ASSESSMENT OF THE IMPACTS OF THE OYSTER CREEK NUCLEAR GENERATING STATION ON KEMP'S RIDLEY (Lepidochelys kempii) AND LOGGERHEAD (Caretta caretta) SEA TURTLES

PREPARED BY

OYSTER CREEK ENVIRONMENTAL CONTROLS

GPU NUCLEAR CORPORATION

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Prepared by
GPU Nuclear Corporation

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SECTION 1.0
SUMMARY AND CONCLUSIONS

This "biological assessment" was prepared by GPU Nuclear Corporation (GPUN) for submittal to the U.S. Nuclear Regulatory Commission and the National Marine Fisheries Service to comply with Section 7 of the Endangered Species Act (the Act). The purpose of this assessment is to examine the potential impacts associated with the continued operation of the Oyster Creek Nuclear Generation Station (OCNGS) on sea turtle species protected under the Act.

OCNGS is located along the western shore of Barnegat Bay between the South Branch of Forked River and Oyster Creek, in Ocean County, New Jersey. Monthly mean salinity values observed in western Barnegat Bay near OCNGS vary seasonally from approximately 18.5 ppt to over 28 ppt. Monthly mean ambient water temperatures in this portion of the Bay range from a winter mean of 1°C (33.8°F) to approximately 28°C (82.4°F) during the summer (Kennish and Lutz, 1984).

OCNGS consists of a single boiling water nuclear reactor with an electrical capacity of approximately 650 megawatts. When OCNGS is in operation, water flows from Barnegat Bay into Forked River and OCNGS, where some of the flow is used to cool the powerplant condensers. Heated water discharged from OCNGS flows eastward in Oyster Creek back into Barnegat Bay.

OCNGS has two water intake structures, the circulating water system intake and the dilution water system intake. During normal operation, the circulating water system moves approximately 1740 m^3/min (0.46 million gpm) of water through the main condensers for cooling purposes. Additionally, up to two dilution pumps (each with a 984 m^3/min or 0.26 million gpm capacity) divert water from the intake canal to the discharge canal to reduce the temperature of the circulating water discharge (Kennish, 1978). Both intakes utilize trash bars to remove debris from the water. The circulating water system intake has vertical traveling screens which have been the modified with Ristroph fish buckets and a fish return system.

Four species of sea turtles have been reported from coastal New Jersey waters. These sea turtle species are: loggerhead (Caretta caretta), Kemp's ridley (Lepidochelys kempii), green turtle (Chelonia mydas), and leatherback (Dermochelys coriacea). Two of these sea turtles species, Kemp's ridley and leatherback, are listed as endangered and two, the loggerhead and green turtle, are listed as threatened. Only the loggerhead and Kemp's ridley

turtles have been captured at the OCNGS.

The loggerhead sea turtle is the most common sea turtle in the coastal waters of the United States and occurs in many other locations throughout the world. Population numbers along the south Atlantic Coast (North Carolina to Florida) have been estimated at 387,594 turtles (NMFS 1987). The loggerhead population in the southeast is considered to be stable by most investigators but the population is threatened by reductions in nesting and foraging habitat due to the continued development of coastal areas and losses resulting from incidental capture in shrimp trawls. An estimated 5,000 to 50,000 turtles have been lost annually from trawling without the use of turtle exclusion devices (TED's) (NMFS 1991a).

The Kemp's ridley is the most endangered of the sea turtle species. There is only a single known colony of this species, almost all of which nest near Rancho Nuevo, Mexico and represent the world population for this species. The population level has been estimated at 2,200 turtles (Márquez 1989). The ridley population is also impacted by coastal development and shrimp trawling. Incidental take by the shrimp industry has been identified as the largest source of mortality (between 500 and 5,000 killed annually) for L. kempii (Magnuson et al. 1990). However, subsequent to the implementation of the NMFS TED regulations in 1989, strandings of drowned sea turtles have been dramatically lower and nesting activity has increased (Crouse et al. 1992).

Sea turtles have been observed and incidentally captured at OCNGS during 1992 through 1994, but were never captured during more than 10 years of field sampling associated with the station since 1969. Their scarcity in Barnegat Bay is largely attributable to the fact that access to the bay is extremely limited. The only direct access to Barnegat Bay from the Atlantic Ocean is via a single, narrow inlet, approximately 300 m (1,000 ft) wide.

Only eight sea turtles have been impinged at OCNGS during more than 24 years of operation. At the circulating water intake, three live loggerheads and one live Kemp's ridley were captured. Two loggerheads, apparently dead on arrival due to boat prop wounds, and three Kemp's ridleys, recently deceased, were collected from the dilution water intake. One of the dead Kemp's ridleys apparently drowned on the trash bars. The cause of death of the other two Kemp's ridleys is unknown, pending the completion of necropsies, but may have been the result of drowning. All specimens captured at OCNGS were subadults or juveniles.

The occurrence of eight sea turtles at the OCNGS during 1992, 1993 and 1994, although none had been observed before despite intensive sampling efforts, may be attributable to at least two factors. Modifications to Barnegat Inlet, completed in 1991, have resulted in significant increases in the depth of the inlet and the volume of water passing through the inlet during each tidal exchange. These changes may have made Barnegat Bay more accessible to sea turtles migrating up the Atlantic coast. In addition, sea turtle

population levels may have increased as a result of the implementation of the NMFS TED regulations in 1989.

It remains to be seen whether or not the changes to Barnegat Inlet will be permanent or, as has happened in the past, shoaling will occur over time, reducing access to Barnegat Bay via the inlet. Similarly, additional data on sea turtle populations and commercial fishing by-catch must be gathered in order to fully evaluate the effectiveness of the TED regulations on reducing sea turtle mortality.

The primary concern with sea turtles at OCNGS is whether or not any station related losses of these endangered or threatened species "jeopardizes their continued existence." Federal regulation defines this term as engaging in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of the listed species in the wild by reducing the reproduction, numbers, or distribution of that species." A comparison was made of sea turtle losses at OCNGS, assuming worst case losses, with population estimates for both species. This worst case estimate of losses includes turtles that died prior to becoming impinged at the OCNGS intake as well as turtles captured alive at OCNGS and returned to the wild. Calculated accordingly, the maximum, estimated, annual loss of loggerheads at the station is three turtles, which represents approximately 0.0008 percent of the population in the southeast U.S. The estimated, worst-case annual loss of Kemp's ridleys at OCNGS is three turtles, which would represent 0.14 percent of the population. It is unlikely that losses at these levels would "appreciably reduce" the distribution or numbers of either species. Losses to reproduction would be restricted to "production foregone" due to the loss of juvenile/subadult animals which could potentially be recruited into the breeding population at some time in the future.

Thermal impacts from the operation of OCNGS, such as acute and chronic thermal impacts and coldshock, are not a concern. The thermal effluent from the station forms only a shallow thermal plume within Barnegat Bay. Both species of sea turtles, which have strong swimming ability, can avoid thermally affected areas which exceed their temperature preferences. In addition, no sea turtles have ever been observed within the discharge canal.

In order to minimize the impact of OCNGS operations on threatened or endangered sea turtles, a variety of measures have been instituted to ensure their timely removal from the intake structures and optimize their chances for survival. Instructions have been developed for station personnel which define the surveillance, handling and reporting requirements necessary to minimize the impact on sea turtles incidentally captured at the OCNGS. These instructions call for the inspection of the intake structures for the presence of sea turtles at least twice per 8-hour shift throughout the sea turtle season. This represents a doubling of the frequency of intake structure inspections previously specified. Guidance on the identification, handling,

and resuscitation of sea turtles is also included in the instructions and large color posters, which illustrate the distinguishing features of sea turtles, resuscitation techniques, and reporting requirements, are prominently posted at the intake structures. Custom-made dipnets and a lift net designed to facilitate the gentle removal of sea turtles from the intake are stored at the intake structures during the sea turtle season. The instructions also include precautions to be taken during routine cleaning of the intake trash bars to ensure that any sea turtles mixed in with the accumulated debris are removed and properly handled.

In summary, GPUN concludes that the continued operation of OCNGS will not jeopardize the continued existence of either the loggerhead or Kemp's ridley sea turtle. The estimated losses of these species attributable to the operation of the station, particularly the water intakes, will not "appreciably reduce" the distribution or numbers of either species. Losses to reproduction would be restricted to "production foregone" due to the loss of juvenile or subadult animals which could potentially be recruited into the breeding female population in the future.

SECTION 2.0
INTRODUCTION

2.1 PURPOSE

This "biological assessment" is submitted to the U.S. Nuclear Regulatory Commission (NRC) by GPU Nuclear Corporation (GPUN) in compliance with Section 7 of the Endangered Species Act of 1973 (as amended) [the Act].

The purpose of this assessment is to examine the potential impacts associated with the continued operation of GPUN's Oyster Creek Nuclear Generating Station (OCNGS) on sea turtle species protected under the Act. The primary species of concern are the Kemp's ridley (Lepidochelys kempii) and loggerhead (Caretta caretta) sea turtles, both of which have been captured on the circulating water or dilution intake trash bars at OCNGS. The U.S. Fish and Wildlife Service, "List of Endangered and Threatened Wildlife and Plants," lists the status of the Kemp's ridley sea turtle as endangered and the loggerhead sea turtle as threatened (50 CFR 17.11). The Atlantic green turtle (Chelonia mydas) and the leatherback turtle (Dermochelys coriacea) are also listed as endangered in U.S. waters and are known to occur in New Jersey waters, but have not been observed at OCNGS. The National Marine Fisheries Service (NMFS) has jurisdiction for these species (50 CFR 222.23(a) and 50 CFR 227.4(b)).

2.2 ENDANGERED SPECIES ACT

This "biological assessment" is part of the formal consultation process provided under Section 7 of the Endangered Species Act. Detailed procedures for this consultation process are defined in 50 CFR 402.

2.3 CHRONOLOGY OF EVENTS LEADING UP TO THIS ASSESSMENT

A review of the sea turtle strandings at OCNGS was recently requested in a letter from the NMFS to the NRC in November 1993 (Mantzaris 1993). This letter followed communications between GPUN, NRC and NMFS regarding the capture of sea turtles at OCNGS during 1992 in spite of OCNGS having operated for many years (1969-1991) prior to any being taken.

The issue of sea turtles at OCNGS was initially addressed in 1992 when sea turtles were first observed at the station's circulating water and dilution structure intake trash bars. The matter was discussed jointly by GPUN, NRC, and NMFS (informal Section 7 review). Subsequent to an additional sea turtle being captured in 1993, NMFS advised NRC that a formal consultation process including preparation of a Biological Assessment would be required (Mantzaris

1993). GPU Nuclear requested that they be authorized to prepare the Biological Assessment.

This document is GPUN's "Assessment of the Impacts of the Oyster Creek Nuclear Generating Station on Kemp's ridley (Lepidochelys kempii) and Loggerhead (Caretta caretta) Sea Turtles."

SECTION 3.0
SITE DESCRIPTION

3.1 LOCATION

GPUN's Oyster Creek Nuclear Generating Station is located along the eastern edge of the coastal pine barrens of New Jersey in Lacey and Ocean Townships, Ocean County (Figure 3-1). The plant site is part of approximately 5.73 x 10^6 m^2 (1,416 acres) of land owned by Jersey Central Power and Light Company. The OCNGS site is located to the west of U.S. Route 9, and is bounded on the north by the South Branch of Forked River and on the south by Oyster Creek. Barnegat Bay forms the eastern site boundary and the Garden State Parkway the western site boundary (Figure 3-2). The power plant structures are situated approximately midway between Oyster Creek and the South Branch of Forked River and about 425 meters (1,394 ft) west of Route 9.

The station site is approximately 55 km (34 mi) north of Atlantic City, New Jersey and 70 km (44 mi) east of Philadelphia, Pennsylvania. Approximately 15 km (9 mi) north of the site are several small residential communities: Toms River, South Toms River, Beachwood, Pine Beach, Ocean Gate, Island Heights and Gilford Park. West of the Garden State Parkway the land is primarily undeveloped woodland, and wooded wetlands are found along the banks of small creeks to the north, south and west of the site. East of the station along the shoreline of Barnegat Bay, the land is characterized by alternating sections of residential development and undeveloped coastal wetlands and adjacent uplands. The terrain surrounding the site is relatively flat along the shoreline to gently rolling inland.

3.2 BARNEGAT BAY MORPHOLOGY AND BATHYMETRY

The OCNGS utilizes Barnegat Bay as a source of cooling water, via the south branch of Forked River, and the bay serves as the receiving water body for thermal discharges, via Oyster Creek (Figure 3-2). Barnegat Bay is a shallow, lagoon-type estuary typical of the back bay systems of barrier island coastlines. The long axis of Barnegat Bay extends approximately 50 km (31 mi) in roughly a north-south direction and parallels the mainland, forming an irregular tidal basin ranging from 1 to 6 km (0.6 - 3.7 mi) in width and 0.3 to 6 m (1 - 20 ft) in depth (Kennish and Olsson 1975; Kennish 1978). The bay is bordered on the west by the New Jersey mainland, on the north by Point Pleasant and Bay Head, on the east by Island Beach and Long Beach Island, and on the south by Manahawkin Causeway. Island Beach and Long Beach Island comprise a barrier island complex breached only at Barnegat Inlet, which is located 10.5 km (6.5 mi) southeast of OCNGS. This single, relatively narrow inlet, provides the only direct access to the bay from the Atlantic Ocean (Figure 3-1).

The surface area and volume of Barnegat Bay have been estimated to be 1.67 x 10^8 m^2 (64.5 square miles) and 2.38 x 10^8 m^3 (8.40 x 10^9 ft^3), respectively (U.S. Atomic Energy Commission 1974). About 73% of the estuary is less than 2 m (6.6 ft) deep at mean low water, which is characteristic of lagoon-barrier island systems (Barnes 1980). The bay's eastern perimeter is shallower (less than 0.9 m or 3.0 ft) than the central and western sectors which are 0.9 to 4.0 m (3.0 - 13.0 ft) deep, with extensive shoal areas exposed at low tide (Chizmadia et al. 1984). The greatest depths of 3 to 4 m (10 - 13 ft) occur along the Intracoastal Waterway, a narrow channel traversing the length of the bay. The Intracoastal Waterway is heavily utilized by both recreational boaters and commercial fishing boats, and is maintained at a depth of approximately 2 m (6.6 ft) for navigation purposes by the U.S. Army Corps of Engineers (Marcellus 1972).

3.3 HYDROLOGY OF BARNEGAT BAY

The bay communicates with Manahawkin Bay to the south and, via the Bay Head-Manasquan Canal, with the Manasquan River to the north (Chizmadia et al. 1984). The primary exchange of ocean and bay water occurs through Barnegat Inlet, where Carpenter (1963) estimated an exchange rate of 7% per tide and a net discharge rate of 56.7 m^3/sec (2,002 ft ^{3}/sec).

The salinity regime and circulation patterns within the bay are affected by the inflow of relatively high salinity waters originating in the Atlantic Ocean which enter the northern and central bay via the Bay Head-Manasquan Canal and Barnegat Inlet, respectively. Because the proportion of bay water which escapes seaward each tidal cycle is relatively small, Chizmadia et al. (1984) estimate that 96 tidal cycles are required for complete turnover of estuarine water to take place. Marcellus (1972) reported a mean tidal current through Barnegat Inlet of 1.1 m/sec (3.6 ft/sec) during flood tide and 1.3 m/sec (4.3 ft/sec) during ebb tide. Ashley (1988) measured peak flood tide flow velocities of 1.1 m/sec (3.6 ft/sec) and peak ebb velocities of 1.0 m/sec (3.3 ft/sec).

3.3.1 INFLUENCE OF BARNEGAT INLET MODIFICATIONS ON BARNEGAT BAY HYDROLOGY

Beginning in 1988, a multi-year project by the U.S. Army Corps of Engineers was undertaken to re-align the south jetty at Barnegat Inlet and to dredge accumulated sediments from within the inlet. The new alignment of the inlet's south jetty so that it is nearly parallel to the north jetty was completed in 1991. The new jetty configuration has not changed the effective width of the inlet, which remains approximately 300 meters (1000 ft) wide, through which Atlantic Ocean waters can enter Barnegat Bay. The mean tidal range at Barnegat Inlet was reported by Ashley (1988) to be approximately 0.6 m (2 ft) prior to the jetty modifications, and the tide range became progressively damped in a landward direction. The small size of Barnegat Inlet and the shallowness of the bay both restrict tidal flow and attenuate tidal energy, thereby

minimizing tidal fluctuations. The depth of the inlet was significantly increased via dredging recently, which permits a freer interchange of ocean and bay waters. The ess restricted tidal flow due to recent dredging and jetty modifications has resulted in a significantly greater volume of water passing through Barnegat Inlet during a given tidal cycle (Table 3-1). Preliminary U.S. Army Corps of Engineers data indicate that the average tidal prism has more than doubled since completion of the modifications, and the mean tide range at Barnegat Inlet has increased by over 30% (Gebert 1994).

3.4 BARNEGAT BAY SALINITY

Maximum Barnegat Bay salinities of over 30 ppt are found near Barnegat Inlet due to the input of Atlantic Ocean water. Most freshwater, however, enters the estuary from surface runoff and ground water seepage along the western shore of the bay (Chizmadia et al. 1984). Several tributaries which drain the New Jersey Pine Barrens provide a mean surface runoff of 10.2 m^3/sec (360 ft^3/sec). Toms River provides the greatest freshwater input (5.7 m^3/sec; 201 ft^3/sec) to the estuary, and Cedar Creek provides an additional 3.1 m^3/sec (110 ft^3/sec) (U.S. Atomic Energy Commission 1974). Other significant tributaries of the bay include the Metedeconk River, Kettle Creek, Forked River, Oyster Creek, and Manahawkin Creek (Figure 3-1). The freshwater input from these tributaries creates a slight salinity gradient from west to east. The salinity of the central bay, in the vicinity of the OCNGS, is typically about 25 ppt (Chizmadia et al. 1984).

A relatively pronounced salinity gradient occurs along the north-south axis of the bay due to the freshwater input of Pine Barrens streams in the northwestern portion and the location of Barnegat Inlet in the southern portion of the bay (Figure 3-3). Relatively high salinity waters entering the northernmost section of the bay through the Bay Head-Manasquan Canal result in elevated salinities in that portion of the bay (Chizmadia et al. 1984).

3.5 WATER TEMPERATURE IN BARNEGAT BAY

Barnegat Bay is a meteorological transition zone between the continent and the ocean. The temperature extremes of both the summer and winter seasons are moderated within the bay by the proximity of the ocean. On an average annual basis, the warmest months of the year are July and August, and the coldest months are January and February. Tatham et al. (1977) reported winter water temperatures in western Barnegat Bay as low as -1.5°C (29.3°F) and summer temperatures approaching 30°C (86°F). Periods of relatively rapid temperature change occur in spring and fall. Atlantic Ocean water that enters the estuary exhibits a somewhat less extreme annual range of temperature.

Ice typically forms each winter adjacent to the shoreline of Barnegat Bay, but more extensive ice covering across a major portion of the bay has occurred only during the coldest of recent

winters. Periodically, during winter or early spring, ice from Barnegat Bay is drawn into the OCNGS intake canal.

3.6 WATER TRANSPARENCY IN BARNEGAT BAY

Water transparency in Barnegat Bay, as measured by Secchi depth, ranges from 0.2 to 2.5 m (0.7 - 8.2 ft). The annual average Secchi depth in the vicinity of Oyster Creek is 1.1 m (3.6 ft) (Vouglitois 1983).

Table 3-1. Barnegat Inlet average tidal prisms, adjusted to mean tidal conditions (from Ashley, 1988; Gebert, 1994).

Date	Average Tidal Prism (10^7 m^3)
June 1932	2.29
December 1940	3.21
April 1941	3.45
November 1941	3.31
September 1943	2.12
June 1945	2.01
May 1968	1.39
March 1980	1.17
September 1987	1.17
June 1993	2.55*

*Based upon preliminary U.S. Army Corps of Engineers data (Gebert 1994).

NOTE: New south jetty constructed 1988-1991; most recent maintenance dredging in Barnegat Inlet completed 1993.

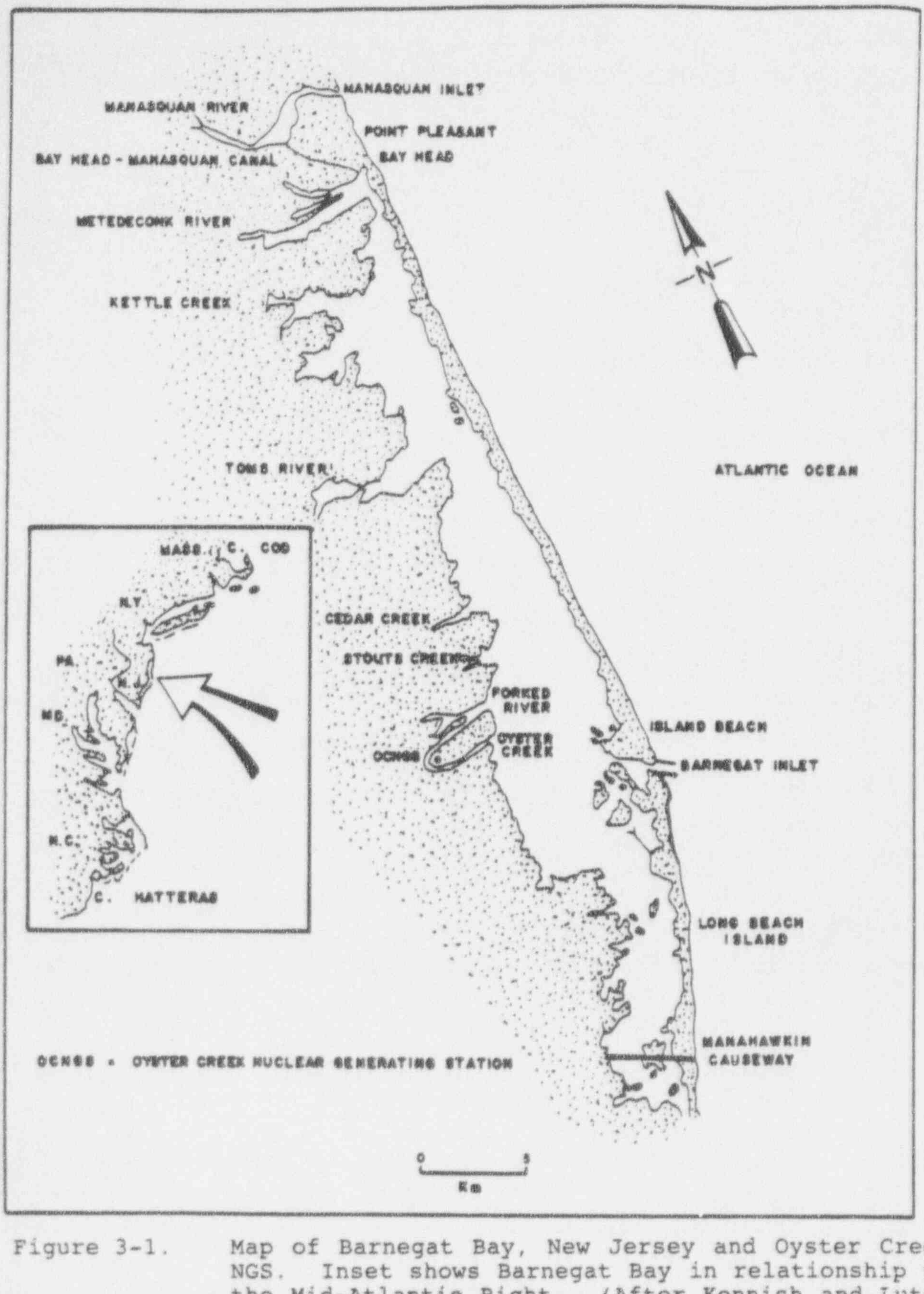


Figure 3-1. Map of Barnegat Bay, New Jersey and Oyster Creek NGS. Inset shows Barnegat Bay in relationship to the Mid-Atlantic Bight. (After Kennish and Lutz, 1984).

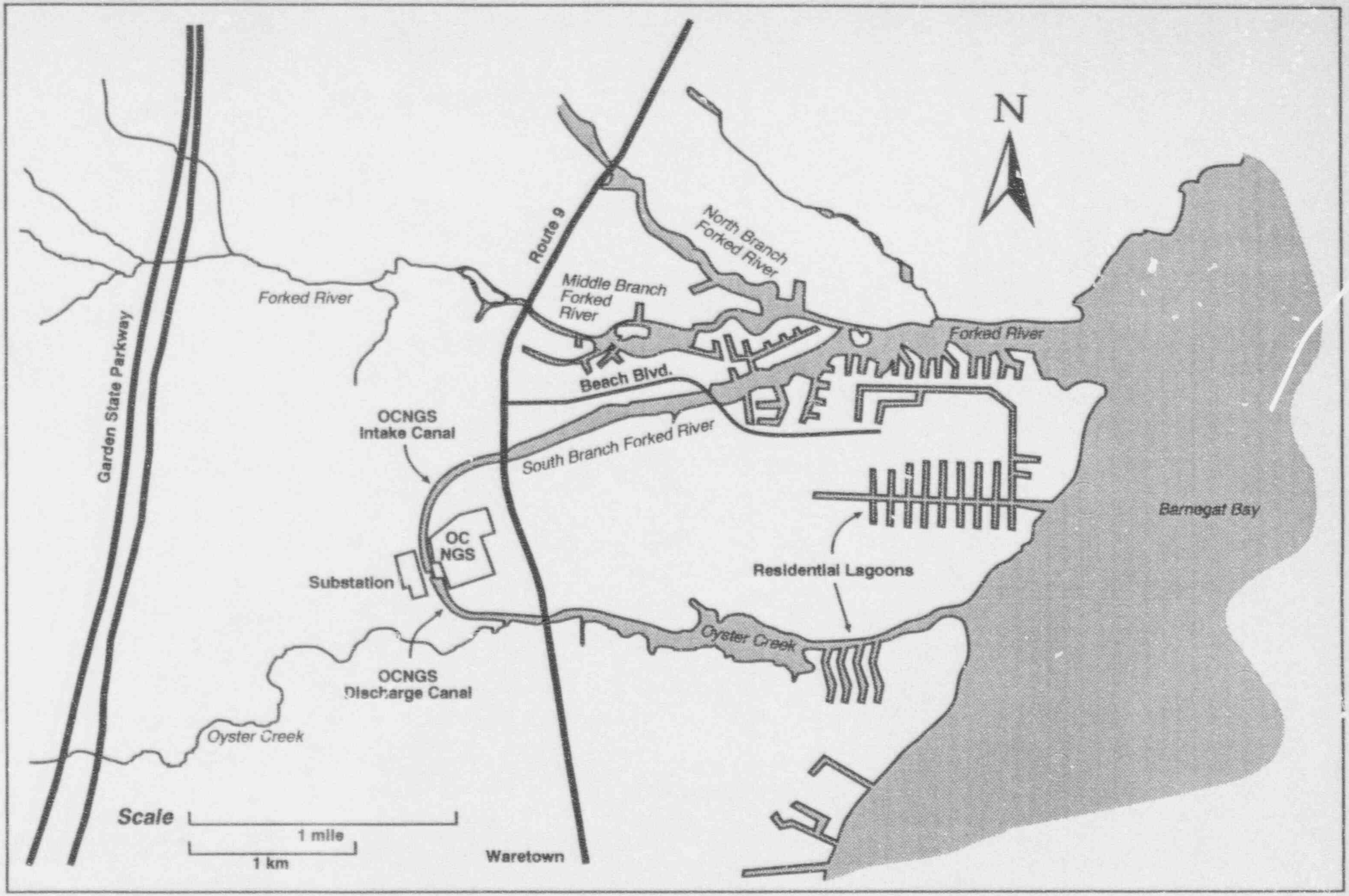


Figure 3-2. Location map of OCNGS and vicinity.

