Biological Assessment of Impact to Sea Turtles at Carolina Power & Light Company's Brunswick Steam Electric Plant

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Summary

This report provides an assessment of the impact of the current operation of Carolina Power & Light Company's two-unit Brunswick Steam Electric Plant (BSEP) on the species of sea turtles that are federally listed as "endangered" or "threatened" under the Endangered Species Act (ESA) of 1973 and as amended. The BSEP began operation in the mid-1970s after being licensed in the early 1970s. BSEP's Final Environmental Statement, which was prepared as part of the licensing process for the facility, was completed in January 1974. The Endangered Species Act was originally enacted on December 28, 1973, and postdated the design, construction, and licensing of the BSEP such that there was no biological assessment or other regulatory review relating to sea turtles at the BSEP. Notwithstanding, BSEP has initiated actions to observe, remove, and release sea turtles from the plant's intake canal in cooperation with the North Carolina Wildlife Resources Commission to mitigate impacts on these species. This report is submitted to the United States 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 with an incidental take statement.

Since the plant began operation in 1975, three species of sea turtles have been observed in the power plant's intake canal. They are the loggerhead, green, and Kemp's ridley sea turtles. When sea turtles enter the intake canal, the majority of them are removed and returned to the ocean alive and unharmed.

This biological assessment demonstrates that reasonable and prudent mitigation measures have been taken at BSEP. It is recommended that the NMFS conclude that BSEP represents no jeopardy to any of the sea turtle species and therefore issue an incidental take statement allowing both lethal and non-lethal "takes" (use as defined in ESA) of sea turtles. While the total number of lethal sea turtle takes has not exceeded four in any year, the variability of the species mix warrants each species having a separate incidental lethal take limit. It is recommended that BSEP's annual incidental lethal take limits be established as; three green sea turtles, three Kemp's ridley sea turtles, and four loggerhead sea turtles. These three species have been collected at the Brunswick Steam Electric Plant and represent historical trends of lethal takes in the plant's intake canal over the past six years. It is further recommended that three leatherback sea turtles and three hawksbill sea turtles be established as an additional component of BSEP's

lethal take. Although these latter two species of sea turtles have never been collected at BSEP, they are known to visit along the North Carolina coast. The basis for this further recommendation relates to the success to date of release of those turtle species that have historically entered the intake canal. Because we have been successful with the Kemp's ridleys, greens, and loggerheads, we would expect similar results with leatherbacks and hawksbills.

CP&L is recommending that no limit be established for non-lethal takes of sea turtles as a result of this biological assessment. The programs in place to discover, remove, and return sea turtles have been demonstrated to be effective and successful.

The populations of sea turtles historically encountered at BSEP or which may be encountered in the future will not be detrimentally affected by the operation of the facility, nor is there jeopardy to the continued existence of the species. The mortalities of turtles experienced at BSEP are conservative and the numbers are minor compared to mortalities from other causes such as natural illnesses, incidental net entanglement in fishing and shrimping gear, and ingestion of debris.

Introduction

The United States Endangered Species Act (ESA or Act) of 1973 (PL93-205) 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 an agency do not jeopardize the continued existence of any endangered or threatened species or result in destruction or adverse modification of the habitat of the species under consideration. Such cooperation allows for what is referred to as a formal consultation. In the case of the review of sea turtle occurrences near the Brunswick Steam Electric Plant (BSEP), consultation involves the United States Nuclear Regulatory Commission (NRC) (the licensing federal agency for BSEP) and the United States National Marine Fisheries Service (NMFS), which has jurisdiction over sea turtles in waters of the United States. The consultation would 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 at BSEP, discussed below, does not involve nesting sea turtles.

The purpose of this biological assessment is to determine the impact, if any, of the operation of BSEP on sea turtles that are protected under the ESA of 1973 and as amended. This assessment was prepared to support a consultation between the NRC and the NMFS in accordance with Section 7 of the ESA.

BSEP is located in Brunswick County, North Carolina, near Southport, on the Cape Fear River estuary (Figure 1). BSEP's initial licensing, which occurred during the mid-1970s, did not include a review of sea turtle impacts. Notwithstanding, BSEP initiated a monitoring program in 1976, less than a year after the first of the two units began commercial operation. In 1981, upon renewal of the National Pollutant Discharge Elimination System (NPDES) permit, various plant modifications were initiated including the installation in November 1982 of a permanent diversion structure across the mouth of the plant intake canal to minimize large fish and shellfish from entering the intake canal.

Initially, in the first several years of operation of the BSEP in the 1970s, there were few occurrences of sea turtles entering the plant's intake canal. As the sea turtle populations in the area increased, incidences of turtles in the plant's intake area also increased. To date, three species of sea turtles have been collected in the intake canal at BSEP since it began operation.

These are the loggerhead (*Caretta caretta*), green (*Chelonia mydas*), and Kemp's ridley (*Lepidochelys kempii*). The United States Fish and Wildlife Service (USFWS) has listed Kemp's ridley as "endangered" and the loggerhead and the green sea turtles as a "threatened" species under the ESA. Neither the leatherback (*Dermochelys coriacea*) nor the hawksbill (*Eretmochelys imbricata*) turtles, which are also protected under the ESA and are listed as "endangered," has ever been captured at BSEP.

BSEP Site Description and Intake System

BSEP is comprised of two units: Unit No.2 (approximately 821 MWe net) began commercial operation in 1975 and Unit No. 1 (approximately 821 MWe net) began commercial operation in 1977. BSEP operates in a once-through cooling mode by withdrawing water from the Cape Fear River through a three-mile-long intake canal. It is this canal, secluded from the main river channel and closed to net fishing by fishermen, that sea turtles occasionally enter. The location of water withdrawal from the river into the intake is about six miles north (upstream) of the mouth of the Cape Fear River. The intake canal is approximately 300 feet wide and 18 feet deep. After passing through the plant's condensers, the water travels through a six-mile-long discharge canal and is then pumped 2,000 feet offshore through subaqueous pipes into the Atlantic Ocean at a depth of approximately 18 feet. The two units operate independently of each other but share a common intake and discharge canal. Approximately 1.5 billion gallons of water pass through the plant per day during normal dual-unit operations. At each of the two units, trash racks and traveling screens collect and remove debris and aquatic organisms prior to the water's entering the plant's cooling water system.

Carolina Power & Light Company was issued a permit to discharge cooling water from BSEP in 1974, under the Clean Water Act's National Pollutant Discharge Elimination System program, and as a condition of the permit, biological monitoring was initiated in 1976 to provide continuous assessment of power plant impact on marine and estuarine organisms in the Cape Fear Estuary. The NPDES permit was re-issued in 1981 and CP&L constructed a permanent diversion structure at the mouth of the intake canal in November 1982 (an earlier experimental temporary structure had been installed and evaluated in 1979) to reduce the number of large fish and shellfish entering the intake canal. This structure (Figure 2) effectively reduces overall

impingement of the larger shellfish and larger fish on the plant's trash racks and traveling screens. The diversion system is V-shaped to increase screen area and to reduce approach-flow velocity, which reduces the impact to marine organisms. It consists of 37 panels of screens made of a copper-nickel alloy with a mesh size of 3/8 x 5/8 inches. The intake canal at the diversion structure varies from a depth of approximately 18 feet at its center (apex) to about four feet at the end bays on either side. Screen panels are designed to release from their frames under high-debris loads to prevent overall damage to the diversion system. Each "screen release" creates an opening of approximately 2 x 4 to 3 x 4 feet—or less than one percent of the diversion structure (Figure 3). The potential exists solely during these screen-release periods for turtles to enter the canal. CP&L provides a maintenance crew for servicing and repairing the diversion structure and gives priority to repairs.

