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).

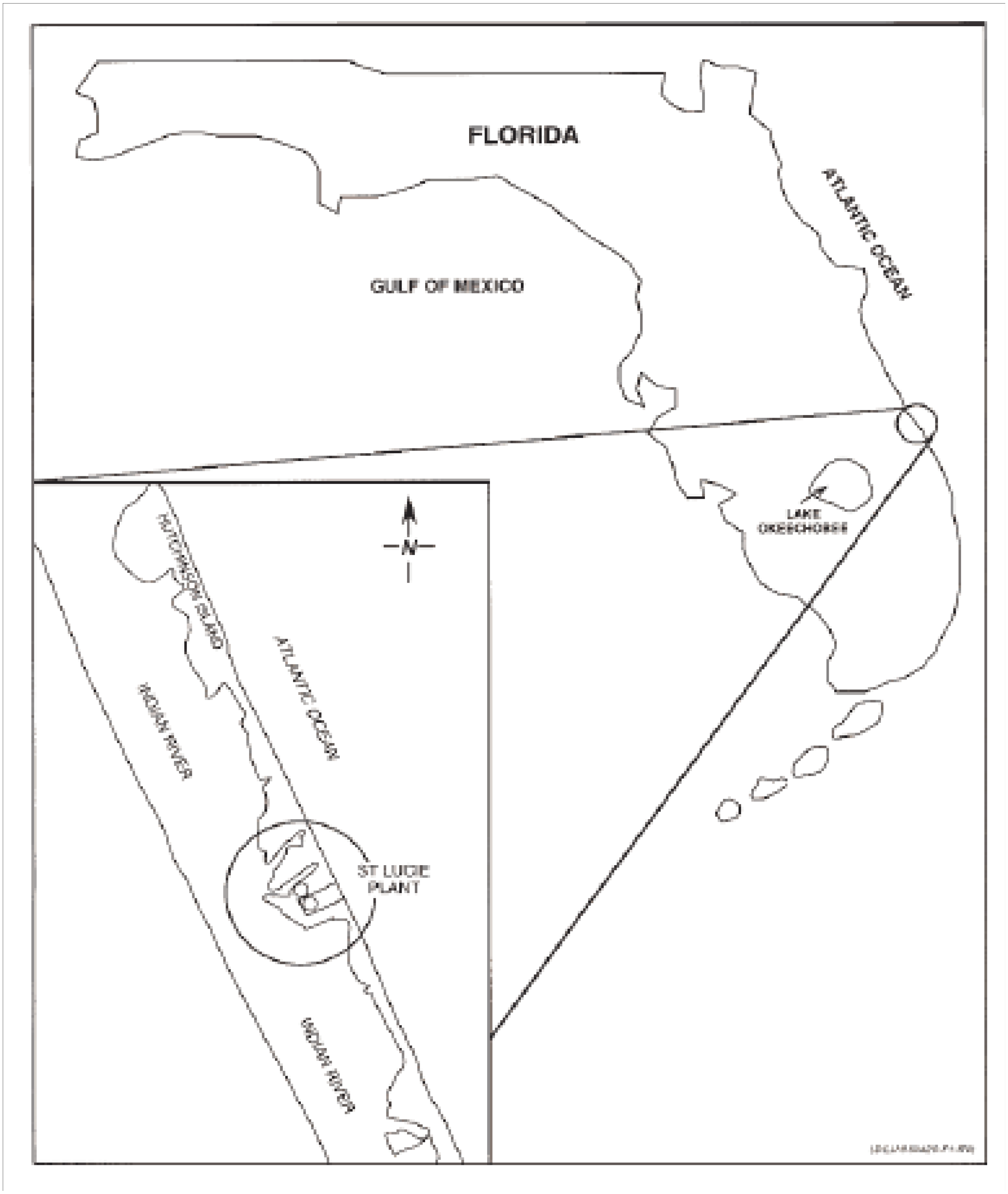

Figure 1. Location of St. Lucie Nuclear Power Plant.

