May 10, 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 DIABLO CANYON POWER PLANT ON THREATENED OR ENDANGERED MARINE SPECIES (TAC NOS. MC2289 AND MC2290)

Dear Mr. McInnis:

The U.S. Nuclear Regulatory Commission (NRC) has reviewed the status of issues regarding the Endangered Species Act (ESA) related to operation of the cooling water system for the Diablo Canyon Power Plant (DCPP) located in central San Luis Obispo County, approximately five miles north of Avila Beach, CA. Approximately seven threatened sea turtles have been entrained in the cooling system of this facility since 1994; all were released back to the ocean.

The NRC staff met informally with National Oceanic and Atmospheric Administration (NOAA) Fisheries staff on November 12, 2003, to discuss ESA issues related to DCPP. The NRC formally requested a list of threatened or endangered species that could be present at the DCPP 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 DCPP on ESA-listed species that are managed by NOAA Fisheries. Based on this BA, the staff has determined that continued operation of DCPP 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*). The staff also determined that continued operation of DCPP would have no effect on the southern California or south central coast stocks of steelhead (*Onchorhynchus mykiss*), the 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 DCPP nor is any critical habitat present in the vicinity of DCPP.

Although the staff has determined that individuals of the four species of sea turtles may be adversely affected by the continued operation of DCPP, it has also determined that DCPP does not contribute to the overall mortality of these species nor jeopardize the continued existence of any of these species. Therefore, the NRC staff proposes maximum annual allowable takes to be four green turtles, two loggerhead turtles, one leatherback turtle, and one olive ridley turtle.

Based on the findings in the enclosed BA, the NRC requests the initiation of 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 or 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.: 50-275 and 50-323

Enclosure: As stated

cc w/encl.: See next page

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DISTRIBUTION:

P.T. Kuo	A. Kugler	J. Wilson
M. Masnik	H. Nash	G. Shukla

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OFFICE	GS:RLEP	LA:RLEP	PM:RLEP	SC:RLEP	PM:PDIV-2	PD:RLEP
NAME	H. Nash	Y. Edmonds	J. Wilson	A. Kugler (w/comments)	G. Shukla	P.T. Kuo
DATE	04/25/05	04/27/05	04/27/05	05/5/05	05/9/05	05/10/05

OFFICIAL RECORD COPY

cc:
NRC Resident Inspector
Diablo Canyon Power Plant
c/o U.S. Nuclear Regulatory Commission
P.O. Box 369
Avila Beach, CA 93424

Sierra Club San Lucia Chapter
c/o Henriette Groot
1000 Montecito Road
Cayucos, CA 93430

Ms. Nancy Culver
San Luis Obispo
Mothers for Peace
P.O. Box 164
Pismo Beach, CA 93448

Chairman
San Luis Obispo County Board of
Supervisors
Room 370
County Government Center
San Luis Obispo, CA 93408

Mr. Truman Burns
Mr. Robert Kinosian
California Public Utilities Commission
505 Van Ness, Room 4102
San Francisco, CA 94102

Diablo Canyon Independent Safety
Committee
ATTN: Robert R. Wellington, Esq.
Legal Counsel
857 Cass Street, Suite D
Monterey, CA 93940

Regional Administrator, Region IV
U.S. Nuclear Regulatory Commission
Harris Tower & Pavillion
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011-8064

Richard F. Locke, Esq.
Pacific Gas & Electric Company
P.O. Box 7442
San Francisco, CA 94120

Mr. David H. Oatley, Vice President
and General Manager
Diablo Canyon Power Plant
P.O. Box 56
Avila Beach, CA 93424

City Editor
The Tribune
3825 South Higuera Street
P.O. Box 112
San Luis Obispo, CA 93406-0112

Mr. Ed Bailey, Chief
Radiologic Health Branch
State Department of Health Services
P.O. Box 997414 (MS 7610)
Sacramento, CA 95899-7414

Mr. James D. Boyd, Commissioner
California Energy Commission
1516 Ninth Street (MS 31)
Sacramento, CA 95814

Mr. James R. Becker, Vice President
Diablo Canyon Operations
and Station Director
Diablo Canyon Power Plant
P.O. Box 3
Avila Beach, CA 93424

Mr. Gregory M. Rueger
Senior Vice President, Generation and
Chief Nuclear Officer
Pacific Gas and Electric Company
Diablo Canyon Power Plant
P.O. Box 3
Avila Beach, CA 93424