Monitoring studies have shown that the installation of the diversion structure has resulted in a demonstrated high degree of effectiveness in reducing larger fish and shellfish from entering the canal. Sea turtle movement into the intake canal is also blocked except when screens release because of debris loading, extreme tides, or unusual weather conditions

Sea Turtles Along the North Carolina Coast

The loggerhead is the most common sea turtle in coastal waters of the United States. Along North Carolina waters, the loggerhead is an annual nester, the green is an occasional nester, and the Kemp's ridley nests only rarely along North Carolina beaches. Most egg clutches of the three species consist of about 110 eggs. The loggerhead and the green are circumglobal in distribution and are mainly found in the tropical to mid-latitudes. The Kemp's ridley is primarily a species of the Gulf of Mexico, nesting at a single location near Rancho Nuevo, Mexico, but juveniles are found off the Atlantic seaboard as far north as the state of New York. In terms of overall size of the adults, the loggerhead and green are the largest, while the Kemp's ridley is the smallest of the three. Neither the leatherback (*Dermochelys coriacea*) nor the hawksbill (*Eretmochelys imbricata*) turtles, also protected under the ESA, has ever been captured at BSEP. They are not as common along North Carolina's coasts and sounds.

Sea turtle hatchlings live in the open sea (pelagic) and return as juveniles and subadults to the near-shore areas where they feed. Two of the three species that have been observed at BSEP

(the loggerhead and the Kemp's ridley) are primarily carnivorous in their feeding habits. In the inshore areas, estuaries, and shallows they tend to feed on crustaceans and mollusks and other invertebrates including jellyfish. The adult green sea turtle is herbivorous, feeding primarily on algae, and sea grasses. Information on near-shore movement of sea turtles around electric generating power stations along the east coast of the United States is further detailed by Florida Power & Light Company (1995) and by General Public Utilities Nuclear Inc. (1994), whose assessments have been forwarded to the NRC.

Sea turtles migrate northward from south of Cape Hatteras, North Carolina, in the spring of the year and move southward in the autumn. There are relatively few sightings during the winter months along the inshore waters of North Carolina. It is not likely that sea turtles over-winter by burying themselves in the bottom in inshore waters of North Carolina because the water temperatures are too cold. Various studies have shown that the post-pelagic juvenile greens and loggerheads frequently utilize Atlantic coast estuaries for feeding (Epperly, et al. 1995).

During the period between 1980 and 1994, the North Carolina statewide sea turtle strandings (i.e., the number of dead or debilitated turtles found on coastal beaches and sounds) averaged 196 turtles annually (North Carolina Wildlife Resources Commission 1997). In 1995, the actual reported strandings increased to 347 turtles and in 1996 the number was 502, which was higher than any strandings reported in the previous 15 years (Tables 1, 2, and 3). These increased strandings may have resulted from population increases as a result of successful conservation efforts and more general public awareness and increased "spotters" who report strandings.

Sea Turtles at BSEP

Data on the occurrence of sea turtles at BSEP have been reported to the North Carolina Sea Turtle Coordinator (NCSTC) of the North Carolina Wildlife Resources Commission (NCWRC). Since 1986 there have been 136 sea turtles incidentally collected and removed from the BSEP intake canal (Figure 4). Of this total, 110 turtles were released alive while 26 were removed dead. Of those turtles collected on the plant trash racks, drowning appears to be the cause of death.

Since 1992, of the total sea turtles collected live, the majority were loggerheads (64); nine were green turtles, and eight were Kemp's ridley. Of those that were removed dead since 1992, five were loggerheads, two were greens, and four were Kemp's ridleys (Figure 5).

"Seasonality" is the monthly or seasonal pattern of distribution or occurrence of sea turtles at a particular location. At BSEP, the seasonality of sea turtles is primarily late April through August based on data from the last 11 years. A few turtle "takes" have occurred as late as November and December (Figure 6). However, the peak season is May through July when takes significantly increase over all the other months combined. This observation of seasonality is generally consistent with Epperly, et al. (1995) who reported two peaks: one in April-June for the entire coast of North Carolina, and the other during October-December for waters on the northern coast of North Carolina.

The diversion structure excludes sea turtles from the plant intake canal, except during those times when there are screen releases. Typically, turtles that move into the canal are classified as incidental takes and are thus deemed to have been associated with plant operations. A few turtles that enter the intake canal are considered as non-incidental takes (i.e., they floated into the intake canal dead or dying, of injuries or illnesses that occurred prior to encountering the canal). This determination of incidental versus non-incidental is made by the NCSTC (Boettcher 1997). Since 1992, the number of non-incidental takes has usually been 0 to 2 turtles per year. However, in 1996, there were 10 non-incidental lethal takes.

Most turtles taken at BSEP are immature (juvenile) turtles based on their carapace length as confirmed by the NCSTC. The young turtles move into the Cape Fear estuary, including the area near the intake canal, for feeding and foraging. It has been confirmed that immature turtles use shallow waters for foraging areas (Epperly, et al. 1995), particularly during the months of April through June. During the last 11 years only one of the incidentally taken turtles (loggerheads) has been an adult of reproductive age. None were adult green or Kemp's ridley turtles.

No turtles are known to nest in the area of BSEP intake canal because the habitat is unsuitable for nesting and greater than 99% of those turtles collected are foraging, non-reproducing juveniles.

Sea Turtle Monitoring at BSEP

CP&L has an aggressive program in place to determine the presence of sea turtles in the plant's intake canal. There are procedures utilized to identify the presence of sea turtles at the diversion structure, in the intake canal, and on the plant's trash racks. The protocol, modified and adapted to respond to increasing numbers of turtles in the intake canal, describes the actions taken by CP&L (Appendix 1).

Sea Turtle Patrols

CP&L generally inspects the plant's intake trash racks as conditions warrant on a daily basis as near low tide as possible during the period from late April through August unless inclement weather or other conditions prevent it. This period coincides with historical higher-than-average occurrences of sea turtles in the area. The inspection consists of visual observations of the entire length of the intake canal from the diversion structure to the plant's intake trash racks.

Mandated as part of this protocol to discover sea turtles is visual examination of each trash rack, an adequate observation (one-half-hour to one-hour) of the plant's intake to note any surfacing sea turtles, and adequate observations (one-half-hour to one-hour) at the diversion structure. In addition, personnel inspect the diversion structure each spring to ensure its integrity. The inspection includes a below-the-water-level check by divers as part of the overall preventive maintenance program.

Further, those crews that maintain the diversion structure on a year-round basis are also instructed to report any observations of dead or live turtles inside the canal, on the diversion structure itself, or outside the structure on the river side. Finally, plant security personnel who patrol the plant intake area year-round are instructed to report any sightings of turtles in the canal.

Live Sea Turtle Sightings

CP&L currently has an environmental staff including a marine biologist who coordinates the company's turtle monitoring, capture, and release program. If sea turtle reports or sightings are received by CP&L employees or contractors, the information is reported to an individual on

the plant's environmental staff who then goes to the area of the sighting and observes for a minimum of one hour. When a sighting is confirmed, attempts are made to capture the turtle using nets of different lengths and mesh sizes depending on the location and the size of the turtle. A 200-foot-long net is used for capture near the plant intake and a 300-foot-long net may be used near the diversion structure. Two net sizes are used: a four-inch mesh for capturing small turtles and an eight-inch mesh for larger turtles.

CP&L has a permit, renewed annually, from the North Carolina Wildlife Resources Commission that allows the temporary possession, tagging, and release of live sea turtles, and the transport and burial of dead ones (Appendix 2). Currently, Passive Injectable Transponder (PIT) electronic scanning tags are placed on the body of a live sea turtle in a predetermined location (the front left flipper). Iconel (clip-on) identification tags are placed on each of the two rear flippers. Turtles weighing less than eight pounds are not generally tagged with Iconel tags. Turtle stranding reports with the tag numbers are filed by CP&L with the NCSTC using the Sea Turtle Stranding and Salvage Network Stranding Report Form (Appendix 3). This tagging information is also sent via the NCSTC to the NMFS's Miami Laboratory, which coordinates the overall marine turtle tagging program (Appendix 4). Upon advice from the NCSTC, injured or stressing turtles are taken to a local veterinarian for treatment prior to release. Severely injured turtles are transported to the NCSTC. Live turtles are photographed and released in the surf at the Yaupon Beach area of Oak Island, North Carolina. The release point is located approximately six miles from the BSEP. Since 1992, there have been 76 sea turtles tagged by CP&L personnel at the plant and released. Turtles transported to the sea turtle coordinator are not tagged by CP&L. The residence time of sea turtles in the intake canal before they are captured and removed varies from a few hours to several days depending on the activity level of the turtle.

