Biological Assessment of Impact to Sea Turtles at Florida Power Corporation's Crystal River Energy Complex

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SUMMARY

This biological assessment examines the impact of Florida Power Corporation's (FPC) Crystal River Energy Complex on five species of federally listed sea turtles. It has been prepared in accordance with Section 7 of the Endangered Species Act (ESA) of 1973, as amended. This biological assessment is being submitted to the Nuclear Regulatory Commission (NRC) to support an ESA Section 7 consultation with the National Marine Fisheries Service (NMFS) and the issuance of a biological opinion and Incidental Take Statement.

There are five species of sea turtles which are known to occur in the Gulf of Mexico. They are the green, loggerhead, leatherback, hawksbill, and Kemp's ridley turtles. Since the initial commercial operation of Crystal River Units 1, 2, and 3 (1966, 1969, and 1977, respectively), green, loggerhead and Kemp's ridley sea turtles have been occasionally observed in the vicinity of the power plant intake canal.

In early 1998, FPC observed a significant increase in the number of Kemp's ridley sea turtles stranded on the bar racks of the Crystal River power plants. As a result, FPC implemented extensive measures to protect the sea turtle population. These measures included: (1) A continuous, 24 hour per day, 7 day per week sea turtle watch; (2) Implementation of sea turtle rescue and handling guidelines; (3) Training of appropriate FPC personnel in basic sea turtle biology, handling, resuscitation, and care; (4) Expedited bar rack cleaning to reduce fouling growth and minimize water velocity across the racks; (5) Implementation of a pilot sea turtle entanglement net program; and (6) Acquisition of a marine turtle permit authorizing FPC personnel to perform sea turtle stranding and salvage activities.

FPC closely coordinated stranding activities with the Florida Department of Environmental Protection (FDEP) to ensure the proper care and treatment of each stranded sea turtle. Live, stranded sea turtles rescued from the intake bar racks were promptly examined by an FPC biologist and overall health was evaluated. At the direction of the FDEP, healthy turtles were returned to the Gulf of Mexico. Weak, injured or diseased turtles were transferred to the Clearwater Marine Science Station for rehabilitation, and sea turtle mortalities were transferred to the FDEP or the Clearwater Marine Science Station for necropsy or disposed in accordance with FDEP instructions.

The sea turtle protective measures implemented at the Crystal River Energy Complex have been effective and successful in protecting sea turtles. By utilizing these protective measures, the Crystal River Energy Complex will not jeopardize any sea turtle species. FPC requests that an Incidental Take Statement be issued which establishes protective measures for sea turtles while allowing incidental take. The annual lethal take related to power plant activity is expected to be limited to four Kemp's ridley and one each of green and loggerhead turtles. FPC can not accurately predict the level of annual lethal takes not related to power plant activity due to the variability and increasing numbers of state-wide sea turtle strandings.

INTRODUCTION

The purpose of this biological assessment is to determine the impact, if any, of the Crystal River Energy Complex on sea turtles that are protected under the Endangered Species Act (ESA) of 1973, as amended. The ESA is designed to conserve endangered and threatened species of fish, wildlife, and plants. Section 7 of the Act provides for cooperation among federal agencies to ensure that actions by the agencies do not jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of habitat of the species under consideration.

Sea turtles historically have had a minimal presence in the waters of the Crystal River Energy Complex intake canal. In early 1998, FPC observed a significant increase in the number of sea turtles present in the canal. The reasons for this sudden increase are not certain.

In response to this increased sea turtle presence, a meeting between FPC, NRC, NMFS and FDEP was held on May 13, 1998, to initiate consultation in accordance with the ESA. It was determined that the consultation will include the NRC, which is the licensing federal agency for Crystal River Unit 3; the NMFS, which has jurisdiction over sea turtles in waters of the United States; the United States Environmental Protection Agency (EPA), which is the federal agency administering the Crystal River Units 1, 2, and 3 National Pollutant Discharge Elimination System (NPDES) permit; and the FDEP, which has been delegated NPDES responsibilities and also coordinates marine turtle stranding activities in Florida.

This consultation does not involve the United States Fish and Wildlife Service, which has jurisdiction over sea turtles only when they venture onto land for nesting purposes and during egg incubation. The impact to sea turtles at the Crystal River Energy Complex does not involve nesting sea turtles.

SITE DESCRIPTION

Location

The Crystal River Energy Complex is located on an approximate 5,000 acre site near the Gulf of Mexico in Citrus County, Florida (Figure 1). The complex is approximately 7-½ miles northwest of the city of Crystal River, within the coastal salt marsh area of west central Florida.

Crystal River Energy Complex

The Crystal River Energy Complex contains five separate power plants (Figure 2). Unit 1 is an approximately 400 MW electric (MWe) coal-fueled plant, which began commercial operation in October 1966. Unit 2 is an approximately 500 MWe coal-fueled plant, which began commercial operation in November 1969. Unit 3 is an approximately 890 MWe pressurized water, nuclear-fueled plant, which began commercial operation in March 1977. Units 4 and 5 are two coal-fueled plants at approximately 640 MWe each. Units 4 and 5 began commercial operation in December 1982 and December 1984, respectively.

The Gulf of Mexico provides cooling and receiving waters for Units 1, 2, and 3 condensers and auxiliary cooling systems. Units 4 and 5 are cooled by natural draft cooling towers, with make-up water drawn from Units 1, 2, and 3 discharge canal.

The discharge canal is a dredged canal 2.8 miles long with an average depth of 15 feet. It is located north of Units 1, 2, and 3 extending westward to the Gulf of Mexico.

The intake canal is a dredged canal approximately 14 miles long with an average minimum depth of 20 feet. The canal is bordered on both sides by land beginning from the plant site and extending 3 miles to the west. The canal then extends westward an additional 11 miles out into the Gulf of Mexico.

The original canal was dredged in 1966 by hydraulic cutter suction and drag line to a depth of 15 feet. Approximately 375,000 cubic yards of material was removed, composed of 90% rock.

In 1977, the canal was maintenance-dredged to remove the shoaling that accumulated at the side slopes of the canal. Approximately 12,000 cubic yards of material were removed by a crane with a clam shell bucket and barged upland to a spoil retention pond. Starting in 1978, the intake canal was expanded to the following specifications:

Depth: 20 feet below mean low water level.

Width: From the plants proceeding west, 150 feet wide for 2.8 miles, then 225 feet wide for the next 6.25 miles, then 300 feet wide for the next 4.9 miles to marker #2 of the Cross Florida Barge Canal.

Length: Approximately 14 miles. The canal alignment includes a dogleg at marker #10 and enters the Cross Florida Barge Canal at marker #8.

Spoils: The existing spoil area was extended 1.2 miles on the south side of the intake in the seaward (west) direction. The dike dimensions are 50-100 feet in top width, elevated approximately 10 feet above mean low water.

Capacity: There is an intake canal water flow of approximately 1.3 million gallons per minute during normal plant operation. This results in an incoming water velocity of approximately one (1) foot per second upstream of the intake structures.

Crystal River Mariculture Center

In addition to the five power plants, FPC operates the Crystal River Mariculture Center at the Energy Complex. This multi-species marine hatchery was established to offset fisheries' concerns associated with the once-through cooling systems of Units 1, 2, and 3. FPC will culture and release twelve different marine species. The Mariculture Center consists of a two-story hatchery building outfitted with various tanks and filtered seawater systems along with eight, one-acre ponds. The facility is staffed by professionals trained in marine ecology, fisheries science, and aquaculture.

Intake Structures

The intake structures of the power plants are concrete structures with bar racks, traveling screens, and seawater pump components. Surface water trash barriers are deployed in front of the bar racks to collect large floating debris. Water is drawn from the intake canal through the bar racks, through the traveling screens, into the pumps and flows through the plant condensers and auxiliary systems. The water is then discharged through an outfall into the discharge canal. The discharge canal directs the water back to the Gulf of Mexico.

Bar Racks

The intake bar racks prevent trash and large debris carried by the seawater from entering the intake structure. The seawater must pass through a bar rack made of steel bars spaced on 4-inch centers. The bar racks extend from well above the water line to the concrete base at the bottom of the intake canal.

Units 1 and 2 have two bar racks for each circulating water pump. There are 16 bar racks at the Units 1 and 2 plants. Unit 1 racks are each 8'-2" x 26'-7¾" (217.6 ft^2). The Unit 2 racks are 7'-2" x 26'-7¾" (191 ft^2). Both units have bar racks with a distance between the vertical bars of 3-5/8". Each rack sits at an angle of 12° from vertical, with the bottom section extending out into the intake canal about 5½ feet.

There are a total of eight bar racks at the Unit 3 intake structure. Seven of the bar racks serve the circulating water condenser system. The other bar rack serves the nuclear services and decay heat water systems. The seven large bar racks are 33' high and 15'-7-5/8" wide. The eighth bar rack is 33' high and 9'-3-5/8" wide. All of the bar racks have 4"x3/8" bars at 4-inch centers, with a 3-5/8" distance between the vertical bars. Each bar rack is aligned at an angle of 10° from vertical, with the bottom section extending out into the canal about 5 feet.

Based on mean sea level, circulation flow rate and flow area, the water velocity through Units 1 and 2 bar racks is less than 1 foot per second. The water velocity through Unit 3 is approximately 1 foot per second.

The CR-3 bar racks are cleaned of large debris, as needed, with the use of a mechanical trash rake. This trash rake can be extended down to the bottom of the bar racks and drawn upward to the surface. During periods of high turtle activity in the intake canal, the rake was operated on a daily basis to check for underwater strandings of sea turtles. The Units 1 and 2 bar racks are periodically cleaned using a manual hand rake, and are also removed for cleaning as needed. Bar rack cleaning is performed mechanically by scraping and pressure washing. The bar racks are then coated with a biofouling preventative material.

