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SUBJECT: Forwards biological opinion in response to NRC request for reinitiation of consultation under Section 7 of Endangered Species Act (ESA) re continued operation of St Lucie Nuclear Generating Plant.

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, Maryland 20910

PDR

FEB 7 1997

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50-389

Mr. Dennis M. Crutchfield
Director
Division of Reactor Program Management
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Mr. Crutchfield:

Enclosed is the Biological Opinion (Opinion) in response to the Nuclear Regulatory Commission's (NRC) request for reinitiation of consultation under Section 7 of the Endangered Species Act (ESA) regarding the continued operation of the St. Lucie Nuclear Generating Plant (Plant).

A series of meetings and discussions were held in May 1995, between the NRC, Florida Power & Light (FPL), Florida Department of Environmental Protection (FLDEP) and the National Marine Fisheries Service (NMFS) due to a large increase in the frequency of small green turtles taken incidentally and occasionally killed by entrapment in the Plant's cooling water intake structure. This opinion considers the effects on listed species of the continued operation of the circulating seawater cooling system at the Plant, the capture-release program for sea turtles entrapped in the Plant's intake canal, the associated sea turtle conservation and monitoring programs, and the assessment submitted by the NRC. FPL's installation of a modified barrier net, completed in January 1996 as a requirement identified during early consultation to reduce the passage of sea turtles into the intake structure was also evaluated. The enclosed opinion is based on the best available information and concludes that the continued operation of the Plant may adversely affect, but is not likely to jeopardize, the continued existence of listed species under NMFS jurisdiction.

An Incidental Take Statement is included with this opinion. Variability in the rate of turtle entrapment at the Plant is considered to be primarily a function of the local abundance of turtles, since the operational characteristics of the intake structures have remained constant over the years. In recent years, green turtle entrapment has increased at a dramatic and



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unpredicted rate and may continue to increase. Therefore, no maximum level will be specified for non-lethal takes through entrapment, capture, and release of any species of turtle. NMFS will continue to monitor the level of turtle entrapment reported by FPL and relate the capture rates to other indices of turtle abundance. However, lethal take levels have been established based on historical numbers of observed lethal takes.

Two lethal take levels are specified; a fixed level of the number of turtles of each species entrapped during the calendar year, and a percentage of the number of turtles of each species entrapped during the calendar year. The allowable lethal take level will be the greater of the two numbers, considering the prevailing entrapment rates. These levels provide for increased total numbers of lethal takings as entrapment levels increase, but restrict the proportion of lethal takes based on historical averages. The following annual incidental lethal take levels are established:

1. 2 loggerheads or 1.5 percent of the total number of loggerheads entrapped at the intake canal, whichever is greater;
2. 3 greens or 1.5 percent of the total number of greens entrapped at the intake canal, whichever is greater;
3. 1 Kemp's ridley or 1.5 percent of the total number of Kemp's ridleys entrapped at the intake canal, whichever is greater;
4. 1 hawksbill or 1.5 percent of the total number of hawksbills entrapped at the intake canal, whichever is greater;
5. 1 leatherback or 1.5 percent of the total number of leatherbacks entrapped at the intake canal, whichever is greater.

The Incidental Take Statement includes terms and conditions necessary to monitor and minimize the lethal take of sea turtles at the Plant. These terms and conditions, with one exception, are generally consistent with current practices at the Plant, but are nonetheless specified as requirements to ensure against degradation of the sea turtle monitoring program in the face of other cutbacks in FPL's environmental programs. We must remind you that the Incidental Take Statement is issued to the NRC, and it is the NRC's responsibility to ensure that the terms and conditions are implemented. Therefore, it is recommended that NRC include these terms and conditions as part of any permit issued to FPL.

This concludes consultation responsibilities under Section 7

of the ESA. Reinitiation of formal consultation is required if: (1) the amount or extent of taking specified in the incidental take statement is exceeded, (2) new information reveals effects of the action that may affect listed species or critical habitat (when designated) in a manner or to an extent not previously considered, (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the opinion, or (4) a new species is listed or critical habitat designated that may be affected by the identified action. However, if take levels are approached, NRC, in conjunction with FPL, should contact NMFS to re-evaluate impacts and to discuss whether reinitiation of consultation is necessary in order to avoid unlawful takes.

Please call David Bernhart, Protected Species Branch, Southeast Region, at (813) 570-5312, if you have questions regarding any information discussed above or enclosed in the opinion.

Sincerely,

PA Montanio

Patricia A. Montanio
Acting Director,
Office of Protected Resources

Enclosure

cc: Gary L. Bouska - St. Lucie Power Plant

ENDANGERED SPECIES ACT

SECTION 7 CONSULTATION

BIOLOGICAL OPINION

| | |
|---|---|
| Agency: | U.S. Nuclear Regulatory Commission |
| Activity: | Reinitiation of Consultation in accordance with Section 7(a) of the Endangered Species Act regarding the continued operation of the Circulating Water System of the St. Lucie Nuclear Generating Plant |
| Consultation Conducted by: | National Marine Fisheries Service Southeast Regional Office |
| Date Issued: | FEB 7 1997 |

**Background**

The St. Lucie Nuclear Power Plant is located on South Hutchinson Island, Florida between the Atlantic Ocean and the Indian River. Florida Power & Light Company (FPL) operates the St. Lucie Plant while the U.S. Nuclear Regulatory Commission (NRC) maintains Federal regulatory authority. The plant consists of two 839 megawatt electrical, nuclear-fueled, Pressurized Water Reactors, Units 1 and 2, beginning commercial operation in February 1977 and August 1983, respectively.

The Atlantic Ocean provides cooling waters for and receives discharge waters from the condensers and auxiliary cooling

systems of the plant via piping systems that run beneath the ocean beach. Sea water is drawn through three separate intake structures and pipes into a 5000 ft long cooling water canal. At the end of the canal, water is drawn into each unit of the plant at the intake wells. Sea turtles encountering the ocean intake structures can be drawn through the intake pipes with the cooling water and become entrapped or impinged and must be removed through a capture-release program run by FPL. Entrapment occurs when an organism enters a confined area and cannot escape, therefore, turtles entering the intake canal cannot escape and are considered to be entrapped. Impingement occurs when an organism is carried by currents and pinned to a water intake structure or barrier, and in the case of a power plant, the trash racks and/or the traveling screens system in the intake wells are the points of impingement.

All five species of sea turtles occurring in the southeastern United States have been documented in the intake canal, and fatalities from various causes have resulted or been observed for three of those five species. In the original evaluation of the environmental impact of St. Lucie Unit 1, sea turtle entrapment and impingement were not evaluated (U. S. Atomic Energy Commission, 1974), and the turtle entrapment and impingement experienced when St. Lucie Unit 1 began commercial operation in 1977 was unexpected. To facilitate the capture of entrapped turtles and to prevent turtles from moving down the canal system toward the plant, a large mesh barrier net was erected in 1978. A mesh size of 8 in. (20.3 cm) by 8 in. was chosen to exclude 95 percent of the turtles, based on the size frequency of turtles captured in the canal before March 1978. A Biological Assessment and a Section 7 consultation were completed in 1982 for St. Lucie Unit 2, which resulted in a no-jeopardy opinion but which made no provisions for mortality. This assessment was based on the entrapment history of the plant from 1976 through 1981 which had been approximately 150 turtles per year. As part of this evaluation, the 8 in. (20.3 cm) square mesh barrier net was determined appropriate to exclude turtles from the plant's intake wells. Also a research program to investigate methods to physically or behaviorally exclude turtles from the offshore intake structures was conducted as part of the Environmental Protection Plan of Unit 2 and concluded that there was no practical method to accomplish this goal (Florida Power & Light, 1985).

Since 1993, FPL has documented significant increases in the numbers of entrapped turtles. A principal component of this increase was juvenile green turtles with carapace widths less than 12 in. (30 cm). In 1995, 673 green turtles, mostly juveniles, were captured. Before 1993, the maximum number of green turtles captured annually at the St. Lucie Plant was 69. This is a marked increase over the record 1994 levels of 193 green turtles. With the increase in the number of turtles handled and the decrease in the average size of the turtles, more green turtles have been able to penetrate the 8 in. (20.3 cm) mesh barrier net and pass down the canal to be entrained in the intake structures of the plant. The entrainment level peaked in 1995, when 97 turtles (14 percent of the turtles captured) were removed from the intake wells of the plant.