Turtles that are found dead in the intake canal or on the trash racks are removed, photographed, and a necropsy performed on them (Wolke and George 1981). As advised by the NCSTC, dead sea turtles are buried on the BSEP site. The coordinator is notified prior to burial and a stranding report is also filed. The left front flipper is removed from the dead turtles as part of a program whose purpose is to provide age determination, and DNA analysis for population genetics studies of the turtles. This flipper program is a volunteer program coordinated by the

NCSTC (NCWRC 1995). BSEP is a repository for sea turtle flippers collected by volunteers in Brunswick County, N.C.

Measures to Reduce Sea Turtle Impact

As sea turtle populations have increased along the North Carolina coast and more turtles have entered the plant's intake canal, CP&L has adapted its maintenance programs and patrols to respond to this increase. If debris or other conditions result in higher-than-normal screen releases on the permanent diversion structure, personnel and other resources are dispatched to respond to these conditions.

The primary means to prevent takes of sea turtles at BSEP is the diversion structure at the mouth of the intake canal. The screens on the diversion structure are generally maintained daily during periods of high-debris loading associated with seasonal vegetation regrowth and high rains (usually May through September), or as conditions warrant. The company has dedicated two boats (one 32-feet long and one 18-feet long) with a three-to-four-person crew to maintain the structure. During the inspections, screens are generally pulled from the water and washed. Any damaged screens are repaired. Removable blocker panels are dropped into place in the opening to prevent sea turtles from entering the intake canal during the maintenance. Repairs to a panel of screens usually take 30 minutes to two hours. Generally the entire diversion structure is cleaned each day during periods of high debris loads unless inclement weather or other conditions prevent it. When the maintenance crew identifies screens that are worn but not damaged, they, too, are removed and replaced.

During the "turtle season" (primarily late April through August), environmental personnel make daily patrols of the intake canal unless inclement weather or other conditions prevent it. Patrols are made from the plant intake trash racks to the diversion structure. Nets, crews, and a boat are dedicated to the effort so that live captures can be made as quickly and efficiently as possible. Plant security personnel who patrol the intake area are instructed to be on the lookout for turtles in the canal. Plant environmental personnel are on call 24 hours per day to respond to turtle sightings.

Environmental Stewardship Programs

CP&L has voluntarily taken several initiatives to promote awareness of sea turtles along our beaches. Environmental stewardship has been an important component of CP&L's activities for a number of years, including projects for education about and protection of sea turtles. In 1993-1994, CP&L provided funding to the North Carolina Wildlife Resources Commission's Non-Game Program to place signs at all coastal public beach and boating access areas in CP&L's service area from the South Carolina-North Carolina state line northward to Cedar Island in Carteret County. The signs, entitled "Help Our Shore Birds and Sea Turtles," advised the public to be aware of beach-nesting wildlife (turtles, sea birds, and shore birds), to stay out of closed areas, not to disturb nests or nest markers, and to keep pets on leashes. In addition, *Wildlife in North Carolina* (May 1993), a monthly publication issued by the North Carolina Wildlife Resources Commission, featured an article on the installation of the signs relating to nesting shore birds and sea turtles and noted CP&L's participation in the program (Appendix 5).

In 1992, the company placed a notice in its customer bill inserts about nesting sea turtles and requested the public, during the nesting and hatching season, to shield, redirect or turn off unnecessary lights along the beach that might cause disorientation of egg-laying females and later of the hatchling turtles. This was done under the auspices of the "Take Pride in America" campaign in conjunction with the Raleigh Field Office of the U.S. Fish and Wildlife Service (May/June 1992 CP&L "Energy Notes") (Appendix 6). CP&L plans another educational North Carolina and South Carolina customer bill insert in the spring of 1998 regarding protection of nesting sea turtles and shore birds along our coastal areas. The public will be asked to avoid crowding or harassing turtles or birds that are on beaches and to keep clear of all nests. In 1998, CP&L is also funding the placement of nesting area signs through a program with the NCSTC.

The Brunswick Visitors Center at Southport, N.C., consists of various educational displays. One display, installed in 1995, describes protection of turtles in general as endangered species and includes information on protection of sea turtles at the BSEP plant intake area; and a section of a diversion structure screen panel. The attendance from the public at the center is about 10,000 visitors per year. Attendees include school and college groups, civic organizations, as well as individuals and seasonal tourists.

Assessment of Current BSEP Operations

The permanent diversion structure installed in the fall of 1982 has played a significant role in reducing potential sea turtle passage into the plant intake canal. Generally, sea turtles are not "drawn" into the intake area because they have the ability to swim faster than the flow at the diversion structure unless they are at the screen when there is a screen release. Flow in the canal itself is approximately 0.6 feet/sec at normal design depth, which is well within the swimming ability of the turtle to freely move around in the canal.

The residence time of sea turtles in the intake canal varies from a few hours to several days with the longer time frequently associated with the activity of the turtle itself and the degree of difficulty in capturing it. One of the indirect effects of those turtles that temporarily reside in the canal before removal is limited disruption of the normal migrations up and down the Atlantic coast. However, because the great majority are subadults or juveniles, their breeding or nesting activities are not impaired during their temporary residence in the canal. Because the canal is closed to net fishing, there is no opportunity for the turtles to become entrapped in fishermen's nets and there is no evidence that turtles are preyed upon while in the canal. A few turtles that are collected and removed have been found with fish hooks in their mouths and flippers. The CP&L turtle capture and removal program has not resulted in any incidences where sea turtles were drowned or injured during the netting and capture attempts. There has been no evidence that turtles sustain scrapes or injuries during the netting and capturing because nylon twine nets are used, which are not abrasive to the turtles. When turtles are captured and detained for measurement and tagging, every attempt is made to limit the holding and handling time to minimize stress to the animal. The estimated "holding" time from capture (removal from the canal) to release at Yaupon Beach on Oak Island is generally less than an hour—unless the turtle is injured, in which case the NCSTC is contacted for advice and possible attention by a veterinarian, or turned over to the NCSTC for attention. Under unusual circumstances, a turtle may be held overnight at the BSEP biology lab before release, primarily if collected late at night or if weather conditions don't favor a timely and safe release.

Based on the observations of turtles that are removed live from the canal, they are in good condition as judged by overall appearance and activity. CP&L's on-site environmental staff oversees and coordinates the turtle monitoring, capture, tagging, and release program at

BSEP. The current sea turtle monitoring program at BSEP demonstrates a high success rate of live turtle removal from the canal.

CP&L takes extra steps to have a veterinarian ensure that any injuries are identified and treated before the turtles are returned to the ocean. Examinations performed on all injured and dead sea turtles taken at BSEP indicate injuries from boat collision, boat motors and propellers, and possibly sharks. There may also be human-induced mortalities, primarily from net entanglement (perhaps from fishermen or shrimp trawling in the estuary near the BSEP). The National Research Council estimated that between 5,000 to 50,000 turtles per year are killed by the shrimping industry in United States waters (National Research Council 1990). This report also noted that power plant intake systems represent a minor source of turtle mortality.

The period of increased sea turtle occurrences at BSEP of the past two years coincides with increased public awareness and conservation efforts and presumably overall higher nesting success for turtles. There has been greater statewide awareness regarding reporting of sightings of sea turtles. It is possible that with increased nesting success resulting from public education and conservation efforts, there may be occurrences similar to that of the past two, higher-than-normal years. This is likely to be true when successful hatchlings return as juveniles and subadults from their pelagic foraging offshore. The relationship of large tropical storms and hurricanes along the North Carolina coast during the past two years to increased sea turtle strandings is unknown.

In this evaluation of potential impact to turtles, BSEP operations other than the intake canal have been considered. There are no known impacts to sea turtles from other plant operations: chlorination system, thermal discharge, or lights. The location and design of the discharge system and its six-mile canal isolate it from the intake area where turtles may be found. The plant's chlorination system is used to reduce fouling from marine organisms on plant equipment such as condenser tubes and heat exchangers. The chlorine concentration in the discharge waters meets North Carolina water quality standards of 0 mg/l.

Further, there are no lights that might attract or disorient adult or hatchling sea turtles toward the plant diversion structure. Further, given that the area around the structure is not suitable beach or nesting habitat, no additional impacts are known. While potential nesting sites exist on the beach in the vicinity of the discharge point in the ocean, there are no known impacts to sea turtles.