Traveling Screens

Debris and marine life smaller than the bar rack 3-5/8" openings are able to pass through the bar racks. The traveling screens effectively remove this floating or suspended debris from the intake water to assure a continuous supply of clean water to the condensers and heat exchangers. The traveling screens prevent debris larger than approximately 3/8" from getting to the pumps.

Intake water passes through these screens, which suspend debris and solid materials onto the screens. The screens are conveyed upwards to an overlapping water spray system which washes these materials off the screens and into a debris trough. The traveling screen systems are operated approximately three times per day.

Water Pumps

Each plant has four large circulating water pumps used to draw seawater into the plant. The water is then pumped through the condensers and out to the discharge canal. On Units 1 and 2, the total design flow is 638,000 gpm. Unit 3 design flow is 680,000 gpm. In addition, Unit 3 has a low flow nuclear services water pumping system with a normal flow rate of approximately 10,000 gpm. Under emergency conditions, additional pumps would increase this flow up to approximately 20,000 gpm.

From the discharge of the pumps, the water flows to the main condensers; and for Unit 3, an additional flow path exists for the nuclear services and decay heat cooling water heat exchangers. After the seawater passes through the tubes of the condenser and/or heat exchangers, the seawater is transported in underground pipes to the discharge canal. The discharge canal directs the water back to the Gulf of Mexico.

SEA TURTLES IN THE GULF OF MEXICO

Loggerhead Sea Turtle

The loggerhead turtle (*Caretta caretta*) is a medium to large sea turtle with a streamlined carapace and limbs modified as flippers. The carapace is elongated and somewhat tapered posteriorly. The head is large with powerful jaws adapted to crushing. The mean straight carapace length of adult southeastern United States loggerheads is about 92 cm with a corresponding mean body weight of about 113 kg. Loggerheads generally have a reddish-brown carapace with a yellow to cream-colored plastron. Hatchlings are brown to reddish-brown dorsally and from buff to gray-black ventrally. The carapace is composed of five pairs of costal scutes, eleven or twelve pairs of marginal scutes, and five vertebral scutes. The loggerhead can be distinguished from other Florida sea turtles by the large size of its head, reddish-brown color, and the presence of two pairs of prefrontal scales on the head and five pairs of pleurals on the carapace.

Loggerhead sea turtles are circumglobal in distribution, but major nesting grounds are located in temperate and subtropical regions, primarily in the southeastern United States, Mexico, Oman, Australia, South Africa, the Mediterranean, and Japan. In Florida, adult loggerheads are found in all coastal waters, and sub-adults frequent the Indian River Lagoon system, among other areas.

In the United States, most nesting occurs from North Carolina southward around the tip of Florida to the vicinity of Tampa Bay. The greatest percentage of loggerhead nesting in the United States occurs in Florida, primarily from Brevard County south to Broward County. Hatchlings and small juveniles from southeastern U. S. beaches ride oceanic currents in offshore drift lines in the Atlantic Ocean for several years, and juvenile loggerheads from Florida have been found rafting as far away as the Azores. Hatchlings and small juveniles are most often associated with floating mats of *Sargassum* in pelagic habitats.

Loggerheads inhabit continental shelves, bays, lagoons, and estuaries in temperate, subtropical, and tropical waters depending on season and life stage. They occur offshore to the western edge of the Gulf Stream, although most individuals prefer the shallow water of the continental shelf. Loggerheads are solitary, although they may form aggregations at sea or in the vicinity of nesting beaches.

Nesting in Florida occurs from late April through September. Loggerheads favor high energy mainland beaches as nesting sites. A female deposits an average of 110 - 120 eggs per nest, and most nest 2 - 6 times per season at 14-day intervals. Most loggerheads do not nest each year. Incubation takes from 50 - 75 days depending on nest temperature. A hatchling's sex is determined by its incubation temperature rather than by genotypic sex determination. Hatching most often occurs at night, and the hatchlings are oriented to the water by positive phototaxis of natural light reflecting off the water surface. Sexual maturity is reached at 15 - 20 years of age depending on growth rate. Little is known of migratory routes or of life history activities away from nesting beaches.

The food of loggerheads consists primarily of mollusks, crustaceans, and horseshoe crabs. As sub-adults, they feed in rich coastal developmental habitats, including lagoonal ecosystems. Loggerheads are active diurnal foragers and make dives of moderate depth and duration.

Loggerhead sea turtles nest farther north than any other sea turtle, and they use a wide variety of habitats during their life span. The Florida population is the second largest nesting population in the world, and one of the only two that includes some individuals that overwinter by burying in mud.

Mortality factors are both natural and human induced. Natural mortality factors affecting nests, hatchlings and adults include predation, beach erosion, tidal inundation, hypothermia, parasitism, disease, and vegetation.

The major predators of nests are raccoons, but eggs are also preyed upon by ghost crabs, hogs, foxes, ants, crows, vultures, and other birds. Hatchlings are eaten by ghost crabs, birds, and many marine predators, and adults are preyed upon by sharks.

The root systems of dune vegetation can invade turtle nests and cause egg mortality, and root systems can grow over a nest and block escape. Hatchlings and females can become fatally entangled in vegetation.

Little is known about diseases in loggerhead turtles or the impact these diseases have on population levels. Papillomas, similar to those found on green turtles, occasionally occur on loggerheads. In addition, a "diseased turtle syndrome" affecting east coast loggerheads has been identified. Stranded turtles have been found infested with blood flukes, and a variety of bacterial and fungal pathogens, which are believed to cause mortalities in loggerheads.

Human-induced mortality factors have been extensively studied. Habitat alteration has accelerated along coastal nesting beaches. This can compromise the suitability of beaches for nesting, result in disturbance of nesting females, destruction of nests by beach activities, and increased injuries and death from boat propellers. Artificial lighting along beachfronts can disorient hatchlings and deter females from nesting.

The most important source of human-induced mortality to juvenile and adult loggerheads is the shrimp fishery. In marine habitats, the National Marine Fisheries Service indicates that greater than 11,000 loggerheads die annually in shrimp trawls. Other types of fishing gear such as gill nets, fish traps, and long lines collectively account for about 10% of the mortality associated with the shrimp fishery, constituting the second largest source of mortality to juveniles and adults.

Dredging has been documented to cause significant turtle mortality in some areas. Boat collisions are also a significant source of mortality in Florida, with 6 - 8% of strandings showing evidence of boat collisions (National Research Council, 1990).

Sea turtle nests are vulnerable to human predation, and though rates of illegal takes are unknown, poaching continues despite regulations against such activities.

More long-term threats result from pollution of the ocean. Plastic debris and tar are commonly found in the digestive tracts of stranded turtles. Loggerheads, especially hatchlings and juveniles, mistake styrofoam, plastic debris, tar balls, and other refuse for food. Though these materials may clog the mouth, throat, gut, and nasal passages of turtles, the exact role of ingested debris in the death of stranded turtles, however, is often unclear.

Entrapment in power plant intake pipes was mentioned in the National Research Council's report as a relatively minor source of turtle mortality. The Council estimates that from New York to Texas, 57 loggerheads are killed per year by power plant entrapment.

Green Sea Turtle

The green sea turtle (*Chelonia mydas)* is the largest hard-shelled turtle. Mature females in Florida have a mean straight carapace length of 101.5 cm and corresponding body weight of 136.1 kg. Hatchlings are solid black to dark gray above with a white margin circumscribing the posterior carapace and the trailing edge of the flippers. The plastron is creamy white. The juvenile carapace is brownish to greenish, with light and dark streaks radiating within each scute. The adult carapace is primarily olive with numerous black spots. The green turtle has four pairs of costal scutes and one pair of prefrontal scales.

The green turtle is circumglobal in distribution, but generally ranges throughout the tropics and subtropics worldwide. In the U. S., green turtles are known to occur from New England to Texas and from Puerto Rico and the Virgin Islands. Nearly all of the species' nesting in the United States occurs in Florida, and most of that along the east coast. There are few records of nesting from the gulf coast of Florida, but there is an important population of immature green turtles in the area from Homosassa Bay to Cedar Key. Other significant populations of immature green turtles forage in the Indian River Lagoon system and Florida Bay.

Hatchlings emerge from beach nests and immediately swim offshore, and are thought to become associated with floating pelagic vegetation. Juveniles first appear along Florida coastal waters at one to three years of age. Juveniles 2 - 60 kg forage as herbivores in shallow coastal waters before abandoning this developmental habitat as sub-adults. The primary habitat of adult green turtles is shallow, protected waters supporting growth of benthic algae and seagrasses.

Nesting occurs on Florida beaches from May to September. Their preferred nesting habitats are on high energy beaches. Females deposit up to six clutches averaging 136 eggs each and return to the same stretch of beach at predominantly two-year intervals. The green turtle does not form social groups and is a solitary nocturnal nester.

Green turtles are diurnal, feeding during the day and often returning to a particular ledge or coral head to spend each night. The green turtle is the only herbivorous sea turtle and one of the very few large marine herbivores. In the pelagic post-hatching stage, green turtles are thought to have an omnivorous or carnivorous diet. Upon entering benthic feeding grounds (20 - 25 cm length), they shift to a diet of algae and seagrasses. Green turtles are selective grazers, favoring growing shoots of seagrasses and a variety of algae. As a result of their low protein herbivorous diet, their growth is slow. They reach sexual maturity later than other sea turtles and have a smaller reproductive output.

Their nesting behavior is very similar to the loggerheads, though they excavate a deeper body pit and produce a higher nest mound. As a result, green turtle eggs are buried deeper than the loggerheads.