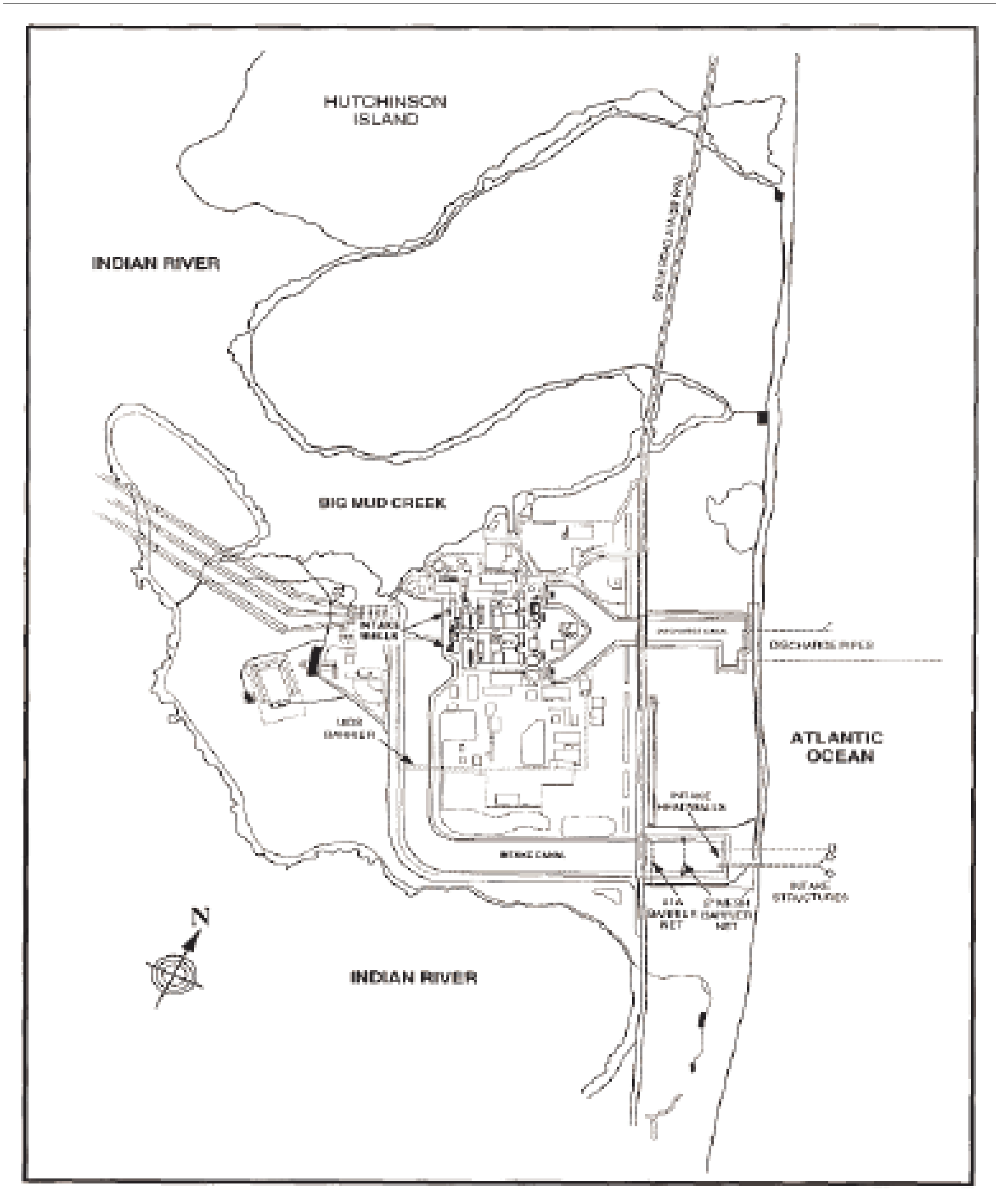

Figure 2. St. Lucie cooling water intake and discharge system.

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.