Biological Assessment

Diablo Canyon Power Plant
Sea Turtle Impact Assessment

San Luis Obispo County, California

April 2005

Docket Nos. 50-275 and 50-323

U.S. Nuclear Regulatory Commission
Rockville, Maryland

1 INTRODUCTION/BACKGROUND

The Diablo Canyon Power Plant (DCPP) is a two-unit nuclear power station operated by Pacific Gas & Electric (PG&E) under license numbers DPR-80 and DPR-82, which are issued and administered by the U.S. Nuclear Regulatory Commission (NRC). Seven green turtles (*Chelonia mydas*) have been entrapped in the DCPP Cooling Water System (CWS) between 1994 and the present. Each turtle was rescued and released back to the ocean alive and healthy. Stranding reports were prepared for each recorded case of turtle entrapment, following guidance provided by letter to PG&E in June 1994 (NOAA 1994). These stranding reports have been submitted to the National Oceanic and Atmospheric Administration (NOAA) Fisheries, and PG&E has notified the NRC of each incident as an usual occurrence.

Although there have been takes of threatened sea turtles at this NRC-regulated facility, neither NOAA Fisheries nor NRC has pursued a 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 of the information contained in this BA was taken from an ESA Section 10 Permit application (PG&E 2002) prepared for PG&E by MBC Applied Environmental Sciences. That 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 informally with representatives from NOAA Fisheries on November 12, 2003, at the NOAA Fisheries Long Beach Office. The NRC sent a letter, dated February 4, 2004, requesting a list of species potentially present at the site. NOAA Fisheries responded with a list of potentially-affected species on March 18, 2004. Copies of these letters are provided in Appendix 1. The environmental impact statement for DCPP (AEC 1973) did not consider the potential impacts of plant operations on sea turtles.

Harbor seals (*Phoca vitulina richardsi*) and southern sea otters (*Enhydra lutris nereis*) inhabit the intake cove, and California sea lions (*Zalophus californianus californianus*) and northern elephant seals (*Mirounga angustirostris*) are occasional visitors. None of these marine mammals appear to have any trouble swimming against the low-velocity current entering the intake structure, and they frequently enter and exit the intake structure while foraging for food. Although all marine mammals are protected by the Marine Mammal Protection Act, the seals and California sea lion are not listed under the ESA, and the southern sea otter, which is listed as threatened, is under the jurisdiction of the U.S. Fish and Wildlife Service. Therefore, these species are not addressed in this BA or within this Section 7 consultation.

2 PROPOSED ACTION

The proposed action is the continued operation of the DCPP CWS. No new construction, facility alterations, or modifications of existing operations is anticipated. An incidental take occurs when a sea turtle enters the DCPP CWS.

3 DESCRIPTION OF PROJECT AREA

Overview of the Diablo Canyon Power Plant

DCPP, owned and operated by PG&E, is a two-unit, nuclear-powered, steam-turbine power plant with a rated output of approximately 2,200 megawatts of electricity. Commercial operation of Unit 1 began in May 1985, and Unit 2 followed in March 1986. Operation is expected to continue at least until the early 2020s, when the current operating licenses expire. PG&E 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. DCPP is located on a coastal terrace along Diablo Cove, which is midway between the communities of Morro Bay and Avila Beach on the central California coast in San Luis Obispo County (Figure 1). The local coast is a steep and rugged rocky shoreline that is exposed to heavy wave activity. The area supports a rich community of marine life that is a biogeographical extension of similar marine communities extending many hundreds of miles to the north. Except for DCPP, the coast is largely uninhabited and undeveloped along the 16-kilometer (km) (10-mile [mi]) stretch between the cities of Morro Bay and Avila Beach.