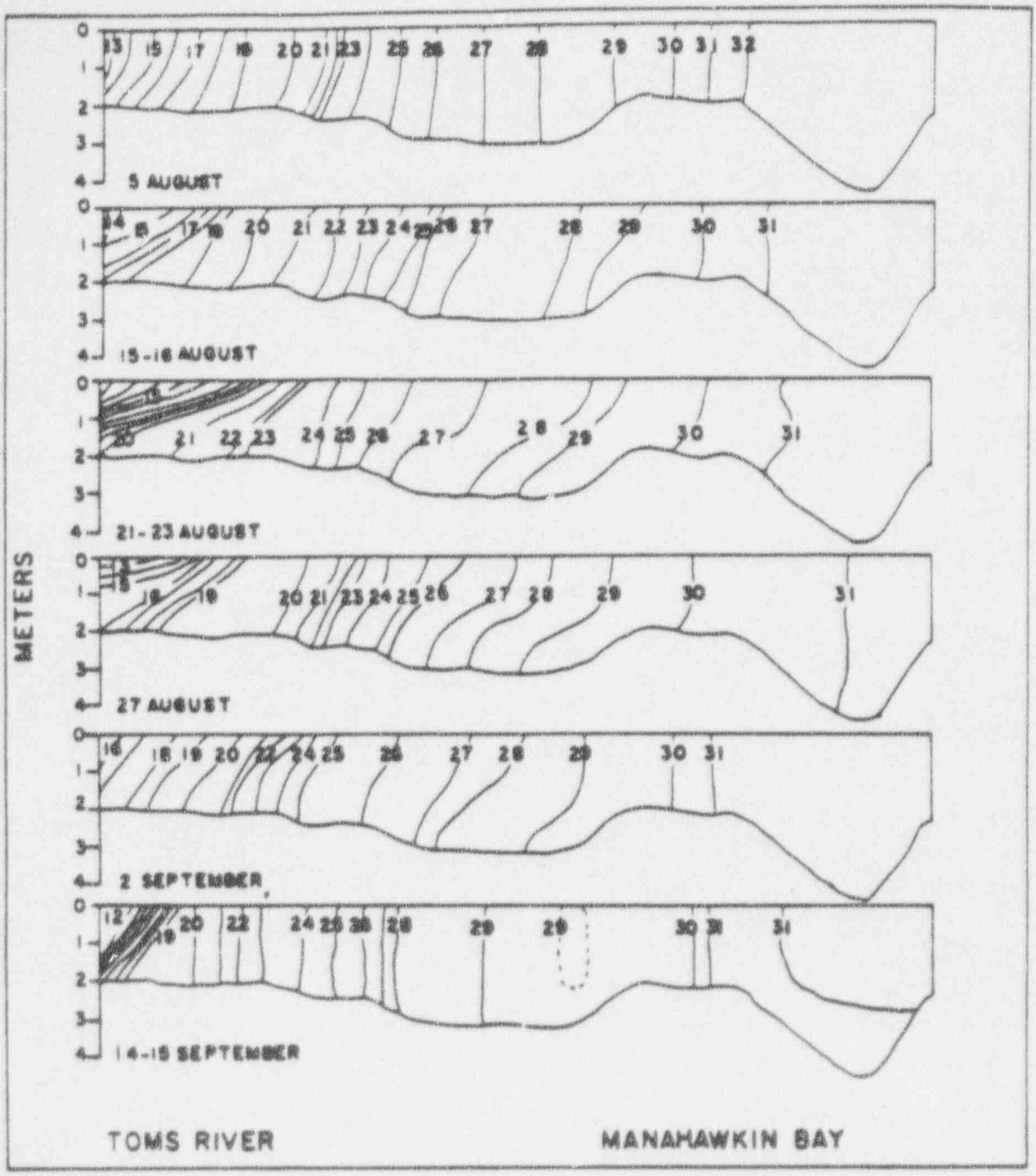


Figure 3-3. Salinity profile of Barnegat Bay from Toms River to Manahawkin Bay for August and September 1963. (After Carpenter, 1963).

SECTION 4.0
OYSTER CREEK NUCLEAR GENERATING STATION DESCRIPTION

4.1 OYSTER CREEK NUCLEAR GENERATING STATION

Oyster Creek Nuclear Generating Station (OCNGS) consists of a boiling water nuclear reactor with an electrical capability of approximately 650 megawatts. OCNGS began commercial operation late in 1969.

The containment structure housing the reactor and the turbine, auxiliary and service buildings for OCNGS are located on a semicircular plot of land bounded by the intake and discharge canals and by U.S. Route 9 (Figure 4-1). Two separate intake structures withdraw water from the intake canal (Figs. 4-2 through 4-9). The circulating water system intake (CWS) provides cooling water for the main condensers and also provides cooling water for safety-related heat exchangers and other equipment within the station. The dilution water system (DWS) minimizes the thermal effects on the discharge canal and Barnegat Bay by "thermally diluting" the circulating water from the condenser with colder water drawn from the intake canal. Water from both systems is discharged via discharge tunnels to the head of the discharge canal, located immediately west of the plant (Fig. 4-2).

4.1.1 CIRCULATING WATER SYSTEM

The once-through CWS is designed to remove waste heat from the stations main condensers. The CWS withdraws cooling water from the intake canal, routes it to the condensers, and returns warmed water to the discharge canal (Figure 4-2). During normal plant operation, four 435 m^3/min (0.115 million gpm) circulating water pumps (Figs. 4-3 and 4-4) withdraw a total of 1740 m^3/min (0.46 million gpm). The typical temperature rise across the condensers in this operating mode is 11°-12.8°C (20°-23°F). Measurements of the intake velocity of water approaching the CWS intake ports show flows of 17-20 cm/sec (0.56-0.66 ft/sec) with four circulating water pumps operating and all six intake bays open.

The station's New Jersey Pollutant Discharge Elimination System (NJPDES) Discharge to Surface Water Permit regulates the intake velocity as well as the effluent characteristics of the CWS. The maximum permissible average intake velocity for water approaching the CWS intake ports is 30 cm/sec (1 ft/sec). The maximum temperature difference between the intake and discharge water is 12.8°C (23°F); the maximum effluent temperature is 41.1°C (106°F). Both of these temperature limits apply during normal operating conditions (i.e; when four circulating water pumps are operating

and condenser backwashing is not underway.)

When fewer than four circulating water pumps are operating, or during condenser backwashing, alternate temperature limitations apply. The maximum temperature difference between the intake and discharge water under those conditions is 18.3°C (33°F); the alternate maximum effluent temperature is 43.3°C (110°F). The operation of dilution pumps (see Section 4.1.2) reduces the water temperature in the discharge canal by approximately 2.8°C (5°F) for each pump operated. Two dilution pumps are typically operated during the summer months, thereby providing a 5.6°C (10°F) reduction in discharge canal temperature.

4.1.1.1 CIRCULATING WATER SYSTEM INTAKE STRUCTURE

The CWS intake consists of six separate, independent intake bays or port cells (Figures 4-3 and 4-4). Each intake port is equipped with its own trash bars and traveling screens. Provisions for stop logs are made within each port to facilitate dewatering the intake bays for maintenance.

Originally, the circulating water intake structure consisted of trash bars followed by conventional traveling screens whose primary purpose was to collect and remove debris from intake water. Traveling screens were intermittently cleaned via a front wash, high pressure spray system activated by differential pressure, a timer, or manual intervention.

To mitigate fish impingement losses, modifications have been made to the original installation by adding: horizontal, water-filled fish survival buckets on the traveling screen baskets (Ristroph modification); a low pressure rear spray wash fish removal system; and a modified fish and trash sluiceway system specifically designed to gently return fish to the discharge canal.

4.1.1.1.1 TRASH BARS AND TRASH RAKE ASSEMBLY

Six sets of trash bars protect each of the six intake ports from large debris, mats of eel grass, marine algae or detritus entrained in the intake water flow (Fig. 4-5). The trash bar assemblies, sometimes referred to as trash racks, are 7.3 m (24 ft) high and extend from the deck of the CWS intake structure at elevation +6.0 ft MSL (mean sea level) to the bottom of each CWS intake port, elevation -18.0 MSL, and are approximately 3.3 m (11 ft) wide. Constructed of 0.95 cm (3/8 in) wide steel bars on 7.5 cm (3.0 in) centers, the openings between the trash bars are 6.6 cm (2.6 in) wide.

The trash bars are inspected at least twice during each 8-hr work shift, throughout the sea turtle season (see Section 7 and Appendix I), and debris is removed as needed by a mobile mechanical trash rake. The trash rake/trash cart assembly is a self-contained unit which traverses the entire width of the intake on rails; it contains a trash hopper which transports the material removed from the bars to a debris container at the south end of the intake.

Figures 4-5 through 4-8 illustrate the trash rake/trash cart assembly at the CWS and DWS intake structures.

The trash rake is 1.8 m (6.0 ft) wide and is controlled by a single operator from a manual pushbutton control panel which is mounted on the unit's frame assembly. The trash rake unit consists of an integral frame assembly which houses the traversing drive, hoisting machinery, hopper and hydraulic control assemblies. The hoisting machinery includes a cable-operated raking device which is designed to remove large floating or submerged objects which may accumulate on the trash bars. Wide-flanged wheels permit the raking device to travel along the face of the inclined trash bars and guide the cleaning device vertically over the bars. The curved tines of the trash rake extend approximately 2.5 cm (1.0 in) beyond the plane of the trash bars to ensure effective cleaning of the trash bars.

Lighting of the intake bays and trash bars is provided by nearby high-intensity lamps, as well as downward-facing floodlights mounted on each corner of the trash cart (Figs. 4-5 and 4-8). Personnel cleaning the CWS and DWS intake trash racks during the June 1 -October 31 period observe the trash rake during the cleaning operation so that the rake may be stopped if a sea turtle is sighted. The debris gathered from the trash racks is hand raked into the trash car hopper. Personnel performing this task are instructed to look for sea turtles and to take particular care to ensure that sea turtles are not mistaken for horseshoe crabs. The floodlights attached to the trash rake unit are utilized during the evening hours to aid station personnel in spotting sea turtles.

4.1.1.1.2 TRAVELING SCREENS

Each CWS intake cell is equipped with a vertical traveling screen. Each traveling screen unit contains thirty-five, stainless steel mesh (0.95 cm; 3/8 inch) fish-removal type screen panels. Each screen panel has a 5.1 cm (2 in) wide lip, which creates a water-filled bucket. As the screen is raised through and out of the water, most impinged organisms such as small fish or invertebrates drop off the screen into the bucket, which prevents them from falling back into the screen well and becoming reimpinged. These organisms are subsequently washed into a fish-return system which gently returns them to the discharge canal.

Normally the screens operate at a speed of 75 cm/sec (2.5 ft/sec). They can be operated at an alternate speed of 300 cm/sec (10 ft/sec) in order to accommodate large debris loads.

For maximum fish survival, the screen wash operates with both low-pressure and high-pressure spray headers. As the screen basket travels over the head sprocket, organisms slide onto the screen face and are washed by one low-pressure spray header located outside the screen unit, and two low-pressure spray headers located inside the screen unit, into an upper sluice. This spray wash is designed to minimize descaling and other injuries that would occur with conventional high-pressure spray headers. Subsequently, heavier debris is washed into a lower sluice by two high-pressure

spray headers.

Because all sea turtles captured at OCNGS have measured at least 26 cm (10 in) carapace length, it is not anticipated that a sea turtle small enough to pass through the 6.6 cm (2.6 in) openings of the trash racks will ever occur at OCNGS. However, in the unlikely event that such a small sea turtle occurs at OCNGS, the fish return system would gently return it to the discharge canal automatically (i.e., without the need for manual intervention by OCNGS personnel).

4.1.1.1.3 CIRCULATING WATER PUMPS

There are four circulating water pumps located on the CWS intake structure (Fig. 4-4). They are vertical wet-pit type pumps rated at 435 m^3/min (0.115 million gpm) which discharge through 1.7 m (6.0 ft) lines to the main condensers and ultimately to a 3.2 m (10.5 ft) square concrete discharge tunnel. The once-through cooling system piping running from the intake to the discharge is approximately 200 m (650 ft) in length. A 1.5 m (5 ft) concrete recirculation pipe for ice control runs below the water level from the discharge tunnel back to the intake structure. The area in close proximity to the CWS intake is kept from freezing due to the intake deicing system and the turbulence induced by the circulating water and dilution pumps.

4.1.1.1.4 SEA TURTLE RETRIEVAL/RESCUE EQUIPMENT

As indicated in Section 4.1.1 of the Sea Turtle Surveillance, Handling and Reporting Instructions for Operations Personnel (Appendix I), a rescue sling suitable for lifting large sea turtles (in excess of 20 kg or 44 lbs) is kept in the fish sampling pool at the Circulating Water System intake structure. The sea turtle rescue sling/lift net (Figure 4-10) consists of a weighted tubular metal frame of 2.5 cm (1 in) O.D. stainless steel measuring 120 cm (48 in) on a side from which 6.4 cm (2.5 in) mesh nylon netting is suspended. Ropes attached at each corner of the rescue sling are joined into a bridle and single lift rope which are designed to allow the user to drop the sling below a turtle at the trash bars, then lift it out of the water to the intake structure deck.

Custom made long-handled dipnets suitable for retrieving the smaller turtles most commonly encountered at OCNGS have also been fabricated for use at the CWS and DWS intake structures (Figure 4-11). The turtle dipnets are constructed of 3.3 cm (1.3 in) O.D. aluminum tubing and consist of a 240 cm (8 ft) handle attached to a rounded rectangular net frame measuring 75 x 45 cm (2.5 x 1.5 ft). Nylon netting of 0.63 cm (1/4 in) mesh is suspended from the dipnet frame. These dipnets will be stored within easy reach, attached to fences, railings, or buildings at the CWS and DWS intake structures during the sea turtle season (June 1 - October 31).

Both the rescue sling and the long-handled dipnets are only adequate for retrieving turtles from the water surface or within

about 1 m (3.3 ft) of the surface because the use of either device requires that the sea turtle be visible from the surface.

4.1.1.1.5 OTHER EQUIPMENT

Screen Wash and Fish-Return Systems

The high pressure and low pressure screen wash systems remove marine life and debris from the CWS intake traveling screens. The contents of the upper fish and lower debris sluices are returned to the discharge canal through return sluices at the CWS intake. The fish-return system has been designed to return the fish and marine life washed from the traveling screens as gently and gradually as possible to the plant's receiving waters.

4.1.1.2 CONDENSERS

There are three sections to the main condenser, one located immediately below each low pressure turbine (Fig. 4-9). There are 14,560 tubes in each main condenser section carrying circulating water from the intake canal. This provides approximately 13,000 m^2 (139,880 ft^2) of cooling surface area. Each section is 12.2 m (40 ft) long by almost 6.1 m (20 ft) wide and 9.9 m (32.5 ft) high. Two 1.8 m (6 ft) diameter pipes deliver circulating water to each section of the main condensers.

The discharge piping from the main condenser is joined through 1.8 m (6 ft) lines into a common 3.2 m (10.5 ft) square concrete discharge tunnel. The discharge tunnel transports the condenser cooling water across the site to the discharge canal (Figs. 4-2 and 4-9).

4.1.2 DILUTION WATER SYSTEM

The dilution water system (DWS) is designed to minimize thermal effects on the environment by withdrawing ambient temperature water from the intake canal and routing it to the discharge canal where it mixes with the main condenser discharge flows (Fig. 4-2). The dilution flow is provided by three low speed, 984 m^3/min (0.26 million gpm) axial flow dilution pumps, with 2.1 m (7ft) diameter impellers (Fig. 4-6). The number of dilution pumps operated is governed by the station's NJPDES Discharge to Surface Water Permit and a maximum of two pumps (1,968 m^3/min; 0.52 million gpm) are operated at one time.

In order to reduce the attraction of migratory fish to the station's discharge canal in the fall, when these species would normally leave Barnegat Bay, two dilution pumps are put into operation when the ambient (intake) water temperature is less than 15.5°C (60°F). In order to reduce the temperature of the discharge canal during the summer months, when the water temperature as measured at the U.S. Route 9 bridge over Oyster Creek (Fig. 4-1) exceeds 30.5°C (87°F), one dilution pump is put into operation. If, after one dilution pump has been in operation for at least two hours, the water temperature at the U.S. Route 9 bridge continues

to exceed 87°F, a second dilution pump is put into operation. The station's third dilution pump is held in reserve to be put into operation within 40 minutes of such time as an insufficient number of dilution pumps are operable in order to meet the intent of the permit requirements described above.

The operation of two dilution pumps during the seasonal periods required by the NJPDES permit reduces the discharge canal temperature by approximately 5.6°C (10°F). During the remainder of the year, one dilution pump is typically operated, providing a temperature reduction of approximately 2.8°C (5°F). Following this seasonal operational regime results in the operation of two dilution pumps during about 70 percent of the June-October sea turtle season.

The average intake velocity in front of the DWS intake, with two pumps in operation, is approximately 73 cm/sec (2.4 ft/sec).

4.1.2.1 DILUTION WATER SYSTEM INTAKE STRUCTURE

The DWS intake is a reinforced concrete structure located on the west side of the intake canal (Figs. 4-2 and 4-6). It consists of six intake bays. Each intake bay is fitted with trash bars identical to those employed at the CWS intake (Figs. 4-5 and 4-6). Unlike the CWS, there are no travelling screens at the DWS intake structure.

4.1.2.1.1 TRASH BARS

The DWS trash bars are 0.95 cm (3/8 in) steel bars set on 7.5 cm (3.0 in) centers. There are six DWS trash bar assemblies, each 3.3 m (11 ft) wide. The DWS is fitted with a mobile mechanical trash rake similar in design and operation to the trash rake used at the CWS intake (Figures 4-5 through 4-8). The process of inspecting and cleaning the trash bars at the DWS is identical to that describied for the CWS in Section 4.1.1.1.1, Section 7.3, and Appendix I.

4.1.2.1.2 OTHER EQUIPMENT

<u>Floating Debris/Ice Barrier</u>

A floating barrier has been designed and installed upstream of the CWS and DWS intake structures to divert floating debris such as wood, eelgrass or ice away from the CWS intake and towards the DWS intake. The barrier is intended to prevent excessive amounts of debris or ice from accumulating on the CWS traveling screens or trash bars. The floating barrier is of wooden construction and extends approximately 60 cm (2 ft) below the surface from just upstream of the CWS intake to just upstream of the DWS intake (Figure 4-2).

4.1.3 THERMAL PLUME STUDIES

Heated condenser cooling water discharged from the CWS and ambient

temperature intake canal water discharged from the DWS meet and mix in the discharge canal and ultimately are returned to Barnegat Bay via the discharge canal (Figure 4-1).

The cooling water discharged from OCNGS has been studied on several occasions to determine the distribution, geometry, and dynamic behavior of the thermal plume. Dye studies as well as real-time mobile mapping of the plume track have been performed (Carpenter 1963; Starosta et al. 1981; JCP&L 1986).

Three rather different thermal regimes can be observed in Oyster Creek and Barnegat Bay. In Oyster Creek, initial mixing of the condenser discharge with dilution water produces a reduction in discharge temperature of between 2.8 to 5.6°C (5 to 10°F) depending upon whether one or two dilution pumps is operating; little temperature decay is observable east of U.S. Route 9 until the discharge reaches Barnegat Bay. Minimal horizontal or vertical temperature change occurs in Oyster Creek between U.S. Route 9 and the bay because of the relatively short residence time and the lack of turbulence or additional dilution. In Barnegat Bay, temperatures are rapidly reduced as substantial mixing with ambient temperature bay water and heat rejection to the atmosphere occurs. In the bay, the plume spreads on the surface, thereby abetting atmospheric heat rejection. Thus, there is a very small area near the OCNGS condenser discharge of relatively high excess temperature in which turbulent dilution mixing produces rapid temperature reductions; a somewhat larger area in Oyster Creek between OCNGS and Barnegat Bay in which little further temperature reduction occurs; and a still larger area in the bay in which the plume spreads on the surface.

About 150 m (492 ft) east of the mouth of Oyster Creek the water depth decreases from approximately 3.4 m (11 ft) to 1.5 m (5 ft), causing turbulence and mixing and directing the plume toward the surface. In general, excess temperatures do not impinge on the bottom of the bay except in the area immediately adjacent to the mouth of Oyster Creek. Shoreline plumes may extend from the surface to the bottom since the water depths are usually less than 1.5 m (5 ft). In Barnegat Bay, the plume occupies a relatively large surface area with low excess temperatures where the balance of the heat discharged by OCNGS is dissipated to the atmosphere or diluted by entrained bay water. The surface excess temperature isotherm of 2.2°C (4°F) under all operating conditions is contained in a rectangle approximately 1.6 km (1 mi) along the east-west axis and 5.6 km (3.5 mi) along the north-south axis bounding the mouth of Oyster Creek. For the 0.8°C (1.5°F) isotherm, the rectangle is 2.4 km (1.5 mi) by 7.2 km (4.5 mi). All measured plumes exhibited a plume length of approximately two to three times their width (JCP&L 1986).

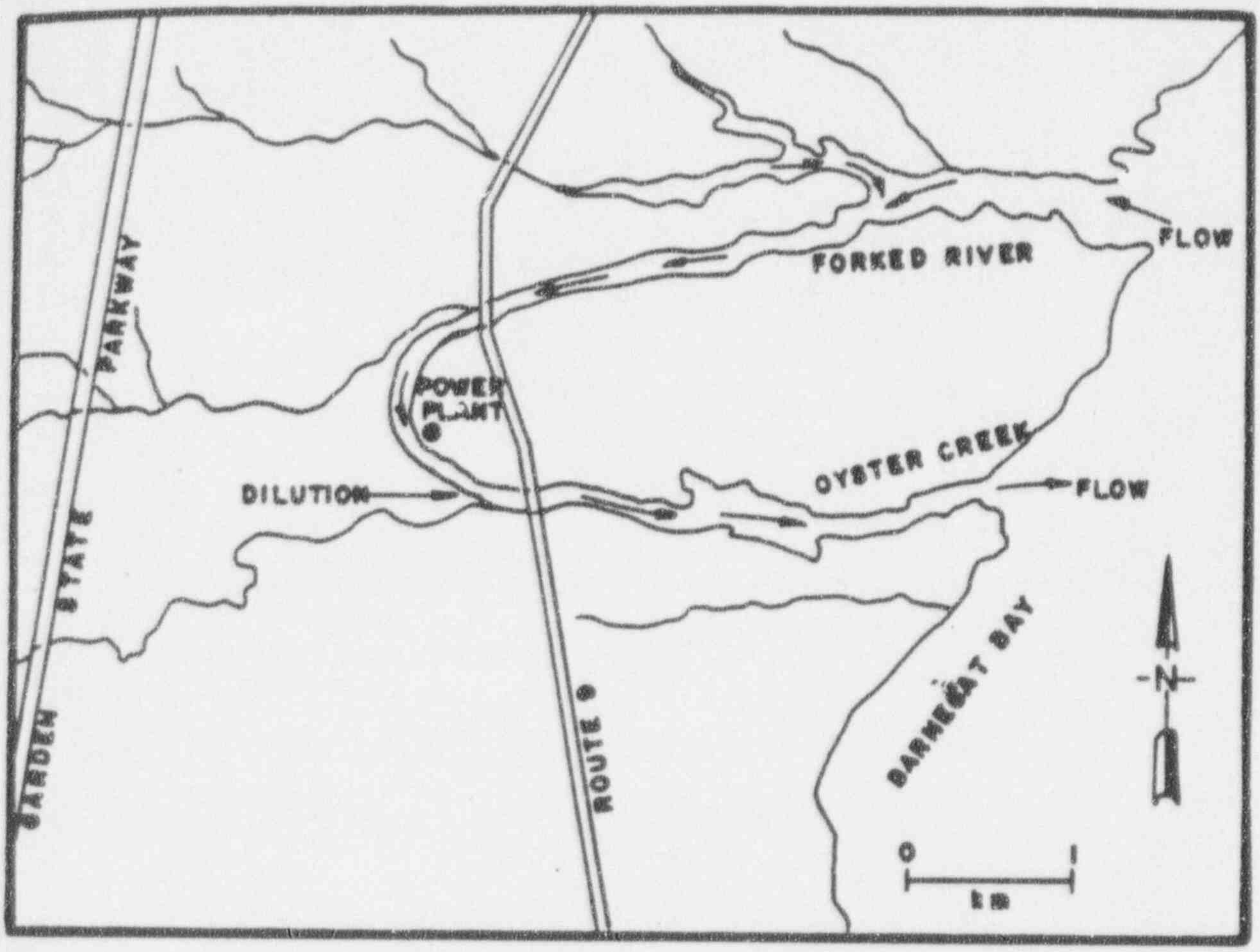


Figure 4-1. Flow characteristics at Forked River, Oyster Creek, and adjacent bay localities. (After Kennish and Olsson, 1975).

Figure 4-2. Schematic diagram of the OCNGS circulating water system (CWS) and dilution water system (DWS) flows.