Cumulative Impact on Operation of BSEP

During the period of 1986-1997, there were 26 turtles that died and they were believed to be causally related to plant operations since they were collected and removed from the BSEP's trash racks. However, 110 turtles have been successfully removed from the plant's intake canal and released alive and unharmed.

Positive results from public education and conservation efforts could increase strandings along the North Carolina coast and increase takes at BSEP. Nevertheless, the populations as a whole of the species of sea turtles historically encountered or apt to be encountered in the future at the BSEP will not be detrimentally affected by the continued operation of the facility.

An annual incidental lethal take of three each is proposed for BSEP for the green and Kemp's ridley sea turtles and four for the loggerhead. The basis for these recommended allowed lethal takes of the three species is the historical record of incidental lethal captures over the last six years as indicated in Figure 5. The data show that despite the higher incidences in the past three years of live incidental takes in the plant's intake canal, there has not been a similar rise in lethal takes, suggesting that the turtle capture and return program in place by CP&L is effective. It is also recommended that three lethal takes each be allowed annually for the leatherback and the hawksbill turtles. While never having been collected at BSEP, these two species are known to be along North Carolina coasts and may move into the plant's intake canal in the future.

CP&L is recommending that no limit for non-lethal takes of sea turtles be established as a result of this biological assessment. The programs in place to discover, remove, and return sea turtles are effective and successful, even during the recent periods of increased numbers of sea turtles in the plant's intake canal.

The current monitoring and patrolling, capture and tagging, and release activities in coordination with the NCSTC are adequate to respond to turtles that enter the canal in the future. No additional mitigation is warranted or necessary to protect the turtle species.

Overall Assessment

The current diversion structure intake design for the BSEP significantly minimizes impact on the sea turtles that travel near the plant intake canal. The plant's diversion structure, initially installed to prevent movement of large fish and large shellfish into the canal, is equally effective in significantly reducing the numbers and kinds of most large organisms that enter the canal, including sea turtles. Coupled with CP&L's aggressive monitoring and patrol program, any turtles that enter the canal have a good chance of being successfully removed and returned to the ocean away from the plant. The company's turtle stewardship programs, including to public education complement efforts by the North Carolina Wildlife Resources Commission to provide increased awareness regarding nesting and hatchling turtles along our coastal areas.

CP&L continues to evaluate enhancements and new processes that may improve the effectiveness of our ability to keep turtles out of the intake canal. One such method being investigated is blocker panels. At the end of July 1997, CP&L installed experimental fixed six-inch-mesh blocker panels on the river side of the intake canal's diversion structure to minimize entry of turtles into the canal. These blocker panels are especially useful during routine maintenance and for replacement of worn or damaged diversion structure screens, including times when screens release. Although unproven for long duration, based on the success of the experimental turtle-blocker panels in the summer of 1997, CP&L is continuing to evaluate long-term use of the blocker panels, including other designs and types of materials.

CP&L believes that a biological opinion from the National Marine Fisheries Service with an incidental take statement is appropriate and that the operation of the BSEP is not a significant risk to the three species of sea turtles that occasionally enter the plant's intake canal. Operation with an allowed annual incidental lethal take for the five sea turtle species poses no significant threat to the sea turtle populations and is unlikely to jeopardize the continued existence of any of the five species. The mortalities of turtles experienced at the BSEP are conservative and the numbers are minor compared to mortalities from other causes such as natural illnesses, incidental net entanglement in fishing and shrimping gear, and ingestion of debris.

Literature Cited

Boettcher, Ruth. 1997. North Carolina Sea Turtle Coordinator, P. O. Box 178, Marshallberg, N.C. 28553. Personal communications.

Carolina Power & Light Company. 1984. Brunswick Steam Electric Plant annual biological monitoring report, 1983. Carolina Power & Light Company, New Hill, N.C.

Carolina Power & Light Company. 1995. Brunswick Steam Electric Plant annual biological monitoring report, 1994. Carolina Power & Light Company, New Hill, N.C.

Carolina Power & Light Company. 1996. Brunswick Steam Electric Plant annual biological monitoring report, 1995. Carolina Power & Light Company, New Hill, N.C.

Epperly, S. P., J. Braun, and A. Veishlow. 1995. Sea turtles in North Carolina waters. Conservation Biology 9(2): 384-394.

Florida Power & Light Company. 1995. Assessment of the impacts of the St. Lucie Nuclear Generating Plant on sea turtle species found in the nearshore waters of Florida.

GPU Nuclear Corporation. 1994. Assessment of the impacts of the Oyster Creek Nuclear Generating Station on Kemp's ridley (*Lepidochelys kempii*) and loggerhead (*Caretta caretta*) sea turtles.

National Research Council. 1990. Decline of the sea turtle: causes and prevention. National Academy Press. Washington, D. C.

North Carolina Wildlife Resources Commission. 1995. Handbook for sea turtle volunteers in North Carolina. Raleigh, N.C.

North Carolina Wildlife Resources Commission. 1997. Report to the Non-Game Wildlife Advisory Committee. February 29, 1997, Raleigh, N.C.

Wolke, R. E. And A. George. 1981. Sea turtle necropsy manual. National Oceanic and Atmospheric Administration, NOAA Technical Memorandum NMFS-SEFC-24, Kingston, R. I.

Table 1. Number (and percent in parentheses) of quarterly sea turtle strandings in North Carolina, 1995-1996.

Quarter	1995 Number of Strandings	1996 Number of Strandings
First	16 (4)	54 (11)
Second	187 (54)	231 (46)
Third	86 (25)	124 (25)
Fourth	58 (17)	93 (18)
Total	**347 (100)**	**502 (100)**

Table 2. Number (and percent in parentheses) of sea turtle strandings by coastal North Carolina county, 1995-1996.

County	1995 Number of Strandings	1996 Number of Strandings
Beaufort	1 (0)	1 (0)
Brunswick	51 (15)	86 (17)
Carteret	58 (17)	187 (37)
Craven	1 (0)	1 (0)
Currituck	32 (9)	15 (3.5)
Dare	152 (44)	162 (32)
Hyde	14 (4)	19 (4)
New Hanover	10 (3)	9 (2)
Onslow	20 (6)	15 (3.5)
Pamlico	1 (0)	0 (0)
Pender	7 (2)	7 (1)
Total	**347 (100)**	**502 (100)**

Table 3. Number (and percent in parentheses) of sea turtle species that stranded in North Carolina, 1995-1996.

Species	1995 Number of Strandings	1996 Number of Strandings
Loggerhead	280 (81)	377 (75)
Green	24 (7)	61 (12)
Leatherback	18 (5)	12 (2)
Kemp's ridley	14 (4)	39 (8)
Unknown	11 (3)	13 (3)
Total	**347 (100)**	**502 (100)**

Source: North Carolina Wildlife Resources Commission (N.C. Sea Turtle Coordinator), 1997.

