UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

April 22, 2025

Refer to NMFS NO:
WCRO – 2024-02902

Briana Arlene
ESA Consultation Coordinator Environmental
Technical Review Branch 1
Division of Rulemaking, Environment, and Financial Support Office
of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson–Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Diablo Canyon Power Plant, Units 1 and 2, Proposed License Renewal in San Luis Obispo County, California (Docket Numbers: 50-275 and 50-323)

Dear Briana Arlene:

Thank you for your letter of October 30, 2024, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Nuclear Regulatory Commission's (NRC) proposed license renewal for the Diablo Canyon Nuclear Power Plant (DCNPP), Units 1 and 2, in San Luis Obispo County, California. Renewal of the facility operating licenses would allow the applicant, Pacific Gas and Electric Company (PG&E) to continue to operate Unit 1 until November 2044 and Unit 2 until August 2045. Thank you also for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1855(b)) for this action.

This document transmits NMFS' final biological opinion based on the NMFS West Coast Region (WCR)'s review of the proposed action and its effects on ESA-listed species and designated critical habitat in accordance with Section 7 of the ESA. This response also includes our EFH consultation based on the NMFS WCR's review of the potential effects on EFH in accordance with Section 305(b) of the MSA, implementing regulations at 50 CFR 600.920, and agency guidance for use of the ESA consultation process to complete EFH consultation.

This opinion and EFH consultation consider the potential effects of continued operations of the DCNPP on several ESA-listed species, designated critical habitat, and EFH that occur within marine waters along the coast of Diablo Canyon. The information used in the development of this opinion and EFH consultation came from the Draft Supplemental Environmental Impact Statement (DSEIS) prepared by the NRC, along with additional supporting documents provided by NRC and PG&E, and review of available scientific literature on pertinent subjects by NMFS staff. A complete administrative record of this consultation is on file at the NMFS WCR Long Beach Office.

Through the analysis presented in this opinion, we have determined that the intake of ocean water and discharge of heated water associated with the DCNPP once-through cooling water system would adversely affect ESA-listed sea turtles, black abalone, and designated critical habitat for black abalone. Based on our analysis, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the following ESA-listed species: East Pacific Distinct Population Segment (DPS) green sea turtles, leatherback sea turtles, North Pacific Ocean DPS loggerhead sea turtles, olive ridley sea turtles, and black abalone. It is also our biological opinion that the proposed action is not likely to destroy or adversely modify designated critical for black abalone.

This opinion also considers "not likely to adversely affect" determinations made by the NRC for the following ESA-listed species and designated critical habitat: Mexico DPS and Central America DPS humpback whales, Western North Pacific DPS gray whales, and designated critical habitat for humpback whales. Based on our analysis, we have concurred with the NRC on these determinations. Through our analysis, we also concluded that designated critical habitat for leatherback sea turtles was not likely to be adversely affected by the proposed action.

This opinion provides Reasonable and Prudent Measures (RPMs) and Terms and Conditions (T&Cs), which are non-discretionary pursuant to Section 7(b)(4) of the ESA. They focus on implementing measures to monitor and rescue ESA-listed sea turtles entrained in the Intake Structure, as well as to monitor discharge temperatures and volumes as a proxy for effects on black abalone and designated critical habitat for black abalone. This opinion also includes discretionary Conservation Recommendations that would contribute to understanding and reducing effects on ESA-listed sea turtles and black abalone.

We also concluded that the proposed action would adversely affect EFH designated under the Pacific Coast Groundfish, Coastal Pelagic Species, and Highly Migratory Species Fishery Management Plans due to effects associated with the intake of ocean water and discharge of heated water for the DCNPP once-through cooling water system. The proposed action includes measures to minimize many of these adverse effects. Therefore, as long as these measures are implemented, in addition to the measures identified in the RPMs and T&Cs of the opinion, we did not recommend any additional measures to avoid or minimize the adverse effects on EFH.

Please contact Susan Wang (Susan.Wang@noaa.gov) if you have any questions concerning this consultation, or if you require additional information

Sincerely,

Chris E. Yates
Assistant Regional Administrator for
Protected Resources

Enclosure

cc: Administrative File: 151422WCR2025PR00058

Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson–Stevens Fishery Conservation and Management Act Essential Fish Habitat Response

License Renewal for Diablo Canyon Nuclear Power Plant, Units 1 and 2, in San Luis Obispo County, California

NMFS Consultation Number: WCRO-2024-02902

Action Agency: U.S. Nuclear Regulatory Commission

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	If likely to adversely affect, Is Action Likely to Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	If likely to adversely affect, is Action Likely to Destroy or Adversely Modify Critical Habitat?
Green turtle, East Pacific DPS (*Chelonia mydas*)	Threatened	Yes	No	NA	NA
Leatherback turtle (*Dermochelys coriacea*)	Endangered	Yes	No	No	NA
Loggerhead turtle, North Pacific DPS (*Caretta caretta*)	Endangered	Yes	No	NA	NA
Olive Ridley turtle (*Lepidochelys olivacea*), Mexico's Pacific Coast breeding population	Endangered	Yes	No	NA	NA
Olive Ridley sea turtle (*Lepidochelys olivacea*), all other populations	Threatened	Yes	No	NA	NA
Black abalone (*Haliotis cracherodii*)	Endangered	Yes	No	Yes	No
Gray whale, Western North Pacific DPS (*Eschrichtius robustus*)	Endangered	No	NA	NA	NA
Humpback whale, Central America DPS (*Megaptera novaeangliae*)	Endangered	No	NA	No	NA
Humpback whale, Mexico DPS (*Megaptera novaeangliae*)	Threatened	No	NA	No	NA

Fishery Management Plan That Identifies EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Coastal Pelagic Species	Yes	No
Highly Migratory Species	Yes	No
Pacific Coast Groundfish	Yes	No

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By: ______________________________

Chris E. Yates
Assistant Regional Administrator for Protected Resources

Date: *April 22, 2025*

TABLE OF CONTENTS

TABLE OF FIGURES

TABLE OF TABLES

Acronyms

CCRWQCB	Central Coast Regional Water Quality Control Board
CPS	Coastal pelagic species
CSTSN	California Sea Turtle Stranding Network
CWP	Circulating water pump
DCNPP	Diablo Canyon Nuclear Power Plant
DDE	Dichlorodiphenyldichloroethene
DNQ	Detected but not quantified
DPS	Distinct Population Segment
DQA	Data Quality Act
DSEIS	Draft Supplemental Environmental Impact Statement
EFH	Essential Fish Habitat
EPO	Eastern Pacific Ocean
ESA	Endangered Species Act
FMP	Fishery Management Plan
HAB	Harmful algal bloom
HAPC	Habitat areas of particular concern
HMS	Highly migratory species
ISFSI	Independent Spent Fuel Storage Installation
ITS	Incidental take statement
MARINe	Multi-agency Rocky Intertidal Network
MGD	Million gallons per day
MLLW	Mean lower low water
MSA	Magnuson-Stevens Fishery Conservation and Management Act
ND	Non-detect
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
PBF	Physical or biological features
PCB	Polychlorinated biphenyls
PCE	Primary constituent element
PG&E	Pacific Gas and Electric Company
PRD	Protected Resources Division
RPM	Reasonable and prudent measures
RWMP	Receiving water monitoring program
SCB	Southern California Bight
SWRCB	State Water Resources Control Board
SWRO	Seawater reverse osmosis
T&C	Terms and conditions
TSS	Traffic separation schemes
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
WCR	West Coast Region
WNP	Western North Pacific

1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3, below.

1.1. Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.), as amended, and implementing regulations at 50 CFR part 402.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson–Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR part 600.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within 2 weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the NMFS West Coast Region (WCR) Long Beach Office.

1.2. Consultation History

On May 20, 2016, the NMFS WCR received a request from the U.S. Nuclear Regulatory Commission (NRC) for a current list of endangered and threatened species under the ESA that may occur on or near the Diablo Canyon Nuclear Power Plant (DCNPP), for the NRC's review of an application submitted by the Pacific Gas & Electric Company (PG&E) to renew the operating licenses for DCNPP Units 1 and 2. On June 17, 2016, the NMFS WCR responded with a letter to the NRC identifying ESA-listed species and designated critical habitat that may occur in the general area surrounding the DCNPP.

On June 23, 2016, the NRC notified NMFS WCR that the NRC's environmental review of PG&E's license renewal application had been put on hold due to PG&E's announcement to shut down the DCNPP at the end of the existing licensing period in 2024 and 2025. Between June 2016 and August 2024, the NRC and PG&E hosted several meetings to discuss and coordinate consultation for both the DCNPP license renewal as well as decommissioning. The NMFS WCR and several other agencies participated in these meetings, including the U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service (USFWS), and the California Department of Fish and Wildlife.

