally, there is a rigid security barrier closest to the plant. Additionally, sea turtle biologists deploy two 30.5-m (100-ft) tangle nets in daylight hours (with occasional night hours as well) seven days a week to capture sea turtles between the intake headwall (where the water enters the intake canal from the pipes) and the 12.7-cm (5-in.) mesh barrier net. The nets are set in adjacent eddies and flow with the current without any weights. The tangle nets are inspected at least hourly. The biologists also use dip nets and free diving to capture turtles. Underwater inspections on the 12.7- and 20-cm (5- and 8-in.) mesh barrier nets are conducted quarterly. During these inspections, any holes found in the nets are repaired.

At the plant, water enters through the eight intake wells (four per unit). In front of each well are trash racks (vertical bars spaced 7.6 cm [3 in.] apart) and 1-cm (3/8-in.) mesh traveling screens, which also prevent impingement and entrainment of organisms. Security personnel inspect the intake wells every three hours as an added precautionary measure. After passing through the plant, the heated water is discharged into a 670-m (2198-ft) long canal that leads to two buried discharge pipelines. These pass underneath the dunes and along the ocean floor to the submerged discharge pipes, the first of which is 3.7 m (12 ft) in diameter and terminates approximately 380 m (1250 ft) offshore. The second discharge pipe has a diameter of 4.9 m (16 ft) and ends about 936 m (3070 ft) offshore. The first discharge pipe has a two-port "Y" diffuser, and the second discharge pipe has a multiport diffuser for about the last 430 m (1415 ft) of the pipe. The discharge pipes are approximately 730 m (2400 ft) north of the intake. The diffusers facilitate rapid distribution of the heated water on a large spatial scale to mix efficiently with ambient waters. Discharge temperatures are kept within limits of the Industrial Wastewater Facility Permit for St. Lucie Units 1 and 2.

5.0 Affected Species

Smalltooth Sawfish

Since the St. Lucie cooling water system began operating in 1976, the only protected species under NMFS's jurisdiction that have been affected by plant operations are five sea turtle species (loggerhead turtle, green turtle, Kemp's ridley turtle, leatherback turtle, and hawksbill turtle) and the smalltooth sawfish. Sea turtle biologists discovered a smalltooth sawfish in the intake canal on May 16, 2005. Because the turtle limits have not been met or exceeded and there is no new information available, no changes to turtle incidental take limits are expected, and this section focuses on the smalltooth sawfish. The smalltooth sawfish take triggered the reinitiation of a Section 7 consultation for St. Lucie Units 1 and 2.

Sawfish belong to a group of fishes called elasmobranchs, fishes of the subclass Elasmobranchii that includes sharks, rays, and skates. All elasmobranchs have cartilagenous skeletons. The smalltooth sawfish are in the Suborder Pristoidea, Family Pristidae, Genus *Pristis*, and species *pectinata*. The sawfish family, Pristidae, comprises elasmobranchs that have a unique rostral extension that is long and flat with teeth along the edges. The smalltooth sawfish has smaller teeth on the rostrum (saw) than most other species in the family. The smalltooth sawfish can have 24 to 32 teeth on each side of the rostrum, and once a sawfish loses its teeth, they do not grow back. These rostral teeth are technically dermal denticles (tiny skin teeth) that are common on shark skin. The rostrum of the smalltooth sawfish is approximately one-quarter the total length of the animal.

The sawfish are similar to sharks, especially the sawshark, in appearance. However, unlike the sawshark, which is a true shark with gills on the side of the head, the sawfish's gills are on the ventral surface like those of rays and skates as the sawfish has a flattened, ray-like head and trunk. While the smalltooth sawfish rests on the bottom, the spiracles, which are located behind the eyes on the dorsal surface, inhale water for breathing while the gills are laid against the bottom. Uncommon with rays and skates, sawfish have large dorsal and caudal fins like those of sharks.

5.1 Status

On April 1, 2003, the NMFS made the final determination to list the smalltooth sawfish *(Pristis pectinata)* as endangered under the ESA. The smalltooth sawfish was the first marine fish to be listed under the ESA; the actual listing occurred on November 16, 2005. After review of the scientific and commercial information available, the status review team determined the U.S. population segment of the smalltooth sawfish was in danger of extinction throughout all or a significant portion of its range. Four factors contributed to the listing of the sawfish: (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or educational purposes; (3) the inadequacy of existing regulatory mechanisms; and (4) other natural or manmade factors affecting its continued existence.

The smalltooth sawfish is also listed as critically endangered on the Red List of Threatened Animals issued by the World Conservation Union (IUCN) (Simpfendorfer 2002).

5.2 Distribution

While the smalltooth sawfish is known to occur in the Pacific and Atlantic Oceans, the U.S. population is only known to exist in the Atlantic Ocean. Historically, the U.S. population was found from New York to the Mexican border (Simpfendorfer and Wiley 2005) with the most common occurrences being from Texas to North Carolina. Now the range of the smalltooth sawfish is limited to the Florida peninsula with the most common sightings occurring in the region of the Everglades in the southern part of the state. (NMFS 2005)

5.3 Abundance

Accurate abundance estimates are not available for this species. However, records from museums and anecdotal observations from fishermen indicate that this species was once common throughout its historic range and that smalltooth sawfish have declined dramatically in U.S. waters over the last century. The significant decline was not recognized immediately because the smalltooth sawfish had no commercial value. The decline can be documented by using the data from smalltooth sawfish landings by shrimp trawlers of Louisiana. Several factors contributed to the decline. The most significant causes for the decline were recreational and commercial fishing and habitat loss. The smalltooth sawfish was taken regularly as bycatch in gillnet, trawl, and seine fisheries (Simpfendorfer 2002).

Information based on encounters with the smalltooth sawfish by fishermen, boaters, divers, and researchers from 1998 to 2004 indicate the majority of the population in Florida can be found from the Caloosahatchee River to Florida Bay. During that time period, 434 smalltooth sawfish encounters were reported throughout Florida, from St. Augustine to the Panhandle. In areas that had frequent historical accounts of the smalltooth sawfish, such as the Indian River Lagoon and the lower St. Johns River, sightings are now rare (Simpfendorfer and Wiley 2005).

5.4 Habitat

Sawfish habitat is found circumglobally in the tropics, and the fish typically reside in shallow or sheltered coastal areas and estuaries. Like only a few other elasmobranchs, sawfish are found in freshwater systems as well. Juvenile sawfish seem to prefer estuarine or freshwater shallows while adults are often found in waters 50 m (164 ft) or deeper (Simpfendorfer 2002). Smalltooth sawfish prefer muddy or sandy substrates close to shore. In the United States, the smalltooth sawfish can be found on inshore bars, mangrove edges, seagrass beds, and sometimes in deeper coastal waters.

5.5 Life History and Behavior

Very little is known about the life history of the smalltooth sawfish because it was not an important commercial species. However, large numbers were caught as bycatch in the early part of the 20th century, which likely contributed to the decline in the population (Poulakis and Seitz 2005). It is known that the smalltooth sawfish are slow-growing, late-maturing, long-living, and slow-reproducing fish, which are all life history characteristics contributing greatly to a potentially rapid population decline and a low recovery rate. Simpfendorfer (2000) calculated the population doubling time for the smalltooth sawfish to be 5.4 to 8.5 years, which would indicate that the recovery time for the depleted population would be very long.

Like all elasmobranchs, the smalltooth sawfish have internal fertilization and low fecundity. The smalltooth sawfish matures at about age 10 and lives 25 to 30 years (NMFS 2005). Typical sizes at maturation are about 270 cm (8.8 ft) for males and approximately 360 cm (11.8 ft) for females (Simpfendorfer 2002). Sawfish are ovoviviparous, and typically produce about 12 young per litter (Banister and Campbell 1985) although some smalltooth sawfish are found to have up to 20 embryos (Poulakis and Seitz 2005). Gestation is probably about one year, and it is thought that the female smalltooth sawfish gives birth during warmer months, thus allowing for continual reproductive cycles in parts of their range with warm waters all year (Passarelli and Curtis, 2005). The embryos resemble the adults, and during development the rostrum is soft and flexible, and its soft teeth are covered by a protective sheath until they are exposed shortly after birth. The rostrum straightens, and the teeth harden soon after birth. The smalltooth sawfish is approximately 2 ft long at birth and can grow up to 18 ft or more. There are no known formal studies on the growth and age of the sawfish, and the size at which the smalltooth sawfish reaches maturity is unknown.

The sawfish diet consists of schooling fish or crab, shrimp, or other benthic prey. The saw can be used to disrupt the bottom and make prey available by dislodging the animals from the substrate. Smalltooth sawfish can also use their rostrum to slash through schools of small fish wounding or stunning the fish to facilitate consumption. The toothed rostrum can also be used as a defensive mechanism by slashing the saw from side to side. Sawfish will defend themselves when threatened but are not known to aggressively attack humans unless they are provoked.

6.0 Incidental Captures

Since St. Lucie Nuclear Power Plant began operation in 1976, only six protected species under NMFS's jurisdiction that have been affected by operation of the plant's cooling water system. Of those six species, five are sea turtles: loggerhead turtle, green turtle, Kemp's ridley turtle, leatherback turtle, and hawksbill turtle. The sixth species is the smalltooth sawfish, which has only been observed once at the St. Lucie Nuclear Power Plant and is the focus of this BA and Section 7 consultation. All animals have entered the cooling water system's intake canal via the pipelines from the ocean. The series of barriers and the biologists' monitoring activities have ensured that the majority of the individuals have been returned to the ocean unharmed or have been treated for injuries.

6.1 Sea Turtles

From initial plant operation in 1976 through 2005, a total of 11,283 sea turtles (including recaptures), representing five different species, has been removed from the intake canal. The majority of the turtles captured were loggerheads (57.4 percent). Table 1 shows the sea turtle capture data over the last five calendar years, all of which have been subject to the existing ITS that took effect when the 2001 BO was issued. 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 occurrence of turtles in the vicinity of the plant, rather than to operational influences of the plant itself. Ongoing evaluations and improvements to the canal capture program during recent years have substantially decreased the amount of time entrapped sea turtles remain in the canal. 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.

The 12.7-cm (5-in.) 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. The improved design and net material has withstood the seaweed and jellyfish events that caused previous design failure of the old barrier net. Additionally, recent dredging of the intake canal (completed in 2002 and 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 regarding the ITS of the May 2001 Biological Opinion, there is language that turtle injury or mortality in the canal shall be counted when "resulting from plant operation." In response to this requirement, a qualified veterinarian determines cause of death or injury in cases that are not readily apparent.

Table 1: Sea Turtle Takes* in Recent Years

Turtle Species	2001	2002	2003	2004	2005
Loggerhead	270 (1)	341 (0)	538 (0)	624 (1)	486 (1)
Green	321 (5)	292 (2)	394 (2)	285 (1)	426 (4)
Kemp's ridley	1 (0)	0	2 (0)	1 (0)	3 (0)
Leatherback	2 (0)	0	4 (0)	2 (0)	0
Hawksbill	6 (0)	3 (0)	6 (0)	2 (0)	1 (0)
TOTAL	600 (6)	636 (2)	944 (2)	914 (2)	917 (5)

* Note: Numbers in parentheses indicate the number of injurious or lethal takes that resulted from plant operations and, therefore, apply to the incidental take limit.
Sources: Quantum Resources and FPL 2005; FPL 2006.

6.2 Smalltooth Sawfish

On May 16, 2005, during the course of normal net-monitoring activities in the St. Lucie Nuclear Power Plant intake canal, a smalltooth sawfish (*Pristis pectinata*) became entangled in the northern tangle net at approximately 5:20 pm. The biologist on duty determined that the animal was too large to handle himself and called for assistance at approximately 5:30 pm. A crew of four biologists assembled at the intake canal at 6:00 pm and discussed a plan to remove the sawfish from the net and release it back to the ocean safely. The 30.5-m (100-ft) net was released from the western end anchor point and was pulled into the boat up to the location of the sawfish. The net was then released from the eastern end anchor point, and the remainder of the net was pulled into the boat leaving the entangled sawfish in the water along side the boat. The saw was the only part of the animal that was entangled in the net so the rest of its body remained unencumbered. The animal was pulled into the boat ramp area where the remaining net was offloaded. The animal remained in the shallow water of the boat ramp until preparations were made for its removal. A stretcher was laid out on the boat ramp, and a winch was attached to the remaining net to pull the sawfish onto the stretcher. At approximately 6:30 pm, the animal was pulled from the water up the boat ramp and onto the stretcher. The sawfish was then moved into the back of a trailer normally used for transporting large sea turtles. At this point the net was cut off the sawfish's rostrum to disentangle the animal, and measurements and photographs were taken. The sawfish measured 415 cm (13.62 feet) in total length, and the rostrum itself measured 86 cm (2.82 feet). The animal was then transported in the trailer via an all-terrain vehicle (ATV) across the dune and to the ocean, a distance of about 100 m (328 ft). Two biologists walked behind the trailer holding up the tail end of the stretcher to ensure the animal would not slide out. The trailer was then filled with ocean water by backing it into the nearshore trough at the beach, and the animal was able to float out of the trailer and swim away freely at approximately 6:45 pm. The area where the sawfish was released was monitored for 25 minutes to make sure that the animal had acclimated and did not wash ashore. There was no sign of the sawfish in the area after it swam away at 6:45 pm.

After the sawfish was released safely by the biologists, FPL contacted NMFS to report the incident. NMFS requested that FPL send photographs and measurement data on the sawfish to Mote Marine Laboratory as a part of Mote's ongoing sawfish research. FPL did so on May 18, 2005. On June 7, 2005, NMFS indicated to FPL that a Section 7 consultation would need to be initiated between the NRC and NMFS concerning the event. On September 29, 2005, NMFS, NRC, and FPL met at the St. Lucie Nuclear Power Plant for a site visit and discussion regarding the smalltooth sawfish take and Section 7 consultation.

7.0 Assessment of Impacts on Threatened and Endangered Species

Impacts to sea turtles have not changed significantly since the last Section 7 consultation. The operation of the cooling water system and the biological monitoring program have not been modified since 2002 when improvements were made. NMFS approved such modifications in a letter dated May 9, 2003, which reiterated that the May 2001 BO and ITS remained valid. Also, FPL biologists conduct a very successful sea turtle tagging program, and the St. Lucie Nuclear Power Plant intake canal is often used as the primary study area for various research projects. The continued operation of the cooling water system for the St. Lucie Nuclear Power Plant is not expected to jeopardize the continued existence of loggerhead turtle, green turtle, Kemp's ridley turtle, leatherback turtle, or hawksbill turtle.

The 2005 smalltooth sawfish take is the only known interaction of the smalltooth sawfish with St. Lucie Units 1 and 2 and, thus, is considered anomalous. The fish was rescued in the intake canal and returned to the ocean where it rapidly swam away with ease. Due to the rarity of the smalltooth sawfish's entrapment in the intake canal (once in 29 years of operation) and FPL's commitment to return any future specimens rapidly to the ocean, the continued operation of the cooling water system for St. Lucie Nuclear Power Plant is not expected to jeopardize the continued existence of the smalltooth sawfish.

8.0 Mitigation Measures

Representatives of NMFS, NRC, and FPL discussed mitigation measures specific to the smalltooth sawfish at the September 29, 2005 meeting. Such measures could include:

- Minimize animal's time out of water by taking measurements in the intake canal
- Develop a method to ensure the animal's spiracles are kept wet during out-of-water transportation over the dunes to the ocean
- Send one or more FPL representatives to an aquarium (such as Sea World) that routinely interacts with the smalltooth sawfish to learn safe handling and transportation techniques (such as using a neoprene sleeve to cover the saw)
- Develop and periodically exercise a rescue and transportation plan, including maintenance and operation of appropriate equipment. Such a plan would reduce the fish's out-of-water time to less than ten minutes.

9.0 Recommendation for Revised Incidental Take Statement

Consistent with the agreement reached in a meeting held with NRC and the NMFS Southeast Region's Regional Administrator on September 26, 2002, the NRC staff has provided suggestions for the revised ITS. The limits for sea turtles have not been met or exceeded, and the NRC staff does not recommend modification of the take limits for sea turtles. The sea turtle take limits are up to one percent of the annual loggerhead and green takes for injurious or lethal loggerhead and green takes, two lethal takes of Kemp's ridley turtles annually, and one lethal take of hawksbill or leatherback every two years. There is also a maximum annual take limit of 1000 for all sea turtle species combined regardless of causation. The NRC staff recommends that the ITS for the St. Lucie Nuclear Power Plant be revised to allow one non-lethal take of the smalltooth sawfish on an annual basis.

Additionally, the NRC staff recommends incorporating into the revised ITS the following reasonable and prudent measures for the protection of the smalltooth sawfish:

1. FPL shall have a transportation plan in place to transport rapidly any future takes of smalltooth sawfish from the intake canal to the ocean for release.

2. FPL shall report all smalltooth sawfish captures and any mortalities per permit conditions.

The NRC staff also recommends adding to the ITS the following terms and conditions:

1. All measurements of individual specimens of smalltooth sawfish captured in the intake canal shall be made while the specimen is in the water in the intake canal.

2. The spiracles of the smalltooth sawfish are to be kept wet during transport of specimens for release into the ocean.

3. The transportation plan shall be exercised annually with the goal of reducing the fish's out-of-water time to less than ten minutes.

The NRC staff finds that these reasonable and prudent measures and terms and conditions would adequately protect any smalltooth sawfish captured in the intake canal and that there is reasonable likelihood that the rescue and release into the ocean would not cause injury or mortality. Therefore, implementation of such measures would ensure that the continued operation of the St. Lucie Nuclear Power Plant's cooling water system would not jeopardize the continued existence of the smalltooth sawfish in U.S. waters.

10.0 References

Banister, K. and A. Campbell, eds. 1985. *The Encyclopedia of Aquatic Life*. Andromeda Oxford Limited: New York (Facts on File, Inc.).

Florida Power & Light Company (FPL). 2006. Personal communication with Stacy Foster of FPL Environmental Services. January 13, 2006.

National Marine Fisheries Service (NMFS). 2000. *Status Review of Smalltooth Sawfish (Pristis pectinata)*. Unpublished report from the NMFS Sawfish Review Team. Accessed on

September 1, 2005 at http://www.nmfs.noaa.gov/prot_res/species/fish/Smalltooth_sawfish.html.

National Marine Fisheries Service (NMFS). 2001. *Biological Opinion on the Continued Operation of the St. Lucie Nuclear Power Plant's Circulating Seawater Cooling System*. May 4, 2001.

National Marine Fisheries Service (NMFS). 2002. Letter from J.E. Powers (NMFS) to P.T. Kuo (NRC). July 30, 2002.

National Marine Fisheries Service (NMFS). 2005. *Smalltooth Sawfish* (Pristis pectinata). Accessed on December 22, 2005 at http://www.nmfs.noaa.gov/pr/species/fish/Smalltooth_sawfish.html.

Passarelli, Nancy and Tobey Curtis. 2005. *Smalltooth Sawfish Biological Profile*. Florida Museum of Natural History Ichthyology Department. Accessed on September 1, 2005 at http://www.flmnh.ufl.edu/fish/Gallery/Descript/STSawfish/STSawfish.html.

Poulakis, G.R. and J.C. Seitz. 2005. Accessed on September 1, 2005 at http://www.floridasawfish.com.

Quantum Resources, Inc. and Florida Power & Light Company (FPL). 2005. *Florida Power & Light Company St. Lucie Plant Annual Environmental Operating Report 2004*.

Simpfendorfer, C. A. 2000. Predicting population recovery rates for endangered western Atlantic sawfishes using demographic analysis. *Environmental Biology of Fishes*, Vol. 58, pp. 371-377.

Simpfendorfer, C. A. 2002. Smalltooth Sawfish: The USA's First Endangered Elasmobranch? *Endangered Species UPDATE*, Vol. 19 No. 3, pp. 45-49.

Simpfendorfer, C. A., and T. R. Wiley. 2005. *Determination of the Distribution of Florida's Remnant Sawfish Population and Identification of Areas Critical to Their Conservation*. Final Report. Florida Fish and Wildlife Conservation Commission.

U.S. Nuclear Regulatory Commission (NRC). 2003. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants – Supplement Regarding St. Lucie Units 1 and 2*, NUREG-1437, Supplement 11, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2005. Letter from P.T. Kuo (NRC) to D. Bernhart (NMFS). July 8, 2005.

Biological Assessment

St. Lucie Nuclear Power Plant Units 1 and 2
Reinitiation of Section 7 Consultation
to Include Sea Turtles

St. Lucie County, Florida

August 2007

Docket Nos. 50-335 and 50-389

U.S. Nuclear Regulatory Commission
Rockville, Maryland

Enclosure

1.0 Introduction and Summary

This Biological Assessment (BA) was prepared in support of reinitiating a formal consultation between the U.S. Nuclear Regulatory Commission (NRC) and National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) in compliance with Section 7 of the Endangered Species Act of 1973, as amended (ESA). The purpose of this BA is to examine the potential impacts on Federally-listed sea turtle species associated with the continued operation of the St. Lucie Nuclear Power Plant's (SLNPP's) circulating seawater cooling system and to support the NRC's July 8, 2005 request to NMFS for reinitiation of formal Section 7 consultation regarding the SLNPP. The NRC has been consulting with NMFS regarding sea turtle takes at the SLNPP since 1982. Several BAs and Biological Opinions (BOs) have been issued since 1982 and resulted in periodic revisions to the Incidental Take Statement (ITS), as appropriate. A reinitiation of formal consultation was triggered by a take of a smalltooth sawfish (*Pristis pectinata*) on May 16, 2005. Sea turtles were added to the reinitiation when the plant exceeded the annual incidental take limit for sea turtles in 2006 and entrained a total of 662 Atlantic green turtles (*Chelonia mydas*) and loggerhead turtles (*Caretta caretta*). The incidental take limit of one percent of entrained Atlantic green and loggerhead turtles was exceeded because 29 of the 662 entrained turtles were injured or killed due to plant operation.

Florida Power and Light Company (FPL) is the licensee that operates the SLNPP and conducts an ongoing turtle capture-and-release program in the station's intake canal. There have been no procedural changes in the operation of the SLNPP's circulating seawater cooling system since the last BO, dated May 4, 2001, which was clarified by letter dated July 30, 2002. The 2001 BO analyzed the effects of operation of the SLNPP's circulating seawater cooling system on loggerhead turtles, Atlantic green turtles, Kemp's ridley turtles (*Lepidochelys kempii*), leatherback turtles (*Dermochelys coriacea*), and hawksbill turtles (*Eretmochelys imbricata*). This BA provides a brief update of information regarding recent effects of the cooling system on these sea turtle species.

Three of the five sea turtle species in the 2001 BO, Kemp's ridley, leatherback, and hawksbill, are Federally listed as endangered. The loggerhead is Federally listed as threatened. Atlantic green turtles in U.S. waters are Federally listed as threatened except for the Florida breeding population that is listed as endangered. Due to the inability to distinguish between the two Atlantic green turtle populations away from the nesting beaches, Atlantic green turtles are considered endangered wherever they occur in U.S. waters. All three species occur in the vicinity of the SLNPP, where they are potentially subject to entrainment.

SLNPP is located on Hutchinson Island in St. Lucie County, Florida. The island is a barrier island bounded by the Atlantic Ocean to the east and the Indian River Lagoon to the west. The cooling system withdraws water from the Atlantic Ocean to cool the condensers of the two operating reactors, St. Lucie Units 1 and 2, which began operating in 1976 and 1983, respectively. The intake portion of the cooling system consists of three intake structures with velocity caps in the ocean, three buried pipelines, a common intake canal, and two intake well structures (one for each unit). In the intake canal has a series of nets, trash bars, and screens to prevent debris and organisms from being impinged on the intake screens or entrained into the plant.

Animals occasionally enter the canal system of the SLNPP along with seawater that is withdrawn from the Atlantic Ocean for condenser cooling. The intake structures and velocity caps for the plant are located about 365 meters (m) (1200 feet [ft]) offshore where they also serve as artificial reefs. As such, these structures attract turtles and other marine life by appearing to offer food and shelter. If an animal passes through the vertical plane of the velocity cap, the animal would enter the intake pipeline, which travels under the ocean floor and barrier island and debouches in the intake canal on the western side of the beach dunes.

Once in the intake canal, the animals cannot escape due to the high flow rates in the intake pipes and must be rescued and returned to the ocean. Therefore, FPL has a capture-and-release program to retrieve sea turtles and return them to the ocean. The program includes conservation efforts and collaboration with research organizations, sea turtle stranding programs, and Federal and State agencies. FPL has an existing agreement with Florida Fish and Wildlife Conservation Commission (FWC) regarding case-specific decisions on how and where to treat injured turtles that are not healthy enough to be returned immediately to the ocean. The FWC is also consulted to conduct turtle necropsies when needed. NRC's long history of consultations with NMFS regarding the SLNPP and FPL's commitment to minimize sea turtle injury and mortality has resulted in the modification and addition of barrier nets over time.

In 2006 SLNPP caused 21 loggerhead hatchling mortalities, which most likely resulted from a single hatching at an undetected nest on the intake canal bank. During the same event, three loggerhead hatchlings were retrieved alive and later released on November 4, 2006. The mortalities resulted from drowning after impingement at the intake screens. In addition, other recent turtle injuries were likely caused by hurricane debris and/or biofouling in the intake pipes leading to the intake canal. FPL inspected intakes pipes during an outage in April 2007. Corrective actions will be determined by NMFS, NRC, and FPL based on the inspection results.

This BA includes four mitigation measures for incidental sea turtle takes developed in discussions among NRC, FPL, NMFS, and FWC staff. These include (1) FPL implementing measures along the banks of the intake canal east of the 12.7-cm (5-in.) turtle net so that turtle crawls would be more visible, (2) FPL developing and implementing a plan to install exclusion devices at the velocity caps to prevent large marine organisms, such as adult sea turtles and smalltooth sawfish, from entering the intake pipes, (3) FPL developing and implementing a plan based on the pipe inspection report for cleaning the intake pipes during the fall 2007 outage to remove protruding debris that may adversely affect animals entrained in the intake canal, and (4) FPL sealing off the dead-end sections of the 12-ft-diameter intake pipes during the fall 2007 outage. This BA also suggests a revision to the ITS that FPL develop and execute a plan for periodic examination of intake pipes to ensure that conditions that could adversely affect sea turtles be found and corrected.