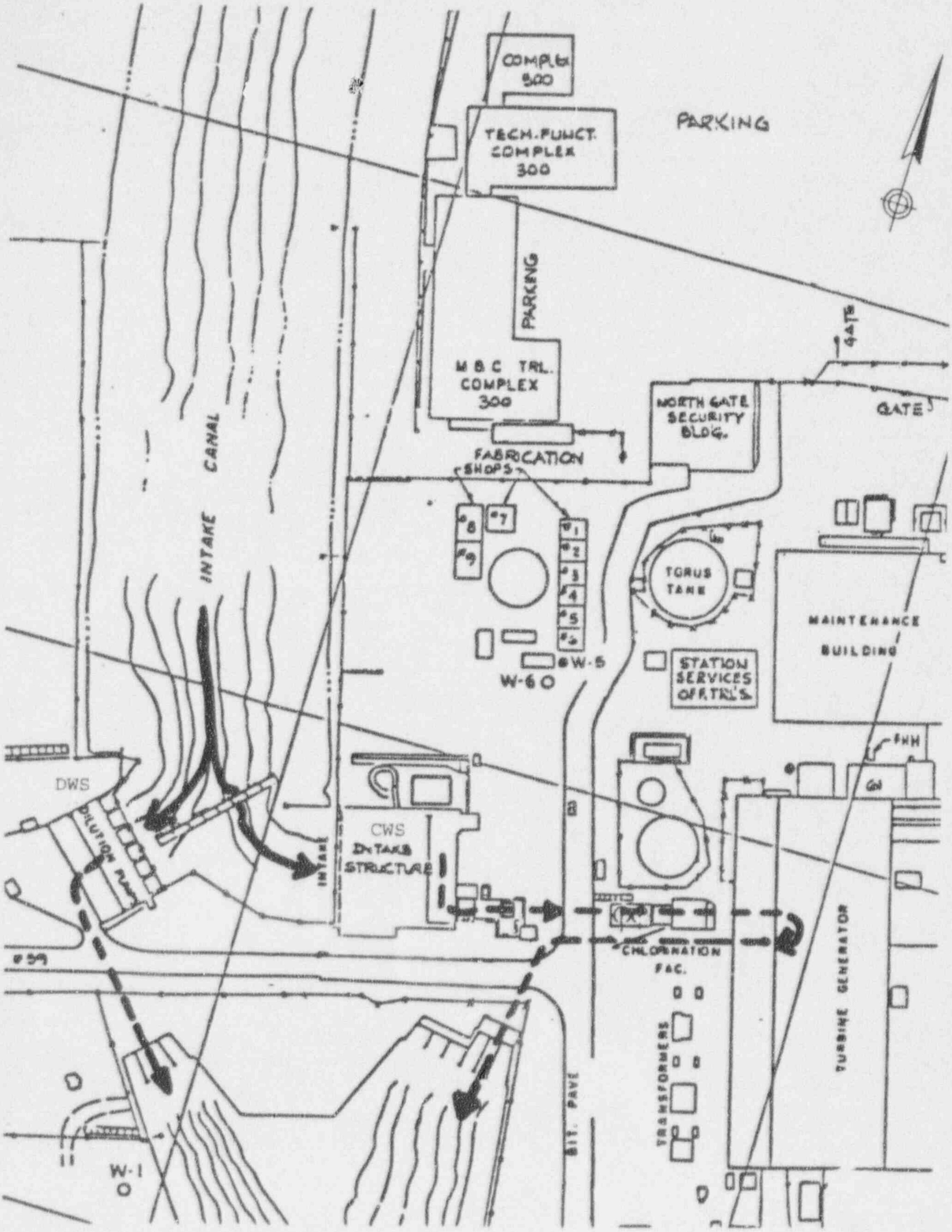
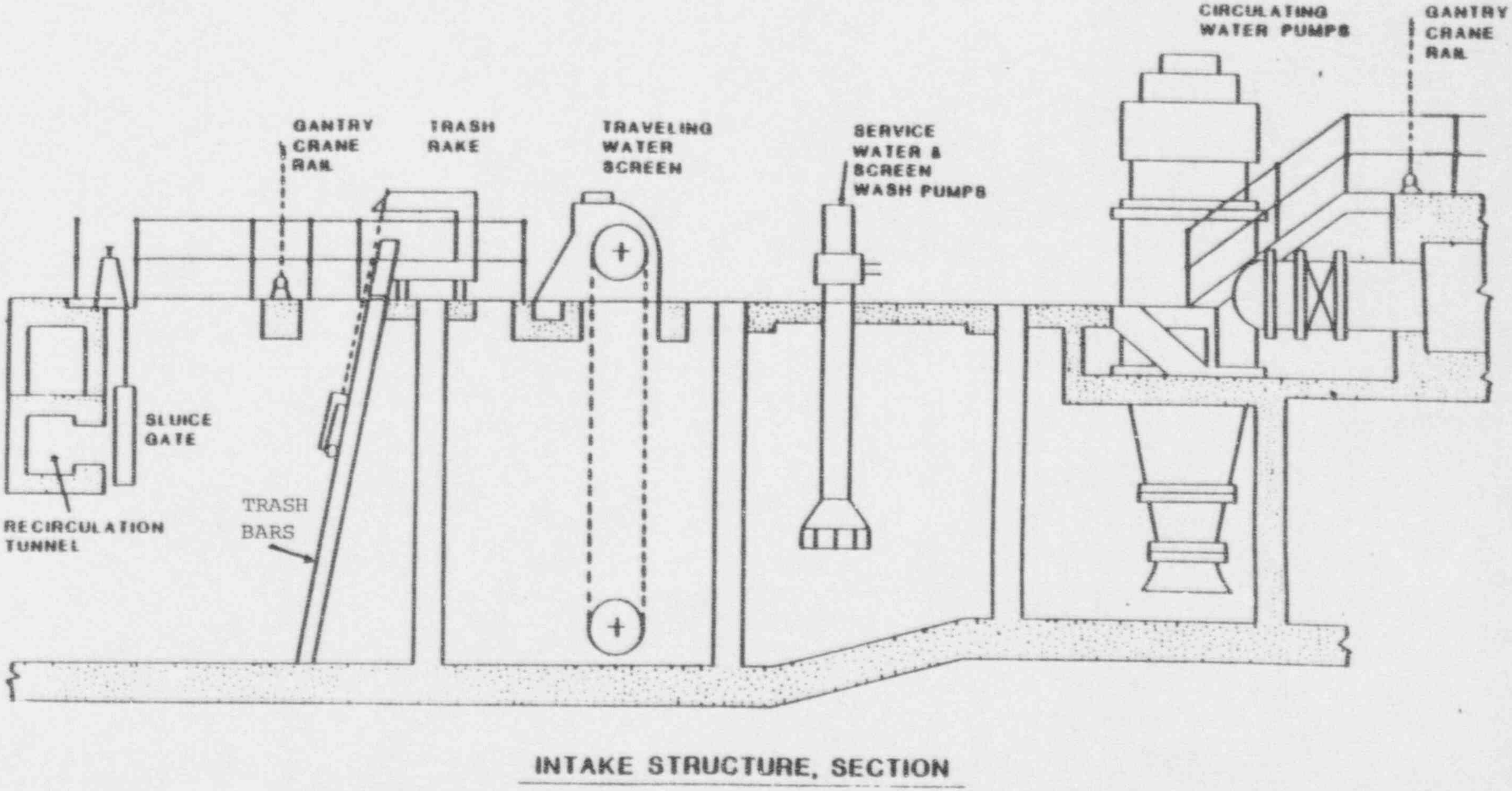


Figure 4-3. OCNGS Circulating System Intake Structure, section view.



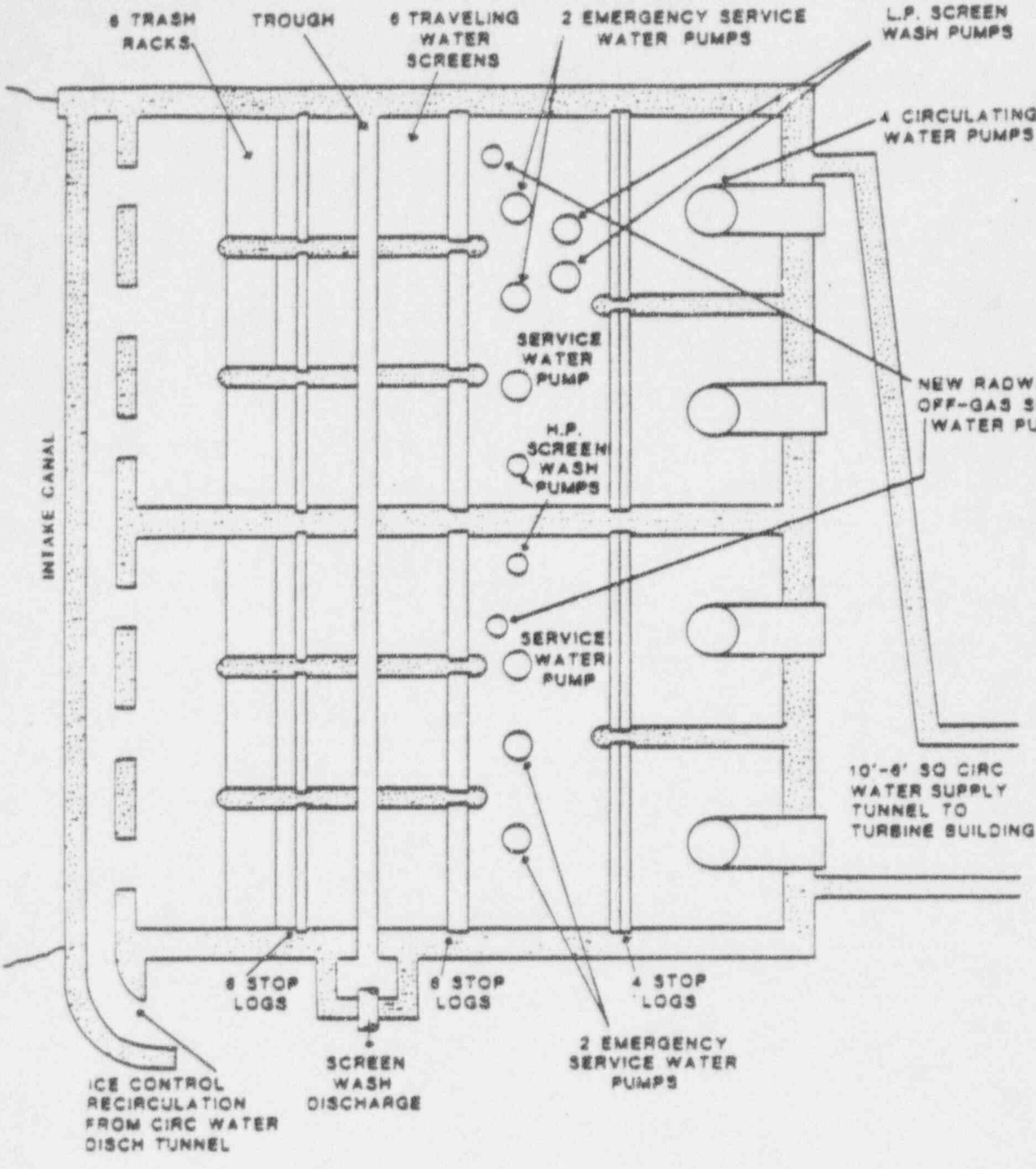


Figure 4-4. OCNGS Circulating Water System Intake Structure in plan view.

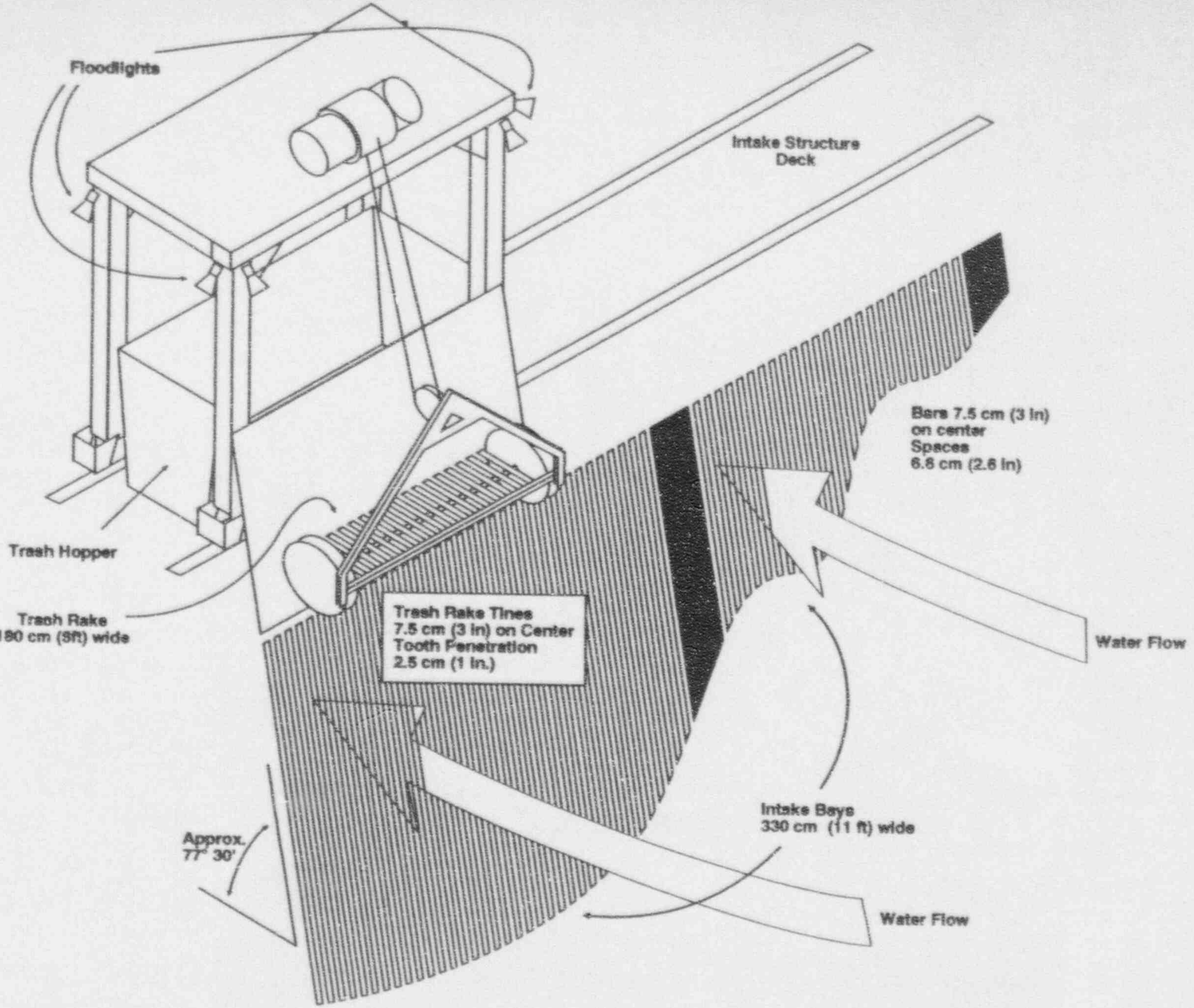


Figure 4-5. Schematic of Circulating Water System (CWS) and Dilution Water System (DWS) intake structures showing trash cart, trash rake & trash bars.

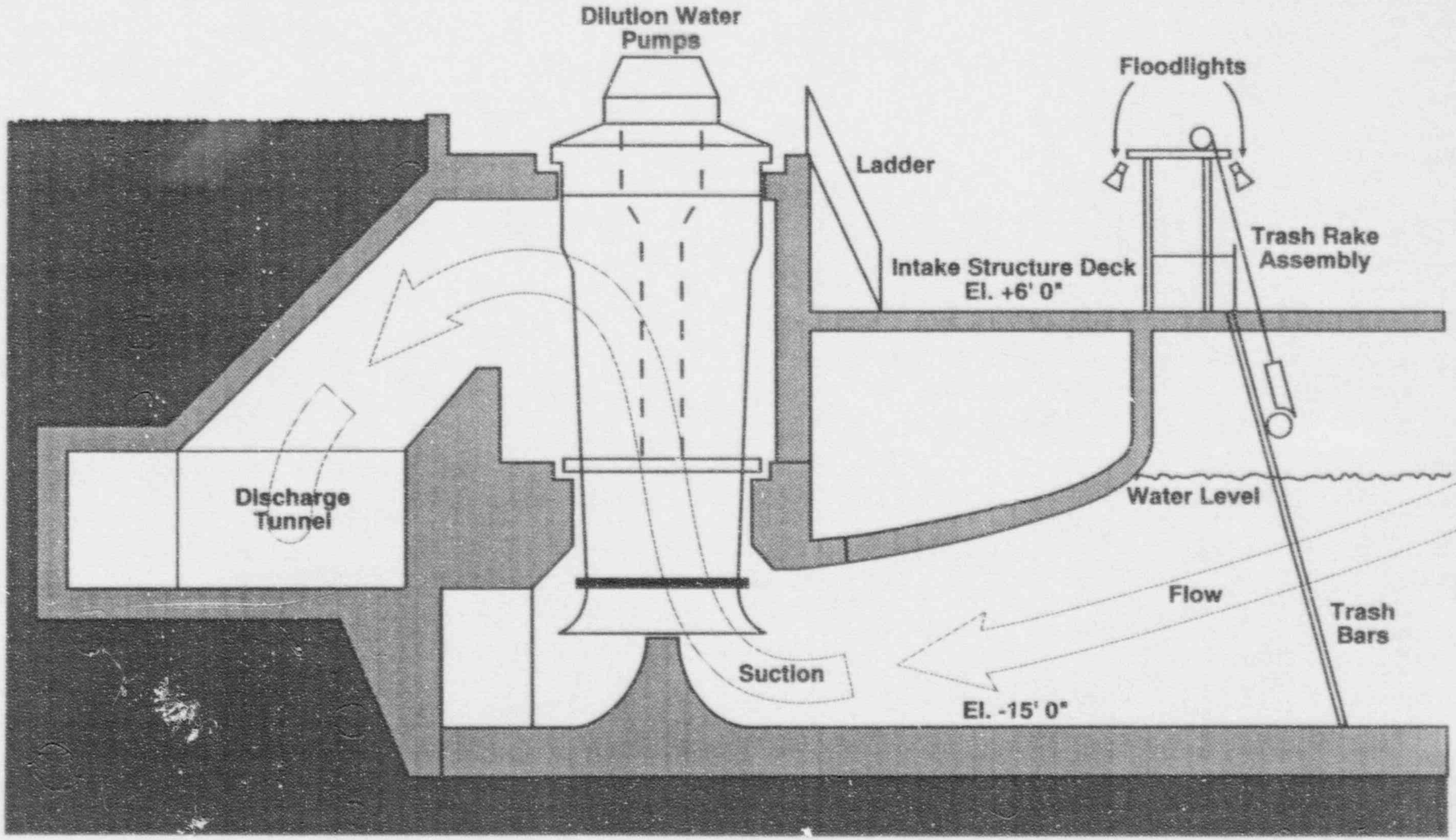


Figure 4-6. OCNGS Dilution Water System Intake Structure, Section View.

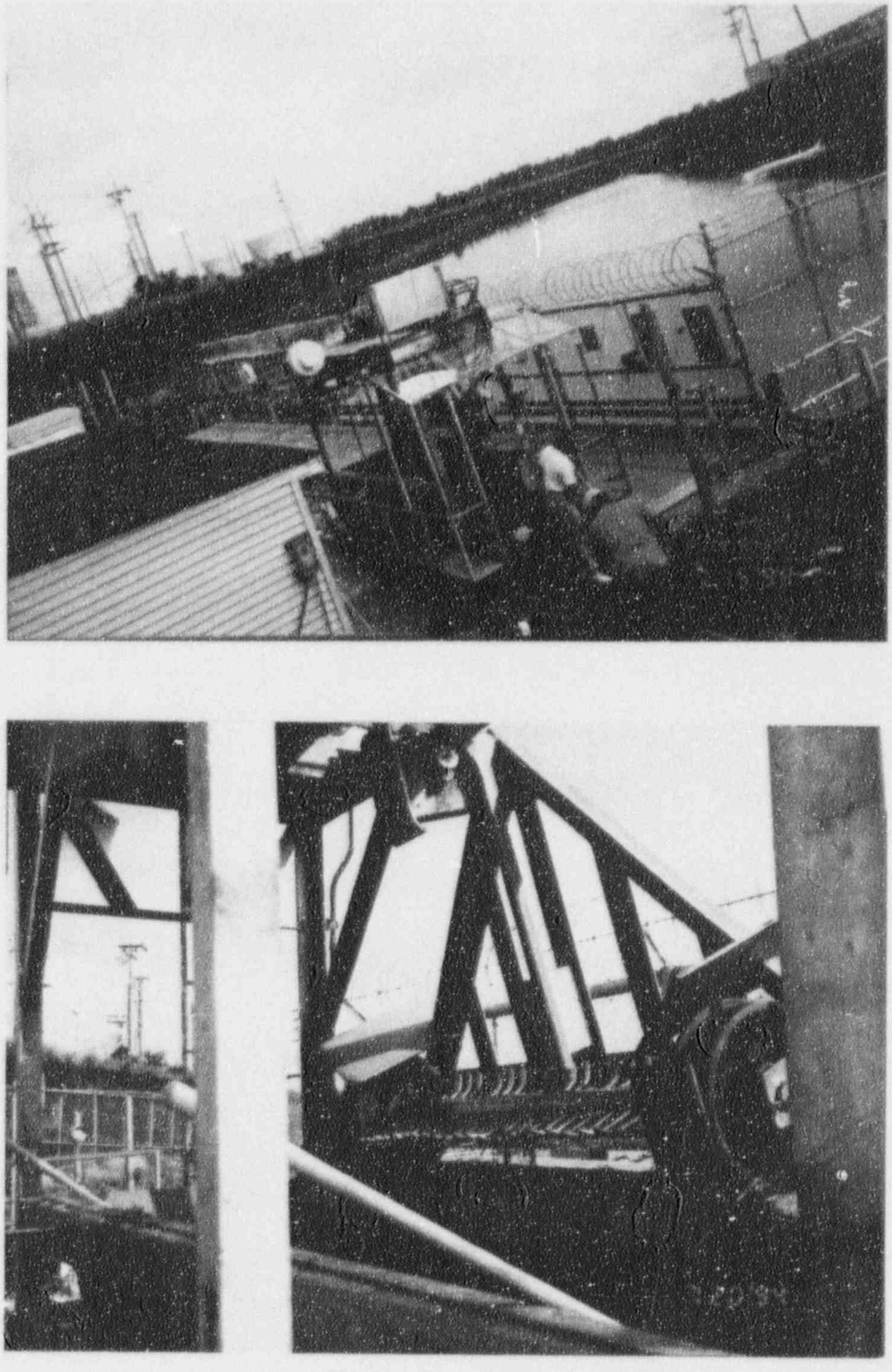


Figure 4-7. View of OCNGS Intake Canal looking upstream from Dilution Water System Intake (top); closeup of trash rake & trash cart (bottom).

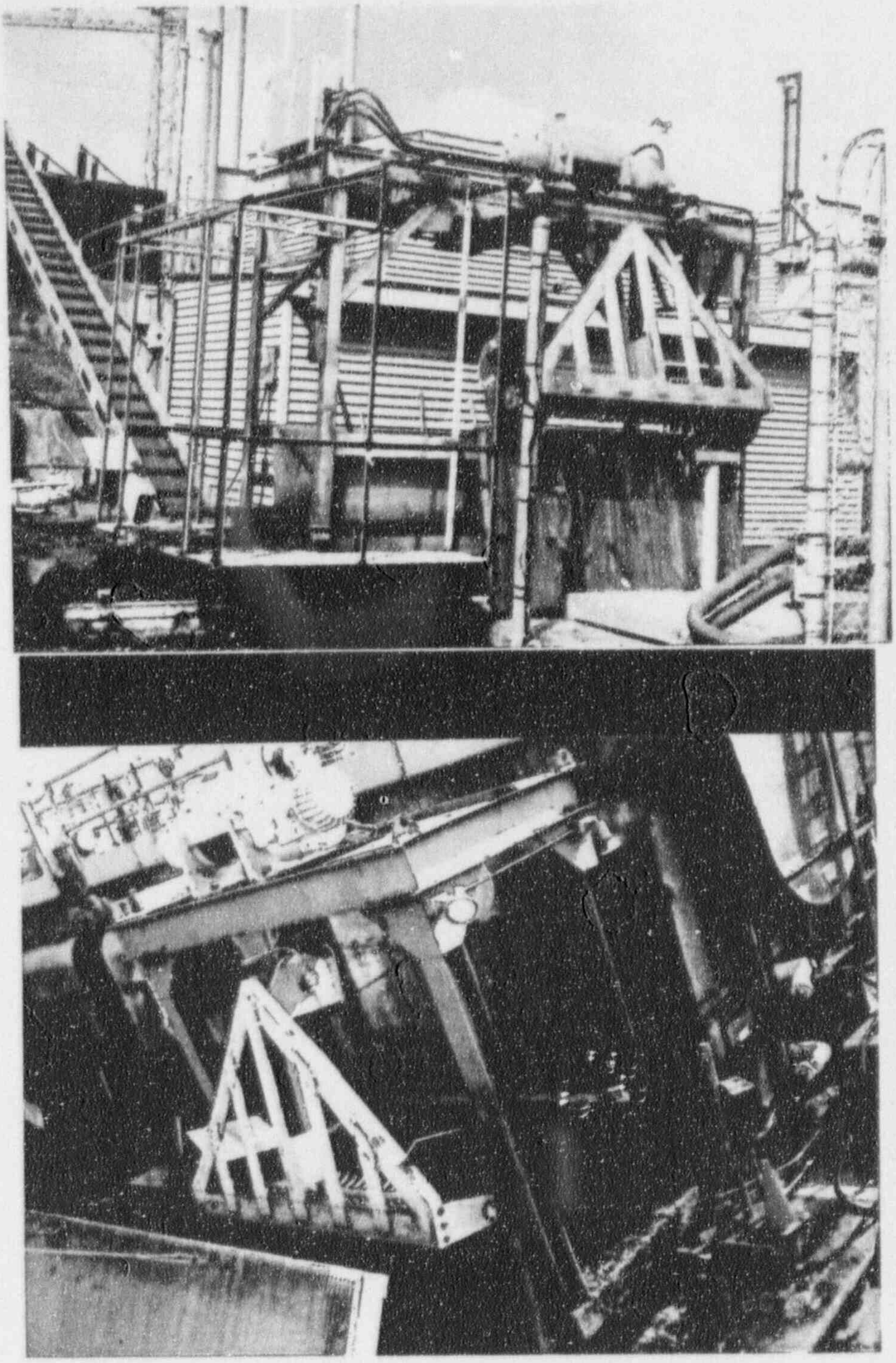


Figure 4-8. Trash rake and trash cart apparatus at the Dilution Water System (top) and the Circulating Water System (bottom) intakes. Note floodlights attached to trash carts.