On November 7, 2023, PG&E submitted a license renewal application for the DCNPP, which the NRC accepted on December 19, 2023. In August 2024, the NRC notified the agencies, including the NMFS WCR, that the NRC planned to conduct their environmental review and make a decision on PG&E's license renewal application by mid-2025. Thus, the consultation for DCNPP license renewal would be requested separately from the consultation for DCNPP decommissioning (which has not been initiated as of the date of this opinion). On August 23, 2024, the NRC provided an overview of the license renewal process. The NRC also provided draft sections of their draft Supplemental Environmental Impact Statement (DSEIS) to NMFS WCR for review. The NMFS WCR provided comments on the draft analysis of effects on ESA-listed species and critical habitat.

On November 4, 2024, the NMFS WCR received a letter from the NRC requesting formal consultation under Section 7 of the ESA for the proposed renewal of the DCNPP facility operating licenses for an additional 20 years. The NRC provided their DSEIS (NRC, 2024a), published on October 25, 2024, and publicly available at the following link: https://www.nrc.gov/docs/ML2429/ML24299A167.pdf.

On November 19, 2024, NMFS WCR staff met with NRC and PG&E staff for a site visit at the DCNPP. On December 11, 2024, NMFS WCR requested additional information needed from the NRC to initiate the ESA and EFH consultations. NMFS WCR provided specific comments on the NRC's analysis of effects on ESA-listed resources and requested additional information about the proposed action, the discharge effluent quality, and the presence and use of the action area by ESA-listed species. In addition, based on preliminary assessment of the proposed action and the information provided, NMFS notified the NRC that NMFS likely would not be able to concur with the NRC's determination that the license renewals for continued operation of the DCNPP would not adversely affect black abalone and designated critical habitat for black abalone.

On December 13, 2024, NMFS WCR staff met with NRC and PG&E staff to discuss NMFS' request for additional information and preliminary responses. On December 17, 2024, NMFS WCR received the NRC's responses to NMFS' request for additional information (NRC, 2024b). After reviewing all of the information provided, we determined that the NRC satisfied the requirements for initiating formal consultation under 50 CFR part 402.14(c), and initiated formal consultation on December 17, 2024.

NMFS WCR and the NRC had several communications, including conference calls on January 15 and January 23, 2025, to discuss the effects determinations for black abalone and designated critical habitat for black abalone. Through these conversations, NMFS and the NRC agreed that formal consultation was needed for black abalone and designated critical habitat for black abalone.

The NRC also requested that a draft of the ITS be made available for their review and discussion prior to finalizing. On April 7, 2025, we transmitted a copy of the draft ITS to review and discuss any Reasonable and Prudent Measures and associated Terms and Conditions, as provided by 50 CFR Section 402.14(g). On April 9, 2025, the NRC requested a minor clarification to the Terms and Conditions. We considered and incorporated the NRC's comment on the ITS.

Updates to the regulations governing interagency consultation (50 CFR part 402) were effective on May 6, 2024 (89 FR 24268). We are applying the updated regulations to this consultation. The 2024 regulatory changes, like those from 2019, were intended to improve and clarify the consultation process, and, with one exception from 2024 (offsetting reasonable and prudent measures), were not intended to result in changes to the Services' existing practice in implementing section 7(a)(2) of the Act (89 Fed. Reg. at 24268; 84 Fed. Reg. at 45015). We have considered the prior rules and affirm that the substantive analysis and conclusions articulated in this biological opinion and incidental take statement would not have been any different under the 2019 regulations or pre-2019 regulations.

1.3. Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies (see 50 CFR 402.02). Under the MSA, "federal action" means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a federal agency (see 50 CFR 600.910).

The proposed action is the NRC's decision to renew the facility operating licenses for DCNPP Units 1 and 2 for an additional 20 years. The Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.), specifies that licenses for commercial nuclear power reactors can be granted for up to 40 years. The NRC regulations at 10 CFR Part 54 (Requirements for Renewal of Operating Licenses for Nuclear Power Plants) allow the NRC to renew these licenses for terms of up to an additional 20 years.

The NRC issued the existing permits for DCNPP Units 1 and 2 (DPR-80 and DPR-82) in 1984 and 1985, with expiration dates in November 2024 and August 2025. Because PG&E submitted their license renewal application before NRC's specified deadline, the existing licenses will not be considered expired until the NRC completes its review and makes a final decision on whether to renew the licenses. License renewal would allow PG&E to continue to operate DCNPP Units 1 and 2 until November 2044 and August 2045, respectively.

The NRC states that the purpose and need for the proposed action is to preserve an option to meet future system power generating needs, as determined by State, utility, system, and Federal decision-makers. The NRC states that its role is simply to decide whether to renew the operating licenses, based on findings in its safety and environmental review. Once licenses are renewed, the decision to continue DCNPP operations is made by the power plant owners, State regulators, system operators, and, in some cases, other Federal agencies.

Given this, we considered, under the ESA, whether or not the proposed action (NRC's decision to renew the operating licenses) would cause any other activities, and determined that it would cause continued operation of DCNPP Units 1 and 2 for up to an additional 20 years. Continued operation of DCNPP Units 1 and 2 is a consequence caused by the proposed action because it would not occur but for the proposed action, and is reasonably certain to occur.

PG&E expects DCNPP operations over the next 20 years under the renewed licenses to be the same as, or similar to, operations during the current license term. In the following subsections, we describe the activities involved in continued operation of DCNPP Units 1 and 2, taken largely from the NRC's DSEIS (NRC, 2024a). In Section 2.5 (Effects of the Action), we analyze the effects of these activities on ESA-listed resources.

1.3.1. DCNPP Facility and Operations

DCNPP is a dual-unit nuclear power plant located on the coast in San Luis Obispo County, California. The NRC issued the operating licenses on November 2, 1984 for DCNPP Unit 1 and on August 26, 1985 for DCNPP Unit 2. Commercial operation began in May 1985 (Unit 1) and March 1986 (Unit 2). The DCNPP facility consists of several structures, including two reactor buildings, a turbine building, storage tanks, a cooling water intake structure, and a discharge structure (Figure 1).

DCNPP Units 1 and 2 each have independent nuclear reactor systems and once-through cooling systems, but use the same intake and discharge structures. The DCNPP once-through (open-cycle) cooling water intake systems withdraw water from the Pacific Ocean through a shoreline intake structure (in Intake Cove) and discharge heated water back to the Pacific Ocean at a separate shoreline location (Diablo Cove). The intake system supplies water to the nuclear reactor systems for condenser cooling as well as to a desalination system to produce the majority of the facility's freshwater. On average, approximately 2.5 billion gallons (9.5 billion liters) of seawater are circulated through the once-through cooling system and discharged into Diablo Cove per day.

PG&E uses liquid, gaseous, and solid waste processing systems to collect and treat, as needed, radioactive materials produced as a byproduct of operations. PG&E stores spent fuel in a spent fuel pool and an Independent Spent Fuel Storage Installation (ISFSI).

Figure 1. Layout of the Diablo Canyon Nuclear Power Plant Facilities (Figure 2-1 from NRC's 2024 DSEIS).

1.3.1.1 Once-Through Cooling Water Intake System

The DCNPP Intake Structure is located in Intake Cove, a human-made cove created by breakwater structures designed to reduce the effects of wave action. The Intake Structure (Figure 2) is approximately 240 ft (43 m) long and 104 ft (32 m) wide; consisting of four circulating water pumps (CWPs) and associated inlet bays, four auxiliary service water pumps and two associated partitioned inlet bays, 14 individual vertical traveling screen wash systems, 14 bar rack units installed in front of each traveling screen inlet passage, and two bar rack units at the end of the intake structure to serve as a fish escape route. The Intake Structure is flat-faced with all bar racks, dewatering gates, and traveling screen systems installed parallel to shore and perpendicular to the inlet flow.

Each of the four CWPs draws water from an isolated pump bay. Each pump bay is open to the ocean through three individually gated 11 ft (3.4 m) wide rectangular passages leading through 10 ft (3 m) wide perpendicular vertical traveling screens. The isolation gates can be closed and sealed, and each bay can be dewatered for maintenance or inspection activities, independent of the other bays.

The auxiliary saltwater system provides cooling and heat absorption during normal operations and emergency conditions (Figure 2). There are two auxiliary service water pumps for each unit. Each pump is serviced by a single 6 ft (1.8 m) wide rectangular concrete passage leading through 5 ft (1.5 m) wide perpendicular vertical traveling screens. Each auxiliary saltwater pump is capable of pumping 11,500 gallons per minute (gpm). During regular plant operations, only one auxiliary pump is in use, while the other remains on standby.