2.0 Purpose

This BA was prepared in support of reinitiating a formal consultation between the NRC and the NMFS in compliance with Section 7 of the ESA. On February 24, 2006, the NRC submitted a BA for the reinitiation of formal consultation regarding the continued operation of SLNPP regarding a smalltooth sawfish take in May 2005. On February 1, 2007, FPL notified the NRC that SLNPP exceeded its 2006 incidental take limit for sea turtles, and NRC then discussed this information with NMFS. In a subsequent letter on April 4, 2007, NRC confirmed to NMFS that sea turtles will be added to the formal consultation on smalltooth sawfish because SLNPP exceeded its annual incidental take limit for sea turtles 2006. The purpose of the present BA is to supplement the February 24, 2007 BA focusing on smalltooth sawfish by adding information on threatened and endangered sea turtles taken by SLNPP.

This BA examines the potential impacts associated with the continued operation of the SLNPP on sea turtle species protected under the ESA. The primary species of concern are loggerhead turtle, Kemp's ridley turtle, Atlantic green turtle, leatherback turtle, and hawksbill turtle. Kemp's ridley turtle is listed as endangered, and the loggerhead turtle is listed as threatened. Atlantic green turtles in U.S. waters are listed as threatened except for the Florida breeding population, which is listed as endangered. Due to the inability to distinguish between these populations away from the nesting beach, these sea turtles are considered endangered wherever they occur in U.S. waters. The leatherback turtle and the hawksbill turtle are also listed as endangered in U.S. waters. NMFS has jurisdiction for these species at sea.

3.0 Site Description

SLNPP is located on a 457-hectare (1130-acre) 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, which is long and shallow. Hutchinson Island is a barrier island that extends 36 km (22.4 mi) between inlets and attains its maximum width of 2 kilometers (km) (1.2 miles [mi]) at the plant site. Elevations approach 5 m (16.4 ft) 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 north parallel to the continental shelf margin, begins to diverge from the coastline at West Palm Beach. The Florida Current is approximately 33 km (20.5 mi) offshore at Hutchinson Island. Oceanic water associated with the western boundary of the Florida Current periodically meanders over the inner shelf, especially during summer months.

4.0 Description of the St. Lucie Power Plant

St. Lucie Units 1 and 2 consist of two 839-net megawatt-electric (MWe) nuclear-fueled generating units that use near shore waters from the Atlantic Ocean for the plant's once-through condenser and auxiliary cooling systems. The cooling water system removes heat from the condensers and other auxiliary equipment. Eight pumps (four per unit) located at the intake wells circulate water through the system. The pumping capacity ranges from 50,470 to 70,660 liters per second (800,000 to 1,120,000 gallons per minute) (NRC 2003).

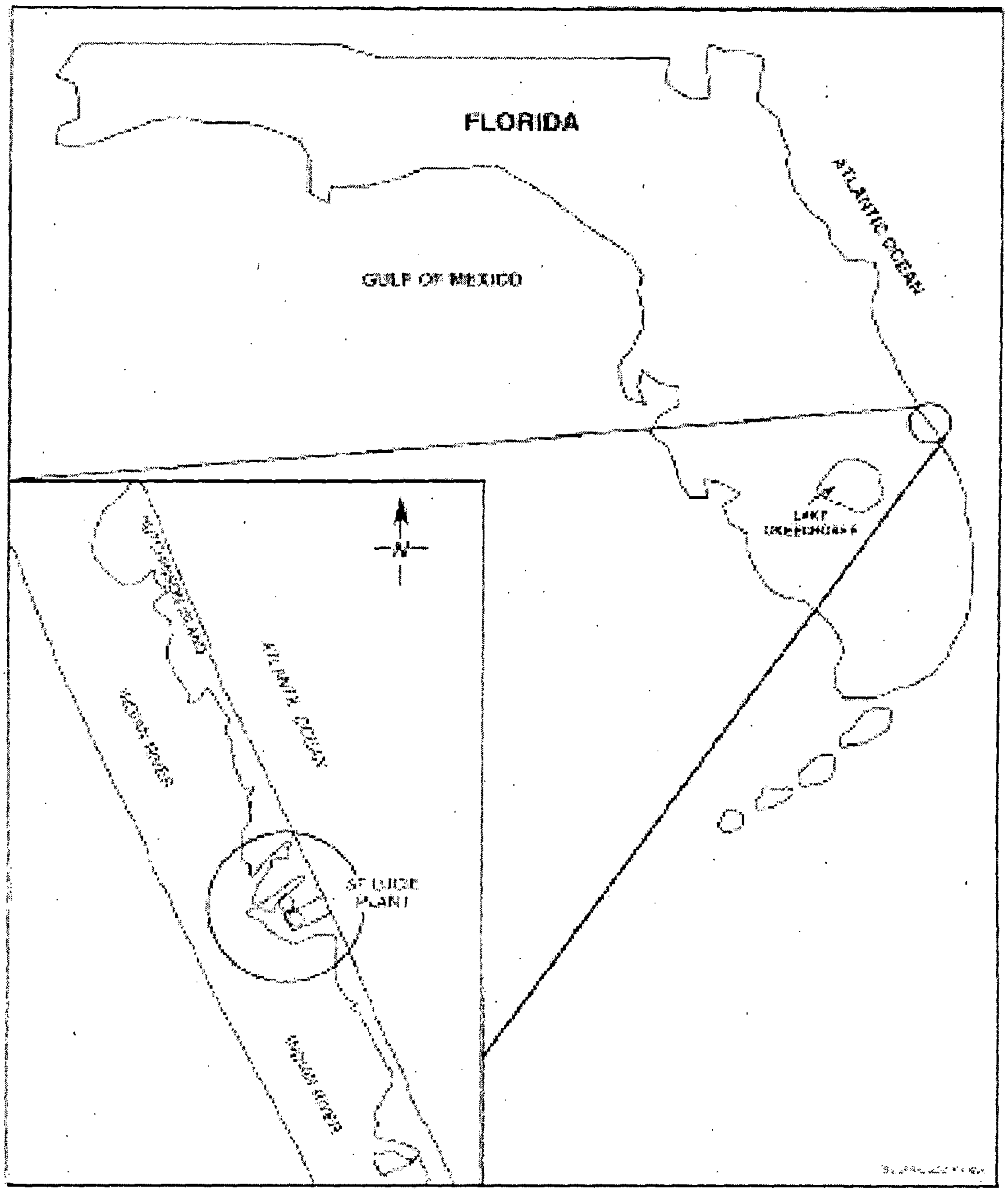

Figure 1. Location of St. Lucie Nuclear Power Plant.

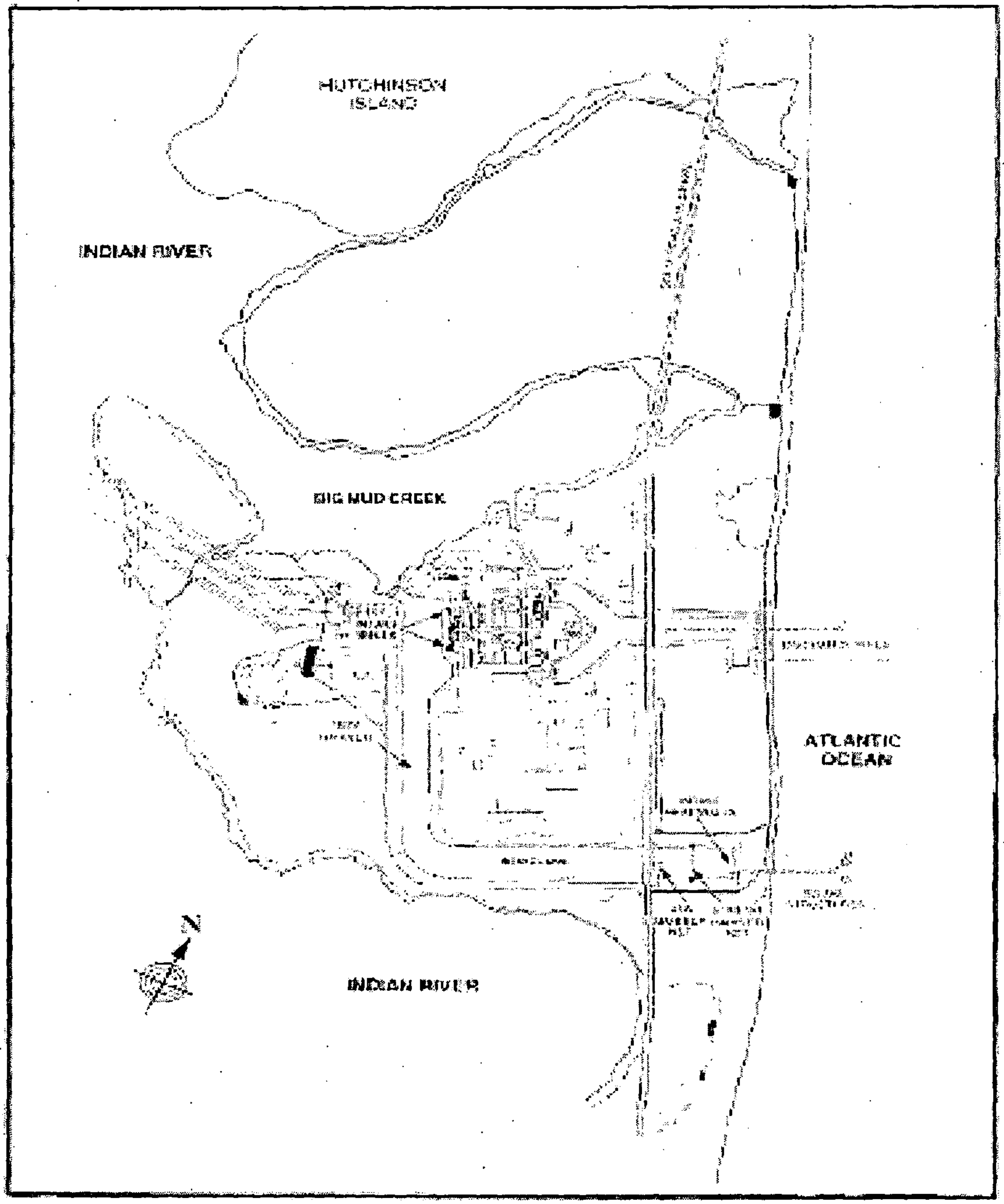

Figure 2. St. Lucie cooling water intake and discharge system.

The cooling system is composed of both intake and discharge components, whose functions are interdependent: if changes or improvements are made to one component (either the intake or discharge side), the other component will be affected. The response of all affected components to changes or improvements requires evaluation to ensure the cooling system operation is kept within design parameters and limits. Unit 1 and Unit 2 condensers and auxiliary cooling systems share common intake and discharge canals and ocean piping. The major components of these canals and ocean piping are (1) three ocean intake structures and associated velocity caps located approximately 1,200 (356 m) from the shoreline; (2) three buried intake pipelines to transport water from the intake structure to the intake canal (one pipeline is 16 ft [4.9 m] in diameter, and two are 12 ft [3.65 m] in diameter); (3) common intake canal to convey sea water to each unit's intake structure; (4) individual unit intake structures; (5) discharge structure for each unit; (6) a common discharge canal; (7) two discharge pipelines to convey water offshore.

Water for the cooling water system enters through three submerged intake structures located about 365 m (1200 ft) offshore at a depth of about 7 m (23 ft) (Figure 2). The intake structures have vertical cylindrical openings and are equipped with concrete velocity caps supported by columns extending about 1.8 m (6 ft) from the intake openings. The velocity caps minimize entrainment of fish and other organisms by eliminating vertical flow and slowing horizontal flow. Water passes through these structures and into submerged pipes (two 3.7 m [12 ft] and one 4.9 m [16 ft] in diameter) running under the beach. Flow velocities in the pipes range from 0.11 to 2.1 m/s (0.37 to 6.8 ft/s), depending on the pipe's orientation and size. The three pipes all deliver water into a 1500-m (4921-ft) long intake canal, which transports the water to the plant. The intake canal is a trapezoidal channel about 55 m (180 ft) wide and 9.1 m (30 ft) deep under normal conditions. FPL occasionally dredges the intake canal to remove accumulated sediments and maintain proper flow conditions; most recently, the canal was dredged in 2002 and 2005.

In addition to the velocity caps on the intake pipes, other measures are in place to minimize impingement of marine biota at the SLNPP. In the intake canal, a series of barriers prevents sea turtles and other biota from being impinged on the screens where the water enters the plant. Heading from the intake canal headwalls toward the intake wells in the intake canal, first there is a 12.7-centimeter (cm) (5-inch [in.]) mesh net that is taut and sloped to prevent turtles from being entangled in the net. The net is monitored hourly by sea turtle biologists who rescue any entrapped turtles. Next is a 20-cm (8-in.) mesh barrier net, and, finally, a rigid security barrier closest to the plant. Additionally, sea turtle biologists deploy two 30.5-m (100-ft) tangle nets in daylight hours (with occasional night hours as well) seven days a week to capture sea turtles between the intake headwall (where the water enters the intake canal from the pipes) and the 12.7-cm (5-in.) mesh barrier net. The nets are set in adjacent eddies and flow with the current without any weights. The biologists inspect tangle nets at least hourly and use dip nets and free diving to capture turtles. Underwater inspections on the 12.7- and 20-cm (5- and 8-in.) mesh barrier nets are conducted quarterly. During these inspections, any holes found in the nets are repaired.

At the plant, water enters through the eight intake wells (four per unit). In front of each well are trash racks (vertical bars spaced 7.6 cm [3 in.] apart) and 1-cm (3/8-in.) mesh traveling screens, which also prevent impingement and entrainment of organisms. Security personnel inspect the intake wells every three hours as an added precautionary measure. After passing through the plant, the heated water is discharged into a 670-m (2198-ft) long canal that leads to two buried discharge pipelines that pass underneath the dunes and along the ocean floor to the submerged discharge pipes, the first of which is 3.7 m (12 ft) in diameter and terminates approximately 380 m (1250 ft) offshore. The second discharge pipe has a diameter of 4.9 m (16 ft) and ends about 936 m (3070 ft) offshore. The first discharge pipe has a two-port "Y" diffuser, and the second discharge pipe has a multiport diffuser for about the last 430 m (1415 ft) of the pipe. The discharge pipes are approximately 730 m (2400 ft) north of the intake. The diffusers facilitate rapid distribution of the heated water on a large spatial scale to mix efficiently with ambient waters. Discharge temperatures are kept within limits of the Industrial Wastewater Facility Permit for St. Lucie Units 1 and 2.

5.0 Information on Sea Turtle Species

5.1 General Biology

Living sea turtles are taxonomically represented by two families, five genera, and seven species (Hopkins and Richardson 1984; Carr 1952). The family Cheloniidae is comprised of four genera and six distinct species. These species are *Caretta caretta* (loggerhead turtle), *Chelonia mydas* (Atlantic green turtle), *Natador depressa* (flatback turtle), *Eretomochelys imbricata* (hawksbill turtle), *Lepidochelys kempii* (Kemp's ridley turtle), and *L. olivacea* (olive ridley turtle). The family Dermochelyidae is comprised of only one genus and species, *Dermochelys coriacea*, commonly referred to as the leatherback turtle.

Most sea turtle species are distributed throughout all of the tropical oceans. The flatback turtle is a major exception as it has a very limited range only in Pacific waters near Australia and Papua New Guinea. Also, the loggerhead occurs primarily in temperate latitudes, and the leatherback, although nesting in the tropics, frequently migrates into cold waters at higher latitudes because of its unique physiology (Mager 1985).

Sea turtles are believed to be descended from species known from the late Jurassic and Cretaceous periods that were included in the extinct family Thallassemyidae (Carr 1952; Hopkins and Richardson 1984). Modern sea turtles have short, thick, incompletely retractile necks, and legs that have been modified to become flippers (Bustard 1972; Carr 1952). All species, except the leatherback, have a hard, bony carapace modified for marine existence by streamlining and weight reduction (Bustard 1972). Chelonians have only a thin layer of bone covered by overlaying scutes and *D. coriacea* has a smooth scaleless black skin and soft carapace with seven longitudinal keels (Carr 1952). These differences in structure are the principal reason for their designation as the only species in the monotypic family Dermochelyidae (Carr 1952).

Sea turtles spend most of their lives in an aquatic environment, and males of many species may never leave the water (Hopkins and Richardson 1984; Nelson 1988). The recognized life stages for these turtles are egg, hatchling, juvenile/subadult, and adult (Hirth 1971). A generalized sea turtle life cycle is presented in Figure 3.

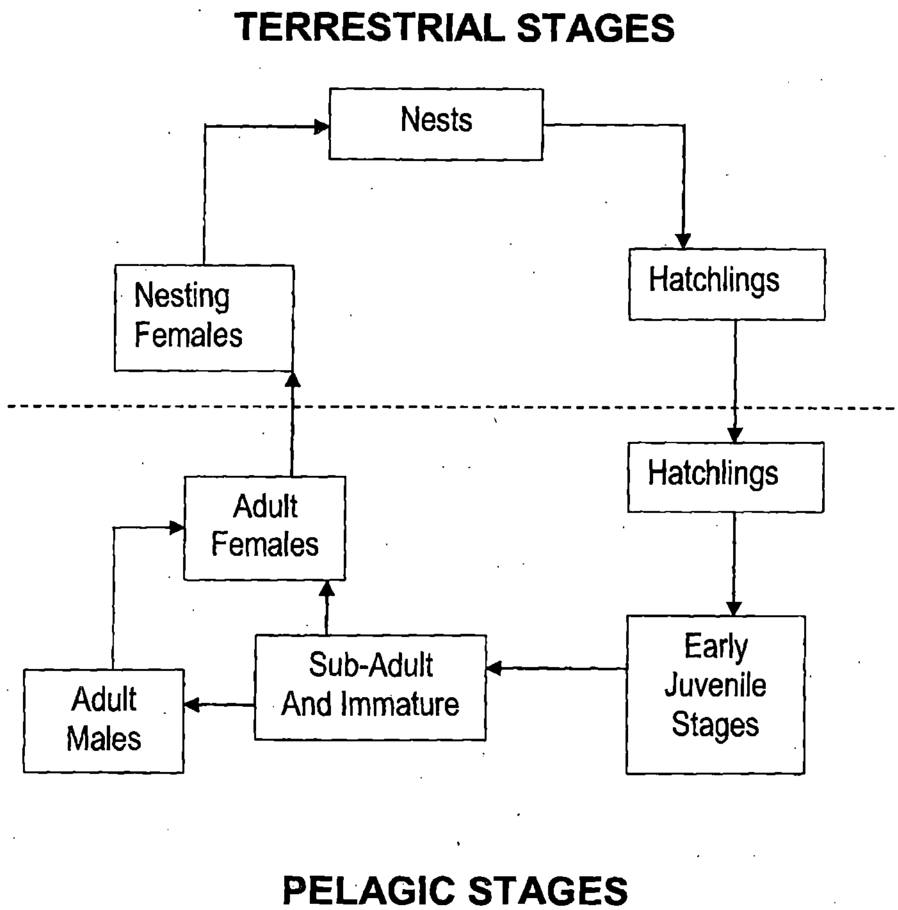

Figure 3. Generalized sea turtle life cycle. (After PSE&G 1989)

Reproductive cycles in adults of all species involve some degree of migration in which the animals return to nest at the same beach year after year (Hopkins and Richardson 1984). Nesting generally begins about mid-April and continues into September (Hopkins and Richardson 1984; Nelson 1988; Carr 1952). Mating and copulation occur just off the nesting beach, and it is theorized that sperm from one nesting season may be stored by the female and thus fertilize a later season's eggs (Ehrhart 1980). A nesting female moved shoreward by the surf lands on the beach and crawls to a point above the high water mark (Carr 1952). She then proceeds to excavate a shallow body pit by twisting her body in the sand (Bustard 1972). After digging the body pit she proceeds to excavate an egg chamber using her rear flippers (Carr 1952). Clutch size, egg size, and egg shape are species specific (Bustard 1972). Incubation periods for loggerhead, Kemp's ridley, Atlantic green, olive ridley, and flatback turtles average 55 days but range from 45 to 65 days depending on local conditions (Nelson 1988). Hawksbill and leatherback turtles have a slightly longer incubation period ranging from 50 to 74 days (Pacific Whale Foundation 2003; Connecticut Department of Environmental Protection 2000).

Hatchlings emerge from the nest at night by breaking the eggshell and digging their way out of the nest (Carr 1952). They find their way across the beach to the surf by orienting to light reflecting off the breaking surf (Hopkins and Richardson 1984). Once in the surf, hatchlings exhibit behavior known as "swim frenzy," during which they swim in a straight line for many hours (Carr 1986). Once into the waters off the nesting beach, hatchlings enter a period known as the "lost year." Researchers are presently trying to determine where young sea turtles spend their earliest years, what habitat(s) they prefer at this age, as well as typical survival rates during the "lost year" (i.e., during their post-hatchling early pelagic stage). It is currently believed the period encompassed by the "lost year" may actually turn out to be several years, and various hypotheses have been put forth regarding sea turtle activities during this period. One is that hatchlings may become associated with floating Sargassum rafts offshore. These rafts provide shelter and are dispersed randomly by the currents (Carr 1986). Another hypothesis is that the "lost year" of some species may be spent in a salt marsh/estuarine system (Garmon 1981).

The functional ecology of sea turtles in the marine and/or estuarine ecosystem is varied. The loggerhead is primarily carnivorous and has jaws well adapted to crushing molluscs and crustaceans and grazing on encrusted organisms attached to reefs, pilings, and wrecks; the Kemp's ridley is omnivorous and feeds on swimming crabs, crustaceans, and molluscs (Seney et al. 2002); the Atlantic green turtle is a herbivore and grazes on marine grasses and algae; the leatherback is a specialized feeder preying primarily upon jellyfish; the olive ridley feeds mostly on shrimp, crabs, sea urchins, and jellyfish; the hawksbill is an omnivorous scavenger feeding mostly on sponges affixed to coral reefs as well as a few other invertebrates; the flatback prefers to eat sea cucumbers, soft corals, and jellyfish. Until recently, sea turtle populations were relatively large and subsequently played a significant role in the marine ecosystem. This role has been greatly reduced in most locations as a result of declining turtle populations. These population declines were a result of, among other things, natural factors such as disease and predation, habitat loss, commercial overutilization, commercial fishing by-catch mortality, and the lack of comprehensive regulatory mechanisms to ensure their protection throughout their geographic range. This has led to several species being threatened with extinction.

Due to changes in habitat use during different life history stages and seasons, sea turtle populations are difficult to census (Meylan 1982). Because of these problems, estimates of population number have been derived from various indices such as numbers of nesting females, numbers of hatchlings per kilometer of nesting beach and number of subadult carcasses (strandings) washed ashore (Hopkins and Richardson 1984). Six of the seven extant species of sea turtles are protected under the ESA. Three turtles, Kemp's ridley, hawksbill, and leatherback, are listed as endangered. The Florida nesting population of Atlantic green turtle and Mexican west coast population of olive ridley are also endangered. All of the remaining populations of Atlantic green turtle, olive ridley, and loggerhead are threatened. The only unlisted species is the locally protected Australian flatback turtle (Hopkins and Richardson 1984).

5.2 Loggerhead (*Caretta caretta*)

5.2.1 Description

The adult loggerhead turtle has a slightly elongated, heart-shaped carapace that tapers towards the posterior and has a broad, triangular head (Pritchard et al. 1983). Loggerheads normally weigh up to 200 kg (450 lb) and attain a straight carapace length (SCL) up to 120 cm (48 in.) (Pritchard et al. 1983). Their general coloration is reddish-brown dorsally and cream-yellow ventrally (Hopkins and Richardson 1984). Morphologically, the loggerhead is distinguishable from other sea turtle species by the following characteristics: (1) a hard shell; (2) two pairs of scutes on the front of the head; (3) five pairs of lateral scales on the carapace; (4) plastron with three pairs of enlarged scutes connecting the carapace; (5) two claws on each flipper; and (6) reddish-brown coloration (Nelson 1988; Dodd 1988; Wolke and George 1981). Loggerhead hatchlings are brown dorsally with light margins ventrally and have five pairs of lateral scales (Pritchard et al. 1983).

5.2.2 Distribution

Loggerhead turtles are circumglobal, inhabiting continental shelves, bays, lagoons, and estuaries in the temperate, subtropical, and tropical waters of the Atlantic, Pacific, and Indian Oceans (Dodd 1988; Mager 1985).

In the western Atlantic Ocean, loggerhead turtles occur from Argentina northward to Newfoundland including the Gulf of Mexico and the Caribbean Sea (Carr 1952; Dodd 1988; Mager 1985; Nelson 1988; Squires 1954). Sporadic nesting is reported throughout the tropical and warmer temperate range of distribution, but the most important nesting areas are on the Atlantic coast of Florida, Georgia, and South Carolina (Hopkins and Richardson 1984). The Florida nesting population of loggerheads has been estimated to be the second largest in the world (Ross 1982).

The foraging range of the loggerhead sea turtle extends throughout the warm waters of the U.S. continental shelf (Shoop et al. 1981). On a seasonal basis, loggerhead turtles are common as far north as the Canadian portions of the Gulf of Maine (Lazell 1980), but during cooler months of the year, distributions shift to the south (Shoop et al. 1981). Loggerheads frequently forage around coral reefs, rocky places, and old boat wrecks; they commonly enter bays, lagoons and estuaries (Dodd 1988). Aerial surveys of loggerhead turtles at sea indicate that they are most common in waters less than 50 m (164 ft) in depth (Shoop et al. 1981), but they occur pelagically as well (Carr 1986).

5.2.3 Food

Loggerheads are primarily carnivorous (Mortimer 1982). They eat a variety of benthic organisms including molluscs, crabs, shrimp, jellyfish, sea urchins, sponges, squids, and fishes (Nelson 1988; Seney et al. 2002). Adult loggerheads have been observed feeding in reef and hard bottom areas (Mortimer 1982). In the seagrass lagoons of Mosquito Lagoon, Florida, subadult loggerheads fed almost exclusively on horseshoe crab (Mendonca and Ehrhart 1982). Loggerheads may also eat animals discarded by commercial trawlers (Shoop and Ruckdeschel 1982). This benthic feeding characteristic may contribute to the capture of these turtles in trawls.

5.2.4 Nesting

The nesting season of the loggerhead is confined to the warmer months of the year in the temperate zones of the northern hemisphere. In south Florida nesting may occur from April through September but usually peaks in late June and July (Dodd 1988; FPL 1983).

Loggerhead females generally nest every other year or every third year (Hopkins and Richardson 1984), but multi-annual remigration intervals ranging from one to six years have been reported (Bjorndal et al. 1983; Richardson et al. 1978). When a loggerhead nests, it usually produces two to three clutches of eggs per season and lays 35 to 180 eggs per clutch (Hopkins and Richardson 1984). The eggs hatch in 46 to 68 days and hatchlings emerge two or three days later (Crouse 1985; Hopkins and Richardson 1984; Kraemer 1979).