Based on the increasing number of sea turtles captured at the St. Lucie Plant, the NRC determined that reinitiation of formal Section 7 consultation with NMFS was required and informed the NMFS Southeast Regional Office of this determination in a May 11, 1995 letter. The NRC submitted a Biological Assessment to NMFS on February 7, 1996. In addition, FPL has installed a new barrier net with 5 in. (12.7 cm) bar length webbing to prevent the passage of small turtles through the existing 8 in. net to the intake wells of the plant. Installation of the new barrier net was identified as a mitigation measure early in the consultation process, when methods to reduce entrainment were first discussed. FPL implemented this requirement before completion of the Section 7 consultation.

<u>Proposed action</u>

The proposed actions considered in this Biological Opinion are the continued operation of the circulating seawater cooling system at the St. Lucie Nuclear Power Plant licensed by NRC, the capture-release program for sea turtles which become entrapped in the plant's intake canal, and the associated sea turtle conservation and monitoring programs. A description of these activities follows.

<u>Circulating Water System</u>
The Atlantic Ocean provides cooling and receiving waters for each unit's condenser and auxiliary cooling systems. These systems share common intake and discharge canals with ocean piping.

Major components of these canals and ocean piping systems are: 1) three ocean intake structures and associated velocity caps located approximately 1200 ft (365 m) from the shore line; 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) a common intake canal to convey sea water to each unit's intake structure; 4) individual unit intake structures; 5) discharge structures for each unit; 6) a common discharge canal; 7) one discharge pipeline to convey water offshore to a "Y" diffuser (12 ft [3.65 m] diameter pipeline) approximately 1200 ft (365 m) offshore and another pipeline to convey water offshore to a multiport diffuser (16 ft (4.9 m) diameter pipeline; solid pipeline from shoreline to approximately 1200 ft (365 m) offshore and then the multiport diffuser segment from approximately 1200 to 2400 ft (365-730 m) offshore.

The design unit flow for Units 1 and 2 is 1150 cubic ft per second (32.6 $m^3$/sec) with maximum and normal temperature rise across the condensers of 31 °F and 25 °F (17°-13° C), respectively (Bellmund *et al.*, 1982).

Intake Structures and Velocity Caps

In 1991-1992, all three velocity caps were rebuilt due to the failure of several panels comprising the caps. The intake structures are located approximately 1200 ft (365 m) offshore and about 2400 ft (731 m) south of the discharge structures. The intake structures have a vertical section to minimize sand intake and a velocity cap to minimize fish entrapment, but no screens or grates are used to deny organisms access to the intake pipes. The tops of the intake structures are approximately 7 ft (2.1 m) below the surface at mean low water. The velocity cap for the 16 ft (4.9 m) diameter pipe is 70 ft (6.5 m) square, 5 ft (1.5) thick, and has a vertical opening of 6.25 ft (1.9 m). The velocity cap for the two 12 ft (3.65) diameter pipes is 52 ft (4.8 m) square, 5 ft (1.5 m) thick, and has a vertical opening of 6.5 ft (2.0 m).

The flow velocities at various locations of the velocity cap and intake structures have been calculated under various levels of biological fouling. The minimum and maximum horizontal intake velocities at the face of the ocean intake structures for the 12 ft (3.65 m) diameter pipe is calculated at 0.37-0.41 ft/sec

(11.2-12.6 cm/sec) and for the 16 ft (4.9 m) diameter pipe is calculated at 0.92-1.0 ft per second (28.3-30.5 cm/sec). As the water passes under the velocity cap, flow becomes vertical and the velocity increases to approximately 1.3 ft/sec (40.2 cm/sec) for the 12 ft (3.65 m) diameter pipe and 6.8 ft/sec (206 cm/sec) for the 16 ft (4.9 m) diameter pipe (Bellmund *et al.*, 1982).

Intake Pipes

From the ocean intake structures, water flows through the three buried pipelines of approximately 1200 ft (365 m) in length, which empty into the open intake canal behind the dune line. The flow through these pipelines varies from 4.2-6.8 ft/sec (127-206 cm/sec) depending on the pipeline and the degree of fouling. Transit time for an object to travel the distance through the pipeline is approximately 180-285 seconds (3 to 4.75 minutes).

Due to the differences in the diameter of the pipelines and friction of the pipeline walls, the calculated volume through the two 12 ft (3.65 m) diameter lines is approximately 20 percent each and approximately 60 percent for the 16 ft (4.9 m) diameter pipeline (Bellmund *et al.*, 1982).

Headwalls and Canal System

Approximately 450 ft (138 m) behind the primary dune line the intake pipes discharge their water at two head wall structures into the intake canal. The headwall structure for the two 12 ft (3.65 m) diameter pipes is a common vertical concrete wall. The head wall for the 16 ft (4.9 m) diameter pipe is more elaborate and consists of a guillotine gate in a concrete box open at the other end. A series of pillars parallel to the flow support a walkway above the discharge area.

The 300 ft (91 m) wide intake canal, whose maximum depth is approximately 25 ft (7.6 m), carries the cooling water 5000 ft (1525 m) to the intake structures. The flow rate in the canal varies from 0.9-1.1 ft/sec (27-32 cm/sec), depending on tidal stage.

Highway Bridge and Underwater Intrusion System

The intake canal is crossed by two permanent structures. One is a bridge owned by the Florida Department of Transportation and is part of U.S. Highway A1A. The roadway is supported by a series of concrete pilings driven into the bottom of the intake canal.

The other barrier is the underwater intrusion detection system (UIDS), which is required for security reasons and has a net with a 9- ft. (23 cm) square mesh to prevent human intrusion into the secure area of the plant.

Intake Wells, Trash Racks, and Traveling Screens

Each unit has a separate intake structure consisting of four bays. Each bay contains trash racks ("grizzlies") that are vertical bars with approximately 3 in. (7.6 cm) spacings to catch large objects, such as flotsam, traveling screens with a 3/8 in. (1 cm) mesh to remove smaller debris, and circulating water pumps. Approach velocities to each bay are calculated to be less than 1 ft/sec (30.5 cm/sec), but increase to approximately 5 ft/sec (150 cm/sec) at the trash racks.

The trash racks are periodically cleaned by a rake that is lowered to the bottom of the rack. The rake's teeth fit into the 3 in. (7.6 cm) vertical openings of the structure. This rake is pulled vertically up and collects any debris that may have accumulated on the structures. This debris is emptied into a trough at the top of the intake bay for subsequent disposal. Any debris that is collected on the traveling screens is washed from the screen by a series of spay jets and is then also emptied into a trough at the top of the intake bay for disposal.

Condensers

After the water has passed through the trash racks, the traveling screens, and the circulating water pump, it travels through the condenser, which contains thousands of 3/8 in. (1 cm) diameter tubes. Condenser water heat is transferred to this water, which is then expelled into the discharge canal.

On Unit 2 FPL has installed a "Taprogge" cleaning system to maintain condenser cleanliness and is in the process of installing the same system on Unit 1. The Unit 2 system has been in operation since January 23, 1996. The Taprogge system works by passing hundreds of sponge balls less than an inch in diameter through the condenser tubes to remove biological fouling and scale. This mechanical cleaning system reduces the need for chemical treatments. The sponge balls are strained and returned to the head of the condenser for re-use. Four separate water boxes and sponge circulating systems are installed on the condenser. Each water box is normally charged with 1800 sponge balls. The sponge ball strainers periodically require backflushing to clean debris from the strainer grid. When the grids are opened, the possibility exists for sponge balls to be released into the discharge waters. FPL has developed "best management practices" to prevent sponge ball loss.

Discharge Systems

Each unit discharges its condenser cooling water into the discharge canal that is approximately 300 ft (91 m) wide and 2200 ft (670 m) long. The canal terminates at two headwall structures approximately 450 ft (137 m) behind the primary dune line. One structure supports a 12 ft (3.65 m) diameter pipeline that is buried under the ocean floor and runs approximately 1500 ft (460 m) offshore where it terminates into a two-port "Y" nozzle. The other structure supports a 16 ft (4.9 m) diameter pipeline that is buried under the ocean floor and runs approximately 3375 ft (1030 m) offshore. The last 1400 ft (425 m) of this pipeline contain a multiport diffuser segment with 58 discharge ports. To minimize plume interference, the ports are oriented in an offshore direction on alternating sides of the pipeline. The velocity of the water inside this pipeline averages about 5.7 ft/sec (174 cm/sec) and the jet velocity of the discharge water at each port averages approximately 13 ft/sec (400 cm/sec) to ensure quick dissipation of the thermal load (Bellmund *et al.*, 1982).