The green turtle has been exploited commercially for its meat (turtle steaks and the stock for green turtle soup) more than any of the other sea turtles. In recent years, green turtles have also been the source of skins and oil for the leather and cosmetics trade.

Natural mortality factors affecting eggs and hatchlings are similar to those described for the loggerhead turtle, with a few exceptions. Due to the greater depth of the egg cavity, green turtle nests are less susceptible to predation by raccoons and other small mammals. Green turtles appear to be more susceptible to hypothermia.

Green turtles are subject to a largely species-specific disease called fibropapillomatosis. Though a specific pathogen is yet to be identified, the disease is thought to be viral in origin. The condition is characterized by tumorous growths on the skin and inside the body cavity. These tumors restrict movement, cause blindness, promote parasite infestation, and increase the likelihood of entanglement.

Green turtles are not commonly taken in shrimp trawls, but are vulnerable to entanglement in other varieties of fishing gear. Other human-induced mortality factors are similar to those described for loggerheads.

Leatherback Sea Turtle

The leatherback sea turtle (*Dermochelys coriacea)* is the largest of all marine turtles, with adults weighing 500 - 900 kg, attaining a carapace length of 150 - 170 cm. The scutes, limb and head scales, and claws typical of nearly all other turtle species are absent, although hatchlings are covered with bead-like scales that disappear within a few months. The overall color of the dorsal surface is black, with variable white spotting. The underside is white or pinkish, with some dark infuscation. The carapace is made primarily of tough, oil-saturated connective tissue raised into seven prominent longitudinal ridges and tapered to a blunt point posteriorly. The beak is strongly cusped at all ages, and in adult females there is a pink blaze on the crown of the head. Specimens between hatchling size and a carapace length of about 120 cm are very rarely encountered.

The morphology is unique, with a shell structure which includes a neomorphic layer of thousands of bones forming a continuous mosaic underlain by a layer of oily connective tissue about 4 cm thick. Physiologically the species is unique among turtles in showing a substantial degree of endothermy, facilitated by counter-current heat exchange mechanisms in the shoulder region to allow the forelimbs to cool close to ambient temperatures without losing significant deep-body heat.

The leatherback is found worldwide, from the tropics to high latitudes. This extremely wide-ranging species nests on tropical beaches, usually mainland shores of the Atlantic, Indian, and Pacific Oceans. Although found in coastal waters, the leatherback is mainly pelagic, and is capable of traveling great distances between nesting and foraging grounds.

Nesting by leatherbacks occurs regularly, though not abundantly, in Florida. Most nesting records are for the Atlantic coast, with few records of hatchlings on the Gulf coast. Preferred nesting habitats are tropical mainland shores with a steep beach profile and deep water close to shore. Philopatry is less precise than in most other marine turtles, and leatherbacks may rapidly occupy newly-formed nesting habitats.

Growth rates in the wild are uncertain but may be extremely rapid, with the possibility of maturity after only three years. Feeding is at the surface or in the water column rather than benthic. Preferred feeding habitats are pelagic, temperate zone waters that support large populations of jellyfish, the leatherback's main prey item. The diving ability of the leatherback is unmatched by any other reptile. They are capable of dives in excess of 1,000 m to reach food.

Leatherbacks have several adaptations for their highly specialized diet of jellyfish and other coelenterates. They have a highly expandable oral cavity, scissor-like jaws and an esophagus lined with stiff spines that project backward to aid in holding and swallowing prey. Jellyfish are a low energy source and large quantities must be consumed to maintain this large turtle. Pritchard (1979) reported that young leatherbacks in captivity consumed twice their weight in jellyfish daily.

Nesting occurs in the spring and early summer months in the North Atlantic. Nests include, on average, 80 - 85 normal eggs, with the addition of smaller, yolkless, and often deformed eggs. These are laid toward the end of the clutch, and usually are a few dozen in number. As many as 10 nestings may occur in a season, at mean intervals of about 10-½ days. Nesting rarely occurs in successive seasons, and often two non-breeding seasons will occur between nesting seasons.

The leatherback nests are resistant to predators because of the depth of the egg cavity, but the high energy beaches they favor for nesting are very prone to storm erosion. The pelagic nature of the leatherback insulates it from many human-induced sources of mortality like trawling, dredging and boat collisions. Excessive egg collecting in Central America and the beach slaughter of nesting females in Guyana and the Antilles contribute to the decline of the Atlantic populations. The leatherback is vulnerable to plastic ingestion, particularly polyethylene bags, which they mistake for jellyfish. No specific disease pathogens are reported for leatherbacks.

Worldwide the leatherback is more abundant than has often been thought, with an estimated world population of 136,000 breeding females. The National Research Council (1990) concluded that although data is scarce, leatherback populations worldwide appear to be stable.

Hawksbill Sea Turtle

The hawksbill sea turtle (*Eretmochelys imbricata)* is a small to medium-sized sea turtle. Adult females in the Caribbean range from 62.5 - 94.0 cm straight carapace length, with adults weighing between 80 – 127 kg. The species is characterized by two pairs of prefrontal scales, posteriorly overlapping scutes on the carapace (except very young or very old animals), four pairs of costal scutes, two claws on each flipper, and a sharply pointed, beak-like mouth. The carapace is often distinctly patterned with radiating streaks of yellow, reddish brown, brown, and black.

Hawksbills are circumpolar in distribution, being widely distributed in the Caribbean and western Atlantic. They normally occur in Florida southward along the Central American mainland to Brazil and throughout the Bahamas and the Greater and Lesser Antilles, almost always in close association with coral reef habitats. Hawksbills are more sedentary than other species as adults, and the hatchlings do not disperse into the north Atlantic gyre. According to stranding and museum records, the known range of the hawksbill in Florida extends north to Duval County on the east coast and to Levy County on the west coast.

Hawksbills are most typically associated with coral reefs but also occupy other hard-bottom habitats such as limestone ledges and outcroppings.

Hawksbills nest on tropical islands and mainland shores of the tropics worldwide. Typical nesting beaches are low energy narrow beaches often with vegetation growing almost to the water's edge. Hawksbills nest throughout their circumtropical range with few known aggregations. Although historical records of nesting in Florida are rare, increased surveillance of beaches has resulted in the documentation of a few nests nearly every year. Females may nest several times within a season, usually at 15 to 18 day intervals. Nesting in subsequent seasons is usually non-annual. Hawksbills have been observed to exhibit a high degree of nest site fidelity.

A wide variety of food items have been documented in feeding studies of hawksbills. But with the exception of a few fishes, no other vertebrate shares the highly spongivorous feeding habit of the hawksbill. The sharp silicate spicules of the sponges make them unpalatable to many organisms, but are tolerated by the digestive system of the hawksbill.

The mortality factors discussed for loggerheads also apply to hawksbills. The hawksbill is unique as being the source of true tortoiseshell, which is derived from the epidermal scutes overlaying bones of the carapace and plastron. This highly decorative material has been used for centuries in jewelry, ceremonial articles, and inlay work. Although the widespread use of eggs and meat is a threat to the species, exploitation for tortoiseshell is undoubtedly the principal cause for the population decline throughout the world.

In the Caribbean, fisheries for lobster and reef fish have resulted in significant incidental take of the hawksbill.

In Florida, pollution of offshore waters by petroleum products is a serious threat to early life-history stages. Entanglement in monofilament line and nets is also a well documented source of mortality.

Kemp's Ridley Sea Turtle

The Kemp's ridley (*Lepidochelys kempi*) is a small species of sea turtle with an extremely broad carapace, not tapered posteriorly, that is sometimes wider than it is long. The small orbit located high on the head above the deep upper jaw creates a parrot-like appearance. Mature females average about 64 cm in carapace length (range 58 - 75 cm) and range in weight from 32 to 49 kg. Dorsal coloration of the adult is gray to olive-green with a yellowish plastron. Hatchlings are uniformly dark (black when wet), with the plastron becoming lighter (white) after several months. This dark color phase persists well after the pelagic life stage. There is a transition from the juvenile coloration to the adult beginning at about 28 cm carapace length.

Kemp's ridleys are largely confined to the Gulf of Mexico, with a few occurring along the United States eastern seaboard as far north as Long Island Sound. Immature Kemp's ridleys range widely throughout the Gulf of Mexico and in the North Atlantic from Florida northward to Nova Scotia and eastward to Bermuda, the Azores, and Europe. Within the Gulf of Mexico, juveniles are more common in the northern Gulf, particularly in the coastal waters from Texas to Florida.

Kemp's ridleys are associated with a wide range of coastal benthic habitats, usually sand or mud bottoms that support an abundant fauna of crustaceans and other invertebrates. Their primary prey consists of portunid crabs, especially the genus *Callinectes*. However, other crab species are consumed, along with mollusks and other benthic species.

The smallest post-pelagic individuals recorded are about 20 cm in carapace length and are usually found in the shallow coastal waters, bays, and sounds in waters less than 2 m deep. However, movement to deeper, warmer water in the winter months has been reported. Adults and older sub-adults are found in deeper water than juveniles but appear to be restricted to the inshore zone or banks further offshore. Seasonal and reproductive migrations also appear to be restricted to coastal rather than pelagic routes.

Kemp's ridleys show a high degree of social behavior. They aggregate offshore of the nesting beaches, sometimes for days, and then all emerge synchronously to nest, usually during daylight. Almost the entire nesting effort takes place on a few kilometers of beach at Rancho Nuevo, Tamaulipas, Mexico. Some scattered nesting does take place to the north and south of Rancho Nuevo in Mexico. In the United States, a few Kemp's ridleys have been recorded nesting in south Texas and Florida. Kemp's ridleys nest annually and deposit 1 - 3 clutches of about 110 eggs each.