The Intake Structure is designed to exclude organisms from becoming impinged or entrained, for example, with the use of bar racks and traveling screens (Figure 3). Cut-outs between the closure gate forebays and bar rack bays at each end of the structure provide a migration route by which fish can escape and avoid impingement. The approach velocity into the mouth of the Intake Structure (between the curtain wall and concrete floor) is approximately 0.8 feet per second (fps) (0.2 m/s) (NRC, 2024a). The intake velocity at the bar racks is approximately 1.1 fps (0.3 m/s) and at the traveling screens is approximately 1.8 to 2.3 fps (0.5 to 0.7 m/s) (NRC, 2024a).

The DCNPP Intake Structure has a maximum design volume of 9.58 million cubic meters per day (2,530 million gallons per day, or MGD). From 2018-2023, the average annual water withdrawal was 2,300 MGD, equating to 830 billion gallons per year. The minimum annual water withdrawal was 755 billion gallons per year in 2019 and the maximum annual water withdrawal was 858 billion gallons per year in 2021.

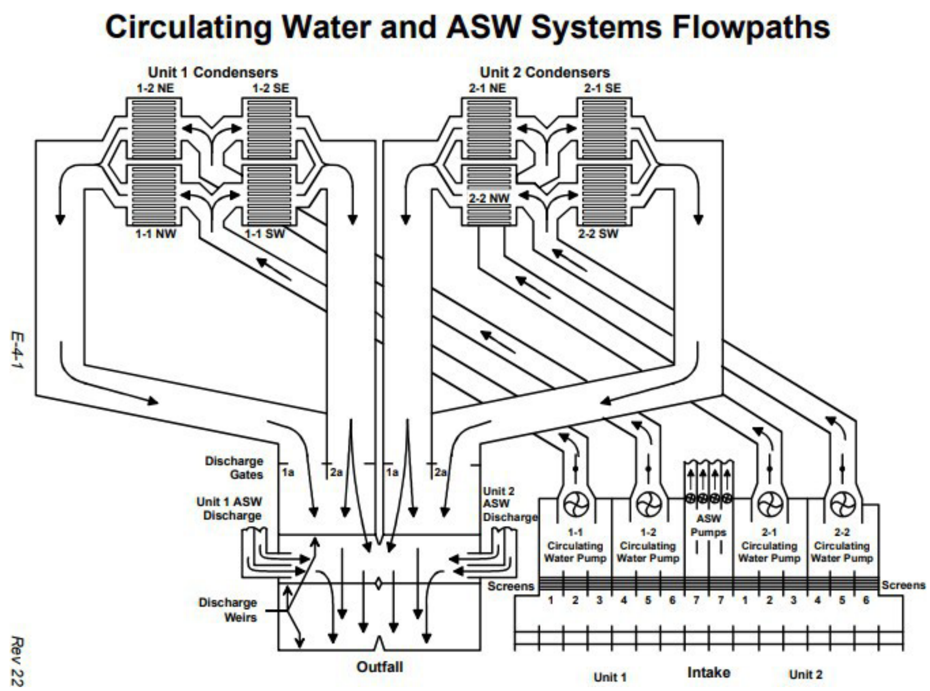

Figure 2. Diagram of Circulating Water and Auxiliary Saltwater (ASW) Systems for the DCNPP (provided by PG&E, 2024).

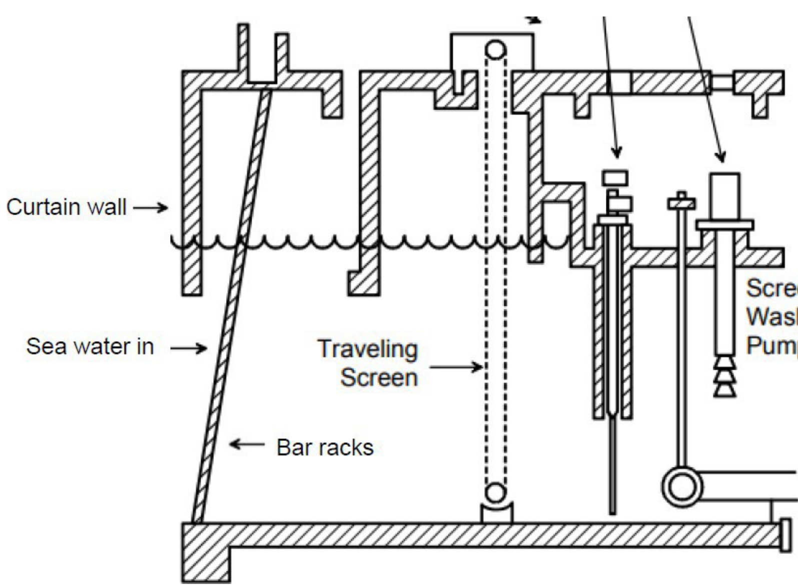

Figure 3. Profile image of DCNPP Intake Structure (from PG&E, 2024).

1.3.1.2 Once-Through Cooling Discharge System

The DCNPP Discharge Structure is located in Diablo Cove, consisting of a shoreline outfall that discharges heated water (thermal effluent) directly into the cove. Heated water (thermal effluent) from Units 1 and 2 flow by gravity from the turbine building into the outfall structure, where the water passes over three weirs and across horizontal platforms fitted with vertical impact blocks. The design causes a cascading effect to mix the thermal effluent from the two units as well as dissipate heat and hydraulic energy, to limit discharge velocities and erosion. The Discharge Structure has two openings, one per unit. Each opening is 27.5 ft (8.4 m) per unit, for a total width of 55 ft (16.8 m) at the mouth of the Discharge Structure.

Once discharged, the thermal effluent mixes with the receiving water in Diablo Cove. The immediate receiving water area is shallow, with a depth of less than 10 ft (3m) below mean lower low water (MLLW). Depending on the tide, the discharge plume is oriented northward toward Diablo Rock (low tide) or southward toward the south channel of the cove (high tide). Deeper portions of the cove below approximately 26 ft (8m) MLLW are typically below the main influence of the discharge plume and show little to no increase in temperature (PG&E, 2023).

The National Pollutant Discharge Elimination System (NPDES) permit for DCNPP (Order No. 90-09, NPDES No. CA0003751, issued by the Central Coast Regional Water Quality Control Board, or CCRWQCB) limits the daily average discharge temperature to no more than 22˚F (12.2˚C) above the daily average intake water temperature, except during heat treatment for de-musseling. During heat treatment, the daily average discharge temperature is limited to no more than 25˚F (13.9˚C) above the daily average intake water temperature, and the maximum discharge temperature must be less than 50˚F (27.8˚C) above the intake water temperature. The duration of maximum temperature during heat treatment must not exceed one hour during any 24-hour period. The NPDES permit also states that the discharge shall not cause degradation of marine communities.

Monitoring reports indicate that DCNPP discharge temperatures are in compliance with the NPDES permit requirements. At full power, the condenser cooling process increases the cooling water temperatures by approximately 20˚F (11˚C). The daily average discharge temperature is 19.6˚F (10.9˚C) above the daily average intake temperature.

The NPDES permit establishes a maximum discharge rate of 2,760 MGD for the discharge into Diablo Cove. It also establishes instantaneous maximum, daily maximum, and 6-month median concentration limits for the following constituents: arsenic, cadmium, hexavalent chromium, copper, lead, mercury, nickel, silver, zinc, cyanide, total residual chlorine, ammonia, toxicity, non-chlorinated phenolic compounds, chlorinated phenolics, and radioactivity. From 2018-2022, there have not been any limit violations associated with DCNPP wastewater discharges.

1.3.1.3 Desalination Treatment System

DCNPP has a seawater reverse osmosis (SWRO) desalination treatment system to supply the majority of the facility's freshwater for the primary and second systems' makeup, fire protection system, and domestic water system supply. The desalination system receives seawater from DCNPP's once-through cooling water intake system as well as from groundwater. The DCNPP SWRO system has the capacity to produce 450 gpm (1,703 liters per minute, or lpm) of freshwater. The freshwater is stored in two reservoirs, each with a capacity of 2.5 million gallons

(9.5 million liters). Brine produced by the DCNPP SWRO system is typically discharged into the auxiliary saltwater system where it mixes and is diluted with cooling water prior to discharge through the Discharge Structure into Diablo Cove (NRC, 2024b). The volume of the brine produced is typically less than 5 percent of the total volume of seawater discharged per day (NRC, 2024b).

1.3.1.4 Chemical Treatment System

DCNPP uses a chlorination system (as needed) to treat circulating water and control fouling in the intake tunnels, piping, and condenser tubes. Liquid sodium hypochlorite and a supplemental chemical, sodium bromide, are stored in tanks at the Intake Structure; each storage tank is contained within a secondary containment tank. When chlorination is required, the chemicals are injected via metering pumps into the Intake Structure. Sodium bisulfite may be injected into the cooling water system at the seawater main condenser to neutralize residual chlorine prior to discharge to maintain residual chlorine below the discharge limits established in the NPDES permit.