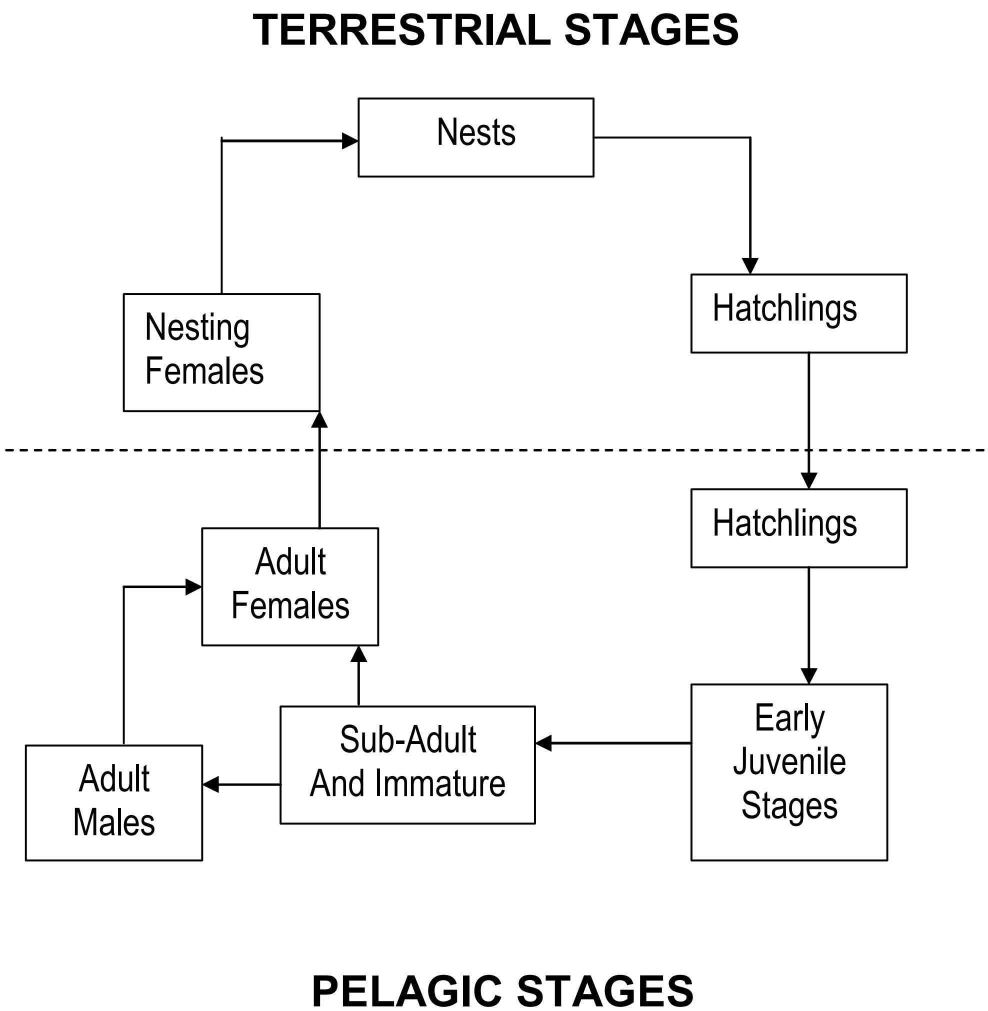

Figure 3. Generalized sea turtle life cycle. (After PSE&G 1989)

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).