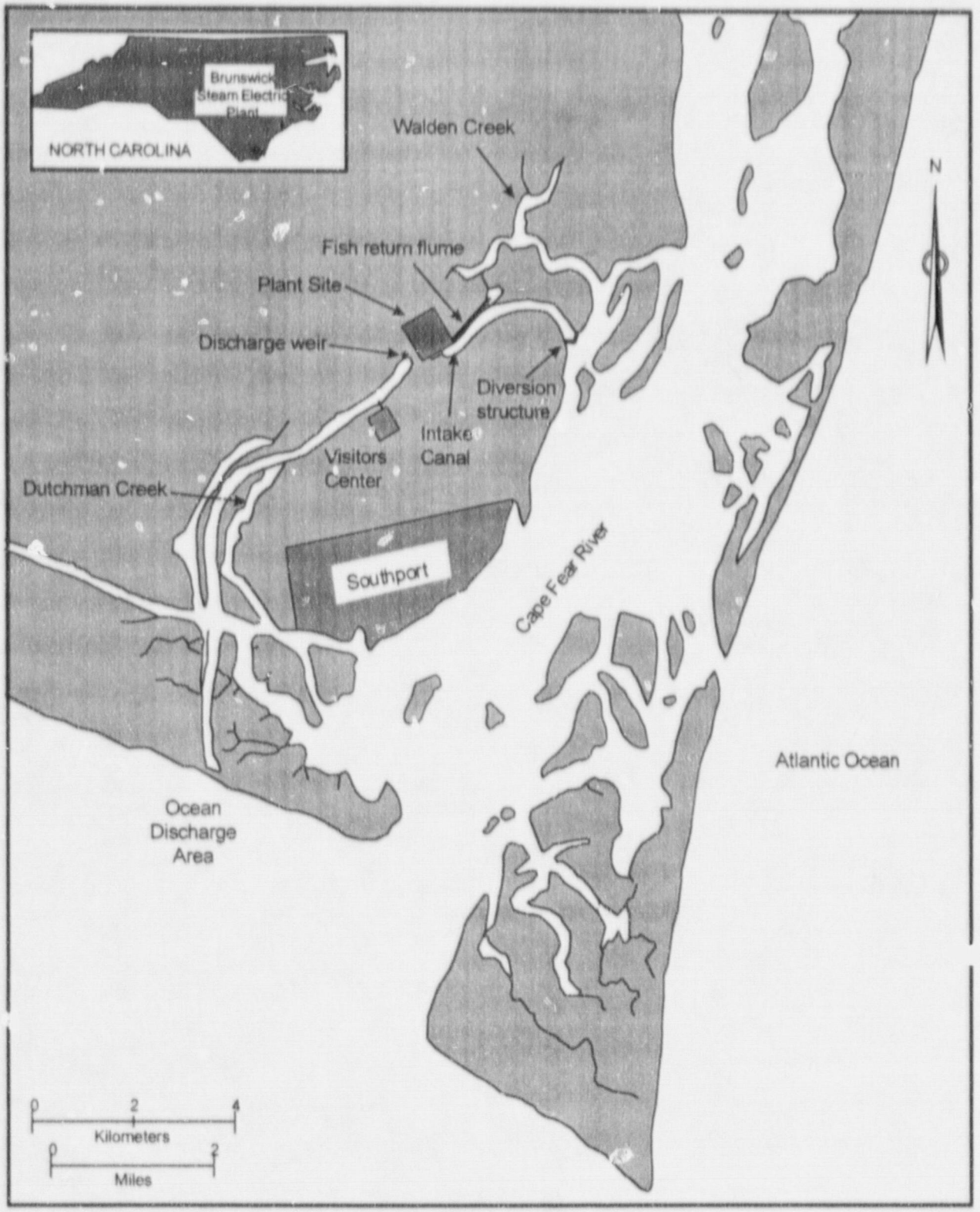


Figure 1. Location of Brunswick Steam Electric Plant near Southport, North Carolina.

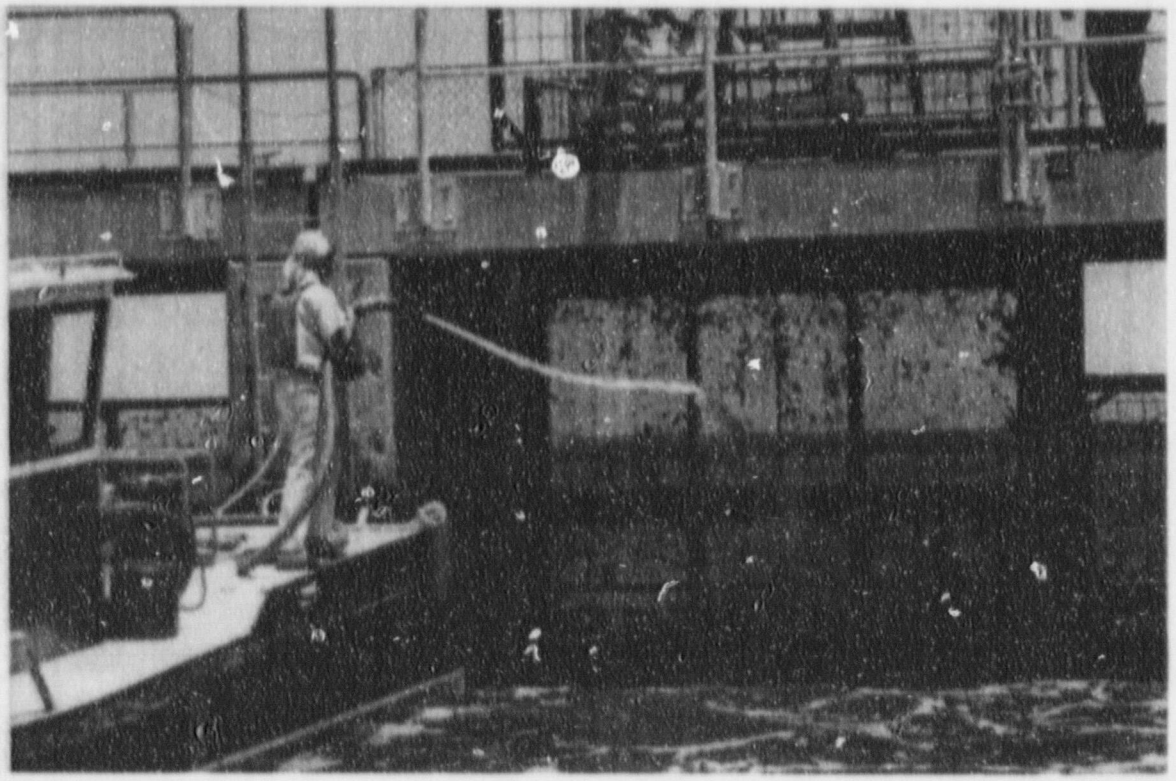


Figure 2. Photograph of fish diversion structure at the mouth of intake canal at Brunswick Steam Electric Plant.

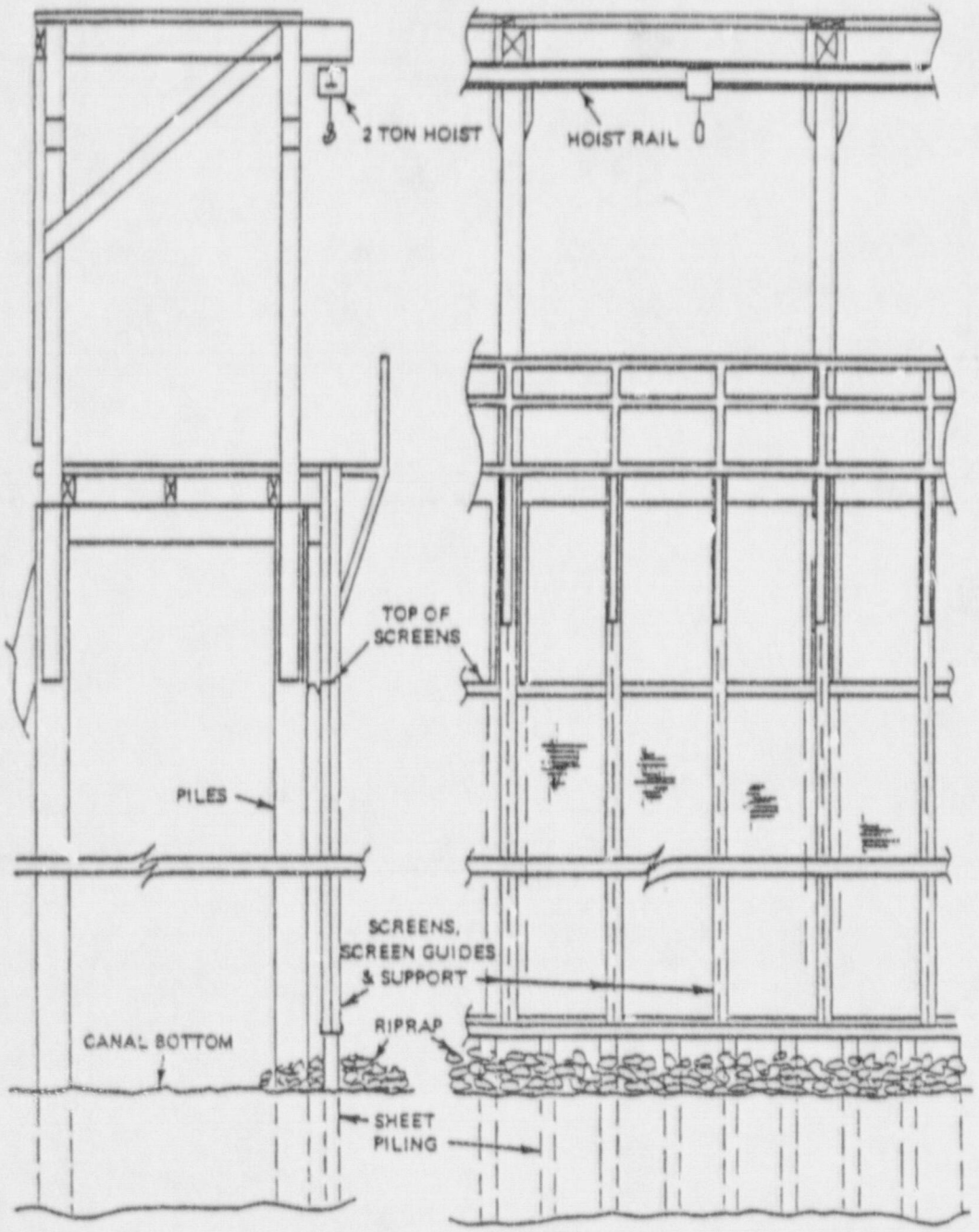


Figure 3. Schematic drawing of the Brunswick Steam Electric Plant permanent diversion structure in the intake canal.