Hatchling loggerheads are a little less than 5 cm (2 in.) in length when they emerge from the nest (Hopkins and Richardson 1984; FPL 1983). They emerge from the nest as a group at night, orient themselves seaward and rapidly move towards the water (Hopkins and Richardson 1984). Many hatchlings fall prey to sea birds and other predators following emergence. Those hatchlings that reach the water quickly move offshore and exist pelagically (Carr 1986).

There are at least four loggerhead nesting subpopulations in the western North Atlantic (Turtle Expert Working Group 2000). The Northern Nesting Subpopulation occurs from North Carolina to northeast Florida. The Southern Florida Nesting Subpopulation is the largest loggerhead nesting assemblage in the Atlantic, occurring from 29 °N on the east coast to Sarasota on the west coast. The Florida Panhandle Nesting Subpopulation is found at Eglin Air Force Base and the beaches near Panama City, Florida. The Yucatan Nesting Subpopulation occurs on the eastern Yucatan Peninsula, Mexico. Historically, only minor nesting activity has occurred elsewhere in the western North Atlantic, with the exception of Central America (Turtle Expert Working Group 2000).

5.2.5 Population Size

Loggerhead sea turtles are the most common sea turtle in the coastal waters of the United States. A number of stock assessments have been performed for loggerhead turtles in U.S. water, but none have developed reliable estimates of absolute population size (TEWG 1998, 2000; NMFS and SEFSC 2001). Population size and temporal trends in abundance have been estimated using nesting data, stranding data, and aerial surveys.

Based on numbers of nesting females, hatchlings per kilometer of nesting beach, and subadult carcasses (strandings) washed ashore, the total number of mature loggerhead females in the southeastern United States has been estimated to be from 35,375 to 72,520 (Hopkins and Richardson 1984; Gordon 1983). The annual average adult female population along the U.S. Atlantic and Gulf coasts for the period 1989-1998 was estimated to be 44,780 individuals based upon nesting data (Turtle Expert Working Group 2000).

Adult and subadult (shell length greater than 60 cm [24 in.]) population estimates have also been based on aerial surveys of pelagic animals observed by NMFS during 1982 to 1984. Based on these studies, the number of adult and subadult loggerhead sea turtles from Cape Hatteras, North Carolina to Key West, Florida was estimated to be 387,594 individuals (NMFS 1987). This number was arrived at by taking the number of observed turtles and converting it to a population abundance estimate using information on the amount of time loggerheads typically spend at the surface.

Some sea turtles that die at sea wash ashore and are found stranded. The NMFS Sea Turtle Salvage and Stranding Network (STSSN) collects stranded sea turtles along both the Atlantic and Gulf Coasts (Turtle Expert Working Group 2000; STSSN 2004). The largest number of loggerhead strandings during the period 1986-2001 (Figure 4) occurred along the southeast Atlantic Coast (14,404 turtles; 61 percent of total), followed by the Gulf Coast (5,320 turtles; 22 percent of total) and the northeast Atlantic Coast (4047 turtles; 17 percent of total). Strandings in the southeast U.S. and the Gulf of Mexico declined in the early 1990s, but have generally increased since then. Strandings in the northeast have more than doubled during the same time period (Turtle Expert Working Group 2000; STSSN 2004).

Frazer (1986) suggested that loggerhead turtle nesting populations in the U.S. were declining, but positive steps have been taken to reverse that trend. In September of 1989, NMFS regulations requiring the use of turtle excluder devices (TEDs) on commercial shrimp trawls were implemented. Based upon onboard observations of offshore shrimp trawling in the southeast Atlantic, NMFS estimated that over 43,000 loggerheads were captured in shrimp trawls annually. The number of loggerhead mortalities from this activity was estimated to be 9874 turtles annually (NMFS 1987). An estimated 5000 to 50,000 loggerheads were killed annually during commercial shrimp fishing activities prior to regulations requiring the use of TEDs (NMFS and FWS 1991a). The use of TEDs may reduce sea turtle mortality in shrimp trawls by as much as 97 percent (Crouse et al. 1992). Studies of TED effects on reducing strandings in South Carolina and Georgia during the period 1980-1997 demonstrated reductions in strandings ranging from 40 to 58 percent (Crowder et al. 1995; Royle and Crowder 1998). Following the implementation of the TED requirement, strandings of drowned threatened and endangered sea turtle species in areas where strandings were historically high decreased dramatically for a few years (Figure 4), which suggests a reduction in shrimp trawl related mortality (Crouse et al. 1992; Turtle Expert Working Group 2000). Increases in strandings since 1993 are indicative of an increasing loggerhead population (Turtle Expert Working Group 2000).

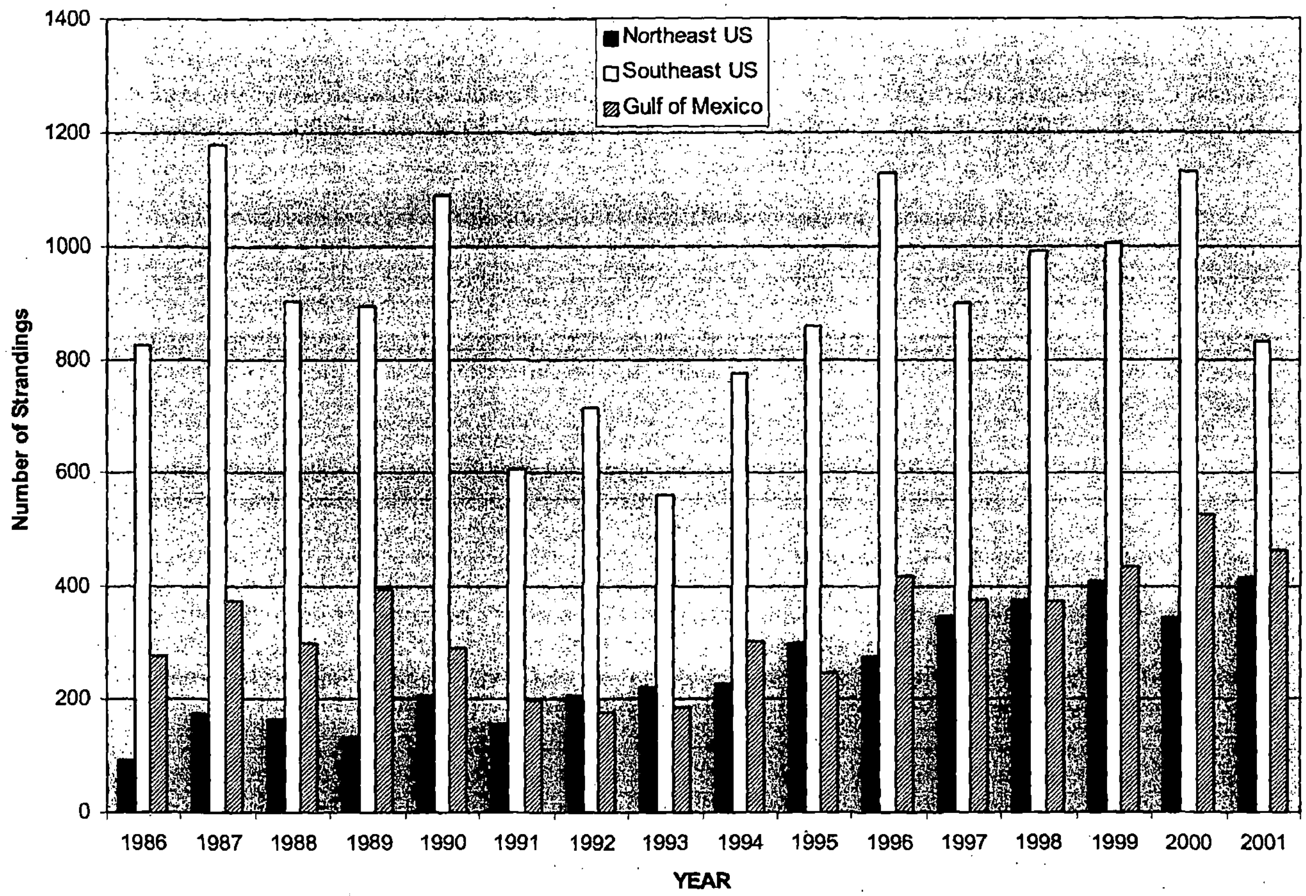

Figure 4. Loggerhead sea turtle strandings by region, 1986-2001 (Turtle Expert Working Group 2000 and STSSN 2004).

Sea turtle nesting activity on two key beaches also increased considerably subsequent to the implementation of the TED regulations (Crouse et al. 1992). The total number of loggerhead nests laid along the U.S. Atlantic and Gulf coasts is approximately 68,000 to 90,000 per year (OPR 2007). The number of nests increased at an average rate of approximately 3.6 percent per year and reached the maximum observed number (92,182) in 1998 (Turtle Expert Working Group 2000). In addition to the apparent success of the TED program, restrictions on development in coastal areas have become more widespread in recent years and may reduce the rate of nesting habitat loss for sea turtles.

The observed trends in strandings and nesting activity in recent years, along with some evidence of a shift in size class distribution toward smaller turtles, suggest that the U.S. loggerhead population is increasing (Turtle Expert Working Group 2000) and that effective measures have been taken to mitigate a major source of loggerhead mortality. Various population estimates suggest that the number of adult and subadult turtles is probably in the hundreds of thousands in the southeastern United States alone. In addition, large populations of loggerheads occur in many other parts of the world (Ross and Barwani 1982; NMFS and FWS 1991a). These facts suggest that although this species needs to be conserved, it is not in any immediate risk of becoming endangered.

5.3 Kemp's Ridley (*Lepidochelys kempii*)

5.3.1 Description

The adult Kemp's ridley has a circular carapace and a medium-sized pointed head. Kemp's ridleys are the smallest of extant sea turtles. They normally weigh up to 42 kg (90 lb) and attain a SCL up to 70 cm (27 in.) (Pritchard et al. 1983). Their general coloration is olive green dorsally and yellow ventrally (Hopkins and Richardson 1984). Morphologically, the Kemp's ridley is distinguishable from other sea turtle species by the following characteristics: (1) a hard shell; (2) two pairs of scutes on the front of the head; (3) five pairs of lateral scutes on the carapace; (4) plastron with four pairs of scutes, with pores, connecting the carapace; (5) one claw on each front flipper and two on each back flipper; and, (6) olive green coloration (Pritchard et al. 1983; Pritchard and Marquez 1973). Kemp's ridley hatchlings are dark grey-black dorsally and white ventrally (Pritchard et al. 1983; Pritchard and Marquez 1973).

5.3.2 Distribution

Kemp's ridley turtles inhabit sheltered coastal areas and frequent larger estuaries, bays, and lagoons in the temperate, subtropical, and tropical waters of the northwestern Atlantic Ocean and Gulf of Mexico (Mager 1985). The foraging range of adult Kemp's ridley turtles appears to be restricted to the Gulf of Mexico. However, juveniles and subadults occur throughout the warm coastal waters of the U.S. Atlantic coast (Hopkins and Richardson 1984; Pritchard and Marquez 1973). Juveniles and subadults travel northward with vernal warming to feed in the productive coastal waters of Georgia through New England, but return southward with the onset of winter to escape the cold (Henwood and Ogren 1987; Lutcavage and Musick 1985; Morreale et al. 1988; Ogren 1989).

5.3.3 Food

Kemp's ridleys are omnivorous and feed on swimming crabs, crustaceans, fish, jellyfish, and molluscs (Pritchard and Marquez 1973; Seney et al. 2002).

5.3.4 Nesting

Nesting of Kemp's ridleys is mainly restricted to a stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Pritchard and Marquez 1973; Hopkins and Richardson 1984). Occasional nesting has been reported in Padre Island, Texas and Veracruz, Mexico (Mager 1985; Turtle Expert Working Group 2000). An estimated 40,000 females nested on a single day in 1947, but between 1978 and 1990 there were less than 1000 nests per season (Figures 5 and 6).

The nesting season of the Kemp's ridley is confined to the warmer months of the year primarily from April through July. Kemp's ridley females generally nest every year to every third year (Márquez et al. 1982; Pritchard et al. 1983). They produce two to three clutches of eggs per season and lay 50 to 185 eggs per clutch. The eggs hatch in 45 to 70 days, and hatchlings emerge two to three days later (Hopkins and Richardson 1984).

Hatchling Kemp's ridleys are about 4.2 cm (a little less than 2 in.) in length when they emerge from the nest (Hopkins and Richardson 1984). They emerge from the nest as a group at night, orient themselves seaward and rapidly move towards the water (Hopkins and Richardson 1984). Following emergence, many hatchlings fall prey to sea birds, raccoons, and crabs. Those hatchlings that reach the water quickly move offshore. Their existence after emerging is not well understood but is probably pelagic (Carr 1986). The post-pelagic stages are commonly found dwelling over crab-rich sandy or muddy bottoms. Juveniles frequent bays, coastal lagoons, and river mouths (NMFS and FWS 1992).

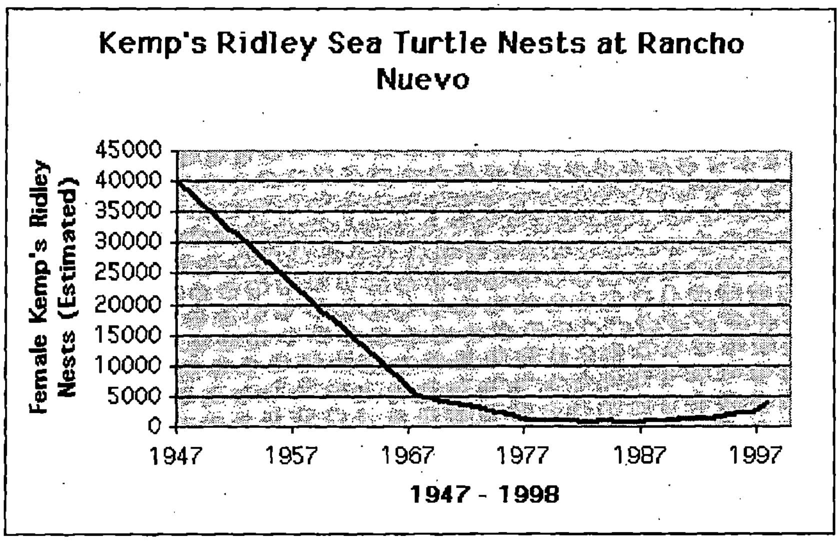

Figure 5. Estimated annual number of nesting female Kemp's Ridley sea turtles at Rancho Nuevo (HEART 1999).

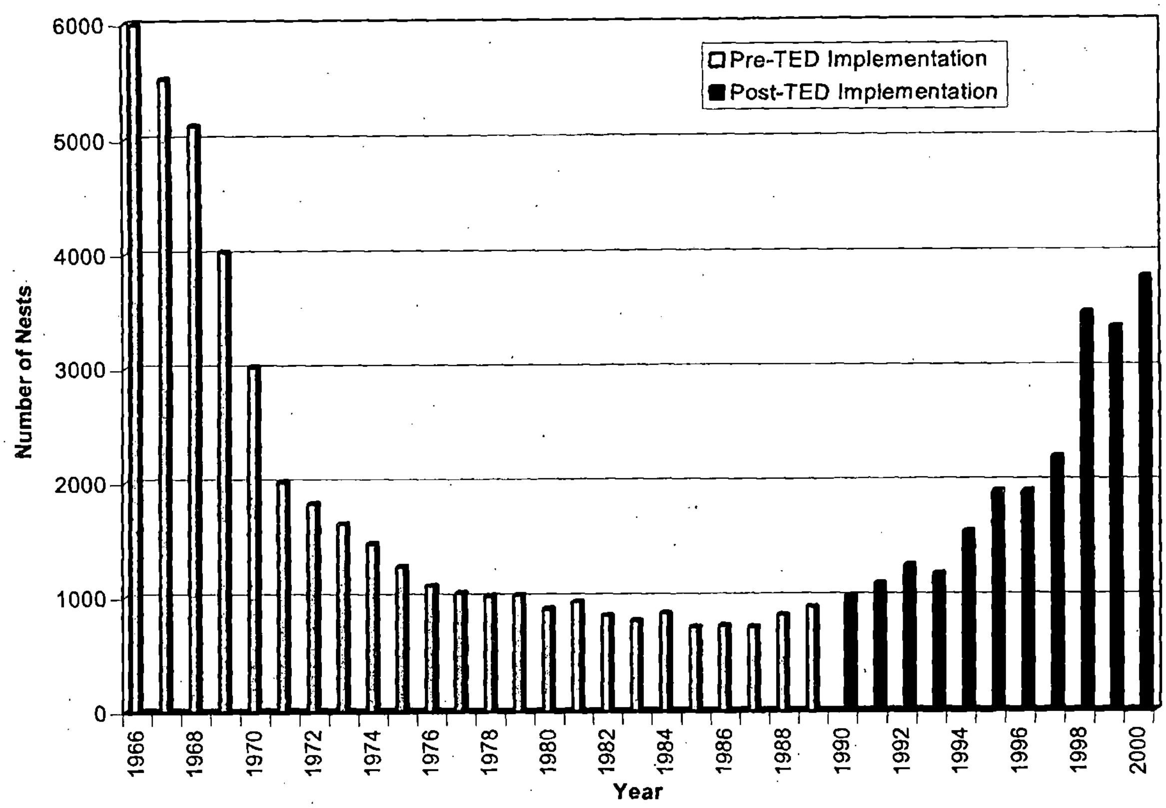

Figure 6. Number of Kemp's ridley nests at Rancho Nuevo before and after implementation of the turtle exclusion device (TED) regulations in 1989. (Turtle Expert Working Group 2000 and Marquez et al. 2001)

5.3.5 Population Size

The Kemp's ridley is the most endangered of the sea turtle species. Based on nesting information from Rancho Nuevo, Ross (1989) estimated that the population was declining at a rate of approximately three percent per year. The lowest number of nests was observed in 1985 (740 nests), but since that time the number of nests has increased by approximately 11.3 percent per year (Turtle Expert Working Group 2000). In 1994, 1565 nests were observed at Rancho Nuevo, and more Kemp's ridley nests have been laid each year since 1990 than in any previous year on record since 1978 (Byles, 1994). By 2000, the number of nests found at Rancho Nuevo increased to 3.788 (Marquez et al. 2001). It has been suggested that this increase in nesting activity reflects the reduction in shrimp trawl related mortality realized since the implementation of the NMFS TED regulations in September of 1989 (Crouse et al. 1992; Turtle Expert Working Group 2000). This hypothesis is supported by analyses of the number of nests counted versus hatchlings released (Turtle Expert Working Group 2000). The results of those analyses indicate that there has been an increase in survivorship from hatchling to maturity during the late 1980s and early 1990s. The increase in nesting activity is also likely to be attributable in part to an increase in recruitment to the population as a result of beach and nest protection efforts at Rancho Nuevo (Marquez et al. 1999; Turtle Expert Working group 2000). The adult Kemp's ridley population was estimated by Márquez (1989) to be approximately 2,200 adults based on the numbers of nests produced at Rancho Nuevo, this species's nesting cycle, male-female ratios, and fecundity. More recently, the Turtle Expert Working Group (1998; 2000) reported that age-based population models suggest that the Kemp's ridley population is increasing rapidly and that the trend was expected to continue into the future. While there is no current population estimate, the nesting population is estimated to be increasing ten percent each year (NOAA Fisheries 2003). As a result, we can expect to find increasing numbers of juveniles and subadults migrating northward each year as Atlantic coastal waters warm to feed in the productive coastal estuaries.

Population estimates of immature *Lepidochelys kempii* are difficult to develop. Increases have been noted in the number of juvenile captures during the late 1980s and early 1990s in long-term tagging studies in the northeast Gulf of Mexico (Ogren, unpublished data). If this increase is indicative of an overall increase in the juvenile population, more recruitment into the adult population should occur in the future (NMFS and FWS 1991a).

Kemp's ridleys also die at sea and wash ashore. The STSSN collects stranded sea turtles along both the Atlantic and Gulf Coasts (Turtle Expert Working Group 2000; STSSN 2004; Figure 7). The largest number of Kemp's ridley strandings during the period 1986-2001 occurred along the Gulf Coast (3,495 turtles; 60 percent of total), followed by the southeast Atlantic Coast (1,555 turtles; 27 percent of total) and the northeast Atlantic Coast (748 turtles; 13 percent of total). The number of strandings along the Gulf Coast increased sharply in 1994 and 1995 but subsequently remained fairly constant (Turtle Expert Working Group 2000). Along the southeast Atlantic Coast, the number of strandings decreased somewhat during the early 1990s but tended to increase from 1993 through 2001.

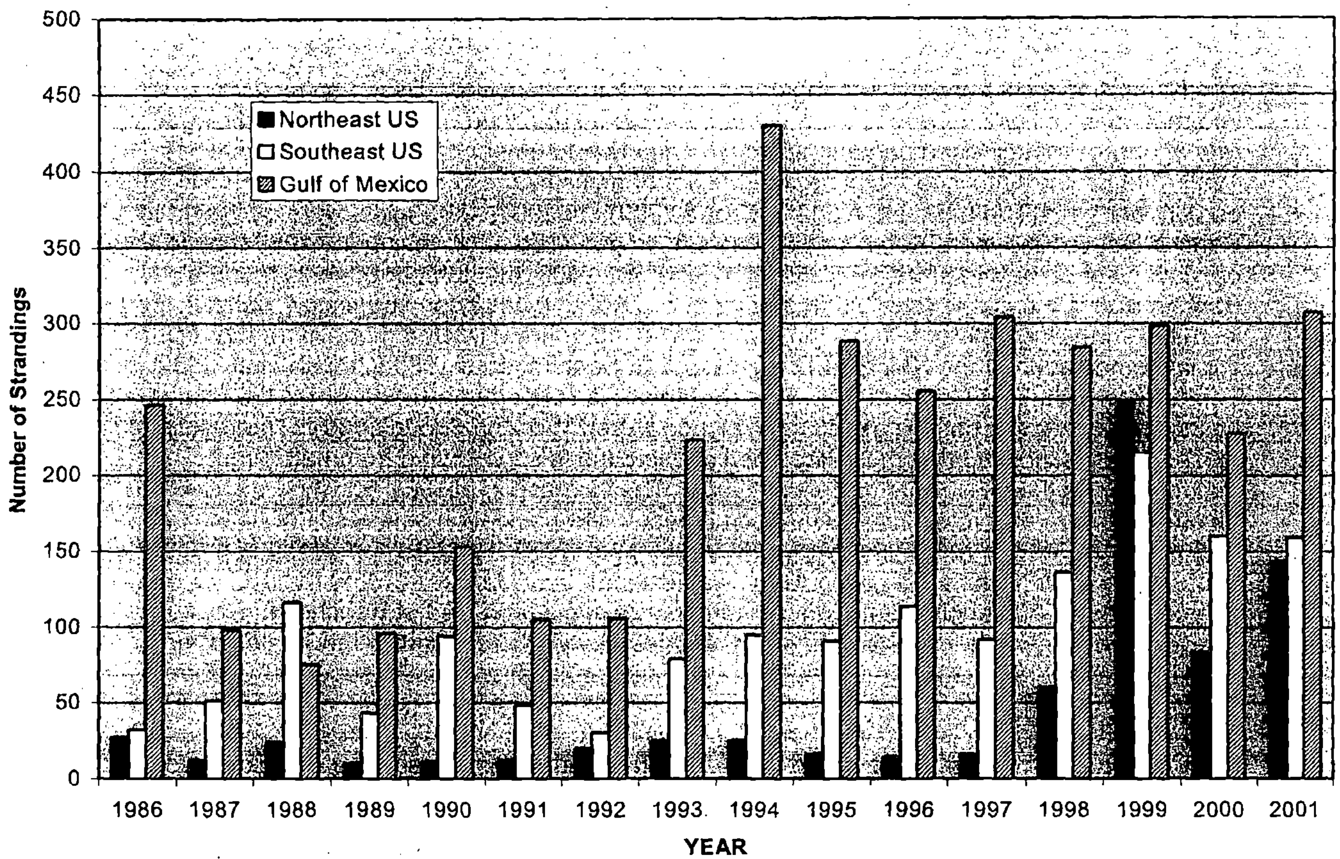

Figure 7. Kemp's ridley sea turtle strandings by region, 1986-2001. (Turtle Expert Working Group 2000 and STSSN 2004)

The number of strandings along the northeast Atlantic Coast was low and variable through 1997, but a noticeable increase was observed during the 1998-2001 period (Figure 7). A dramatic increase in strandings of Kemp's ridleys was also observed along the North Carolina coast from 1993 to 1999 (Boettcher 2002). Prior to 1993, 20 or fewer Kemp's ridley strandings were reported annually. The number of stranded individuals steadily increased from 12 in 1992 to a maximum of 122 in 1999. The timing of these increases in Kemp's ridley strandings seems to coincide with the implementation of the NMFS TED regulations described above, and suggests that the population is increasing.

An analysis of the size of stranded Kemp's ridleys indicated that many more large immature individuals were stranded during the 1990s relative to the 1980s (Turtle Expert Working Group 2000). These results also suggest that juvenile mortality has decreased and that the population is increasing.

Onboard observation of offshore shrimp trawling by NMFS in the southeast Atlantic indicated that over 2800 Kemp's ridleys are captured in shrimp trawls annually. The number of Kemp's ridley mortalities attributable to this activity was estimated to be 767 turtles annually and most of these (65 percent) occurred in the western portion of the Gulf of Mexico (NMFS 1987). Magnuson et al. (1990) estimated the annual shrimp trawl by-catch mortality to be between 500 and 5000 individuals. As discussed above, significant reductions in this source of mortality have been achieved as a result of the implementation of the TED regulations by the NMFS in 1989 (Crouse et al. 1992). The reduction in shrimp-trawl-related mortality, as well as the efforts to protect nesting beaches, have probably resulted in the recent indications that the population is steadily increasing (Turtle Expert Working Group 1998; 2000).

Despite these improvements, the data suggest that this population remains at critically low levels. This species was listed as endangered in 1970 and is considered the most endangered of all sea turtles (NMFS and FWS 1991a; Burke et al. 1994).

5.4 Atlantic Green Turtle (*Chelonia mydas*)

5.4.1 Description

The Atlantic green turtle is a medium-to-large sea turtle with a nearly oval carapace and a small, rounded head (Pritchard et al. 1983). Its carapace is smooth and olive brown in color with darker streaks and spots. Its plastron is yellow. Full-grown adult Atlantic greens normally weigh 100 to 150 kg (220 to 330 lb) and attain a SCL of 90 to 100 cm (35 to 40 in.) (Pritchard et al. 1983; Hopkins and Richardson 1984; Witherington and Ehrhart 1989). Morphologically, this species can be distinguished from the other sea turtles by the following characteristics: (1) a relatively smooth shell with no overlapping scutes; (2) one pair of scutes on the front of the head; (3) four pairs of lateral scutes on the carapace; (4) plastron with four pairs of enlarged scutes connecting the carapace; (5) one claw on each flipper; and (6) olive, dark brown mottled coloration (Nelson 1988; Pritchard et al. 1983; Carr 1952). Hatchlings are about 25 grams (0.88 ounces) and 55 millimeters (2.2 in.) long. They have a black carapace that is white on the ventral side.

