May 20, 2005

Mr. Rodney McInnis
Southwest Regional Administrator
NOAA Fisheries
501 West Ocean Blvd.
Long Beach, CA 90802-4213

SUBJECT: BIOLOGICAL ASSESSMENT FOR THE EFFECTS OF THE CONTINUED OPERATION OF THE SAN ONOFRE NUCLEAR GENERATING STATION ON THREATENED OR ENDANGERED MARINE SPECIES (TAC NOS. MC5524 AND MC5525)

Dear Mr. McInnis:

The U.S. Nuclear Regulatory Commission (NRC) has reviewed the status of issues regarding the Endangered Species Act (ESA) related to the operation of the cooling water system for the San Onofre Nuclear Generating Station (SONGS) located in northwestern San Diego County, approximately 3 miles southeast of San Clemente, CA. Thirty-three threatened or endangered sea turtles have been entrained in the cooling system of this facility since 1983. Only four takes were lethal, and all other takes were released into the ocean either immediately or after appropriate veterinary care and recovery.

NRC staff met informally with NOAA Fisheries staff on November 12, 2003, to discuss ESA issues related to SONGS, and then toured the SONGS site with NOAA Fisheries staff on November 13, 2003. The NRC formally requested a list of threatened or endangered species that could be present at the SONGS site in a letter dated February 4, 2004. NOAA Fisheries provided a response letter dated March 18, 2004.

As a result of this review, the staff prepared the attached biological assessment (BA) to document and evaluate the impacts of continued operation of SONGS on ESA-listed species that are managed by NOAA Fisheries. Based on this BA, the staff has determined that continued operation of SONGS may adversely affect the green turtle *(Chelonia mydas*), the loggerhead turtle (*Caretta caretta*), the leatherback turtle (*Dermochelys coriacea*) and the olive ridley turtle (*Lepidochelys olivacea*). Continued operation of SONGS may affect, but is not likely to adversely affect, the southern California steelhead (*Onchorhynchus mykiss*), and will have no effect on the white abalone (*Haliotis sorenseni*), Guadalupe fur seal (*Arctocephalus townsendi*), Steller sea lion (*Eumetopias jubatus*), the blue whale (*Balaenoptera musculus*), fin whale (*B. physalus*), Sei whale *(B. borealis*), sperm whale (*Physeter macrocephalus*), or the humpback whale *(Megaptera novaeangliae*). No critical habitat for any of these species would be affected by the continued operation of SONGS.

Because occasional sea turtle takes are assumed to continue at SONGS, the NRC staff proposes allowable incidental annual take limits of eight green turtles, two loggerhead turtles, two leatherback turtles, and two olive ridley turtles. Although the staff has determined that individuals of the four species of sea turtles may be adversely affected by the continued operation of SONGS, it has also determined that SONGS does not contribute to the overall mortality of these species nor jeopardize the continued existence of any of these species.

Based on the findings in the enclosed BA, the NRC requests the initiation of a formal consultation regarding the four species of sea turtles. If you have any questions or require additional information, please contact Ms. Harriet Nash of the Environmental Section at (301) 415-4100 or via e-mail at hln@nrc.gov and Mr. James Wilson, Senior Project Manager, Environmental Section at (301) 415-1108 or via e-mail at jhw1@nrc.gov.

Sincerely,
/RA/
Pao-Tsin Kuo, Program Director
License Renewal and Environmental Impacts Program
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Docket Nos.: 50-361 and 50-362

Enclosure: As stated

cc w/encl.: See next page

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Biological Assessment

San Onofre Nuclear Generating Station
Sea Turtle Impact Assessment

San Diego County, California

April 2005

Docket Nos. 50-361 and 50-362

U.S. Nuclear Regulatory Commission
Rockville, Maryland

1 INTRODUCTION/BACKGROUND

The San Onofre Nuclear Generating Station (SONGS) is a two-unit nuclear power generating station operated by Southern California Edison (SCE) under license numbers NPF-10 and NPF-15, which were issued and are administered by the U.S. Nuclear Regulatory Commission (NRC). Thirty-three sea turtles have been entrained in the SONGS Cooling Water System (CWS) since 1983. Most turtles were recovered and released alive back to the ocean, but a few were injured or dead upon recovery. Stranding reports have been prepared for each recorded case of turtle entrainment, and these reports have been submitted to National Oceanic and Atmospheric Administration (NOAA) Fisheries and the NRC.

Although there have been takes of threatened and endangered sea turtles at this NRC-regulated facility, neither NOAA Fisheries nor NRC has pursued consultation under Section 7 of the U.S. Endangered Species Act of 1973, as amended, (ESA) until this time. This Biological Assessment (BA) was prepared to support such a consultation. Some information contained in this BA was taken from an ESA Section 10 Permit application (SCE 2002), dated March 29, 2002, prepared for SCE by MBC Applied Environmental Sciences. The Section 10 Permit application has been superceded by the present Section 7 interagency consultation because the regulatory authority of the NRC provides a Federal nexus, indicating the need for evaluation under Section 7, rather than Section 10, of the ESA.

Representatives from the NRC met with representatives from NOAA Fisheries on November 12, 2003 at the NOAA Fisheries Long Beach Office, and on November 13, 2003 at the SONGS site. On February 4, 2004, the NRC sent a letter requesting a list of species potentially present at the site. NOAA Fisheries responded on March 18, 2004 with a list of potentially-affected species. The potential impacts of plant operations on sea turtles were not considered during the original environmental review and licensing of SONGS Units 2 and 3 (AEC 1973).

Also, harbor seals (*Phoca vitulina richardsi*) and California sea lions (*Zalophus californianus californianus*) have been entrained in the SONGS CWS. Because these species are not listed under the ESA, they are not addressed in this BA, nor are they considered in this Section 7 Consultation. SCE is consulting directly with NOAA Fisheries regarding the take of these species, which are protected under the Marine Mammal Protection Act.

2 PROPOSED ACTION

The proposed action is the continued operation of the SONGS CWS and Salt Water Cooling System (SWCS). No new constructions, facility alterations, or modifications of existing operations are anticipated. An incidental sea turtle take occurs when a sea turtle enters the SONGS CWS.

3 DESCRIPTION OF PROJECT AREA

Overview of the San Onofre Nuclear Generating Station

SONGS Units 2 and 3 are collectively an approximately 2,150-megawatt-electric nuclear power generating facility located near the California coastal town of San Clemente, approximately 72 kilometers (km) (45 miles [mi]) north of San Diego and 97 km (60 mi) south of Los Angeles. SCE is the majority owner of SONGS, along with San Diego Gas & Electric Company and the cities of Anaheim and Riverside. It is operated by SCE as managing agent for the station's owners. SONGS Units 2 and 3 began commercial operation in 1983 and 1984, respectively, and are expected to operate at least until 2022 when the current SONGS operating licenses expire. SCE has the option to apply for a license renewal that, if approved by the NRC, would extend the operating licenses for an additional 20 years. SONGS Unit 1 began operation in 1964, was taken off-line in 1992, and is currently being decommissioned. Although one turtle was apparently entrained in the Unit 1 CWS in 1992, no sea turtles have been entrained by Unit 1 since it was taken off-line. All discussion in this assessment refers to the operation of Units 2 and 3.

Sea turtle takes occur when sea turtles enter either of the SONGS CWS intake structures that are located approximately 980 meters (m) (3,200 feet [ft]) offshore. Some sea turtles entering the intake structures become entrapped as the cooling water is drawn through the intake tunnel to the plant. Once the animal enters a tunnel, it is underwater and unable to breathe until it reaches the station forebay. Transit time for water to pass through the pipe is approximately eight minutes.

Design and History of SONGS's CWS and SWCS

As a base-load plant, SONGS normally operates at full power unless shut down for scheduled refueling and maintenance, or for an unscheduled forced outage. During normal power operations, the Units 2 and 3 CWSs each provide about 3,142 cubic meters per minute (m^3/min) (830,000 gallons per minute [gpm]) of ocean cooling water to the station. Most of this water goes to the main condenser via the CWS. In the main condenser, the cooling water flows through thousands of condenser tubes and condenses the steam exhaust from the main turbine, which is used to generate the plant's electrical output. A smaller amount of ocean cooling water, about 182 m^3/min (48,000 gpm), is pumped to various heat exchangers via the SWCS and the four SWCS pumps, two of which are normally in operation. The SWCS is used to provide cooling water for other plant machinery and heat exchangers, some of which are related to nuclear safety.

The ocean cooling water is drawn into two offshore intake structures, which are located approximately 980 m (3,200 ft) offshore from the plant (Figure 1). The Unit 2 and Unit 3 intakes are 200 m (647 ft) apart, and are located in water about 10 m (30 ft) deep. The intake structures were designed with velocity caps that allow the relatively large volume of ocean water to be drawn in at a relatively low speed of about 0.5 meters per second (m/s) (1.7 feet per second [ft/s] or about 1.0 knot). The low intake velocities, as well as the horizontal intake currents provided by the velocity caps, minimize the entrapment of marine organisms.