Thermal Plume

FPL had the thermal plume modeled for two-unit operation. The results indicated that the maximum surface temperatures are strongly dependent on ambient ocean conditions. The maximum surface horizontal temperature difference is predicted to be less than 4.9 °F (2.7 °C) and the resulting +2 °F (+1.1 °C) surface isotherm is estimated to encompass 963 acres (390 ha) (Bellmund *et al.*, 1982).

**Sea Turtle Capture and Removal Program**

The goal of the sea turtle capture program at the St. Lucie Plant is to remove entrapped turtles from the intake canal system quickly once they have entered the system. FPL, in conjunction with Applied Biology, Inc., and Quantum Resources, Inc., former and current contractors for sea turtle conservation and monitoring activities at St. Lucie Plant, have developed

procedures and methods for handling marine turtles entrapped or impinged (Applied Biology, 1993; Quantum, 1994).

FPL hypothesizes that the intake structures and velocity caps serve as an artificial reef, since the structures are the only significant physical feature in this inshore environment. Turtles may encounter these structures in their normal range of activities and feed on the fouling organisms growing on the structures, or seek the structures for shelter. Based on the intake velocities of the intake structures, once a turtle passes the vertical plane of the velocity cap, it can be quickly sucked into the intake pipeline and, after a 3-5 minute ride through the pipeline, be discharged into the intake canal.

From 1976 through 1994, all five species of turtles present in the inshore waters of Florida have been entrapped, and a total of 3199 turtles have been removed from the intake canal of the St. Lucie Plant. Loggerheads are the dominant turtle in numbers (n = 2394), greens are next (n = 751), followed by Kemp's ridleys (n = 24), leatherbacks (n = 17), and hawksbills (n = 13). During 1995, turtle entrapment rates have increased sharply. Through June 30, 1995, a total of 609 turtles have been handled and 414 of those have been green turtles.

Barrier Nets-Past Configuration

To facilitate the capture of entrapped turtles and to reduce the likelihood of turtles moving down the intake canal toward the plant to be impinged, a large mesh barrier net (8 in. (20.3 cm) square mesh) was erected at the A1A bridge in 1978. The net was suspended across the canal and was anchored at the bottom with weights and supported at the top by cables and floats. The net was hung so that it had a 1:1 slope, with the bottom anchors being positioned upstream of the surface floats. This configuration was designed to prevent bowing of the net in the center, minimizing the risk of an injured or lethargic turtle being pinned against the net and drowning. By confining most turtles to the canal area east of the A1A bridge, the net capture of turtles in this part of the canal was facilitated. Additionally, any turtle with a carapace width of 11.3 in. (28.7 cm) or greater was excluded from passing through the net and moving down the canal and becoming impinged.

The net has been rehung several times (e.g., 1985, 1988, 1990) to maintain its 1:1 slope and blockage of the canal. The net is inspected approximately quarterly to ensure its integrity throughout the water column, its sides, and its bottom. Repairs are made as necessary, and sediment is removed by an air lift if the foot of the net is buried by a build-up of material. Because of deterioration of this net over time, a new net with the same 8 in. (20.3 cm) mesh was installed in 1987. In 1990, the headcable of the net was given more support by attaching a series of floatation rafts, which would keep the top of the net at or above the surface of the water under varying water levels that result from tides or operational changes of the generating units (e.g., if a unit is not operating, the water level in the canal rises about 4 ft (1.2 m)). This reconfiguration would also keep turtles from swimming over the top of the net.

Barrier Net-New Configuration

Due to observed increases in the entrapment rate in 1993 and 1994 (Quantum, 1994) for greens and loggerheads, the continuing upward trend in 1995, and the increases in impingement rates and subsequent mortality at the intake wells of the plant, construction of a new, smaller mesh barrier net east of the present barrier net was identified early in the consultation process as a necessary mitigation measure t reduce lethal takes. Specific details of the net configuration were discussed during early consultation activities, which included FPL's solicitation of ideas from their engineers, Florida Department of Environmental Protection (FLDEP) turtle specialists, and NMFS personnel. FPL completed construction of the new barrier net, a 5 in. (12.7 cm) square mesh with a deployed diagonal measurement of 7 in. (18 cm) in January 1996. FPL selected the 5 in. mesh size based on the size distribution of turtles seen in the first half of 1995. None of the 414 green turtles entrapped in the intake canal during the first half of 1995 had a straight carapace width measurement smaller than 18 cm. FPL predicts that all turtles encountering the 5 in. barrier net will be prevented from moving down the canal toward the plant, if future turtle size distributions match those of 1995. The net is located approximately halfway between the old 8 in. barrier net and the intake headwalls, thus entrapped sea turtles will be confined in a much smaller area. The new net is anchored along the bottom of the canal and is held up by an aerial wire that is strung between tensioning towers on the sides of the canal. The net is designed to remain partially out of the water at varying water levels. Due to potential fouling situations from jellyfish or seaweed, the top of the net can be quickly released from the tensioning towers so that it can drop to the bottom of the canal. The net will be inspected quarterly to ensure its integrity and to provide necessary cleaning and maintenance as required. The old 8- ft. (20.3 cm) mesh barrier net will also be maintained in its existing place to serve as a backup in case there is a failure of the 5- ft. (12.7 cm) mesh net or the new net needs to be lowered because of fouling from jellyfish, seaweed, or flotsam.

Underwater Intrusion Detection System (UIDS)
In 1986, the UIDS was installed to prevent human entry into the plant via the canal system and to provide further security for the plant. This system also provides an additional barrier for turtles that penetrate the old 8 in. barrier net. The barrier is on the north-south arm of the canal and consists of a rigid net with a 9 in. (22.9 cm) mesh. The net is hung at approximately a 0.9:1 slope with the bottom of the net downstream of the top. This net is inspected periodically by security personnel and several turtles, both live and dead, have been removed from this area in 1994 and 1995.

Intake Well Inspection and Removal
In December 1994 and through 1995, FPL has provided inspection of the intake wells by at least once every three hours over a 24-hour period. This increase in surveillance was necessary due to increased turtle presence and mortality in the intake wells.

Any plant or security personnel who see any turtle that is impinged or swimming in the intake well area are required to notify a plant turtle biologist through a beeper system. Sea turtle biologists are constantly on call and response time is within an hour. The responding biologist then captures the turtle with a long-handle dip net and places it in a padded box for holding and transport.

Netting Program
Sea turtles are removed from the intake canal by means of large-mesh entanglement net fished between the intake headwall and the barrier net at the A1A bridge. From 1976 through the present, this netting program has been constantly evaluated and continuously improved to minimize trauma to turtles and to

maximize capture efficiency. Nets presently used are from 100-120 ft (30-37 m) long, 9-12 ft (2.7-3.7 m) deep, and composed of 16 in. (41 cm) stretch-mesh multifilament nylon. Large floats are attached to the top of the net to provide buoyancy and the bottom of the net is unweighted. Prior to April 1990, turtle nets were deployed on Monday mornings and retrieved on Friday afternoons. During periods of deployment, the nets were inspected for captures at least twice daily (e.g., mornings and afternoons). Additionally, plant and security personnel checked the net periodically, and notified biologists immediately if a capture had occurred. Sea turtle biologists were on call 24 hours/day to retrieve turtles entangled in capture nets

Beginning in April 1990, after consultation with NMFS, net deployment was scaled back to daylight hours only. Concurrently, surveillance of the intake canal and the nets was increased to the hours the nets were being fished. This measure decreased response time for removal of entangled turtles from the nets and decreased mortalities from accidental drowning. The presence of a biologist also provided a daily assessment of turtle numbers in the canal and an indication of when a given turtle was first sighted. Biologists were then able to estimate the residence time of the turtle from the first observation to capture and release.