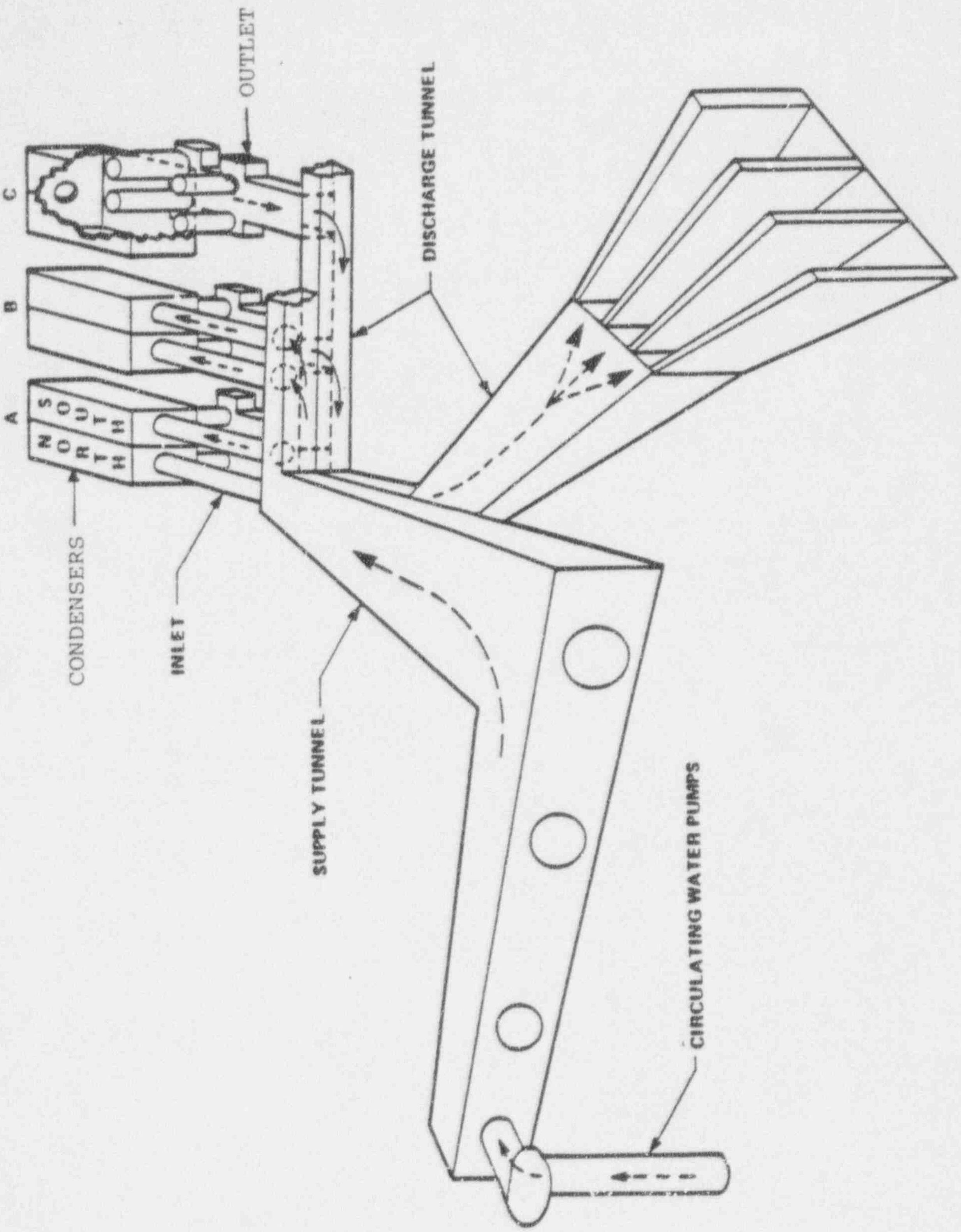


Figure 4-9. Schematic (oblique view) of OCNGS intake and discharge tunnels.

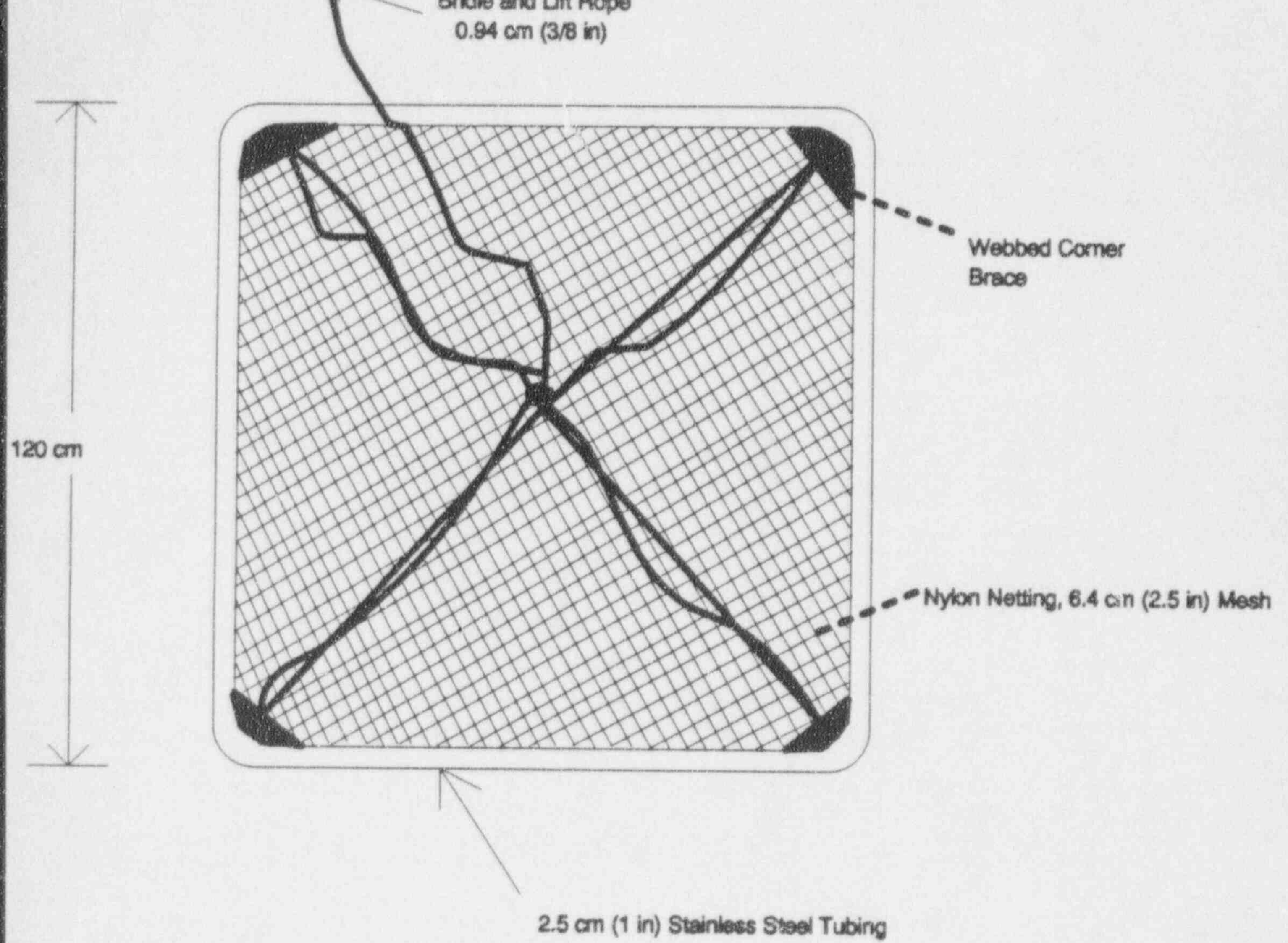


Figure 4-10. Sea Turtle Rescue Sling/Lift Net.

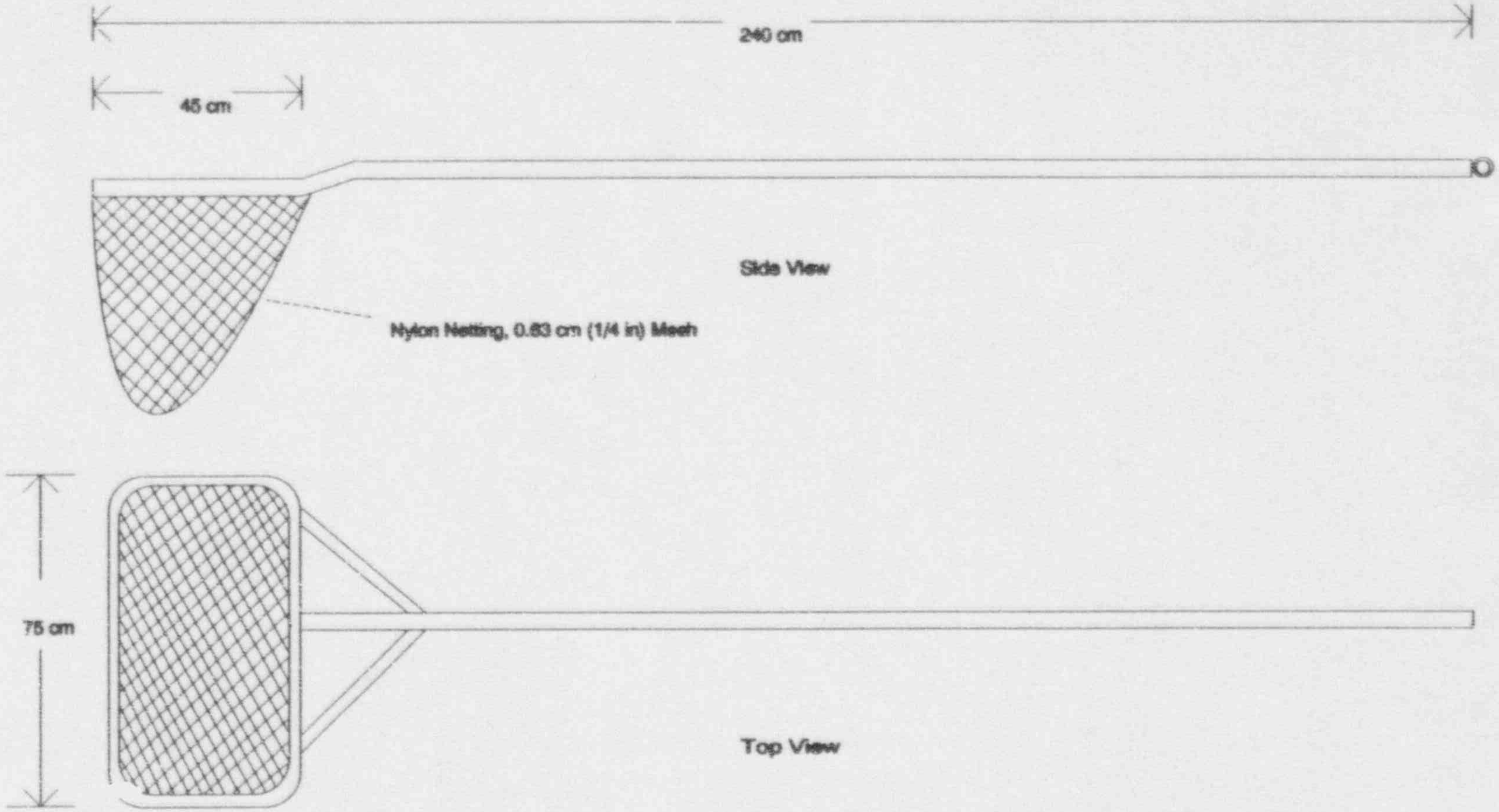


Figure 4-11. Long Handled Dipnet for Sea Turtle Retrieval.

SECTION 5.0
INFORMATION ON SEA TURTLE SPECIES

5.1 GENERAL SEA TURTLE INFORMATION

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

Most of these seven sea turtle species are distributed throughout all of the tropical oceans. However, the loggerhead occurs primarily in temperate latitudes, and the leatherback, although nesting in the tropics, frequently migrates into cold waters at higher latitudes because of its unique physiology (Mager 1985).

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

Sea turtles spend most of their lives in an aquatic environment and males of many species may never leave the water (Hopkins and Richardson 1984; Nelson 1988). The recognized life stages for these turtles are egg, hatchling, juvenile/subadult, and adult (Hirth 1971). A generalized sea turtle life cycle is presented in Figure 5-1.

Reproductive cycles in adults of all species involve some degree of migration in which the animals return to nest at the same beach year after year (Hopkins and Richardson 1984). Nesting generally begins about the middle of April and continues into September (Hopkins and Richardson 1984; Nelson 1988; Carr 1952). Mating and copulation occur just off the nesting beach and it is theorized that sperm from one nesting season may be stored by the female and thus fertilize a later season's eggs (Ehrhart 1980). A nesting

female moved shoreward by the surf lands on the beach and crawls to a point above the high water mark (Carr 1952). She then proceeds to excavate a shallow body pit by twisting her body in the sand (Bustard 1972). After digging the body pit she proceeds to excavate an egg chamber using her rear flippers (Carr 1952). Clutch size, egg size, and egg shape are species specific (Bustard 1972). Incubation periods for loggerheads and green turtles average 55 days but range from 45 to 65 days depending on local conditions (Nelson 1988).

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

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

Due to changes in habitat use during different life history stages and seasons, sea turtle populations are difficult to census (Meylan 1982). Because of these problems, estimates of population numbers have been derived from various indices such as numbers of nesting females, numbers of hatchlings per kilometer of nesting beach and

1982). Because of these problems, estimates of population numbers have been derived from various indices such as numbers of nesting females, numbers of hatchlings per kilometer of nesting beach and number of subadult carcasses (strandings) washed ashore (Hopkins and Richardson 1984). Six of the seven extant species of sea turtles are protected under the Endangered Species Act. Three of the turtles, Kemp's ridley, hawksbill and leatherback, are listed as endangered. The Florida nesting population of green turtle and Mexican west coast population of olive ridley are also endangered. All of the remaining populations of green turtle, olive ridley and loggerhead are threatened. The only unlisted species is the locally protected Australian flatback turtle (Hopkins and Richardson 1984). Only two species of sea turtles, loggerheads and Kemp's ridleys, occur in Barnegat Bay and coastal waters near OCNGS. Leatherbacks do occur in coastal New Jersey waters but typically are found at considerable distances offshore. Green turtles have only been sporadically reported from the New Jersey coast. Regional sea turtle distribution will be discussed in more detail later in this section.

5.2 LOGGERHEAD (Caretta caretta)

5.2.1 DESCRIPTION

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

Loggerhead hatchlings are brown above with light margins below and have five pairs of lateral scales (Pritchard et al. 1983).

5.2.2 DISTRIBUTION

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

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

nesting population of loggerheads has been estimated to be the second largest in the world (Ross 1982).

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

5.2.3 FOOD

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

5.2.4 NESTING

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

Loggerhead females generally nest every other year or every third year (Hopkins and Richardson 1984) but multi-annual remigration intervals ranging from one to six years have been reported (Bjorndal et al. 1983; Richardson et al. 1978). When a loggerhead nests, it usually will lay 2 to 3 clutches of eggs per season and will lay 35 to 180 eggs per clutch (Hopkins and Richardson 1984). The eggs hatch in 46 to 68 days and hatchling emerge 2 or 3 days later (Crouse 1985; Hopkins and Richardson 1984; Kraemer 1979).

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

Nesting by loggerheads as far north as the New Jersey coast is

considered rare. Anecdotal reports of loggerhead nests at Ocean City, NJ and Island Beach State Park during the 1980's are among the few known nesting activities in local waters (Schoelkopf, personal communication, 1993). More recently, a loggerhead nest was found at Holgate, NJ on Long Beach Island during the summer of 1994 (Schoelkopf, personal communication, 1994).

5.2.5 POPULATION SIZE

Loggerhead sea turtles are the most common sea turtle in the coastal waters of the United States. Based on numbers of nesting females, numbers of hatchlings per kilometer of nesting beach and number of subadult carcasses (strandings) washed ashore, the total number of mature loggerhead females in the southeastern United States has been estimated to be from 35,375 to 72,520 (Hopkins and Richardson 1984; Gordon 1983).

Adult and sub-adult (shell length greater than 60 centimeters) population estimates have also been based on aerial surveys of pelagic animals observed by NMFS during 1982 to 1984.

Based on these studies the current estimated number of adult and sub-adult loggerhead sea turtles from Cape Hatteras, North Carolina to Key West, Florida is 387,594 (NMFS 1987). This number was arrived at by taking the number of observed turtles and converting it to a population abundance estimate using information on the amount of time loggerheads typically spend at the surface.

Some sea turtles which die at sea wash ashore and are found stranded. The NMFS Sea Turtle Salvage and Stranding Network collects stranded sea turtles along both the Atlantic and Gulf Coasts (NMFS 1988). Using 1987 data as an example, over 2,300 loggerhead turtles were reported by the network (Figures 5-2 and 5-3). The largest portion was collected from the southeast Atlantic Coast (1,414 turtles) followed by the Gulf Coast (593 turtles) and northeast Atlantic Coast (347 turtles).

One researcher has suggested that loggerhead turtle nesting populations in the U.S. have been declining (Frazer 1986), but positive steps have recently been taken to reverse that trend. In September of 1989, NMFS regulations requiring the use of turtle excluder devices (TED's) on commercial shrimp trawls were implemented. Based upon onboard observations of offshore shrimp trawling in the southeast Atlantic, NMFS estimated that over 43,000 loggerheads are captured in shrimp trawls annually. The number of loggerhead mortalities from this activity was estimated to be 9,874 turtles annually (NMFS 1987). An estimated 5,000 to 50,000 loggerheads were killed annually during commercial shrimp fishing activities prior to regulations requiring the use of TED's (NMFS 1991a). The use of TED's may reduce sea turtle mortality in shrimp trawls by as much as 97% (Crouse et al. 1992). Since the implementation of the TED requirement, strandings of drowned threatened and endangered sea turtle species, in areas where strandings were historically high, have been dramatically lower (Crouse et al. 1992). Sea turtle nesting activity on two key

beaches also increased considerably subsequent to the implementation of the TED regulations (Crouse et al. 1992). In addition to the apparent success of the TED program, restrictions on development in coastal areas have become more widespread in recent years and may reduce the rate of habitat loss for sea turtles.

Based on these data, it is evident that a large population of loggerhead sea turtles does exist in the southeast Atlantic and Gulf of Mexico and that effective measures have been taken to mitigate a major source of loggerhead mortality. Various populations estimates suggest that the number of adult and subadult turtles is probably in the hundreds of thousands in the southeastern United States alone. In addition, large populations of loggerheads occur in many other parts of the world (Ross and Barwani 1982; NMFS 1991a). These facts suggest that although this species needs to be conserved, it is not in any immediate risk of becoming endangered.

5.3 KEMP'S RIDLEY (Lepidochelys kempii)

5.3.1 DESCRIPTION

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

Kemp's ridley hatchlings are dark grey-black above and white below (Pritchard et al. 1983; Pritchard and Marquez 1973).

5.3.2 DISTRIBUTION

Kemp's ridley turtles inhabit sheltered coastal areas and frequent larger estuaries, bays and lagoons in the temperate, subtropical and tropical waters of the northwestern Atlantic Ocean and Gulf of Mexico (Mager 1985).

The foraging range of adult Kemp's ridley sea turtles appears to be restricted to the Gulf of Mexico. However, juveniles and subadults occur throughout the warm coastal waters of the U.S. Atlantic coast (Hopkins and Richardson 1984; Pritchard and Marquez 1973). Juveniles/subadults travel northward with vernal warming to feed in the productive coastal waters of Georgia through New England, but return southward with the onset of winter to escape the cold (Henwood and Ogren 1987; Lutcavage and Musick 1985; Morreale et al.

1988; Ogren 1989).

5.3.3 FOOD

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

5.3.4 NESTING

Nesting of Kemp's ridleys is mainly restricted to a stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Pritchard and Marquez 1973; Hopkins and Richardson 1984). Occasional nesting has been reported in Padre Island, Texas and Veracruz, Mexico (Mager 1985).

The nesting season of the Kemp's ridley is confined to the warmer months of the year primarily from April through July. Kemp's ridley females generally nest every year to every third year (Márquez et al. 1982; Pritchard et al. 1983). They will lay 2 to 3 clutches of eggs per season and will lay 50 to 185 eggs per clutch. The eggs hatch in 45 to 70 days and hatchling emerge 2 or 3 days later (Hopkins and Richardson 1984).

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

5.3.5 POPULATION SIZE

Kemp's ridley sea turtles are the most endangered of the sea turtle species. There is only a single known colony of this species, almost all of which nest near Rancho Nuevo, Tamaulipas, Mexico. An estimated 40,000 females nested on a single day in 1947, but between 1978 and 1990 there were less than 1,000 nests per season (Figures 5-4 and 5-5). Based on nesting information from Rancho Nuevo, Ross (1989) estimated that the population was declining at a rate of approximately 3 percent per year. In 1994 however, 1,568 nests were observed at Rancho Nuevo, and more Kemp's ridley nests have been laid each year since 1990 than in any previous year on record since 1978 (Byles, 1994). It has been suggested that this recent increase in nesting activity reflects the reduction in shrimp trawl related mortality realized since the implementation of the NMFS TED regulations in September of 1989 (Crouse et al. 1992). The adult Kemp's ridley population has been estimated by Márquez (1989) to be approximately 2,200 adults based on the numbers of nests produced at Rancho Nuevo, this species' nesting cycle, male-female ratios, and fecundity.

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

Kemp's ridleys also die at sea and wash ashore. The NMFS Sea Turtle Salvage and Stranding Network collects stranded sea turtles along both the Atlantic and Gulf Coasts (NMFS 1988). Based on 1987 data, 767 ridleys were reported by the network (Figures 5-2 and 5-3). The largest portion was collected from the Gulf Coast (103 turtles), primarily the western portion of the Gulf. Nearly equal numbers of ridleys were reported from the northeast and southeast Atlantic Coasts (64 and 50, respectively).

Onboard observation of offshore shrimp trawling by NMFS in the southeast Atlantic indicated that over 2,800 ridleys are captured in shrimp trawls annually. The number of ridley mortalities attributable to this activity was estimated to be 767 turtles annually and most of these (65 percent) occurred in the western portion of the Gulf of Mexico (NMFS 1987). Magnuson et al. (1990) estimated the annual shrimp trawl by-catch mortality to be between 500 and 5,000 individuals. As discussed above, significant reductions in this source of mortality, by as much as 97 percent, have been achieved as a result of the implementation of the TED regulations by the NMFS in 1989 (Crouse et al. 1992).

Despite the apparent reduction in mortality afforded by the use of TED's, these data suggest that this population remains at critically low levels. The species was listed as endangered in 1970 and is considered the most endangered of all sea turtles (NMFS 1991a; Burke et al. 1994).

5.4 GREEN TURTLE (Chelonia mydas)

5.4.1 DESCRIPTION

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

Green turtles are circumglobally distributed mainly in waters between the northern and southern 20°C (68°F) isotherm (Mager 1985). In the western Atlantic, several major assemblages have been identified and studied (Parsons 1962; Pritchard 1966; Schulz 1975; 1982; Carr et al. 1978). In the continental U.S., however, the only known green turtle nesting occurs on the Atlantic coast of Florida (Mager 1985). In U.S. Atlantic waters, green turtles are found around the U.S. Virgin Islands, Puerto Rico, and the continental United States from Texas to Massachusetts (NMFS, 1991b).

5.4.3 FOOD

Green sea turtles leave their pelagic habitat phase and enter benthic feeding grounds upon reaching a carapace length of 20 to 25 cm (8-10 in). They are primarily herbivores eating sea grasses and algae (NMFS 1991b). Other organisms living on sea grass blades and algae add to their diet (Mager 1985).

5.4.4 NESTING

Green turtle nesting occurs on the Atlantic coast of Florida from June to September (Hopkins and Richardson 1984). Mature females may nest one to seven times per season at about 10 to 18 day intervals (Carr et al. 1978). Average clutch sizes vary between 100 and 200 eggs that usually hatch within 45 to 60 days (Hopkins and Richardson 1984). Hatchlings emerge, mostly at night, travel quickly to the water, and swim out to sea. At this point, they enter a period which is poorly understood but is likely spent pelagically in areas where currents concentrate debris and floating vegetation such as sargassum (Carr 1986).

5.4.5 POPULATION SIZE

The number of green sea turtles that existed before commercial exploitation and the total number that now exists are not known. Records show drastic declines in the Florida catch during the 1800's and similar declines occurred in other areas where they were commercially harvested in the past, such as Texas (Hildebrand 1982; Hopkins and Richardson 1984).

The elimination or deterioration of many nesting beaches and less frequent encounters with green turtles provide inferential evidence that stocks are generally declining (Mager 1985; Hopkins and Richardson 1984).

5.5 LEATHERBACK TURTLE (*Dermochelys coriacea*)

5.5.1 DESCRIPTION

The leatherback turtle is the largest of the sea turtles. It has an elongated, somewhat triangularly shaped body with longitudinal ridges or keels. It has a leathery blue-black shell composed of a thick layer of oily, vascularized cartilaginous material,

strengthened by a mosaic of thousands of small bones. This blue-black shell may also have variable white spotting (Pritchard et al. 1983). Its plastron is white. Leatherbacks normally weigh up to 300 kg (660 lb) and attain a carapace length (straight line) of 140 cm (55 in) (Pritchard et al. 1983; Hopkins and Richardson 1984). Specimens as large as 910 kg (2,000 lb) have been observed.

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

5.5.2 DISTRIBUTION

Leatherbacks have a circumglobal distribution and occur in the Atlantic, Indian and Pacific Oceans. They range as far north as Labrador and Alaska to as far south as Chile and the Cape of Good Hope. Their occurrence farther north than other sea turtle species is probably related to their ability to maintain a warmer body temperature over a longer period of time (NMFS 1985). Thompson (1984) reported that leatherbacks prefer water temperatures of about 20°C (±5°) and were likely to be associated with cooler, more productive waters than the Gulf Stream.

Aerial surveys have shown leatherbacks to be present from April to November between North Carolina and Nova Scotia, but most likely to be observed from the Gulf of Maine south to Long Island during summer (Shoop et al. 1981).

5.5.3 FOOD

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

5.5.4 NESTING

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

5.5.5 POPULATION SIZE

The world population estimates for the leatherback have been revised upward to over 100,000 females in recent years due to the

The world population estimates for the leatherback have been revised upward to over 100,000 females in recent years due to the discovery of nesting beaches in Mexico (Pritchard 1983).

5.6 SEA TURTLES IN COASTAL WATERS OF NEW JERSEY

Four species of sea turtles are known to occur in the coastal marine and estuarine waters of New Jersey, based on the records of sea turtle strandings compiled by the Marine Mammal Stranding Center (Schoelkopf 1994). The Marine Mammal Stranding Center (MMSC) is a member of the Northeast Sea Turtle Salvage and Stranding Network supported by NMFS.

The records of the MMSC include strandings of sea turtles along the seaside beaches of New Jersey as well as New Jersey's coastal embayments and estuaries such as Barnegat Bay and Delaware Bay. The four species of sea turtles reported from these areas include loggerhead, leatherback, Kemp's ridley, as well as green sea turtles.

The MMSC has reported 526 sea turtle strandings in coastal New Jersey, from Delaware Bay to Sandy Hook between 1977 and 1994 (Tables 5-1 and 5-2). Only eight of these strandings occurred at OCNGS; the details of these strandings are discussed in Section 6.0. Loggerheads were the most commonly stranded turtle, comprising almost two-thirds of the strandings between 1977 and 1994. Kemp's ridleys and leatherback were less common (6 and 31 percent of the strandings, respectively). Less than one percent of the reported strandings were green sea turtles (Schoelkopf 1994).

The majority of the strandings and/or sightings reported by MMSC have occurred between June and October (Table 5-2), although leatherbacks can occur virtually all year in New Jersey.

The MMSC (Schoelkopf 1994) reports that the majority of New Jersey sea turtle strandings have occurred in Cape May, Monmouth, Ocean and Salem counties, with fewer occurrences in Atlantic, Cumberland, Middlesex and Burlington counties (Figure 5-6).

Stomach content analyses from dead turtles have shown that primary food items for loggerheads are often blue crab and horseshoe crab. Blue crab occur during most of the year in the OCNGS intake and discharge canals and adjacent areas of Barnegat Bay. Horseshoe crab move into Barnegat Bay to lay eggs in the spring and summer, which coincides with the northward seasonal movement of loggerheads along the coast. Kemp's ridley stomachs which have been examined also often contain primarily blue crab. From a functional ecological viewpoint, loggerhead and Kemp's ridleys would be secondary consumers. They are not likely to be an important link in the Barnegat Bay food web, however, because of their apparently low abundance.