Little is known about the distribution or occurrence of Kemp's ridley hatchlings in the pelagic stage in the Gulf of Mexico. The coastal benthic zone of the northern Gulf of Mexico is an important developmental habitat for young Kemp's ridleys after leaving the pelagic environment. Older sub-adults are found in the eastern Gulf at Cedar Key, Florida. In the Atlantic, sub-adult Kemp's ridleys appear to be highly migratory, foraging as far north as Chesapeake Bay in the spring, summer, and fall, then migrating south in winter to Cape Canaveral, Florida. In New England, small Kemp's ridleys are frequently found cold-stunned in winter in Long Island Sound and Cape Cod Bay.

Mortality factors affecting nests and hatchlings for the Kemp's ridleys are similar to those discussed for loggerheads. There has been a dramatic decline of the nesting assemblage from an estimated 40,000 females in 1947 to approximately 600 females in the late 1980s. Since that time, the number of recorded nests has increased, indicating an increase in the number of nesting females. In 1995, 1,930 Kemp's ridley nests were reported.

Reasons for the decline were intensive egg collecting, taking of females, and shrimp trawl mortality on the foraging grounds. Drowning of Kemp's ridleys in shrimp trawls is believed to be the single most important factor responsible for the continued decline of females and the prevention of recruitment of sub-adults into the breeding stock. The small population and restricted distribution of the Kemp's ridley make it particularly vulnerable to catastrophic population declines.

There are no specific pathogens reported for the Kemp's ridley, although bacterial and fungal infection are major causes of egg mortality in the closely related olive ridley.

The Kemp's ridley is the most seriously endangered of the sea turtles. Five decades ago, Kemp's ridley was very abundant in the Gulf. Its rapid decline since 1947 was most likely caused by human impacts at the primary nesting beach near Rancho Nuevo, Tamaulipas, Mexico and at sea due to shrimp fisheries.

Following the precipitous population decline, the Mexican and U.S. governments began protecting the species. In the mid-1980s, the number of Kemp's ridley nests laid at Rancho Nuevo began to increase in what now appears to be an exponential trend of 11% per year. The annual level of total human-induced mortality and serious injury was estimated by the National Research Council (1990) to be 575 - 5,750 Kemp's ridleys.

Kemp's ridley turtles are known to inhabit the coastal areas of the Gulf of Mexico along the Florida west coast. The area from Homosassa to Cedar Key is an area documented to be frequented by juvenile and sub-adult Kemp's ridleys. Therefore, it would not be unusual to expect immature Kemp's ridleys near the intake canal of the Crystal River Energy Complex.

The Kemp's ridley population appears to be in the early stage of exponential expansion. A majority of the sea turtles stranded at the Crystal River Energy Complex during 1998 were Kemp's ridley sea turtles. Population increases in the Gulf of Mexico could result in an increased occurrence of juvenile and sub-adult Kemp's in the vicinity of the power plant intake canal. It remains to be seen if the large influx of sea turtles, beginning in February 1998, was an unusual event, or the beginning of an increased seasonal presence of sea turtles in the intake canal.

SEA TURTLES AT THE CRYSTAL RIVER ENERGY COMPLEX

Historical Perspective

Five species of marine turtles are known to occur in the Gulf of Mexico. They are the green, hawksbill, Kemp's ridley, leatherback, and loggerhead turtles. Of those, the Kemp's ridley, green, and loggerhead have occasionally been found near the Crystal River Energy Complex.

Since Units 1, 2, and 3 began commercial operation, marine turtles have been occasional visitors in the intake canal. FPC records indicate that from 1994 through 1997, eight sea turtles were stranded on the Unit 3 intake bar racks. During these strandings, the Florida Marine Patrol Division of the Department of Environmental Protection was consulted and provided instructions on handling and disposition.

1998 Occurrences

The number of marine turtle sightings in the intake canal and strandings on the bar racks increased dramatically beginning in late March and early April 1998. The majority of these were Kemp's ridley sea turtles on the Unit 3 bar racks. The sightings and strandings decreased dramatically in May 1998.

During February 1998, FPC discovered two live sea turtles stranded against the bar racks of Crystal River Unit 3. FPC notified FDEP and returned the healthy turtles to the Gulf of Mexico. At the time, the presence of these sea turtles was considered to be typical of the occasional appearance of sea turtles.

During March 1998, an additional 19 sea turtles were stranded and rescued from the Unit 3 bar racks. Four mortalities were discovered floating in the intake canal. These four mortalities were considered not causally related to plant operation since they were found upstream of the power plant intake structures. It is highly unlikely that a turtle mortality related to power plant operation could float upstream against the incoming water current and bypass the surface trash boom structures.

When it became apparent that the influx of sea turtles during March was much higher than historical precedence, FPC took several comprehensive steps to protect sea turtles in the intake canal. These steps included a continuous 24 hour per day observation of the bar racks; implementation of rescue, resuscitation, and handling guidelines; and expedited cleaning of the bar racks.

In April, the influx of sea turtles continued but began to decline toward the end of the month. An additional 14 stranded sea turtles were rescued and 7 mortalities were discovered. Four of the mortalities were discovered in early April when the bar racks were raised for cleaning. From the condition of the carcasses, it is evident that the mortalities had occurred prior to the initiation of the 24-hour observation program. The apparent cause of death was drowning against the bar racks. The other three mortalities were found floating in the intake canal upstream of the power plants and were not considered to be causally related to power plant operation.

During May 1998, the number of sea turtles observed in the intake basin, as well as stranded against the bar racks, began to decrease as rapidly as it had increased. A total of four sea turtles were rescued from the bar racks, with two mortalities also being recovered. One of the mortalities was a carcass seen floating upstream in the intake canal and eventually recovered near the intakes of Unit 1 and 2. It had evidence of a boat collision. The other mortality was a small Kemp's ridley observed to slip between the vertical bars of the Unit 3 bar racks and became stranded between the bar racks and the traveling screens. Rescue efforts were made to release the turtle back out into the intake canal. However, approximately two weeks after the initial observation, the turtle was recovered from the traveling screen trash basket. Attempts at resuscitation were unsuccessful, and the carcass was transferred to the University of Florida for a detailed necropsy. Necropsy results indicated that the sea turtle was likely in a weakened condition due to disease prior to entering the intake structure.

During June and July 1998, no sea turtles were stranded at the Crystal River Energy Complex. The 24-hour continuous observations were reduced to once every 2 hours, 24 hours per day, 7 days per week.

During August 1998, one live sub-adult green turtle was recovered from the bar racks of Units 1 and 2. The turtle had been observed drifting in the canal at the surface and was recovered when it reached the bar racks. The turtle was severely debilitated by fibropapillomatosis and was transferred, under the direction of the FDEP, to the Clearwater Marine Science Center for rehabilitation.

SEA TURTLE PROTECTION ACTIVITIES AT THE CRYSTAL RIVER ENERGY COMPLEX

Sea Turtle Observations

FPC has implemented continuing long-term protective measures at the Crystal River Energy Complex, ensuring the early detection and protection of sea turtles in the intake canal. A copy of the detailed measures is attached to this document as Appendix A. Participating organizations include Site Security, Nuclear Operations, Nuclear Maintenance, Fossil Operations and the Environmental Services departments. Programmatic oversight is provided by Nuclear Operations management.

The appropriate surveillance schedule and plant response are determined by the number of sea turtles observed in the intake canal. A continuous 24 hours per day turtle watch is provided when large numbers of sea turtles are observed in the intake canal or stranded on the bar racks. A minimum observation schedule of once every 2 hours is provided during known turtle presence. Periodic observations are provided at other times. Trained turtle watch personnel routinely observe the intake basin and log any turtle observations so that the presence of sea turtles is known. FPC biologists and environmental staff review these logs to ensure the appropriate actions are being taken. FPC biologists also perform weekly sea turtles observations and quality assurance oversight over the turtle watch personnel. Site Security and plant Control Rooms are promptly notified of any strandings.

Stranded turtles are immediately rescued by turtle watch personnel trained in the proper handling and care of sea turtles. Rescued sea turtles are placed in an appropriate container at the waterfront pending transfer to a designated seawater holding tank at the FPC Mariculture Center. The FPC turtle watch personnel perform an initial evaluation of the rescued turtle's health. If any obvious distress, injury, or disease is evident, a Mariculture Center staff biologist is immediately notified and responds on a 24 hour per day basis. The FDEP is subsequently notified by the Mariculture Center personnel of each stranding and sea turtle condition.

Sea Turtle Rescue and Handling Guidelines

FPC developed the Sea Turtle Rescue and Handling Guidelines based on information from the FDEP and sea turtle experts. FPC developed these procedures to protect the turtles as well as personnel who respond to turtle strandings. Rescue personnel are provided with a basic understanding of sea turtle biology, handling, and rescue techniques.

It has been documented that sea turtles can remain underwater for hours while resting. It is possible that resuscitation procedures may be successful when applied to a turtle rescued from an underwater stranding. Observers and rescue personnel have been trained in sea turtle resuscitation techniques.

These procedures provide for the proper handling of sea turtles to minimize stress, prevent injury, and care for diseased or distressed turtles.

Sea Turtle Stranding and Salvage Network Participation

Sea turtle rescue and resuscitation activities resulted in the successful rescue of 39 live stranded turtles from the intake bar racks. These procedures are also seen as a way to provide valuable data on the Kemp's ridley turtles. A permit from the FDEP has been obtained to allow FPC personnel to perform marine turtle stranding and salvage activities (Appendix B). Sea turtles are identified to species, measured, weighed, and examined for overall health and condition. Healthy turtles are tagged and returned to the Gulf of Mexico north of the plant site as soon as possible. Distressed or injured turtles are held for observation or until transfer to an approved rehabilitation facility can be arranged.