Hand Capture and Dip Netting

In addition to the use of entanglement nets to capture turtles, dip nets and hand captures by snorkel and SCUBA divers are used. Long-handle dip nets used from small boats and from the canal banks and headwalls are effective in capturing turtles with carapace lengths of 12 in. (30.5 cm) or less. Hand nets have also been used to remove dead and floating small green turtles from various areas in the canal system and this factor accounts for the high mortality level associated with this recovery system (4 out of 20 green turtles captured with this method in the first half of 1995 were mortalities).

Under good water visibility conditions, divers have proven to be very effective in capturing turtles of all sizes, particularly inactive turtles partially buried in the sediment near the barrier net or sleeping individuals throughout the canal. FPL believes that hand captures have had a significant impact in reducing residence times for turtles in the canal.

Tagging and Health Assessment Activities

All turtles removed from the St. Lucie Plant intake canal system are identified to species, measured, weighed, tagged, and examined for overall condition (wounds, abnormalities, parasites, missing appendages). Healthy turtles are released into the ocean on the day of capture.

Since July 1, 1994, all turtles captured are photographed dorsally and ventrally prior to release, and the photographs are retained for future reference. Inconel tags supplied by NMFS are applied to the proximal edge of the foreflippers. The tag numbers, the species, and morphometrics of each turtle are reported monthly to FLDEP.

If a turtle has been previously tagged either at the St. Lucie facility or elsewhere, that fact is noted in a monthly data sheet and reported. These data are forwarded by FLDEP to NMFS for inclusion in their data base. From 1976-1994, 177 recaptures (150 loggerhead and 27 green turtles) have occurred and a number of turtles have been recaptured more than once (Quantum, 1994). One loggerhead in particular has been recaptured 11 times. Several other turtles with tag scars have also been recovered, suggesting that the actual number of recaptures may be higher. Occasionally, turtles are captured that have been tagged by other researchers. One such capture occurred in 1994, and was a female leatherback with tags from French Guiana.

Necropsy and Rehabilitation Activities

Resuscitation techniques are used on turtles that appear to be comatose. Lethargic or slightly injured turtles are treated and occasionally held for observation prior to release. If further treatment is warranted, FLDEP is notified and a decision is made about which facility would provide additional veterinarian treatment. Beginning in 1982, necropsies were conducted on dead turtles found in fresh conditions. Three necropsies were performed in 1994.

**Sea Turtle Conservation and Monitoring Program**

FPL has been conducting nesting studies as part of the St. Lucie Unit 1 and Unit 2 reporting requirements for the U.S. Fish and Wildlife Service (FWS). In addition, FWS and FLDEP have started a long-term nesting index survey, and the data generated by FPL

since 1971 are an integral part of this program. Nesting reports are summarized on a yearly basis (Applied Biology, 1976-1994; Quantum, 1994). Nesting surveys run from April 15-September 15. Biologists used small off-road motorcycles to survey the island early morning, generally completing the survey before 10 A.M. New nests, non-nesting emergences (false crawls), and nests destroyed by predators are recorded for each of the 0.62-mile (1 km) survey areas on Hutchinson Island. In addition to nesting data, data from stranded turtles found during beach nesting surveys are logged. These data are routinely provided to FLDEP and NMFS through the Sea Turtle Stranding and Salvage Network (STSSN). NMFS uses the STSSN database to monitor impacts to sea turtles from natural and human sources of mortality, as well as to infer turtle population characteristics. Also FPL has been conducting turtle walk programs at the St. Lucie Plant since 1982 as a public service. These walks are permitted by FLDEP and have become quite popular.

Listed Species Likely to Occur in the Action Area

Listed species under the jurisdiction of NMFS that occur in the nearshore or inshore waters of Florida's Atlantic Coast and may be affected by the proposed activities include:

Endangered

| | |
|---|---|
| Northern right whale | *Eubalaena glacialis* |
| Leatherback sea turtle | *Dermochelys coriacea* |
| Kemp's ridley sea turtle | *Lepidochelys kempii* |
| Green sea turtle* | *Chelonia mydas* |
| Hawksbill sea turtle | *Eretmochelys imbricata* |

*Green turtles in U.S. waters are listed as threatened except the Florida breeding population which is listed as endangered. Due to the inability to distinguish between these populations away from the nesting beach, green turtles are considered endangered wherever they occur in U.S. waters.

Threatened

| | |
|---|---|
| Loggerhead sea turtle | *Caretta caretta* |

Threatened, proposed

Johnson's seagrass *Halophila johnsonii*

<u>Species Not Likely to be Affected</u>

The best available information indicates that right whales and Johnson's seagrass are not likely to be adversely affected by the continued operation of the circulating cooling water system at St. Lucie Plant.

**Biology and Distribution**

<u>Sea Turtles</u>:

Precise data regarding the total number of sea turtles in waters of the southeastern U.S. Atlantic are not available. Trends in turtle populations are identified through monitoring of their most accessible life stages on the nesting beaches, where hatchling production and the number of nesting females can be directly measured. NMFS selected an Expert Working Group (EWG) consisting of population biologists, sea turtle biologists and state and federal managers to consider the best available information to formulate population estimates for sea turtles affected by the shrimp fishery. The EWG focused on determining population estimates for Kemp's ridley and loggerhead sea turtles, the species of greatest concern. Preliminary information generated by the EWG in November 1995 was considered in the June 11 and June 27, 1996 sea turtle conservation regulations BOs. Completed reports by the Group, entitled "Kemp's ridley (*Lepidochelys kempii*) Sea Turtle Status Report," dated June 28, 1996, and the "Status of the Loggerhead Turtle Population (*Caretta caretta*) in the Western North Atlantic", dated July 1, 1996, were submitted in early July. These reports are incorporated by reference.

**Kemp's ridley sea turtle (*Lepidochelys kempi*)**

The EWG report, "Kemp's ridley (*Lepidochelys kempii)* Sea Turtle Status Report", dated June 28, 1996, provides a summary of Kemp's ridley habitat use, life history parameters and estimates of the number of adults in the populations, as well as current and projected population trends. Additionally, updated information regarding Kemp's ridley nesting for 1996 is considered in this

BO. Figure 1 illustrates Kemp's ridley nesting data from Rancho Nuevo and, since 1990, adjacent beaches in Mexico. Although data are still preliminary for the 1996 nesting season, 1,957 nests were protected in corrals; 37 were placed in styrofoam boxes for incubation; and 13 nests were left *in situ* for a total of 2,007 nests. (Burchfield, 1996b). Unusual nesting behavior, such as two weeks of night-time nesting, was observed and attributed to the odd climatic conditions this summer (Burchfield, 1996a). The EWG identified an average Kemp's ridley population growth rate of 13 percent per year since 1991, however, this rate of growth did not continue in 1996. Annual fluctuations due in part to irregular internesting periods are normal for sea turtle populations.

Figure 1 shows the upward trend in Kemp's ridleys nests since the late 1980s, although the increase is not dramatic at the Rancho Nuevo camp. The area surveyed for ridley nests was expanded in 1990 due to destruction of the primary nesting beach by Hurricane Gilbert. The EWG assumed that the increased nesting observed particularly since 1990 was a true increase, rather than the result of expanded beach coverage. Because systematic surveys of the adjacent beaches were not conducted prior to 1990, there is no way to determine what proportion of the nesting increase documented since that time is due to the increased survey effort rather than an expanding ridley nesting range. As noted by the EWG, trends in Kemp's ridley nesting suggest that recovery of this population has begun, but continued caution is necessary to ensure recovery and to meet the goals identified in the Kemp's ridley Recovery Plan.

**Leatherback turtle (*Dermochelys coriacea*)**

The Recovery Plan for Leatherback Turtles (*Dermochelys coriacea*) contains a description of the natural history and taxonomy of this species (NMFS and USFWS, 1992). Leatherbacks are widely distributed throughout the oceans of the world, and are found throughout waters of the Atlantic, Pacific, Caribbean, and the Gulf of Mexico (Ernst and Barbour, 1972). Leatherbacks are predominantly distributed pelagically, feeding primarily on jellyfish such as *Stomolophus*, *Chryaora*, and *Aurelia* (Rebel, 1974). However, their distribution over nearshore waters does not vary significantly from loggerheads (Shoop and Kenney, 1992),

and they likely come into shallow waters if there is an abundance of jellyfish nearshore.