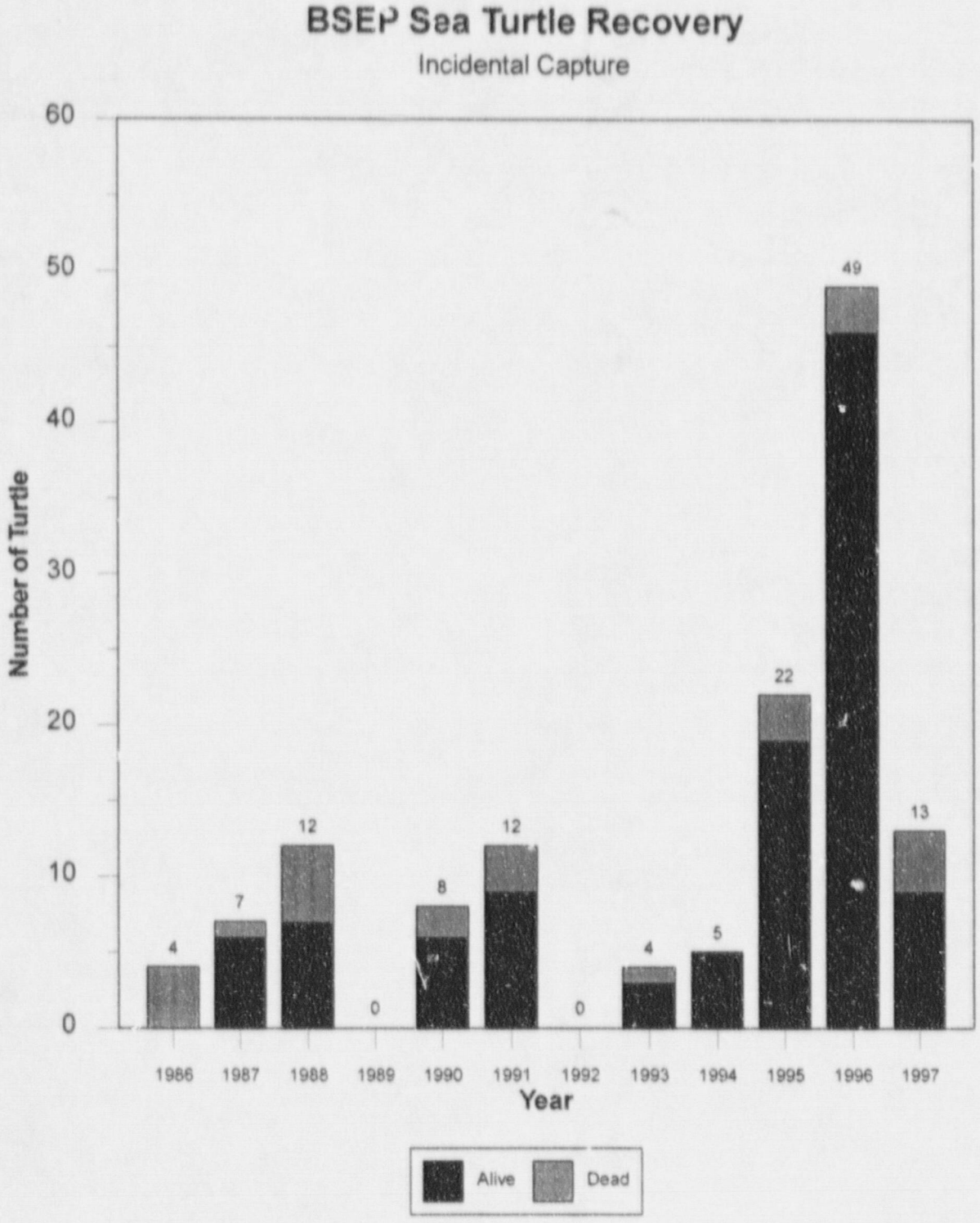


Figure 4. Brunswick Steam Electric Plant sea turtle recovery incidental capture (alive and dead) by year, 1986-1997.

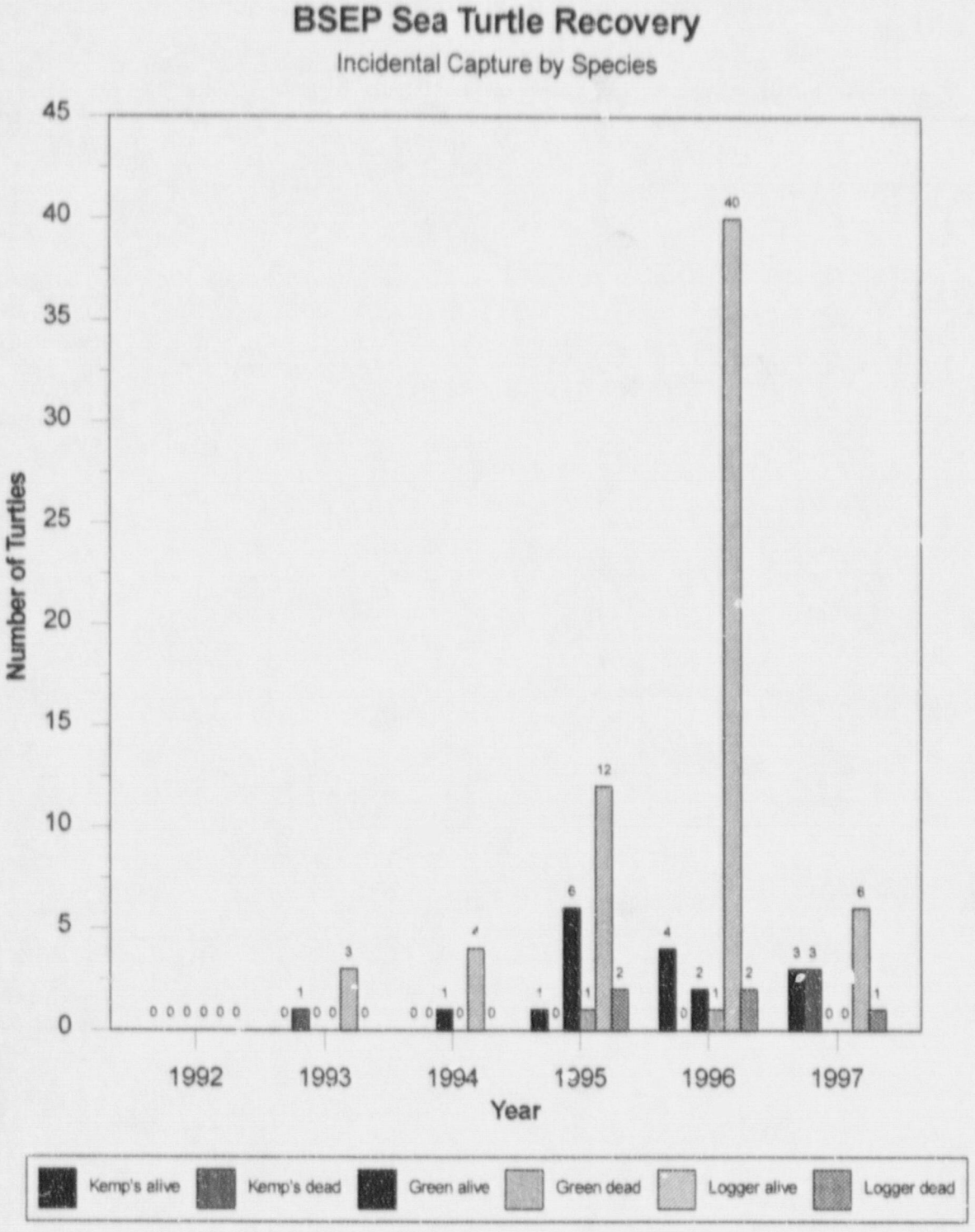


Figure 5. Brunswick Steam Electric Plant sea turtle recovery incidental capture (dead and alive) by species, 1992-1997.