5.6.1 SEA TURTLES IN BARNEGAT BAY

A considerable body of evidence exists which indicates that sea

turtles are not commonly found in Barnegat Bay. From 1975 to 1985, GPUN and its environmental consultants conducted an intensive biological monitoring program designed to qualify and quantify the marine biota of Barnegat Bay. The program included sampling organisms impinged upon the CWS travelling screens and entrained in the cooling water flow of the condenser and dilution pump intakes at the OCNGS. In addition, thousands of trawl, seine and gill-net samples were collected in Barnegat Bay, Forked River and Oyster Creek (Danila et al. 1979; Ecological Analysts, Inc. 1981; EA Engineering, Science and Technology, Inc. 1986; EA Engineering, Science, and Technology, Inc. 1986a; Jersey Central Power and Light Company 1978; Tatham et al. 1977; Tatham et al. 1978).

Impingement and entrainment sampling involved the presence of 2 to 4 biologists at the intake structures during day and night sampling periods. No sea turtles were captured or observed during more than 20,000 hours of sampling.

Nearly 3,000 trawl samples were collected during day and night sampling periods. These samples consisted of 5-minute hauls of a 4.9 meter (16 ft) semiballoon otter trawl. The trawl had a 3.8 cm (1.5 in) stretch mesh body, a 3.2 cm (1.25 in) stretch mesh cod end and a 1.3 cm (0.5 in) stretch mesh inner liner. No sea turtles were found in any of these samples. More than 2,000 seine samples were collected during day and nite periods using 12.2 meter (40 ft) and 45.7 meter (150 ft) seines with 0.6 cm (0.25 in) and 1.3 cm (0.5 in) stretch mesh, respectively. No sea turtles were found in any of these samples.

Gill-net samples were collected using a 91.4 x 1.8 meter (300 x 6 ft) net consisting of three, 30.5 m (100 ft) panels of 38, 70 and 89 mm (1.5, 2.75, and 3.5 in) monofilament stretch mesh or a 61.0 meter (200 ft) net, identical to that described above but without the 70 mm (2.75 in) mesh panel. Several hundred samples were collected during day and night periods but no sea turtles were captured.

The New Jersey Department of Environmental Protection, Division of Fish, Game and Wildlife, has conducted periodic trawl and seine sampling in Barnegat Bay since 1971 (NJDEP 1973; Makai 1993; McLain 1993) and have reported no sea turtle captures. Similarly, Rutgers University reports that only one loggerhead turtle was captured during more than 5 years of periodic trawl sampling in Great Bay and Little Egg Harbor, estuaries located immediately south of Barnegat Bay (Able 1993).

The scarcity of sea turtles in Barnegat Bay is not surprising considering the fact that the only direct access to the bay from the Atlantic Ocean is through a single, narrow inlet, approximately 300 m (1000 ft) wide. By contrast, the inlet to Delaware Bay is over 18 km (11 mi) wide (Figure 5-7), providing unrestricted access from the Atlantic Ocean. Largely as a result of this accessibility, sea turtles have been much more common in Delaware Bay. At the Salem Generating Station located on upper Delaware Bay, Public Service Electric and Gas (1989) has captured sea

turtles in the vicinity of their cooling water intakes since 1980, only three years after the first of two generating units began operating. As many as 10 sea turtles have been captured at that facility in a single year.

The location of the generating station relative to the inlet from the ocean, as well as the rate and velocity of the cooling water flows should also be considered when comparing incidental capture rates at the Salem and Oyster Creek generating stations. The OCNGS is located much closer to Barnegat Inlet than Salem Generating Station is to the mouth of Delaware Bay. However, a sea turtle entering Barnegat Bay must travel along several kilometers of narrow, relatively shallow navigation channels, characterized by very heavy boat traffic, and pass through the wooden support structures of 3 bridges, in order to reach the OCNGS (Figure 5-8).

The rate of cooling water withdrawal for either the CWS or the DWS for OCNGS (1740 and 1968 m^3/min respectively) is about 25 percent of that for the cooling water system at Salem (approximately 7565 m^3/min). Similarly, the intake velocity at the OCNGS CWS intake (17-20 cm/sec) is approximately 25% of that at Salem (61-72 cm/sec). The intake velocity at the DWS intake for OCNGS (73 cm/sec) is similar to that at Salem's cooling water intake.

These factors play an important role in minimizing the number of incidental takes, as well as the potential for mortality, at the OCNGS intakes.

The occurrence of 3 sea turtles at the OCNGS during 1992, one during 1993, and four during 1994, when none had been observed before despite intensive sampling efforts, may be attributable to recent changes in the accessibility of Barnegat Bay and increases in sea turtle population levels.

The modifications to Barnegat Inlet that were completed in 1991 resulted in a significant increase in the depth of the inlet, and concomitant increase in the volume of water moving through the inlet during each tidal cycle. Recent preliminary data indicate that the average tidal prism after completion of the modifications is approximately 2.5 times greater than during the 1980's prior to the modifications (Gebert 1994). In addition, the removal of shoals near the inlet entrance reduced the amount of turbulence associated with breaking surf. These changes may have made the inlet more accessible to sea turtles migrating along the Atlantic coast.

Dramatically smaller numbers of strandings of drowned sea turtles and increases in sea turtle nesting activity on two key beaches have been attributed to the implementation of the NMFS TED requirements in September of 1989 (Crouse et al. 1992). The use of TED's has apparently resulted in a significant reduction in shrimp trawl by-catch mortality, possibly by as much as 97 percent. According to NMFS estimates (NMFS 1991a), shrimp trawls may have killed as many as 5,000 to 50,000 loggerhead and more than 700 Kemp's ridley turtles each year, prior to the use of TED's. This

relatively recent reduction in sea turtle mortality may have resulted in an increase in the number of individuals migrating up the Atlantic coast and moving into the estuaries. This theory is supported by recent trends in incidental sea turtle captures at the Salem Generating Station. From 1980 through 1988, sea turtles were captured at Salem at a rate of approximately 4.2 per year (PSE&G 1989). The rate of capture increased to more than 9 per year during the 1989-1993 period, following implementation of TED's by commercial shrimp trawlers.

It is difficult to predict future trends in the occurrence of sea turtles at the OCNGS. If the number of individuals migrating up and down the Atlantic coast is the major determining factor, incidental captures may continue to occur if the TED regulations are as effective as they seem to be after the first few years of experience. If accessibility to Barnegat Bay is the most important factor, the frequency of incidental captures at OCNGS may decline with time. Barnegat Inlet is notoriously dynamic, the position of the channel shifting frequently and the volume of the tidal prism continuously decreasing due to sedimentation (Table 3-1; Ashley 1988). As a result, accessibility to the bay through the inlet was probably at its maximum following the completion of the inlet modifications and associated dredging in 1993 and is likely to decrease with time.

TABLE 5-1

SEA TURTLE STRANDINGS IN NEW JERSEY COASTAL AND ESTUARINE WATERS REPORTED BY MARINE MAMMAL STRANDING CENTER, 1977-1994. (SCHOELKOPF 1994)

ANNUAL DISTRIBUTION					
YEAR	LOGGERHEAD	RIDLEY	LEATHERBACK	GREEN	UNKNOWN
1977	1	0	1	0	0
1978	4	0	2	0	0
1979	11	0	10	0	0
1980	9	0	2	0	0
1981	4	0	13	0	0
1982	2	0	13	0	0
1983	8	4	9	0	0
1984	8	0	2	0	0
1985	22	1	7	0	0
1986	15	0	2	0	0
1987	37	1	33	0	0
1988	13	0	6	0	0
1989	17	7	3	0	0
1990	26	0	9	1	0
1991	55	4	13	2	0
1992	39	5	5	1	0
1993	17	6	28	2	1
1994*	33	4	6	1	1
TOTALS	321	32	164	7	2

*Note: Partial year data for 1994

TABLE 5-2

SEASONAL OCCURRENCE OF SEA TURTLE STRANDINGS IN NEW JERSEY COASTAL AND ESTUARINE WATERS REPORTED BY MARINE MAMMAL STRANDING CENTER AND PUBLIC SERVICE ELECTRIC AND GAS, 1977-1994. (PSE&G 1989; SCHOELKOPF 1994)

MONTHLY DISTRIBUTION (*)					
MONTH	LOGGERHEAD	RIDLEY	LEATHERBACK	GREEN	UNKNOWN
JAN	1(0)	1(0)	3(0)	0	0
FEB	0	0	3(0)	0	0
MAR	0	0	1(0)	0	1(0)
APR	0	0	1(0)	0	0
MAY	0	0	2(0)	0	0
JUNE	37(2)	4(0)	4(0)	0	0
JULY	108(1)	10(2)	10(0)	1(0)	0
AUG	77(0)	9(0)	30(0)	2(0)	1(0)
SEP	84(1)	13(0)	56(0)	1(0)	0
OCT	40(0)	4(2)	44(0)	1(0)	0
NOV	5(0)	1(0)	8(0)	2(0)	0
DEC	0	0	2(0)	0	0
TOTALS	352(4)	42(4)	164(0)	7(0)	2(0)

Note:
* Number of incidental captures at OCNGS in parentheses.
** Data for 1994 includes all standings through mid-September.

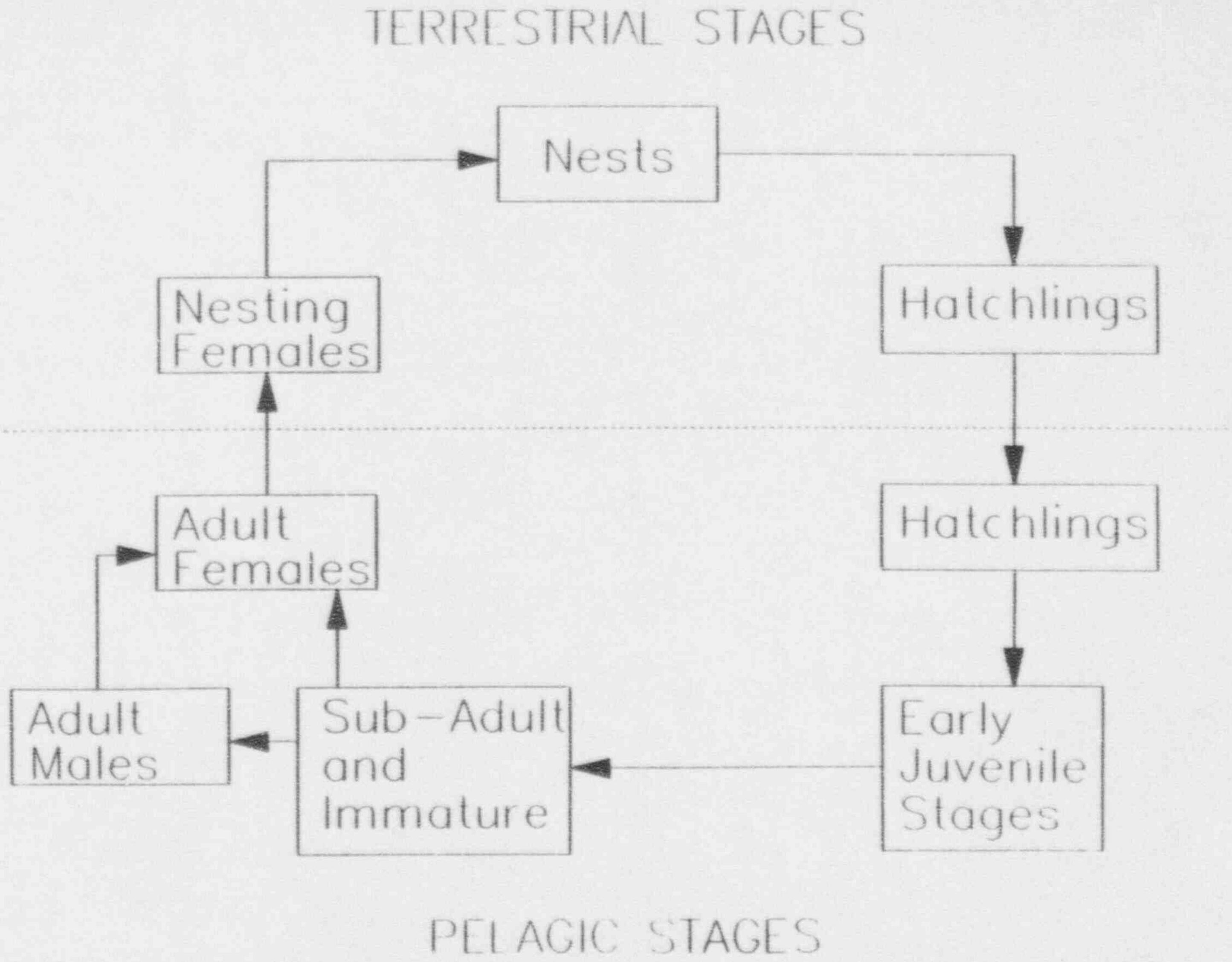


Figure 5-1. Generalized sea turtle life cycle (After PSE&G 1989).

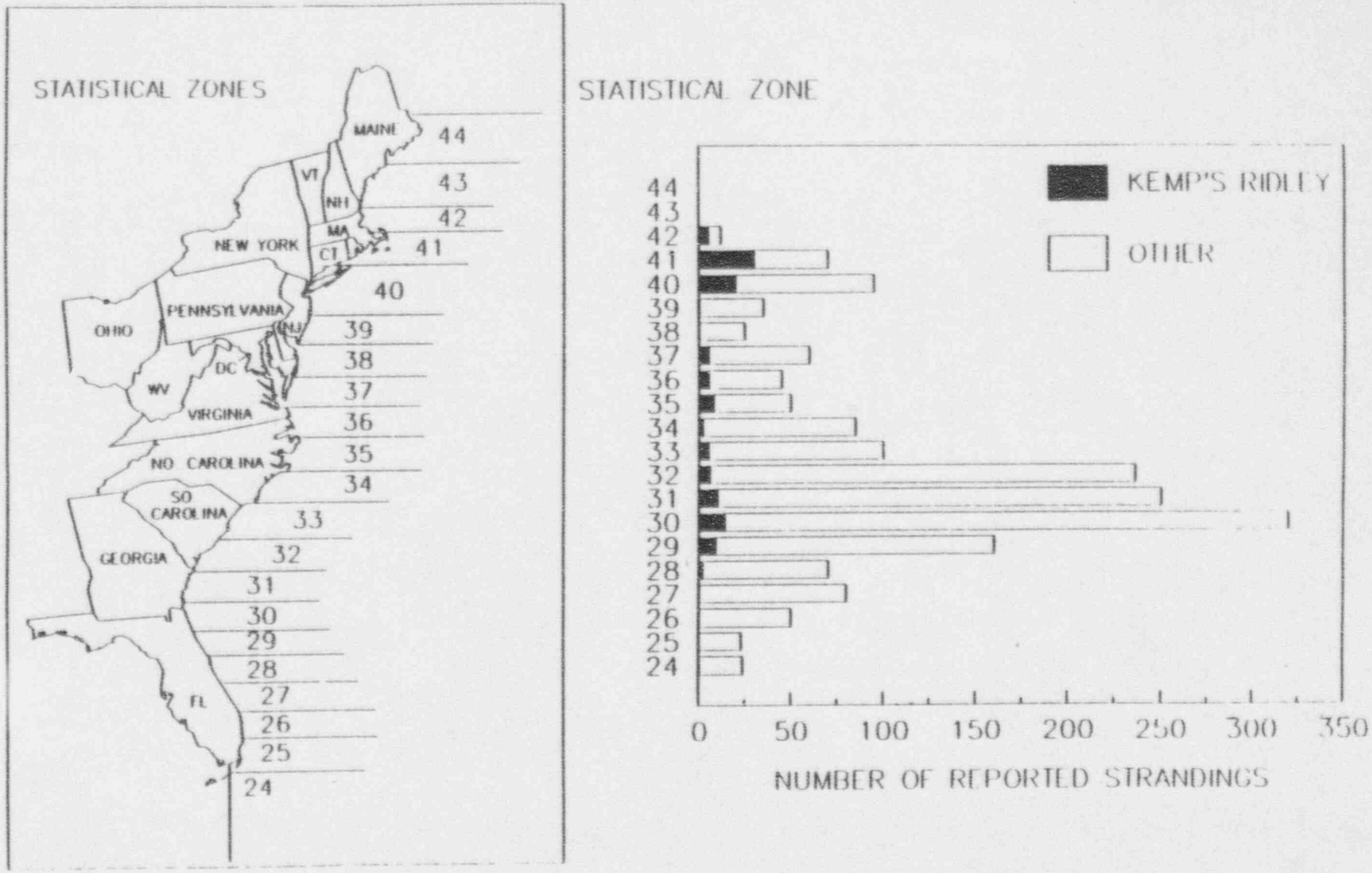


Figure 5-2. Sea Turtle Strandings, U.S. Atlantic Coast 1987 (After NMFS 1988).

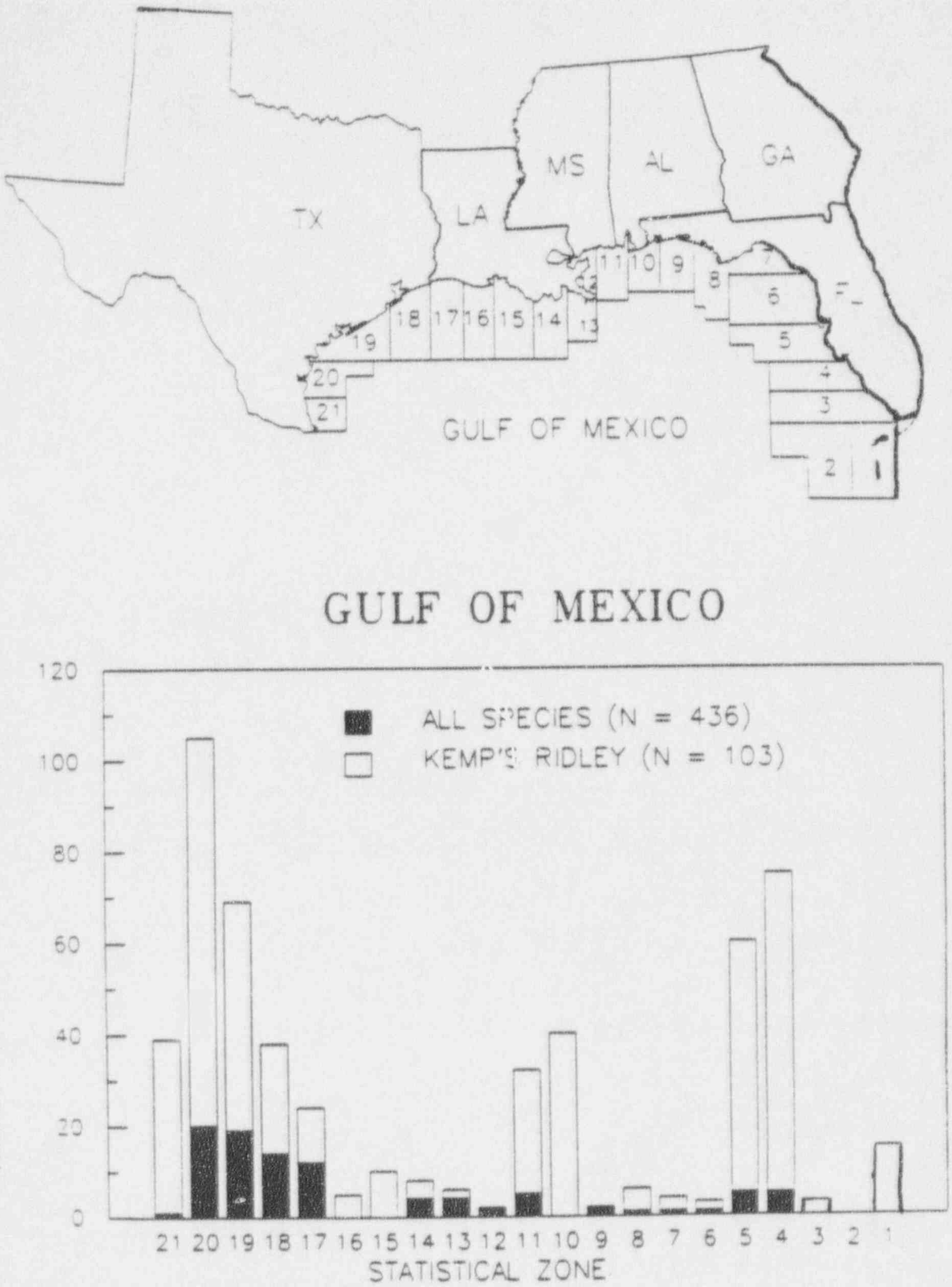


Figure 5-3. Sea Turtle Strandings, U.S. Gulf of Mexico 1987 (After NMFS 1988).

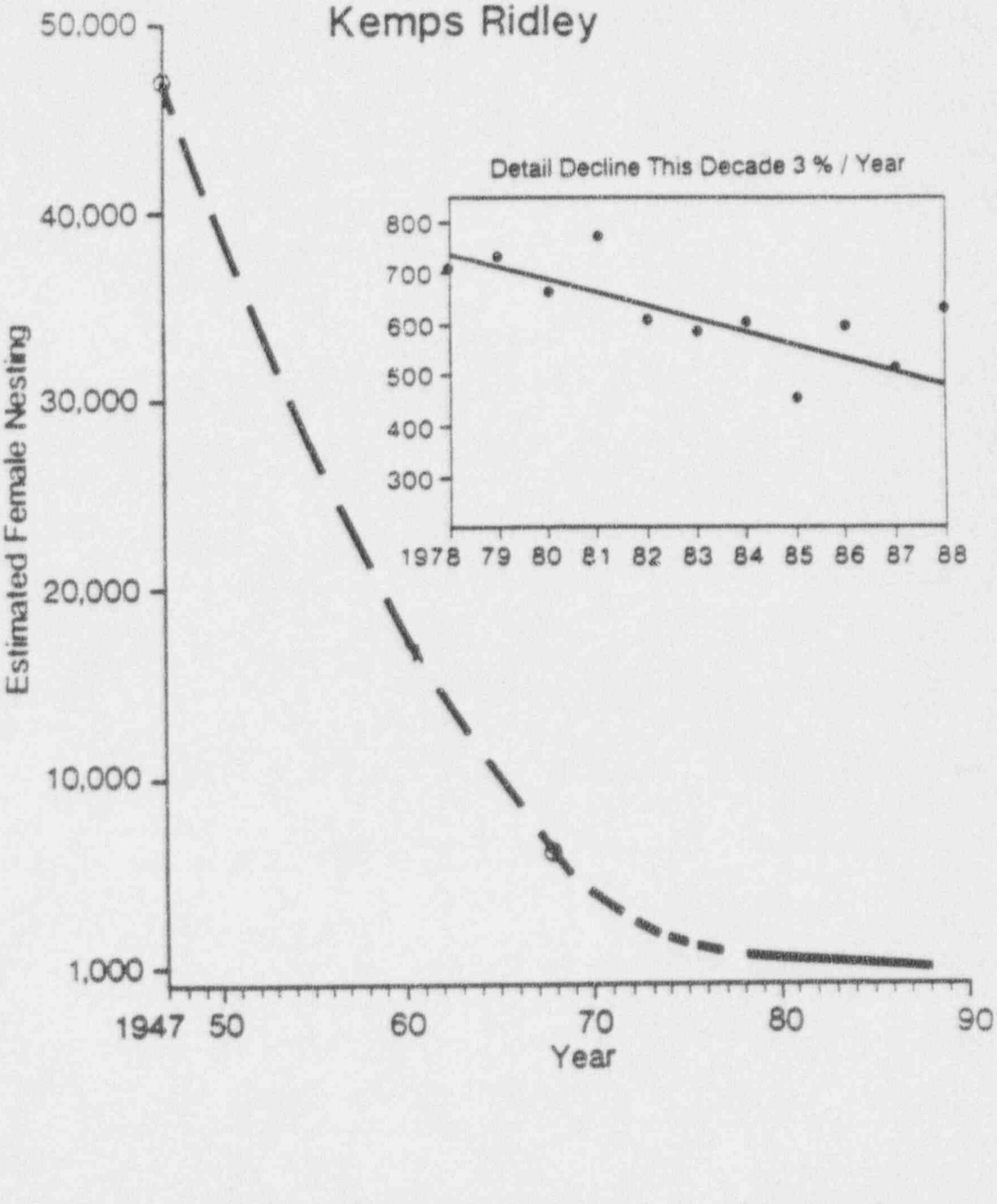


Figure 5-4. Estimated Annual Number of Nesting Female Kemp's Ridley Sea Turtles (After Ross 1989).

Figure 5-5. Number of Kemp's Ridley Nests at Rancho Nuevo Before and After Implementation of TED Regulations (Byles, 1994).