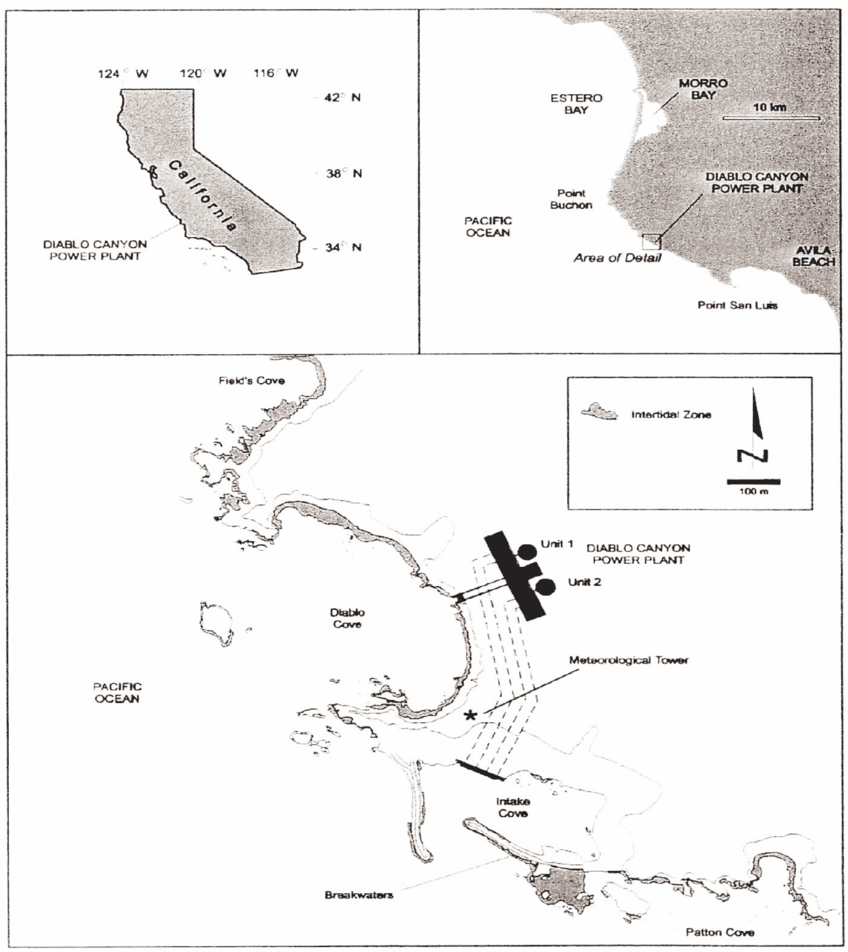

Figure 1. Location of the Diablo Canyon Power Plant. Latitude: 35°2'30"N, Longitude: 120°51'15"W.

Design and History of DCCP's CWS

The power plant draws in sea water from a constructed intake cove just south of Diablo Cove (see Figure 1) through the CWS to provide cooling for plant operations. The common Unit 1 and Unit 2 intake structure is located at the northern end of the intake cove created by two breakwaters, which mitigate the effects of wave action.

On the ocean side of the intake structure, a concrete curtain wall extends approximately 2.4 meters (m) (7.9 feet [ft]) below mean sea level to prevent floating debris from entering the intake structure. The intake for DCPP is a shoreline structure that houses bar racks, vertical traveling screens, auxiliary CWSs, and main circulating water pumps (Figure 2). The cooling water for each unit is supplied by two main circulating water pumps and one auxiliary sea water pump.