5.4.2 Distribution

Atlantic green turtles are circumglobally distributed mainly in waters between the northern and southern 20 °C (68 °F) isotherms (Mager 1985). Preferred nesting grounds include sandy beaches of mainland shores, barrier islands, coral islands, and volcanic islands (NOAA Fisheries 2002).

In the western Atlantic, several major assemblages have been identified and studied (Parsons 1962; Pritchard 1966; Schulz 1975; 1982; Carr et al. 1978). In U.S. Atlantic waters, Atlantic green turtles are found around the U.S. Virgin Islands, Puerto Rico, and the continental United States from Texas to Massachusetts (NMFS and FWS and FWS 1991b). Nesting grounds extend from Texas to North Carolina as well as in the U.S. Virgin Islands and Puerto Rico. Eastern Florida has some of the main nesting beaches; other important nesting beaches are found on St. Croix and Puerto Rico (NOAA Fisheries 2002). Critical habitat is designated in waters around Isla Culebra, Puerto Rico.

5.4.3 Food

Atlantic green turtles leave their pelagic habitat phase and enter benthic feeding grounds upon reaching a SCL of 20 to 25 cm (8-10 in.). They are primarily herbivores eating sea grasses and algae (NMFS and FWS 1991b). Jellyfish, sponges, and other organisms living on sea grass blades and algae add to their diet (Mager 1985). Pelagic post-hatchlings are most likely omnivorous (NOAA Fisheries 2002).

5.4.4 Nesting

Atlantic green turtle nesting primarily occurs on the Atlantic coast of Florida from June to September (Hopkins and Richardson 1984). Other important nesting beaches include beaches in Yucatán and Tortuguero, Costa Rica. It is thought that nesting activity is increasing in Florida and Tortuguero; sparse data make it impossible to reliably estimate nesting trends in Yucatán (NOAA Fisheries 2002).

Although males mate annually, females only nest every two to four years (NOAA Fisheries 2002). Mature females may nest one to seven times per season at about 10-to-18-day intervals (Carr et al. 1978). Average clutch sizes vary between 100 and 200 eggs that usually hatch within 45 to 60 days (Hopkins and Richardson 1984). Hatchlings emerge, mostly at night, travel quickly to the water, and swim out to sea. At this point, they enter a period that is poorly understood but is likely spent pelagically in areas where currents concentrate debris and floating vegetation such as *Sargassum* spp. (Carr 1986).

5.4.5 Population Size

Elimination and deterioration of many nesting beaches and less-frequent encounters with Atlantic green turtles provided inferential evidence of declining stocks in the early to mid-1980s (Mager 1985; Hopkins and Richardson 1984). The number of Atlantic green sea turtles that existed before commercial exploitation and the total number that now exists are not known.

Records show drastic declines in the Florida catch during the 1800s, and similar declines occurred in other areas, such as Texas, where they were commercially harvested in the past (Hildebrand 1982; Hopkins and Richardson 1984). Although estimates are not available for the total population, it is estimated, while taking into account the two-year remigration interval, that the nesting population in the southeastern U.S. is recovering and has reached an approximate level of 1,000 nesting females (NOAA Fisheries 2002). Also, in Indian River Lagoon in Florida, a long-term study in juvenile foraging grounds found significant increases between the early and late 1980s in the population of juvenile Atlantic green turtles (NOAA Fisheries 2002).

There are many ongoing threats to the Atlantic green turtle population. While TED regulations have helped reduce incidental take in trawl fisheries, incidental takes with fishing gear interactions continue to occur. Other threats at sea include pollution, foraging habitat loss through human-based direct destruction and secondary siltation, vessel strikes, and suction dredges. Nesting beaches are threatened by erosion control, artificial lighting, beach armoring, and disturbance. Finally, green turtle fibropapillomatosis disease, an often fatal tumor disease, is widespread and may be a contributor to population decline in Hawaii and Florida (NOAA Fisheries 2002). Outside the U.S., some areas continue direct takes of Atlantic green turtles for their shells, eggs, and meat.

5.5 Leatherback Turtle (*Dermochelys coriacea*)

5.5.1 Description

The leatherback turtle is the largest sea turtle. It has an elongated, somewhat triangularly-shaped body with longitudinal ridges or keels. It has a leathery, blue-black shell composed of a thick layer of oily, vascularized, cartilaginous material, strengthened by a mosaic of thousands of small bones. This blue-black shell may also have variable white spotting (Pritchard et al. 1983). Its plastron is white. Leatherbacks normally weigh up to 300 kg (660 lb) and attain a SCL of 140 cm (55 in.) (Pritchard et al. 1983; Hopkins and Richardson 1984). Specimens as large as 910 kg (2,000 lb) have been observed.

Morphologically, this species can be easily distinguished from the other sea turtles by the following characteristics: (1) its smooth unscaled carapace; (2) carapace with seven longitudinal ridges; (3) head and flippers covered with unscaled skin; and, (4) no claws on the flippers (Nelson 1988; Pritchard et al. 1983; Pritchard 1971; Carr 1952).

5.5.2 Distribution

Leatherbacks have a circumglobal distribution and occur in the Atlantic, Indian, and Pacific Oceans. They range as far north as Labrador and Alaska to as far south as Chile and the Cape of Good Hope. Their occurrence farther north than other sea turtle species is probably related to their ability to maintain a warmer body temperature over a longer period of time (NMFS 1985). Thompson (1984) reported that leatherbacks prefer water temperatures of 20 ± 5 °C (68 ± 9 °F) and were likely to be associated with cooler, more productive waters than the Gulf Stream. Aerial surveys have shown leatherbacks to be present from April to November between North Carolina and Nova Scotia, but most likely to be observed from the Gulf of Maine south to Long Island during summer (Shoop et al. 1981).

5.5.3 Food

The diet of the leatherback consists primarily of soft-bodied animals such as jellyfish and tunicates, together with juvenile fishes, amphipods, and other organisms (Hopkins and Richardson 1984).

5.5.4 Nesting

Leatherback turtle nesting occurs on the mid-Atlantic coast of Florida from late February or March to September (Hopkins and Richardson 1984; NMFS 1992). Mature females may nest one to nine times per season at about 9-to-17-day intervals. Average clutch sizes vary between 50 and 170 eggs that usually hatch within 50 to 75 days (Hopkins and Richardson 1984; Tucker 1988). Hatchlings emerge, mostly at night, travel quickly to the water, and swim out to sea. The life history of the leatherback is poorly understood since juvenile turtles are rarely observed.

5.5.5 Population Size

The world population estimate for the leatherback in 1980 was estimated to be about 115,000 females with the discovery of nesting beaches in Mexico (Pritchard 1983). Probably due to exploitation of eggs on the beach and fishery mortality, that number declined to about 34,500 by 1995 (Spotila et al. 1996), and numbers may still be declining.

5.6 Hawksbill Turtle (*Eretmochelys imbricata*)

5.6.1 Description

Hawksbill turtles are small to medium turtles with elongated heads with pointy mouths. The hawksbill turtle is best known for its "tortoise shell" carapace, which is mostly brown, mottled with light and dark spots on the dorsal side. The ventral side is a light yellow or white, acting as a natural camouflage against predators. Identifying characteristics include overlapping costal scutes, serrated marginal scutes, two pairs of prefrontal scales, and two claws on each flipper. The hatchling and juvenile carapaces are heart-shaped and become elongated as the turtles mature.

5.6.2 Distribution

Post-hatchlings are pelagic while juvenile, subadult, and adult hawksbills are found in coral reef environments or in bays and estuaries with mangroves when coral reefs are absent. Generally, hawksbills are found in tropical and subtropical waters, although they have been sighted as far north as Maine in Atlantic waters. Most sightings on the eastern coast of the U.S. have been reported from Florida and Texas.

5.6.3 Food

The hawksbill diet consists mostly of sponges found on coral reefs. Other common prey include mollusks, algae, sea anemones, squid, and other invertebrates.

Hawksbills use their sharp beak-like mouth to forage for sponges in crevices of coral reefs (Pacific Whale Foundation 2003).

5.6.4 Nesting

Hawksbill turtles have solitary nesting behavior and are known to nest in the U.S. in Puerto Rico, U.S Virgin Islands, Florida, and Hawaii. Critical habitat is designated for nesting beaches in Puerto Rico. Individual nesting sites are often under vegetation. Females nest every two to three years, and lay up to six clutches per season with a 15-to-21-day interval; the average clutch size has 130 eggs (Pacific Whale Foundation 2003).

5.6.5 Population Size

Although there are few data about the hawksbill turtle, nesting populations are thought to be declining. An estimate based on data from the early to mid-1990s is approximately 34,000 nesting females (Caribbean Conservation Corporation 2003). Critical habitat is designated for some nesting beaches in Puerto Rico, but Mexico probably has the biggest nesting population in the Atlantic and Caribbean. Most sightings off Texas and Florida are thought to be of populations from the Mexican nesting beaches.

6.0 Incidental Captures and Plant-Related Mortality

Correspondence regarding the ITS of the May 2001 BO contains language that turtle injury or mortality in the canal shall be counted when "resulting from plant operation." In response to this requirement, a qualified veterinarian determines cause of death or injury in cases that are not readily apparent.

From initial plant operation in May 1976 through 2006, FPL captured and removed from the intake canal a total of 6876 loggerhead, including 507 recaptures; 4954 Atlantic green, including 1641 recaptures; 31 leatherback; 45 Kemp's ridley; and 45 hawksbill turtles. Table 1 shows the sea turtle capture data over the last five calendar years, all of which have been subject to the existing ITS that took effect when the 2001 BO was issued. NRC staff believes that variation in the number of turtles found during different months and years, including dramatic increases in Atlantic green turtle captures in recent years, is primarily due to natural variations in the occurrence of turtles in the vicinity of the plant rather than to operational influences of the plant itself.

The plant exceeded the annual incidental take limit for sea turtles in 2006 and entrained a total of 662 Atlantic green and loggerhead turtles. The incidental take limit of 1 percent of entrained Atlantic green and loggerhead turtles was exceeded because 29 of the 662 entrained turtles were injured or killed due to plant operation (Table 2). The first mortality occurred on January 22, 2006, when a small, dead Atlantic green turtle was discovered impinged at the intake well for Unit 2. On October 25 and 26, 2006, 21 loggerhead hatchling mortalities were discovered and likely resulted from a single hatching at an undetected nest on the intake canal bank. During the same event, three loggerhead hatchlings were retrieved alive and later released on November 4, 2006. The January and October mortalities resulted from drowning after impingement at the intake wells.

Table 1. Sea turtle takes (mortalities) at St. Lucie Nuclear power Plant in the last five years.

	Year				
Turtle Species	2002	2003	2004	2005	2006
Loggerhead	341 (0)	583 (0)	623 (2)	485 (2)	395 (21)
Atlantic Green Turtle	292 (3)	394 (3)	286 (1)	427 (2)	267 (8)
Kemp's Ridley	0 (0)	4 (0)	2 (0)	0 (0)	1 (0)
Leatherback	3 (0)	6 (0)	2 (0)	2 (0)	2 (0)
Hawksbill	0 (0)	2 (0)	1 (0)	3 (0)	3 (0)
Total	636 (3)	989 (3)	914 (3)	917 (4)	668 (29)

Source: FPL and Quantum Resources, Inc. 2006.

Table 2. Sea turtle takes causal to operation of St. Lucie Nuclear Power Plant in 2006.

Date (2006)	Species	Number of Turtles	Injury or Mortality
1/22	Atlantic green turtle	1	Mortality
7/12	Atlantic green turtle	1	Injury
7/18	Atlantic green turtle	1	Injury
8/15	Atlantic green turtle	1	Injury
9/2	Atlantic green turtle	1	Injury
9/13	Atlantic green turtle	1	Injury
9/25	Atlantic green turtle	1	Injury
10/12	Atlantic green turtle	1	Injury
10/25	Loggerhead	11/3*	Mortality/Injury
10/26	Loggerhead	10*	Mortality

* Loggerhead hatchlings likely from an undetected nest on intake canal berm were found in Unit 1 and 2 weir pits.

Ongoing evaluations and improvements to the canal capture program during recent years have substantially decreased the amount of time entrapped sea turtles remain in the canal. Turtles confined between the barrier net and intake headwalls typically reside in the canal for a relatively short period prior to capture, and most turtles have been in good to excellent condition when caught. The 12.7-cm (5-in.) mesh barrier net completed in January 1996 substantially reduced sea turtle residence times in the intake canal. During major influxes of seaweed and jellyfish, however, 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. The improved design and net material has withstood the seaweed and jellyfish events that caused previous design failure of the old barrier net. Additionally, dredging of the intake canal completed in 2002 and in 2005 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. Recent turtle injuries were likely caused by hurricane debris and/or biofouling in the intake pipes leading to the intake canal. FPL inspected intakes pipes during an outage in April 2007. Corrective actions will be determined by NMFS and NRC based on the inspection results, which have not yet been received.

7.0 Assessment of Plant Operations on Sea Turtles

Until 2006, impacts to sea turtles had not changed significantly since the last Section 7 consultation. The October 2006 impingement and deaths of 21 loggerhead turtle hatchlings brought recognition that this event could happen again with loggerhead or other sea turtle species, even though this was a single event that had not happened before during operation of SLNPP and so might have low probability of occurrence in the future. In addition, seven Atlantic green turtles were injured in 2006, which suggested possible collisions with debris in the intake pipe that might have accumulated due to a recent hurricane.

8.0 Planned Projects

The following three planned projects on the cooling system have the potential to adversely affect sea turtles or smalltooth sawfish. Each includes steps to avoid or minimize such adverse effects.

- **Repair/Replacement of the 5-in. Mesh Turtle Net.** The service life of the anti-fouling coating on the 5-in. mesh turtle net requires replacement of the net approximately every five years. The project will require the use of cranes, work boats, and divers for implementation. Installation of a temporary net will be required during the time period that the permanent net is removed. Any underwater work will be performed by divers.

- **Maintenance Canal Dredging.** Normal plant operation may cause erosion of the canal banks and transport of sediments into the canals, resulting in the partial infilling of areas of the canal. Additionally, environmental events such as hurricanes and severe storms may cause additional erosion of the canal banks and infilling of the canal. Maintenance dredging of the canal may be required to restore the canal profile. Canal dredging is performed with the use of a suction dredge to remove the unwanted material. The suction head of the dredge is fitted with bars to limit the maximum opening size to approximately 5 in. Placement of the cutter head into the water is done slowly to allow marine life to exit the area and prevent them from being trapped. Canal dredging is performed on an as-required basis. Normal maintenance dredging may be required approximately every 8 to 10 years. Additional dredging may be required due to an environmental event such as a hurricane or severe storm.

- **Hurricane Restoration of Canal Bank.** Hurricanes during 2004 and 2005 have caused significant damage to the canal banks. A project to restore canal bank is scheduled to start during 2007 and continue into 2009. The project involves re-profiling the canal banks and installing an articulating concrete block revetment system. The work plan calls for the use of a suction dredge to remove the cut material. Dredging operations will be done as discussed above. Long reach excavators stationed on barges will be used for final grading of the canal slopes prior to placement of the revetment system. Landscape fabric and the articulating block mats installation will be installed using cranes, supported by divers. This is a one-time hurricane restoration project, and no additional work associated with this project is scheduled beyond its completion date.

9.0 Mitigation Measures

Several mitigation measures for incidental sea turtle takes were developed in discussions among FPL, NRC, and NMFS staff during a site visit on April 17-18, 2007 (NRC 2007) and a subsequent conference call among FPL, NRC, NMFS, and FWC staff on April 30, 2007. Possible measures to prevent or mitigate future nesting along the intake canal bank and to decrease turtle injuries include the following:

- Implement measures, such as cutting back existing vegetation, so that turtle crawls would be more visible. NRC and NMFS suggested that a prudent measure should be implemented as soon as possible since the 2007 sea turtle nesting season has already begun. If turtles might be injured during implementation, mitigation measures should be included.

- FPL could develop a plan to install exclusion devices at the velocity caps to prevent large marine organisms, such as adult sea turtles and smalltooth sawfish, from entering the intake pipes. NRC and NMFS observed that the design and installation of such devices would likely be a longer-term project, but suggested to FPL that this project should be done as soon as possible, with a proposed implementation, maintenance, and inspection plan to be provided for this project no later than September 30, 2007.

- During the April 2007 outage at SLNPP, FPL inspected the intake and discharge pipes. Inspection results are expected to identify the amount and location of any significant structural impediment or biofouling and debris accumulation that extends into the flow path of the intake pipes. NRC and NMFS suggested that FPL develop an implementation and future inspection plan based on the pipe inspection report for cleaning the intake pipes during the fall 2007 outage to remove protruding structures or debris that may adversely affect animals entrained in the intake canal. NRC and NMFS suggested that FPL should coordinate and obtain concurrence of the implementation and future inspection plan from the NRC and NMFS prior to implementation. NRC and NMFS believe that removal of significant biofouling and debris could reduce adverse effects on animals entrained into the intake canal.

- The exploration of the intake pipes in April 2007 also revealed a dead-end section in each 12-ft (3.66-m) diameter intake pipe, and a live Atlantic green turtle was discovered in one of them. FPL blew air into that section so the turtle could continue breathing, and the turtle entered the intake canal on June 15, 2007. Because of the potential for sea turtles to be trapped in this section, which no longer has a functional purpose, NRC and NMFS suggested that FPL could seal off the dead-end sections of the 12-ft (3.66-m) diameter intake pipes during the fall 2007 outage.

- When turtle injuries appeared to be increasing, FPL staff deduced that hurricane debris might have lodged in the plant's intake pipes. To better document turtle injuries that might occur in the future, FPL might submit monthly reports of causal injuries that include the number of scrapes and other damage, whether the number of turtle injuries appears to be decreasing or decreasing, and, if increasing, courses of action that FPL might take to reduce the causal injuries.

10.0 Conclusion and Recommendation for Revised Incidental Take Statement

Examination of the intake pipes in April 2007 revealed both the presence of protruding debris that can could cause injuries to sea turtles and the presence of a turtle trapped in a no-longer-used dead-end pipe section. Both can contribute to incidental takes of sea turtles and resulted in recommendations for mitigative measures. NRC recommends that existing terms and conditions be modified to add requirements for periodic inspections of intake pipes during planned outages, sealing off dead-end sections of intake pipes, and appropriate mitigation measures to protect listed species during maintenance projects in the intake canal. Implementation of such measures would ensure sea turtle protection, and the NRC concludes that the continued operation of SLNPP's cooling water system would not jeopardize the continued existence of sea turtles in U.S. waters.

11.0 References

50 CFR 17.11, Endangered and Threatened Wildlife.

50 CFR 222.23(a), Endangered Fish or Wildlife Permits (under National Marine Fisheries Service jurisdiction).

Bjorndal, K. A., A. B. Meylan and B. J. Turner. 1983. Sea turtles nesting at Melbourne Beach, Florida. I. Size, growth and reproductive biology. Biol. Conserv. 26:65-77.

Boettcher, R. 2002. Sea turtle mortality in North Carolina (USA): A summary of 1999 stranding events. Proceedings of the Twentieth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-477, 369 pp.

Burke, V. J., S. J. Morreale and E. A. Standora. 1994. Diet of the Kemp's ridley sea turtle, *Lepidochelys kempii*, in New York waters. Fishery Bulletin 92:26-32.

Bustard, H. R. 1972. Sea Turtles. Natural history and conservation. Taplinger Publishing Company, NY, 220 pp.

Byles, R.A 1994. Personal communication. U.S. Fish and Wildlife Service. National Sea Turtle Coordinator, Albuquerque, N.M.

Caribbean Conservation Corporation. 2003. Species Fact Sheet: Hawksbill Sea Turtle. Accessed on March 8, 2005 at http://www.cccturtle.org/hawksbill.htm.

Carr, A. 1952. Handbook of Turtles. Comstock Publishing Associates, Cornell University Press, Ithaca, NY.

Carr, A., M. Carr, and A. Meylan, 1978. The ecology and migrations of sea turtles: 7. The West Caribbean Green Turtle Colony. Bull. Amer. Mus. Nat. Hist. 162(I):1-46.

Carr, A. 1986. New Perspectives on the Pelagic Stage of Sea Turtle Development, U.S. Dept. Comm. NOAA, NMFS, NOAA Technical Mem. NMFS-SEFC-190, 36 pp.

Connecticut Department of Environmental Protection. 2000. Leatherback Sea Turtle Fact Sheet. Accessed on February 28, 2005 at http://dep.state.ct.us/burnatr/wildlife/factshts/lbttl.htm.

Crouse, D. T. 1985. Biology and conservation of sea turtles in North Carolina. Unpubl. Ph.D. Dissert. Univ. Wisconsin, Madison.

Crouse, D. T., M. Donnelly, M. Bean, A. Clark, W. Irvin and C. Williams. 1992. The TED Experience: Claims and Reality. A report to the Center for Marine Conservation, Environmental Defense Fund, National Wildlife Federation, Washington, D.C., 17 pp.

Crowder, L.B., S.R. Hopkins-Murphy, and J.A. Royle. 1995. Effects of turtle excluder devices (TEDs) on loggerhead sea turtle populations. Copeia 1995:773-779.

Dodd, K., Jr., 1988. Synopsis of the Biological Data on the Loggerhead Turtle *Caretta caretta* (Linneaus 1758). U.S. Fish and Wildlife Serv., Biol. Rep. 88(14). 110 pp.

Ehrhart, L. M. 1980. Marine turtle nesting in north Brevard County, Florida, in 1979. Fla. Sci. 43:27 (abstract).

Florida Power & Light Company (FPL). 1983. Florida's Sea Turtles. 46 pp.

Florida Power & Light Company (FPL) and Quantum Resources. 2007. Florida Power & Light Company St. Lucie Plant Annual Environmental Operating Report 2006.

Frazer, N. B. 1986. Survival from egg to adulthood in a declining population of loggerhead turtles, *Caretta caretta*. Herptologica 42(I): 47-55.

Garmon, L. 1981. Tortoise marsh wallow? Science News 119(14) Apr.: 217.

Gordon, W. G., ed. 1983. National report for the country of the United States. Pages 3-423 to 3-488 P. Bacon et al., eds., In Proc. Western Atlantic Turtle Symp. Vol 3, Appendix 7: National Reports. Center for Environmental Education, Washington D.C.

HEART (Help Endangered Animals – Ridley Turtles). 1999. Accessed on March 9, 2005 at http://www.ridleyturtles.org/popchart.html.

Henwood, T. A. and L. H. Ogren. 1987. Distribution and migrations of immature Kemp's ridley turtles (*Lepidochelys kempii*) and green turtles (*Chelonia mydas*) off Florida, Georgia, and South Carolina. Northeast Gulf Science, 9(2):153-160.

Hildebrand, H. 1982. A historical review of the status of sea turtle populations in the western Gulf of Mexico. In Bjorndal, K. (ed.), Biology and conservation of sea turtles. Smithsonian Institution Press, Washington, D.C. pp. 447-453.

Hirth, H. F. 1971. Synopsis of biological data on green turtle *Chelonia mydas* (Linneaus) 1758. FAO Fish. Synop. No. 85.

Hopkins, S. R. and J. I. Richardson, eds. 1984. Recovery Plan for Marine Turtles. U.S. Dept. Comm. NOAA, NMFS, St. Petersburg, FL, 355 pp.

Kraemer, J.E. 1979. Variation in incubation length of loggerhead sea turtle, *Caretta caretta*, clutches on the Georgia coast. Unpubl. M.S. Thesis, Univ. Georgia, Athens.

Lazell, J.D. 1980. New England waters: Critical habitat for marine turtles. Copeia (2):290-295.

Lutcavage, M. and J.A. Musick. 1985. Aspects of the biology of sea turtles in Virginia. Copeia 1985(2):449-456.

Mager, A. 1985. Five-year status reviews of sea turtles listed under the Endangered Species Act of 1973. U.S. Dept. Comm. NOAA, NMFS, St. Petersburg, FL, 90 pp.

Magnuson, J. J., K. A. Bjorndal, W. D., DuPaul, G. L. Graham, D. W. Owens, C. H. Peterson, P. C. H. Pritchard, J. I. Richardson, G. E. Saul, and C. W. West. 1990. Decline of the sea turtles: causes and prevention. National Academy Press, Washington, D.C., 274 pp.

Márquez, R. 1989. Status Report of the Kemp's Ridley Turtle, Pages 159 to 165. In: L. Ogren et al., eds., Proc. Second Western Atlantic Turtle Symposium. Department of the Interior, Fish and Wildlife Service, Washington D.C.

Márquez, R., A. Villanueva and M. Sanchez. 1982. The population of Kemp's Ridley Sea Turtle in the Gulf of Mexico, *Lepidochelys kempii*, In Bjorndal, K., ed. Biology and Conservation of Sea Turtles. Proc. World Conf. of Sea Turtle Conserv. Smithsonian Inst. Press. Washington, D.C. pp. 159-164.

Márquez, R., J. Diaz, M. Sanchez, P. Burchfield, A. Leo, M. Carrasco, J. Pena, C. Jimenez and R. Bravo. 1999. Results of Kemp's ridley nesting beach conservation efforts in Mexico. Marine Turtle Newsletter 85:2-4.

Márquez, R., P. Burchfield, M. Carrasco, C. Jimenez, J. Diaz, M. Garduno, A. Leo, J. Pena, R. Bravo and E. Gonzalez. 2001. Update on the Kemp's ridley turtle nesting in Mexico. Marine Turtle Newsletter 92:2-4.

Mendonca, M. T. and L. M. Ehrhart. 1982. Activity, Population size and structure of immature *Chelonia mydas* and *Caretta caretta* in Mosquito Lagoon, Florida. Copeia (1): 161-167.

Meylan, A. B. 1982. Sea turtle migration - evidence from tag returns. In Biology and Conservation of Sea Turtles. Bjorndal, K., ed., Smithsonian Institution Press, Washington, D.C., pp. 91-100.

Morreale, S. J., S. S. Standove and E. A. Standora. 1988. Kemp's Ridley Sea Turtle Study 1987-1988, Occurrence and Activity of the Kemp's Ridley (*Lepidochelys kempii*) and Other Species of Sea Turtles of Long Island, New York. New York State Dept. of Environmental Conservation, Contract No. C001693.

Mortimer, J. A. 1982. Factors influencing beach selection by nesting sea turtles. In Biology and Conservation of Sea Turtles. Bjorndal, K., ed. Smithsonian Institution Press, Washington, D.C., pp. 45-51.