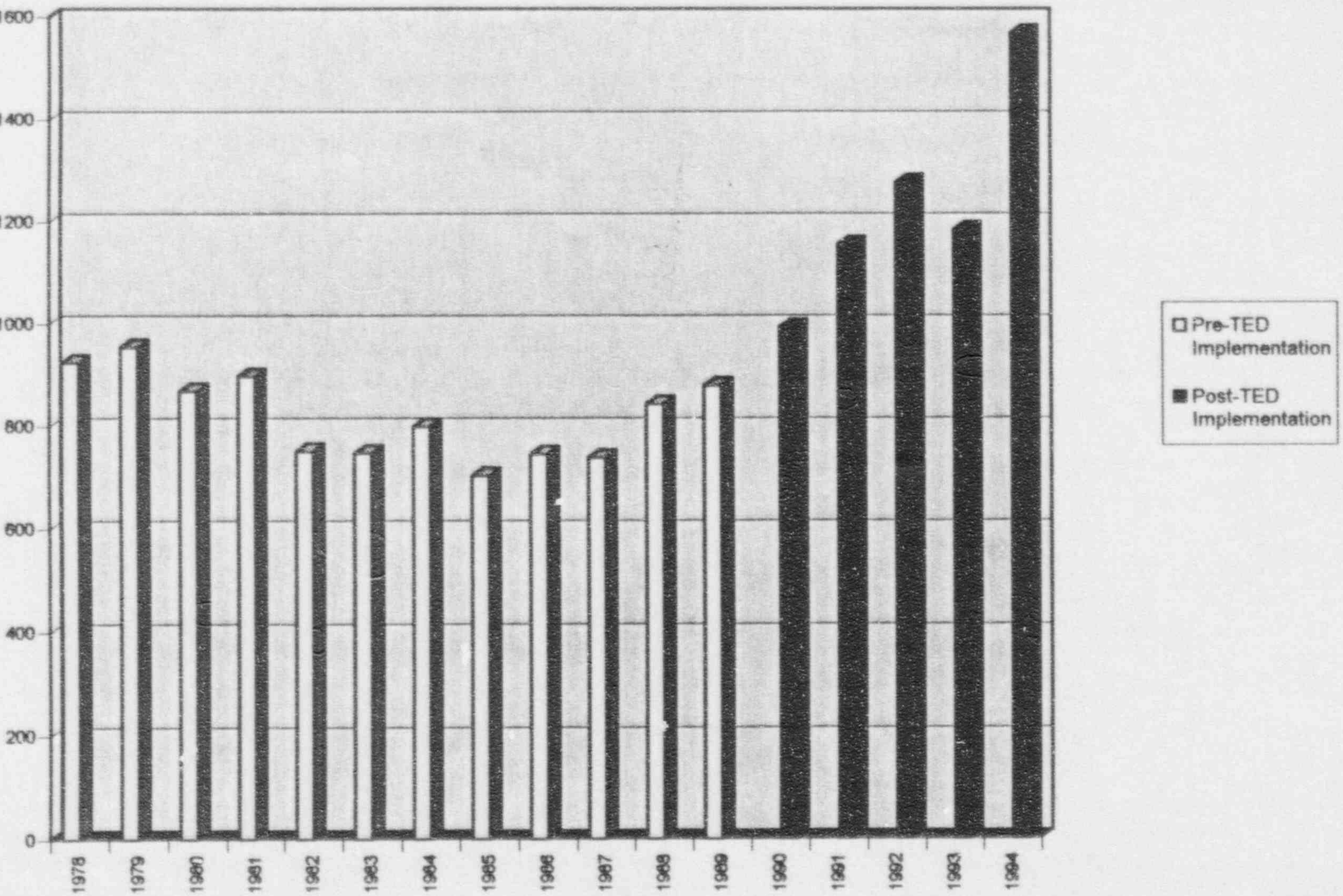
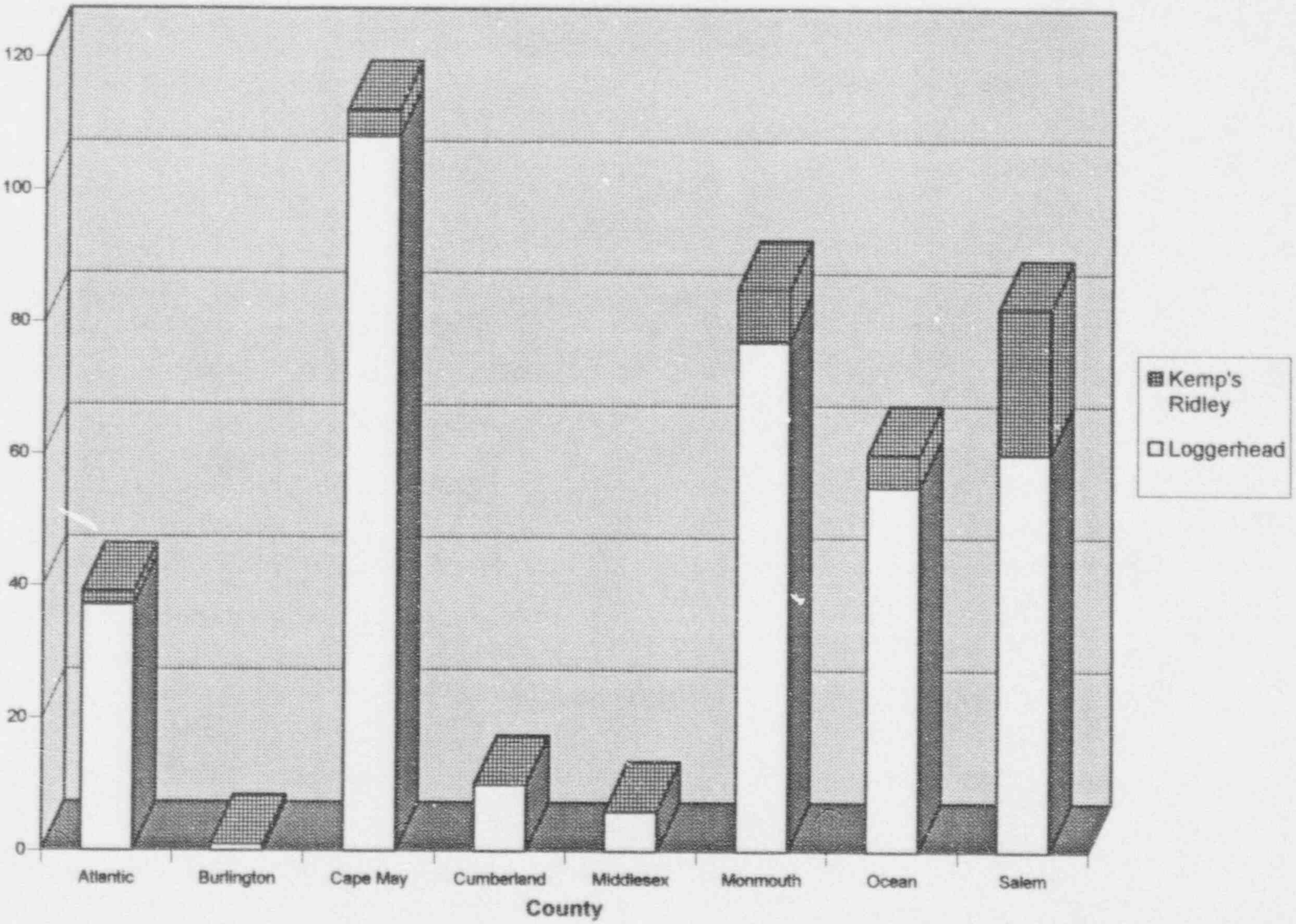


Figure 5-6. New Jersey Sea Turtle Strandings By County, As Reported By Marine Mammal Stranding Center, 1977-1994 (Schoelkopf, 1994).



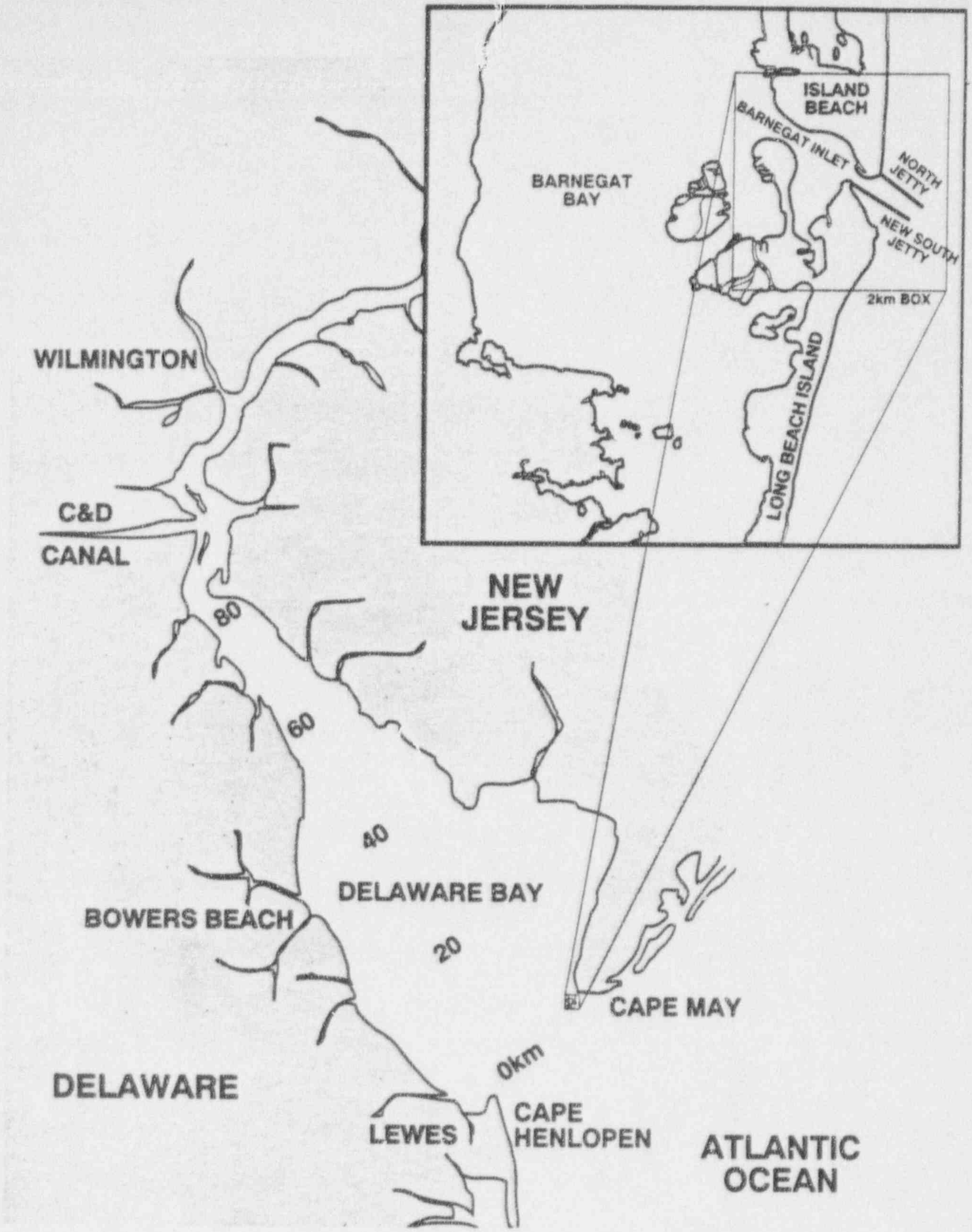


Figure 5-7. Relative widths of the mouth of Delaware Bay and Barnegat Inlet. Inset shows Barnegat Inlet vicinity in greater detail.

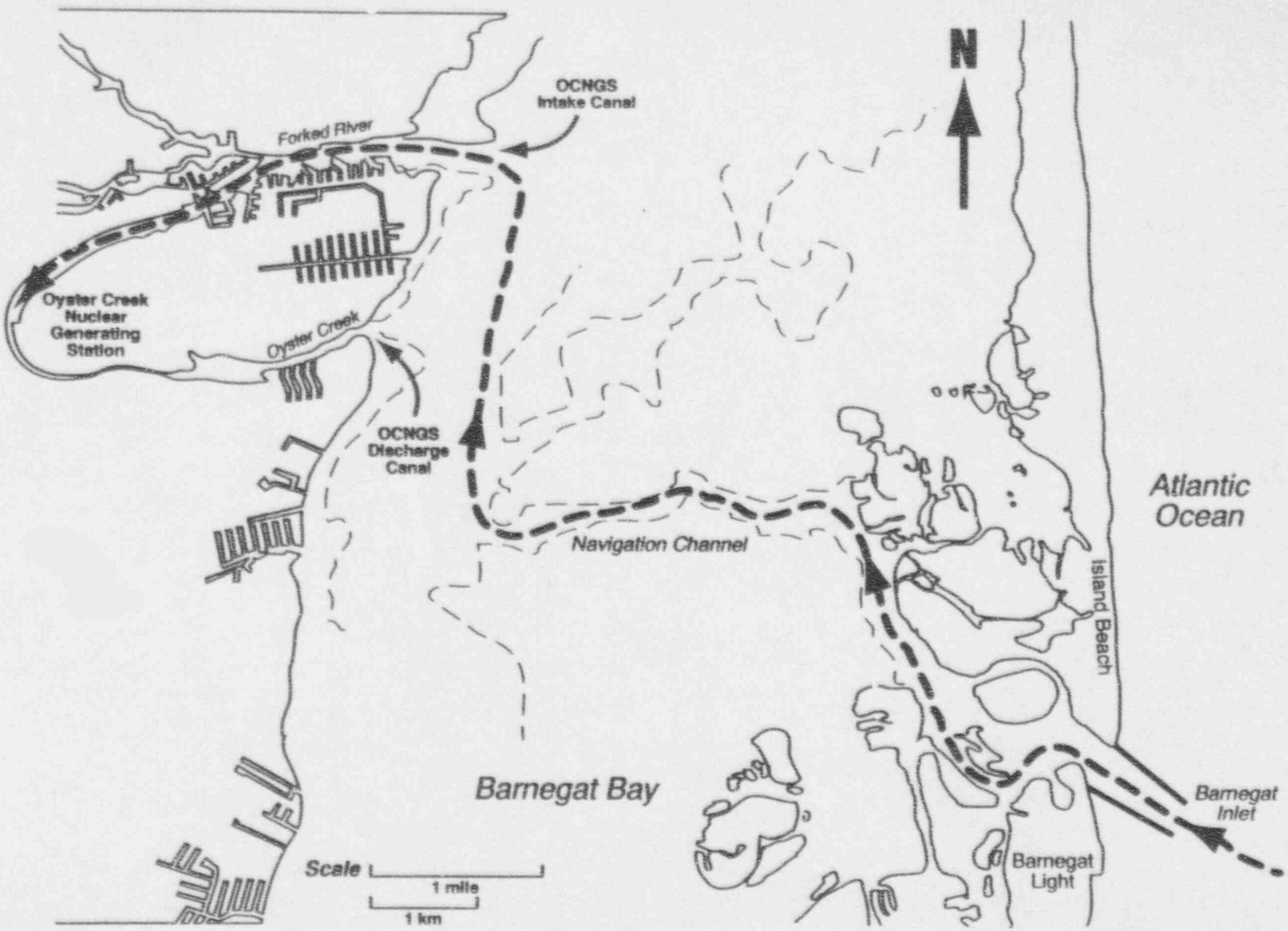


Figure 5-8 Probable pathway of sea turtles moving from the Atlantic Ocean to OCNGS via Barnegat Inlet.

SECTION 6.0
ONSITE INFORMATION

6.1 OCCURRENCE OF SEA TURTLES AT OYSTER CREEK NUCLEAR GENERATING STATION

As discussed in Section 5.0, despite intensive sampling efforts, no sea turtles were observed during the 23 years of OCNGS operation prior to 1992; eight sea turtles have been captured since 1992 (Tables 5-2 and 6-1). Three sea turtles were taken in 1992: a dead loggerhead with deep boat propeller wounds was impinged on June 25, 1992; a live loggerhead taken twice in September 1992; and a live Kemp's ridley turtle was taken October 26, 1992. During 1993, the only sea turtle observed at OCNGS was a dead subadult Kemp's ridley turtle taken on October 17, 1993.

Four sea turtles were taken in 1994: a live juvenile loggerhead in June, a dead loggerhead subadult taken during July (and for which the necropsy showed that death due to infections and boat propeller wounds had occurred prior to capture at OCNGS), and two dead Kemp's ridley juveniles taken during July for which necropsies are incomplete (Table 6-1).

6.1.1 DETAILS OF INCIDENTAL CAPTURES AT OCNGS

Descriptions of the circumstances surrounding each of the incidental captures at OCNGS based on available information are provided in Sections 6.1.1.1 through 6.1.1.8. This information is also summarized in Table 6-1. In some cases, observations or inferences about the turtles' behavior or orientation could be made. However, when turtles were removed from more than about 1 m (3 ft) below the surface, or if they were obscured by debris near the surface, detailed information on their exact location and orientation was not always available. The OCNGS Sea Turtle Incidental Sighting/Capture Report Form, an attachment to the Sea Turtle Surveillance, Handling and Reporting Instructions (Appendix I), was developed in order to standardize the gathering of data related to future incidental captures.

6.1.1.1 INCIDENTAL CAPTURE OF JUNE 25, 1992

A dead sea turtle was removed from the dilution water system intake trash bars at approximately 12:50 PM on June 25, 1992. Members of the OCNGS Environmental Affairs Department identified it as a juvenile loggerhead measuring 35.5 cm (14 in) carapace length and noted that this turtle had several deep gashes on its side which appeared to be boat propeller wounds. The Marine Mammal Stranding Center (MMSC) of Brigantine, NJ was notified and requested to

perform a necropsy. MMSC confirmed that the specimen was a juvenile Caretta caretta. The MMSC necropsy determined that the cause of death was from boat propeller wounds and that the specimen had died prior to becoming impinged on OCNGS.

6.1.1.2 INCIDENTAL CAPTURES OF SEPTEMBER 9 AND 11, 1992

During the early evening (approx. 6:00 PM) of September 9, 1992 a live sea turtle was noticed by OCNGS Operations personnel during a routine inspection of the circulating water system (CWS) intake trash bars. The turtle was carefully removed by several plant personnel, tentatively identified as a juvenile loggerhead, and released alive into the OCNGS discharge canal. Although this individual was alive and healthy when released, it was noted that it had a small wound surrounded by scar tissue just behind its head. The turtles carapace length was 46.7 cm (18.4 in).

During a mid-afternoon (approx. 2:00 PM) tour of the circulating water system intake structure on September 11, 1992, an OCNGS security officer noticed a live sea turtle impinged on the CWS trash bars. When the turtle was removed from the intake structure, it was identified as a juvenile loggerhead with a neck wound identical to that noted on the loggerhead released at OCNGS on September 9, 1992. The Marine Mammal Stranding Center was notified and the turtle was released in healthy condition to MMSC personnel who took it their Brigantine facility for examination, holding, tagging and subsequent release. MMSC personnel confirmed the turtle to be a juvenile loggerhead and observed that it had a small (0.6 cm; 0.25 in) wound with scar tissue on the dorsal midline just behind the head. MMSC Director Robert Schoelkopf stated that he believed it to be the same juvenile loggerhead which was collected and released at OCNGS on September 9, 1992. The turtle was tagged by MMSC personnel and released in the Atlantic Ocean near Brigantine in healthy condition.

6.1.1.3 INCIDENTAL CAPTURE OF OCTOBER 26, 1992

During an early morning routine inspection of the CWS intake, an OCNGS Operations department representative noticed a live sea turtle impinged against the trash bars. The turtle was initially found at about 3:00 AM with its head out of the water and pointing upward. The turtle was carefully retrieved as quickly as possible and found to be in good condition. Environmental Affairs department personnel who took custody of the turtle identified it as a subadult Kemp's ridley and made arrangements for its immediate transfer to the MMSC. Although it was impossible to say precisely how long the turtle had been on the intake structure prior to removal, it may have been there between three and eight hours.

MMSC personnel who examined the turtle found that it was very healthy, swam freely, and required no direct care. However, two scars from slash-like wounds were apparent on the plastron, indicating that the turtle had been wounded at some time prior to its incidental capture at OCNGS. The turtle measured 32 cm (12.6 in) carapace length.

indicating that the turtle had been wounded at some time prior to its incidental capture at OCNGS. The turtle measured 32 cm (12.6 in) carapace length.

The water temperature in the OCNGS intake canal at the time of the impingement was 11.1°C (51°F). Because of concerns that the turtle may be subject to cold stunning if released into New Jersey coastal waters, MMSC personnel made arrangements for the turtle to be transported to North Carolina prior to being released to ensure that cold stunning would not occur. The turtle was tagged and released on October 31, 1992 at Kure Beach, North Carolina.

6.1.1.4 INCIDENTAL CAPTURE OF OCTOBER 17, 1993

OCNGS Operations department personnel conducting a routine morning (approx. 12 noon) inspection of the dilution water system intake on October 17, 1993 noticed a sea turtle impinged against the trash bars. The turtle was found to be limp, immobile and with no apparent breathing when retrieved. OCNGS Environmental Affairs personnel who examined the turtle identified it as a juvenile Kemp's ridley. No tags, prominent scars or slash-like propeller wounds were apparent on the turtle. Minor scrape marks which were observed on the plastron may have occurred during removal of the turtle from the dilution intake area. The turtle measured 26 cm (10.25 in) carapace length.

The water temperature in the intake canal at the time of the impingement was approximately 14.4°C (58°F). Although it was impossible to say precisely how long the turtle had been on the intake structure prior to removal, it may have been between four and eight hours. Within three to four hours after its capture, the turtle was placed in a freezer for temporary storage at an on-site OCNGS biological laboratory. At the suggestion of the National Marine Fisheries Service, arrangements were made to have a necropsy of the turtle performed by sea turtle expert Dr. Steven Morreale of Cornell University and his associates at the New York State College of Veterinary Medicine. The following is an excerpt from Dr. Morreale's necropsy:

> "... The overall condition of this turtle was one of an otherwise healthy young Kemp's ridley, typical of the many that I have examined in northeastern waters. The lack of food in the gut is typical of the sea turtles that I have seen at this time of year and is indicative of a behavioral change prior to migrating southward. The lack of any obvious trauma would tend to implicate drowning as the cause of death to this animal. The lack of fluid in the lungs is not necessarily contradictory to this conclusion. It is my opinion that sea turtles suffocate underwater rather than inhaling water. The superficial scrapes on the plastron and neck were very fresh and probably occurred on the intake (trash racks). However, I could not tell whether these occurred prior to or after death. The only potentially contradictory evidence of this turtle having died as a result of

impingement, was the condition of the specimen. From the information given to me about the timing of death, the water temperature, and the subsequent handling of the carcass, I expected to observe slightly less decomposition. The moderate levels of decomposition of liver and gonad tissues are usually more representative of a turtle that has been dead for one to two days at those temperatures."

6.1.1.5 INCIDENTAL CAPTURE OF JUNE 19, 1994

During the early afternoon (approx. 1:30 PM) of June 19, 1994, OCNGS Operations personnel conducting a routine inspection of the circulating water system intake area observed a sea turtle in the #4 CWS intake bay (CWS and DWS intake bays are sequentially numbered from 1 through 6, north to south). The turtle was swimming freely a few feet upstream of the face of the CWS intake trash bars. The turtle was removed carefully and as quickly as possible and found to be active, healthy and with no apparent wounds. OCNGS Environmental Affairs department personnel identified it as a juvenile loggerhead turtle and immediately notified the Marine Mammal Stranding Center of the capture. The turtle measured 36.8 cm (14.5 in) carapace length.

Although it was impossible to determine precisely how long the turtle had been near the intake structure prior to retrieval, it is believed to have been in the vicinity for a relatively short period of time. Within three to four hours of the time of its capture, the turtle was taken to MMSC. Personnel at MMSC examined and tagged it, and subsequently released it offshore of Brigantine, NJ.

6.1.1.6 INCIDENTAL CAPTURE OF JULY 1, 1994

During a routine mid-morning (approx. 10:00 AM) cleaning of the dilution water system intake trash bars on July 1, 1994, a dead sea turtle was retrieved from the trash bars in front of DWS bay #5. The turtle was removed as quickly as possible by OCNGS Operations personnel. It was found to be inactive and exhibited a strong odor of decomposition. Environmental Affairs personnel identified it as a juvenile Kemp's ridley turtle and tried unsuccessfully to resuscitate it. The turtle measured 27.7 cm (10.9 in) carapace length.

Although it was impossible to say precisely how long the turtle had been at the intake structure prior to removal, it is known that the intake bay in which the turtle was found had been cleaned during the previous afternoon. No prominent scars or slash-like propeller wounds were apparent on the turtle. The turtle has been sent to marine turtle experts at the Center for the Environment, Cornell University, who will perform a thorough necropsy. As of this writing, the results of the necropsy are not yet available.

6.1.1.7 INCIDENTAL CAPTURE OF JULY 6, 1994

At approximately 6:15 AM on July 6, 1994, OCNGS Operations

personnel conducting routine cleaning of the dilution water system intake area removed a sea turtle from the DWS trash bars in bay #4. OCNGS Environmental Affairs personnel who took custody of the turtle identified it as a subadult loggerhead (carapace length 61.4 cm or 24.5 in) and tried unsuccessfully to resuscitate it. Although it was impossible to say precisely how long the turtle had been at the intake structure prior to removal, the trash bars at the DWS intake had previously been cleaned 6-8 hours earlier.

At least three deep scars or slash-like propeller wounds were apparent on the turtle. These scars were not fresh because blue mussels were attached and growing within the scars.

Several hours after its capture, the turtle was taken to the Marine Mammal Stranding Center (MMSC) in Brigantine, NJ. MMSC Director Robert Schoelkopf performed a necropsy of the carcass. Mr. Schoelkopf reported that the turtle did not die at the intake nor did it suffocate. The lungs were found to be in good condition. The turtle was believed to have died one to two days prior to arriving at OCNGS, probably due to a long term illness. Decomposition of all four appendages, as well as a large notch along the turtle's marginal scutes, were attributed by Schoelkopf to bacterial or fungal infections.

6.1.1.8 INCIDENTAL CAPTURE OF JULY 12, 1994

At approximately 10:40 PM on July 12, 1994, OCNGS Operations personnel conducting routine cleaning of the dilution water system intakes removed a sea turtle from the trash bars at bay #4. The turtle was found to be inactive, but had no apparent wounds. OCNGS Environmental Affairs personnel who took custody of the turtle identified it as a juvenile Kemp's ridley turtle (26.7 cm or 10.5 in carapace length) and tried unsuccessfully to resuscitate it.

Although it was impossible to say precisely how long the turtle had been at the intake structure prior to removal, it may have been there for up to several hours. No prominent scars or slash-like propeller wounds were evident on the turtle.

This turtle has been sent to marine turtle experts at the Center for the Environment, Cornell University, who will perform a thorough necropsy. As of this writing, the results of the necropsy are not yet available.

6.1.2 ANNUAL COMPARISON

During any particular year the number of sea turtles collected at the Oyster Creek CWS and DWS intakes ranged from zero (in all years from 1970 to 1991) to four during 1994 (Table 6-2). The actual number of loggerheads incidentally captured on the intake ranged between zero and two animals annually. The actual number of Kemp's ridleys incidentally captured on the intake ranged between zero and two animals annually.

Given the very small number of sea turtles captured at OCNGS and

the fact that they have only occurred during 1992 through 1994, it is difficult to predict how many may be captured in the future. However, based on the levels of incidental capture observed at the intake to date, it is estimated that zero to three loggerheads and zero to three Kemp's ridleys could be expected to be taken from the OCNGS intake during any given year.

6.1.3 SPECIES COMPOSITION

Four loggerhead sea turtles (Caretta caretta) and four Kemp's ridleys (Lepidochelys kempii) have been captured at the circulating and dilution water intakes.

The loggerheads were all juveniles or subadults. Carapace lengths (straight length) ranged from 35.5 to 61.4 cm (14 to 24 in) with a mean of 45.1 cm (17.8 in) (Figure 6-1). The ridleys were also juveniles or subadults. Their carapace lengths (straight length) ranged from 26 to 32 cm (10-13 in) with a mean of 28.1 cm (11 in) (Figure 6-1).

6.1.4 SEASONAL DISTRIBUTION OF OCCURRENCES

Two out of eight sea turtle strandings at the OCNGS were reported during June, three during July, one during September, and two during October. No turtles were collected during the winter months (Table 6-3).

The timing of sea turtle occurrences at OCNGS corresponds well with the available information on the seasonal movements of these animals. Based on aerial surveys of pelagic turtles (Shoop et al. 1981), sea turtles, loggerheads in particular, migrate up the coast from the southeast in the spring and summer months. They move into the bays and coastal waters as water temperatures reach suitable levels and forage on crabs and other preferred foods (Keinath et al. 1987; Morreale and Standora 1989). As the temperatures of the bays and coastal waters start to decline, these animals move southward to the warmer water of the southeast Atlantic Coast. Recapture information from tagged animals provides evidence for such movements in loggerheads and ridleys (Shoop et al. 1981; Henwood 1987; PSE&G 1989).

6.1.5 CONDITION OF TURTLES CAPTURED AT INTAKE STRUCTURES

Of the eight turtles captured at the OCNGS intakes, five were dead and three were alive and subsequently released (Tables 6-1 and 6-2).