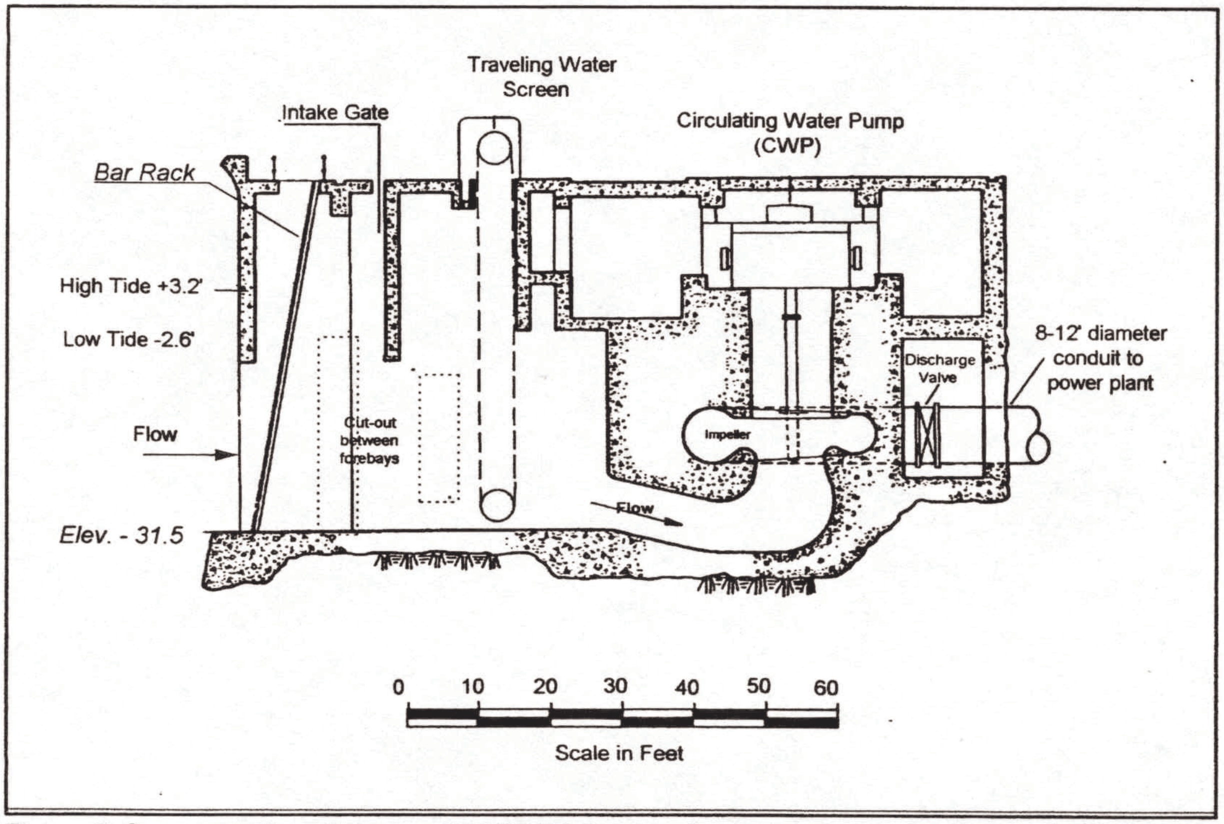

Figure 2. Cross-section diagram of DCPP intake structure showing water flow path. Elevations are based on mean sea level.

Seawater entering the intake structure passes through one of 16 sets of bar racks designed to exclude large debris from the forebays. The bar racks consist of vertical, inclined rows of steel bars spaced about 8 centimeters (cm) (3 inches [in.]) apart. The two auxiliary seawater bar racks are 1.5 m (4.9 ft) wide, while the 14 circulating water pump bar racks are 3.1 m (10 ft) wide. The underwater portion of the bar racks is approximately 10 m (32.8 ft) high depending on the tide.

The overall intake opening is approximately 10 m (32.8 ft) high by 52.6 m (172.6 ft) wide. Due to the large surface area of the intake opening, the flow velocity of seawater through the bar racks into the interior of the intake structure is relatively low (about 0.3 meters per second [m/s] [1 ft/s] or about 0.5 knot). Sets of traveling screens with 0.95-cm (0.37-in.) mesh stainless steel screens are located behind the bar racks to remove smaller debris that passes through the bar racks.

DCPP normally operates at full power unless shut down for scheduled refuelings and maintenance, or for an unscheduled forced outage. During normal operations, the four circulating water pumps (two for each unit) each provide an average of approximately 1,613 cubic meters per minute (m^3/min) (426,000 gallons per minute [gpm]), for a total of 6,450 m^3/min (1,704,000 gpm) of ocean cooling water. Most of this water goes to the main condenser tubes and condenses the steam exhaust from the main turbine, which is used to generate the power plant's electrical output. A smaller amount of ocean cooling water is pumped, at about 83.3 m^3/min (22,000 gpm), to various heat exchangers via the two auxiliary seawater conduits. The auxiliary seawater system is used to provide cooling water for other plant machinery and heat exchangers, some of which are related to nuclear safety.

After passing through the condensers, the cooling water is returned to the ocean via a stair-step weir structure that opens on the eastern end of Diablo Cove. The discharged water is usually approximately 10 to 11 EC (18 to 20 EF) warmer than the intake water. The maximum temperature rise allowed under DCPP's National Pollutant Discharge Elimination System (NPDES) permit is 12 EC (22 EF).

A combination of sodium hypochlorite and sodium bromide is used to help control biofouling of the CWS. These materials are injected just downstream of the traveling screens via the chlorine injection system. The chemicals are injected six times daily, for 20 minutes each injection. The total residual oxidant (TRO) concentration in the discharge stream is usually between 20 and 60 parts per billion (ppb), well below the permitted level of 200 ppb (PG&E 2004). Heat treatments are no longer used at DCPP.