1.3.2. DCNPP Aquatic Studies, Monitoring, and Assessments

PG&E conducts ecological studies and monitoring programs in the area surrounding DCNPP. These include:

- Impingement studies (1985-1986)
- Entrainment studies (1996-1999 and 2008-2009)
- Alternative cooling technologies assessment (2012 and 2014)
- Intake Cove bathymetry surveys (2019, 2021, 2023)
- Marine biological resources assessment (2020)
- Ongoing receiving water monitoring program (RWMP)

Below, we describe the impingement and entrainment studies and the RWMP in more detail. We also describe PG&E’s monitoring of the Intake Structure to rescue and release any entrained sea turtles observed.

Impingement studies

Tenera (1988) conducted an impingement study at DCNPP from April 1985 to March 1986. The study concluded that the cooling water intake system rarely impinged adult fish and shellfish. PG&E (2009) estimated a loss of 19 fish per day or approximately 2.5 lbs (1.13 kg) of fish and shellfish per day due to impingement during full flow intake operations. This equates to approximately 7,000 individual fish/shellfish or a maximum of 900 to 1,200 lbs (408 – 544 kg) of fish/shellfish per year. Steinbeck (2008) compared the rate of impingement at DCNPP with those of other power plants in California, and found that DCNPP had the lowest impingement rate of all the plants that use the Pacific Ocean as a source of cooling water.

Entrainment studies

Tenera conducted two entrainment studies at DCNPP, from October 1996 to June 1999 (Tenera, 2000) and from July 2008 to June 2009 (NRC, 2024a). In 1996-1999, the estimated annual average number of larval fish entrained per year ranged from 1.48 to 1.77 billion, or about 11 percent of the larval population in the source water body (PG&E, 2009). In 2008-2009, the estimates nearly doubled, primarily due to increased entrainment of a few species (PG&E, 2024a). Nearshore fish and larvae that inhabit intertidal habitat were more likely to be entrained than offshore fish and larvae. PG&E (2024a) concluded that, despite higher estimated annual larval entrainment for some species, the estimated adult equivalent loss was low. PG&E (2009) concluded that entrainment in the DCNPP Intake Structure has not had significant impacts on fish populations, based on monitoring data indicating no declines in adult fish populations around Diablo Canyon over the 30 year monitoring period.

Ongoing receiving water monitoring program (RWMP)

PG&E has conducted thermal and biological monitoring studies in the action area since 1976, before DCNPP began operations. Originally referred to as the thermal effluent monitoring program, the studies are now conducted under the Receiving Water Monitoring Program (RWMP) required by the NPDES permit. The purpose of the RWMP is to assess the effects of the DCNPP discharge on the receiving water quality and aquatic environment. The program consists of continuous intertidal and subtidal temperature monitoring along the Diablo Canyon coastline, as well as quarterly intertidal and subtidal assessments of algae, invertebrates (including black abalone), and fish in Diablo Cove, Field's Cove, and reference sites north and south of Diablo Cove. Since 1983, PG&E has submitted annual RWMP reports to the CCRWQCB.

Intake Structure Monitoring and Sea Turtle Rescues

Since DCNPP operations began in 1985, PG&E has implemented procedures to detect and rescue sea turtles entrained in the DCNPP Intake Structure and release them unharmed when possible (NRC, 2024a, 2005). PG&E personnel conduct daily visual inspections of the area between the curtain wall and the bar racks. If a sea turtle is observed in the Intake Structure, on-site biologists conduct rescue procedures, using nets, platforms, and other equipment to lift the sea turtle out of the water. Once removed from the Intake Structure, biologists assess the sea turtle's health and physical characteristics. Individuals needing veterinary care are transported to an appropriate animal care facility. Healthy individuals (non-injured animals and those with minor scrapes or abrasions) are released back to the ocean. If dead sea turtle carcasses are found, they are documented, reported, and either delivered to NMFS or disposed of in an appropriate manner following NMFS guidance. Since 2006, PG&E personnel have received training on safe handling and release techniques to minimize stress to sea turtles, as well as training on resuscitation methods (NMFS, 2006). PG&E completes and submits a Stranding Report Form to NMFS and to the NRC for each entrained sea turtle.

2. Endangered Species Act: Biological Opinion And Incidental Take Statement

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species or to adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, federal action agencies consult with NMFS. Section 7(b)(3) requires that, at the conclusion of consultation, NMFS provide an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

The NRC determined the proposed action is likely to adversely affect green sea turtles (East Pacific DPS), leatherback sea turtles, loggerhead sea turtles (North Pacific DPS), olive ridley sea turtles, black abalone, and designated critical habitat for black abalone. This biological opinion analyzes the effects of the proposed action on these ESA-listed species and critical habitat.

The NRC also determined the proposed action is not likely to adversely affect gray whales (Western North Pacific DPS), humpback whales (Central America DPS and Mexico DPS), and designated critical habitat for humpback whales. Our concurrence is documented in the "Not Likely to Adversely Affect" Determinations section (Section 2.12). Through our analysis, we also concluded that the proposed action may affect but is not likely to adversely affect designated critical habitat for leatherback sea turtles.

2.1. Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This biological opinion also relies on the regulatory definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR 402.02).

The designation of critical habitat for black abalone uses the term primary constituent element (PCE) or essential features. The 2016 final rule (81 FR 7414; February 11, 2016) that revised the critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The ESA Section 7 implementing regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the final rule revising the definition and adding this term (84 FR 44976, 44977; August 27, 2019), that revision does not change the scope of our analysis, and, in this opinion, we use the terms "effects" and "consequences" interchangeably.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.
- Evaluate the environmental baseline of the species and critical habitat.
- Evaluate the effects of the proposed action on species and their critical habitat using an exposure–response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) directly or indirectly reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species; or (2) directly or indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.2. Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that is likely to be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' "reproduction, numbers, or distribution" for the jeopardy analysis. The opinion also examines the condition of designated critical habitat, evaluates the conservation value of the various coastal and marine environments that make up the designated critical habitat, and discusses the function of the PBFs that are essential for the species' conservation.

2.2.1. Sea Turtles

2.2.1.1 Green Sea Turtles, East Pacific DPS

Green sea turtles (*Chelonia mydas*) were first listed under the ESA in 1978. In 2016, the listing for this species was divided into 11 DPSs worldwide, with three DPSs listed as endangered and eight DPSs listed as threatened (81 FR 20057). The East Pacific DPS that occurs within the action area is listed as threatened. NMFS and the USFWS have proposed to designate waters in Southern California as critical habitat for East Pacific DPS green turtles (88 FR 46572, July 7, 2023). The proposed critical habitat designation does not include the action area.

Green sea turtles in the eastern Pacific Ocean (EPO) are migratory as adults, conducting reproductive migrations every three years on average between their natal nesting sites and foraging areas (Seminoff et al., 2015). The East Pacific DPS extends from the California/Oregon border (42°N) southward along the Pacific coast of the Americas to central Chile (40°S), but most commonly occur from southern California to northwestern Mexico. East Pacific DPS green turtles originate on nesting beaches along the Pacific coast and offshore islands of the Americas from Baja California to Peru (Seminoff et al., 2015). No East Pacific DPS green turtle nesting is known to occur within U.S. jurisdiction. Green turtles foraging in southern California and along the Pacific coast of Baja California originate primarily from the Islas Revillagigedos (Dutton, 2003) and Michoacán (Dutton et al., 2019). Individuals show fidelity to foraging areas, often returning to the same areas after successive nesting seasons. In neritic foraging areas, green turtles in the EPO are omnivorous, consuming marine algae, seagrass, mangrove parts and invertebrates.

Three resident foraging populations of green sea turtles are known to occur in southern California nearshore waters. South San Diego Bay has been identified as an important foraging area for the East Pacific DPS along the U.S. west coast (Lemons et al., 2011), with a year-round resident population of at least 60 juvenile and adult green turtles (Eguchi et al., 2010). The San Gabriel River and surrounding coastal areas in the vicinity of Long Beach and Seal Beach also have a persistent population of East Pacific DPS green sea turtles (Crear et al., 2016, 2017; Hanna et al., 2020; Lawson et al., 2011; Massey et al., 2023). Seasonal shifts in movement and distribution indicate that green turtles in the San Gabriel River use warm effluent from two power plants as a thermal refuge, although the river sustains juveniles and adults year-round, including in areas upriver from the power plants (Crear et al., 2016, 2017). In addition, a small resident foraging population has been documented at La Jolla Shores (Hanna et al., 2021).