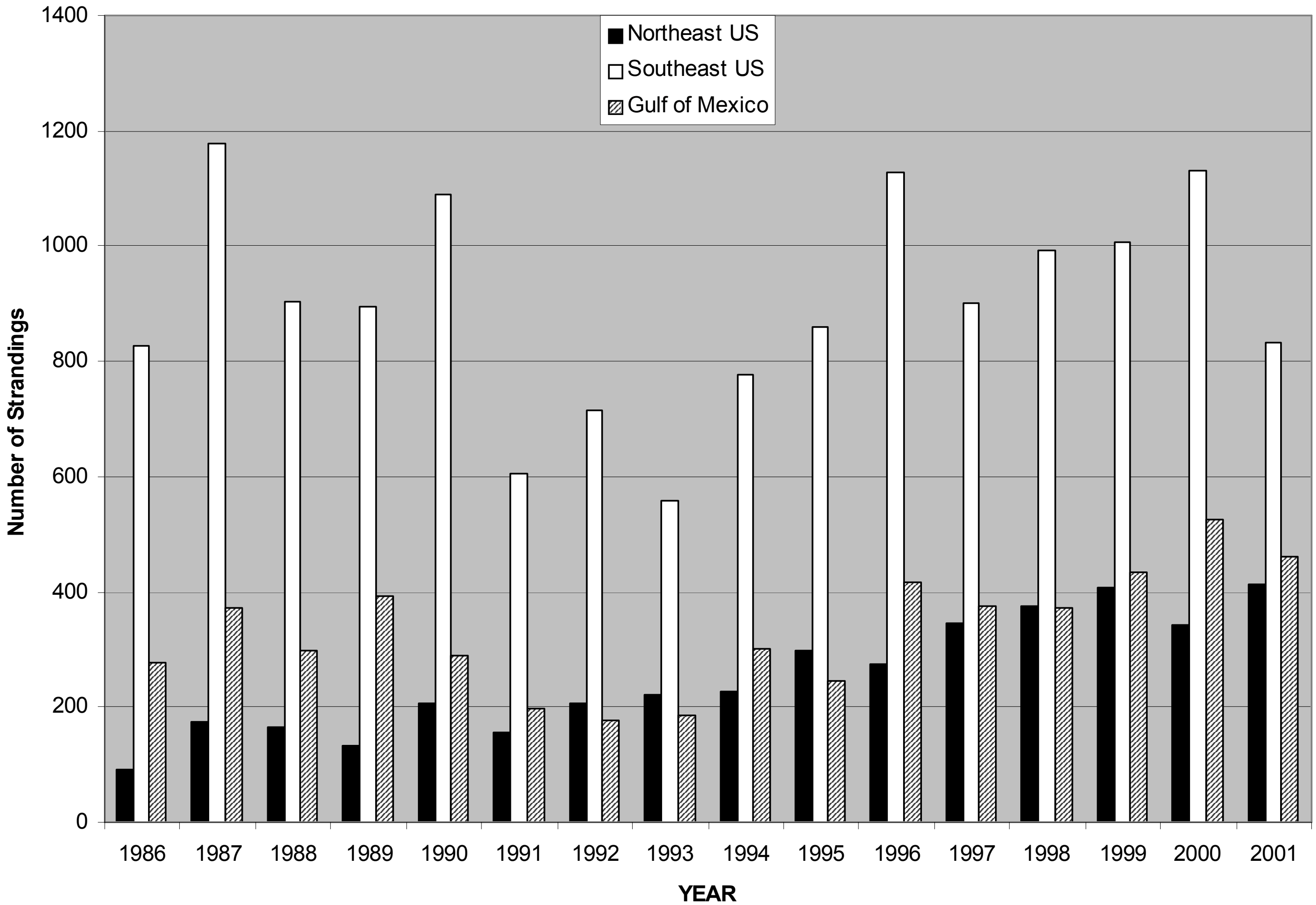

Figure 4. Loggerhead sea turtle strandings by region, 1986-2001 (Turtle Expert Working Group 2000 and STSSN 2004).

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).

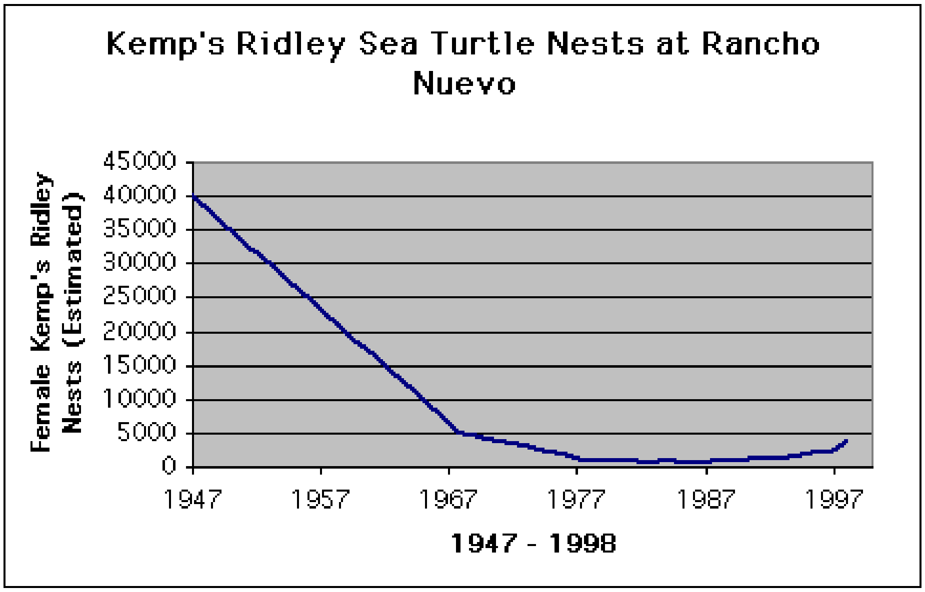

Figure 5. Estimated annual number of nesting female Kemp's Ridley sea turtles at Rancho Nuevo (HEART 1999).