During licensing of the DCPP in the 1970s, the design and environmental impact potential of the plant's CWS were reviewed by the NRC, the Environmental Protection Agency (EPA), and the Central Coast Regional Water Quality Control Board (Regional Board). The plant operates under a Clean Water Act NPDES permit (Permit # CA0003751) issued by the Regional Board.

4 ESA-LISTED SPECIES POTENTIALLY AFFECTED

The list of species provided by NOAA Fisheries is in Table 1 (the threatened southern sea otter is under the jurisdiction of the U.S. Fish and Wildlife Service and, therefore, is not addressed in this BA). To date there have been no known takes at DCPP of any endangered or threatened species other than the green turtle. It is assumed that some other species of sea turtles have a similar potential to be taken at DCPP; therefore, this BA includes assessments for all of the species of sea turtles listed in Table 1. Takes of the non-turtle species listed in Table 1 are considered to be unlikely; therefore, these species are not considered in detail. These other species are discussed briefly in Section 9.

TABLE 1. Federally-listed endangered and threatened marine species potentially occurring near the DCPP.		
Common Name	**Species**	**Status**
Green 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
Steelhead (Southern California and South-Central Coast stocks)	*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 abundance estimates difficult. 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 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 of the tropics. 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* (the black turtle) and *C. m. mydas*. *C. m. agassizii* 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 turtle's range. The size of adult green turtles varies in different parts of the world, but a length of 1 m (39 in.) and a weight of 150 kilograms (kg) (330 pounds [lbs]) are typical (Pritchard 1979). For the purposes of this report, *Chelonia mydas* will refer to all green 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 km (1,964 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, although females are thought to nest somewhere in Mexico. 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. 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 (Eckert 1993). Green turtles are found throughout the Hawaiian archipelago, but primary nesting grounds are at French Frigate Shoals in the Northwestern Hawaiian Islands. In Mexico, green 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 2- to 3-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 at about 35 cm (14 in.) in straight carapace length (SCL) and are herbivorous. Juvenile greens 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.

Because they are herbivorous, adult and juvenile green turtles maintain a nutritionally-limiting diet, which results in a slow growth rate and delayed sexual maturity (Bjorndal 1981). It has been estimated that green turtles may not reach maturity until 15 or 20 years (Witham 1982), 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 has tripled since 1973 (NMFS 1999).

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 from about 30 km (19 mi) to 60 km (37 mi) offshore (Eckert 1993). Their incidental takes in pelagic North Pacific drift nets indicate 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. In Florida, nesting peaks in June and July. No nesting areas exist on the Pacific coast of North America. In the Pacific, 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. 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. Fidelity to nesting beaches has been documented (Eckert 1993); however, Talbert et al. (1980) found that loggerheads may use more than one nesting beach within a season, and thus would be more flexible in choosing nest sites than green turtles. Mating occurs just prior to nesting season in waters off nesting beaches. Females can 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). Although no data exist on distribution of juvenile loggerheads in the North Pacific, the transition from hatchling to juvenile likely takes place in the open sea. Juvenile loggerheads present off Baja California Sur 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 95 to 100 cm (37 to 39 in.) in curved carapace length (CCL) (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 of the sea turtles and can reach 1.8 m (6 ft) CCL and up to 590 kg (1300 lbs) (Pritchard 1979). The top shell 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 coasts 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 per season (averaging 5.7) at 9- to 10-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 percent 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 with all sea turtles species), and the significance of the yolkless eggs is not known. Incubation 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).

Generally, 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 SCL, and 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 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, well-known arribadas occur in 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 also 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 percent 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 typically about 100 to 110 eggs, and incubation usually lasts between 50 and 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 surface than when in waters near nesting beaches.

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 300 m (984 ft) in the Sea of Cortez (Eckert 1993). Growth rate and age at sexual maturity are unknown for olive ridleys.