A comprehensive review of the status of and threats to green sea turtles is available in the 2015 Status Review (Seminoff et al., 2015). Green sea turtles found off the U.S. west coast originate from nesting beaches in the eastern Pacific, likely from mainland Mexico and the offshore islands. Information suggests steady increases in nesting at the primary nesting sites in Michoacán, Mexico, in Costa Rica, and in the Galapagos Islands since the 1990s (Senko et al., 2011; Wallace et al., 2010). Colola beach in Michoacán is the most important green turtle nesting area in the eastern Pacific and has the longest time series of monitoring data since 1981. Nesting trends in Colola have continued to increase since 2000. Based on 2022/2023 nesting beach monitoring efforts, approximately 35,000 females nest at Colola beach each season. At Maruata, a secondary nesting beach, researchers estimate there are between 4,000 and 6,000 nesting females (Delgado-Trejo, Instituto de Investigaciones sobre los Recursos Nationale, pers. comm., November 2023). Using an average remigration interval of three years, the total number of female green turtles nesting throughout Michoacán is estimated to be 105,000 (Delgado-Trejo and Bedolla-Ochoa, 2024).

Major threats to East Pacific DPS green turtles include (Seminoff et al., 2015): coastal development (including heavy coastal armoring and subsequent erosion) leading to loss of nesting and foraging habitat; incidental capture by fisheries (commercial and recreational); and the harvest of eggs, sub-adults, and adults. Warming ocean waters may affect green sea turtles by skewing sex ratios (Chan and Liew, 1995; Kaska et al., 2006), increasing embryonic mortality (Matsuzawa et al., 2002), and altering the growth and distribution of seagrasses, a major food source for the species (Duarte, 2002; Short and Neckles, 1999).

Data from the NMFS stranding records indicate green sea turtles entering coastal or inshore areas have been entrained in the cooling water systems of power generating plants. From 1969 through mid-2024, 79 green sea turtle strandings in California were due to entrainment and most were released alive (NMFS SWFSC, unpublished stranding records); this includes the 14 green sea turtles entrained at DCNPP in 1994 to 2023 (NRC, 2024a) (pers. comm. with Briana Arlene, NRC, on January 23, 2025). From 2017 to June 2024, only five green sea turtles have been entrained in power plants, all released alive (NMFS-WCR, unpublished stranding records), including two green sea turtles entrained at DCNPP (one in 2019 and one in 2023) (NRC, 2024a) (pers. comm. with Briana Arlene, NRC, on January 23, 2025).

Important conservation initiatives and advances have benefited the East Pacific DPS, including non-profit organizations and conservation networks whose efforts are raising awareness about sea turtle conservation. Among the notable regional and/or multinational conservation groups and initiatives are the Central American Regional Network for the Conservation of Sea Turtles, Grupo Tortuguero de las Californias, Permanent Commission of the South Pacific, and the InterAmerican Convention for the Protection and Conservation of Sea Turtles. These groups and their initiatives have resulted in reduced green sea turtle hunting and local consumption throughout northwestern Mexico, development of international agreements to reduce fisheries bycatch and habitat destruction, and regional trainings and tools to address sea turtle conservation needs.

The recovery plan for U.S. Pacific populations of the East Pacific green sea turtle (NMFS and USFWS, 1998a) identifies six major recovery actions, one of which is to identify and protect primary foraging areas in U.S. jurisdiction. In southern California, NMFS has increased outreach and education efforts to improve public awareness of the presence of green turtles and to reduce threats to foraging populations, particularly in San Diego Bay, the San Gabriel River, and adjacent watersheds. NMFS has worked with partners to develop educational materials and signs to specifically address local threats such as recreational fishing and vessel strikes.

2.2.1.2 Loggerhead Sea Turtles, North Pacific DPS

Loggerheads are circumglobal, inhabiting continental shelves, bays, estuaries, and lagoons in temperate, subtropical, and tropical waters. Major nesting grounds are generally located in temperate and subtropical regions, with scattered nesting in the tropics. Until 2011, loggerheads were listed globally as a threatened species under the ESA. A recovery plan for the then threatened U.S. Pacific loggerhead populations was completed over 20 years ago (NMFS and USFWS, 1998b).

In 2011, a final rule was published describing ESA-listings for nine DPSs of loggerhead sea turtles worldwide (76 FR 58868). The North Pacific DPS is the only DPS found in the action area, and is listed as endangered under the ESA. The most recent five-year review reaffirmed the endangered status of this DPS (NMFS and USFWS, 2020a). A recovery plan for the North Pacific DPS has not been completed. However, through a U.S. initiative, three countries (United States, Japan, and Mexico) have been developing a tri-national recovery plan.

The North Pacific DPS nests primarily in Japan (Kamezaki et al., 2003), although low level nesting may occur outside of Japan in areas surrounding the South China Sea (Chan et al., 2007; Conant et al., 2009). Researchers have identified important juvenile turtle foraging areas off the coast of Baja California Sur, Mexico (Conant et al., 2009; Peckham et al., 2007). After spending years foraging in the central and eastern Pacific, mature loggerheads migrate to forage in oceanic or neritic waters closer to Japan in between breeding seasons (Hatase et al., 2002, 2010). Thus, adult loggerheads remain in the western Pacific for the remainder of their life cycle (Conant et al., 2009; Hatase et al., 2002; Iwamoto et al., 1985; Kamezaki et al., 1997). Loggerheads documented off the U.S. west coast are primarily found south of Point Conception, California in the Southern California Bight (SCB).

A more detailed account of the status of and threats to loggerhead sea turtles is provided in recent status reviews and five-year reviews (Conant et al., 2009; NMFS and USFWS, 2007a, 2020a). Kamezaki et al. (2003) concluded a substantial decline (50–90%) in the size of the annual loggerhead nesting population in Japan has occurred since the 1950s. Current nesting (referring to the number of nests laid each year, not the number of females that are nesting) in Japan represents a fraction of historical nesting levels, declining steeply from an initial peak of approximately 6,638 nests in 1990–1991, to a low of 2,064 nests in 1997 (Conant et al., 2009)(76 FR 58868). Since that time, nesting has been variable, increasing and decreasing over time as is typical of sea turtle nesting trends. Overall, an increasing trend of approximately 9 percent annual growth in the number of nests was documented for the entire nesting assemblage, from 2003/2004 through 2015 (i.e., all nesting beaches combined) (Y. Matsuzawa, Sea Turtle Association of Japan, personal communication, 2017).

Van Houtan (2011) estimated the total number of adult nesting females in the North Pacific DPS to be 7,138 for 2008-2010. An abundance assessment using data available through 2013 was conducted by Casale and Matsuzawa (2015) as part of an IUCN Red List assessment and estimated 8,100 nesting females in the North Pacific DPS. Jones et al. (2018) used a model estimate of 3,632 females nesting at Yakushima, assumed to represent 52% of all nesting females in the population, to estimate the total number of North Pacific DPS nesting females at 6,984 (NMFS, 2019).

Most recently, Martin et al.'s (2020a, 2020b) model results suggest that the adult female portion of the North Pacific DPS is increasing at a rate of 2.3 percent per year (95% confidence interval (CI): −1.1% to 15.6%), with a minimum of 4,541 adult females (95% CI: 4,074-5063; total nesters for the three index beaches in Japan). It is estimated that there are approximately 328,744 juveniles (years 1-25) (T. Jones, NMFS, personal communication, 2019). Using the estimate of 4,541 females nesting in Yakushima, representing 52% of nesting females, the total number of

North Pacific DPS nesting females is 8,733 (4,541*100/52). Using a sex ratio of 65% female (Martin et al., 2020a) suggests that the abundance of the North Pacific DPS is approximately 13,435 (8,733*100/65) adults, or a total population size of 342,179 (328,744 juveniles + 13,435 adults), but we note that we do not have loggerhead nesting information post-2015.

North Pacific DPS loggerheads have been documented in high numbers off the central Pacific coast of Baja California, Mexico. Aerial surveys conducted from 2005 through 2007 in the Gulf of Ulloa, a known "hot spot," provided an estimated foraging population of over 43,000 juveniles (Seminoff et al., 2014). NMFS conducted aerial surveys of the SCB in 2015 (a year when the sea surface temperatures were anomalously warm, and an El Niño was occurring) and estimated more than 70,000 loggerheads throughout the area (Eguchi et al., 2018), likely feeding on pelagic red crabs and pyrosomes which are the species' preferred prey. Recent analysis of loggerhead sea turtle presence in the SCB suggests that loggerhead presence offshore of Southern California is tied not just to warm temperatures, but to persistently warm temperatures over a period of months such as what occurred during the recent large marine heatwave experienced by the Eastern North Pacific Ocean (Welch et al., 2019).