National Marine Fisheries Service (NMFS). 1985. Five Year Status Reviews of Sea Turtles Listed Under the Endangered Species Act of 1973. NMFS Protected Species Management Branch, Washington, D.C.

National Marine Fisheries Service (NMFS). 1987. Final Supplement to the Final Environmental Impact Statement on Listing and Protecting the Green Sea Turtle, Loggerhead Sea Turtle and the Pacific Ridley Sea Turtle under the Endangered Species Act of 1973. National Marine Fisheries Service, Southeast Office, St. Petersburg, FL. 48 pp.

National Marine Fisheries Service (NMFS). 1992. Recovery Plan for Leatherback Turtles in the U.S. Caribbean, Atlantic and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C. 65 pp.

National Marine Fisheries Service Southeast Fisheries Science Center (NMFS SWFSC). 2001. Stock assessments of loggerheads and leatherback sea turtles and an assessment of the impact of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the Western North Atlantic. U.S. Department of Commerce, National Marine Fisheries Service, Miami, FL, SEFSC Contribution PRD-00/01-08; Parts I-III and Appendices I-IV. NOAA Tech. Memo NMFS-SEFSC-455, 343 pp.

Nati

Biological Assessment

St. Lucie Nuclear Power Plant Units 1 and 2 Reinitiation of Section 7 Consultation to Include Sea Turtles

St. Lucie County, Florida

August 2007

Docket Nos. 50-335 and 50-389

U.S. Nuclear Regulatory Commission Rockville, Maryland

Enclosure

1.0 Introduction and Summary

This Biological Assessment (BA) was prepared in support of reinitiating a formal consultation between the U.S. Nuclear Regulatory Commission (NRC) and National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) in compliance with Section 7 of the Endangered Species Act of 1973, as amended (ESA). The purpose of this BA is to examine the potential impacts on Federally-listed sea turtle species associated with the continued operation of the St. Lucie Nuclear Power Plant's (SLNPP's) circulating seawater cooling system and to support the NRC's July 8, 2005 request to NMFS for reinitiation of formal Section 7 consultation regarding the SLNPP. The NRC has been consulting with NMFS regarding sea turtle takes at the SLNPP since 1982. Several BAs and Biological Opinions (BOs) have been issued since 1982 and resulted in periodic revisions to the Incidental Take Statement (ITS), as appropriate. A reinitiation of formal consultation was triggered by a take of a smalltooth sawfish (*Pristis pectinata*) on May 16, 2005. Sea turtles were added to the reinitiation when the plant exceeded the annual incidental take limit for sea turtles in 2006 and entrained a total of 662 Atlantic green turtles (*Chelonia mydas*) and loggerhead turtles (*Caretta caretta*). The incidental take limit of one percent of entrained Atlantic green and loggerhead turtles was exceeded because 29 of the 662 entrained turtles were injured or killed due to plant operation.

Florida Power and Light Company (FPL) is the licensee that operates the SLNPP and conducts an ongoing turtle capture-and-release program in the station's intake canal. There have been no procedural changes in the operation of the SLNPP's circulating seawater cooling system since the last BO, dated May 4, 2001, which was clarified by letter dated July 30, 2002. The 2001 BO analyzed the effects of operation of the SLNPP's circulating seawater cooling system on loggerhead turtles, Atlantic green turtles, Kemp's ridley turtles (*Lepidochelys kempii*), leatherback turtles (*Dermochelys coriacea*), and hawksbill turtles (*Eretmochelys imbricata*). This BA provides a brief update of information regarding recent effects of the cooling system on these sea turtle species.

Three of the five sea turtle species in the 2001 BO, Kemp's ridley, leatherback, and hawksbill, are Federally listed as endangered. The loggerhead is Federally listed as threatened. Atlantic green turtles in U.S. waters are Federally listed as threatened except for the Florida breeding population that is listed as endangered. Due to the inability to distinguish between the two Atlantic green turtle populations away from the nesting beaches, Atlantic green turtles are considered endangered wherever they occur in U.S. waters. All three species occur in the vicinity of the SLNPP, where they are potentially subject to entrainment.

SLNPP is located on Hutchinson Island in St. Lucie County, Florida. The island is a barrier island bounded by the Atlantic Ocean to the east and the Indian River Lagoon to the west. The cooling system withdraws water from the Atlantic Ocean to cool the condensers of the two operating reactors, St. Lucie Units 1 and 2, which began operating in 1976 and 1983, respectively. The intake portion of the cooling system consists of three intake structures with velocity caps in the ocean, three buried pipelines, a common intake canal, and two intake well structures (one for each unit). In the intake canal has a series of nets, trash bars, and screens to prevent debris and organisms from being impinged on the intake screens or entrained into the plant.

Animals occasionally enter the canal system of the SLNPP along with seawater that is withdrawn from the Atlantic Ocean for condenser cooling. The intake structures and velocity caps for the plant are located about 365 meters (m) (1200 feet [ft]) offshore where they also serve as artificial reefs. As such, these structures attract turtles and other marine life by appearing to offer food and shelter. If an animal passes through the vertical plane of the velocity cap, the animal would enter the intake pipeline, which travels under the ocean floor and barrier island and debouches in the intake canal on the western side of the beach dunes.

Once in the intake canal, the animals cannot escape due to the high flow rates in the intake pipes and must be rescued and returned to the ocean. Therefore, FPL has a capture-and-release program to retrieve sea turtles and return them to the ocean. The program includes conservation efforts and collaboration with research organizations, sea turtle stranding programs, and Federal and State agencies. FPL has an existing agreement with Florida Fish and Wildlife Conservation Commission (FWC) regarding case-specific decisions on how and where to treat injured turtles that are not healthy enough to be returned immediately to the ocean. The FWC is also consulted to conduct turtle necropsies when needed. NRC's long history of consultations with NMFS regarding the SLNPP and FPL's commitment to minimize sea turtle injury and mortality has resulted in the modification and addition of barrier nets over time.

In 2006 SLNPP caused 21 loggerhead hatchling mortalities, which most likely resulted from a single hatching at an undetected nest on the intake canal bank. During the same event, three loggerhead hatchlings were retrieved alive and later released on November 4, 2006. The mortalities resulted from drowning after impingement at the intake screens. In addition, other recent turtle injuries were likely caused by hurricane debris and/or biofouling in the intake pipes leading to the intake canal. FPL inspected intakes pipes during an outage in April 2007. Corrective actions will be determined by NMFS, NRC, and FPL based on the inspection results.

This BA includes four mitigation measures for incidental sea turtle takes developed in discussions among NRC, FPL, NMFS, and FWC staff. These include (1) FPL implementing measures along the banks of the intake canal east of the 12.7-cm (5-in.) turtle net so that turtle crawls would be more visible, (2) FPL developing and implementing a plan to install exclusion devices at the velocity caps to prevent large marine organisms, such as adult sea turtles and smalltooth sawfish, from entering the intake pipes, (3) FPL developing and implementing a plan based on the pipe inspection report for cleaning the intake pipes during the fall 2007 outage to remove protruding debris that may adversely affect animals entrained in the intake canal, and (4) FPL sealing off the dead-end sections of the 12-ft-diameter intake pipes during the fall 2007 outage. This BA also suggests a revision to the ITS that FPL develop and execute a plan for periodic examination of intake pipes to ensure that conditions that could adversely affect sea turtles be found and corrected.

2.0 Purpose

This BA was prepared in support of reinitiating a formal consultation between the NRC and the NMFS in compliance with Section 7 of the ESA. On February 24, 2006, the NRC submitted a BA for the reinitiation of formal consultation regarding the continued operation of SLNPP regarding a smalltooth sawfish take in May 2005. On February 1, 2007, FPL notified the NRC that SLNPP exceeded its 2006 incidental take limit for sea turtles, and NRC then discussed this information with NMFS. In a subsequent letter on April 4, 2007, NRC confirmed to NMFS that sea turtles will be added to the formal consultation on smalltooth sawfish because SLNPP exceeded its annual incidental take limit for sea turtles 2006. The purpose of the present BA is to supplement the February 24, 2007 BA focusing on smalltooth sawfish by adding information on threatened and endangered sea turtles taken by SLNPP.

This BA examines the potential impacts associated with the continued operation of the SLNPP on sea turtle species protected under the ESA. The primary species of concern are loggerhead turtle, Kemp's ridley turtle, Atlantic green turtle, leatherback turtle, and hawksbill turtle. Kemp's ridley turtle is listed as endangered, and the loggerhead turtle is listed as threatened. Atlantic green turtles in U.S. waters are listed as threatened except for the Florida breeding population, which is listed as endangered. Due to the inability to distinguish between these populations away from the nesting beach, these sea turtles are considered endangered wherever they occur in U.S. waters. The leatherback turtle and the hawksbill turtle are also listed as endangered in U.S. waters. NMFS has jurisdiction for these species at sea.

3.0 Site Description

SLNPP is located on a 457-hectare (1130-acre) 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, which is long and shallow. Hutchinson Island is a barrier island that extends 36 km (22.4 mi) between inlets and attains its maximum width of 2 kilometers (km) (1.2 miles [mi]) at the plant site. Elevations approach 5 m (16.4 ft) 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 north parallel to the continental shelf margin, begins to diverge from the coastline at West Palm Beach. The Florida Current is approximately 33 km (20.5 mi) offshore at Hutchinson Island. Oceanic water associated with the western boundary of the Florida Current periodically meanders over the inner shelf, especially during summer months.

4.0 Description of the St. Lucie Power Plant

St. Lucie Units 1 and 2 consist of two 839-net megawatt-electric (MWe) nuclear-fueled generating units that use near shore waters from the Atlantic Ocean for the plant's once-through condenser and auxiliary cooling systems. The cooling water system removes heat from the condensers and other auxiliary equipment. Eight pumps (four per unit) located at the intake wells circulate water through the system. The pumping capacity ranges from 50,470 to 70,660 liters per second (800,000 to 1,120,000 gallons per minute) (NRC 2003).

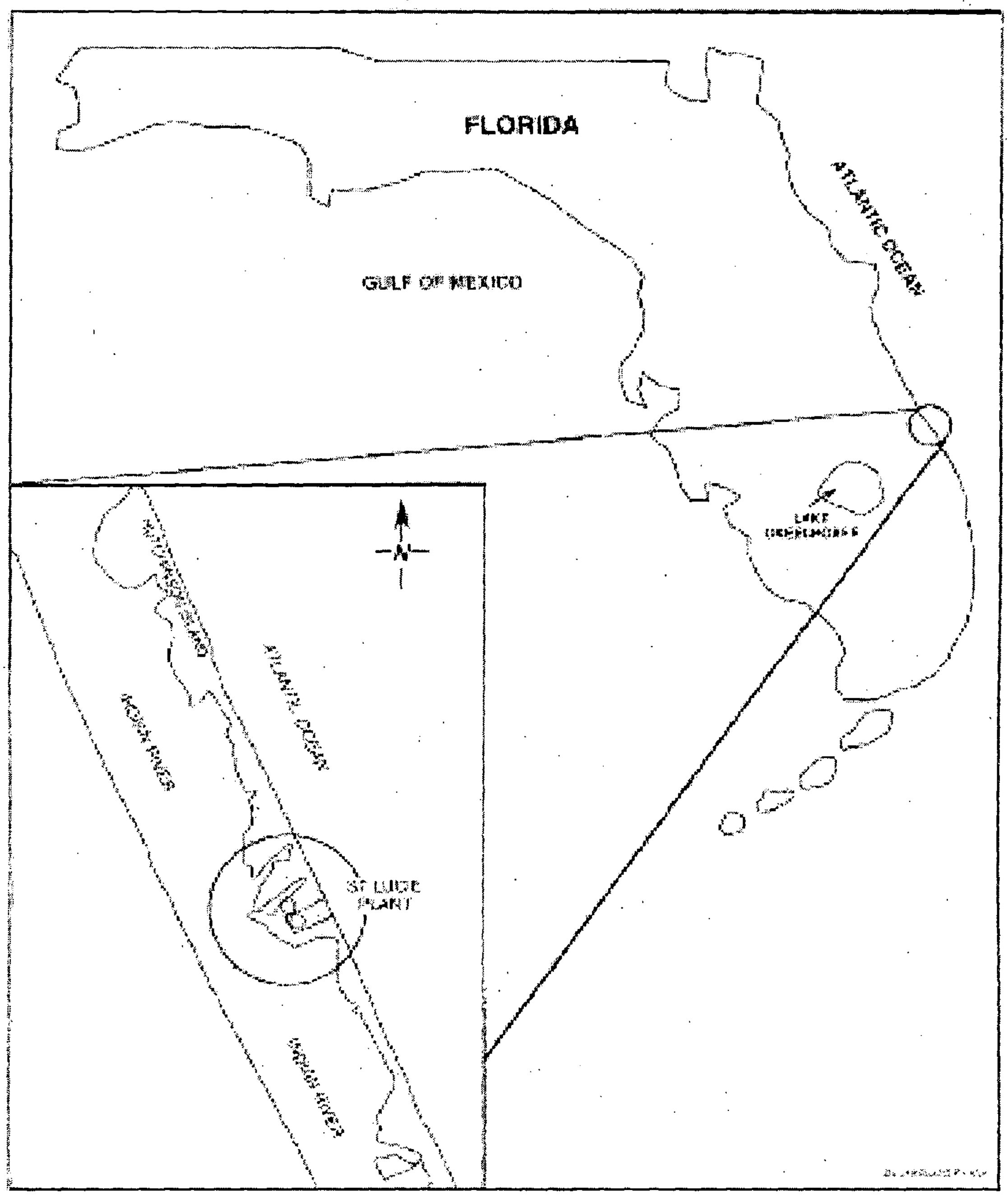

Figure 1. Location of St. Lucie Nuclear Power Plant.

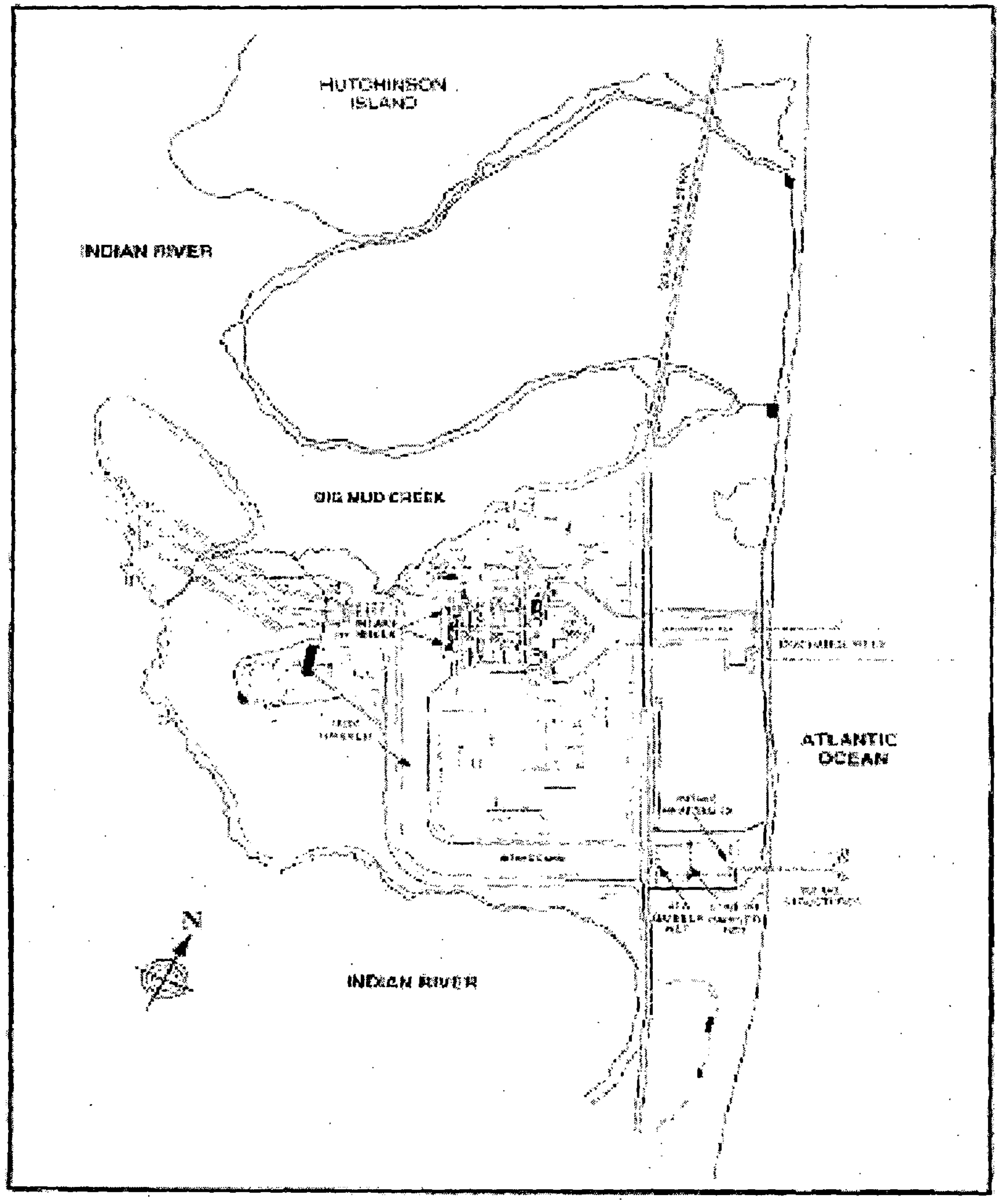

Figure 2. St. Lucie cooling water intake and discharge system.

The cooling system is composed of both intake and discharge components, whose functions are interdependent: if changes or improvements are made to one component (either the intake or discharge side), the other component will be affected. The response of all affected components to changes or improvements requires evaluation to ensure the cooling system operation is kept within design parameters and limits. Unit 1 and Unit 2 condensers and auxiliary cooling systems share common intake and discharge canals and ocean piping. The major components of these canals and ocean piping are (1) three ocean intake structures and associated velocity caps located approximately 1,200 (356 m) from the shoreline; (2) three buried intake pipelines to transport water from the intake structure to the intake canal (one pipeline is 16 ft [4.9 m] in diameter, and two are 12 ft [3.65 m] in diameter); (3) common intake canal to convey sea water to each unit's intake structure; (4) individual unit intake structures; (5) discharge structure for each unit; (6) a common discharge canal; (7) two discharge pipelines to convey water offshore.

Water for the cooling water system enters through three submerged intake structures located about 365 m (1200 ft) offshore at a depth of about 7 m (23 ft) (Figure 2). The intake structures have vertical cylindrical openings and are equipped with concrete velocity caps supported by columns extending about 1.8 m (6 ft) from the intake openings. The velocity caps minimize entrainment of fish and other organisms by eliminating vertical flow and slowing horizontal flow. Water passes through these structures and into submerged pipes (two 3.7 m [12 ft] and one 4.9 m [16 ft] in diameter) running under the beach. Flow velocities in the pipes range from 0.11 to 2.1 m/s (0.37 to 6.8 ft/s), depending on the pipe's orientation and size. The three pipes all deliver water into a 1500-m (4921-ft) long intake canal, which transports the water to the plant. The intake canal is a trapezoidal channel about 55 m (180 ft) wide and 9.1 m (30 ft) deep under normal conditions. FPL occasionally dredges the intake canal to remove accumulated sediments and maintain proper flow conditions; most recently, the canal was dredged in 2002 and 2005.

In addition to the velocity caps on the intake pipes, other measures are in place to minimize impingement of marine biota at the SLNPP. In the intake canal, a series of barriers prevents sea turtles and other biota from being impinged on the screens where the water enters the plant. Heading from the intake canal headwalls toward the intake wells in the intake canal, first there is a 12.7-centimeter (cm) (5-inch [in.]) mesh net that is taut and sloped to prevent turtles from being entangled in the net. The net is monitored hourly by sea turtle biologists who rescue any entrapped turtles. Next is a 20-cm (8-in.) mesh barrier net, and, finally, a rigid security barrier closest to the plant. Additionally, sea turtle biologists deploy two 30.5-m (100-ft) tangle nets in daylight hours (with occasional night hours as well) seven days a week to capture sea turtles between the intake headwall (where the water enters the intake canal from the pipes) and the 12.7-cm (5-in.) mesh barrier net. The nets are set in adjacent eddies and flow with the current without any weights. The biologists inspect tangle nets at least hourly and use dip nets and free diving to capture turtles. Underwater inspections on the 12.7- and 20-cm (5- and 8-in.) mesh barrier nets are conducted quarterly. During these inspections, any holes found in the nets are repaired.

At the plant, water enters through the eight intake wells (four per unit). In front of each well are trash racks (vertical bars spaced 7.6 cm [3 in.] apart) and 1-cm (3/8-in.) mesh traveling screens, which also prevent impingement and entrainment of organisms. Security personnel inspect the intake wells every three hours as an added precautionary measure. After passing through the plant, the heated water is discharged into a 670-m (2198-ft) long canal that leads to two buried discharge pipelines that pass underneath the dunes and along the ocean floor to the submerged discharge pipes, the first of which is 3.7 m (12 ft) in diameter and terminates approximately 380 m (1250 ft) offshore. The second discharge pipe has a diameter of 4.9 m (16 ft) and ends about 936 m (3070 ft) offshore. The first discharge pipe has a two-port "Y" diffuser, and the second discharge pipe has a multiport diffuser for about the last 430 m (1415 ft) of the pipe. The discharge pipes are approximately 730 m (2400 ft) north of the intake. The diffusers facilitate rapid distribution of the heated water on a large spatial scale to mix efficiently with ambient waters. Discharge temperatures are kept within limits of the Industrial Wastewater Facility Permit for St. Lucie Units 1 and 2.

5.0 Information on Sea Turtle Species

5.1 General Biology

Living sea turtles are taxonomically represented by two families, five genera, and seven species (Hopkins and Richardson 1984; Carr 1952). The family Cheloniidae is comprised of four genera and six distinct species. These species are *Caretta caretta* (loggerhead turtle), *Chelonia mydas* (Atlantic green turtle), *Natador depressa* (flatback turtle), *Eretomochelys imbricata* (hawksbill turtle), *Lepidochelys kempii* (Kemp's ridley turtle), and *L. olivacea* (olive ridley turtle). The family Dermochelyidae is comprised of only one genus and species, *Dermochelys coriacea*, commonly referred to as the leatherback turtle.

Most sea turtle species are distributed throughout all of the tropical oceans. The flatback turtle is a major exception as it has a very limited range only in Pacific waters near Australia and Papua New Guinea. Also, the loggerhead occurs primarily in temperate latitudes, and the leatherback, although nesting in the tropics, frequently migrates into cold waters at higher latitudes because of its unique physiology (Mager 1985).

Sea turtles are believed to be descended from species known from the late Jurassic and Cretaceous periods that were included in the extinct family Thallassemyidae (Carr 1952; Hopkins and Richardson 1984). Modern sea turtles have short, thick, incompletely retractile necks, and legs that have been modified to become flippers (Bustard 1972; Carr 1952). All species, except the leatherback, have a hard, bony carapace modified for marine existence by streamlining and weight reduction (Bustard 1972). Chelonians have only a thin layer of bone covered by overlaying scutes and *D. coriacea* has a smooth scaleless black skin and soft carapace with seven longitudinal keels (Carr 1952). These differences in structure are the principal reason for their designation as the only species in the monotypic family Dermochelyidae (Carr 1952).

Sea turtles spend most of their lives in an aquatic environment, and males of many species may never leave the water (Hopkins and Richardson 1984; Nelson 1988). The recognized life stages for these turtles are egg, hatchling, juvenile/subadult, and adult (Hirth 1971). A generalized sea turtle life cycle is presented in Figure 3.

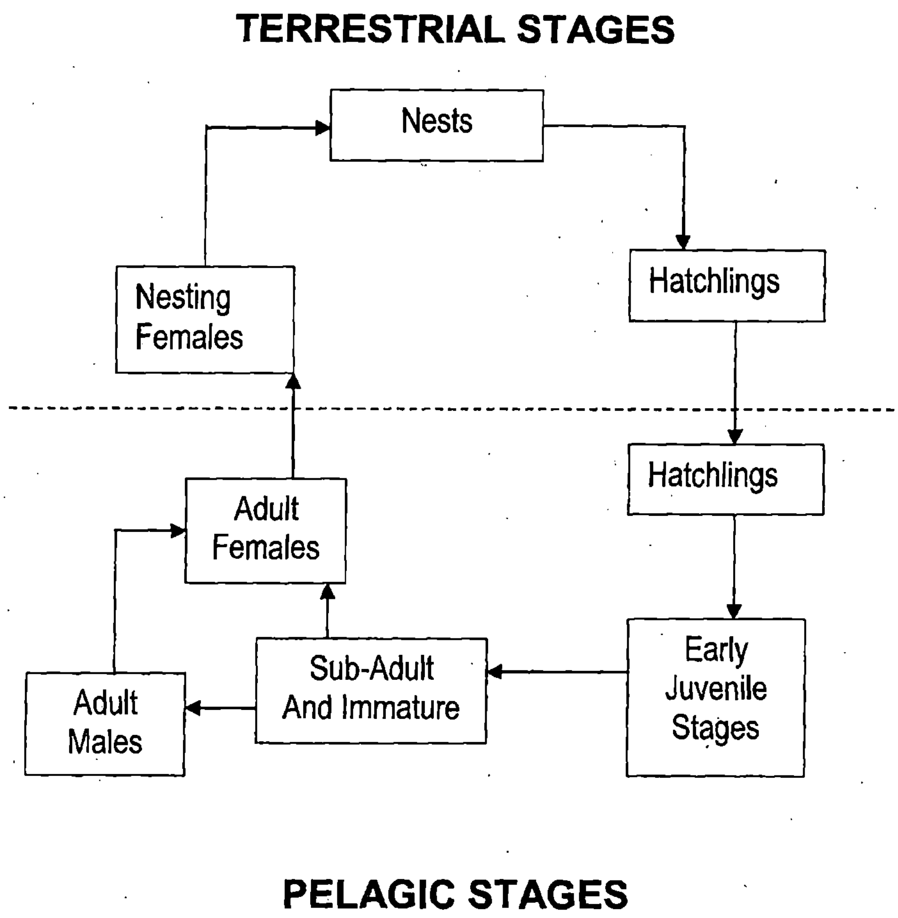

Figure 3. Generalized sea turtle life cycle. (After PSE&G 1989)

Reproductive cycles in adults of all species involve some degree of migration in which the animals return to nest at the same beach year after year (Hopkins and Richardson 1984). Nesting generally begins about mid-April and continues into September (Hopkins and Richardson 1984; Nelson 1988; Carr 1952). Mating and copulation occur just off the nesting beach, and it is theorized that sperm from one nesting season may be stored by the female and thus fertilize a later season's eggs (Ehrhart 1980). A nesting female moved shoreward by the surf lands on the beach and crawls to a point above the high water mark (Carr 1952). She then proceeds to excavate a shallow body pit by twisting her body in the sand (Bustard 1972). After digging the body pit she proceeds to excavate an egg chamber using her rear flippers (Carr 1952). Clutch size, egg size, and egg shape are species specific (Bustard 1972). Incubation periods for loggerhead, Kemp's ridley, Atlantic green, olive ridley, and flatback turtles average 55 days but range from 45 to 65 days depending on local conditions (Nelson 1988). Hawksbill and leatherback turtles have a slightly longer incubation period ranging from 50 to 74 days (Pacific Whale Foundation 2003; Connecticut Department of Environmental Protection 2000).