The two dead loggerheads both had boat propeller wounds and were partially decomposed when impinged at the dilution water system intake structure at OCNGS. One of the live loggerheads taken at OCNGS, a juvenile, was removed alive from the CWS intake and released in good condition on September 9, 1992. The same individual was subsequently recaptured at the CWS intake on September 11, 1992, delivered to the Marine Mammal Stranding Center where it was examined, found to be healthy and released into the

Atlantic Ocean. Another live loggerhead juvenile was removed from the CWS intake in good condition on June 19, 1994, delivered to the Marine Mammal Stranding Center, and also subsequently released into the ocean.

One of the Kemp's ridleys was alive when captured in October 1992 and was successfully transported and released into the Atlantic Ocean in North Carolina by the Marine Mammal Stranding Center after observing its behavior for several days. The three dead ridleys, all juveniles, appeared to be fresh dead. The specimens were sent to Dr. Steven Morreale of the Center for the Environment, Cornell University, to perform necropsies on them. Dr. Morreale reported that the most likely cause of death of the Kemp's ridley captured on October 17, 1993 was drowning at the OCNGS DWS intake (see Section 6.1.1.4). Because the necropsies of the two individuals captured in 1994 have not yet been completed, the cause of death remains uncertain but may be attributable to drowning.

Information collected at Salem Generating Station has shown that both anthropogenic and natural causes of death contribute to sea turtle mortalities in local estuaries (PSE&G 1989). Furthermore, based on other necropsy information available from the Marine Mammal Stranding Center, boat-related injuries appear to be common occurrences in both stranded loggerheads and ridleys in Delaware Bay and coastal New Jersey (Schoelkopf 1994). This is consistent with NMFS findings which show boat-related injuries as a common carcass anomaly (NMFS 1988).

TABLE 6-1. OYSTER CREEK NUCLEAR GENERATING STATION SEA TURTLE INCIDENTAL CAPTURES

DATE OF COLLECTION	TIME OF CAPTURE	SPECIES AND LIFE STAGE	LENGTH (cm/in) AND WEIGHT (kg/lb)	CAPTURED AT CIRC. OR DIL. WATER INTAKE	INTAKE TEMP. deg. F (C)	ALIVE WHEN CAPTURED?	FRESH DEAD?	BOAT PROP WOUNDS?	RELEASE SITE
6/25/92	12:50 PM	Loggerhead juvenile	35.5 cm/14.0 in 9.6 kg/21.2 lb	Dilution Water System	70.8 F (21.6 C)	No	No	Yes	N/A
9/9/92	6:00 PM	Loggerhead juvenile	46.7 cm/18.4 in 19.1 kg/42.1 lb	Circulating Water System	78.2 F (25.6 C)	Yes	N/A	No	NJ
9/11/92*	2:00 PM	Loggerhead juvenile	46.7 cm/18.4 in 19.1 kg/42.1 lb	Circulating Water System	79.2 F (26.2 C)	Yes	N/A	No	NJ
10/26/92	3:00 AM	Kemp's ridley subadult	32.0 cm/12.6 in 5.7 kg/12.6 lb	Circulating Water System	52.4 F (11.3 C)	Yes	N/A	No	NC
10/17/93	12:00 Noon	Kemp's ridley juvenile	26.0 cm/10.2 in 3.0 kg/6.6 lb	Dilution Water System	58.0 F (14.4 C)	No	Yes	No	N/A
6/19/94	1:30 PM	Loggerhead juvenile	36.8 cm/14.5 in 9.8 kg/21.6 lb	Circulating Water System	81.1 F (27.3 C)	Yes	N/A	No	NJ
7/1/94	10:00 AM	Kemp's ridley juvenile	27.7 cm/10.9 in 3.6 kg/7.9 lb	Dilution Water System	78.3 F (25.7 C)	No	**	No	N/A
7/6/94	6:40 AM	Loggerhead subadult	61.4 cm/24.2 in 40.4 kg/89.1 lb	Dilution Water System	80.5 F (26.9 C)	No	No	Yes	N/A
7/12/94	10:40 PM	Kemp's ridley juvenile	26.7 cm/10.5 in 3.3 kg/7.3 lb	Dilution Water System	83.2 F (28.4 C)	No	**	No	N/A

NOTES: 1.) No sea turtles were captured during the first 22 full years of OCNGS operation, 1970-1991.
2.) Lengths are straight line carapace lengths.
3.) In all cases, two dilution pumps or four circulating water pumps were operating.

* Loggerhead captured on 9/11/92 was the same turtle that was captured on 9/9/92.

** Necropsy currently underway.

TABLE 6-2

MORTALITY OF SEA TURTLES CAPTURED FROM INTAKE TRASH BARS AT OYSTER CREEK NUCLEAR GENERATING STATION (LIVE/DEAD)

YEAR	LOGGERHEAD	RIDLEY	TOTALS
1969	0/0	0/0	0/0
1970	0/0	0/0	0/0
1971	0/0	0/0	0/0
1972	0/0	0/0	0/0
1973	0/0	0/0	0/0
1974	0/0	0/0	0/0
1975	0/0	0/0	0/0
1976	0/0	0/0	0/0
1977	0/0	0/0	0/0
1978	0/0	0/0	0/0
1979	0/0	0/0	0/0
1980	0/0	0/0	0/0
1981	0/0	0/0	0/0
1982	0/0	0/0	0/0
1983	0/0	0/0	0/0
1984	0/0	0/0	0/0
1985	0/0	0/0	0/0
1986	0/0	0/0	0/0
1987	0/0	0/0	0/0
1988	0/0	0/0	0/0
1989	0/0	0/0	0/0
1990	0/0	0/0	0/0
1991	0/0	0/0	0/0
1992	1/1	1/0	2/1
1993	0/0	0/1	0/1
1994	1/1	0/2	1/3
TOTALS	2/2	1/3	3/5

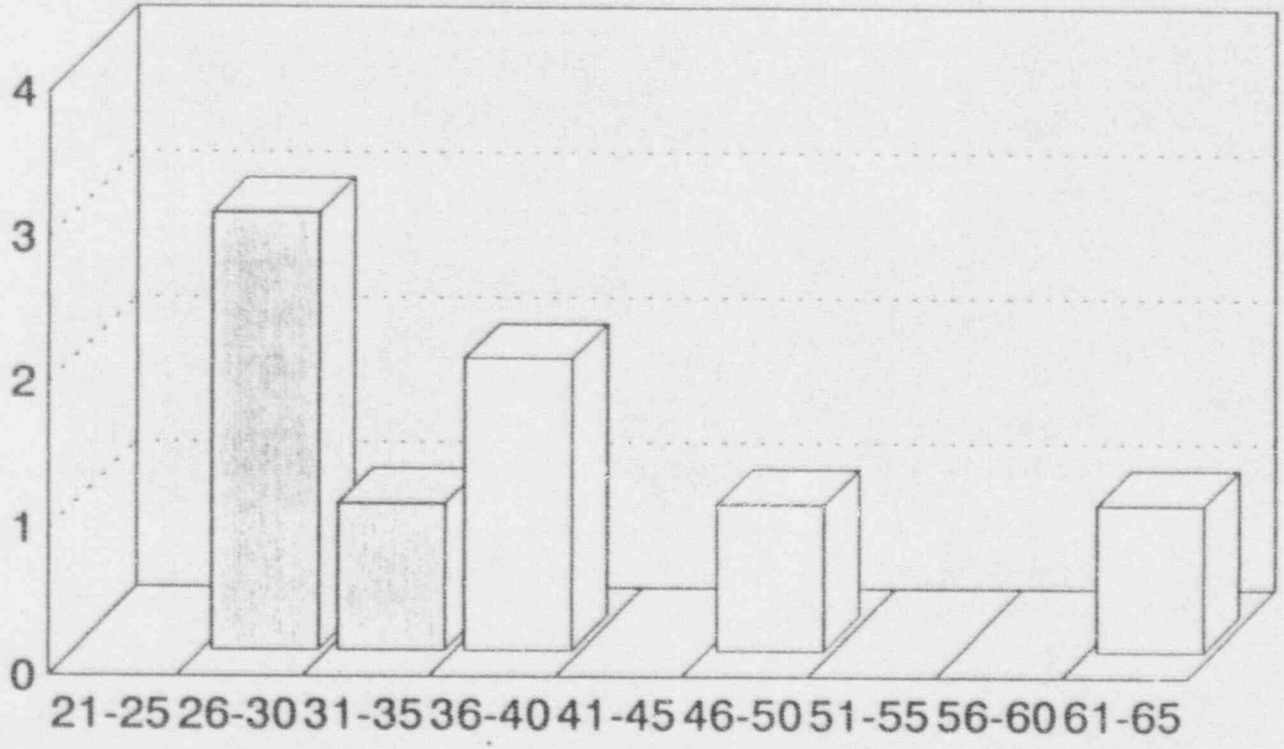
TABLE 6-3

SEASONAL OCCURRENCE OF SEA TURTLES AT OYSTER CREEK NUCLEAR GENERATING STATION INTAKES

MONTHLY DISTRIBUTION			
MONTH	LOGGERHEAD	RIDLEY	TOTALS
JAN	0	0	0
FEB	0	0	0
MAR	0	0	0
APR	0	0	0
MAY	0	0	0
JUN	2	0	2
JUL	1	2	3
AUG	0	0	0
SEP	1	0	1
OCT	0	2	2
NOV	0	0	0
DEC	0	0	0
TOTALS	4	4	8

SEA TURTLE LENGTH FREQUENCY DISTRIBUTION

CARAPACE LENGTH, STRAIGHT LINE MEASUREMENT (CM)



	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65
L. kempii	0	3	1	0	0	0	0	0	0
C. caretta	0	0	0	2	0	1	0	0	1

L. kempii = Kemp's ridley   C. caretta = Loggerhead

Figure 6-1. Frequency Distribution of Carapace Lengths for Loggerhead and Kemp's Ridley Sea Turtles Captured from Intake Structures at OCNGS.

SECTION 7.0
ASSESSMENT OF PRESENT OPERATIONS

The primary concern with sea turtles at OCNGS is whether or not any station related losses of these endangered or threatened sea turtle species "jeopardizes their continued existence." Federal regulation (50 CFR 402) defines "jeopardizes the continued existence" as "engaging in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of the listed species in the wild by reducing the reproduction, numbers, or distribution of that species." Therefore, the question relative to OCNGS is: Do the activities associated with the operation of Oyster Creek Nuclear Generating Station "appreciably reduce" the reproduction, numbers or distribution of either the loggerhead or Kemp's ridley sea turtles?

7.1 IMPACTS OF CONTINUED OPERATION OF OYSTER CREEK NUCLEAR GENERATING STATION ON SEA TURTLE POPULATIONS

7.1.1 IMPACTS DUE TO INCIDENTAL CAPTURE (IMPINGEMENT) OF TURTLES ON CWS AND DWS INTAKE TRASH RACKS

Eight sea turtles have been retrieved from either the circulating water or dilution water system intake at OCNGS during 1992, 1993 and 1994. Three of these turtles were alive and returned to the Atlantic Ocean by Marine Mammal Stranding Center (MMSC) personnel. Typically the live sea turtles were released near the MMSC in Brigantine, New Jersey. However, one Kemp's ridley was transported by MMSC personnel to warmer Atlantic Ocean waters for release near Kure Beach, North Carolina due to the cold and falling ocean water temperatures in New Jersey at the time. Five of the turtles removed from the intake were dead. Of these, two loggerheads exhibited severe boat prop wounds and were moderately decomposed indicating that death occurred prior to encountering the intake. The intake trash bars routinely capture floating debris during normal operation; dead and injured turtles which wash ashore, buoyed by the gases of decomposition, would be expected to be part of the debris load in the intake canal removed by the station. The remaining three sea turtles found dead at the OCNGS intake structures were all Kemp's ridleys. The most likely cause of death of one of these individuals was drowning at the DWS intake. The necropsies of the remaining two have not been completed but their deaths may also be attributable to drowning at the DWS intake. Therefore, it is apparent that there have been only three dead turtles removed from the intake since the plant began operation in 1969 whose cause of death may have been attributable to OCNGS operations.

Based on these levels of incidental capture at the intake, it is estimated that zero to three loggerheads and zero to three Kemp's

ridleys would be expected to be taken from the intake during any given year.

7.1.1.1 ASSESSMENT OF IMPACT ON LOGGERHEAD SEA TURTLE POPULATIONS

The annual number of loggerheads incidentally captured at OCNGS has ranged from zero to two turtles. Two of the four loggerheads captured were alive and released back into the wild. The two dead loggerheads taken were moderately decomposed when collected, suggesting death prior to involvement with the station. Carapace wounds suggested that the damage from boat propellers caused the death of one of these loggerheads, and the effects of a variety of diseases had resulted in the death of the other. Therefore, if live and long dead animals are removed from the assessment of impact, the OCNGS has had no impact on loggerhead sea turtle populations to date.

Adult and subadult loggerhead sea turtle populations have been recently estimated to be approximately 387,000 in the southeast United States (see Section 5.0). The estimated number of mature females in this same area has been estimated to range between 35,000 and 72,000 turtles. (Gordon 1983; Hopkins and Richardson 1984; NMFS 1987).

In order to determine if any future losses attributable to OCNGS "appreciably reduce" the reproduction, numbers or distribution of loggerheads, it is necessary to compare on-site information with breeding information, population estimates, and distribution information for this species.

Although three loggerhead nests were reported from New Jersey in the 1980's and 1990's (Schoelkopf 1994), loggerhead nesting in the United States primarily occurs along coastal beaches in Florida, Georgia, South Carolina and North Carolina. Also, all loggerheads incidentally captured at the CWS and DWS intakes were juveniles or subadults too young to reproduce which are more prevalent along the mid-Atlantic coast than adults (Van Buskirk and Crowder, 1994).

Therefore, based on the immaturity of the specimens captured and the fact that loggerhead nesting does not typically occur in New Jersey, the only loss to loggerhead reproduction would be from production foregone due to the loss of juvenile/subadult animals on the intake which could potentially be recruited into the breeding female population at some time in the future.

The observed worst case incidental catch level for loggerheads at OCNGS has been two turtles during any given year, with no mortality attributable to the OCNGS. However, for the purposes of this assessment we will assume that three deaths per year is a worst case estimate of loggerhead mortality associated with the OCNGS. If we compare this with the estimated population size of 387,000 animals, this mortality would represent 0 0008 percent of the population in the southeast U.S. It should be kept in mind that the population estimate on which this percentage is based does not include juveniles or subadults in the region or populations from

include juveniles or subadults in the region or populations from areas other than the U.S. This means that the population size is probably underestimated and the worst case estimate of losses attributable to OCNGS is overestimated. Mortality at this level will not "appreciably reduce" the distribution or numbers of loggerhead sea turtles along the Atlantic Coast of the United States.

7.1.1.2 ASSESSMENT OF IMPACT ON KEMP'S RIDLEY SEA TURTLE POPULATIONS

The number of Kemp's ridleys incidentally captured at OCNGS has been one each year during 1992 and 1993 and two during 1994. One of the ridleys captured was alive and was successfully released back into the wild. The Kemp's ridleys found dead at the OCNGS appeared to be fresh dead. The observed worst case incidental catch level was in 1994 when two dead Kemp's ridleys were taken at the DWS intake.

In order to determine if OCNGS "appreciably reduces" the reproduction, numbers or distribution of ridley sea turtles, it is necessary to compare on-site information with breeding information, population estimates, and distribution information for this species. The adult Kemp's ridley sea turtle population has recently been estimated to be approximately 2,200 turtles based on breeding females observed in Mexico (see Section 5.0). Since this breeding colony is the only known colony in the world, this estimate apparently represents the worldwide breeding population for Kemp's ridleys. All specimens captured at OCNGS were juveniles or subadults not yet capable of reproducing (Van Buskirk and Crowder, 1994). Therefore, based on the immaturity of the specimens captured and the fact that ridley nesting does not occur in New Jersey, the only loss to ridley reproduction would be from production foregone due to the mortality of juvenile/subadult animals on the intake which could potentially be recruited into the breeding female population at some time in the future.

If we assume a worst case incidental mortality rate at OCNGS of three Kemp's ridley sea turtles during any given year and compare it with the estimated population size of 2,200, they would represent 0.14 percent of the population. This population estimate does not include juveniles and subadults and therefore underestimates the actual population size. It is unlikely that losses at this level would "appreciably reduce" the distribution or numbers of Kemp's ridley sea turtles along the Atlantic Coast of the United States.

7.2 OTHER POTENTIAL STATION IMPACTS ON SEA TURTLES

7.2.1 ACUTE THERMAL EFFECTS

The discharges from the circulating water and dilution water systems of OCNGS are located 45 and 105 m (150 and 450 ft) west of the reactor building, respectively (Figure 4-2). As discussed in Section 4.0, the temperature rise of the CWS discharge is typically

about 11°C (20°F) above ambient intake canal temperatures. Because of the relatively high discharge velocities (65-95 cm/sec; 2.1-3.1 ft/sec), a sea turtle is not likely to remain in the immediate vicinity of the condenser discharge for any length of time. Furthermore, turtles in the area would easily be able to avoid entrainment in the thermal discharge flow by swimming away. Downstream of the condenser discharge, complete mixing with ambient temperature water from the DWS occurs, reducing the discharge canal water temperatures by approximately 5.6°C (10°F) when two dilution pumps are operating. The resulting water temperature of approximately 5.6°C (10°F) above ambient should not be stressful for any sea turtle species. Therefore, it is concluded that no adverse acute thermally-related impacts will be sustained by either sea turtle species.

7.2.2 CHRONIC THERMAL EFFECTS

The thermal discharge from Oyster Creek Nuclear Generating Station will not adversely impact the reproduction or migratory behavior of sea turtles inhabiting Barnegat Bay or coastal oceanic waters in the vicinity of OCNGS.

Because the vast majority of reproduction occurs in the southeastern United States in the case of the loggerhead and Mexico in the case of the Kemp's ridley, no reproductive impacts are expected.

The New Jersey Department of Environmental Protection evaluation of the impact of the OCNGS thermal plume on Barnegat Bay concluded that the effects on fish distribution and abundance were small and localized with few or no regional consequences (Summers et al. 1989). Similarly, due to the shallow nature of the plume, the relatively small area affected, and the small temperature increases within Barnegat Bay, the movements of sea turtles in the bay should not be adversely impacted. The areal extent of the thermal plume, as measured by the 1.1°C excess temperature isotherm, depends upon prevailing wind conditions and tidal stage but has been estimated to be less than 1.6 km (5,300 ft) in an east-west direction by 5.6 km (18,500 ft) in a north-south direction, under all conditions (Starosta et al. 1979, JCP&L 1986). More importantly, as discussed in Section 4.1.3, outside of the immediate vicinity of the mouth of Oyster Creek, the plume is primarily a surface phenomenon. As such, it is easily avoidable by sea turtles which move freely about in the water column, spending a large portion of their time foraging on the bottom.

7.2.3 COLD SHOCK

Cold shock mortalities of fishes have occurred at the OCNGS in the past. These events occurred when migratory species, attracted to the heated condenser discharge, remained in the discharge canal after they would normally have migrated out of Barnegat Bay in response to falling autumn water temperatures. Subsequent station outages, after ambient water temperatures had fallen below 10°C

(50°F), resulted in cold-shock fishkills. The number and severity of these events has been reduced as a result of the operation of two dilution pumps in the fall, when ambient water temperatures began to drop, to decrease the attractiveness of the discharge canal as overwintering habitat (Summers et al. 1989).

Cold-shock mortality of sea turtles has not been observed and is not expected to occur at the OCNGS for a number of reasons. The area where sea turtles could overwinter is extremely limited, including only the immediate vicinity of the condenser discharge, prior to any mixing with the DWS flow. Winter water temperatures in the discharge canal, downstream of the area where CWS and DWS flows mix, routinely fall below 7.2°C (45°F).

The small area where winter water temperatures would be suitable for overwintering sea turtles is characterized by a relatively high discharge velocity of 65-95 cm/sec (2.1-3.1 ft/sec). This would require continuous swimming activity, 24 hours per day, in order for a sea turtle to maintain its position in the heated discharge flow.

Food availability in the potential overwintering area would be extremely limited and probably insufficient to support the amount of swimming activity required to maintain a turtle in the heated discharge flow throughout the winter. Their preferred food, blue crabs and horseshoe crabs, would not be found in this area during the winter months. In addition, the canal bottom has a very hard substrate in the vicinity of the condenser discharge, and does not support a wide variety of benthic organisms that might serve as sea turtle forage.

7.2.4 BIOCIDES

Low level, intermittent chlorination is used to control biofouling in the OCNGS service water system and circulating water systems. New Jersey Pollutant Discharge Elimination System (NJPDES) permit conditions limit chlorine discharge levels to a maximum daily concentration of 0.2 mg/l or a maximum daily chlorine usage of 41.7 kg/day. The main condenser cooling water is chlorinated for approximately 2 hours per day. The chlorine demand in the main condenser discharge consumes almost all remaining free chlorine and results in essentially no chlorine being released to the discharge canal.

Given the very small quantities of chlorine applied, the short duration of the application periods, the fact that residual chlorine levels in the condenser discharge are at or near zero, and the fact that the condenser discharge is combined with unchlorinated DWS flow, the use of this biocide will not have any impact on sea turtles that may occur in the discharge canal or Barnegat Bay.

7.3 MITIGATING MEASURES

In order to minimize the potential impact of station operations on threatened or endangered sea turtles, a variety of mitigating measures have been instituted at OCNGS and are described in this section.

7.3.1 SEA TURTLE SURVEILLANCE AND HANDLING

The surveillance and handling requirements necessary to minimize the impact of OCNGS operations on sea turtles are defined in the Sea Turtle Surveillance, Handling, and Reporting Instructions for Operations Personnel (Appendix I). These instructions apply to all Operations Department personnel responsible for conducting surveillances of the intake structures, cleaning trash bars, and making notifications. This includes Equipment Operators, Group Operating Supervisors, and Group Shift Supervisors.

7.3.1.1 SURVEILLANCE OF CIRCULATING WATER SYSTEM AND DILUTION WATER SYSTEM INTAKES

The CWS and DWS intake trash bars, and the area immediately upstream of the trash bars, will be inspected for the presence of sea turtles at least twice per 8-hour shift during the June 1 - October 31 period. This represents a doubling of the frequency of intake structure inspections previously specified, and is a response to the incidental capture of two Kemp's ridley sea turtles during July of 1994. Prior to 1994, only two individuals of this species had been observed at the OCNGS, both during the month of October. The increased frequency of inspections previously proposed for the month of October has now been extended throughout the sea turtle season.

The first inspection will normally be conducted one to two hours into the work-shift; the second inspection will normally be performed five to six hours into the work-shift. Although emergencies or other responsibilities may periodically prohibit strict adherence to this schedule, the intent of the schedule is to prevent the individual inspections from being clustered together in a relatively short time period. The time that each inspection is completed will be recorded on intake area supplemental tour sheets.

Because the sea turtle season typically coincides with the period of greatest debris loading at the intakes, additional inspections of the intakes are often made during this period to ensure that they are sufficiently clean of debris. The cleaning of all of the CWS and DWS intake trash bars may take several hours when debris levels are high. These additional activities at the intake structures provide further opportunities for plant personnel to observe sea turtles.

The Sea Turtle Surveillance, Handling, and Reporting Instructions for Operations Personnel (Appendix I) provides guidance on how to distinguish sea turtles from Diamondback Terrapins. In addition, large color posters which illustrate the distinguishing features of sea turtles have been placed in prominent locations at both the CWS and DWS intake structures (Fig. 7-1). This information is also

published in the OCNGS employee newspaper each spring in order to increase the level of awareness of station personnel just prior to the period when sea turtles are likely to occur in the vicinity of the station.

Station personnel conducting sea turtle surveillances will use portable spot lights during night inspections in order to assist them in spotting turtles. It should be noted, however, that visibility is limited to approximately 1 m (3 ft) below the waters surface.

7.3.1.2 SPECIAL PRECAUTIONS DURING TRASH RACK CLEANING

Personnel cleaning the CWS and DWS intake trash racks during the June 1 - October 31 period observe the trash rake while cleaning operations are underway so that the rake may be stopped if a sea turtle is sighted. The debris gathered from the trash racks is hand raked into the trash car hopper. Personnel performing this task are instructed to look for sea turtles and to take particular care to ensure that sea turtles are not mistaken for horseshoe crabs. The floodlights attached to the trash rake unit (Figs. 4-5 and 4-8) are utilized during the evening hours to aid station personnel in spotting sea turtles. Note, however, that organisms are only visible in the upper few feet of water at the intakes because water transparency is typically about 1 m (3 ft).

7.3.1.3 ACTIONS TAKEN IF A SEA TURTLE IS OBSERVED

Sea turtles observed on the trash racks or in the vicinity of the intake structures are recovered as soon as possible, taking care to prevent injury to the animal. The method of recovery depends upon the size and location of the turtle. A rescue sling suitable for larger turtles (in excess of 40 pounds), is kept in the fish sampling pool at the CWS intake structure. This device consists of large-mesh netting on a rigid metal frame with ropes attached to each corner (Fig. 4-10). Long handled dip nets suitable for the smaller turtles most commonly encountered have also been fabricated (Fig. 4-11). These dip nets will be stored within easy reach, attached to fences, railings, or buildings at the CWS and DWS intake structures during the sea turtle season (June 1 - October 31).

Both the rescue sling and the long handled dip nets are adequate for retrieving turtles from the surface to approximately 1 m (3 ft) below the surface. The use of either device requires that the sea turtles be visible from the surface. The retrieval of sea turtles from the trash bars, more than 1 m (3 ft) below the waters surface, requires the use of the trash rake alone or in combination with the dip nets or rescue sling.

7.3.1.4 SEA TURTLE HANDLING AND RESUSCITATION

In accordance with the Sea Turtle Surveillance, Handling and Reporting Instructions for Operations Personnel (Appendix I), sea turtles removed from the intake structures, regardless of their

condition, are kept moist and out of direct sunlight. Fiberglass tubs suitable for holding sea turtles are stored in the fish sampling pool building at the CWS intake structure. Station personnel are cautioned not to assume that an inactive turtle is dead and that they should attempt to revive inactive animals immediately after they are retrieved. Specific guidance on handling and resuscitation is provided in the written instructions and on large color posters placed in prominent locations at both the CWS and DWS intake structures (Fig. 7-2). Special instructions are also provided for cold-stunned turtles (Appendix I).

Live sea turtles are delivered to the local affiliate of the Sea Turtle Salvage and Stranding Network (Marine Mammal Stranding Center in Brigantine, New Jersey) for examination and subsequent release into the ocean. The disposition of any dead sea turtles is determined on a case by case basis after consultation with the NMFS and the NRC.

7.4 NOTIFICATION AND REPORTING OF INCIDENTAL CAPTURES

Section 9 of OCNGS Procedure 126, entitled Notification of Station Events, directs station personnel to report all sightings or captures of sea turtles to the NRC and the NMFS. The Sea Turtle Surveillance, Handling, and Reporting Instructions for Operations Personnel (Appendix I) call for the Group Shift Supervisor (GSS) to be notified immediately of any sea turtle observations or captures. The GSS or his designee is required to notify Environmental Affairs personnel as soon as possible and to complete the Sea Turtle Incidental Sighting/Capture Report form, an attachment to Appendix I. Environmental Affairs personnel are required to provide oral notification to the NRC and NMFS within 24 hours of the event. In addition, a written report is prepared by the Environmental Affairs Department and submitted to both regulatory agencies within 30 days of the event. The written report provides the details of the capture or sighting including the time and place of capture; the length, weight and condition of the turtle; the disposition of the turtle, and any other pertinent information.