The intake velocity caps are 15 m (49 ft) in diameter with 2-m (7-ft) tall horizontal openings. The bottom of the horizontal intake cap openings are 3 m (10 ft) above the ocean bottom to minimize the entrapment of bottom fish and lobsters. The top of the intake cap opening is about 3.7 m (12.3 ft) below the ocean surface. Each of the two velocity capped intakes draws ocean cooling water inward in a horizontal direction and redirects the flow downward through its respective cooling water intake tunnel.

Once the ocean cooling water enters the intake tunnels, the flow velocity is about 2.2 m/s (7.3 ft/s) during normal plant power operations. It takes approximately 7.9 minutes for water to reach the station forebays once it enters the tunnel.

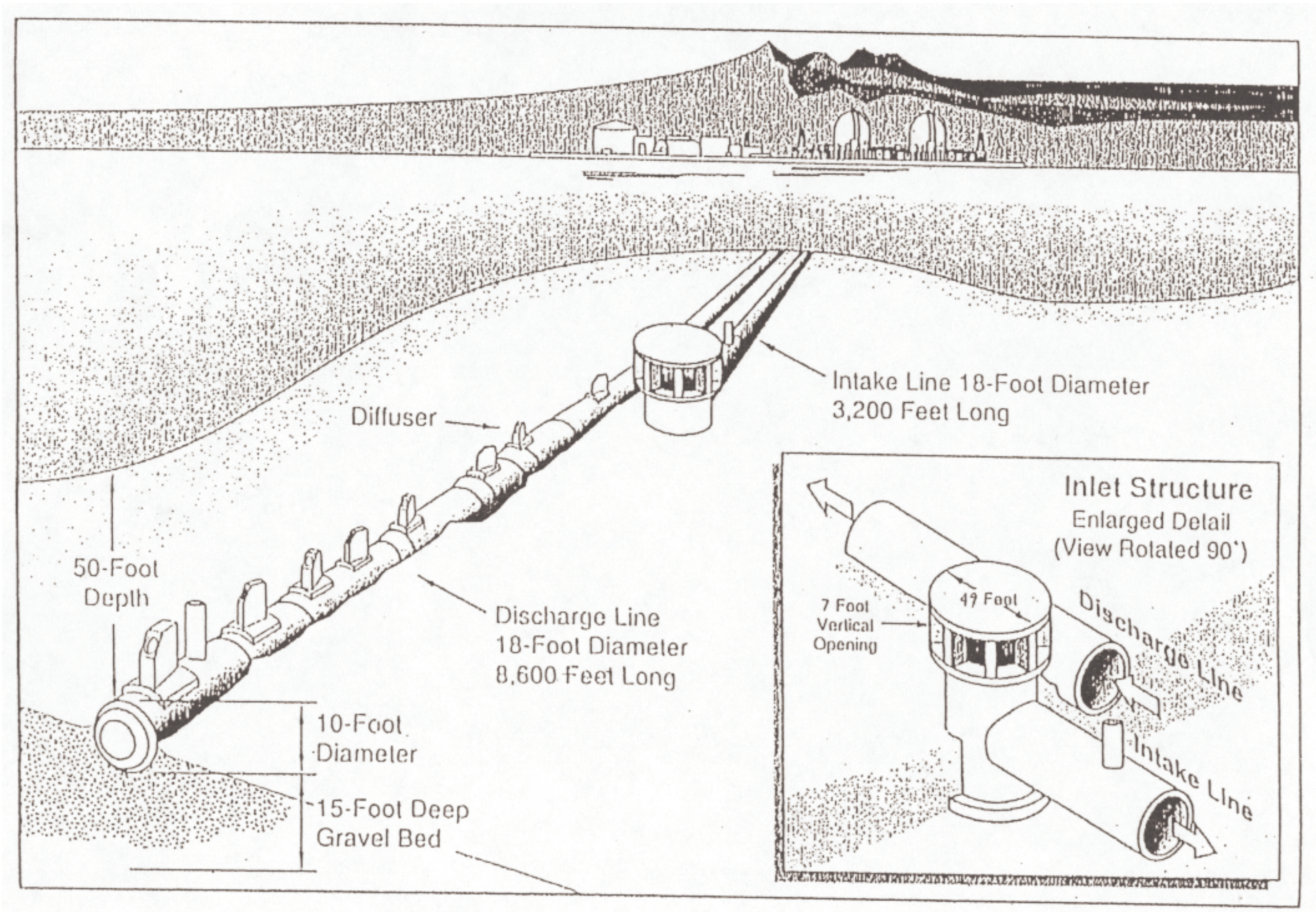

Figure 1. SONGS Unit 2 intake and discharge structures.

The intake tunnels terminate at the plant in a large concrete transition structure called a forebay (Figure 2). The forebay is open to the outside air and serves as a surge chamber for the water entering from the intake tunnel. From the intake forebay, the cooling water is directed to the CWS and the SWCS pumps, delivering cooling water to the main condenser and other plant heat loads. There are four CWS pumps and four SWCS pumps located within each unit. The forebay area contains traveling screens, which remove waterborne debris before it enters the pump suction. The CWS forebay is about 8 m (26 ft) deep and 20 m (64 ft) across.

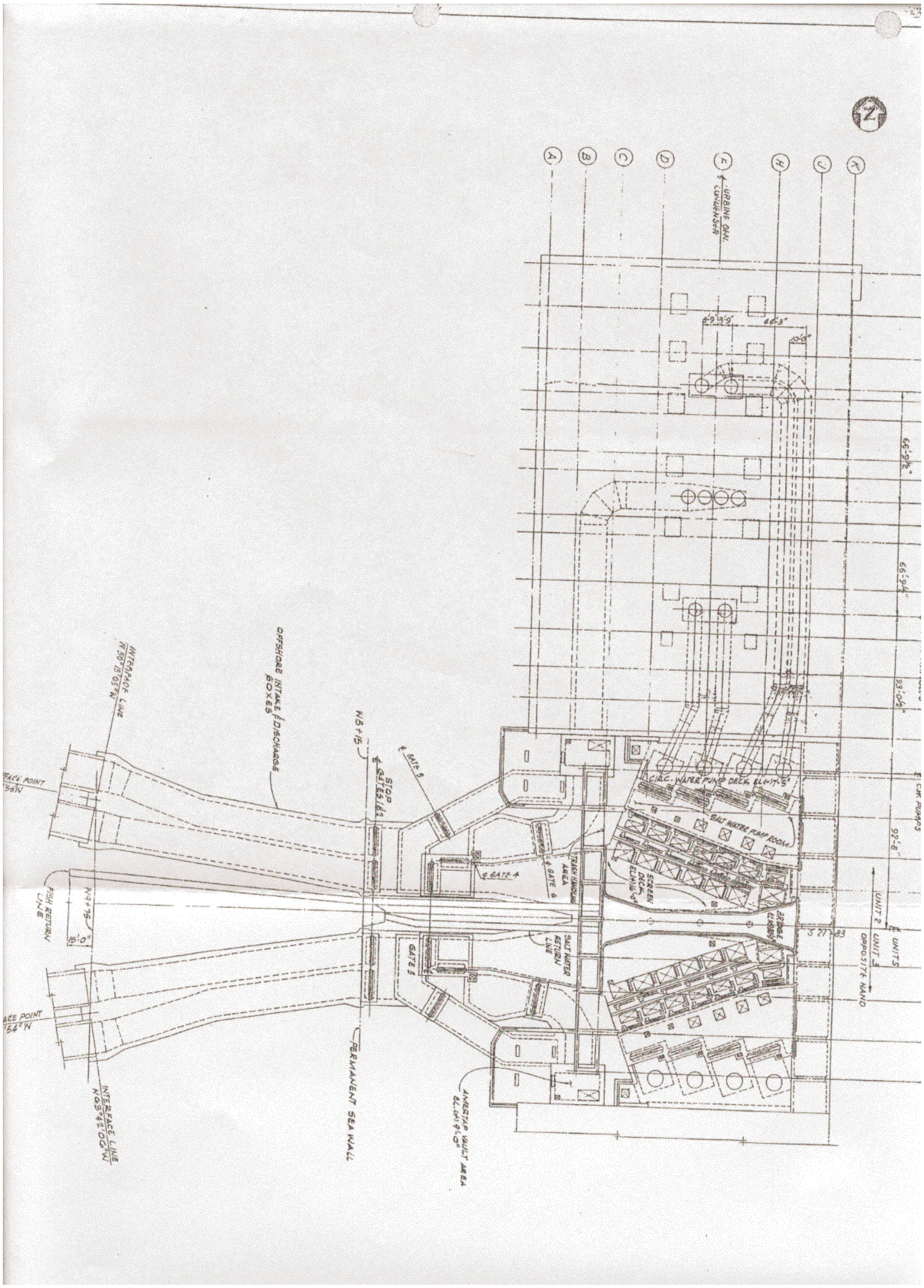

Figure 2. SONGS intake transition structure (forebay).