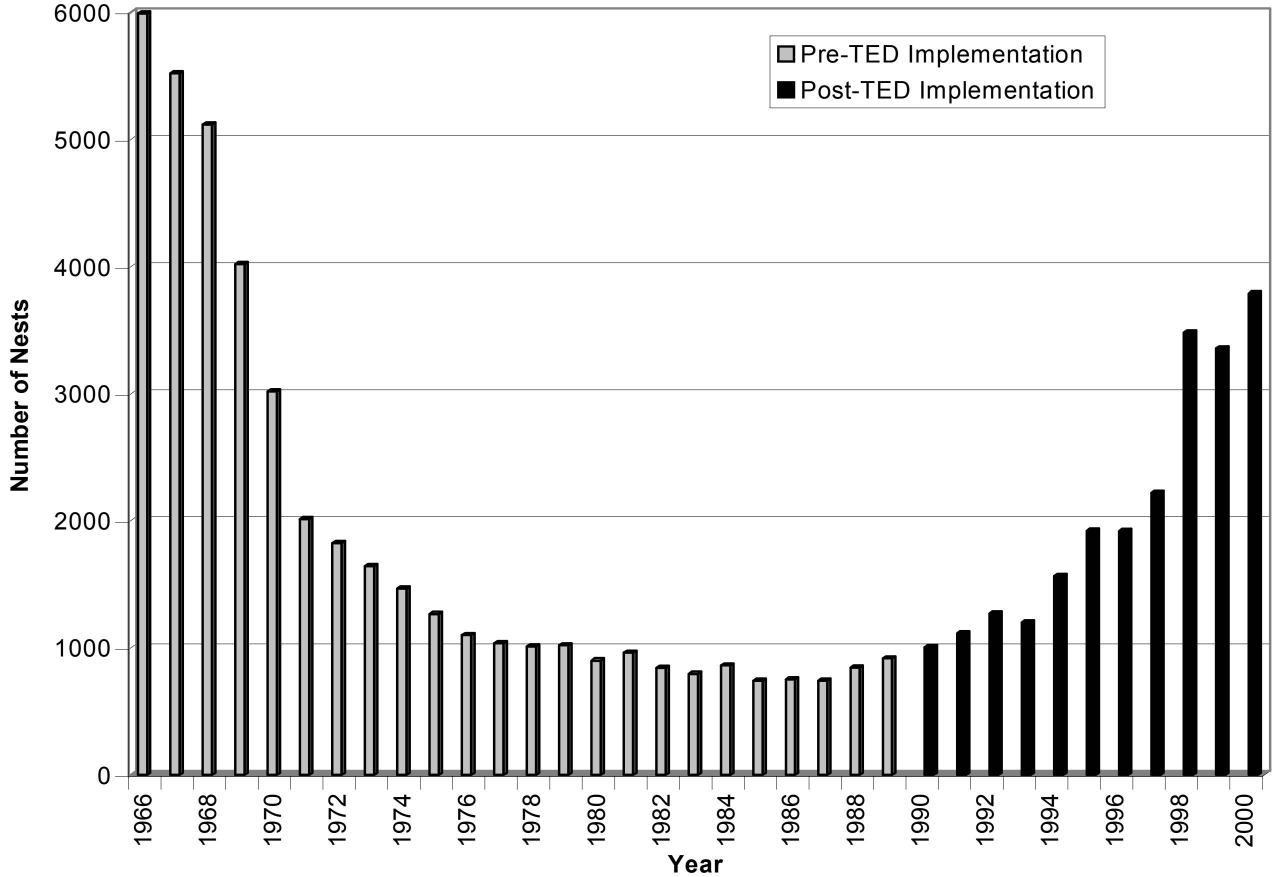

Figure 6. Number of Kemp's ridley nests at Rancho Nuevo before and after implementation of the turtle exclusion device (TED) regulations in 1989. (Turtle Expert Working Group 2000 and Marquez et al. 2001)

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.