Leatherbacks were observed most commonly during summer and fall months, and showed a more pelagic and northerly distribution than loggerheads. Aerial surveys conducted over coastal waters from North Carolina south identified the greatest abundance of leatherbacks within the Southeast Region during summer months off the northern east coast of Florida, adjacent to leatherback nesting beaches (Thompson and Huang, 1993).

Trends in the leatherback population are the most difficult to assess since major nesting beaches occur over broad areas within tropical waters outside the United States. In the eastern Caribbean, nesting occurs primarily in the Dominican Republic, the Virgin Islands, and on islands near Puerto Rico. Sandy Point, on the western edge of St. Croix, Virgin Islands, has been designated by the FWS as critical habitat for nesting leatherback turtles. Nesting also occurs the Atlantic Coast of Florida on a smaller scale. The primary leatherback nesting beaches in the western Atlantic occur in French Guiana, Suriname, and Mexico. Although increased observer effort on some nesting beaches has resulted in increased reports of leatherback nesting, declines in nest abundance have been reported in the beaches of greatest nesting densities. At Mexiquillo, Michoacan, Mexico, between 1986 and 1987, 4796 nests were laid on 4.5 km of beach. During the 1990-1991 season, only an estimated 1200 nests were reported. Another large western Atlantic nesting beach is located at Yalimapo-Les Hattes, French Guiana, where Fretey and Girondot estimated the total number of adult females at 14,700 to 15,300 in the late 1980s. Beach erosion has pushed nesting into Suriname, confounding efforts to monitor trends from this colony. Anecdotal information suggests nesting has declined at Caribbean beaches over the last several decades (Eckert, 1993).

Leatherbacks are the largest of sea turtles and are able to maintain body temperatures several degrees above ambient temperatures, likely by virtue of their size, insulating subdermal fat, and an arrangement of blood vessels in the skin and flippers that enables retention of heat generated during swimming (Paladino *et al.*, 1990).

In the northwest Atlantic, leatherbacks have been reported in New England and as far north as Nova Scotia and Newfoundland from April to November (CeTAP, 1982). Although their tolerance of low temperatures is greater than for other sea turtles, leatherbacks are generally absent from northern waters in winter and spring. In Cape Cod Bay, sightings peak in August and September (Prescott, 1988). Adult leatherbacks stranded in the western Atlantic identify impressive migrations between temperate and tropical waters. For example, leatherbacks tagged on nesting beaches in French Guiana and Suriname have stranded on New York beaches (Morreale, pers comm), and other leatherbacks tagged while nesting in the Caribbean have stranded on New England Beaches (NMFS and USFWS). Shoop and Kenney (1992) observed leatherbacks during summer months scattered along the continental shelf from Cape Hatteras to Nova Scotia. Relative concentrations of leatherbacks were seen off the south shore of Long Island and off New Jersey during summer and fall months. Leatherbacks in these waters are thought to be following their preferred jellyfish prey, including *Cyanea* sp. (Lazell, 1980; Shoop and Kenney, 1992). Researchers in the Chesapeake have observed leatherbacks in the mouth of the Bay during summer months (Byles, 1988).

Hawksbill turtle (*Eretmochelys imbricata*)

The hawksbill turtle is relatively uncommon in the waters of the continental United States. Hawksbills prefer coral reefs, such as those found in the Caribbean and Central America. However, there are accounts of hawksbills in south Florida and a surprising number are encountered in Texas. Most of the Texas records are small turtles, probably in the 1-2 year class range. Many of these captures or strandings are of individuals in an unhealthy or injured condition (Hildebrand, 1982). The lack of sponge-covered reefs and the cold winters in the northern Gulf of Mexico probably prevent hawksbills from establishing a viable population in this area.

Hawksbills feed primarily on a wide variety of sponges but also consume bryozoans, coelenterates, and mollusks. The Culebra Archipelago of Puerto Rico contains especially important foraging habitat for hawksbills. Nesting areas in the western North Atlantic include Puerto Rico and the Virgin Islands.

Green turtle (*Chelonia mydas*)

Green turtles are distributed circumglobally, mainly in waters between the northern and southern 20°C isotherms (Hirth, 1971). In the western Atlantic, several major nesting assemblages have been identified and studied (Peters, 1954; Carr and Ogren, 1960; Parsons, 1962; Pritchard, 1969; Carr *et al.*, 1978). Most green turtle nesting in the continental United States occurs on the Atlantic Coast of Florida (Ehrhart, 1979). Recently, limited nesting has been documented along the southeast and panhandle coasts of Florida (Schroeder, pers. comm.). The Florida Department of Environmental Protection established an index nesting beach survey program in 1989 to standardize data collection methods and effort on key nesting beaches. The pattern of green turtle nesting on index beaches shows biennial peaks in abundance, with a generally positive trend during the eight years of regular monitoring since the index beaches were established.

While nesting activity is obviously important in determining population distributions, the remaining portion of the green turtle's life is spent on the foraging grounds. Some of the principal feeding pastures in the western Atlantic Ocean include Florida, the northwestern coast of the Yucatan Peninsula, the south coast of Cuba, the Mosquito Coast of Nicaragua, the Caribbean Coast of Panama, and scattered areas along Colombia and Brazil (Hirth, 1971). The preferred food sources in these areas are *Cymodocea, Thalassia, Zostera, Sagittaria, and Vallisneria* (Babcock 1937; Underwood, 1951; Carr, 1952; 1954; Mexico, 1966).

In Florida, important foraging grounds include the shallow, protected waters of the Indian River Lagoon, the Florida Keys, Florida Bay, Homosassa, Crystal River and Cedar Key. Additionally, the nearshore waters along Florida's east coast from Cape Canaveral south through Broward County also provide important foraging habitat. Evidence provided by Mendonca and Ehrhart (1982) indicates that immature green turtles utilize estuarine systems during periods of their lives. These authors identified a population of young green turtles (carapace length 29.5-75.4 cm) resident in Mosquito Lagoon, Florida. The Indian River system, of which Mosquito Lagoon is a part, supported a green turtle fishery during the late 1800s (Ehrhart, 1983), and these turtles may be remnants of this historical colony.

Additional juvenile green turtles occur north to Long Island Sound, presumably foraging in coastal embayments. In North Carolina, green turtles are known from estuarine and oceanic waters and occasional nests are documented as far north as Cape Hatteras National Seashore.

Loggerhead turtle (*Caretta caretta*)

The EWG report, "Status of the loggerhead turtle population (*Caretta caretta*) in the Western North", dated July 1, 1996, provides a summary of loggerhead habitat use, life history parameters and population trends and estimates. This report is incorporated by reference. The EWG report identified four nesting subpopulations of loggerheads in the western North Atlantic based on mitochondrial DNA evidence. These include: (1) the Northern Subpopulation producing approximately 6,200 nests/year from North Carolina to Northeast Florida; (2) the South Florida Subpopulation occurring from just north of Cape Canaveral on the east coast of Florida and extending south to the Florida Keys and continuing north to Naples on the west coast and producing approximately 64,000 nests/year; (3) the Florida Panhandle Subpopulation, occurring at Eglin Air Force Base and the beaches near Panama City and producing approximately 450 nests/year; and (4) the Yucatan Subpopulation occurring on the northern and eastern Yucatan Peninsula in Mexico and producing approximately 1,500 - 2,000 nests/year.

The EWG believed that the Northern subpopulation appears to be stable after a period of decline; the South Florida Subpopulation appears to have shown significant increases over the last 25 years suggesting the population is recovering, although the trend could not be detected over the most recent 7 years of nesting. An increase in the numbers of adult loggerheads has been reported in recent years in Florida waters without a concomitant increase in benthic immatures. Since loggerheads take approximately 20-30 years to mature, the effects of decline in immature loggerheads might not be apparent on nesting beaches for decades. Therefore, the EWG cautions against over-interpreting upward trends in nesting. In addition, these subpopulations cannot be managed separately because the in-water distribution of each is unknown, and research suggests that at least two of the subpopulations intermingle on the foraging grounds of the U.S. Atlantic coast.

Assessment of Impacts

Four thousand one hundred thirty-two sea turtles have become entrapped at the St. Lucie intake canal between 1976 and 1995. One hundred seventy-eight of those have died, for a total mortality rate of 4.3 percent. Loggerheads have been the species most involved over this period, although green turtles have been the dominant species encountered since 1993.