After passing through the condensers or SWCS, the cooling water is discharged to the ocean via 5.5-m (18-ft) diameter pipes (Unit 2, approximately 2620 m [8600 ft] long; Unit 3 approximately 1,860 m [6,100 ft] long) with 0.6-m (2-ft) diameter diffuser vents spaced at 12-m (40-ft) intervals over the last 760 m (2,493 ft) of each pipe. The normal temperature rise after passing through the condenser is approximately 11 EC (19 EF); the facility's National Pollution Discharge Elimination System (NPDES) permit allows a temperature rise of 14 EC (25 EF). Typically, the monthly average increase in surface water temperature is less than 2 EC (3 EF) beyond 300 m (1,000 ft) of the discharge.

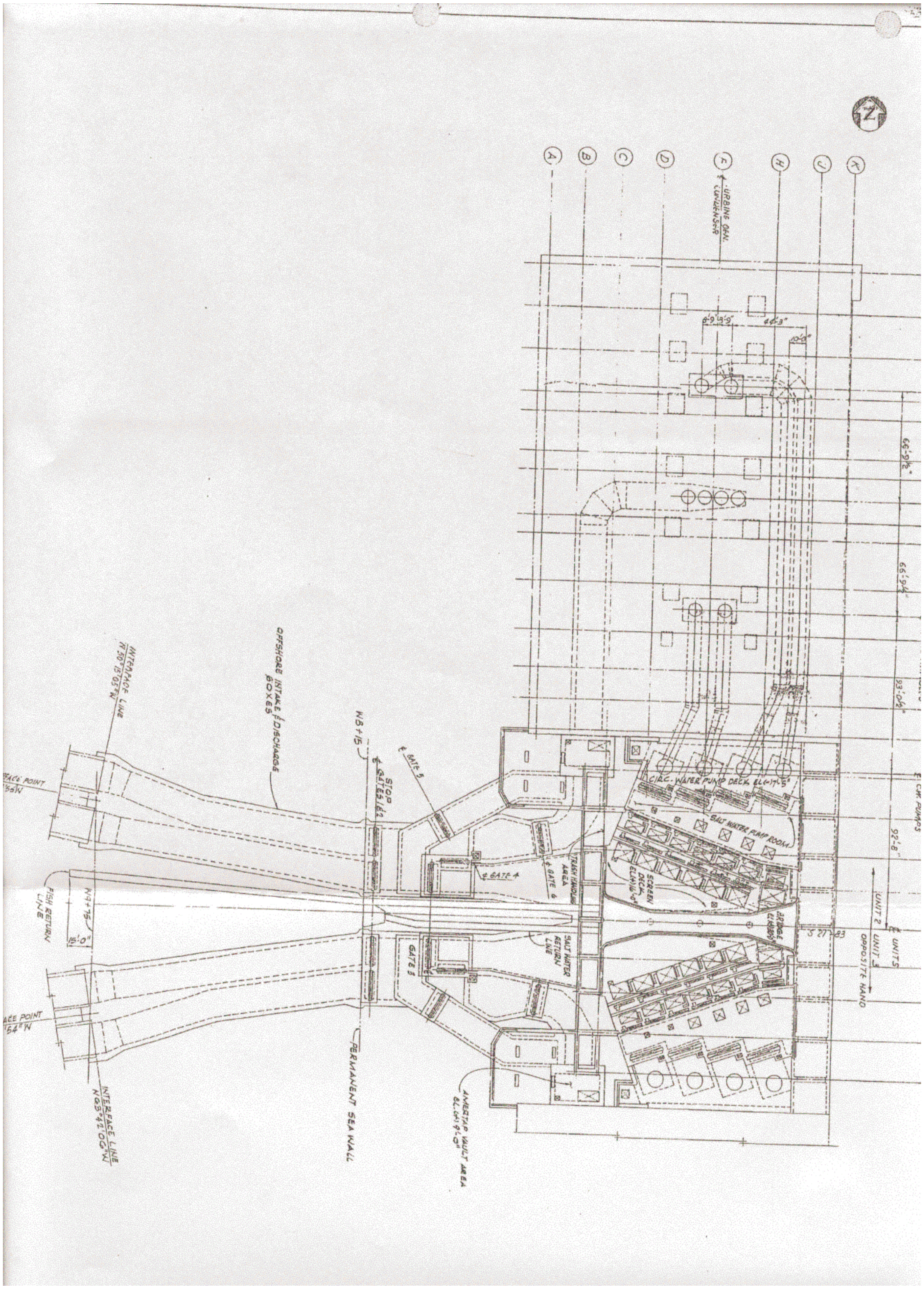

Figure 2. SONGS intake transition structure (forebay).

SONGS is unique among coastal generating stations in that it includes a fish return system (FRS), which is designed to return entrained fish and other marine organisms back to offshore waters in a viable condition. Studies have shown that the FRS returns approximately 80% of entrained fish back to the ocean. The system functions by guiding fish and other marine life through the use of vanes and louvers to a fish return elevator. The elevator lifts the organisms in a water-filled bucket and then empties them into a concrete conduit to be carried back to the ocean. Sea turtles that enter the station are similarly guided to the fish-return elevator. Although the FRS is not used to return turtles, it is at the fish return elevator that they are removed from the CWS.

During licensing of SONGS, the design and environmental impact potential of the station's CWS were reviewed by the NRC. Subsequent reviews conducted by the Environmental Protection Agency (EPA) and the San Diego Regional Water Quality Control Board determined that the SONGS discharge was in compliance with the 316(a) & (b) requirements of the Clean Water Act.

4 LIST OF SPECIES POTENTIALLY AFFECTED

The list of potentially-affected species provided by NOAA Fisheries is in Table 1. To date there have been no known takes of any endangered or threatened species other than three species of sea turtle: green turtle (*Chelonia mydas*), loggerhead turtle (*Caretta caretta*), and leatherback turtle (*Dermochelys coriacea*). With the possible exception of the southern California steelhead (*Oncorhynchus mykiss*), the NRC staff believes that it is unlikely that any of the species in Table 1 other than the sea turtles would occur in the vicinity of SONGS. Therefore, the potential impacts of SONGS CWS operation on sea turtles is the focus of this BA, and the other species are discussed briefly in Section 9.

TABLE 1. Threatened and Endangered Marine Species Potentially Occurring near the San Onofre Nuclear Generating Station.

Common Name	Species	Status
Green (black) turtle	*Chelonia mydas*	Threatened
Loggerhead turtle	*Caretta caretta*	Threatened
Leatherback turtle	*Dermochelys coriacea*	Endangered
Olive ridley turtle	*Lepidochelys olivacea*	Endangered
Blue whale	*Balaenoptera musculus*	Endangered
Sperm whale	*Physeter macrocephalus*	Endangered
Fin whale	*Balaenoptera physalus*	Endangered
Humpback whale	*Megaptera novaeangliae*	Endangered
Sei whale	*Balaenoptera borealis*	Endangered
Guadalupe fur seal	*Arctocephalus townsendi*	Threatened
Steller sea lion	*Eumetopias jubatus*	Threatened
White abalone	*Haliotis sorenseni*	Endangered
Southern California steelhead	*Oncorhynchus mykiss*	Endangered

5 DESCRIPTIONS OF SPECIES AND HABITATS

Sea Turtle Biology and Distribution

Precise numbers of sea turtles in waters off southern California are not available. Their relatively small numbers and wide-ranging, pelagic distributions make abundances difficult to estimate. Information on the biology and distribution of sea turtles in the following text is largely from Eckert (1993), who summarized available literature and research on the sea turtles of the North Pacific, and from the recovery plans for the Pacific stocks of these turtles (NOAA 1998a, 1998b, 1998c, and 1998d).

Sea turtles are oviparous, laying eggs in depressions that they excavate in sand above the high-tide level on beaches in various areas. Hatchlings instinctively head to the ocean where growth and development continue. Many aspects of the early life stages of sea turtles are not well-known.

Green turtle (*Chelonia mydas*)

Currently, the green turtle breeding populations in Florida and on the Pacific coast of Mexico are listed as endangered under the ESA. All other green turtle populations are listed as threatened. Critical habitat is designated in Puerto Rico.

The genus *Chelonia* is comprised of the single species *C. mydas*, with two subspecies: *C. m. agassizii* and *C. m. mydas*. *C. m. agassizii* (the black turtle) is recognized in the eastern Pacific from Baja California, Mexico, south to Peru, and west to the Galapagos Islands, whereas *C. m. mydas* is recognized in the rest of the green sea turtle's range. For the purposes of this report, *Chelonia mydas* will refer to all green sea turtles.