Hatchlings emerge from the nest at night by breaking the eggshell and digging their way out of the nest (Carr 1952). They find their way across the beach to the surf by orienting to light reflecting off the breaking surf (Hopkins and Richardson 1984). Once in the surf, hatchlings exhibit behavior known as "swim frenzy," during which they swim in a straight line for many hours (Carr 1986). Once into the waters off the nesting beach, hatchlings enter a period known as the "lost year." Researchers are presently trying to determine where young sea turtles spend their earliest years, what habitat(s) they prefer at this age, as well as typical survival rates during the "lost year" (i.e., during their post-hatchling early pelagic stage). It is currently believed the period encompassed by the "lost year" may actually turn out to be several years, and various hypotheses have been put forth regarding sea turtle activities during this period. One is that hatchlings may become associated with floating Sargassum rafts offshore. These rafts provide shelter and are dispersed randomly by the currents (Carr 1986). Another hypothesis is that the "lost year" of some species may be spent in a salt marsh/estuarine system (Garmon 1981).

The functional ecology of sea turtles in the marine and/or estuarine ecosystem is varied. The loggerhead is primarily carnivorous and has jaws well adapted to crushing molluscs and crustaceans and grazing on encrusted organisms attached to reefs, pilings, and wrecks; the Kemp's ridley is omnivorous and feeds on swimming crabs, crustaceans, and molluscs (Seney et al. 2002); the Atlantic green turtle is a herbivore and grazes on marine grasses and algae; the leatherback is a specialized feeder preying primarily upon jellyfish; the olive ridley feeds mostly on shrimp, crabs, sea urchins, and jellyfish; the hawksbill is an omnivorous scavenger feeding mostly on sponges affixed to coral reefs as well as a few other invertebrates; the flatback prefers to eat sea cucumbers, soft corals, and jellyfish. Until recently, sea turtle populations were relatively large and subsequently played a significant role in the marine ecosystem. This role has been greatly reduced in most locations as a result of declining turtle populations. These population declines were a result of, among other things, natural factors such as disease and predation, habitat loss, commercial overutilization, commercial fishing by-catch mortality, and the lack of comprehensive regulatory mechanisms to ensure their protection throughout their geographic range. This has led to several species being threatened with extinction.

Due to changes in habitat use during different life history stages and seasons, sea turtle populations are difficult to census (Meylan 1982). Because of these problems, estimates of population number have been derived from various indices such as numbers of nesting females, numbers of hatchlings per kilometer of nesting beach and number of subadult carcasses (strandings) washed ashore (Hopkins and Richardson 1984). Six of the seven extant species of sea turtles are protected under the ESA. Three turtles, Kemp's ridley, hawksbill, and leatherback, are listed as endangered. The Florida nesting population of Atlantic green turtle and Mexican west coast population of olive ridley are also endangered. All of the remaining populations of Atlantic green turtle, olive ridley, and loggerhead are threatened. The only unlisted species is the locally protected Australian flatback turtle (Hopkins and Richardson 1984).

5.2 Loggerhead (*Caretta caretta*)

5.2.1 Description

The adult loggerhead turtle has a slightly elongated, heart-shaped carapace that tapers towards the posterior and has a broad, triangular head (Pritchard et al. 1983). Loggerheads normally weigh up to 200 kg (450 lb) and attain a straight carapace length (SCL) up to 120 cm (48 in.) (Pritchard et al. 1983). Their general coloration is reddish-brown dorsally and cream-yellow ventrally (Hopkins and Richardson 1984). Morphologically, the loggerhead is distinguishable from other sea turtle species by the following characteristics: (1) a hard shell; (2) two pairs of scutes on the front of the head; (3) five pairs of lateral scales on the carapace; (4) plastron with three pairs of enlarged scutes connecting the carapace; (5) two claws on each flipper; and (6) reddish-brown coloration (Nelson 1988; Dodd 1988; Wolke and George 1981). Loggerhead hatchlings are brown dorsally with light margins ventrally and have five pairs of lateral scales (Pritchard et al. 1983).

5.2.2 Distribution

Loggerhead turtles are circumglobal, inhabiting continental shelves, bays, lagoons, and estuaries in the temperate, subtropical, and tropical waters of the Atlantic, Pacific, and Indian Oceans (Dodd 1988; Mager 1985).

In the western Atlantic Ocean, loggerhead turtles occur from Argentina northward to Newfoundland including the Gulf of Mexico and the Caribbean Sea (Carr 1952; Dodd 1988; Mager 1985; Nelson 1988; Squires 1954). Sporadic nesting is reported throughout the tropical and warmer temperate range of distribution, but the most important nesting areas are on the Atlantic coast of Florida, Georgia, and South Carolina (Hopkins and Richardson 1984). The Florida nesting population of loggerheads has been estimated to be the second largest in the world (Ross 1982).

The foraging range of the loggerhead sea turtle extends throughout the warm waters of the U.S. continental shelf (Shoop et al. 1981). On a seasonal basis, loggerhead turtles are common as far north as the Canadian portions of the Gulf of Maine (Lazell 1980), but during cooler months of the year, distributions shift to the south (Shoop et al. 1981). Loggerheads frequently forage around coral reefs, rocky places, and old boat wrecks; they commonly enter bays, lagoons and estuaries (Dodd 1988). Aerial surveys of loggerhead turtles at sea indicate that they are most common in waters less than 50 m (164 ft) in depth (Shoop et al. 1981), but they occur pelagically as well (Carr 1986).

5.2.3 Food

Loggerheads are primarily carnivorous (Mortimer 1982). They eat a variety of benthic organisms including molluscs, crabs, shrimp, jellyfish, sea urchins, sponges, squids, and fishes (Nelson 1988; Seney et al. 2002). Adult loggerheads have been observed feeding in reef and hard bottom areas (Mortimer 1982). In the seagrass lagoons of Mosquito Lagoon, Florida, subadult loggerheads fed almost exclusively on horseshoe crab (Mendonca and Ehrhart 1982). Loggerheads may also eat animals discarded by commercial trawlers (Shoop and Ruckdeschel 1982). This benthic feeding characteristic may contribute to the capture of these turtles in trawls.

5.2.4 Nesting

The nesting season of the loggerhead is confined to the warmer months of the year in the temperate zones of the northern hemisphere. In south Florida nesting may occur from April through September but usually peaks in late June and July (Dodd 1988; FPL 1983).

Loggerhead females generally nest every other year or every third year (Hopkins and Richardson 1984), but multi-annual remigration intervals ranging from one to six years have been reported (Bjorndal et al. 1983; Richardson et al. 1978). When a loggerhead nests, it usually produces two to three clutches of eggs per season and lays 35 to 180 eggs per clutch (Hopkins and Richardson 1984). The eggs hatch in 46 to 68 days and hatchlings emerge two or three days later (Crouse 1985; Hopkins and Richardson 1984; Kraemer 1979).

Hatchling loggerheads are a little less than 5 cm (2 in.) in length when they emerge from the nest (Hopkins and Richardson 1984; FPL 1983). They emerge from the nest as a group at night, orient themselves seaward and rapidly move towards the water (Hopkins and Richardson 1984). Many hatchlings fall prey to sea birds and other predators following emergence. Those hatchlings that reach the water quickly move offshore and exist pelagically (Carr 1986).

There are at least four loggerhead nesting subpopulations in the western North Atlantic (Turtle Expert Working Group 2000). The Northern Nesting Subpopulation occurs from North Carolina to northeast Florida. The Southern Florida Nesting Subpopulation is the largest loggerhead nesting assemblage in the Atlantic, occurring from 29 °N on the east coast to Sarasota on the west coast. The Florida Panhandle Nesting Subpopulation is found at Eglin Air Force Base and the beaches near Panama City, Florida. The Yucatan Nesting Subpopulation occurs on the eastern Yucatan Peninsula, Mexico. Historically, only minor nesting activity has occurred elsewhere in the western North Atlantic, with the exception of Central America (Turtle Expert Working Group 2000).

5.2.5 Population Size

Loggerhead sea turtles are the most common sea turtle in the coastal waters of the United States. A number of stock assessments have been performed for loggerhead turtles in U.S. water, but none have developed reliable estimates of absolute population size (TEWG 1998;

2000; NMFS and SEFSC 2001). Population size and temporal trends in abundance have been estimated using nesting data, stranding data, and aerial surveys.

Based on numbers of nesting females, hatchlings per kilometer of nesting beach, and subadult carcasses (strandings) washed ashore, the total number of mature loggerhead females in the southeastern United States has been estimated to be from 35,375 to 72,520 (Hopkins and Richardson 1984; Gordon 1983). The annual average adult female population along the U.S. Atlantic and Gulf coasts for the period 1989-1998 was estimated to be 44,780 individuals based upon nesting data (Turtle Expert Working Group 2000).

Adult and subadult (shell length greater than 60 cm [24 in.]) population estimates have also been based on aerial surveys of pelagic animals observed by NMFS during 1982 to 1984. Based on these studies, the number of adult and subadult loggerhead sea turtles from Cape Hatteras, North Carolina to Key West, Florida was estimated to be 387,594 individuals (NMFS 1987). This number was arrived at by taking the number of observed turtles and converting it to a population abundance estimate using information on the amount of time loggerheads typically spend at the surface.

Some sea turtles that die at sea wash ashore and are found stranded. The NMFS Sea Turtle Salvage and Stranding Network (STSSN) collects stranded sea turtles along both the Atlantic and Gulf Coasts (Turtle Expert Working Group 2000; STSSN 2004). The largest number of loggerhead strandings during the period 1986-2001 (Figure 4) occurred along the southeast Atlantic Coast (14,404 turtles; 61 percent of total), followed by the Gulf Coast (5,320 turtles; 22 percent of total) and the northeast Atlantic Coast (4047 turtles; 17 percent of total). Strandings in the southeast U.S. and the Gulf of Mexico declined in the early 1990s, but have generally increased since then. Strandings in the northeast have more than doubled during the same time period (Turtle Expert Working Group 2000; STSSN 2004).

Frazer (1986) suggested that loggerhead turtle nesting populations in the U.S. were declining, but positive steps have been taken to reverse that trend. In September of 1989, NMFS regulations requiring the use of turtle excluder devices (TEDs) on commercial shrimp trawls were implemented. Based upon onboard observations of offshore shrimp trawling in the southeast Atlantic, NMFS estimated that over 43,000 loggerheads were captured in shrimp trawls annually. The number of loggerhead mortalities from this activity was estimated to be 9874 turtles annually (NMFS 1987). An estimated 5000 to 50,000 loggerheads were killed annually during commercial shrimp fishing activities prior to regulations requiring the use of TEDs (NMFS and FWS 1991a). The use of TEDs may reduce sea turtle mortality in shrimp trawls by as much as 97 percent (Crouse et al. 1992). Studies of TED effects on reducing strandings in South Carolina and Georgia during the period 1980-1997 demonstrated reductions in strandings ranging from 40 to 58 percent (Crowder et al. 1995; Royle and Crowder 1998). Following the implementation of the TED requirement, strandings of drowned threatened and endangered sea turtle species in areas where strandings were historically high decreased dramatically for a few years (Figure 4), which suggests a reduction in shrimp trawl related mortality (Crouse et al. 1992; Turtle Expert Working Group 2000). Increases in strandings since 1993 are indicative of an increasing loggerhead population (Turtle Expert Working Group 2000).

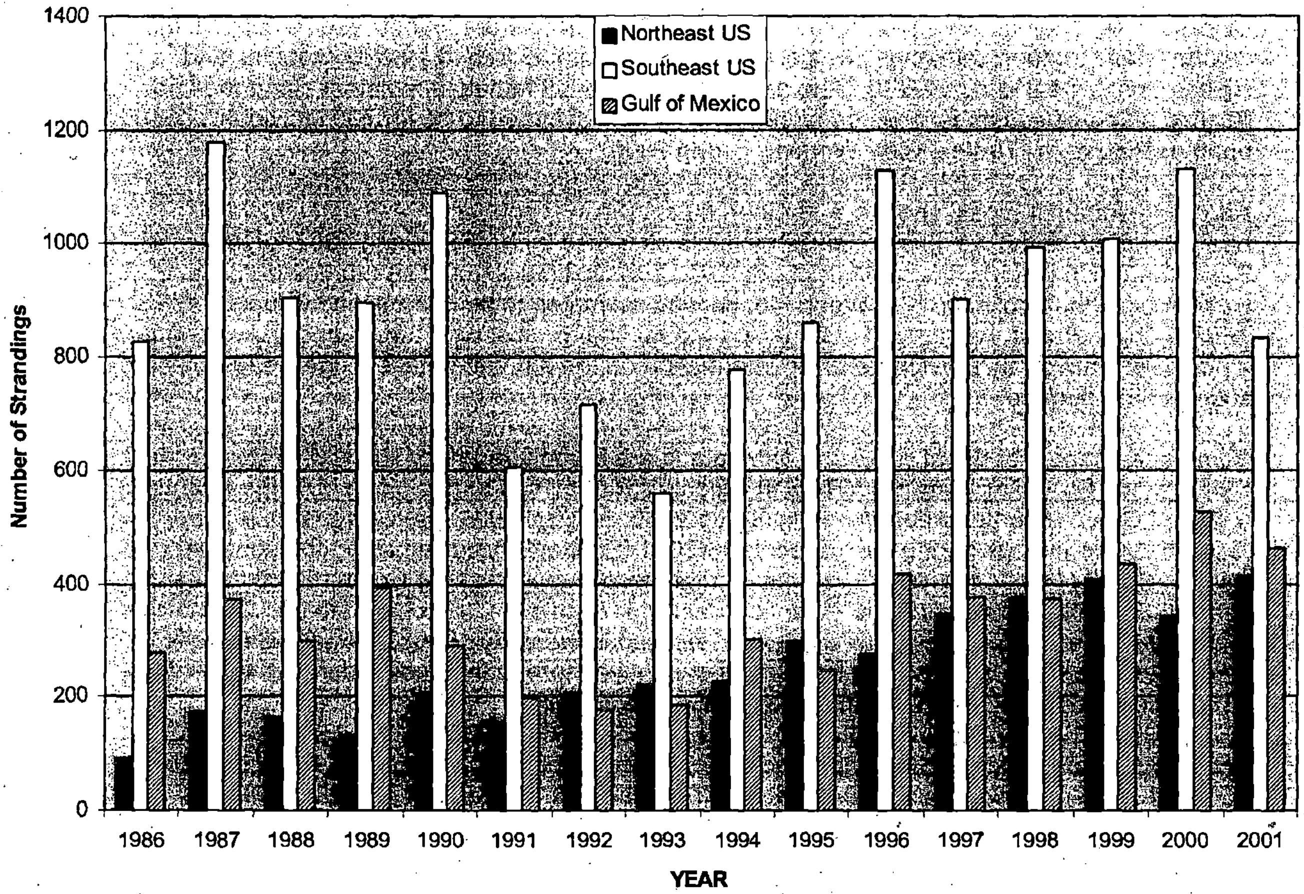

Figure 4. Loggerhead sea turtle strandings by region, 1986-2001 (Turtle Expert Working Group 2000 and STSSN 2004).

Sea turtle nesting activity on two key beaches also increased considerably subsequent to the implementation of the TED regulations (Crouse et al. 1992). The total number of loggerhead nests laid along the U.S. Atlantic and Gulf coasts is approximately 68,000 to 90,000 per year (OPR 2007). The number of nests increased at an average rate of approximately 3.6 percent per year and reached the maximum observed number (92,182) in 1998 (Turtle Expert Working Group 2000). In addition to the apparent success of the TED program, restrictions on development in coastal areas have become more widespread in recent years and may reduce the rate of nesting habitat loss for sea turtles.

The observed trends in strandings and nesting activity in recent years, along with some evidence of a shift in size class distribution toward smaller turtles, suggest that the U.S. loggerhead population is increasing (Turtle Expert Working Group 2000) and that effective measures have been taken to mitigate a major source of loggerhead mortality. Various population estimates suggest that the number of adult and subadult turtles is probably in the hundreds of thousands in the southeastern United States alone. In addition, large populations of loggerheads occur in many other parts of the world (Ross and Barwani 1982; NMFS and FWS 1991a). These facts suggest that although this species needs to be conserved, it is not in any immediate risk of becoming endangered.

5.3 Kemp's Ridley (*Lepidochelys kempii*)

5.3.1 Description

The adult Kemp's ridley has a circular carapace and a medium-sized pointed head. Kemp's ridleys are the smallest of extant sea turtles. They normally weigh up to 42 kg (90 lb) and attain a SCL up to 70 cm (27 in.) (Pritchard et al. 1983). Their general coloration is olive green dorsally and yellow ventrally (Hopkins and Richardson 1984). Morphologically, the Kemp's ridley is distinguishable from other sea turtle species by the following characteristics: (1) a hard shell; (2) two pairs of scutes on the front of the head; (3) five pairs of lateral scutes on the carapace; (4) plastron with four pairs of scutes, with pores, connecting the carapace; (5) one claw on each front flipper and two on each back flipper; and, (6) olive green coloration (Pritchard et al. 1983; Pritchard and Marquez 1973). Kemp's ridley hatchlings are dark grey-black dorsally and white ventrally (Pritchard et al. 1983; Pritchard and Marquez 1973).

5.3.2 Distribution

Kemp's ridley turtles inhabit sheltered coastal areas and frequent larger estuaries, bays, and lagoons in the temperate, subtropical, and tropical waters of the northwestern Atlantic Ocean and Gulf of Mexico (Mager 1985). The foraging range of adult Kemp's ridley turtles appears to be restricted to the Gulf of Mexico. However, juveniles and subadults occur throughout the warm coastal waters of the U.S. Atlantic coast (Hopkins and Richardson 1984; Pritchard and Marquez 1973). Juveniles and subadults travel northward with vernal warming to feed in the productive coastal waters of Georgia through New England, but return southward with the onset of winter to escape the cold (Henwood and Ogren 1987; Lutcavage and Musick 1985; Morreale et al. 1988; Ogren 1989).

5.3.3 Food

Kemp's ridleys are omnivorous and feed on swimming crabs, crustaceans, fish, jellyfish, and molluscs (Pritchard and Marquez 1973; Seney et al. 2002).

5.3.4 Nesting

Nesting of Kemp's ridleys is mainly restricted to a stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Pritchard and Marquez 1973; Hopkins and Richardson 1984). Occasional nesting has been reported in Padre Island, Texas and Veracruz, Mexico (Mager 1985; Turtle Expert Working Group 2000). An estimated 40,000 females nested on a single day in 1947, but between 1978 and 1990 there were less than 1000 nests per season (Figures 5 and 6).

The nesting season of the Kemp's ridley is confined to the warmer months of the year primarily from April through July. Kemp's ridley females generally nest every year to every third year (Márquez et al. 1982; Pritchard et al. 1983). They produce two to three clutches of eggs per season and lay 50 to 185 eggs per clutch. The eggs hatch in 45 to 70 days, and hatchlings emerge two to three days later (Hopkins and Richardson 1984).

Hatchling Kemp's ridleys are about 4.2 cm (a little less than 2 in.) in length when they emerge from the nest (Hopkins and Richardson 1984). They emerge from the nest as a group at night, orient themselves seaward and rapidly move towards the water (Hopkins and Richardson 1984). Following emergence, many hatchlings fall prey to sea birds, raccoons, and crabs. Those hatchlings that reach the water quickly move offshore. Their existence after emerging is not well understood but is probably pelagic (Carr 1986). The post-pelagic stages are commonly found dwelling over crab-rich sandy or muddy bottoms. Juveniles frequent bays, coastal lagoons, and river mouths (NMFS and FWS 1992).

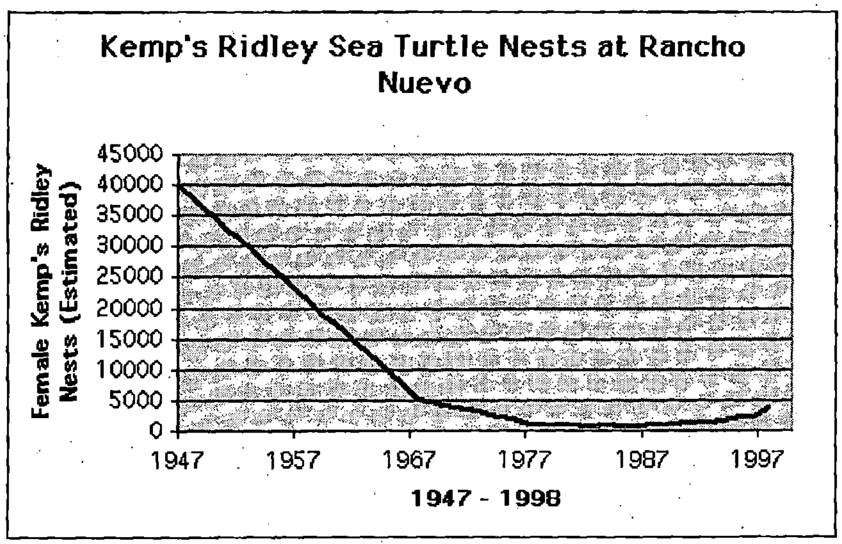

Figure 5. Estimated annual number of nesting female Kemp's Ridley sea turtles at Rancho Nuevo (HEART 1999).

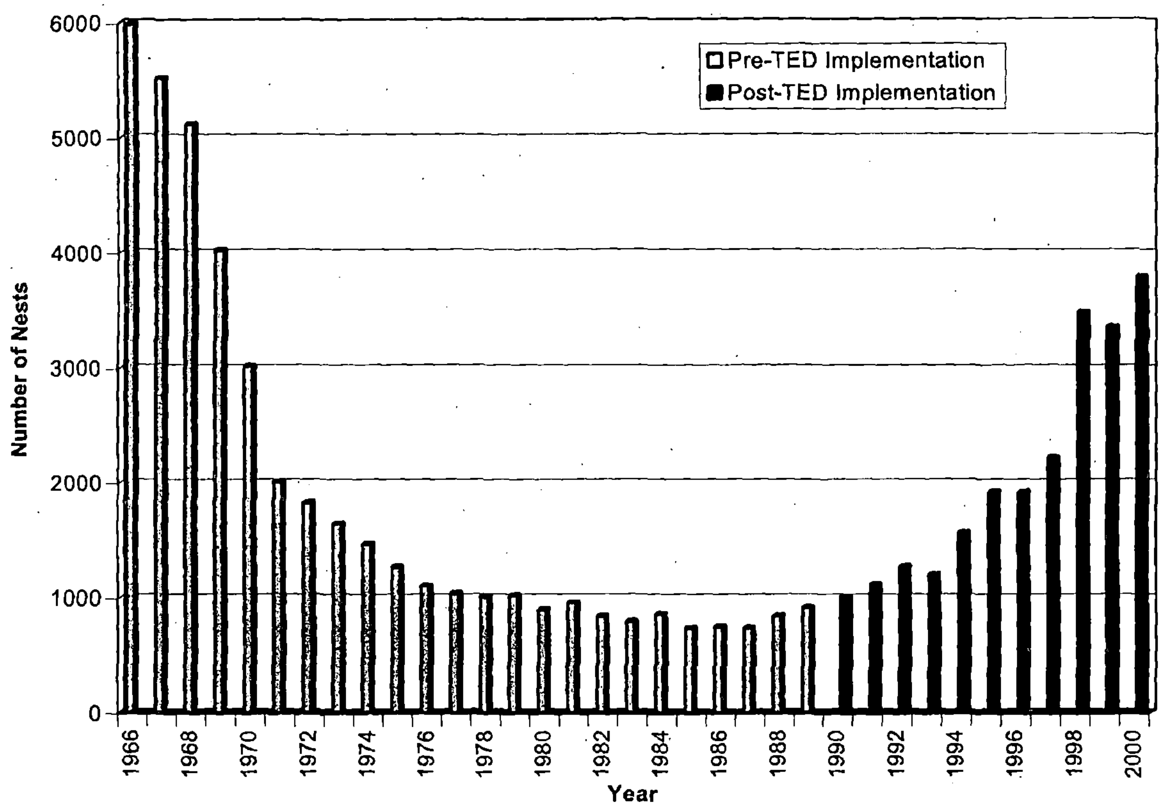

Figure 6. Number of Kemp's ridley nests at Rancho Nuevo before and after implementation of the turtle exclusion device (TED) regulations in 1989. (Turtle Expert Working Group 2000 and Marquez et al. 2001)

5.3.5 Population Size

The Kemp's ridley is the most endangered of the sea turtle species. Based on nesting information from Rancho Nuevo, Ross (1989) estimated that the population was declining at a rate of approximately three percent per year. The lowest number of nests was observed in 1985 (740 nests), but since that time the number of nests has increased by approximately 11.3 percent per year (Turtle Expert Working Group 2000). In 1994, 1565 nests were observed at Rancho Nuevo, and more Kemp's ridley nests have been laid each year since 1990 than in any previous year on record since 1978 (Byles, 1994). By 2000, the number of nests found at Rancho Nuevo increased to 3.788 (Marquez et al. 2001). It has been suggested that this increase in nesting activity reflects the reduction in shrimp trawl related mortality realized since the implementation of the NMFS TED regulations in September of 1989 (Crouse et al. 1992; Turtle Expert Working Group 2000). This hypothesis is supported by analyses of the number of nests counted versus hatchlings released (Turtle Expert Working Group 2000). The results of those analyses indicate that there has been an increase in survivorship from hatchling to maturity during the late 1980s and early 1990s. The increase in nesting activity is also likely to be attributable in part to an increase in recruitment to the population as a result of beach and nest protection efforts at Rancho Nuevo (Marquez et al. 1999; Turtle Expert Working group 2000). The adult Kemp's ridley population was estimated by Márquez (1989) to be approximately 2,200 adults based on the numbers of nests produced at Rancho Nuevo, this species's nesting cycle, male-female ratios, and fecundity. More recently, the Turtle Expert Working Group (1998; 2000) reported that age-based population models suggest that the Kemp's ridley population is increasing rapidly and that the trend was expected to continue into the future. While there is no current population estimate, the nesting population is estimated to be increasing ten percent each year (NOAA Fisheries 2003). As a result, we can expect to find increasing numbers of juveniles and subadults migrating northward each year as Atlantic coastal waters warm to feed in the productive coastal estuaries.