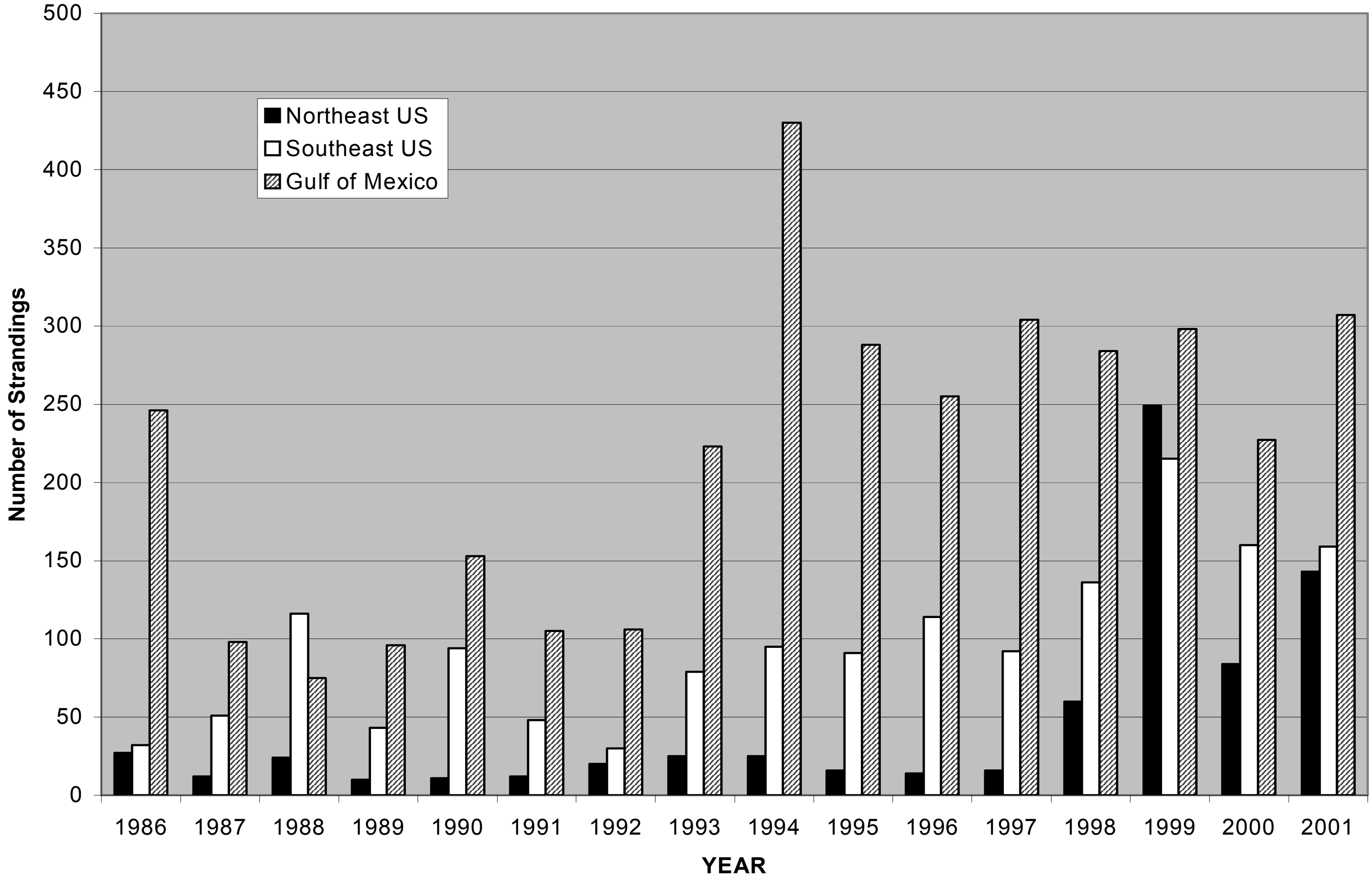

Figure 7. Kemp's ridley sea turtle strandings by region, 1986-2001. (Turtle Expert Working Group 2000 and STSSN 2004)

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.

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