All turtles recovered are to be photographed dorsally and ventrally prior to release. Tags supplied by NMFS are applied to the proximal edge of the foreflipper. The tag numbers, species, and morphometric data of each turtle is reported on a monthly basis to the FDEP. This data is then entered into the FDEP Sea Turtle Stranding and Salvage Network database.

Sea Turtle Netting Activities

In addition to the 24 hour observation program and rescue and resuscitation guidelines, FPC implemented a sea turtle netting pilot program. FPC's objective was to determine the feasibility and efficiency of safely recovering sea turtles from the intake canal before they became stranded on the intake bar racks.

An FDEP approved and permitted consultant with specialization in sea turtle biology and conservation was hired to deploy large mesh entanglement nets in the intake canal. This consultant has over 18 years experience in sea turtle observation, capture and tagging. Recommended turtle netting procedures were implemented to minimize impacts to the turtles. Strict safety guidelines were enforced to ensure the safety of the work crews and the operation of the nuclear plant.

The consultant deployed a 45 m long, 6 m deep net in front of the Unit 3 intake structure (Figure 3). The net was deployed during daylight hours and fished for a total of 16 hours over three days. The net was constantly monitored from a johnboat while being fished. No turtles were captured during the netting effort, although turtles were observed in the intake canal. FPC has pursued improved netting techniques to increase the likelihood of turtle capture success should subsequent netting attempts be considered.

Bar Rack Cleaning

FPC has postulated that marine growth on the intake bar racks might be one of the reasons sea turtles remain in the intake canal. The turtles may regard some of the marine organisms on the bar racks as food items. As the turtles surface for air while swimming near the bar racks, they may be drawn against the racks by the velocity of water. Under certain circumstances, sea turtles may be unable to extricate themselves from the bar racks.

FPC has implemented an increased frequency of bar rack cleaning in an effort to discourage sea turtles from being attracted to the racks. Historically, FPC was cleaning the bar racks on the average of once every six months. In the interval between cleanings, significant fouling growth has been observed on the bar racks. By increasing the frequency of cleaning, FPC has controlled the amount of fouling growth on the bar racks. Additionally, the water velocity across the bar racks is minimized by maintaining the largest surface area available for water flow. Intake bar racks are now scheduled to be cleaned more frequently and seasonally prior to anticipated turtle influxes. If a sea turtle influx is observed, FPC will inspect the bar racks to ensure that they are in a proper condition of cleanliness.

In response to the possibility that some sea turtles might be stranded underwater against the bar racks, FPC also began operating the Unit 3 trash rake on a more frequent basis. FPC continued increased frequency of operation of the trash rake while sea turtles were observed in the intake canal. One live turtle was rescued and no mortalities were recovered. Periodic continued operation of the trash rake has demonstrated no further underwater strandings.

ASSESSMENT OF PRESENT ENERGY COMPLEX OPERATIONS

Loggerhead Sea Turtle

Although loggerhead sea turtles have been observed in the intake canal, very few have historically been recovered from the intake structures. Due to the low numbers observed and the habitat utilization and behavior of the loggerheads, there will be no impact to the species by the Energy Complex.

Green Sea Turtle

Green turtles have been observed in small numbers in the intake canal and stranded against the intake bar racks. Once the 24-hour observation procedures were implemented, only 2 live sub-adult green turtles were observed and rescued from the bar racks. The 2 green turtles rescued were diseased with fibropapillomatosis. Mortalities recovered from the intake canal include those suffering from a severe infestation of the papilloma tumors.

Due to the low numbers of green turtles encountered at the intake structures, and the specific programs in place for the rescue and resuscitation of impacted sea turtles, there will be no impact to this species by the Energy Complex.

Leatherback Sea Turtle

Leatherback turtles have never been observed in the intake canal or vicinity of the Crystal River Energy Complex. Due to the habitat utilization and behavior of the leatherback, there will be no impact to the species by the Energy Complex.

Hawksbill Sea Turtle

Hawksbill turtles have never been observed in the intake canal or vicinity of the Crystal River Energy Complex. Due to the habitat utilization and behavior of the hawksbill, there will be no impact to the species by the Energy Complex.

Kemp's Ridley Sea Turtle

From February 6, 1998, through May 24, 1998, a total of 38 sea turtles (Figure 4) were rescued live and released or relocated to a rehabilitation facility. Of those, 37 were Kemp's ridley. In addition, on August 12, 1998, a green sea turtle was rescued which was severely debilitated by fibropapillomatosis. All of these turtles were sub-adults, ranging from a straight carapace length of approximately 21 cm to 55 cm. A total of 13 sea turtle mortalities have been recorded. Eight mortalities can be attributed to factors other than the operation of the power plants. These were floating carcasses drawn into the intake canal by the water current. These carcasses eventually become stranded on the intake bar racks or debris screens.

Once FPC implemented the Sea Turtle Rescue and Handling Guidelines measures, all Kemp's ridleys stranded on the bar racks were rescued, except for one mortality. This was the occurrence of a small, diseased individual passing through the 3-5/8" space between the vertical bars on the bar racks. FPC was unsuccessful in subsequent attempts to rescue or remove this individual from the area behind the bar racks.

With the sea turtle protective measures in place, there will be no impact to the species by the Crystal River Energy Complex.

OTHER POTENTIAL STATION IMPACTS

Thermal Effects

The seawater systems of Units 1, 2, and 3 transport water from the intake canal through the main condensers. After the seawater passes through the tubes of the condensers (and heat exchangers for Unit 3), the water is returned through underground pipes to an outfall at the discharge canal. The discharge canal directs the water back to the Gulf of Mexico.

There are no known sea turtle nestings in the vicinity of the Crystal River Energy Complex. There are no known effects from the thermal discharge of Units 1, 2, and 3 on sea turtles or sea turtle nesting.

Barge Activity

Crystal River's four coal-fueled units consume about six million tons of coal each year. The coal is received by train and by ocean barge from coal transloading facilities in Louisiana. The intake canal has been dredged to a depth and width to allow the safe arrival and departure of ocean barges. The barges are moved at a slow speed while in the intake canal and are kept within the marked channel. The 82 foot beam of the barge fills approximately one-half the width of the 150 foot wide double dike area of the canal. Barges typically traverse the marked canal during high tide. The ocean barges dock on the south side of the intake canal for the offloading of coal. The empty barge is then moved to the north side of the intake canal to allow for the loading of mined limerock, which is back-hauled to offloading facilities in Louisiana.

Each barge is approximately 460 feet long and 80 feet wide. With a dry bulk capacity of 681,508 cu. ft., the barge has a loadline draft of 21'-10.25". The ocean tugs attached to the stern of the barges are 136 feet long, with a beam of 40 feet and a maximum draft of 18 feet. The tugs are typically powered by twin diesels, and have two 10-foot diameter propellers which are completely surrounded by kort nozzle shrouds to increase thrust and maneuverability. The tugs sustain a minimum speed while in the intake canal in order to maintain steerage of the barge. The propellers turn at 125 rpm while in the outer canal, and are reduced to 80 rpm from the double dike area to the dock.

To contact the propeller blades, a turtle would have to be drawn through the kort nozzle by the flow of water past the propellers. In such an instance, severe trauma would occur to a turtle which came in contact with the tug boat shrouded propellers. There is no evidence of this type of severe damage to any sea turtle mortalities found floating in the intake canal.

No significant impacts to sea turtle populations are anticipated from continued barge activities in the intake canal.

Chlorination

Units 1 and 2 are permitted under NPDES to chlorinate all four water boxes of the circulating water system to control fouling organisms. Chlorination as a means of fouling control has not been used at Units 1 and 2 for several years.

In the discharge canal, the Energy Complex utilizes helper cooling towers to reduce the temperature of water as limited by the NPDES permit. The helper cooling towers are also permitted to utilize chlorination for fouling control. Sulfur dioxide is used to dechlorinate the treated water prior to discharge into the canal. Chlorination has not been utilized at the helper cooling towers since 1995.

No significant impacts on sea turtles are anticipated from the use of chlorination as a means of biofouling control at Units 1 and 2 and the helper cooling towers.

Clam-Trol

Marine fouling growth occurs on structures in contact with seawater. Most of the intake structures are mechanically cleaned during power plant outages. However, the nuclear plant has a service water system that must be available and reliable during both routine operation and postulated nuclear emergencies. In order to maintain reliability of these service water emergency systems, the marine growth must be controlled.

The growth is controlled by the chemical addition of Clam-trol to the service water and decay heat systems. This chemical addition is made downstream of the bar racks, and is neutralized by clay adsorption prior to release into the discharge canal. Comprehensive biotoxicity testing using sensitive test organisms has shown that the neutralization process is effective. Clam-trol is toxic to fouling invertebrate marine organisms by disrupting oxygen transport across the gill membranes. It is harmless to mammals and other air breathing animals.

Since the injection of Clam-trol is downstream of the bar racks, and neutralization is complete before release to the discharge canal, no significant impacts on sea turtles is anticipated from the continued use of Clam-trol.

Condenser Cleaning Systems

At Units 1 and 2, the condenser tube cleaning system (called SIDTEC) is used to ensure condenser cleanliness by removing fouling that may deposit in the condenser tubes. Flexible cleaning plugs that are oversized with respect to the condenser tube inner diameter are injected into the inlet water boxes of the condenser. The differential pressure between the inlet and discharge of the condenser compresses the plugs and forces them through the condenser tubes.

The floating plugs are discharged to the discharge canal where they are collected by a series of three booms. The boom funnels the plugs to a collection point where they are collected by a centrifugal pump. The plugs are pumped to an open tank and then returned back to the inlet water box. The booms are held in place by a stainless steel cable. The NPDES permit requires that the best management practices be used for the operation of the SIDTEC cleaning system to minimize environmental impact.