Population estimates of immature *Lepidochelys kempii* are difficult to develop. Increases have been noted in the number of juvenile captures during the late 1980s and early 1990s in long-term tagging studies in the northeast Gulf of Mexico (Ogren, unpublished data). If this increase is indicative of an overall increase in the juvenile population, more recruitment into the adult population should occur in the future (NMFS and FWS 1991a).

Kemp's ridleys also die at sea and wash ashore. The STSSN collects stranded sea turtles along both the Atlantic and Gulf Coasts (Turtle Expert Working Group 2000; STSSN 2004; Figure 7). The largest number of Kemp's ridley strandings during the period 1986-2001 occurred along the Gulf Coast (3,495 turtles; 60 percent of total), followed by the southeast Atlantic Coast (1,555 turtles; 27 percent of total) and the northeast Atlantic Coast (748 turtles; 13 percent of total). The number of strandings along the Gulf Coast increased sharply in 1994 and 1995 but subsequently remained fairly constant (Turtle Expert Working Group 2000). Along the southeast Atlantic Coast, the number of strandings decreased somewhat during the early 1990s but tended to increase from 1993 through 2001.

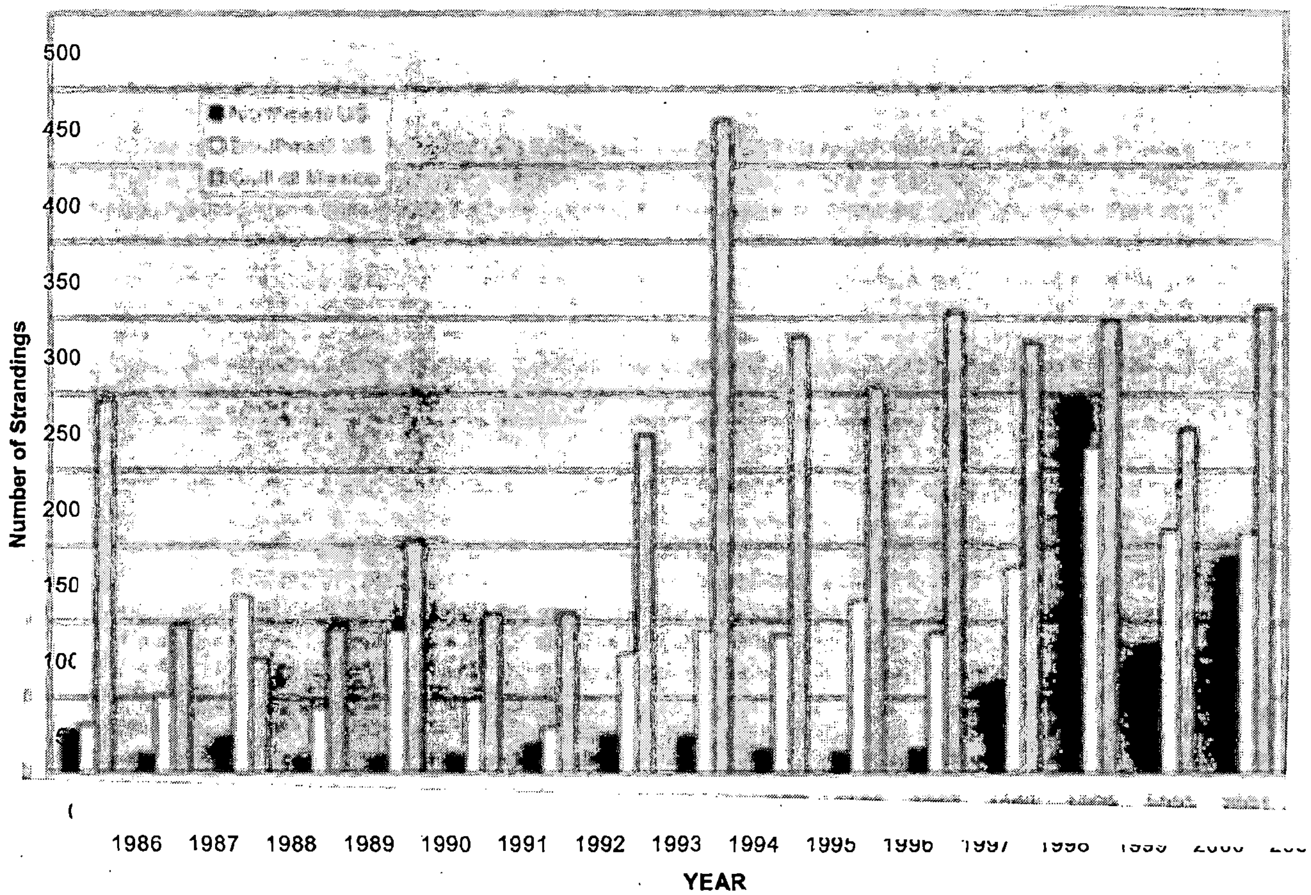

Figure 7. Kemp's ridley sea turtle strandings by region, 1986-2001. (Turtle Expert Working Group 2000 and STSSN 2004)

The number of strandings along the northeast Atlantic Coast was low and variable through 1997, but a noticeable increase was observed during the 1998-2001 period (Figure 7). A dramatic increase in strandings of Kemp's ridleys was also observed along the North Carolina coast from 1993 to 1999 (Boettcher 2002). Prior to 1993, 20 or fewer Kemp's ridley strandings were reported annually. The number of stranded individuals steadily increased from 12 in 1992 to a maximum of 122 in 1999. The timing of these increases in Kemp's ridley strandings seems to coincide with the implementation of the NMFS TED regulations described above, and suggests that the population is increasing.

An analysis of the size of stranded Kemp's ridleys indicated that many more large immature individuals were stranded during the 1990s relative to the 1980s (Turtle Expert Working Group 2000). These results also suggest that juvenile mortality has decreased and that the population is increasing.

Onboard observation of offshore shrimp trawling by NMFS in the southeast Atlantic indicated that over 2800 Kemp's ridleys are captured in shrimp trawls annually. The number of Kemp's ridley mortalities attributable to this activity was estimated to be 767 turtles annually and most of these (65 percent) occurred in the western portion of the Gulf of Mexico (NMFS 1987). Magnuson et al. (1990) estimated the annual shrimp trawl by-catch mortality to be between 500 and 5000 individuals. As discussed above, significant reductions in this source of mortality have been achieved as a result of the implementation of the TED regulations by the NMFS in 1989 (Crouse et al. 1992). The reduction in shrimp-trawl-related mortality, as well as the efforts to protect nesting beaches, have probably resulted in the recent indications that the population is steadily increasing (Turtle Expert Working Group 1998; 2000).

Despite these improvements, the data suggest that this population remains at critically low levels. This species was listed as endangered in 1970 and is considered the most endangered of all sea turtles (NMFS and FWS 1991a; Burke et al. 1994).

5.4 Atlantic Green Turtle (*Chelonia mydas*)

5.4.1 Description

The Atlantic green turtle is a medium-to-large sea turtle with a nearly oval carapace and a small, rounded head (Pritchard et al. 1983). Its carapace is smooth and olive brown in color with darker streaks and spots. Its plastron is yellow. Full-grown adult Atlantic greens normally weigh 100 to 150 kg (220 to 330 lb) and attain a SCL of 90 to 100 cm (35 to 40 in.) (Pritchard et al. 1983; Hopkins and Richardson 1984; Witherington and Ehrhart 1989). Morphologically, this species can be distinguished from the other sea turtles by the following characteristics: (1) a relatively smooth shell with no overlapping scutes; (2) one pair of scutes on the front of the head; (3) four pairs of lateral scutes on the carapace; (4) plastron with four pairs of enlarged scutes connecting the carapace; (5) one claw on each flipper; and (6) olive, dark brown mottled coloration (Nelson 1988; Pritchard et al. 1983; Carr 1952). Hatchlings are about 25 grams (0.88 ounces) and 55 millimeters (2.2 in.) long. They have a black carapace that is white on the ventral side.

5.4.2 Distribution

Atlantic green turtles are circumglobally distributed mainly in waters between the northern and southern 20 °C (68 °F) isotherms (Mager 1985). Preferred nesting grounds include sandy beaches of mainland shores, barrier islands, coral islands, and volcanic islands (NOAA Fisheries 2002).

In the western Atlantic, several major assemblages have been identified and studied (Parsons 1962; Pritchard 1966; Schulz 1975; 1982; Carr et al. 1978). In U.S. Atlantic waters, Atlantic green turtles are found around the U.S. Virgin Islands, Puerto Rico, and the continental United States from Texas to Massachusetts (NMFS and FWS and FWS 1991b). Nesting grounds extend from Texas to North Carolina as well as in the U.S. Virgin Islands and Puerto Rico. Eastern Florida has some of the main nesting beaches; other important nesting beaches are found on St. Croix and Puerto Rico (NOAA Fisheries 2002). Critical habitat is designated in waters around Isla Culebra, Puerto Rico.

5.4.3 Food

Atlantic green turtles leave their pelagic habitat phase and enter benthic feeding grounds upon reaching a SCL of 20 to 25 cm (8-10 in.). They are primarily herbivores eating sea grasses and algae (NMFS and FWS 1991b). Jellyfish, sponges, and other organisms living on sea grass blades and algae add to their diet (Mager 1985). Pelagic post-hatchlings are most likely omnivorous (NOAA Fisheries 2002).

5.4.4 Nesting

Atlantic green turtle nesting primarily occurs on the Atlantic coast of Florida from June to September (Hopkins and Richardson 1984). Other important nesting beaches include beaches in Yucatán and Tortuguero, Costa Rica. It is thought that nesting activity is increasing in Florida and Tortuguero; sparse data make it impossible to reliably estimate nesting trends in Yucatán (NOAA Fisheries 2002).

Although males mate annually, females only nest every two to four years (NOAA Fisheries 2002). Mature females may nest one to seven times per season at about 10-to-18-day intervals (Carr et al. 1978). Average clutch sizes vary between 100 and 200 eggs that usually hatch within 45 to 60 days (Hopkins and Richardson 1984). Hatchlings emerge, mostly at night, travel quickly to the water, and swim out to sea. At this point, they enter a period that is poorly understood but is likely spent pelagically in areas where currents concentrate debris and floating vegetation such as *Sargassum* spp. (Carr 1986).

5.4.5 Population Size

Elimination and deterioration of many nesting beaches and less-frequent encounters with Atlantic green turtles provided inferential evidence of declining stocks in the early to mid-1980s (Mager 1985; Hopkins and Richardson 1984). The number of Atlantic green sea turtles that existed before commercial exploitation and the total number that now exists are not known.

Records show drastic declines in the Florida catch during the 1800s, and similar declines occurred in other areas, such as Texas, where they were commercially harvested in the past (Hildebrand 1982; Hopkins and Richardson 1984). Although estimates are not available for the total population, it is estimated, while taking into account the two-year remigration interval, that the nesting population in the southeastern U.S. is recovering and has reached an approximate level of 1,000 nesting females (NOAA Fisheries 2002). Also, in Indian River Lagoon in Florida, a long-term study in juvenile foraging grounds found significant increases between the early and late 1980s in the population of juvenile Atlantic green turtles (NOAA Fisheries 2002).

There are many ongoing threats to the Atlantic green turtle population. While TED regulations have helped reduce incidental take in trawl fisheries, incidental takes with fishing gear interactions continue to occur. Other threats at sea include pollution, foraging habitat loss through human-based direct destruction and secondary siltation, vessel strikes, and suction dredges. Nesting beaches are threatened by erosion control, artificial lighting, beach armoring, and disturbance. Finally, green turtle fibropapillomatosis disease, an often fatal tumor disease, is widespread and may be a contributor to population decline in Hawaii and Florida (NOAA Fisheries 2002). Outside the U.S., some areas continue direct takes of Atlantic green turtles for their shells, eggs, and meat.

5.5 Leatherback Turtle (*Dermochelys coriacea*)

5.5.1 Description

The leatherback turtle is the largest sea turtle. It has an elongated, somewhat triangularly-shaped body with longitudinal ridges or keels. It has a leathery, blue-black shell composed of a thick layer of oily, vascularized, cartilaginous material, strengthened by a mosaic of thousands of small bones. This blue-black shell may also have variable white spotting (Pritchard et al. 1983). Its plastron is white. Leatherbacks normally weigh up to 300 kg (660 lb) and attain a SCL of 140 cm (55 in.) (Pritchard et al. 1983; Hopkins and Richardson 1984). Specimens as large as 910 kg (2,000 lb) have been observed.

Morphologically, this species can be easily distinguished from the other sea turtles by the following characteristics: (1) its smooth unscaled carapace; (2) carapace with seven longitudinal ridges; (3) head and flippers covered with unscaled skin; and, (4) no claws on the flippers (Nelson 1988; Pritchard et al. 1983; Pritchard 1971; Carr 1952).

5.5.2 Distribution

Leatherbacks have a circumglobal distribution and occur in the Atlantic, Indian, and Pacific Oceans. They range as far north as Labrador and Alaska to as far south as Chile and the Cape of Good Hope. Their occurrence farther north than other sea turtle species is probably related to their ability to maintain a warmer body temperature over a longer period of time (NMFS 1985). Thompson (1984) reported that leatherbacks prefer water temperatures of 20 ± 5 °C (68 ± 9 °F) and were likely to be associated with cooler, more productive waters than the Gulf Stream. Aerial surveys have shown leatherbacks to be present from April to November between North Carolina and Nova Scotia, but most likely to be observed from the Gulf of Maine south to Long Island during summer (Shoop et al. 1981).

5.5.3 Food

The diet of the leatherback consists primarily of soft-bodied animals such as jellyfish and tunicates, together with juvenile fishes, amphipods, and other organisms (Hopkins and Richardson 1984).

5.5.4 Nesting

Leatherback turtle nesting occurs on the mid-Atlantic coast of Florida from late February or March to September (Hopkins and Richardson 1984; NMFS 1992). Mature females may nest one to nine times per season at about 9-to-17-day intervals. Average clutch sizes vary between 50 and 170 eggs that usually hatch within 50 to 75 days (Hopkins and Richardson 1984; Tucker 1988). Hatchlings emerge, mostly at night, travel quickly to the water, and swim out to sea. The life history of the leatherback is poorly understood since juvenile turtles are rarely observed.

5.5.5 Population Size

The world population estimate for the leatherback in 1980 was estimated to be about 115,000 females with the discovery of nesting beaches in Mexico (Pritchard 1983). Probably due to exploitation of eggs on the beach and fishery mortality, that number declined to about 34,500 by 1995 (Spotila et al. 1996), and numbers may still be declining.

5.6 Hawksbill Turtle (*Eretmochelys imbricata*)

5.6.1 Description

Hawksbill turtles are small to medium turtles with elongated heads with pointy mouths. The hawksbill turtle is best known for its "tortoise shell" carapace, which is mostly brown, mottled with light and dark spots on the dorsal side. The ventral side is a light yellow or white, acting as a natural camouflage against predators. Identifying characteristics include overlapping costal scutes, serrated marginal scutes, two pairs of prefrontal scales, and two claws on each flipper. The hatchling and juvenile carapaces are heart-shaped and become elongated as the turtles mature.

5.6.2 Distribution

Post-hatchlings are pelagic while juvenile, subadult, and adult hawksbills are found in coral reef environments or in bays and estuaries with mangroves when coral reefs are absent. Generally, hawksbills are found in tropical and subtropical waters, although they have been sighted as far north as Maine in Atlantic waters. Most sightings on the eastern coast of the U.S. have been reported from Florida and Texas.

5.6.3 *Food*

The hawksbill diet consists mostly of sponges found on coral reefs. Other common prey include mollusks, algae, sea anemones, squid, and other invertebrates.

Hawksbills use their sharp beak-like mouth to forage for sponges in crevices of coral reefs (Pacific Whale Foundation 2003).

5.6.4 Nesting

Hawksbill turtles have solitary nesting behavior and are known to nest in the U.S. in Puerto Rico, U.S Virgin Islands, Florida, and Hawaii. Critical habitat is designated for nesting beaches in Puerto Rico. Individual nesting sites are often under vegetation. Females nest every two to three years, and lay up to six clutches per season with a 15-to-21-day interval; the average clutch size has 130 eggs (Pacific Whale Foundation 2003).

5.6.5 Population Size

Although there are few data about the hawksbill turtle, nesting populations are thought to be declining. An estimate based on data from the early to mid-1990s is approximately 34,000 nesting females (Caribbean Conservation Corporation 2003). Critical habitat is designated for some nesting beaches in Puerto Rico, but Mexico probably has the biggest nesting population in the Atlantic and Caribbean. Most sightings off Texas and Florida are thought to be of populations from the Mexican nesting beaches.

6.0 Incidental Captures and Plant-Related Mortality

Correspondence regarding the ITS of the May 2001 BO contains language that turtle injury or mortality in the canal shall be counted when "resulting from plant operation." In response to this requirement, a qualified veterinarian determines cause of death or injury in cases that are not readily apparent.

From initial plant operation in May 1976 through 2006, FPL captured and removed from the intake canal a total of 6876 loggerhead, including 507 recaptures; 4954 Atlantic green, including 1641 recaptures; 31 leatherback; 45 Kemp's ridley; and 45 hawksbill turtles. Table 1 shows the sea turtle capture data over the last five calendar years, all of which have been subject to the existing ITS that took effect when the 2001 BO was issued. NRC staff believes that variation in the number of turtles found during different months and years, including dramatic increases in Atlantic green turtle captures in recent years, is primarily due to natural variations in the occurrence of turtles in the vicinity of the plant rather than to operational influences of the plant itself.

The plant exceeded the annual incidental take limit for sea turtles in 2006 and entrained a total of 662 Atlantic green and loggerhead turtles. The incidental take limit of 1 percent of entrained Atlantic green and loggerhead turtles was exceeded because 29 of the 662 entrained turtles were injured or killed due to plant operation (Table 2). The first mortality occurred on January 22, 2006, when a small, dead Atlantic green turtle was discovered impinged at the intake well for Unit 2. On October 25 and 26, 2006, 21 loggerhead hatchling mortalities were discovered and likely resulted from a single hatching at an undetected nest on the intake canal bank. During the same event, three loggerhead hatchlings were retrieved alive and later released on November 4, 2006. The January and October mortalities resulted from drowning after impingement at the intake wells.

Table 1. Sea turtle takes (mortalities) at St. Lucie Nuclear power Plant in the last five years.

	Year				
Turtle Species	2002	2003	2004	2005	2006
Loggerhead	341 (0)	583 (0)	623 (2)	485 (2)	395 (21)
Atlantic Green Turtle	292 (3)	394 (3)	286 (1)	427 (2)	267 (8)
Kemp's Ridley	0 (0)	4 (0)	2 (0)	0 (0)	1 (0)
Leatherback	3 (0)	6 (0)	2 (0)	2 (0)	2 (0)
Hawksbill	0 (0)	2 (0)	1 (0)	3 (0)	3 (0)
Total	636 (3)	989 (3)	914 (3)	917 (4)	668 (29)

Source: FPL and Quantum Resources, Inc. 2006.

Table 2. Sea turtle takes causal to operation of St. Lucie Nuclear Power Plant in 2006.

Date (2006)	Species	Number of Turtles	Injury or Mortality
1/22	Atlantic green turtle	1	Mortality
7/12	Atlantic green turtle	1	Injury
7/18	Atlantic green turtle	1	Injury
8/15	Atlantic green turtle	1	Injury
9/2	Atlantic green turtle	1	Injury
9/13	Atlantic green turtle	1	Injury
9/25	Atlantic green turtle	1	Injury
10/12	Atlantic green turtle	1	Injury
10/25	Loggerhead	11/3*	Mortality/Injury
10/26	Loggerhead	10*	Mortality

* Loggerhead hatchlings likely from an undetected nest on intake canal berm were found in Unit 1 and 2 weir pits.

Ongoing evaluations and improvements to the canal capture program during recent years have substantially decreased the amount of time entrapped sea turtles remain in the canal. Turtles confined between the barrier net and intake headwalls typically reside in the canal for a relatively short period prior to capture, and most turtles have been in good to excellent condition when caught. The 12.7-cm (5-in.) mesh barrier net completed in January 1996 substantially reduced sea turtle residence times in the intake canal. During major influxes of seaweed and jellyfish, however, 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. The improved design and net material has withstood the seaweed and jellyfish events that caused previous design failure of the old barrier net. Additionally, dredging of the intake canal completed in 2002 and in 2005 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. Recent turtle injuries were likely caused by hurricane debris and/or biofouling in the intake pipes leading to the intake canal. FPL inspected intakes pipes during an outage in April 2007. Corrective actions will be determined by NMFS and NRC based on the inspection results, which have not yet been received.

7.0 Assessment of Plant Operations on Sea Turtles

Until 2006, impacts to sea turtles had not changed significantly since the last Section 7 consultation. The October 2006 impingement and deaths of 21 loggerhead turtle hatchlings brought recognition that this event could happen again with loggerhead or other sea turtle species, even though this was a single event that had not happened before during operation of SLNPP and so might have low probability of occurrence in the future. In addition, seven Atlantic green turtles were injured in 2006, which suggested possible collisions with debris in the intake pipe that might have accumulated due to a recent hurricane.

8.0 Planned Projects

The following three planned projects on the cooling system have the potential to adversely affect sea turtles or smalltooth sawfish. Each includes steps to avoid or minimize such adverse effects.

- **Repair/Replacement of the 5-in. Mesh Turtle Net.** The service life of the anti-fouling coating on the 5-in. mesh turtle net requires replacement of the net approximately every five years. The project will require the use of cranes, work boats, and divers for implementation. Installation of a temporary net will be required during the time period that the permanent net is removed. Any underwater work will be performed by divers.

- **Maintenance Canal Dredging.** Normal plant operation may cause erosion of the canal banks and transport of sediments into the canals, resulting in the partial infilling of areas of the canal. Additionally, environmental events such as hurricanes and severe storms may cause additional erosion of the canal banks and infilling of the canal. Maintenance dredging of the canal may be required to restore the canal profile. Canal dredging is performed with the use of a suction dredge to remove the unwanted material. The suction head of the dredge is fitted with bars to limit the maximum opening size to approximately 5 in. Placement of the cutter head into the water is done slowly to allow marine life to exit the area and prevent them from being trapped. Canal dredging is performed on an as-required basis. Normal maintenance dredging may be required approximately every 8 to 10 years. Additional dredging may be required due to an environmental event such as a hurricane or severe storm.

- **Hurricane Restoration of Canal Bank.** Hurricanes during 2004 and 2005 have caused significant damage to the canal banks. A project to restore canal bank is scheduled to start during 2007 and continue into 2009. The project involves re-profiling the canal banks and installing an articulating concrete block revetment system. The work plan calls for the use of a suction dredge to remove the cut material. Dredging operations will be done as discussed above. Long reach excavators stationed on barges will be used for final grading of the canal slopes prior to placement of the revetment system. Landscape fabric and the articulating block mats installation will be installed using cranes, supported by divers. This is a one-time hurricane restoration project, and no additional work associated with this project is scheduled beyond its completion date.

9.0 Mitigation Measures

Several mitigation measures for incidental sea turtle takes were developed in discussions among FPL, NRC, and NMFS staff during a site visit on April 17-18, 2007 (NRC 2007) and a subsequent conference call among FPL, NRC, NMFS, and FWC staff on April 30, 2007. Possible measures to prevent or mitigate future nesting along the intake canal bank and to decrease turtle injuries include the following:

- Implement measures, such as cutting back existing vegetation, so that turtle crawls would be more visible. NRC and NMFS suggested that a prudent measure should be implemented as soon as possible since the 2007 sea turtle nesting season has already begun. If turtles might be injured during implementation, mitigation measures should be included.

- FPL could develop a plan to install exclusion devices at the velocity caps to prevent large marine organisms, such as adult sea turtles and smalltooth sawfish, from entering the intake pipes. NRC and NMFS observed that the design and installation of such devices would likely be a longer-term project, but suggested to FPL that this project should be done as soon as possible, with a proposed implementation, maintenance, and inspection plan to be provided for this project no later than September 30, 2007.

- During the April 2007 outage at SLNPP, FPL inspected the intake and discharge pipes. Inspection results are expected to identify the amount and location of any significant structural impediment or biofouling and debris accumulation that extends into the flow path of the intake pipes. NRC and NMFS suggested that FPL develop an implementation and future inspection plan based on the pipe inspection report for cleaning the intake pipes during the fall 2007 outage to remove protruding structures or debris that may adversely affect animals entrained in the intake canal. NRC and NMFS suggested that FPL should coordinate and obtain concurrence of the implementation and future inspection plan from the NRC and NMFS prior to implementation. NRC and NMFS believe that removal of significant biofouling and debris could reduce adverse effects on animals entrained into the intake canal.

- The exploration of the intake pipes in April 2007 also revealed a dead-end section in each 12-ft (3.66-m) diameter intake pipe, and a live Atlantic green turtle was discovered in one of them. FPL blew air into that section so the turtle could continue breathing, and the turtle entered the intake canal on June 15, 2007. Because of the potential for sea turtles to be trapped in this section, which no longer has a functional purpose, NRC and NMFS suggested that FPL could seal off the dead-end sections of the 12-ft (3.66-m) diameter intake pipes during the fall 2007 outage.

- When turtle injuries appeared to be increasing, FPL staff deduced that hurricane debris might have lodged in the plant's intake pipes. To better document turtle injuries that might occur in the future, FPL might submit monthly reports of causal injuries that include the number of scrapes and other damage, whether the number of turtle injuries appears to be decreasing or decreasing, and, if increasing, courses of action that FPL might take to reduce the causal injuries.

10.0 Conclusion and Recommendation for Revised Incidental Take Statement

Examination of the intake pipes in April 2007 revealed both the presence of protruding debris that can could cause injuries to sea turtles and the presence of a turtle trapped in a no-longer-used dead-end pipe section. Both can contribute to incidental takes of sea turtles and resulted in recommendations for mitigative measures. NRC recommends that existing terms and conditions be modified to add requirements for periodic inspections of intake pipes during planned outages, sealing off dead-end sections of intake pipes, and appropriate mitigation measures to protect listed species during maintenance projects in the intake canal. Implementation of such measures would ensure sea turtle protection, and the NRC concludes that the continued operation of SLNPP's cooling water system would not jeopardize the continued existence of sea turtles in U.S. waters.