Green turtles are circumglobal and are known to travel large distances between foraging and nesting grounds; one individual tagged in Michoacán, Mexico was recovered at El Faro, Charambira, Columbia, 3,160 kilometers (km) (1964 miles [mi]) away (Eckert 1993). Green turtles have been sighted as far north as Eliza Harbor, Admiralty Island, Alaska (57° N) and as far south as Chile (50° S) (Hodge 1981, Eckert 1993). They are the most commonly observed sea turtles on the western coast of the United States. The northernmost resident population in the eastern Pacific resides in San Diego Bay. An estimated 30 to 60 green turtles utilize San Diego Bay, specifically the warm waters of the South Bay Power Plant discharge channel (USN 1999). Green turtles have been observed in this area in summer and winter. It is unknown whether green turtles observed along the California coast migrate to the Pacific coast of Mexico or to Hawaiian beaches to nest (NMFS 1999).

Green turtles nest on beaches in the eastern, central, and western Pacific Ocean and the western North Atlantic beaches. Although there is some green turtle nesting in Florida, no nesting occurs on the Pacific coast of the U.S. mainland. Important nesting grounds in the North Pacific include Hawaii, Mexico, Palau, the Phillippines, and Malaysia, and the primary nesting site is at French Frigate Shoals in the Northwestern Hawaiian Islands (Eckert 1993). In Hawaii, green turtles are found throughout the Hawaiian archipelago, but most nesting occurs at French Frigate Shoals (in the Northwestern Hawaiian Islands). In Mexico, green (black) turtles nest at two nearby beaches at Maruata Bay and Colola, Michoacán, as well as on the

Islas Revillagigedos. Genotypic analysis indicates green turtle nesting beaches constitute isolated reproductive units, and green turtles exhibit high nest-site fidelity (Eckert 1993).

Mating in green turtles normally precedes egg laying by 25 to 35 days. Reproductive characteristics appear to vary depending on population (Eckert 1993), but females tend to lay between 1 and 11 clutches per year (averaging between 1.8 and 2.5) with nesting intervals of approximately 13 to 14 days. Average clutch size in the eastern Pacific varies from 65 to 87 eggs, and the incubation period ranges from 42 to 62 days (NOAA 1998a). Females typically nest in two-to-three-year cycles, but over half of the adult males may return to the breeding grounds annually (Eckert 1993).

Green turtle hatchlings have been associated with drifting *Sargassum* communities, presumably feeding upon a variety of invertebrates and small fishes (Carr 1987). As hatchlings, green turtles are primarily carnivorous, but at about one year of age, they become mainly herbivorous. Post-hatchlings from Hawaii are epipelagic for an unknown period of time. In Hawaii, green turtles move into coastal waters when they reach about 35 centimeters (cm) (14 inches [in]) straight carapace length (SCL) and are then herbivorous. Juvenile green turtles in Hawaii feed primarily on benthic algae, although sea grass and invertebrates are also consumed (Balazs 1980, Eckert 1993). Adults have feeding habits similar to juveniles.

The size of adult green turtles varies in different parts of the world, but a length of 1m (39 in.) and a weight of 150 kilograms (kg) (330 pounds [lbs]) are typical (Pritchard 1979). It has been estimated that green turtles may not reach maturity until 15 or 20 years (Witham 1983), 30 years (Mendoca 1979, Limpus and Walter 1980), or even 40 to 50 years of age (Eckert 1993).

The green turtle population at French Frigate Shoals is thought to be increasing, though marine turtle fibropapilloma is threatening the recovery of this species (NMFS 1999). The cause of this tumor-associated disease is unknown and is most prevalent in green turtles off Hawaii, Florida, and Caribbean islands. Eckert (1993) reported a decline in green turtle numbers virtually throughout their range, with the possible exception of Hawaii. However, NMFS (1999) reports green turtle numbers have increased since 1992 throughout their U.S. range. From 1981 to 1987, an estimated 940 to 5,586 females nested at Michoacán. In 1997, about 500 green turtles nested at French Frigate Shoals indicating the nesting population there tripled since 1973 (NMFS 1999). Although estimates are not available for the total population, it is estimated that the nesting population in the southeastern U.S. is recovering and has reached an approximate level of 1,000 nesting females (NOAA Fisheries 2002).

Loggerhead turtle (*Caretta caretta*)

The loggerhead turtle is currently listed as threatened throughout its entire range. No critical habitat has been designated for this species.

Loggerheads are circumglobal, inhabiting continental shelves, bays, estuaries, and lagoons in the temperate, subtropical, and tropical waters of the Atlantic, Pacific, and Indian Oceans. In the eastern Pacific, loggerheads have been sighted off Shuyak Island, Alaska (58° N) in the north and off Chile (52° S) in the south (Eckert 1993). Large aggregations of juvenile loggerheads (more than 100,000 individuals) have been observed off the western coast of Baja California Sur along a band extending from about 30 to 60 km (19 to 37 mi) offshore (Eckert

1993). Their presence in pelagic North Pacific drift nets indicates they are present in the high seas of the Pacific (Eckert 1993).

Major nesting grounds generally occur in temperate and subtropical areas. The largest known loggerhead nesting areas are on Masirah Island, Oman, and on the U.S. Atlantic coast from Florida to North Carolina. No nesting areas exist on the Pacific coast of North America. In the north Pacific basin, loggerhead nesting is primarily restricted to Japan and Australia, with reports of limited nesting in China, New Guinea, Indonesia, and possibly a few other areas (Eckert 1993, NOAA 1998c). Nesting in Japan extends from late May through August. In Florida, nesting peaks in June and July. Florida loggerheads are sexually mature at 12 to 30 years of age, but Pacific loggerheads likely mature slower (Eckert 1993). Once mature, females typically migrate at multiple-year intervals to nesting beaches, and fidelity to nesting beaches has been documented (Eckert 1993), although Talbert et al. (1980) found that loggerheads may use more than one nesting beach within a season and would thus be more flexible in choosing nest sites than green turtles. Mating occurs just prior to nesting season in waters off nesting beaches. Females lay from one to nine clutches of eggs per season, but most lay only two or three (NOAA 1998c). The average nesting interval within a season is about 13 days, and the incubation period is about 60 days (NOAA 1998c).

Similar to green turtles, loggerhead hatchlings from the southeastern U.S. have been associated with drifting *Sargassum* communities, where they feed upon macroalgae, marine invertebrates, and terrestrial insects carried to sea by the wind (Carr 1987). Though no data exist on distribution of juvenile loggerheads in the North Pacific, the transition from newborn to juvenile likely takes place in the open sea. Juvenile loggerheads present off Baja California Sur (as discussed previously) are greater than 10,000 km (6,214 mi) from the nearest significant nesting areas in Japan.

Adult loggerhead turtles typically weigh 80 to 150 kg (175 to 330 lbs), and world-wide adult females average 92 cm (36 in.) in SCL (Eckert 1993, Dodd 1988). Adult loggerheads typically feed on benthic invertebrates in hard-bottom areas (Eckert 1993). Loggerheads from Queensland, Australia were found to feed on cnidarians, cephalopods, gastropods, pelecypods, decapods, echinoderms, and fish (Dodd 1988). Off Baja California Sur, Mexico, presence of loggerheads coincided with dense concentrations of the pelagic red crab, *Pleuroncodes planipes*, on which loggerheads feed (Eckert 1993).

The status of the loggerhead populations in the Pacific is unknown because historical abundance and distribution data are lacking; however, data from Queensland, Australia indicate loggerheads are declining there (NMFS 1999).

Leatherback turtle (*Dermochelys coriacea*)

The leatherback turtle is endangered throughout its entire range. Critical habitat is designated on St. Croix Island in the Carribean.

Leatherbacks are the most wide-ranging living reptile. In the Pacific, leatherbacks have been sighted as far north as Alaska (60° N) (Hodge 1979) and as far south as Isla Mocha, Chile (38° S) (Eckert 1993). One study concluded leatherbacks were the most common sea turtle north of Mexico, noting their arrival in southern California often coincides with the summer arrival of the 18-20° C (64-68° F) isotherms moving north from Mexico (Stinson 1984). The leatherback is the largest sea turtle and can reach 1.8 m (6 ft) in CCL and up to 590 kg (1300 lbs) (Pritchard 1979). The top shell or carapace lacks the horny plates, or scutes, found on other sea turtles, and is composed of thick layers of oily, vascularized cartilaginous material, strengthened by a mosaic of thousands of small bones. Unlike some other sea turtles that feed on benthic organisms, leatherbacks are generally not associated with near-shore habitats, instead preferring deep water.