7.5 DISCUSSION OF GENERAL IMPACTS ON SEA TURTLE POPULATIONS

Five factors have been listed by the federal government as factors contributing to the decline in sea turtle populations (43 FR 146:32800-32811):

1. Destruction or modification of habitat;
2. Overutilization for commercial, scientific or educational purposes;
3. Inadequate regulatory mechanisms;
4. Disease and/or predation; and,
5. Other natural or man-made sources.

The destruction and/or modification of habitat from coastal development and losses due to incidental capture during commercial fishing are likely the two major factors impacting sea turtle populations along the Atlantic Coast of the United States. The continued development of beachfront and estuarine shoreline areas is likely to be impacting foraging and nesting grounds for several sea turtle species. Incidental capture (take) is defined as the capture of species other than those towards which a particular fishery is directed. As implied by this definition, the commercial fishing industry has been implicated in many of the turtle carcass strandings on southeast U.S. beaches. The annual by-catch of sea turtles by shrimp trawlers in the southeast alone has been estimated by Henwood and Stuntz (1987) to be nearly 48,000 turtles (primarily loggerheads), resulting in over 11,000 turtle deaths per year. In a study conducted for Congress, the National Academy of Sciences concluded that incidental drowning in shrimp trawls "kills more sea turtles than all other human activities combined...", and may result in as many as 55,000 sea turtle drownings annually in U.S. waters (Magnuson et al. 1990).

The drowning of sea turtles in commercial fishing nets is not the only anthropogenic source of mortality. Other human-related causes include injuries from encounters with boats, plastic ingestion, and entanglement in trash. In New Jersey and New York, boat related damage is a commonly observed injury in stranded turtles. The loggerhead, because it is the most abundant sea turtle in U.S. coastal waters, is the species most frequently encountered by fishermen and other boat operators. More research needs to be conducted to identify all of the sources of sea turtle mortality and to develop methods of mitigating those losses.

The unintentional entrapment of sea turtles during non-fishery related industrial processes, such as the generation of electricity, is another source of incidental capture and mortality. We have documented the capture of eight sea turtles at the OCNGS during more than 24 years of operation. Only three of these turtles may have died as a result of their encounter with the station's intakes. Relative to losses from other sources, such as commercial fishery by-catch, this loss is extremely small. Even though any loss of any individual of an endangered or threatened species is important, the magnitude of the potential losses of loggerhead and Kemp's ridley sea turtles from Oyster Creek Nuclear Generating Station would not be expected to significantly impact the U.S. Atlantic coast populations of these sea turtle species.

Figure 7-1. Sea Turtle Identification Poster Placed at OCNGS Intake Structures.

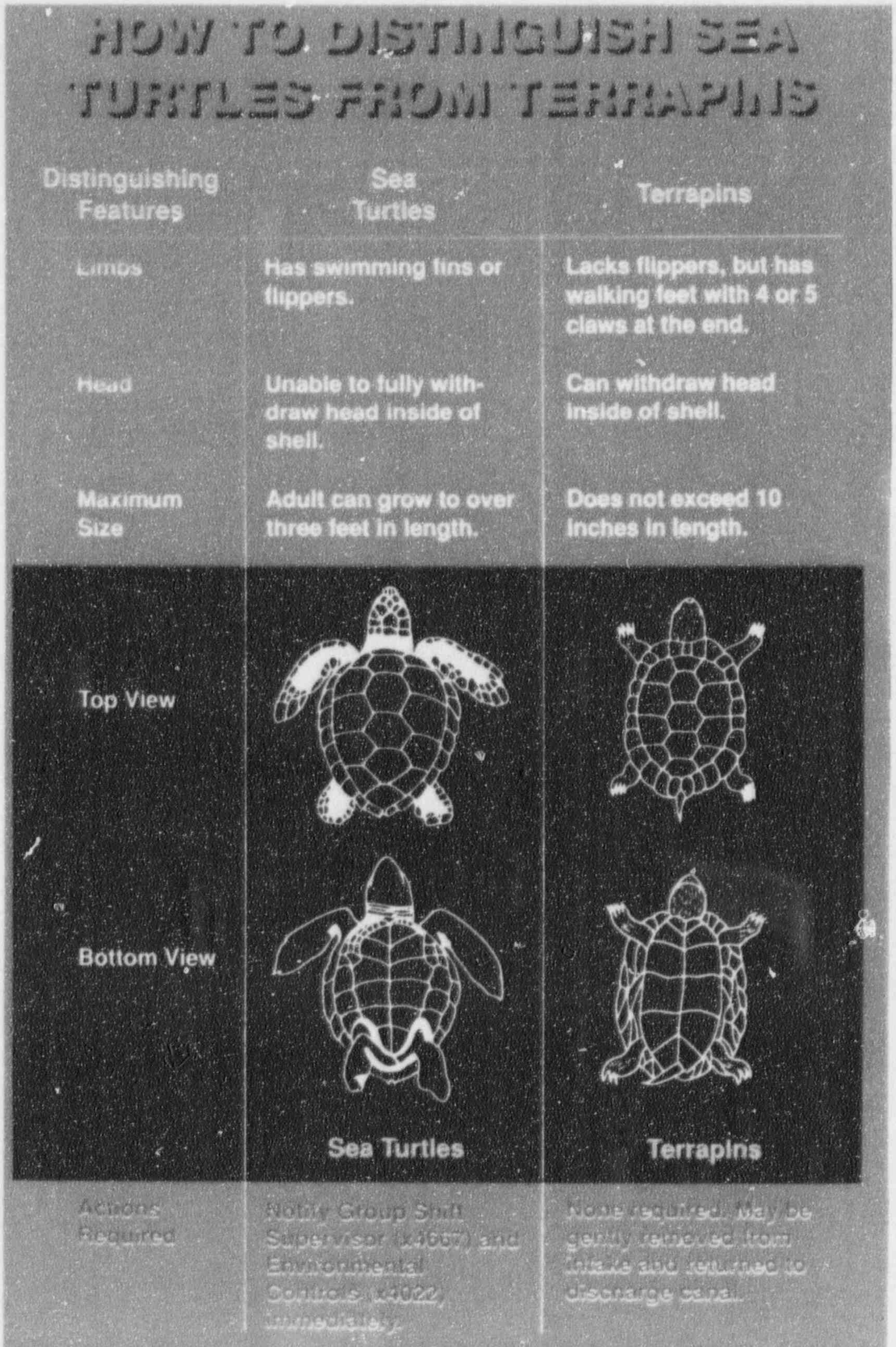


Figure 7-2. Sea Turtle Resuscitation Poster Placed at OCNGS Intake Structures.

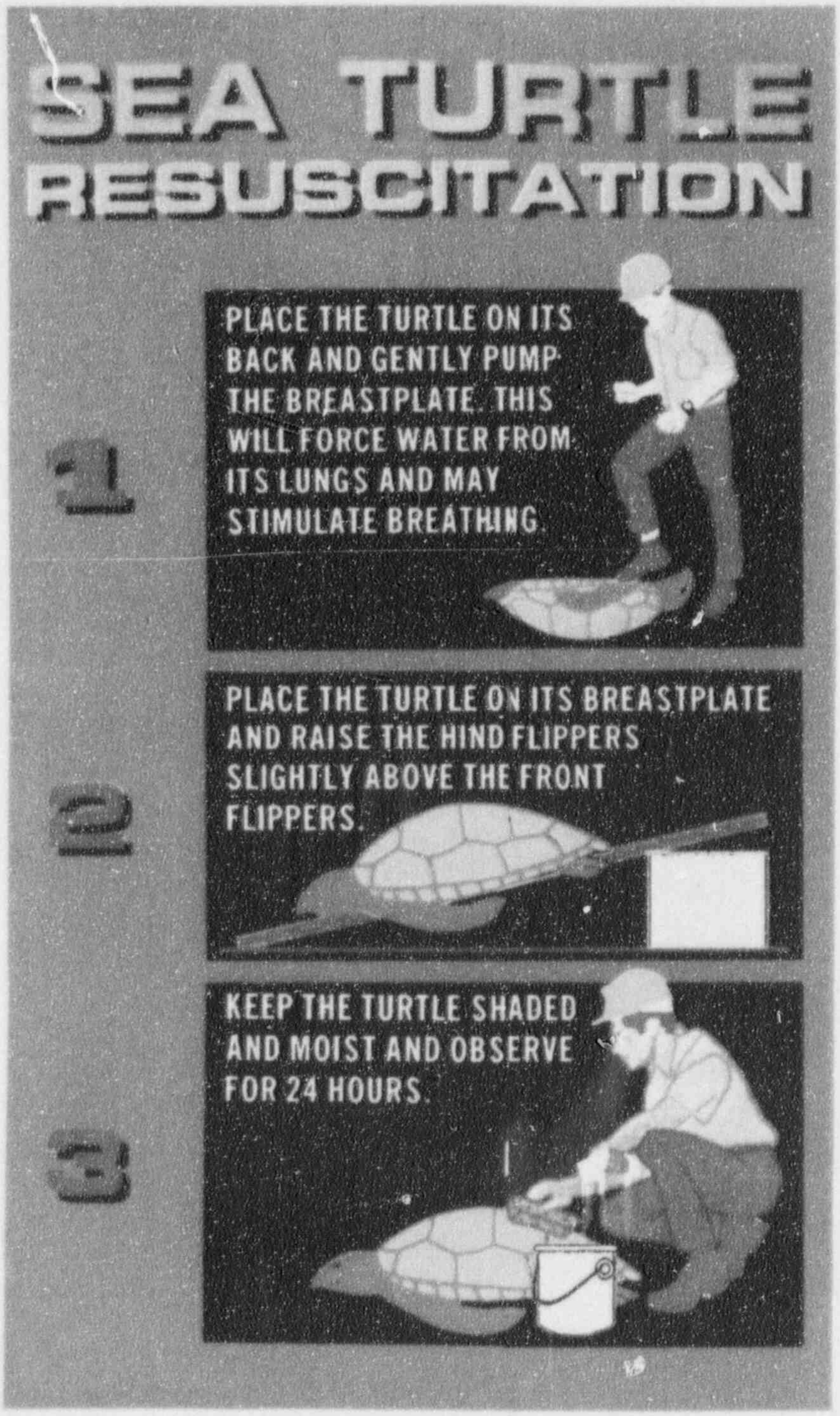


Figure 7-1. Sea Turtle Identification Poster Placed at OCNGS Intake Structures.

HOW TO DISTINGUISH SEA TURTLES FROM TERRAPINS

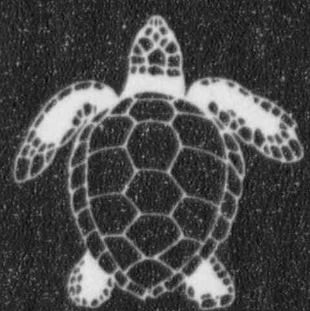
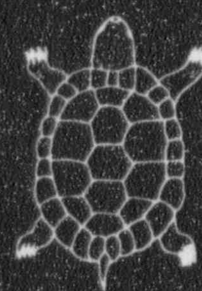
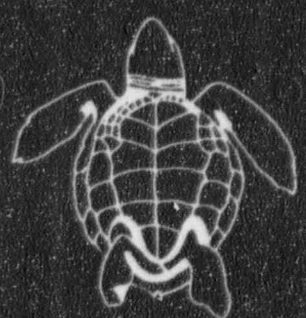
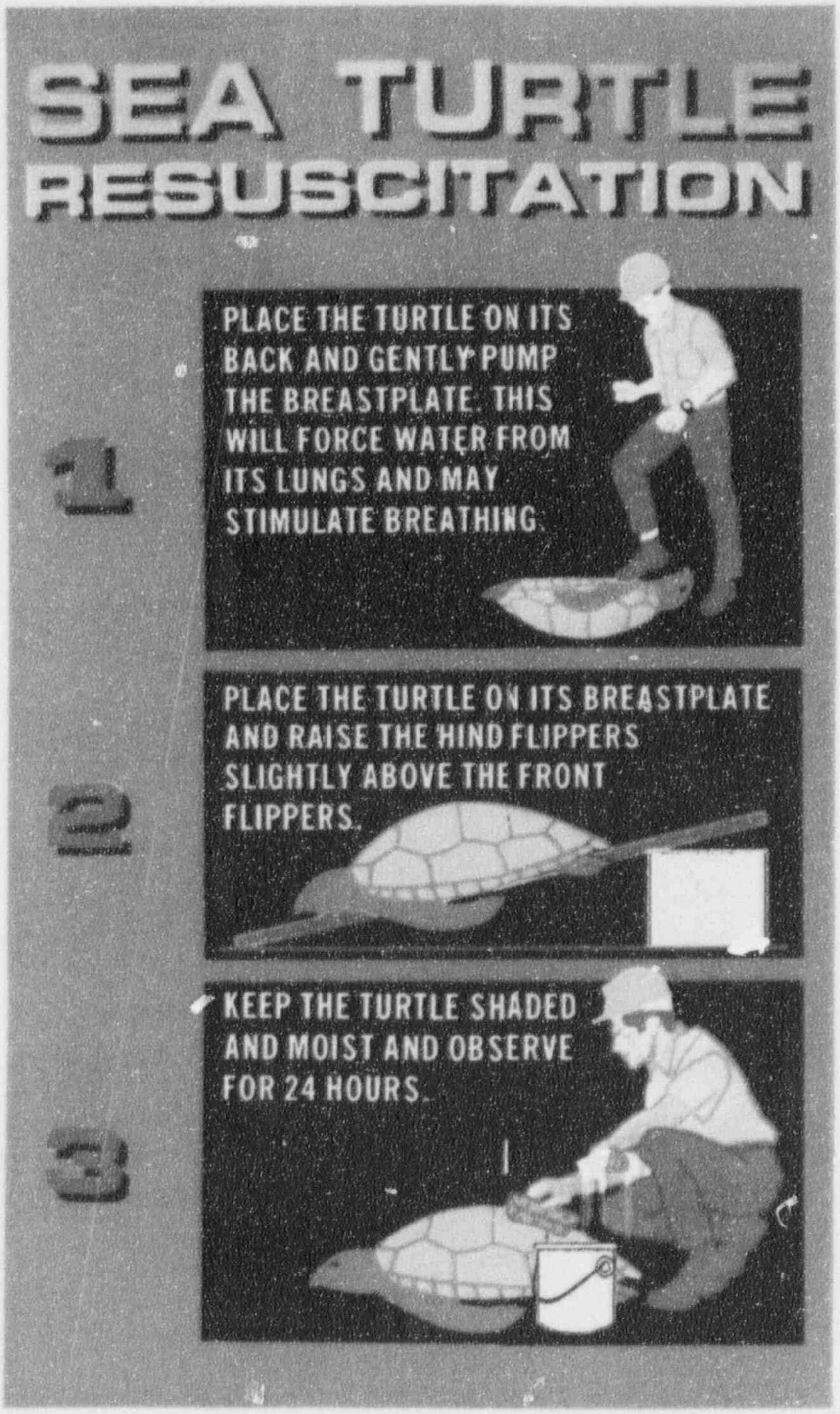
Distinguishing Features	Sea Turtles	Terrapins
Limbs	Has swimming fins or flippers.	Lacks flippers, but has walking feet with 4 or 5 claws at the end.
Head	Unable to fully withdraw head inside of shell.	Can withdraw head inside of shell.
Maximum Size	Adult can grow to over three feet in length.	Does not exceed 10 inches in length.
Top View		
Bottom View		
	Sea Turtles	Terrapins
Actions Required	Notify Group Shift Supervisor (x4667) and Environmental Controls (x4022) immediately.	None required. May be gently removed from intake and returned to discharge canal.

Figure 7-2. Sea Turtle Resuscitation Poster Placed at OCNGS Intake Structures.



SECTION 8.0

REFERENCES

50 CFR 17.11; Endangered and Threatened Wildlife

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

50 CFR 227.4(b); Threatened Fish and Wildlife, Enumeration of Threatened Species

50 CFR 402; Interagency cooperation - Endangered Species Act of 1973, as amended (Joint regulations of U.S. Fish and Wildlife Service and National Marine Fisheries Service).

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APPENDIX I

Oyster Creek Nuclear Generating Station

Sea Turtle Surveillance, Handling and
Reporting Instructions for Operations Personnel

Revision 0
8/20/94

1.0 Purpose

To define the surveillance, handling and reporting requirements necessary to minimize the impact of station operation on sea turtles as well as document the occurrence of sea turtles in the vicinity of the station's intake structures.

2.0 Applicability

These instructions apply to all operations personnel responsible for conducting surveillances of the intake structures, cleaning trash racks and making notifications. This includes Equipment Operators, Group Operating Supervisors and Group Shift Supervisors.

3.0 Surveillance of Circulating Water Pump and Dilution Pump Intakes

3.1 Seasonality and Frequency

During the June 1-October 31 period the Circulating Water Pump and the Dilution Pump intake trash racks, and the area immediately upstream of the trash racks, will be inspected at least twice per 8-hour shift for the presence of sea turtles.

3.2 Timing

The first inspection should normally be conducted one to two hours into the work-shift; the second inspection should normally be conducted five to six hours into the work-shift.

It is recognized that other responsibilities or emergencies may periodically prohibit adherence to this schedule. The intent of the schedule is to prevent the individual inspections from being clustered together in a relatively short time period.

3.3 Conduct of Inspections

The trash racks and the area immediately upstream of the trash racks should be inspected for the presence of sea turtles. Note that sea turtles are distinguishable from Diamondback Terrapins and Snapping Turtles by the presence of swimming flippers on sea turtles, instead of walking feet with claws. In addition, unlike Terrapins and Snapping Turtles, sea turtles are unable to completely withdraw their heads into their shell (see Attachment I). Information on how to identify sea turtles is also posted at the Circulating Water and Dilution Pump intake structures.

Portable spot lights shall be used during night inspections to assist in spotting sea turtles. The time that each inspection of the Circulating Water Intake and Dilution Intake is completed shall be recorded on the intake area supplemental tour sheets.

4.0 Trash Rack Cleaning

Personnel cleaning the Circulating Water and Dilution intake trash racks during the June 1-October 31 period shall observe the trash rake during the cleaning operation so that the rake may be stopped if a sea turtle is sighted. It may be necessary to utilize the nets described in Section 4.1.1 in order to prevent injury to the turtle while it is removed from the trash racks.

As the debris removed from the trash racks is hand raked into the trash car hopper, the Equipment Operator should observe the material to ensure that sea turtles are not present. Particular care must be taken to ensure that sea turtles are not mistaken for horseshoe crabs.

4.1 Actions Required if a Sea Turtle is Observed

4.1.1 Sea Turtles observed on the trash racks shall be recovered immediately, taking care to prevent injury to the animal.

Long handled dip nets suitable for smaller turtles are located at the Circulating Water Intake and at the Dilution Pump Intake structures, hanging on the fence adjacent to the sea turtle posters.

A rescue sling that is suitable for larger turtles is stored in the fish sampling pool at the Circulating Water Intake.

When handling sea turtles, do not assume an inactive turtle is dead. When water temperatures are relatively low, for example during the fall, inactive turtles may only be "cold-stunned", resulting in a temporary, coma-like condition (see Attachment II).

Keep clear of the head and front flippers which have claws. Pick up sea turtles by the front and back of the top shell. Do not pick them up by the flippers, the head or the tail.

4.1.2 The presence of <u>any</u> sea turtle, alive or dead, on the trash racks or in the vicinity of the intake structures must be reported in accordance with sections 4.1.3 and 4.1.4 of these Instructions.

4.1.3 The Group Shift Supervisor (Ext. 4667) shall be notified immediately.

4.1.4 The Group Shift Supervisor, or his designee, shall notify Environmental Affairs as soon as possible in accordance with

Procedure 126 "Notification of Station Events".

4.1.5 Sea turtles removed from the intakes, regardless of their condition, should be kept moist and out of direct sunlight until Environmental Affairs personnel arrive to remove them from the site. Fiberglass tubs suitable for holding sea turtles are stored in the fish sampling pool building at the Circulating Water intake structure. A small amount of intake water may be added to the tub, **but do not cover the mouth or nostrils with water**.

Diamondback Terrapins or Snapping Turtles removed from the intake structures may be released into the discharge canal; no additional actions or notification are required for these species.

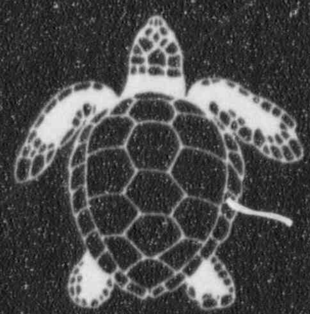
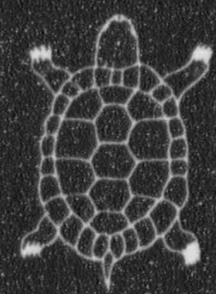
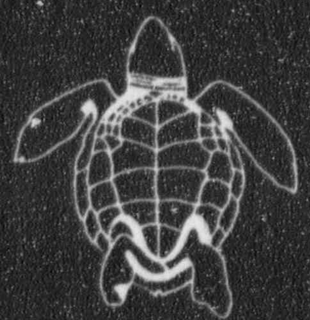
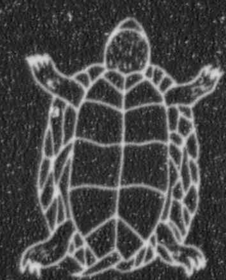
4.1.6 Attempts should be made to revive inactive sea turtles immediately after they are retrieved. Normally, this activity would be performed by Environmental Affairs personnel, however, if they do not arrive within a few minutes after the sea turtle is retrieved, resuscitation efforts should be initiated by Station personnel. Guidance on handling and resuscitation is provided in Attachment II and is posted at the intake structures.

4.1.7 After consulting with Environmental Affairs personnel regarding the identity and condition of the sea turtle, the Group Shift Supervisor or his designee shall make the appropriate regulatory agency notification in accordance with Procedure 126 "Notification of Station Events".

4.1.8 The Group Shift Supervisor or his designee shall complete the Sea Turtle Incidental Sighting/Capture Report form (Attachment III) and submit it to Environmental Affairs.

ATTACHMENT I

HOW TO DISTINGUISH SEA TURTLES FROM TERRAPINS

Distinguishing Features	Sea Turtles	Terrapins
Limbs	Has swimming fins or flippers.	Lacks flippers, but has walking feet with 4 or 5 claws at the end.
Head	Unable to fully withdraw head inside of shell.	Can withdraw head inside of shell.
Maximum Size	Adult can grow to over three feet in length.	Does not exceed 10 inches in length.
Top View		
Bottom View		
	Sea Turtles	Terrapins
Actions Required	Notify Group Shift Supervisor (x4657) and Environmental Controls (x4022) Immediately.	None required. May be gently removed from intake and returned to discharge canal.

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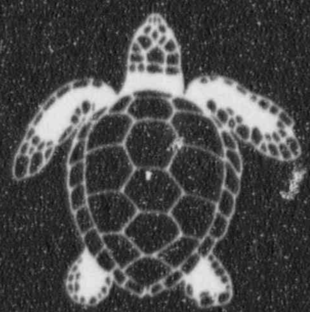
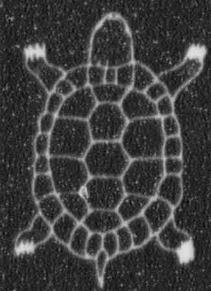
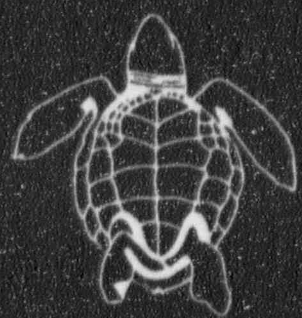
Top View		
Bottom View		
	Sea Turtles	Terrapins
Actions Required	Notify Group Shift Supervisor ([illegible]) and Environmental Controls ([illegible]) immediately.	None required. May be gently removed from intake and returned to discharge canal.

ATTACHMENT II

Sea Turtle Handling and Resuscitation Procedures

Handling:

Do not assume an inactive turtle is dead. Pressing the soft tissue around the nose of a sea turtle may result in an eye reflex in a comatose turtle. The onset of rigor mortis is often the only definite indication that a turtle is dead.

Keep clear of the head.

Adult male sea turtles of all species other than leatherbacks have claws on their foreflippers. Keep clear of slashing foreflippers.

Pick up sea turtles by the front and back of the top shell (carapace). Do not pick up sea turtles by flippers, the head or the tail.

Resuscitation Procedures:

If a turtle appears to be comatose (unconscious), attempts should be made to revive it immediately. These procedures are designed to void the turtles' lungs of water by active pumping and passive drainage. Sea turtles have been known to revive up to 24 hours after these procedures have been followed:

1) Place the turtle on its back and gently pump the breastplate. This may stimulate the animal to breathe and allow water to drain.

2) Place the animal on its breastplate and raise the hindquarters. The degree of elevation depends on the size of the turtle; greater elevations are required for larger turtles.

4) Keep the turtle shaded and moist and observe for 24 hours.

Special Instructions for Cold-Stunned Turtles:

Comatose turtles found in water less than 10°C (50°F) are probably "cold-stunned". This is most common in the fall and early winter. If a turtle appears to be cold-stunned, the following applies:

To increase blood flow, flap the flippers and rub the skin. Gradually, (over a period of six hours) move the turtle to a warmer area.

If possible, place the animal in a few inches of water that is warmer than the water it was removed from. Do not cover the mouth or nostrils with water. It is not imperative that sea turtles be kept in water.

Dead sea turtles should be retained for necropsy.

OCNGS SEA TURTLE INCIDENTAL SIGHTING/CAPTURE REPORT FORM

Reporter's full name (print): ______________ Dept. __________ Tel. no. __________
(GSS or designee)

Date of sighting/capture: ____________ (mm-dd-yy) **Time of day of sighting/capture:** ______ hrs.

Who first observed the turtle? (print name): ____________________ **Tel. no.** __________

Location of sighting/capture:
- ☐ Circ. water intake **Which bay?** ______ ☐ **# Circ. pumps op.?**
- ☐ Dilution intake **Which bay?** ______ ☐ **# Dil. pumps op.?**

Turtle behavior and orientation:
- ☐ Was turtle impinged against trash rack?
- ☐ Was turtle swimming near trash racks?
- ☐ Other (Describe below)

First observation:
- ☐ Was turtle first observed at or near the water surface?
- ☐ Brought up from below surface with trash rake?
- ☐ Other (Describe below)

Method of capture:
- ☐ Trash rake
- ☐ Dipnet
- ☐ Sling

When was trash rack in bay with turtle last cleaned? ______________ (Date & time)

Condition of specimen:
- ☐ Alive
- ☐ Stunned or comatose
- ☐ Dead/decomposed
- ☐ Not sure

Intake water temperature when sighted/captured: ____ F.

Remarks: ____
____
____
____
____