Entrapment at the St. Lucie intake canal can result in direct negative impacts on turtles in a number of ways: drowning in the intake pipes, injury sustained in the pipes and the canal, injury sustained during canal dredging, loss of condition due to long entrapment, exposure to predators in the intake canal, injury and stress sustained during capture, entanglement and drowning in fish gillnets and turtle capture nets, and impingement and drowning on barrier nets and in the intake wells.

Drowning and injury in the intake pipes are unlikely to be major direct impacts. With both generating units operating, the transit time through the intake pipes (5 minutes through the 12 ft pipes and 3 minutes through the 16 ft pipes) is likely too short to drown a sea turtle, and there are no known instances of turtle mortalities from forced submergence in the intake pipes. Some captured turtles have shown recent superficial scrapes, usually to the anterior carapace or plastron, which may have resulted from contact with encrusting organisms in the pipeline. From July 1, 1994 to June 30, 1995, 14 of 361 turtles captured had significant injuries, most of which were old and well-healed (Quantum, 1994). One loggerhead captured in 1994 had a fresh penetrating crack in the carapace which may have been sustained in the intake pipes or before entrapment, possibly by boat collision.

NMFS has conducted several formal consultations with the U.S. Army Corps of Engineers (COE) on the effects of channel maintenance dredging on sea turtles, which have generally concluded that the operation of hopper dredges, but not hydraulic or clamshell dredges, adversely affect sea turtles. This conclusion does not apply, however, to dredging conducted in the narrow confines of the St. Lucie intake canal where turtles have limited ability to evade a dredge. All types of dredging may affect sea turtles there. In fact, from 1976 to 1990, 7

loggerheads were killed during maintenance dredging in the St. Lucie intake canal. In 1994, however, hydraulic dredging was accomplished without any sea turtle mortality by isolating the dredging area with a temporary 4 in. square barrier net. FPL engineers expect that future maintenance dredging in the intake canal will generally only be necessary west of the newly installed 5 in. barrier net. Impacts to sea turtles from dredging west of the new barrier net are considered unlikely. In the rare instances where dredging may be required to the east of the 5 in. barrier net, FPL will contact NMFS and initiate consultation on the particular project, in conjunction with NRC or COE. Dredging associated with the construction of the 5 in. barrier net was the subject of a separate, informal consultation with NMFS (concluded October 26, 1995), and the work was accomplished without any impacts to turtles.

The extent of impacts resulting from loss of condition and exposure to predation is largely dependent on the species and the total residence time of individual animals in the intake canal. Green turtles in particular would not have access to their normal food sources of sea grasses or algae in the canal. Loggerheads may be able to find some of their prey species that have also become entrapped in the canal. In 1994, FPL reported residence times based on visual observations for turtles entrapped east of the Highway A1A barrier net. Average residence times were 1.47 days for loggerheads and 2.00 days for green turtles, and 100 percent of the loggerheads and 97 percent of the greens were captured within one week of first sighting. Loss of condition from lack of adequate food sources should not have serious negative impacts on turtles over these relatively short periods of time. Predatory fish, including barracuda, sharks, and jewfish, occur in the intake canal and may pose a threat to the smaller turtles in the canal. The level of predation on turtles entrapped in the intake canal has not been quantified, but can be mitigated by minimizing the residence time for individuals entrapped at the St. Lucie Plant. The contribution of predation to the overall turtle mortality rate at the St. Lucie Plant is probably small.

Drowning in capture nets has occurred occasionally throughout the history of the St. Lucie Plant's capture program during the period 1976-June 1995. Since the capture-release program began, 7 loggerheads (7 mortalities out of 2583 captures or 0.3

percent) and 13 green turtles (13 mortalities out of 1165 captures or 1.1 percent) have drowned in capture nets. Turtles can drown when they become tightly entangled, when the net becomes fouled on the bottom, or when a small turtle becomes tangled with a large turtle and is held underwater. Since April 1990, the nets have been set only during daylight hours and constantly tended resulting in 3 greens drowned in capture nets, but no loggerheads.

Injuries sustained during capture are all reported to be superficial. Typically they involve small cuts from net strands and abrasions sustained during handling. Efforts can be made to reduce effects from stress by minimizing handling time (reported to be generally under one-half hour to obtain biological information and to tag the animal) and by keeping turtles cool and shaded prior to release.

Impingement of turtles on the barrier nets has been implicated in only one mortality since improvements to the 8 in. barrier net were completed in 1990. Since then, one loggerhead has become entangled in the 8 in. barrier net and drowned. Six other loggerheads and 5 green turtles have been recovered dead at the barrier net, but their cause of death is unknown and the carcasses would naturally accumulate at the barrier net. The UIDS barrier is believed by FPL to pose a greater threat to turtles than the other barrier nets because of its downward slope relative to the current flow, and 1 UIDS-associated mortality has been reported since 1990. Generally, however, small turtles capable of penetrating the A1A barrier net can presumably penetrate the UIDS barrier without impingement and end up in the intake wells. The large number of small turtles removed from the intake wells in recent years bears this out. With the recent installation of the 5 in. barrier net, any turtles which penetrate that net will likely be of such a small size that they will easily pass through the UIDS barrier.

Since 1992, the number of small green turtles entrapped in the St. Lucie intake canal has been rising rapidly. Correspondingly, more small turtles are penetrating the barrier nets and eventually reaching the intake wells. In 1995, 673 green turtles were entrapped in the St. Lucie intake canal, and 97 of those had to be removed from the intake wells, where 7 died. Since 1990, a total of 16 green turtles have been recovered dead from the

intake wells. FPL has reported that 3 of the 16 died as the result of injury inflicted by the mechanical debris-removing rakes. The other 13 are reported by FPL as dying of unknown causes. These small turtles possibly died from exhaustion and drowning after swimming against the currents in the intake well. Certainly other factors may contribute to a weakened state of health in some small individuals that reach the intake wells, but it is clear that entrapment in the intake wells poses a mortality threat to these small turtles. In 1995, green turtles reaching the intake wells experienced a mortality rate approximately five times higher than those green turtles that were captured elsewhere in the canal. Kemp's ridley turtles, due to their small size, are also at risk to penetrate the 8 in. barrier net and to become exposed to the intake wells. Kemp's ridleys become entrapped at St. Lucie much less frequently than green turtles, however, and no ridley mortalities have occurred at St. Lucie since 1988.

In addition to the impacts to sea turtles already discussed, entrapment at the St. Lucie intake canal can have several other negative effects on sea turtles, through interruption of migration, loss of mating opportunities, and loss of nesting opportunities. Leatherbacks are probably more sensitive to interruption of migration than the other species of sea turtle because their spring migrations seem to be closely synchronized with the presence of prey species. The problem of loss of mating opportunities is impossible to quantify but would affect adults prior to and during the nesting season. Loss of nesting opportunities is a documented problem, with several instances of females nesting on the canal bank reported by FPL. The severity of any of these impacts can be reduced by minimizing residence time of individual turtles in the canal.

The recent installation of a new barrier net with a 5 in. square mesh should reduce many of the current impacts of entrapment in the intake canal. The new mesh size was selected based on the observed carapace widths of green turtles removed from the canal during the first half of 1995 when no green turtles were observed with a carapace width smaller than the maximum diagonal opening in the mesh of the proposed barrier net. Smaller turtles have been encountered historically, but the 5 in. mesh net would prevent virtually all of the turtles encountering it from penetrating the barrier, so long as the net is properly maintained. Intake well mortalities should therefore approach zero with the new barrier net in place. The new barrier net has been erected to the east of the existing large mesh net, which will continue to be maintained. The area of the canal in which turtles will be entrapped has been reduced by about 40 percent, and capture activities are reported to have become more efficient (J. Gorham, pers. comm.), which may reduce residence times in the canal.