Principal leatherback nesting populations are found at the Solomon Islands, Irian Juya, Papua New Guinea, Mexico, Costa Rica, and Malaysia (NMFS 1999). The largest known nesting colonies, comprising nearly half the known number of adult females, are on the Pacific coast of Mexico in Michoacán, Guerrero, and Oaxaca. In 1982, an estimated 30,000 leatherbacks nested on the Pacific coast of Mexico (Pritchard 1982).

Reproductive migrations of leatherbacks in the Pacific are not well-studied; however, migratory corridors along the western coast of North and South America likely exist (Stinson 1984). Post-nesting females may travel north and south from Mexican rookeries. Females undertake reproductive migrations on two-year, three-year, and greater intervals to nesting areas (Eckert 1993). Age of sexual maturity is not known.

In Mexico, leatherback turtles lay between 1 and 11 clutches (averaging 5.7) per season at nine- to ten-day intervals. The average clutch has approximately 64 yolked eggs, but there is often a large number of yolkless eggs that may comprise over 50% of a total clutch (NOAA 1998b). The yolkless eggs are typically smaller than the yolked eggs, are often misshapen, and are often deposited after the yolked eggs. This is unique to sea turtles (and occurs in all sea turtle species), and the significance of the yolkless eggs is not known. Incubation for leatherbacks lasts between 55 and 75 days, depending on ambient temperatures.

No data exist on the dispersal patterns of leatherback hatchlings, and immature leatherbacks are rarely observed anywhere in the world. Adults are highly migratory, thus making them difficult to study. Adults are assumed to have primarily open-water distributions, feeding on medusae, salps, and siphonophores, among other things, in the water column and at the ocean surface (Eckert 1993).

Leatherback stocks in the Pacific are declining (NMFS 1999). Along the Pacific coast of Mexico, leatherbacks declined at an annual rate of 22% during the 12 years prior to 1999 (NMFS 1999).

Olive ridley turtle (*Lepidochelys olivacea*)

The breeding populations of olive ridley turtles along the Pacific coast of Mexico are listed as endangered, and all others as threatened under the ESA. No critical habitat has been designated for this species.

The olive ridley is a small turtle, 60 to 70 cm (24 to 30 in.) in length, that feeds primarily on crustaceans. The olive ridley is circumglobal, found in the tropical regions of the Atlantic, Indian, and Pacific Oceans. Although the most abundant sea turtle in the North Pacific, little is known of the olive ridley's oceanic distribution. As with leatherbacks, it is postulated olive ridley sea turtles spend post-hatchling and juvenile life stages in the open waters of the Pacific (Eckert 1993). Olive ridleys are most abundant off Mexico during nesting season (August through October). It is speculated the range of the olive ridley in the Eastern Tropical Pacific is bounded to the north by the cold California Current (that veers southwest off the southern tip of Baja California) and to the south by the cold Humboldt Current (that veers northwest off the coast of northern Peru). However, olive ridleys have been found as far north as Seaside, Oregon (46° N) (Stinson 1984) and Copalis Beach, Washington (approximately 47° N) (Eckert 1993). Long-distance migration of olive ridleys was recorded from nesting grounds in Mexico and Central America southward to Ecuador (optimal feeding conditions may exist off Ecuador--a result of the confluence of the warm Panama Current and the cold Humboldt Current) (Eckert 1993). Post-nesting females are capable of traveling greater than 9,000 km (5,592 mi) in 16 months (Eckert 1993).

In the Pacific, most nesting areas for this species are in continental coastal areas, and rarely on oceanic islands (NMFS 1999). Nesting may take place singly, in small colonies, or in synchronized nesting aggregations called "arribadas," which may be comprised of up to tens of thousands of females that all emerge from the sea within a few hours of each other to nest. Very large arribadas occur in only two locales--Orissa State (Bengal, India) and at two beaches on the Pacific coast of Costa Rica (Eckert 1993). On the Pacific coast of Mexico, major arribadas occur in Jalisco, Guerrero, and Oaxaca. Nesting in smaller numbers occurs in the states of Sinaloa, Colima, Michoacán, and Baja California Sur. Low-density nesting is also reported in Guatemala, El Salvador, Honduras, Nicaragua, and Panama. The largest arribadas occur in Pacific Mexico and Costa Rica from August through October (Eckert 1993). However, nesting occurs from February through July on peninsular Malaysia, and from October through February at Phuket, Thailand (Eckert 1993). Mating may occur along migratory routes or at other locations at sea, and is not restricted to waters off nesting beaches. Hubbs (1977) reported mating off the coast of San Diego in 1973, 1000 km (621 mi) north of the nearest nesting beach in Magdalena Bay, Baja California Sur.

The olive ridley reproductive cycle is nearly annual, with more than 60% of turtles nesting each year (Eckert 1993). Arribadas occur on a 28-day, lunar-associated cycle (NOAA 1998d). Although there may be up to seven arribadas at a site within a season, most females lay two clutches per season, and they tend to remain nearshore during the 28-day internesting period. Mean clutch size is about 100 to 110 eggs, and incubation usually takes 50 to 60 days (NOAA 1998d).

Though juveniles are rarely encountered in the Pacific, they have been observed off Hawaii, Micronesia, and China (Eckert 1993). Juveniles are commonly associated with floating objects and oceanographic fronts and driftlines (Eckert 1993). Adult females swim actively during the migratory period, tracking zones of upwelling and spending slightly more time near the water surface (14% migrating compared with 4% in waters adjacent to the nesting beach) .

Olive ridley turtles are carnivores, feeding mainly on mollusks, sessile and pelagic tunicates, fishes, fish eggs, jellyfish, crabs, shrimps, amphipods, and other crustaceans (Marquez 1990). Individuals may dive deep while foraging; they have been observed feeding on crabs at depths of 300 m (984 ft) in the Sea of Cortez (Eckert 1993). Growth rate and age at maturity are unknown for olive ridleys.

6 ANALYSIS OF EFFECTS

Incidental Takes by Ocean CWS Intakes

Because of the underwater, offshore location of the intake structures, sea turtles have not actually been observed entering the intake velocity caps. The horizontal flow velocity of 0.5 m/s (1.7 ft/s) into the intakes is potentially strong enough to draw sea turtles involuntarily inside the intake structures. Though sea turtles are strong swimmers, they probably have limited ability to escape the intake currents. The following sequence of events is thought to take place: a sea turtle swims into the space between the intake riser and the velocity cap either out of curiosity, in search of prey, or for shelter. Once under the intake velocity cap, the flow rate increases as the animal approaches the center vertical riser shaft that connects to the intake conduit. This increasing velocity and downward-turning flow causes the animal to be drawn into the riser. The downward current is not something sea turtles normally encounter in their natural environment. This situation, combined with the lack of light and confinement inside the velocity cap and riser, may disorient the animal and prevent an effective escape response. As a result, the animal is unable to exit, and it is drawn into the forebay.

All but four sea turtles found in the forebay were alive and successfully released to the ocean. The four dead turtles encountered at the generating station were all in various states of decomposition when found. It is possible that some animals may drown or sustain fatal injuries in transit in the intake conduit or forebay, but it is unlikely that any of these could have remained undiscovered long enough to decompose to the extent that they had. It is possible that dead sea turtles drifting in the vicinity of the intake structure are entrained along with other debris.

Incidental takes occur at SONGS when sea turtles inadvertently enter the CWS of the generating station. Table 2 summarizes the history and condition of the sea turtles entrained at SONGS Units 2 and 3 from July 1983 through March 2005. Stranding reports for these incidents are available on request.

Types and frequency of takes include:

Harassment: Sea turtles that enter the intake tunnels as described above are discovered by SONGS personnel in the forebay inside the plant. From there, the animals are encouraged toward the FRS via the design of the forebays. Once in the FRS, the turtles are retrieved with a cargo net. If the animal is healthy and uninjured, it is tagged on both front flippers and reported and then released to the ocean.

Injury: Two of the 33 sea turtles entrained had visible injuries (minor abrasions). It cannot be determined whether these injuries occurred during transit in the intake conduit or were existing conditions prior to entrainment. Injured animals are turned over to one of several animal rescue organizations (e.g. Friends of Sea Lions or Seaworld) for veterinary care and are eventually released.