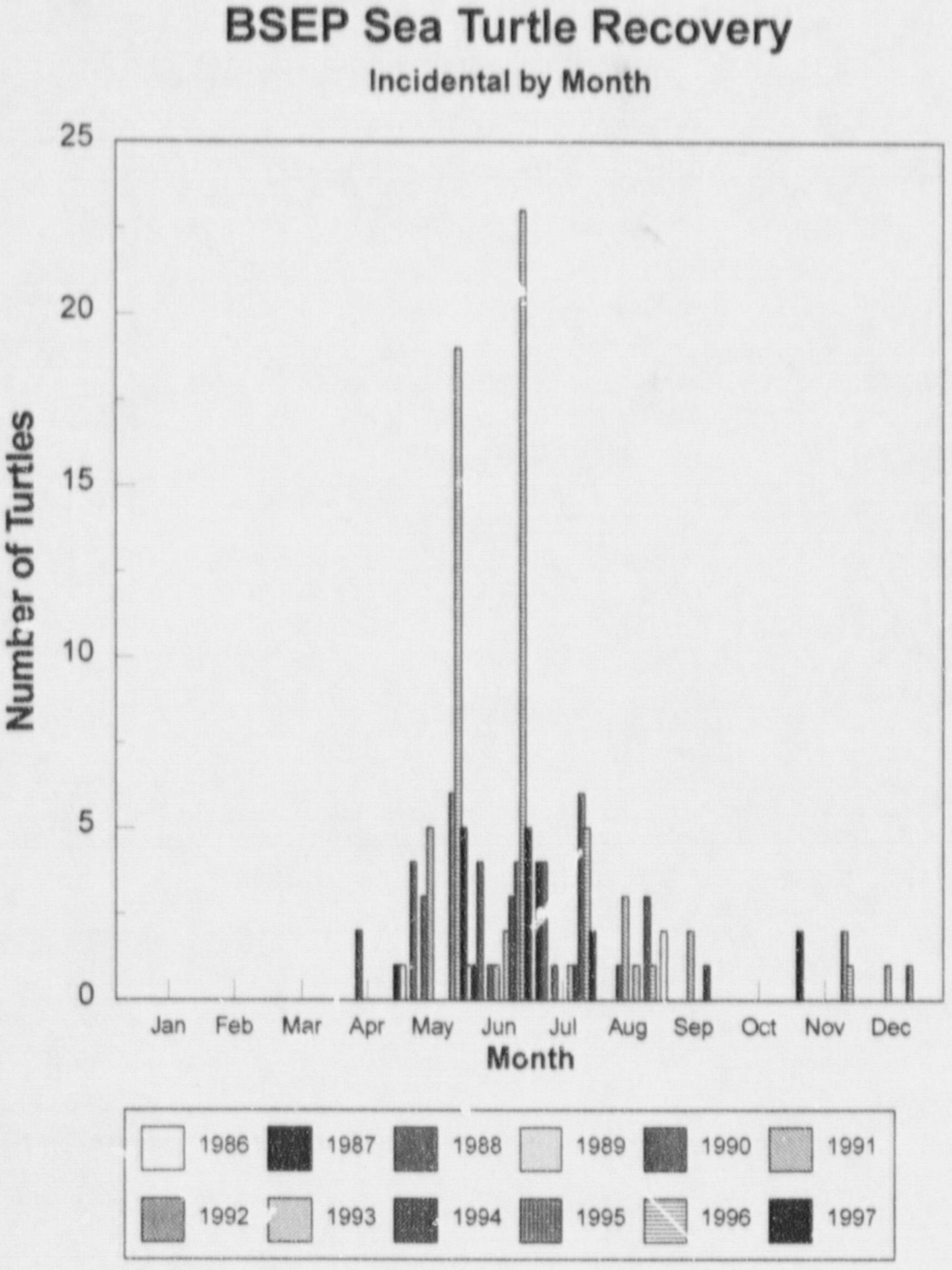


Figure 6. Brunswick Steam Electric Plant sea turtle recovery incidental capture by month and percent of total number capture by month, 1986-1997.

Appendix I. Current Sea turtle sighting and capturing protocol at Brunswick Steam Electric Plant.

Sea Turtle Patrols

As conditions warrant:

Inspect the intake trash racks generally daily during turtle season (late April through August) unless inclement weather or other conditions prevent it. Conduct inspections at or near low tide.

Inspections of the trash racks should include close-up inspection of each rack and 30 to 60 minutes in the area to observe for sea turtle surfacing.

Observe the entire length of the canal while traveling between plant intake screens and the diversion structure.

Observe the diversion structure area for 30 to 60 minutes.

Live Sea Turtle Sightings

If a live sea turtle is observed by other employees, question them about:
the species,
the approximate size, and
the exact location.

If a live sighting is reported, observe the area for one hour.

If a live turtle is observed, set the turtle capture net.

Ensure that you have the Endangered Species Permit in your possession before setting the net.

Use the 200-foot-long net if the turtle is observed near the plant intake structure.

Net should be securely tied to the fence post directly across the canal from the intake structure.

Deploy the net toward the intake structure until the net is completely set.

The net may be left unattended for only a few minutes at a time.

If a turtle becomes tangled in the net, remove it immediately.

Use the 300-foot-long net if the turtle is observed near the diversion structure.

Net should be securely tied to a ladder or cleat on the diversion structure near the area

where the turtle was last observed.

Deploy the net until it is completely set.

Observe the net in the water flow and make adjustments as needed.

The net may be left unattended for only a few minutes at a time.

If a turtle becomes tangled in the net, remove it immediately.

Sea Turtle Tagging

Ensure that you have the Endangered Species Permit in your possession.

All live sea turtles should be tagged except those under eight pounds.

Place a PIT tag just anterior of the second scale from the shoulder on the left front flipper.

Ensure the PIT tag is operational by scanning the tag.

Place an Iconel clip-on tag on each rear flipper on sea turtles that weigh greater than 8 pounds.

Ensure that the Iconel tag is locked into place.

Stranding and Tagging Reports

Complete a sea turtle stranding report for each turtle captured.

Complete a sea turtle tagging report for each tagged turtle.

Give reports to CP&L sea turtle coordinator.

Sea Turtle Release

Ensure that you have the Endangered Species Permit in your possession.

Photograph the turtle.

Transport sea turtle to Yaupon Beach and release it in the surf.

Dead Sea Turtles

Ensure that you have the Endangered Species Permit in your possession.

Remove sea turtle from canal.

Complete the Sea Turtle Stranding Report.

Call Ruth Boettcher, the N.C. Sea Turtle Coordinator at (919) 729-1359.

Photograph the turtle.

Bury the turtle on site near the Land Clearing Inert Debris (LCID) landfill.

Give report to CP&L sea turtle coordinator.

Appendix 2. Carolina Power & Light Company-held endangered species permit.