Two important threats facing the North Pacific DPS include coastal development and bycatch in commercial fisheries. Coastal development and coastal armoring on nesting beaches in Japan are significant threats to the persistence of this DPS (Conant et al., 2009; NMFS and USFWS, 2020a)(76 FR 58868). For both juveniles and adults, bycatch in commercial fisheries, both coastal and pelagic fisheries (including longline, drift gillnet, set-net, trawling, dredge, and pound net) throughout the species' range is a major threat (Conant et al., 2009), particularly in 'hotspot" areas where loggerheads are known to congregate (Peckham et al., 2007). Between recent developments to reduce sea turtle bycatch in domestic fisheries that have been working their way into some international fisheries, and the incomplete data sets and reporting that exists, the exact level of current sea turtle bycatch internationally is not clear. However, given the information that is available, bycatch of sea turtles in fisheries throughout the Pacific Ocean continues to occur at significant rates several orders of magnitude greater than what is being documented or anticipated in U.S. domestic fisheries.

Considerable effort has been made since the 1980s to document and reduce loggerhead bycatch in Pacific Ocean fisheries, as this is the highest conservation priority for the species. NMFS has formalized conservation actions to monitor and reduce loggerhead bycatch in U.S fisheries, worked with U.S. and international entities to assess and reduce bycatch in Mexico and Japan, and pursued several strategies to reduce both bycatch rates and post-hooking mortality (Conant et al., 2009; Howell et al., 2008, 2015; NMFS and USFWS, 2007a).

Conservation efforts have also focused on protecting nesting beaches, nests, and hatchlings from beach erosion and armament (Conant et al., 2009). Beach management activities include conducting nightly patrols during the summer nesting season to relocate nests from erosion prone areas, protecting nests from predators and people with mesh and fences, and cooling nests with water and shading to prevent overheating during incubation. Nest relocation in 2004-08 resulted in an estimated 160,000 hatchlings being released that otherwise may have been lost (76 FR 58868; September 22, 2011).

The conservation and recovery of loggerhead turtles is facilitated by a number of regulatory mechanisms at international, regional, national, and local levels. As a result of these designations and agreements, many of the intentional impacts on sea turtles have been reduced; harvest of eggs and adults have been slowed at several nesting areas through nesting beach conservation efforts, and an increasing number of community-based initiatives are in place to slow the take of turtles in foraging areas.

2.2.1.3 Leatherback Sea Turtles

Leatherback sea turtles are listed as endangered under the ESA (35 FR 8491; June 2, 1970). A recovery plan for the U.S. Pacific populations of leatherbacks was completed over 20 years ago (NMFS and USFWS, 1998c). In 2012, NMFS revised critical habitat for leatherbacks to include additional areas within the Pacific Ocean (77 FR 4170; January 26, 2012). The revised designation includes marine waters off California from Point Arena to Point Arguello and off Washington and Oregon from Cape Flattery, Washington, to Cape Blanco, Oregon. The PBF identified for leatherback critical habitat was prey, primarily scyphomedusae. The action area occurs within Pacific leatherback critical habitat, and we analyze potential effects to designated leatherback critical habitat in Section 2.12 of this opinion.

Leatherback sea turtles have the most extensive global distribution of any reptile. They occur throughout the oceans of the world, from the equator to subpolar regions in both hemispheres. Leatherback turtles lead a completely pelagic existence, foraging widely in temperate and tropical waters except during the nesting season, when gravid females return to tropical beaches to lay eggs. Leatherback nesting aggregations are found in the eastern and western Pacific. Aerial surveys conducted between 2004 and 2007 identified Indonesia, Papua New Guinea, and the Solomon Islands as the core nesting areas for the population (Benson et al., 2011).

The population most likely to occur within the action area is the Western Pacific population. The East Pacific population generally occupies a distribution distinct from the Western Pacific population and is considered to be located outside of the action area for the proposed action (NMFS and USFWS, 2020b). Based on genetic analyses of leatherbacks found off the U.S. west coast, we consider the probability of the East Pacific leatherback sea turtles occurring in the action area to be extremely low.

Leatherback population trends vary in different regions and nesting beaches. In 1980, the leatherback population was approximately 115,000 (adult females) globally (Pritchard, 1982). By 1995, one estimate claimed this global population of adult females had declined to 34,500 (Spotila et al., 1996). Abundance and trend estimates of nesting females for five of the populations outside of the Pacific indicate that all are at risk of extinction (NMFS and USFWS, 2020b). In the Pacific, leatherback populations are declining at all major Pacific basin nesting beaches, particularly over the last three decades (NMFS and USFWS, 2020b, 2007b; Spotila et al., 2000, 1996).

Results from a population viability analysis (Martin et al., 2020a, 2020b) indicate the adult female portion of the Western Pacific population has been declining at a long-term rate of 6 percent per year (95% CI: -23.8% to 12.2%), and that the population from two nesting beaches in

Indonesia consisted of about 790 adult female leatherback sea turtles (95% CI: 666-942) in 2017. To estimate the total number of nesting females from all nesting beaches in the West Pacific, we considered that approximately 50 to 70 percent of nesting occurs at the two beaches in Indonesia (Dutton et al., 2007; NMFS and USFWS, 2020b). Applying the conservative estimate of 75 percent to the Martin et al. (2020a) estimate of 790 females would generate an estimate of be 1,054 nesting females in the West Pacific population (95% CI: 888 to 1,256 females). Recent preliminary data from the Jamursba Medi and Wermon index beaches indicate that nest numbers were relatively stable from 2017 to 2021, but the data are not yet available in sufficient detail to update model estimates (NMFS, 2024a). Based on the estimates presented in Jones et al. (2012) for all Pacific populations, NMFS inferred an estimated West Pacific leatherback total population size (i.e., juveniles and adults) of 250,000 (95% CI: 97,000-535,000) in 2004. Based on the relative change in the estimates derived from Jones et al. (2012) and the more recent Martin et al. (2020a), NMFS estimates the juvenile and adult population size of the West Pacific leatherback population is around 100,000 sea turtles (95% CI: 47,000-195,000). Abundance and trend data collected over 28 years indicate that the abundance of leatherbacks foraging off central California has declined at an annual rate of -5.6 percent (95% CI: -9.8 to -1.5%) to less than 200 individuals (Benson et al., 2020).

Threats to leatherback sea turtles include fisheries bycatch, direct harvest, alteration of nesting habitat, and predation by birds and fish (NMFS and USFWS, 2020b). In addition, habitat changes attributed to changing environmental conditions (e.g., sand temperatures that result in mortality or changes in sex ratios, erosion), pollution and marine debris are also threats to this species (Tiwari et al., 2013). The drivers of the species' decline have been described in detail (Bellagio Steering Committee, 2008; Eckert, 1993; Tapilatu et al., 2013; Tapilatu and Tiwari, 2007).

Fisheries bycatch is still considered the major obstacle to this population's recovery (Bailey et al., 2012; Benson et al., 2011; Tapilatu et al., 2013; Wallace et al., 2013). Leatherbacks are vulnerable to bycatch in a variety of fisheries, including longline, drift gillnet, set gillnet, bottom trawling, dredge, and pot/trap fisheries that are operated on the high seas or in coastal areas throughout the species' range. Given that recent developments to reduce sea turtle bycatch in fisheries have been working their way into some international fisheries, and the incomplete data sets and reporting that exist, the exact level of current sea turtle bycatch internationally is not clear. However, given the information that is available, we believe that international bycatch of sea turtles in fisheries throughout the Pacific Ocean continues to occur at significant rates several orders of magnitude greater than what NMFS documents or anticipates in domestic U.S. Pacific Ocean fisheries.

NMFS (2021, 2016) identified the following top five recovery actions for leatherbacks: (1) reduce fishery interactions; (2) improve nesting beach protection and increase reproductive output; (3) international cooperation; (4) monitoring and research; and (5) public engagement. Considerable effort has been made since the 1980s to document and address leatherback sea turtle bycatch in fisheries around the world, including strategies to reduce both bycatch rates and post-interaction mortality such as the use of circle hooks, turtle excluder devices, seasonal time-area closures, and Sea Turtle Handling Guidelines. Community-based conservation projects have been developed to monitor and protect nests from harvest and predation, increasing the production of hatchlings from these nesting areas. These efforts have led, for example, to increased hatchling production at Western Pacific nesting beaches (from 32,000-50,000 hatchlings produced in 2017-2019) (Pakiding et al., 2020; Tapilatu, 2014) and reductions in poaching from over 60 percent of nests in 2017 to less than one percent of nests in 2022 (NMFS, 2023a). Many intentional impacts on sea turtles have been reduced; harvest of eggs and adults have been reduced at several nesting areas through nesting beach conservation efforts (although significantly more effort is needed to reduce harvest pressure), and a number of community-based initiatives have helped reduce the harvest of turtles in foraging areas.