Death: Four of the 33 sea turtles (12%) entrained between July 1983 and March 2005 were found dead in the SONGS holding area. All the dead sea turtles were decomposed to various degrees, ranging from days to weeks old. However, the exact cause of death could not be determined because there were no clear or obvious signs of external trauma that would indicate that the animal was injured or dead prior to being drawn into the tunnel. Where there are no

TABLE 2. Condition of Sea Turtles Entrained at SONGS July 1983 - March 2005				
DATE ENTRAINED	**DATE REMOVED**	**ANIMAL TYPE**	**STATION**	**DISPOSITION**
3/15/05	3/15/05	GRN SEA TURTLE	SONGS 3	TAGGED AND RELEASED ON 3/16/05
9/13/2004	9/13/2004	GRN SEA TURTLE	SONGS 2	RELEASED ALIVE
7/16/2004	7/16/2004	GRN SEA TURTLE	SONGS 2	RELEASED ALIVE
8/15/2002	8/15/2002	GRN SEA TURTLE	SONGS 3	RELEASED UNHARMED; Tags Left front X196; Right front X197
11/18/2000	11/18/2000	GRN SEA TURTLE	SONGS 3	TAGGED AND RELEASED SO BEACH; TAGS X194 & X195
6/19/2000	6/19/2000	GRN SEA TURTLE	SONGS 2	RELEASED UNHARMED; 22"; 40 LB.
8/15/1999	8/15/1999	GRN SEA TURTLE	SONGS 3	RELEASED UNHARMED W/ TAG # X191 OF LEFT FRONT FLIPPER
11/24/1997	11/24/1997	GRN SEA TURTLE	SONGS 2	RELEASED ON BEACH : 21.5"; 40 LBS; PHOTOS
7/15/1996	7/15/1996	LOGGERHEAD	SONGS 3	RELEASED UNHARMED DANA PT; 25.5 INCHES; X-187 AND X-188
5/22/1996	5/22/1996	LEATHERBACK	SONGS 2	LONG DEAD, DECOMPOSED; 60"; 300 LBS;
5/8/1996	5/8/1996	GRN SEA TURTLE	SONGS 2	RELEASED UNHARMED; 22.5"; TAGGED W/ X-183 AND X-184
9/9/1994	9/9/1994	GRN SEA TURTLE	SONGS 3	LIVE; RELEASED W/ TAGS X181 & X182
5/29/1994	5/31/1994	LEATHERBACK	SONGS 3	DECOMPOSED CARCASS APPROX. 700LBS; HEAD COLLECTED
2/27/1993	2/27/1993	LOGGERHEAD	SONGS 3	TAGGED AND RELEASED SO BEACH; TAGS 179 & 180; Recov. in Mexico
9/16/1992	9/16/1992	GRN SEA TURTLE	SONGS 3	MINOR ABRASIONS; TAGGED W/ X770 & X771; 18.75"
9/9/1992	9/9/1992	GRN SEA TURTLE	SONGS 3	NO INJURIES OBSERVED; TAGGED W/ X767 & X768 27.5"
8/13/1992	8/13/1992	GRN SEA TURTLE	SONGS 2	RELEASED OK S.O. BEACH
7/30/1992	7/30/1992	GRN SEA TURTLE	SONGS 3	RELEASED OK PENDLETON
7/13/1992	7/15/1992	GRN SEA TURTLE	SONGS 1	RELEASED OK SO. LAGUNA
6/3/1992	6/3/1992	GRN SEA TURTLE	SONGS 3	TAGGED W/ 763&764 OK
5/6/1992	5/6/1992	GRN SEA TURTLE	SONGS 3	RELEASED W/ TAG X762
10/6/1991	10/6/1991	GRN SEA TURTLE	SONGS 3	RELEASED OK N OF SONGS
5/4/1991	5/4/1991	GRN SEA TURTLE	SONGS 2	RELEASED OK SOSB 90LBS
3/14/1991	3/14/1991	GRN SEA TURTLE	SONGS 3	DEAD
2/21/1991	2/21/1991	GRN SEA TURTLE	SONGS 2	RELEASED OK PENDLETON
10/30/1990	10/30/1990	GRN SEA TURTLE	SONGS 2	RELEASED OK PENDLETON
10/3/1990	10/3/1990	GRN SEA TURTLE	SONGS 3	DEAD; DELIVERED TO NMFS
9/26/1990	9/26/1990	GRN SEA TURTLE	SONGS 2	RELEASED OK PENDLETON
9/14/1990	9/14/1990	GRN SEA TURTLE	SONGS ?	RELEASED OK SAN ONOFRE
9/23/1988	9/23/1988	GRN SEA TURTLE	SONGS 2	RELEASED UNHARMED DANA
10/2/1986	10/2/1986	GRN SEA TURTLE	SONGS 3	45LBS, SLIGHT ABRASIONS HEAD AND R. FLIPPER. RELASED BY "FRIENDS"
1/11/1984	1/11/1984	GRN SEA TURTLE	SONGS 2	RELEASED UNHARMED SAN CLM. ST. BCH. LENG=20.5 WIDTH=20.25" 30LBS
7/16/1983	7/16/1983	GRN SEA TURTLE	SONGS 2	RELEASED TO DANA PT. HARBOR

external signs of the animal's cause of death, it is not possible to ascertain whether it died from drowning in the intake system, or in conjunction with previous contributing factors received before entering the SONGS intake tunnels. However, it is unlikely that any of these turtles could have remained undiscovered in the forebay long enough after death (days to weeks) to decompose to the extent that they had.

Both green turtle carcasses discovered at SONGS (3 October 1990 and 14 March 1991) had been dead for at least several days. Both leatherback turtle carcasses discovered at SONGS (29 May 1994 and 22 May 1996) were extremely decomposed, and were probably weeks old. The carcasses were disposed of in an appropriate landfill after notifying NOAA Fisheries and the NRC.

Other Potential Impacts

SONGS uses heat treatments and periodic chlorination treatments to help minimize biofouling of the CWS. Heat treatments are performed at six-week intervals in the summer and at nine-week intervals in the winter. By manipulating several gates, the heated water can be recirculated through the condenser, sent through the intake pipeline, or sent out through the normal discharge pipeline to allow for heat treatment of the entire CWS. The temperature is raised slowly, taking several minutes for each degree Celsius (EC), with several hold points during the increase to encourage fish into the fish-handling area and FRS. The slow temperature increase also allows any seals or sea lions in the forebay time to get out of the water before it gets too hot. The forebay is monitored to detect the presence of pinnipeds or sea turtles, and the heat treatment is delayed if any are detected. The fish handling system is operated continuously until the temperature reaches approximately 29 - 31 EC (85 - 88 EF). Maximum condenser outlet temperature does not exceed 52 EC (125 EF).

In addition to the heat treatment, fouling organism growth is controlled in the onshore portion of the CWS by chlorination using sodium hypochorite. The chlorination injection point is just downstream of the traveling screens. Injections occur four times each day, for a duration of 25 minutes per injection period. Sodium hypochlorite injection is administratively controlled to prevent chemical injection while the circulating water pumps are not operating, during fish handling operations, and during heat treatment. The facility NPDES permit (CA0108073) limits the residual chlorine levels to 22 micrograms per liter (µg/l) for a six-month median, 88 µg/l maximum daily average, and 200 µg/l maximum instantaneous reading. The system is monitored with an in-line chlorine analyzer, which has a trip alarm set at 150 µg/l. If this alarm is tripped, the chlorination is immediately terminated.

These concentrations of residual chlorine are typical of intake systems for electric power plants, and are deemed by the Environmental Protection Agency (EPA) to be protective of marine life. The particular sensitivity of sea turtles to chlorine is not known. However, sea turtle guidelines published by the Florida Fish and Wildlife Conservation Commission (2002) indicate that, for turtles being held in captivity, free chlorine levels should be maintained between 1000 and 1500 µg/l. For comparison, chlorine concentrations in swimming pools are normally maintained between 1000 and 3000 µg/l. In any case, these residual chlorine levels are many times greater than those that result from operation of the SONGS CWS. Therefore, it is not likely that either the heat treatments or the chlorination of the CWS would have detrimental effects on sea turtles in the vicinity of SONGS.

7 CUMULATIVE EFFECTS

The total number of sea turtles taken each year along the Pacific coast is not known. Recovery plans for the various sea turtle species (NOAA 1998a, 1998b, 1998c, 1998d) indicate that the most important threats include incidental take during fishing operations, ingestion of debris, oil exploration and development, pollution, and natural disasters. Entrainment in power plant intake systems is acknowledged as an issue, but for most species it is not likely to be a significant threat.

Entrainment at the SONGS facility averages approximately 1.5 turtles per year (maximum of 7 in 1992). There have been at least seven years when no sea turtles were entrained. The majority of these entrained turtles were released unharmed, therefore, SONGS operations probably contributes very little to the overall mortality of these species. Although it is difficult to determine the average number of takes from all sources, the number of turtles taken at SONGS is likely to be significantly less than the number seriously injured or killed along the Pacific coast due to other sources, especially commercial fishing, and is unlikely to contribute significantly to the overall annual mortality of sea turtles.