The system has just recently begun operation. It is anticipated that it will be operated more frequently in the summer months and less frequently in the winter months. Plans are to initially operate the system for eight consecutive hours twice a week. Schedule and frequency will be adjusted based on the level of condenser cleanliness.

There have been no instances of accidental ingestion of SIDTEC plugs by sea turtles. Due to the short residence time in the discharge canal and the fact that few, if any, of the plugs would be expected to escape the boom capture system, no impacts to sea turtles are anticipated from the continued operation of the SIDTEC condenser cleaning system.

Unit 3 uses a condenser tube cleaning system (called Amertap) to perform condenser cleaning. Elastomeric sponge rubber balls that are oversized with respect to the condenser tube inner diameter are injected into the cooling water stream at the condenser inlet. The differential pressure between the inlet and discharge of the condenser forces the sponge rubber balls through the condenser tubes.

A special screening device, called the strainer section, is installed in the condenser discharge line to funnel the balls along with a small quantity of cooling water into a recirculation pump. The recirculation pump returns the rubber balls to the condenser inlet completing the loop.

Occasionally, some of the balls escape the collector and enter the discharge canal. There are no known instances of sea turtle ingestion of Amertap balls. Therefore, no significant impact to turtles is anticipated from the continued operation of the Amertap condenser cleaning system.

Intake Canal Dredging

Permit No. 199101778 was obtained on November 12, 1991, from the Department of the Army, Jacksonville District Corps of Engineers (ACOE) to perform maintenance dredging of the Crystal River Energy Complex intake canal. The ACOE authority is established under Section 10 of the Rivers and Harbors Act of 3 March 1899 (33 U.S.C. Section 403). The permit is valid through November 12, 2001, and allows up to 560 cubic yards of material to be dredged annually and placed in an existing diked disposal area. The maintenance dredging complies with the State of Florida permitting requirements provided the following conditions are met:

- The spoil material removed must be deposited on a self-contained upland site which prevents the escape of spoil material and return water into surface waters;
- Dredging is limited to that amount necessary to restore the canal to original design specifications;
- Turbidity control devices must be used at the site to prevent the discharge of turbidity and toxic or deleterious substance from discharging into adjacent water during maintenance dredging.

There has been no observed impact to sea turtles during previous dredging operations. All prudent and reasonable steps will be taken during future dredging operations to minimize environmental impacts. This includes a best management practice on dredging operations. In addition, FPC plans to restrict future dredging activities during the presence of sea turtles. Thus, no significant impacts on sea turtles are expected from maintenance dredging operations.

CUMULATIVE IMPACT OF ENERGY COMPLEX OPERATIONS

During the period February 6, 1998, through May 24, 1998, there were 38 live sea turtles successfully rescued from the Crystal River Energy Complex intake bar racks, with 13 mortalities also being recovered. One additional severely diseased green sea turtle was recovered in August 1998. Live turtles were either released to the Gulf of Mexico or transferred to an FDEP approved facility for rehabilitation.

Eight of the mortalities were attributed to factors other than the power plant operation. These include natural as well as human-induced causes. The floating carcasses appeared to have been drawn into the intake canal with the incoming current. The exact causes were difficult to determine since the carcasses were in various stages of decomposition.

Five of the mortalities were likely related to power plant activities. The most probable cause of death for four of the five mortalities was drowning while stranded against the bar racks. These four mortalities in all likelihood occurred prior to the implementation of the Crystal River Energy Complex sea turtle protective measures. The fifth mortality was a small diseased sea turtle which was able to slip past the bar racks and which became confined in the water space between the bar racks and the traveling screens.

Other Energy Complex activities have not been observed to have any detrimental effect on the populations of sea turtles in the Gulf of Mexico. The only station impacts would be those already discussed regarding the bar rack structures.

CONCLUSION

The FPC protective measures for monitoring, rescue and resuscitation, netting, tagging and release activities in coordination with the FDEP are effective in protecting sea turtles and minimize the likelihood of power plant causally related mortalities. The FPC Marine Turtle Permit allows the unlimited rescue of sea turtles under the direction of the FDEP. With these provisions, there will be no jeopardy to any sea turtle species.

FPC expects that lethal takes will occur from both power plant causally related and non-causally related factors at the Crystal River Energy Complex. These can occur despite the best reasonable and prudent protective measures. Based on existing sea turtle protective measures and early 1998 observed sea turtle influx levels, annual lethal takes related to power plant activity are expected to be limited to four Kemp's ridley and one each of green and loggerhead turtles. There are no expected mortalities related to power plant activities for leatherback or hawksbill turtles.

The Crystal River Energy Complex facilities do not influence the occurrence of non-plant related mortalities. These are functions of the level of sea turtle activity along the coast and other factors external to FPC and its operations. FPC's experience with non-plant related mortalities and FDEP's Sea Turtle Stranding and Salvage Network information indicates that mortalities from non-plant related causes are variable and increasing.

For this reason, as well as due to the difficulty in differentiating with certainty between plant and non-plant related causes of death, FPC proposes that no specific numeric mortality limit be established in the Incidental Take Statement. Instead, FPC proposes that sea turtle protection be accomplished through existing FPC protective measures. FPC also proposes to document and report the circumstances surrounding any future sea turtle mortality observed at the Crystal River Energy Complex.

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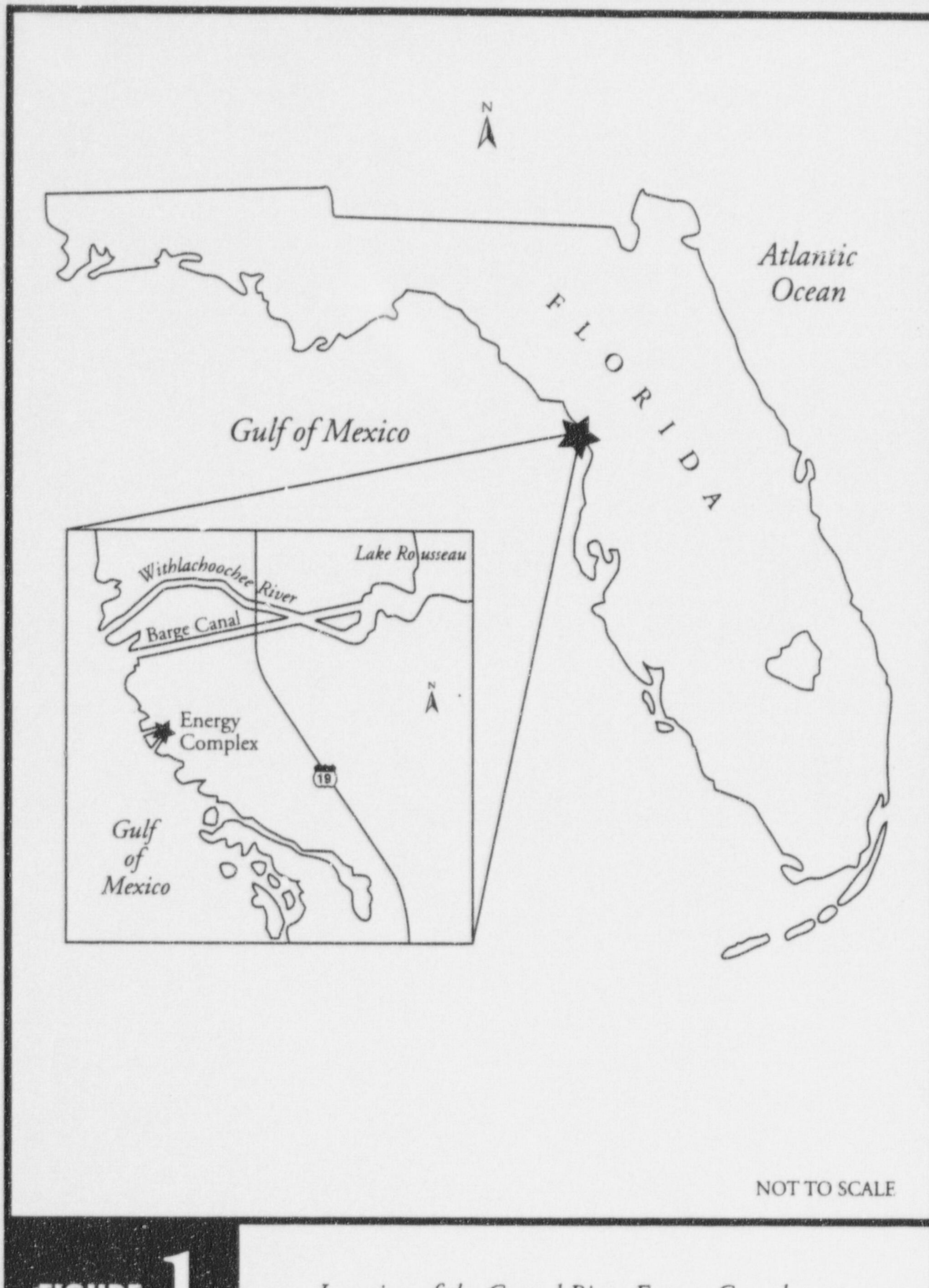