6 ANALYSIS OF EFFECTS

Incidental Takes by Ocean CWS Intakes

An incidental take of a sea turtle at DCPP occurs when an individual enters the mouth of the cooling water intake structure and gets trapped between the bar racks and the concrete curtain wall. Turtles likely enter the intake cove out of curiosity, in pursuit of prey, or in search of shelter. Once inside the intake cove, the incoming flow may cause the animal to be drawn toward the bar racks. The sloped bar racks and the upward moving currents may disorient the animal and prevent an effective escape response. As a result, the animal rises to the surface behind the curtain wall and may be unable to dive back under the wall to escape. At that location, the turtles are detected by DCPP personnel. However, it is possible that some turtles behind the curtain wall manage to escape before being detected. Harbor seals and sea otters regularly enter and exit the area between the bar racks and curtain wall.

Since 1994, seven green turtles have been observed between the bar racks and curtain wall. All takes were reported to the NRC and NOAA Fisheries via Stranding Reports. All turtles were successfully rescued and released to the ocean with only minor abrasions. The turtles are carefully removed from the intake structure with large nets (such as urchin or kelp nets). Although it has not occurred to date, if an animal was found to need veterinary care, it would be transported to an appropriate animal care facility, or cared for on-site by animal care facility personnel.

Although it has not happened to date, it is possible that an unhealthy or weakened animal could drown if it became pinned against the bar rack, or an already dead turtle could drift in the vicinity of the structure and get drawn onto the bar racks with other debris. If this were to occur, the carcass would be disposed of in an appropriate manner after notification and input from NOAA Fisheries and NRC.

Table 2 provides a summary of the incidental green turtle takes at DCPP. Stranding reports for these incidents are available on request.

Table 2. Summary of green turtle takes at the DCPP.				
DATE	**Sex**	**CCL (cm)**	**Est. Weight (pounds)**	**Description and Disposition**
34450	Female	97	50-60	Healthy, no abrasions, released 0.8 km (0.5 mi) offshore
35439	Female	85	50	Healthy, minor abrasions on right front flipper, released 0.4 km (0.25 mi) offshore
35592	Male	84	100	Healthy, no abrasions, released down coast from DCPP
36308	Male	69	50 - 75	Healthy, minor scrapes on the rear of the shell, released 0.4-1.2 km (0.25-0.75 mi) southwest of DCPP
36395	Male	68	40	Healthy, small scrapes on top of shell and minor abrasions on front flippers. Released 0.8-1.2 km (0.5-0.75 mi) southwest of DCPP
36631	Unknown	52	20	Healthy, minor abrasions around edge of shell and on right front flipper. Released 0.8 km (0.5 mi) southwest of DCPP
36948	Unknown	47	14	Healthy, minor abrasions on sides and front of head, and on ends of front flippers. Released 0.8 km (0.5 mi) southwest of DCPP.

Types and frequency of takes include:

Harassment: Sea turtles enter the intake structure as described above and are discovered by DCPP personnel between the curtain wall and bar rack. Divers then dive under the curtain wall, wrap the turtle in a kelp net or other large net, which is used to lift the animal out of the water, where it is inspected. If the animal is healthy and not seriously injured, it is released to the ocean. None of the turtles recovered at DCPP have been tagged.

Injury: None of the turtles recovered from the DCPP intake structure had visible serious injuries. Although many had minor abrasions on the shell, head or flippers, none had what appeared to be fresh wounds. It is likely that the observed abrasions were existing conditions prior to entering the DCPP intake structure, but there is a potential for injury to occur within the intake structure. If a seriously-injured animal were discovered, it would be transferred to an appropriate veterinary care facility for treatment and subsequent release.

Death: None of the seven turtles recovered from the DCPP intake structure were dead.

Other Potential Impacts

DCCP uses periodic chlorine/bromine treatments to help minimize biofouling of the CWS. Heat treatments are no longer performed at DCPP. The treatment uses Acti-Brom (a sodium bromide solution with an added biodispersant) in combination with sodium hypochlorite to control settlement and growth of biofouling organisms. The program consists of six daily 20-minute injections (at four-hour intervals) of a 1:1 molar ratio blend of Acti-Brom and sodium hypochlorite to all four of DCPP's intake conduits. Each injection attempts to achieve a target concentration of 200 ppb TRO when measured at the inlet waterbox of the condenser. Discharge TRO, measured at the plant outfall, remains below NPDES limitation of 200 ppb and typically is between 20 and 60 ppb.

These concentrations of residual chlorine are typical of intake systems for electric power plants, and are deemed by the 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 ppb. For comparison, chlorine concentrations in swimming pools are normally maintained between 1000 and 3000 ppb. In any case, these residual chlorine levels are many times greater than those that result from operation of DCPP.