8 MANAGEMENT AND MITIGATION ACTIONS

As mentioned previously, all but 4 of the 33 sea turtles that have entered the SONGS intake systems were found alive. SONGS has developed and implemented procedures to rescue these animals and return them to the ocean unharmed when possible. Once a live sea turtle or sea turtle carcass is recovered from the forebay, physical characteristics of the sea turtle are documented on a stranding report, which is sent to the NOAA Fisheries at the end of each month. Copies of each sea turtle stranding report are provided to the NRC. Healthy sea turtles are released immediately, while animals that are malnourished or have visible injuries are sent to marine animal care centers where they receive veterinary care before being released back to the ocean.

The following is a list of steps SONGS has taken to improve the efficiency of sea turtle releases:

- SONGS Emergency Preparedness has developed methods to use cargo nets for capture of live sea turtles.

- On-site fire department/paramedics have been given responsibility to rescue and return live sea turtles to the ocean on a 24-hour, seven-days-per-week schedule.

- Environmental Affairs has provided training to SONGS firefighters in identification, rescue, and handling of sea turtles.

- Training in sea turtle identification and reporting has been presented to SONGS Operations personnel.

- Signs have been posted at screenwells instructing all personnel to report any observations of sea turtles immediately to Emergency Preparedness so that rescues can be quickly effected.

SONGS will continue to review and evaluate ways to improve turtle releases.

Sea turtle monitoring at SONGS consists of an in-plant program to detect and report the entrainment of sea turtles. Screen wash debris is inspected and assessed by plant operators for evidence of sea turtle remains. In addition, daily visual inspections of the water surface in SONGS CWS and FRS are performed by SONGS operations department staff. Signs are posted near the CWS to encourage workers to quickly report any sighting of animals in the station. Live sea turtles are lifted by the FRS for inspection and release. Cargo capture nets are used to extract the turtles from the FRS.

Sea turtle carcasses are documented as to species and are either delivered to NOAA Fisheries at their request or disposed of in the local landfill. Full reports of all sea turtles found at the station are reported to the NOAA Fisheries, Southwest Division and the NRC on a monthly basis.

Live sea turtles are inspected for obvious injury. Uninjured animals are promptly released on the beach, while those injured are released to one of several animal rescue organizations (e.g. Friends of the Sea Lion or Seaworld). Prior to release, sea turtles may be tagged so their movements can be tracked by NOAA Fisheries. SONGS personnel do not usually include the sea turtle's age, sex, or reproductive condition in their reports, because these parameters are usually difficult to discern by non-specialists.

During refueling outages, the forebays are inspected, and any indication of sea turtle remains or presence would be documented and reported.

Options to reduce sea turtle entrainment at SONGS were discussed at a meeting held in July 2001. Representatives from SCE and MBC Applied Environmental Sciences (biological consultant to SCE) met with Dr. Peter Dutton, NOAA Fisheries. It was concluded at that meeting that no other physical measures (i.e. modification of the intake structure or system) could be implemented at the plant to reduce sea turtle entrainment without either jeopardizing station operations or increasing the potential for attracting and entraining pinnipeds.

Sea turtle and pinniped entrainment has been an issue at a number of power plants, and various technologies to reduce entrainment have been evaluated (Table 3). As described in the table, most of these could not be implemented at SONGS without seriously affecting plant operations or increasing the potential for take of pinnipeds.

9 IMPACTS TO OTHER LISTED SPECIES

There have been no known impacts to any of the species listed in Table 1 other than three species of sea turtles. The non-turtle species are discussed below.

Table 3. Technologies and methods evaluated to deter sea turtles and pinnipeds from power plant intake structures	
Technology / Method	**Evaluation Conclusions**
Bubble curtain around the intake	Unlikely to deter turtles, and may attract pinnipeds
Escape hatch in intake	Would adversely affect station flow and entrain more fish and invertebrates
Strobe or other lights to scare turtles	May attract fish and other organisms; effect on turtles unknown
Maze of bars on intake	Clogging of intake likely
Net covering entire intake	Clogging of intake likely
Turning turbine inside intake to scare turtles	Would likely attract curious pinnipeds and reduce water flow; effect on turtles unknown
Flexible triangles around intake opening to deter animals from entering	Not likely to deter animals and could reduce cooling water flow
Dangling chains around intake to give visual cue of danger	Effect on turtles unknown, and may attract curious pinnipeds
Bars or cage around intake structure with small spacing so that large animals could not enter	Clogging of intake likely; danger of clogging presents safety concerns at offshore intakes.

Whales - None of the five species of endangered whales potentially occurring in the vicinity of SONGS (Table 1) are common in the area. Blue and sei whales, in particular are typically found quite far from the coast. The current velocity at the intake structure (about 1 knot) is considerably less than the typical whale swim speed of 4 - 6 knots. Additionally, the intake structures are similarly sized or smaller than most of the endangered whale species; therefore, entrainment is virtually impossible. The heated effluents and the chlorine or other chemicals in the discharge water are quickly diluted, and are not likely to affect whales.

Guadalupe fur seal - This species was extirpated from California waters in the early 1800s, but has since recolonized areas on San Miguel and San Nicolas Islands. Some animals were observed on San Clemente Island (approximately 100 km [65 mi] southwest of SONGS) in 1991 (NOAA 2004a). Guadalupe fur seals have not been observed in the vicinity of San Onofre and, therefore, are not likely to be affected by plant operations.

Steller sea lion - Although the historic range of Steller sea lions includes the region around SONGS, they have not been observed in the vicinity of the plant in recent years. The southernmost active rookery is at Año Nuevo Island north of Santa Cruz (NOAA 1992, 1997) approximately 640 km (400 mi) northwest of SONGS. A population on San Miguel Island, approximately 270 km (170 mi) northwest of SONGS disappeared in 1983. Steller sea lions are not known to exist in the vicinity of SONGS and, therefore, are not likely to be affected by plant operations.

White abalone - Very sparse populations of white abalone are still found in the vicinity of several of the Channel Islands (NOAA 2001). This large mollusk inhabits rocky substrates in waters that are between 24 and 60 m (80 and 200 ft) deep (NOAA 2004b). The intake and discharge structures are at depths of approximately 9 to 15 m (30 to 50 ft), in an area with sandy or gravelly substrate. Therefore, white abalone do not occur in the vicinity of the intake or discharge structures, and they are not likely to be affected by plant operations.

Southern California Steelhead - Steelhead were recently discovered to be spawning in the upper reaches of San Mateo Creek, which enters the Pacific ocean near the northern boundary of the SONGS site (NOAA 2002). Therefore, one may assume that the returning adults and the out-migrating juvenile steelhead travel relatively close to the SONGS facility, and potentially near the intake and discharge structures. However, habitat factors within San Mateo Creek are probably more important to the survival of the population than other factors such as the SONGS CWS. To date, there have been no observed cases of salmonid entrainment or impingement at SONGS, although this may be a reflection of the very low numbers of steelhead in the area. Because of the FRS, any adults or juveniles that were entrained would likely be returned to the sea unharmed. If the population of steelhead spawning in San Mateo Creek increases to the point that entrainment at SONGS is observed or becomes more likely, the effects of intake system operation may need to be reassessed.

10 CONCLUSIONS

The NRC staff's conclusions regarding the potential impacts of continued operation of the SONGS CWS and SWCS to Federally-listed threatened or endangered marine species in the vicinity of the SONGS site are summarized in Table 4.

The "is likely to adversely affect" conclusions for the four species of sea turtle are made based on the fact that turtles are occasionally entrained in the CWS, and are thus "taken." Although this entrainment could be injurious to individual turtles, the majority of the turtles are taken alive and healthy, and subsequently are released. The four turtles that were found dead likely died prior to entering the SONGS CWS. The NRC staff believes that continued operation of the SONGS CWS would not have a significantly adverse effect on the overall population of sea turtles in the vicinity of the site, and would not jeopardize the continued existence of these species.

The staff also concludes that there are no reasonable and prudent measures that can be taken at SONGS to further reduce the number of sea turtles taken at the facility.

Small numbers of Southern California steelhead are potentially in the vicinity of the plant, but there is no indication that operation of the SONGS CWS has an adverse effect on this species. If the steelhead population in San Mateo Creek increases, or if entrainment or impingement of adult or juvenile steelhead is observed, there may be a need to re-evaluate this conclusion and reinitiate this consultation.