NORTH CAROLINA WILDLIFE RESOURCES COMMISSION
512 North Salisbury St.
Raleigh, NC 27604-1188

ENDANGERED SPECIES PERMIT		
Date Issued: 1/15/97	Expiration Date: 12/31/97	Permit No.: 97ST16
Issued to: George Baird Environmental Coordinator CP&L, Brunswick Nuclear Power Plant PO Box 10429 Southport, NC 2846[illegible]	**SPECIES:** Loggerhead (*Caretta caretta*), Green (*Chelonia mydas*), Kemp's Ridley (*Lepidochelys kempii*), Leatherback (*Dermochelys coriacea*), Hawksbill (*Eretmochelys imbricata*). Sea Turtles.	
The above named person and t[illegible] under his(her) authority is(are) hereby authorized to conduct the following activities with the specified Federally-listed endangered or threatened species as a designated agent of the North Carolina Wildlife Resources Commission:		

AUTHORIZED ACTIVITIES

Possession and Disposition of Stranded Sea Turtles - this permit authorizes the possession and transportation of injured or sick stranded sea turtles for the purpose of rehabilitation and/or release and the possession and transportation of dead stranded sea turtles for the purposes of disposition.

a. The North Carolina Wildlife Resources Commission's Sea Turtle Stranding Coordinator, Ruth Boettcher (919-729-1359), or Coastal Nongame Project Leader, David H. Allen (919-224-1288), must be contacted within twenty-four hours of *each* stranding event.

b. A Sea Turtle Stranding Report form must be completed and submitted to the North Carolina Wildlife Resources Commission at the time of each stranding occurrence.

Tagging of Live Sea Turtles Entrained in the Brunswick Nuclear Power Plant's Intake Canal - this permit authorizes the tagging of live sea turtles entrained in the intake canal prior to their release.

Issued by:
David H. Allen
David H. Allen
Coastal Nongame Project Leader
(919) 224-1288

cc: Division of Wildlife Enforcement
Nongame Section Manager

Appendix 3. Turtle stranding and salvage network-stranding report.

SEA TURTLE STRANDING AND SALVAGE NETWORK - STRANDING REPORT

PLEASE PRINT CLEARLY AND FILL IN ALL APPLICABLE BLANKS. Use codes below. Measurements may be straight line (caliper) and/or over the curve (tape measure). Measure length from the center of the nuchal notch to the tip of the most posterior marginal. Measure width at the widest point of carapace. **CIRCLE THE UNITS USED.** See diagram below. Please give a specific location description. **INCLUDE LATITUDE AND LONGITUDE.**

Observer's Full Name _____ Stranding Date ____ ____ ____
year month day

Address / Affiliation _____

Area Code / Phone Number _____

Species _____ Turtle Number By Day _____

Reliability of I.D.: (CIRCLE) Unsure Probable Positive Species Verified by State Coordinator? Yes☐ No☐

Sex: (CIRCLE) Female Male Undetermined How was sex determined? _____

State _____ County _____

Location (be specific and include closest t own) _____

_____

Latitude _____ Longitude _____

Condition of Turtle (use codes) _____ Final Disposition of Turtle (use codes) _____

Tag Number(s) (include tag return address and disposition of tag) _____

_____

Remarks (note if turtle was involved with tar or oil, gear or debris entanglement, wounds or mutilations, propellor damage, papillomas, epizoa, etc.) continue on back if necessary

_____

_____

_____

MEASUREMENTS: CIRCLE UNITS

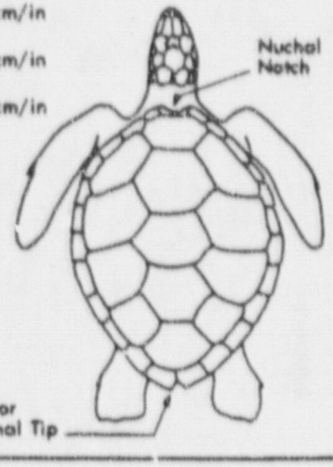
Straight Length _____ cm/in

Straight Width _____ cm/in

Curved Length _____ cm/in

Curved Width _____ cm/in

Mark wounds, abnormalities, and tag locations



CODES:

SPECIES:
- CC = Loggerhead
- CM = Green
- DC = Leatherback
- EI = Hawksbill
- LK = Kemp's ridley
- UN = Unidentified

CONDITION OF TURTLE:
- 0 = Alive
- 1 = Fresh dead
- 2 = Moderately decomposed
- 3 = Severely decomposed
- 4 = Dried carcass
- 5 = Skeleton, bones only

FINAL DISPOSITION OF TURTLE:
- 1 = Painted, left on beach
- 2 = Buried: on beach / off beach
- 3 = Salvaged specimen: all / part
- 4 = Pulled up on beach or dune
- 5 = Unpainted, left on beach
- 6 = Alive, released
- 7 = Alive, taken to a holding facility

Appendix 4. National Marine F[illegible]vice/Southeast Fisheries Center cooperative marine turtle taggi[illegible]gram report.

NMFS/SEFC COOPERATIVE MARINE TURTLE TAGGING PROGRAM
TAGGING DATA (REHABILITATED, NETTED, OR OTHER RELEASE)

.g Number(s) (list all tag #'s and letter prefix) _____ Species _____

_____ Date Released _____

407751306F

Describe release location (be specific - includs county and lat/long if available):

_____

_____

_____

Describe original stranding or capture location AND stranding or capture date (where did this turtle come from?):

_____

_____

_____

Describe capture method and/or type of gear in use when turtle was caught (if applicable):

_____

_____

Carapace length straight line _____ cm _____ in

Carapace width straight line _____ cm _____ in

Carapace length over curve _____ cm _____ in

Carapace width over curve _____ cm _____ in

Weight _____ kg _____lbs

Additional remarks or data (use back if necessary): _____

_____

_____ _____

Organization Tagging (include area code/phone number): _____

_____

M'l completed forms to: NMFS - Miami Lab
Cooperative Marine Turtle Tagging Program
75 Virginia Beach Drive
Miami, FL 33149

Appendix 5. "Wildlife in North Carolina" magazine article on new signs advising protection of shore birds and sea turtles.

CP&L Donates Funds for Signs

Coastal Wildlife Nesting Areas Posted with Warnings

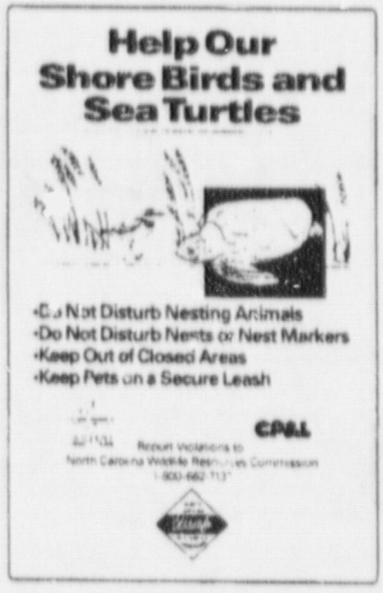
Tread with care if you see signs displaying a turtle and a tern posted in coastal areas. The signs are being posted on barrier islands from the Cedar Island area to the South Carolina line and are meant to alert visitors to the presence of wildlife nests on the beach.

"The purpose of these signs is to inform the beach-going public about the need to prevent disturbance in these areas during nesting time for sea turtles and colony-nesting seabirds," said Randy Wilson, section leader for the Wildlife Commission's Nongame and Endangered Wildlife Program. "Walking, playing or driving in these areas can destroy critical nests. Visitors should view wildlife from a distance that doesn't disturb nesters at this critical breeding season."

Carolina Power & Light Company provided $8,000 in funding for the signs, posts and mounting hardware. "We're pleased to support this project to heighten public awareness of the plight of beach-nesting wildlife in areas of high human development," said Rick Yates, manager of biological assessment for CP&L.

Special care should always be taken when driving anywhere near bird or turtle nests. Not only can vehicles crush nests, but hatchling turtles and some newly hatched seabirds can become trapped in the tire ruts.

Nests of threatened loggerhead sea turtles and colony-nesting seabirds are protected by state and federal laws. Violations of these laws may be reported to the Wildlife Commission's toll-free hotline at 1-800-662-7137.



Beach visitors should be aware of signs like this alerting them that beach nesting wildlife is nearby.

Appendix 6. Carolina Power & Light Company customer bill insert on protection of nesting sea turtles.

CP&L Works With Fish & Wildlife Agencies

The Carolinas are home to many endangered creatures including sea turtles. At night they come ashore and lay their eggs in the sand. Lights near the beach can disorient their hatchlings and cause them to wander away. Most die from exposure, dehydration or being run over. You can help just by not disturbing turtles crawling to or from the ocean and by shielding or redirecting lighting away from the beach.

For more information on how you can help, in North Carolina, call **1-800-662-7137**, and in South Carolina call **1-800-922-5431.**