FIGURE 1 *Location of the Crystal River Energy Complex.*

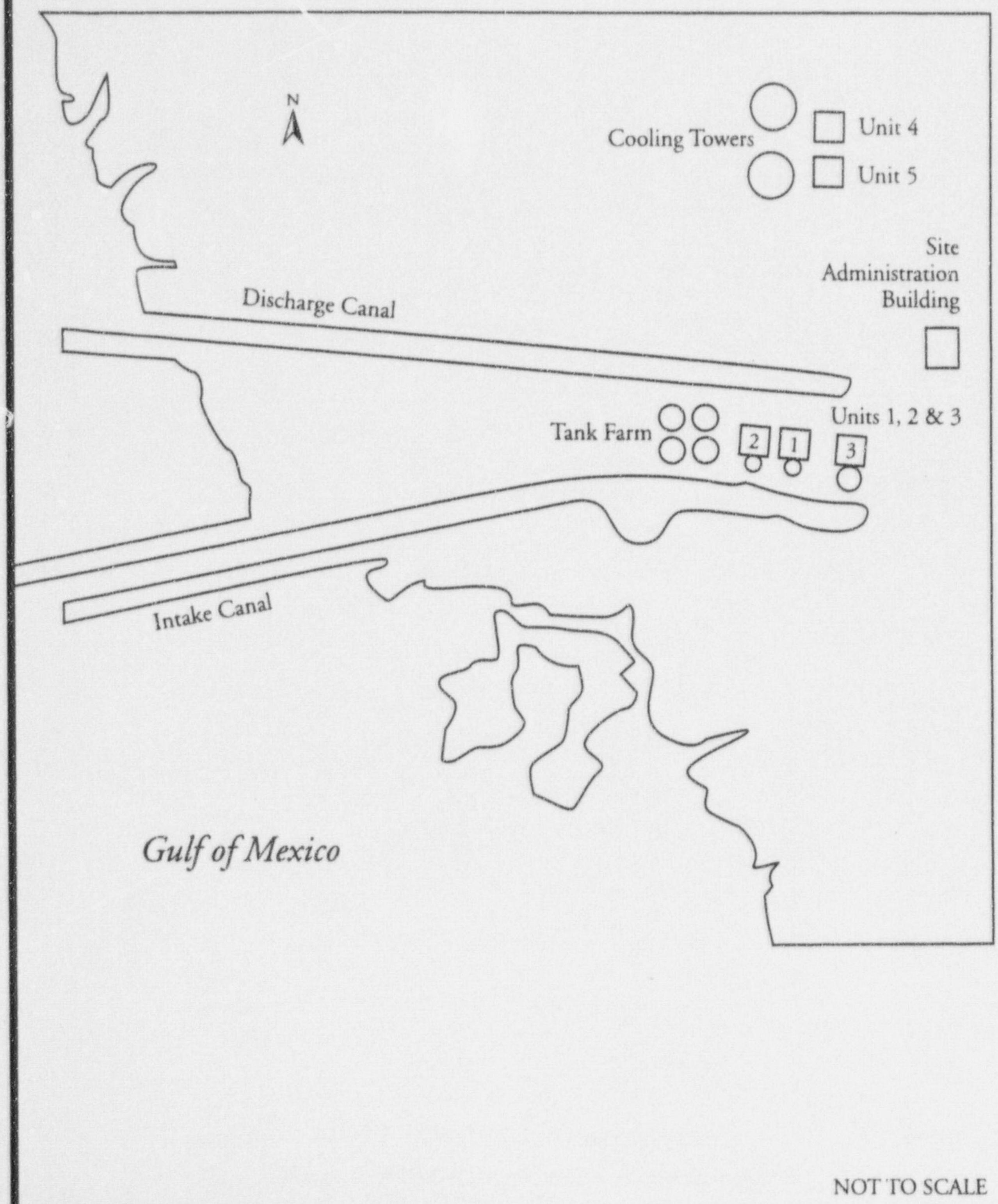

FIGURE 2 *Site layout of the Crystal River Energy Complex.*

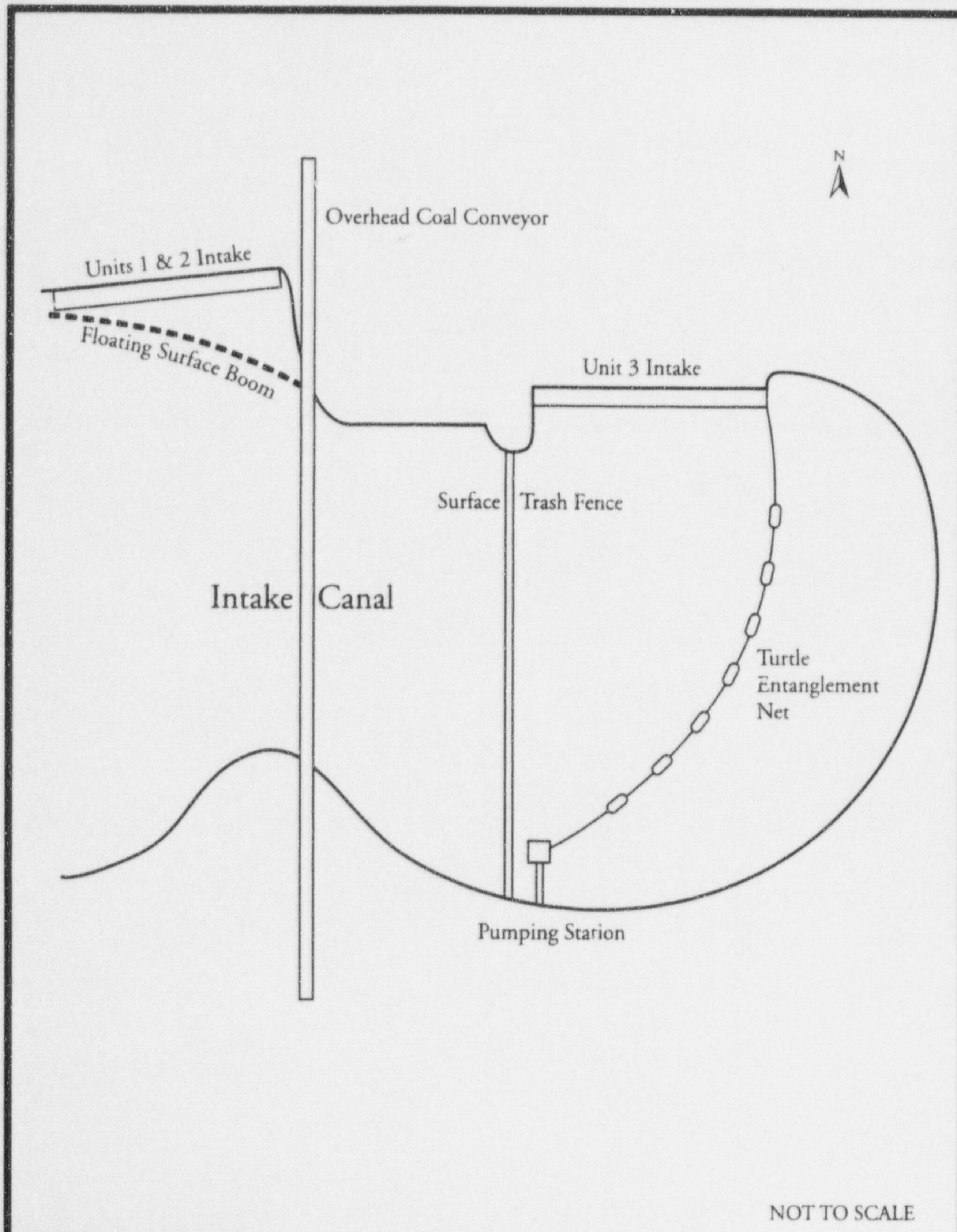

FIGURE 3 *Orientation of turtle entanglement net deployed in the intake canal.*

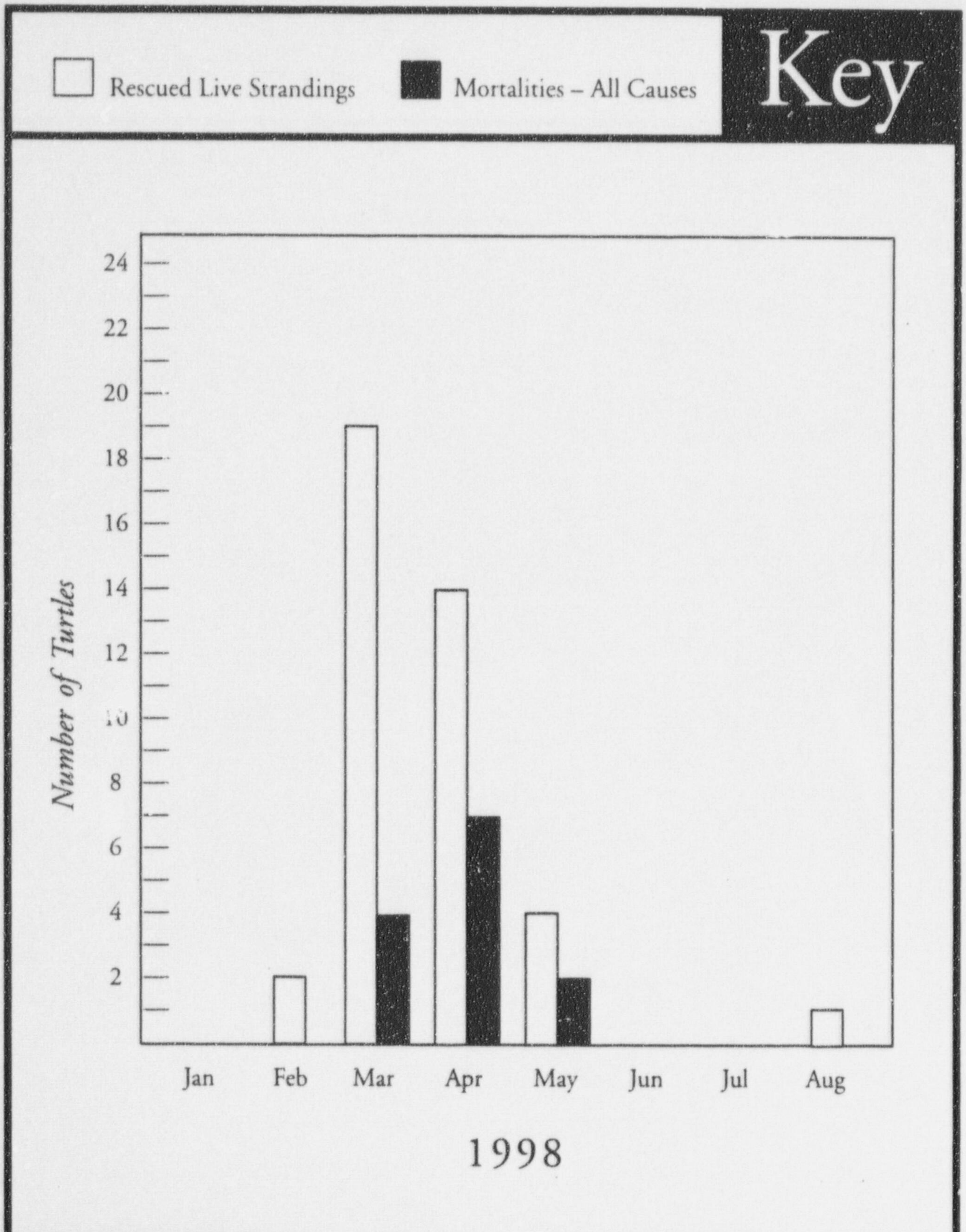

FIGURE 4

Total number of live and dead sea turtles recovered at the Crystal River Energy Complex from January through August, 1998.

APPENDIX A

SEA TURTLE RESCUE & HANDLING GUIDELINES

CRYSTAL RIVER ENERGY COMPLEX

Revision 4

Effective Date: 9/28/98

BACKGROUND

Sea turtles are graceful saltwater reptiles, well adapted to life in the marine environment. With streamlined bodies and flipper-like limbs, they are able to swim long distances in a relatively short time.

Sea turtles are air-breathing, and when they are active they must swim to the water surface every few minutes. Turtles have been observed swimming underwater for periods of up to 20 minutes, and when resting some have been observed to remain underwater for as long as 2 hours without breathing.

OBSERVATION and RESCUE

Call Site Security at extension 4832 or Radio Channel 6.

The Supervisor, Environmental and Radiological Compliance in conjunction with the Manager of the Mariculture Center will determine the appropriate surveillance schedule. A 24 hour per day turtle watch will be provided during periods of high turtle population or stranding incidence on the bar racks. When the 24 hour watch is no longer necessary due to the infrequent observation or absence of sea turtles, a reduced turtle protection program will still be conducted. This reduced program will consist of the following:

Site Security
- inspect bar racks once every 2 hours (except during infrequent times when security staff must respond to other non-routine call out).
- perform 1 hour per day observation of the intake basin to determine presence of sea turtles.
- make routine reports to the Supervisor, Environmental and Radiological Compliance and the Manager, Mariculture Center.

CR-3 Operations
- inspect bar racks once per shift during operation of traveling screens.

CR 1 & 2 Operations
- inspect bar racks once per shift.

Maintenance
- inspect CR-3 bar racks for underwater strandings using the trash rake during periods of turtle influxes as directed by the Supervisor, Environmental and Radiological Compliance.

Mariculture Staff - perform observations for turtle presence in the intake canal basin for 2 hours per week.

- do a weekly survey of the intake canal to identify the presence of sea turtles.

The Turtle Watch personnel must monitor sea turtle activity in front of the bar racks so that any sea turtle in distress can be safely and efficiently moved to a safe area. The Turtle Watch personnel should:

1) **OBSERVE** the intake basin and log turtle observations so that the presence/absence of turtles is known.

2) **INSPECT** the bar racks for the presence of any stranded or deceased sea turtles.

3) **NOTIFY** the Security Dispatch Desk if a sea turtle is observed stranded on the bar racks (extension 4832 or Radio Channel 6). The Security Captain will dispatch support personnel to the intake area to help the person discovering a turtle. This is to ensure personnel safety and to provide rescue support. The Security support personnel shall keep the Site Security Dispatch Desk informed, who in turn shall keep the applicable Control Room informed during and after the rescue. If requested, the Control Room will likely dispatch a person from Operations to support the rescue (provide manpower or operate equipment).

4) **RECOVER** the sea turtle **IMMEDIATELY** (after notification to the Security Dispatch Desk). Use dip net or other equipment provided to remove the sea turtle. Observe all safety procedures when working at the waterfront. Take all steps possible to minimize stress on the sea turtle.

Turtle Handling Guidance

Note: Turtles are to be protected from harassment at all times.

> **CAUTION**
>
> Gloves should be worn when handling sea turtles.
>
> Sea turtles have powerful crushing jaws. They will bite when handled and can cause significant bodily harm. Keep clear of the turtle's head whenever possible.
>
> Sea turtles may have claws on their front flippers. Keep clear of the front flippers whenever possible.
>
> Handle sea turtle with the nets provided. Only if necessary, handle the turtle by the front and back of the shell. Do not pick them up by the flippers, head, or tail.

DO NOT release any turtle. Any sea turtle that has been stranded against the intake bar racks should be held for identification and evaluation:

- **Healthy turtles** should be immediately placed in the small tank at the intake basin, which has been provided with enough seawater to allow the turtle to float (approximately 6-12 inches). Observe turtle to ensure that it is strong enough to lift its head to breathe.

  During regular business hours, the Security Site Dispatch Desk should contact the Mariculture Center staff for pick-up.

  After hours, or if Mariculture Center staff is unavailable, the turtle should be carefully transported by Site Security personnel to the holding tank at the Mariculture Center.

  Note: The Turtle Rescue personnel are not to abandon their observation post (i.e., this transport is provided by the Security support personnel).

  The Mariculture Center staff will check daily for turtles in the holding tank (including weekends. Therefore, after-hours notification to the Mariculture staff is **NOT** necessary for healthy turtles.

- **Sick, injured** or **weak** turtles should be placed on a wet towel. The turtle should be kept in a cool, quiet area out of direct sunlight. Do not place the turtle on any hot or abrasive surface.

  The Site Security Dispatch Desk should contact the Mariculture staff immediately to inform them of the distressed turtle (24 hours per day). Mariculture staff will respond immediately to provide support.

  Note: Notify Mariculture staff in order of listing on the call out list unless otherwise instructed.

Resuscitation

NOTE

Attempts should be made to resuscitate comatose sea turtles.
Sea turtles can remain motionless and appear dead for up to several hours.

- If turtles are recovered comatose, **ATTEMPT** resuscitation by:

  1) **PLACING** turtle on its back and elevate hindquarters to help drain lungs
  2) **PUMPING** firmly but carefully on the bottom shell with a hand or foot
  3) **MAINTAINING** a pumping rate of approximately 30 times per minute
  4) **REPEATING** several times, while monitoring turtle for signs of breathing

  If no results are achieved after several attempts:

  5) **PLACE** the turtle on its belly
  6) **ELEVATE** the hindquarters several inches
  7) **MAINTAIN** the turtle in the shade on a wet towel
  8) **ATTEND** to sea turtle until the Mariculture Center staff respond to the call out arrive who can perform advanced resuscitation techniques

- **Dead** turtle:

  If sea turtle can not be revived or is obviously dead, place dead turtles in a plastic tank with ice to prevent decomposition and retard odor. Site Security Dispatch Desk should notify the Mariculture staff between 8:00 a.m. and 5:00 p.m., 7 days a week, to arrange for pick-up and disposal per FDEP instructions.

Follow-up Evaluations, Notifications and Documentation

Follow-up Evaluations

- Mariculture staff will perform an identification and health evaluation for all rescued turtles. Following the evaluation, the FDEP will be contacted for instructions on whether to release the turtle to the Gulf of Mexico or to arrange for transportation to a rehabilitation facility. The Clearwater Marine Science Center is an authorized facility for the treatment of sick or injured turtles.

Off-Site Notifications

- FDEP and rehabilitation facility notifications will be made by the Mariculture staff. The Mariculture Center will be used as an interim facility to hold sea turtles prior to pick-up and treatment or disposal.
- The Security Dispatch Desk will log turtle events accordingly.
- The Control Room will make NRC notifications in accordance with CR-3 procedures.

Documentation

- The Turtle Watch Rescue should document:

  1) Time of incident.
  2) Position sea turtle was found.
  3) Activity level of sea turtle.
  4) Any injuries or other abnormal conditions of the sea turtle.
  5) Any other relevant information.

- The Security Dispatch Desk will collect and maintain data entry logs from the Turtle Watch Rescue.
- The respective Control Rooms will log turtle rescue and mortality events.

Department of Environmental Protection

Lawton Chiles
Governor

Virginia B. Wetherell
Secretary

MARINE TURTLE PERMIT

Mr. David A. Bruzek
Florida Power Corporation
15760 West Powerline Street, FH-34
Crystal River, Florida 33428

TP #042

Permit Expires: 31 January 1999

New Permit.

Authorized To: (1) conduct stranding/salvage activities.

Authorized Nesting Survey Area: None.

Authorized Research Projects: None.

Authorized Personnel: D. Bruzek, E. Latimer, S. Butler, E. Olsen.

General Conditions: Permitted individuals must adhere to the FDEP marine turtle permit guidelines developed under a Section 6 Cooperative Agreement between FDEP and the U.S. Fish and Wildlife Service.

Special Conditions: None.

David W. Arnold

David W. Arnold, Chief
Bureau of Protected Species Management
Division of Marine Resources

7-20-98
Date

cc: Sandy MacPherson, Southeast Regional Sea Turtle Coordinator, USFWS
FMP, District(s) General Headquarters
FDEP, Tequesta Office