Table 4. Conclusions regarding potential impacts of continued SONGS CWS operations		
Common Name	Species	Conclusion
Green turtle	*Chelonia mydas*	Is likely to adversely affect
Loggerhead turtle	*Caretta caretta*	Is likely to adversely affect
Leatherback turtle	*Dermochelys coriacea*	Is likely to adversely affect
Olive ridley turtle	*Lepidochelys olivacea*	Is likely to adversely affect
Blue whale	*Balaenoptera musculus*	No effect
Sperm whale	*Physeter macrocephalus*	No effect
Fin whale	*Balaenoptera physalus*	No effect
Humpback whale	*Megaptera novaeangliae*	No effect
Sei whale	*Balaenoptera borealis*	No effect
Guadalupe fur seal	*Arctocephalus townsendi*	No effect
Steller sea lion	*Eumetopias jubatus*	No effect
White abalone	*Haliotis sorenseni*	No effect
Southern California steelhead	*Oncorhynchus mykiss*	Not likely to adversely affect

Estimated Take Levels

It is assumed that occasional takes of sea turtles would continue at the SONGS site. Variability in the rate of turtle entrapment at SONGS is considered to be primarily a function of the local abundance of turtles because the operational characteristics of the intake structure remain constant through time. Precise numbers of sea turtles in waters offshore of southern California are not available, and their relatively small numbers and wide-ranging, pelagic distributions make abundances difficult to estimate. Based on historical evidence, sea turtle takes are more likely to occur during incursions of warm water to southern California associated with El Niño events. In its Section 10 permit application (SCE 2002), SCE estimated take levels for each species, based on both the maximum historical takes at SONGS and assumed increased numbers of turtles as populations of these species recover. Based on these estimates, the NRC staff proposes that the take levels listed in Table 5 be used as an action level that would trigger reinitiation of this consultation. If the number of annual takes remains at or below the numbers listed in Table 5, SONGS staff would continue to rescue, document, release, and report each take following the existing site procedures. If these numbers are exceeded, NRC and NOAA Fisheries would reinitiate the Section 7 consultation to re-examine the potential impacts of station operations on these species and to evaluate mitigation options, if needed.

Table 5. Proposed maximum number of sea turtle takes and action levels for re-initiation of consultation		
Common Name	**Species**	**Maximum Take Per Calendar Year**
Green turtle	*Chelonia mydas*	eight individuals
Loggerhead turtle	*Caretta caretta*	two individuals
Leatherback turtle	*Dermochelys coriacea*	two individuals
Olive ridley turtle	*Lepidochelys olivacea*	two individuals

11. REFERENCES

Balazs, G.H. 1980. Synopsis of biological data on the green turtle in the Hawaiian Islands. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-SWFSC-7. 141 p.

Bjorndal, K.A. 1981. The consequences of herbivory for the life history pattern of the Carribean green turtle, *Chelonia mydas*. Pages 111-116 in K.A. Bjorndal, ed. Biology and conservation of sea turtles. Proceedings of the World Conference on Sea Turtle Conservation, 26-30 November 1979, Washington, DC. Smithsonian Institution Press, Washington, DC. 583 pp.

Carr, A.F. 1987. New perspectives on the pelagic stage of sea turtle development. Conserv. Biol. 1(2):103-121.

Dodd, C.K. Jr. 1988. Synopsis of the biological data on the loggerhead sea turtle, *Caretta caretta* (Linnaeus 1758). USFWS Biol. Rep. 88(14). 110 p.

Eckert, K.L. 1993. The biology and population status of marine turtles in the North Pacific Ocean. NOAA-TM-NMFS-SWFSC-186. Prepared for Honolulu Laboratory, SWFSC, NMFS, NOAA.

Florida Fish and Wildlife Conservation Commission (FFWCC). 2002. Sea turtle conservation guidelines. Available at http://www.floridaconservation.org/psm/turtles/Guidelines/Guidelines.PDF. Accessed on 27 April 2004.

Hodge, R.P. 1979. *Dermochelys coriacea schlegeli* (Pacific leatherback) U.S.A.: Alaska. Herpetol. Rev. 10(3):102.

Hodge, R.P. 1981. *Chelonia mydas agassizi* (Pacific green turtle) U.S.A.: Alaska. Herpetol. Rev. 12(3):83.

Hubbs, C.L. 1977. First record of mating of olive ridleys in California, with notes on commensals, characters, and systematics. Calif. Fish and Game 63(4):262-267.

Limpus, C.J., and D.G. Walter. 1980. The growth of immature green turtles (*Chelonia mydas*) under natural conditions. Herpetologica 36(2):162-165.

Marquez, M.R. 1990. Sea turtles of the world. FAO Species Catalogue, Vol. 11. Food and Agricultural Organization of the United Nations, Rome. 81 p.

Mendoca, M.T. 1979. Growth rates of immature green (*Chelonia mydas*) and loggerhead (*Caretta caretta*) sea turtles in the wild. American Zoologist 19:953.

National Marine Fisheries Service (NMFS). 1999. Our living oceans. Report on the status of U.S. living marine resources, 1999. U.S. Dept. Commer., NMFS Tech. Memo. NMFS-F/SPO-41, 301 p.

National Oceanographic and Atmospheric Administration (NOAA). 1992. Final Recovery Plan for Steller Sea Lions *Eumetopias jubatus*. Prepared by the Steller Sea Lion Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland.

National Oceanographic and Atmospheric Administration (NOAA). 1997. Threatened Fish and Wildlife; Change in listing status of Steller sea lions under the Endangered Species Act. 62 FR 24345 - 24355, 5 May 1997.

National Oceanographic and Atmospheric Administration (NOAA). 1998a. Recovery plan for U.S. Pacific populations of the East Pacific Green Turtle (*Chelonia mydas*). National Marine Fisheries Service, Silver Springs, Maryland. 61 pp.

National Oceanographic and Atmospheric Administration (NOAA). 1998b. Recovery Plan for U.S. populations of the Leatherback Turtle (*Dermochelys coriacea*). National Marine Fisheries Service, Silver Spring, Maryland. 77 pp.

National Oceanographic and Atmospheric Administration (NOAA). 1998c. Recovery Plan for the U.S. Pacific population of the Loggerhead Turtle (*Caretta caretta*). National Marine Fisheries Service, Silver Spring, Maryland. 72 pp.

National Oceanographic and Atmospheric Administration (NOAA). 1998d. Recovery Plan for the U.S. Pacific populations of the Olive Ridley Turtle (*Lepdochelys olivacea*). National Marine Fisheries Service. Silver Springs, Maryland. 63 pp.

National Oceanographic and Atmospheric Administration (NOAA). 2001. Endangered and Threatened Species; Endangered status for White Abalone. 66 FR 29046-29055, May 29, 2001.

National Oceanographic and Atmospheric Administration (NOAA). 2002. Endangered and threatened species: Range extension for endangered steelhead in southern California. 67 Federal Register pp 21586-21598. 1 May 2002.

National Oceanographic and Atmospheric Administration (NOAA). 2004a. "Guadalupe Fur Seal". http://www.nmfs.noaa.gov/prot_res/species/Pinnipeds/guadalupefurseal.html Accessed 28 April 2004.

National Oceanographic and Atmospheric Administration (NOAA). 2004b. "White Abalone" http://www.nmfs.noaa.gov/prot_res/species/inverts/White_AB.html Accessed 28 April 2004.

NOAA Fisheries. 2002. Biological Opinion on Shrimp Trawling in the Southeastern United States, under the Sea Turtle Conservation Regulations and as Managed by the Fishery Management Plans for Shrimp in the South Atlantic and Gulf of Mexico.

Pritchard, P.C.H. 1979. Encyclopedia of turltes. TFH Publications, Inc. Neptune, New Jersey. 895 pp.

Pritchard, P.C.H. 1982. Nesting of the leatherback turtle, *Dermochelys coriacea*, in Pacific Mexico, with a new estimate of the world population status. Copeia 1982:741-747.

Southern California Edison (SCE). 2002. San Onofre Generating Station, Endangered Species Act - Section 10 Application for Sea Turtle Incidental Take Permit. Southern California Edison, San Clemente, California.

Stinson, M.L. 1984. Biology of sea turtles in San Diego Bay, California, and in the northeastern Pacific Ocean. M.S. Thesis, San Diego State Univ., California. 578 p.

Talbert, O.R., S.E. Stancyk, J.M. Dean, and J.M. Will. 1980. Nesting activity of the loggerhead turtle (*Caretta caretta*) in South Carolina I: A rookery in transition. Copeia 1980 (4)709-718.

U.S. Atomic Energy Commission (AEC). 1973. Final Environmental Statement related to the proposed San Onofre Nuclear Generating Station Units 2 and 3. Southern California Edison Company and the San Diego Gas and Electric Company. Docket No. 50-361 and 50-362. U.S. Atomic Energy Commission, Washington, D.C.

U.S. Department of Navy (USN). 1999. San Diego Bay Integrated Natural Resources Management Plan, and San Diego Unified Port District Public Draft. September 1999. San Diego, CA. Prepared by Tierra Data Systems, Escondido, California.

Witham, R. 1983. Green Turtles. Paper presented at Third Annual Sea Turtle Research Workshop, 7-8 April, 1983, Marine Resources Laboratory, Charleston, South Carolina.

Wood, J.R. and F. E. Wood. 1980. Reproductive biology of captive green sea turtles *Chelonia mydas*. American Zoologist 20:499-505.