The heated discharge probably does not affect turtle habitat or behavior. Typically, the monthly average increase in surface water temperature is less than 16 EC (3 EF) beyond 300 m (1000 ft) of the discharge. This heated discharge does not extend to the intake structure and, therefore, does not modify sea turtle behavior near the intake. Although it is possible that sea turtles would be attracted to the warm water discharge, no observation of sea turtles frequenting the discharge area have been reported.

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.

Entrapment at the DCPP facility averages less than one turtle per year (maximum of two in 1997 and 1999). There have been at least six years since 1994 when there were no sea turtles found in the intake system, and the plant operated for approximately nine years before the first turtle was found. All turtles were released unharmed; therefore, DCPP operations has not contributed to the overall mortality of this species. Although it is difficult to determine the average number of takes from all sources, the number of turtles harassed at DCPP 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 significantly affect the overall annual mortality of sea turtles.

8 MANAGEMENT AND MITIGATION ACTIONS

As mentioned previously, all seven green turtles that have entered the DCPP intake systems were found alive and healthy. DCPP has developed and implemented procedures to rescue these animals and return them to the ocean unharmed when possible. Once a sea turtle is recovered from the intake structure, 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. If any animals are discovered that are malnourished or have visible injuries, they would be transported to an appropriate animal care facility, or would be cared for onsite by animal care facility personnel before being released back to the ocean.

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

- Operations personnel check the area between the bar racks and the curtain wall on their daily rounds.
- The intake maintenance personnel maintain nets for use in capture and removal of sea turtles.
- Divers are available as needed to assist with moving the turtles into the nets for removal.
- On-site biologists assist in turtle identification, rescue, handling, and release.
- Signs have been posted at the intake structure instructing personnel to report any observations of sea turtles immediately to the plant's environmental group so that rescues can be quickly effected.

Sea turtle monitoring at DCPP consists of an in-plant program to detect and report the presence of sea turtles in the intake structure. Daily visual inspections of the water surface between the bar racks and the curtain wall are conducted by DCPP operators and/or biologists. Signs are posted at the intake to encourage workers to quickly report any sightings of animals in the intake structure.

If any sea turtle carcasses are found (which could include individuals that died within the intake structure, those that died from natural causes, or were injured or killed by predators or other parties [i.e. boat collisions, fishing vessels] prior to entering the intake), they would be documented as to species, size, and visible injuries. They would either be delivered to NOAA Fisheries (at their request) or disposed of in an appropriate manner following guidance from NOAA Fisheries. Full reports of all sea turtles found at DCPP are reported to NOAA Fisheries, Southwest Division and the NRC as they occur.

Live sea turtles found in the intake structure would continue to be inspected for obvious injury. Non-injured animals or those with minor abrasions would be promptly released near the power plant, while those requiring veterinary care would be transferred to an animal care facility or cared for on site. The physical condition and mode of release would be documented and forwarded on to NOAA Fisheries, Southwest Division. Sea turtles are not currently tagged at DCPP, but site personnel could be trained by NOAA Fisheries in tagging procedures if desired.

Options to reduce sea turtle encounters at DCPP were discussed at a meeting held in July 2001. Representatives from MBC Applied Environmental Sciences (biological consultant to PG&E) 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 plant operations or increasing the potential for attracting and entraining pinnipeds or sea otters.

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). Many of the proposed technologies that are possible at other coastal power plants would be physically impossible to implement at DCPP because of the shoreline intake structure; others would be unlikely to be sufficiently beneficial. The design of DCPP's intake structure and shoreline discharge already minimizes the potential incidental takes of sea turtles and effectively reduces the potential for an impact to the sea turtle populations due to DCPP operations.

9 IMPACTS TO OTHER LISTED SPECIES

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

Whales - Whales of several different species are occasionally seen in the vicinity of DCPP, including the area within Diablo Cove. However, most of the species listed in Table 1 are not 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 0.5 knot) is considerably less than the typical whale swim speed of 4-6 knots so they would be unlikely to be impinged on the bar racks. Additionally, the whales would need to navigate between the breakwaters to enter the intake cove before being influenced by the intake flow. 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 (about 140 km [90 miles] south of DCPP) and San Nicolas Islands. Some animals were observed on San Clemente Island in 1991 (NOAA 2004). Guadalupe fur seals have not been recently observed in the vicinity of Diablo Canyon and therefore are not likely to be affected by plant operations. Other pinnipeds (harbor seals and California sea lions) reside in the intake cove and regularly interact with the intake structure without apparent harm. It is likely that if a Guadalupe fur seal were to enter the vicinity of DCPP, it would not be adversely affected.