11.0 References

50 CFR 17.11, Endangered and Threatened Wildlife.

50 CFR 222.23(a), Endangered Fish or Wildlife Permits (under National Marine Fisheries Service jurisdiction).

Bjorndal, K. A., A. B. Meylan and B. J. Turner. 1983. Sea turtles nesting at Melbourne Beach, Florida. I. Size, growth and reproductive biology. Biol. Conserv. 26:65-77.

Boettcher, R. 2002. Sea turtle mortality in North Carolina (USA): A summary of 1999 stranding events. Proceedings of the Twentieth Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-477, 369 pp.

Burke, V. J., S. J. Morreale and E. A. Standora. 1994. Diet of the Kemp's ridley sea turtle, *Lepidochelys kempii*, in New York waters. Fishery Bulletin 92:26-32.

Bustard, H. R. 1972. Sea Turtles. Natural history and conservation. Taplinger Publishing Company, NY, 220 pp.

Byles, R.A 1994. Personal communication. U.S. Fish and Wildlife Service. National Sea Turtle Coordinator, Albuquerque, N.M.

Caribbean Conservation Corporation. 2003. Species Fact Sheet: Hawksbill Sea Turtle. Accessed on March 8, 2005 at http://www.cccturtle.org/hawksbill.htm.

Carr, A. 1952. Handbook of Turtles. Comstock Publishing Associates, Cornell University Press, Ithaca, NY.

Carr, A., M. Carr, and A. Meylan, 1978. The ecology and migrations of sea turtles: 7. The West Caribbean Green Turtle Colony. Bull. Amer. Mus. Nat. Hist. 162(l):1-46.

Carr, A. 1986. New Perspectives on the Pelagic Stage of Sea Turtle Development, U.S. Dept. Comm. NOAA, NMFS, NOAA Technical Mem. NMFS-SEFC-190, 36 pp.

Connecticut Department of Environmental Protection. 2000. Leatherback Sea Turtle Fact Sheet. Accessed on February 28, 2005 at http://dep.state.ct.us/burnatr/wildlife/factshts/lbttl.htm.

Crouse, D. T. 1985. Biology and conservation of sea turtles in North Carolina. Unpubl. Ph.D. Dissert. Univ. Wisconsin, Madison.

Crouse, D. T., M. Donnelly, M. Bean, A. Clark, W. Irvin and C. Williams. 1992. The TED Experience: Claims and Reality. A report to the Center for Marine Conservation, Environmental Defense Fund, National Wildlife Federation, Washington, D.C., 17 pp.

Crowder, L.B., S.R. Hopkins-Murphy, and J.A. Royle. 1995. Effects of turtle excluder devices (TEDs) on loggerhead sea turtle populations. Copeia 1995:773-779.

Dodd, K., Jr., 1988. Synopsis of the Biological Data on the Loggerhead Turtle *Caretta caretta* (Linneaus 1758). U.S. Fish and Wildlife Serv., Biol. Rep. 88(14). 110 pp.

Ehrhart, L. M. 1980. Marine turtle nesting in north Brevard County, Florida, in 1979. Fla. Sci. 43:27 (abstract).

Florida Power & Light Company (FPL). 1983. Florida's Sea Turtles. 46 pp.

Florida Power & Light Company (FPL) and Quantum Resources. 2007. Florida Power & Light Company St. Lucie Plant Annual Environmental Operating Report 2006.

Frazer, N. B. 1986. Survival from egg to adulthood in a declining population of loggerhead turtles, *Caretta caretta*. Herptologica 42(l): 47-55.

Garmon, L. 1981. Tortoise marsh wallow? Science News 119(14) Apr.: 217.

Gordon, W. G., ed. 1983. National report for the country of the United States. Pages 3-423 to 3-488 P. Bacon et al., eds., In Proc. Western Atlantic Turtle Symp. Vol 3, Appendix 7: National Reports. Center for Environmental Education, Washington D.C.

HEART (Help Endangered Animals – Ridley Turtles). 1999. Accessed on March 9, 2005 at http://www.ridleyturtles.org/popchart.html.

Henwood, T. A. and L. H. Ogren. 1987. Distribution and migrations of immature Kemp's ridley turtles (*Lepidochelys kempii*) and green turtles (*Chelonia mydas*) off Florida, Georgia, and South Carolina. Northeast Gulf Science, 9(2):153-160.

Hildebrand, H. 1982. A historical review of the status of sea turtle populations in the western Gulf of Mexico. In Bjorndal, K. (ed.), Biology and conservation of sea turtles. Smithsonian Institution Press, Washington, D.C. pp. 447-453.

Hirth, H. F. 1971. Synopsis of biological data on green turtle *Chelonia mydas* (Linneaus) 1758. FAO Fish. Synop. No. 85.

Hopkins, S. R. and J. I. Richardson, eds. 1984. Recovery Plan for Marine Turtles. U.S. Dept. Comm. NOAA, NMFS, St. Petersburg, FL, 355 pp.

Kraemer, J.E. 1979. Variation in incubation length of loggerhead sea turtle, *Caretta caretta*, clutches on the Georgia coast. Unpubl. M.S. Thesis, Univ. Georgia, Athens.

Lazell, J.D. 1980. New England waters: Critical habitat for marine turtles. Copeia (2):290-295.

Lutcavage, M. and J.A. Musick. 1985. Aspects of the biology of sea turtles in Virginia. Copeia 1985(2):449-456.

Mager, A. 1985. Five-year status reviews of sea turtles listed under the Endangered Species Act of 1973. U.S. Dept. Comm. NOAA, NMFS, St. Petersburg, FL, 90 pp.

Magnuson, J. J., K. A. Bjorndal, W. D., DuPaul, G. L. Graham, D. W. Owens, C. H. Peterson, P. C. H. Pritchard, J. I. Richardson, G. E. Saul, and C. W. West. 1990. Decline of the sea turtles: causes and prevention. National Academy Press, Washington, D.C., 274 pp.

Márquez, R. 1989. Status Report of the Kemp's Ridley Turtle, Pages 159 to 165. In: L. Ogren et al., eds., Proc. Second Western Atlantic Turtle Symposium. Department of the Interior, Fish and Wildlife Service, Washington D.C.

Márquez, R., A. Villanueva and M. Sanchez. 1982. The population of Kemp's Ridley Sea Turtle in the Gulf of Mexico, *Lepidochelys kempii*, In Bjorndal, K., ed. Biology and Conservation of Sea Turtles. Proc. World Conf. of Sea Turtle Conserv. Smithsonian Inst. Press. Washington, D.C. pp. 159-164.

Márquez, R., J. Diaz, M. Sanchez, P. Burchfield, A. Leo, M. Carrasco, J. Pena, C. Jimenez and R. Bravo. 1999. Results of Kemp's ridley nesting beach conservation efforts in Mexico. Marine Turtle Newsletter 85:2-4.

Márquez, R., P, Burchfield, M. Carrasco, C. Jimenez, J. Diaz, M. Garduno, A. Leo, J. Pena, R. Bravo and E. Gonzalez. 2001. Update on the Kemp's ridley turtle nesting in Mexico. Marine Turtle Newsletter 92:2-4.

Mendonca, M. T. and L. M. Ehrhart. 1982. Activity, Population size and structure of immature *Chelonia mydas* and *Caretta caretta* in Mosquito Lagoon, Florida. Copeia (1): 161-167.

Meylan, A. B. 1982. Sea turtle migration - evidence from tag returns. In Biology and Conservation of Sea Turtles. Bjorndal, K., ed., Smithsonian Institution Press, Washington, D.C., pp. 91-100.

Morreale, S. J., S. S. Standove and E. A. Standora. 1988. Kemp's Ridley Sea Turtle Study 1987-1988, Occurrence and Activity of the Kemp's Ridley (*Lepidochelys kempii*) and Other Species of Sea Turtles of Long Island, New York. New York State Dept. of Environmental Conservation, Contract No. C001693.

Mortimer, J. A. 1982. Factors influencing beach selection by nesting sea turtles. In Biology and Conservation of Sea Turtles. Bjorndal, K., ed. Smithsonian Institution Press, Washington, D.C., pp. 45-51.

National Marine Fisheries Service (NMFS). 1985. Five Year Status Reviews of Sea Turtles Listed Under the Endangered Species Act of 1973. NMFS Protected Species Management Branch, Washington, D.C.

National Marine Fisheries Service (NMFS). 1987. Final Supplement to the Final Environmental Impact Statement on Listing and Protecting the Green Sea Turtle, Loggerhead Sea Turtle and the Pacific Ridley Sea Turtle under the Endangered Species Act of 1973. National Marine Fisheries Service, Southeast Office, St. Petersburg, FL. 48 pp.

National Marine Fisheries Service (NMFS). 1992. Recovery Plan for Leatherback Turtles in the U.S. Caribbean, Atlantic and Gulf of Mexico. National Marine Fisheries Service, Washington, D.C. 65 pp.

National Marine Fisheries Service Southeast Fisheries Science Center (NMFS SWFSC). 2001. Stock assessments of loggerheads and leatherback sea turtles and an assessment of the impact of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the Western North Atlantic. U.S. Department of Commerce, National Marine Fisheries Service, Miami, FL, SEFSC Contribution PRD-00/01-08; Parts I-III and Appendices I-IV. NOAA Tech. Memo NMFS-SEFSC-455, 343 pp.

National Marine Fisheries Service and U.S. Fish and Wildlife Service (NMFS and FWS). 1991a. Recovery Plan for U.S. Population of Loggerhead Turtle. National Marine Fisheries Service, Washington, D.C. 64 pp.

National Marine Fisheries Service and U.S. Fish and Wildlife Service (NMFS and FWS). 1991b. Recovery Plan for U.S. Population of Atlantic Green Turtle. National Marine Fisheries Service, Washington, D.C. 52 pp.

National Marine Fisheries Service and U.S. Fish and Wildlife Service (NMFS and FWS). 1992b. Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*). National Marine Fisheries Service, Washington, D.C. 40 pp.

Nelson, D. A. 1988. Life History and Environmental Requirements of Loggerhead Turtles. U.S. Fish and Wildlife Service Biol. Rep. 88(23). U.S. Army Corps of Engineers TR EL-86-2 (Rev.). 34 pp.

NOAA Fisheries. 2002. Biological Opinion on Shrimp Trawling in the Southeastern United States, under the Sea Turtle Conservation Regulations and as Managed by the Fishery Management Plans for Shrimp in the South Atlantic and Gulf of Mexico.

NOAA Fisheries 2003. Biennial Report to Congress on the Recovery Program for Threatened and Endangered Species, October 1, 2000 to September 30, 2002.

NOAA Fisheries, Office of Protected Resources (OPR). 2007. Loggerhead Turtle. Accessed at http://www.nmfs.noaa.gov/pr/species/turtles/loggerhead.htm on June 12, 2007.

Ogren, L. H. 1989. Distribution of juvenile and sub-adult Kemp's ridley sea turtle: Preliminary results from 1984-1987 surveys. In Caillouet, C. W. and A. M. Landry, eds. First International Symposium on Kemp's Ridley Sea Turtle Biology, Conservation and Management. Texas A & M Univ., Galveston, TX, Oct. 1-4, 1985. TAMU-SG-89-105, pp. 116-123.

Pacific Whale Foundation. 2003. Hawksbill Sea Turtle Fact Sheet. Accessed at http://www.pacificwhale.org/printouts/fshawksbill.html on February 28, 2005.

Parsons, J. J. 1962. The Green Turtle and Man. Univ. of Florida Press, Gainesville, FL. 126 pp.

Pritchard, P. 1966. Sea turtles of the Guianas. Bull. Florida State Mus. 13(2):85-140.

Pritchard, P. 1971. The Leatherback or Leathery Turtle *Dermochelys coriacea*. IUCN Monog. No. 1, Marine Turtle Series. 39 pp.

Pritchard, P. 1983. Leatherback Turtle. In Bacon, P. et al., eds., Proc. Western Atlantic Turtle Symp. Vol. 1. Center for Environmental Education, Washington D.C. pp. 125-132.

Pritchard, P., P. Bacon, F. Berry, A. Carr, J. Fletemeyer, R. Gallagher, S. Hopkins, R. Lankford, R. Márquez, L. Ogren, W. Pringle, H. Reichardt and R. Witham. 1983. Manual of Sea Turtle Research and Conservation Techniques (Bjorndal, K. and G. Balazs, eds.). Center for Environmental Education, Washington, D.C., Second ed., 108 pp.

Pritchard, P. and R. Márquez. 1973. Kemp's Ridley turtles or Atlantic ridley, *Lepidochelys kempii*. IUCN Monog. No. 2, Marine Turtle Series. 30 pp.

Public Service Electric and Gas Company. 1989. Assessment of the Impacts of the Salem and Hope Creek Nuclear Generating Stations on Kemp's Ridley (*Lepidochelys kempii*) and Loggerhead (*Caretta caretta*) Sea Turtles. PSE&G Nuclear Department, Newark, N.J. 68 pp.

Richardson, T. H., J. I. Richardson, C. Ruckdeschel and M. W. Dix. 1978. Remigration patterns of loggerhead sea turtles *Caretta caretta* nesting on Little Cumberland and Cumberland Islands, Georgia. Mar. Res. Publ. 33:39-44.

Ross, J. P. 1982. Historical decline of loggerhead, ridley, and leatherback sea turtles. Biology and Conservation of Sea Turtles. Bjorndal, K., ed. Smithsonian Institution Press, Washington, D.C., pp. 189-195.

Ross, J. P. 1989. Status of Sea Turtles: 1. Kemp's Ridley. A Report to the Center for Marine Conservation, Washington, D.C.

Ross, J. P. and M. A. Barwani. 1982. Review of sea turtles in the Arabian area. Pages 373-383. In: Bjorndal, K. (Ed.), Biology and conservation of sea turtles. Smithsonian Institution Press, Washington, D.C.

Royle, J.A. and L.B. Crowder. 1998. Estimation of a TED effect from loggerhead strandings in South Carolina and Georgia strandings data from 1980-97. Unpublished report. U.S. Fish and Wildlife Service, Laurel, Maryland, 12pp.

Schroeder, B. A. and A. A. Warner. 1988. 1987 Annual Report of the Sea Turtle Strandings and Salvage Network, Atlantic and Gulf Coasts of the United States, January-December 1987. National Marine Fisheries Service, Southeast Fisheries Center, Cont. No. CRD-87/88-28, Miami, FL., 45 pp.

Schulz, J. P. 1982. Status of sea turtle nesting in Surinam with notes on sea turtles nesting in Guyana and French Guiana. Pages 435-437 In K. Bjorndal (ed.), Biology and Conservation of Sea Turtles. Smithsonian Institution Press, Washington D.C.

Schulz, J. P. 1975. Sea turtles nesting in Surinam. Zool. Verh. (Leiden) No. 143.

Sea Turtle Stranding and Salvage Network (STSSN) 2004. Online stranding reports accessed at www.sefsc.noaa.gov/seaturtlestssn.jsp.

Seney, E.E., J.A. Musick, and A.K. Morrison. 2002. Diet analysis of stranded loggerhead and Kemp's ridley sea turtles in Virginia, USA: 2001. Proceedings of the Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum NMFS-SEFSC-503.

Shoop, C. P. and C. Ruckdeschel. 1982. Increasing turtle strandings in the Southeast United States: A complicating factor. Biol. Conserv. 23(3):213-215.

Shoop, C. P., T. Doty, and N. Bray. 1981. Sea Turtles in the Region of Cape Hatteras and Nova Scotia in 1979. Pages 1-85 In A characterization of marine mammals and turtles in the mid- and north-Atlantic areas of the U.S. Outer Continental Shelf, University of Rhode Island, Kingston, R.I. pp. 1-85.

Spotila, J.R., A.E. Dunham, A.J. Leslie, A.C. Steyermark, P.T. Plotkin, and F.V. Paladino. 1996. Worldwide Population Decline of *Demochelys coriacea*: Are Leatherback Turtles Going Extinct? Chelonian Conservation and Biology 2(2):209-222.

Squires, H. J. 1954. Records of marine turtles in the Newfoundland area. Copeia 1954:68.

Thompson, N. B. 1984. Progress Report on estimating density and abundance of marine turtles: results of first year pelagic surveys in the southeast U.S. National Marine Fisheries Service, Miami, FL. 32 pp.

Tucker, A. D. 1988. A summary of leatherback turtle *Dermochelys coriacea* nesting at Culebra, Puerto Rico, from 1984-1987 with management recommendations. Rept. submitted to U. S. Fish and Wildlife Service. 33 pp.

Turtle Expert Working Group (TEWG). 1998. An assessment of the Kemp's ridley (*Lepidochelys kempii*) and loggerhead (*Caretta caretta*) sea turtle populations in the Western North Atlantic. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SEFSC-409: 1-96.

Turtle Expert Working Group (TEWG). 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the Western North Atlantic. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SEFSC-444:1-115.

U.S. Nuclear Regulatory Commission (NRC). 2003. Generic Environmental Impact Statement for License Renewal of Nuclear Plants – Supplement Regarding St. Lucie Units 1 and 2, NUREG-1437, Supplement 11, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2007. Letter to Stacy Foster, Florida Power & Light Company and Shelly Norton, National Marine Fisheries Service. Summary of April 17-18, 2007 Site Visit Regarding formal Consultation Under Section 7 of the Endangered Species Act Regarding Operation of the St. Lucie Nuclear Power Plant. June 13. ADAMS Accession Number ML0712400973.

Witherington, B. E. and L. M. Ehrhart. 1989. Status and reproductive characteristics of green turtles (*Chelonia mydas*) nesting in Florida. In Ogren, L., F. Berry, K. Bjorndal, H. Kumpf, R. Mast, G. Medina, H. Reichart, and R. Witham (eds.), Proceedings of the Second Western Atlantic Turtle Symposium. pp. 351-352. NOAA Tech. Memo. NMFS-SEFC-226.

Wolke, R. E. and A. George. 1981. Sea Turtle Necropsy Manual, U.S. Dept. Comm. NOAA, NMFS, NOAA Technical Mem. NMFS-SEFC-24, 20 pp.

June 13, 2007

Stacy Foster
Florida Power & Light Company
Environmental Services
700 Universe Blvd.
Juno Beach, FL 33408

Shelley Norton
National Marine Fisheries Service
263 13th Avenue South
St. Petersburg, FL 33701

SUBJECT: SUMMARY OF APRIL 17-18, 2007 SITE VISIT REGARDING FORMAL CONSULTATION UNDER SECTION 7 OF THE ENDANGERED SPECIES ACT REGARDING OPERATION OF THE ST. LUCIE NUCLEAR POWER PLANT (TAC NOS. MD4260 AND MD4261)

Dear Ms. Foster and Ms. Norton:

Under Section 7 of the Endangered Species Act, the U.S. Nuclear Regulatory Commission (NRC) reinitiated formal consultation with the National Marine Fisheries Service (NMFS) regarding the continued operation of the St. Lucie Nuclear Power Plant (SLNPP), after the incidental take limit for sea turtles was exceeded in 2006. At that time, NRC and NMFS were already in consultation regarding the capture of a smalltooth sawfish (*Pristis pectinata*) at SLNPP, and the agencies agreed that the consultations could be combined for a comprehensive biological opinion addressing sea turtles and the smalltooth sawfish.

On April 17-18, 2007, representatives of the NRC, NMFS, and Florida Power & Light Company (FPL) met to observe the inspection of the southern 12-ft-diameter intake pipe and discuss possible mitigation measures to reduce impingement and entrainment of protected marine species, specifically sea turtles and smalltooth sawfish, at SLNPP.

As a result of the October 2006 loggerhead turtle (*Caretta caretta*) hatchling impingements at the intake wells, NRC, NMFS, and FPL discussed potential mitigation measures. As a result of a conference call with FPL, NRC, NMFS, and Florida Fish and Wildlife Conservation Commission (FWC) staff, on April 30, 2007, NRC and NMFS suggested that FPL implement measures along the banks of the intake canal east of the 5-in. turtle net, so that a turtle crawl would be visible. NRC and NMFS suggested that this prudent measure should be implemented as soon as possible since the 2007 sea turtle nesting season has already begun.

During the April 2007 outage at SLNPP, FPL inspected the intake and discharge pipes. Inspection results are expected to identify the amount and location of any significant biofouling and debris accumulation that extend into the flow path of the intake pipes. NRC and NMFS suggested that FPL develop an implementation plan based on the pipe inspection report for cleaning the intake pipes during the fall 2007 outage, to remove protruding debris that may adversely affect animals entrained into the intake canal. NRC and NMFS suggested that FPL should coordinate and obtain concurrence of the implementation plan from the NRC and NMFS prior to implementation. NRC and NMFS believe that removal of significant biofouling and debris could reduce adverse effects on animals entrained into the intake canal. Also, such improvements would likely need to be evaluated for potential effects in the discharge canal. The cooling system is composed of both intake and discharge components whose functions are interdependent. If changes or improvements are made to one component, the other component would likely be affected.

The exploration of the intake pipes also revealed a dead-end section in each 12-ft-diameter intake pipe. A live green turtle (*Chelonia mydas*) was discovered in the dead-end section of the southern 12-ft-diameter intake pipe. The NRC, NMFS, and FPL observed the turtle breathe from an air pocket in the dead-end pipe section. FPL was able to blow air into that section so the turtle could continue breathing from the pocket overnight. This event, however, revealed the potential for animals to be trapped in this section, and since it has no functional purpose, NRC and NMFS suggested that FPL seal off the dead-end sections of the 12-ft-diameter intake pipes during the fall 2007 outage.

To reduce the potential for incidental takes in 2007, NRC and NMFS suggested that FPL should employ several mitigation measures: cut back existing vegetation along the banks of the intake canal, remove protruding debris in the intake pipes, and seal off the dead-end sections of the intake pipes. In addition, the agencies suggested that FPL should develop a plan to install excluder devices at the velocity caps to prevent large marine organisms, such as adult sea turtles and smalltooth sawfish, from entering the intake pipes. NRC and NMFS observed that the design and installation of such devices would likely be a longer-term project, but suggested to FPL that this project should be done as soon as possible, with a proposed implementation plan to be provided for this project no later than September 30, 2007. Finally, NRC and NMFS suggested that if FPL conducts any dredging, bank restoration, or other similar activities within the intake canal, FPL should work with NRC and NMFS to identify appropriate mitigation measures to ensure the safety of any marine organisms that might be affected.

NRC plans to submit to NMFS a biological assessment regarding sea turtles and foreseeable future activities at SLNPP that may affect protected marine species. NRC and NMFS suggested that after receiving the final pipe inspection report, FPL should submit to NRC any new or updated information, including an updated description of the cooling system if necessary, for inclusion in the biological assessment for sea turtles.

At the meeting, several changes were suggested to FPL's smalltooth sawfish handling, transportation, and release protocol; FPL should send the revised document to NRC and NMFS for approval. Also, the NRC and NMFS agreed that FPL should continue communicating with both agencies regarding the design and implementation of any mitigation measures and projects that could affect protected marine species.

FPL agreed to take the NRC and NMFS suggestions under advisement. The parties agreed that all proposed recommendations would be discussed further among the parties prior to issuance of a final biological opinion.

If there are any questions regarding this meeting summary or the recommendations described, please contact Dr. Dennis Logan at DTL1@nrc.gov. or 301-415-0490.

Sincerely,

/RA/

Harriet Nash, Environmental Scientist
Environmental Branch A
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-335 and 50-389

cc: See next page

If there are any questions regarding this meeting summary or the recommendations described, please contact Dr. Dennis Logan at DTL1@nrc.gov. or 301-415-0490.

Sincerely,

/RA/
Harriet Nash, Environmental Scientist
Environmental Branch A
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-335 and 50-389

cc: See next page

Adam Accession No. **ML071240097**

OFFICE	DLR:REBA:AB	DLR:LA	DLR:REBA:ES	OGC	DLR:REBA:BC
NAME	E. Wexler	S. Figueroa	H. Nash	A. Curatola	E. Benner
DATE	06/13/07	06/12/07	06/13/07	06/05/07	06/13/07

OFFICIAL RECORD COPY

Letter to S. Foster and S. Norton from H. Nash dated June 13, 2007

SUBJECT: SUMMARY OF APRIL 17-18, 2007 MEETING REGARDING FORMAL CONSULTATION UNDER SECTION 7 OF THE ENDANGERED SPECIES ACT REGARDING OPERATION OF THE ST. LUCIE NUCLEAR POWER PLANT (TAC NOS. MD4260 AND MD4261)

DISTRIBUTION:

Hard Copy:
H. Nash
E. Wexler
D. Logan
E. Benner
B. Mozafari

Mr. J. A. Stall
Florida Power and Light Company

ST. LUCIE PLANT

cc:

Mr. William E. Webster
Vice President, Nuclear Operations
Florida Power & Light Company
P.O. Box 14000
Juno Beach, FL 33408-0420

Senior Resident Inspector
St. Lucie Plant
U.S. Nuclear Regulatory Commission
P.O. Box 6090
Jensen Beach, FL 34957

Craig Fugate, Director
Division of Emergency Preparedness
Department of Community Affairs
2740 Centerview Drive
Tallahassee, FL 32399-2100

M. S. Ross, Managing Attorney
Florida Power & Light Company
P.O. Box 14000
Juno Beach, FL 33408-0420

Marjan Mashhadi, Senior Attorney
Florida Power & Light Company
801 Pennsylvania Avenue, NW
Suite 220
Washington, DC 20004

Mr. Douglas Anderson
County Administrator
St. Lucie County
2300 Virginia Avenue
Fort Pierce, Florida 34982

Mr. William A. Passetti, Chief
Department of Health
Bureau of Radiation Control
2020 Capital Circle, SE., Bin #C21
Tallahassee, FL 32399-1741

Mr. Gordon L. Johnson
Site Vice President
St. Lucie Nuclear Plant
6351 South Ocean Drive
Jensen Beach, FL 34957-2000

Mr. Christopher R. Costanzo
Plant General Manager
St. Lucie Nuclear Plant
6351 South Ocean Drive
Jensen Beach, FL 34957

Mr. Terry Patterson
Licensing Manager
St. Lucie Nuclear Plant
6351 South Ocean Drive
Jensen Beach, FL 34957

Mr. Rajiv S. Kundalkar
Vice President - Nuclear Engineering
Florida Power & Light Company
P.O. Box 14000
Juno Beach, FL 33408-0420

Mr. J. Kammel
Radiological Emergency Planning
Administrator
Department of Public Safety
6000 Southeast Tower Drive
Stuart, FL 34997

Mr. Bill Parks
Operations Manager
St. Lucie Nuclear Plant
6351 South Ocean Drive
Jensen Beach, Florida 34957-2000

Mr. Seth B. Duston
Training Manager
St. Lucie Nuclear Plant
6351 South Ocean Drive
Jensen Beach, FL 34957-2000

Mr. Gordon A. Clefton
Nuclear Energy Institute
1776 I Street, NW., Suite 400
Washington, DC 20006-3708