Since reporting of sea turtle entrapment and mortality at St. Lucie Plant began in 1976, two general trends in the impacts on sea turtles are clear. The total number of turtles entrapped has increased, particularly in the last five years, and the mortality rate of the entrapped turtles has decreased. With the exception of the activation of Unit 2 in 1982, the operating characteristics of the circulating water system have not changed over time. The increased number of entrapments are most likely the result of increased local abundances of turtles, especially juvenile green turtles. The decreasing mortality rates are due to incremental improvements in the turtle program executed at FPL, including the construction of barrier nets, improved monitoring, and fine-tuning capture methods. Since 1990, turtle

mortalities have resulted from drowning in the capture or barrier nets, entrapment in the intake wells, and unknown, presumably natural, causes. Small green turtles from the intake wells constitute half of these mortalities.

A new trend may also be emerging. In 1995, only 14 of the 673 green turtles (2.1 percent) captured were visibly afflicted with fibropapilloma tumors. From January 1 through May 31, 1996, 37 out of 276 green turtles (13.4 percent) captured have been afflicted. Whether this increase in fibropapilloma rates will continue is uncertain. If it does, however, mortality rates of entrapped green turtles may increase beyond the rates observed historically. Afflicted animals may suffer a general loss of fitness and be more likely to succumb to natural sources of stress, as well as any stress due to entrapment at the intake canal.

Possible impacts of the Taprogge condenser cleaning system have been examined. Release of the system's sponge balls in the plant's discharge waters would introduce persistent marine debris offshore of the plant. The cleaning balls, made of vulcanized natural rubber, could be mistaken for prey items by turtles and consumed, with unknown health effects. To address this and other concerns relating to the Taprogge system's operation, FPL instituted operational procedures for the system to prevent sponge ball release into the environment. FPL has been making operational reports to FLDEP since March 1996 on the Taprogge system. Through April, sponge ball loss was quite low, maximally estimated at 3 balls/day. These sponge balls would most likely have been lost as a result of deterioration to a small enough size to pass through the strainer grid. In May, however, the loss of 1200 out of the 1800 balls in one of the water boxes was detected. This loss was not associated with a backflush, but probably resulted from accidental opening of the strainer grid. Although a survey of the beach along Hutchinson Island did not result in the finding of any of the discharged sponge balls, it is important to note that the size and coloring of the balls would make them extremely difficult to observe on a sandy beach. FPL subsequently has increased controls on sponge ball inventories and has added key lock controls on the ball strainers. The sponge ball loss rate that was reported, prior to the large loss event, was quite low, and probably consisted of very small sponge parts. No impacts to sea turtles are expected

from this normal operational loss rate. Single, large losses of sponge balls should be preventable through proper management controls, which FPL appears to be implementing. No impacts from the Taprogge system are anticipated as long as effective operational and management measures are maintained. FPL should continue to generate the monthly reports on the operation of the Taprogge system which have been required by the FLDEP Bureau of Protected Species Management, and a copy should also be provided to the NMFS Southeast Regional Office to allow NMFS to evaluate whether impacts from sponge ball loss are greater than presently anticipated.

Future levels of impacts to marine turtles at the St. Lucie Plant are difficult to assess in absolute terms, since the continuation of the recent increases in entrapment is likely but unpredictable. However, an estimate of future mortality rates can be derived from recent observations. Under the turtle capture and release program that has been in place since 1990, no hawksbill, leatherback, or Kemp's ridley mortalities have occurred, and entrapped greens and loggerheads have experienced mortality rates of 2.6 percent and less than 1 percent, respectively. The new barrier net should greatly reduce or even eliminate intake well turtle mortalities, even though the overall green turtle mortality rate since 1990, excluding intake well mortalities, has been less than 1 percent. Future lethal impacts to greens and loggerheads are not expected to exceed greatly the current 1 percent rates. Although no leatherback, Kemp's ridley, or hawksbill mortalities have occurred in the last six years at St. Lucie Plant, a very low level of impact not likely to exceed 1 individual per year is possible for these species.

Conclusion

Continued operation of the circulating water system at the St. Lucie Plant is likely to result in adverse effects on loggerhead, green, and to a lesser extent, Kemp's ridley, hawksbill and leatherback sea turtles, however, NMFS believes that the level of impact is not likely to jeopardize the continued existence of any sea turtle species.

Cumulative Effects

Cumulative effects are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation. State regulated fishing activities, including trawl and seine fisheries, in nearshore Atlantic waters probably take endangered species. These takes are not regulated or reported. It is expected that States will continue to license/permit large vessel and thrill-craft operations which do not fall under the purview of a Federal agency and may issue regulations which will affect fishery activities. Increased recreational vessel activity in inshore and nearshore waters of the Atlantic will likely increase the number of turtles taken by injury or mortality in vessel collisions. Recreational hook-and-line fisheries have also been known to lethally take sea turtles. Although pathological effects of oil spills have been documented in laboratory studies of marine mammals, as well as sea turtles (Vargo *et al.*, 1986), the impacts of other anthropogenic toxins have not been investigated.

## Reinitiation of Consultation

Reinitiation of formal consultation is required if: (1) the amount or extent of taking specified in the incidental take statement is exceeded, (2) new information reveals effects of the action that may affect listed species or critical habitat (when designated) in a manner or to an extent not previously considered, (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the Biological Opinion, or (4) a new species is listed or critical habitat designated that may be affected by the identified action.

## Conservation Recommendations

Pursuant to section 7(a)(1) of the ESA, the following conservation recommendations are suggested to further reduce or mitigate adverse impacts from the continued operation of the cooling sea water system at St. Lucie Nuclear Generating Plant on loggerhead, leatherback, green, Kemp's ridley and hawksbill turtles:

(1) FPL should continue to carry out or assist in research to determine the subsequent dispersal of captured and released

turtles through its tagging program and through cooperation with properly permitted scientists.

(2) Current procedures for determining turtle residence times in the intake canal tend to underestimate actual residence times. FPL should continue efforts to improve residence time estimates. These efforts may include directed studies of residence time, so long as research permits are obtained from the proper authority.

## Incidental Take Statement

Section 7(b)(4) of the ESA requires that when an agency action is found to comply with Section 7(a)(2), NMFS will issue a statement specifying the impact of any incidental taking, providing reasonable and prudent measures necessary to minimize impacts, and setting forth terms and conditions that must be followed. Only incidental taking by the Federal agency or applicant that complies with the specified terms and conditions is authorized. Specifically, reasonable and prudent measures described below are non-discretionary, and must be implemented by the agency so that they become binding conditions of any permit issued to applicants, as appropriate, in order for the exemption in section 7 (o)(2) to apply. Under the terms of Section 7 (b)(4) and 7 (o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

Based on historical records of sea turtle capture and mortality at the St. Lucie Plant cooling water intake canal, NMFS anticipates that continued operation of the circulating water system at St. Lucie Nuclear Generating Plant may result in the capture and mortality of loggerhead, leatherback, Kemp's ridley, green and hawksbill turtles. Therefore, an incidental take level, and terms and conditions necessary to minimize and monitor takes, is established. Variability in the rate of turtle entrapment at the St. Lucie Plant is considered to be primarily a function of the local abundance of turtles, since the operational characteristics of the intake structures have remained constant over the years. In recent years, green turtle entrapment has increased at a dramatic and unpredicted rate and may continue to increase. Therefore, no take level will be specified for entrapment, capture, and release of any species of turtle.

The lethal take levels below are based on the historical observed lethal takes, but provide for increased total numbers of lethal takings as entrapment levels increase. Consequently, two lethal take levels are specified: one is a fixed level of the number of turtles of each species entrapped during the calendar year, while the other is a percentage of the number of turtles of each species entrapped during the calendar year. The allowable take level will be the greater of the two numbers, considering the

prevailing entrapment rates. The following annual incidental lethal take levels are established:

1. 2 loggerheads, *Caretta caretta*, or 1.5 percent of the total number of loggerheads entrapped at the intake canal, whichever is greater;
2. 3 greens, *Chelonia mydas*, or 1.5 percent of the total number of greens entrapped at the intake canal, whichever is greater;
3. 1 Kemp's ridley, *Lepidochelys kempi*, or 1.5 percent of the total number of Kemp's ridleys entrapped at the intake canal, whichever is greater;
4. 1 hawksbill, *Eretmochelys imbricata*, or 1.5 percent of the total number of hawksbills entrapped at the intake canal, whichever is greater;
5. 1 leatherback, *Dermochelys coriacea*, or 1.5 percent of the total number of leatherbacks entrapped at the intake canal, whichever is greater;

The following terms and conditions are established to monitor the level of take and to minimize the adverse impacts of entrapment and the possibility of lethal takes:

1) Install and maintain a 5in (12.7cm) bar mesh barrier net across the intake canal, east of the existing 8in mesh barrier net. The new net must receive regular inspection, maintenance, and repair on at least a quarterly basis. The regular maintenance schedule notwithstanding, any holes or damage to the net that are discovered must be promptly repaired to prevent the passage of turtles through the barrier net.