2.2.1.4 Olive Ridley Sea Turtles, All Pacific Populations

Two populations of olive ridley sea turtles were listed under the ESA in 1978 (43 FR 32800; July 28, 1978): the breeding populations on the Pacific coast of Mexico were listed as endangered, and all other olive ridleys were listed as threatened. Because olive ridleys found off the U.S. west coast are likely to originate from nesting beaches on the Pacific coast of Mexico, we assume that any olive ridleys within the action belong to this endangered population. A recovery plan for the U.S. Pacific populations of olive ridleys was completed nearly 20 years ago (NMFS and USFWS, 1998d). A 5-year review of olive ridley sea turtles was completed in 2014 (NMFS and USFWS, 2014).

Olive ridley sea turtles occur throughout the world, primarily in tropical and sub-tropical waters. Nesting aggregations in the Pacific Ocean are found in the Marianas Islands, Australia, Indonesia, Malaysia, and Japan (western Pacific), and Mexico, Costa Rica, Guatemala, and South America (eastern Pacific). Like leatherback turtles, most olive ridley sea turtles lead a primarily pelagic existence (Plotkin et al., 1993), migrating throughout the Pacific, from their nesting grounds in Mexico and Central America to the deep waters of the Pacific that are used as foraging areas (Plotkin et al., 1994). While olive ridleys generally have a tropical to subtropical range, with a distribution from Baja California, Mexico to Chile (Silva-Batiz et al., 1996), individuals do occasionally venture north, some as far as the Gulf of Alaska (Hodge and Wing, 2000). Their migratory pathways vary annually, there are no apparent migratory corridors, and there is no spatial and temporal overlap in migratory pathways among groups or cohorts of turtles (NMFS and USFWS, 2014).

According to the Marine Turtle Specialist Group of the IUCN, there has been a 50 percent decline in olive ridleys worldwide since the 1960s, although there have recently been substantial increases at some nesting sites (NMFS and USFWS, 2007c). A major nesting population exists in the eastern Pacific on the west coast of Mexico and Central America. Both of these populations use the north Pacific as foraging grounds (Polovina et al., 2004). As described above, because the proposed action is most likely to occur closer to eastern Pacific nesting and foraging sites, we assume that individuals from this population would be more likely (i.e., than the western Pacific population) to occur within the action area. The eastern Pacific population is thought to be increasing, while there is inadequate information to suggest trends for other populations. Eastern Pacific olive ridleys nest primarily in large arribadas (mass nesting) on the west coasts of Mexico and Costa Rica. Since reduction or cessation of egg and turtle harvest in both countries in the early 1990s, annual nest totals have increased substantially. Population trends for most non-arribada beaches indicate they are stable or increasing (Abreu-Grobois and Plotkin, 2008). On the Mexican coast alone, at a major nesting beach (La Escobilla), a mean annual estimate of nesting females was over one million (NMFS and USFWS, 2014). Eguchi et al. (2007) analyzed sightings of olive ridleys at sea, leading to an estimate of 1.15 to 1.62 million turtles in the eastern tropical Pacific, based on a weighted average of yearly estimates from 1992-2006.

Threats to olive ridleys are described in the most recent five-year review (NMFS and USFWS, 2014). Direct harvest and fishery bycatch are considered the two biggest threats. In the 1950s through the 1970s, it is estimated that millions of olive ridleys were killed for meat and leather and millions of eggs were collected at nesting beaches in Mexico, Costa Rica, and other locations in Central and South America. Harvest has been reduced in the 1980's and 1990's, although eggs are still harvested in parts of Costa Rica and there is an illegal harvest of eggs in parts of Central America and India (NMFS and USFWS, 2014).

Olive ridleys have been observed caught in a variety of fishing gear including longline, drift gillnet, set gillnet, bottom trawl, dredge and trap net. Fisheries operating in coastal waters near arribadas can kill tens of thousands of adults (NMFS and USFWS, 2007c). Based upon available information, it is likely that olive ridley sea turtles are being affected by sea-level rise and rising sea surface temperatures as well as related changes in ice cover, salinity, oxygen levels and circulation. Impacts could include shifts in ranges and changes in algal, plankton and fish abundance, which could affect olive ridley prey distribution and abundance. However, olive ridleys are wide ranging and could shift from an unproductive habitat to more biologically productive waters. Sea level rise and other environmental and oceanographic changes such as the frequency and timing of storms may accelerate the loss of suitable nesting habitats and could increase beach loss via erosion or inundation of nests (NMFS and USFWS, 2014).

Efforts to decrease or eliminate poaching of nesting females and eggs and protect their habitat have been implemented in many areas of Mexico, including establishment of 17 reserve areas in 1986 to protect sea turtles, a ban on harvest and trade of sea turtles in 1990, and the use of TEDs in shrimp fisheries to reduce sea turtle bycatch. The U.S. has implemented several fisheries regulations to reduce sea turtle bycatch, including olive ridleys. For example, sea turtles captured during commercial fishing operations must be handled to prevent injury, resuscitated (if necessary), and returned safely to the water. Use of circle hooks, non-squid bait, fishery closures, and disentangling and dehooking equipment, and proper handling and reporting of sea turtle interactions are required to address olive ridley bycatch in the U.S. Hawai'i-based longline fishery operating in the central Pacific (NMFS, 2008).

As a result of these international, national, and local efforts, many of the anthropogenic threats have been reduced. The ban on direct harvest resulted in stable (e.g., Mismaloya and Tlacoyunque) or increasing (e.g., La Escobilla and Ixtapilla) nesting populations on the Pacific coast of Mexico, although the Chacahua arribada beach continues to decline. Conservation measures to reduce incidental bycatch have benefited the endangered populations; however, fisheries remain a concern.

2.2.2. Black Abalone and Black Abalone Critical Habitat

2.2.2.1 Black Abalone

Black abalone were listed as endangered under the ESA in 2009 (74 FR 1937; January 14, 2009). Black abalone are marine snails with one shell and a large muscular foot used for movement as well as to hold tightly onto hard substrates and avoid being dislodged by wave action (Cox, 1960). They are broadcast spawners, with a relatively short planktonic larval stage (McShane, 1992). Their current geographical range extends from Point Arena, California, to Bahía Tortugas, Mexico (74 FR 1937; January 14, 2009).

Black abalone occupy rocky habitats from the upper intertidal to six meters depth. They are most commonly observed in the middle and lower intertidal, in habitats with complex surfaces and deep crevices that provide shelter for juvenile recruitment and adult survival (Cox, 1960; Douros, 1987, 1985; Haaker et al., 1995; Leighton and Boolootian, 1963; Leighton, 2005, 1959; Miller and Lawrenz-Miller, 1993; VanBlaricom et al., 1993). They are able to withstand variations in temperature, salinity, moisture, and wave action, and are usually strongly aggregated, with some individuals stacking two or three on top of each other (Cox, 1960; Leighton, 2005).

Over the past four decades, black abalone have declined throughout California. In the mid-1900s through early 1980s, black abalone were most abundant south of Monterey, particularly at the Channel Islands off southern California (Cox, 1960; Karpov et al., 2000). Beginning in the mid-1980s through the 1990s, black abalone declined dramatically throughout the southern portion of their range, due primarily to mass mortalities caused by the disease called withering syndrome (Neuman et al., 2010). Black abalone south of Cayucos declined in abundance by more than 80% (Neuman et al., 2010) and generally remain at low densities currently, except for a few sites at the Channel Islands where numbers have increased in recent years (NMFS, 2020a). Black abalone north of Cayucos have not experienced disease-induced mortalities, but have also declined over the last 20 to 25 years, due to poaching, sedimentation and burial, and/or mussel encroachment into black abalone habitat (unpublished data from the Multi-Agency Rocky Intertidal Network, MARINe).

Warming ocean temperatures and ocean acidification may have range-wide effects on black abalone. In addition to increasing susceptibility to disease (Friedman et al., 1997; Harley and Rogers-Bennett, 2004; Raimondi et al., 2015; Vilchis et al., 2005), warming ocean temperatures could reduce the growth of macroalgae (an important food source) and shift the distribution of black abalone northward if temperatures increase above the optimal range (Burgess et al., 2023; Diaz et al., 2022; Hines et al., 1980; Kawana et al., 2019). Sea level rise could alter the distribution and availability of rocky intertidal habitat. Black abalone may be able to adapt to changes in their habitat conditions, depending on the timeframe over which these changes occur, but some populations and habitats may be lost.