Steller sea lion - Although the historic range of Steller sea lions includes the entire California coastline, they have not been observed in the vicinity of the DCPP. The southernmost active rookery is at Año Nuevo Island, north of Santa Cruz (NOAA 1992, 1997) and approximately 240 km (150 miles) northwest of DCPP. A population on San Miguel Island, approximately 140 km (90 miles) south of DCPP, disappeared in 1983. Steller sea lions are not known to exist in the vicinity of DCPP and, therefore, are not likely to be affected by plant operations. It is likely that if a Steller sea lion were to enter the vicinity of DCPP, it would not be adversely affected.

Table 3. Technologies and methods evaluated to deter sea turtles, pinnipeds, and fissipeds from power plant intake structures	
Technology / Method	**Evaluation Conclusions**
Bubble curtain around the intake	Unlikely to deter turtles, and may attract pinnipeds and fissipeds
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 fissipeds and reduce cooling 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 and fissipeds
Bars or cage around intake structure with small spacing so that large animals could not enter	Danger of clogging presents safety concerns at offshore intakes. However, at DCPP the intake is already fitted with 7.62-cm (3-in.) vertical bars that effectively exclude sea turtles from entering the plant.

Southern California and South-Central Coast Steelhead - According to an environmental report prepared for a proposed Independent Spent Fuel Storage Installation at the Diablo Canyon site (PG&E 2001), the occurrence of sea-run rainbow trout (steelhead) has not been verified on the Diablo Canyon site. Populations of resident rainbow trout have been documented to occur within Diablo Creek. Individuals may variously exhibit anadromy (meaning they migrate as juveniles from freshwater to the ocean, then return to spawn in freshwater) or freshwater residency. The relationship between these two life forms is poorly understood, and it is not known with what frequency individuals that exhibit one life form (anadromy vs. fresh water residency) may cross over to assume the other mode.

Diablo Creek is probably not accessible to upstream-migrating steelhead due to migration barriers located near the mouth of the stream. While these barriers probably would not prevent downstream migrants from reaching the sea, they do not facilitate completion of the anadromous life cycle. Resident rainbow trout are able to spawn, rear, and forage in the various riffle, pool, and run habitats afforded by the stream.

To date, there have been no observed cases of salmonid entrainment or impingement at DCPP. If steelhead spawning is discovered in Diablo Creek, the effects of plant operations on this species may need to be reassessed.

10 CONCLUSIONS

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

Table 4. Conclusions regarding potential impacts of continued DCPP 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
Steelhead (Southern California and South-Central Coast stocks)	*Oncorhynchus mykiss*	No effect

The "is likely to adversely affect" conclusions for the four species of sea turtles are made based on the fact that green turtles are occasionally entrapped in the cooling system, and are thus "taken," and because this entrapment could be injurious to the affected turtles. Because all taken turtles have been released alive and healthy, the NRC staff believes that although individuals may be affected, continued operation of the DCPP CWS would not have an adverse effect on the overall population of 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 DCPP to further reduce the number of sea turtles taken at the facility.

Estimated Take Levels

It is assumed that occasional takes of sea turtles would continue at the DCPP site. Variability in the rate of turtle entrapment at DCPP is considered to be primarily a function of 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 California are not available, and their relatively small populations and wide-ranging, pelagic distributions make abundance 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 (PG&E 2002), PG&E estimated the maximum take levels for each species, based on both the maximum historical takes at DCPP and assumed increased numbers of turtles as populations of these species recover. Based on those estimates, the NRC proposes that the maximum 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, DCPP 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 plant operations and evaluate mitigation options.

Table 5. Proposed maximum number of sea turtle takes

Common Name	**Species**	**Maximum Take Per Calendar Year**
Green turtle	*Chelonia mydas*	four individuals
Loggerhead turtle	*Caretta caretta*	two individuals
Leatherback turtle	*Dermochelys coriacea*	one individual
Olive ridley turtle	*Lepidochelys olivacea*	one individual

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