2) The existing 8in mesh barrier net must be retained to serve as a backup to the new 5 in. mesh barrier net, which may be lowered occasionally because of fouling and water flow problems. The 8in mesh net must receive regular inspection, maintenance, and repair on at least a quarterly basis. The regular maintenance schedule notwithstanding, any holes or damage to the net that are discovered must be promptly repaired to prevent the passage of turtles through the barrier net.

3) FPL must continue its current program to capture and release turtles from the intake canals. The handling of

captured turtles, treatment and rehabilitation of sick and injured turtles, and disposition of dead turtle carcasses shall be in accordance with permits granted through the FLDEP.

4) Capture netting in the intake canal shall be conducted with a surface floating tangle net with an unweighted lead line. The net must be closely and thoroughly inspected via boat at least once per hour. Netting shall be conducted whenever sea turtles are present in the intake canal according to the following schedule:

a) 8 hours per day, 5 days per week, under normal circumstances;
b) 12 hours per day or during daylight hours, whichever is less, 7 days per week, under any of the following circumstances:
   i) an adult turtle occurs in the canal during mating or nesting season (March 1 through September 30),
   ii) an individual turtle has remained in the canal for 7 days or more,
   iii) a leatherback turtle occurs in the canal,
   iv) an apparently sick or injured turtle occurs in the canal.

From DEP permit. If DEP changes the permit then the license condition would require

Reasonable deviations from this schedule due to human safety considerations (i.e., severe weather) are expected.

5) If a turtle is observed in the intake canal west of the 8 in. barrier net, directed capture efforts shall be undertaken to capture the turtle and to prevent it from entering the intake wells.

6) The gratings at each of the intake wells shall be visually checked for turtles at least 8 times each 24-hour period. If a turtle is sighted in an intake well, dip nets or other non-injurious methods should be used to remove the turtle.

7) Considering the recent increases in turtle entrapment at the St. Lucie Plant intake canal and the possibility of future increases, operation of the current turtle capture and removal program may become increasingly expensive and

result in unacceptable take levels. Although some engineering solutions to prevent or reduce turtle entrainment at the intake structures have already been investigated, increasing burdens on the turtle capture and removal program warrant the investigation of other possible alternatives. Little or no information has been provided on the factors that attract turtles to the intake structures and the specific behaviors of turtles in the immediate vicinity of the intake structures. Without such information, it is unlikely that solutions or mitigative measures can be developed to decrease the current take levels. FPL must design and implement a study to collect information on the behavior of turtles at the intake structures. This may be accomplished by remote videography or similarly designed methodology that will not interfere with turtle behavior. FPL shall provide NMFS with the proposed plan for collecting these data by June 30, 1997. Once the plan is approved and the study is initiated, FPL must report quarterly on progress in this regard and shall provide a final report by December 31, 1998.

8) FPL must continue to participate in the STSSN, under proper permits and authority, in order to assess any possible delayed lethal impacts of capture as well as to provide background data on the mortality sources and health of local sea turtles. As a point of clarification, stranded sea turtles will generally not be counted against the authorized level of lethal incidental take in this incidental take statement, but information from strandings may be the basis for the determination that unanticipated impacts or levels of impacts are occurring.

9) FPL should continue to conduct, under proper permits and authority, the ongoing sea turtle nesting programs and public service turtle walks.

10) Monthly reports covering sea turtle entrapment, capture efforts, turtle mortalities, available information on barrier net inspections and maintenance, and the Taprogge cleaning system operation and any sponge ball loss at St. Lucie Plant shall be furnished to NMFS. In addition, an annual report discussing these same topics shall be furnished to NMFS. Also, a meeting shall be convened



reports required by DEP

between FPL, NRC, and NMFS to discuss endangered and threatened species information and developments at the St. Lucie Plant approximately every two years beginning January 1998.

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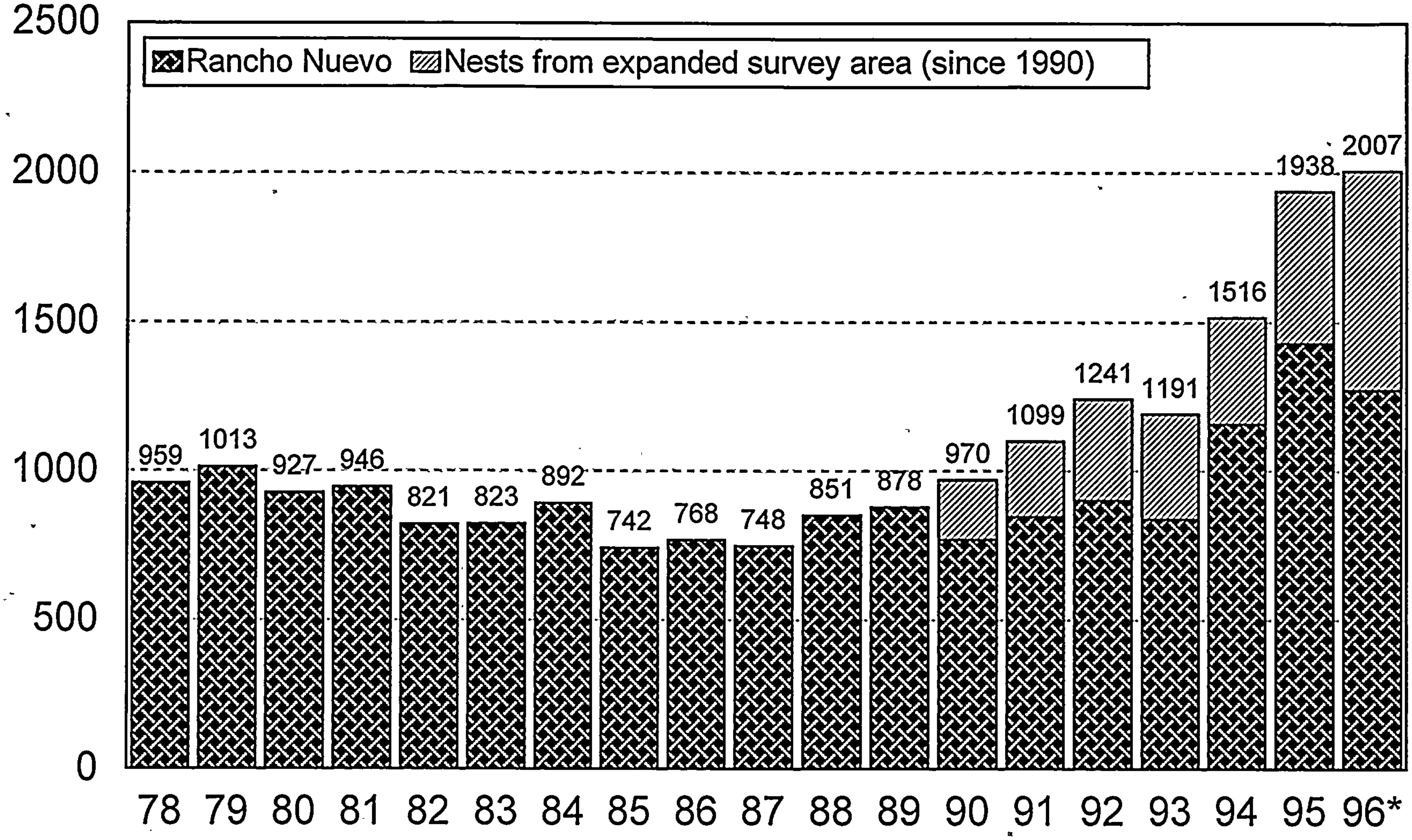
Figure 1

# Kemp's ridley nests at Rancho Nuevo, Mexico, 1978-1996

Data from R. Marquez et al., 1995 manuscript submitted to Marine Turtle Newsletter and Marquez pers comm




*1996 numbers are preliminary