Overall, black abalone face high risk in the following demographic risk criteria: abundance, growth and productivity, and spatial structure and connectivity (NMFS, 2018, 2020a; VanBlaricom et al., 2009). Data from long-term monitoring indicate black abalone throughout southern and south-central California remain at low abundance and densities, less than the adult densities needed to support reproduction (Neuman et al., 2010; NMFS, 2018, 2020a). Black abalone are far from meeting the Demographic Recovery Criteria for density, recruitment, size structure, and population trends, established in the Final ESA Recovery Plan for Black Abalone (NMFS, 2020a). Black abalone also have a high recovery potential, demonstrated by signs of natural recovery at a few sites on the Channel Islands where black abalone densities are sufficient to support reproduction and recruitment (NMFS, 2018). The Final ESA Recovery Plan (NMFS, 2020a) identifies several priority recovery actions, including continued long-term monitoring, population and habitat restoration, emergency response planning and preparation, and enforcement, outreach, and education, particularly to address poaching.

2.2.2.2 Black Abalone Critical Habitat

NMFS designated black abalone critical habitat on October 27, 2011 (76 FR 66806). The designation encompasses rocky intertidal and subtidal habitat (to a depth of 6m MLLW) within five segments of the California coast from the Del Mar Landing Ecological Reserve to the Palos Verdes Peninsula, as well as on the Farallon Islands, Año Nuevo Island, San Miguel Island, Santa Rosa Island, Santa Cruz Island, Anacapa Island, Santa Barbara Island, and Santa Catalina Island. NMFS identified the following PBFs (physical or biological features) for black abalone critical habitat:

- rocky substrate (e.g., rocky benches formed from consolidated rock or large boulders that provide complex crevice habitat);
- food resources (e.g., bacterial and diatom films, crustose coralline algae, and detrital macroalgae);
- juvenile settlement habitat (rocky substrates with crustose coralline algae and crevices or cryptic biogenic structure);
- suitable water quality (e.g., temperature, salinity, pH) for normal survival, settlement, growth, and behavior; and
- suitable nearshore circulation patterns to support successful fertilization and larval settlement within appropriate habitat.

Critical habitat north of Cayucos (where black abalone have not experience disease-related mass mortalities) was generally identified as containing areas of high conservation value. These areas contain habitat of good to excellent quality that is able to support larger numbers of black abalone. Over the last 10 years, sedimentation events (e.g., landslides and fire-induced debris flows) have resulted in the degradation and loss of critical habitat along the Big Sur coast due to scouring and burial (NMFS, 2022; Raimondi et al., 2017). More recently, mussel encroachment into the lower intertidal, likely a result of the decline in sea stars following the sea star wasting disease outbreak in 2013-2014 (Miner et al., 2018; Moritsch and Raimondi, 2018), has filled in cracks and crevices and reduced habitat quality for black abalone (pers. comm. with Christy Bell, UCSC, 2023).

South of Cayucos (where black abalone have experienced disease-related mass mortalities), community shifts have occurred and persisted following the decline of black abalone (Miner et al., 2006). Algae, sponges, sandcastle worms (*Phragmatopoma*), and other encrusting organisms have overgrown rock surfaces and filled in cracks and crevices once occupied by black abalone. These changes may reduce habitat suitability for adult black abalone (e.g., by reducing available space in cracks and crevices) and for larval settlement (e.g., by reducing the surface area for crustose coralline algae to grow) (Miner et al., 2006; NMFS, 2011; Toonen and Pawlik, 1994; VanBlaricom et al., 2009). In general, however, these critical habitat areas continue to provide a high conservation value to the species, because they contain habitat of good to excellent quality that is able to support black abalone. Recruitment and increasing numbers of black abalone have been observed at a few sites in southern California (Eckdahl, 2015; Kenner and Yee, 2022; Richards and Whitaker, 2012).

Warming ocean temperatures and ocean acidification may have range-wide effects on black abalone critical habitat. As discussed above, warming ocean temperatures may reduce the quantity and quality of food resources (macroalgae) and, if above the optimal range for black abalone, affect the survival, health, and growth of abalone. Sea level rise could result in the re-distribution as well as loss of rocky intertidal habitat. Ocean acidification is predicted to reduce pH levels, affecting water quality to support normal growth and development of black abalone as well as of crustose coralline algae (Crim et al., 2011; O'Leary et al., 2017). Changes in pH levels at the local scale may vary and will be important to assess effects on black abalone and their critical habitat (Feely et al., 2009, 2008, 2004; Hauri et al., 2009).

2.3. Action Area

"Action area" means all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area encompasses the terrestrial region within which DCNPP is located (Diablo Canyon Site), freshwater habitat within this region, and marine waters including the Intake Cove, Diablo Cove, and nearshore/offshore waters within the extent of the thermal plume associated with DCNPP cooling water discharge. The following description was provided in the NRC's DSEIS (NRC, 2024a).

Diablo Canyon Site (terrestrial region) (Figure 1): DCNPP is located on the coast in San Luis Obispo County, California, about 7 miles northwest of Avila Beach, 8 miles south of Los Osos, and 12 miles west-southwest of San Luis Obispo. DCNPP is located on approximately 750 acres (304 hectares) of PG&E property; access is controlled. The Diablo Canyon Site is contained within the larger Diablo Canyon Lands encompassing an approximately 12,000 acre (4,856 ha) area.

Freshwater habitat: There are four primary drainages near the Diablo Canyon Site: Coon Creek, Diablo Creek, Irish Canyon Creek, and Pecho Creek. Only Diablo Creek lies within the boundaries of the Diablo Canyon Site and is included in the action area. The other three creeks do not traverse the Diablo Canyon Site and are not expected to be affected by DCNPP operations. Diablo Creek flows into the northern boundary of the Diablo Canyon site. During construction of DCNPP, a portion (2,700 ft; 823 m) of Diablo Creek was culverted and the original channel in this area was filled to construct the DCNPP switchyard (PG&E, 2023). Diablo Creek discharges into Diablo Cove north of the Discharge Structure. Diablo Creek is not a source of surface water for DCNPP.

Intake Cove: The Intake Cove is an artificial embayment formed by two breakwaters and encompasses a surface area of approximately 15 acres (6 ha). The Intake Cove consists of sand and soft sediments, boulder fields, low rock ridges, and emergent rocks. The shoreline consists of a granite boulder riprap-armored and graded road, a vertical concrete curtain wall (the ocean-side of the Intake Structure), and sections of natural rock upcoast of the Intake Structure. Depths within Intake Cove range from 16 ft (4.9 m) below MLLW in the eastern portion to 33 ft (10m) below MLLW adjacent to the Intake Structure.

Diablo Cove: DCNPP discharges heated water directly into Diablo Cove, located to the north of the Intake Cove. Diablo Cove is a natural cove that encompasses a surface area of approximately 42 acres (17ha), with an average depth of 26 ft (7.9m) below MLLW, and a maximum depth of 60 ft (18m) below MLLW. Intertidal and subtidal areas within Diablo Cove consist predominantly of bedrock, boulder, and cobble fields. The immediate receiving water area directly in front of the discharge is shallow with a typical water depth of less than 10 ft (3m) MLLW. The topography consists of shallow water rock ridges at oblique angles to the plume's trajectory. During low tide, these rock ridges deflect the discharge plume northward toward Diablo Rock. During high tide, the discharge plume passes over the rock ridges and mainly exits through the south channel. The deeper portions of Diablo Cove (below 26 ft or 8m MLLW) are typically below the main influence of the discharge plume and experience little to no increase in temperature due to the discharge.

Nearshore and offshore waters: The action area includes nearshore and offshore waters within the extent of the thermal plume associated with cooling water discharge. Surveys conducted from 1986 to 1990 (PG&E, 2008) indicate the thermal plume extends as far as 2 miles (3.2 km) to the north and south of Diablo Cove. The thermal plume is primarily detectable between 0.5 to 1 mile (0.8 to 1.6 km) offshore.

2.4. Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early section 7 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The impacts to listed species or designated critical habitat from federal agency activities or existing federal agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

2.4.1. Sea Turtles

As described above in the status section, ESA-listed sea turtles present along the U.S. west coast (East Pacific DPS green, North Pacific DPS loggerhead, olive ridley, and leatherback sea turtles) are exposed to potential injury and mortality from fisheries bycatch, vessel collisions, scientific research, ingestion of or entanglement in plastics or marine debris, changes in climate or oceanographic conditions, and entrainment in coastal power plants. Where available, we present specific information about these effects on ESA-listed sea turtles within the action area. In most cases, information is available for the general area surrounding and including the action area. For example, much of the information in this section comes from sea turtle stranding data, which has been documented by NMFS throughout the U.S. west coast since 1969. Figure 4 summarizes available sea turtle stranding data for the coast of California from 1969 to 2024, including within the action area. Although many of the documented strandings and their causes occurred outside of the action area, these data inform our understanding of the threats affecting sea turtles in the general area surrounding the action area and to which sea turtles entering the action area may be exposed. Because the mechanisms of impact on these species are similar, we look at the environmental baseline for these four species together, calling out differences among species as appropriate.

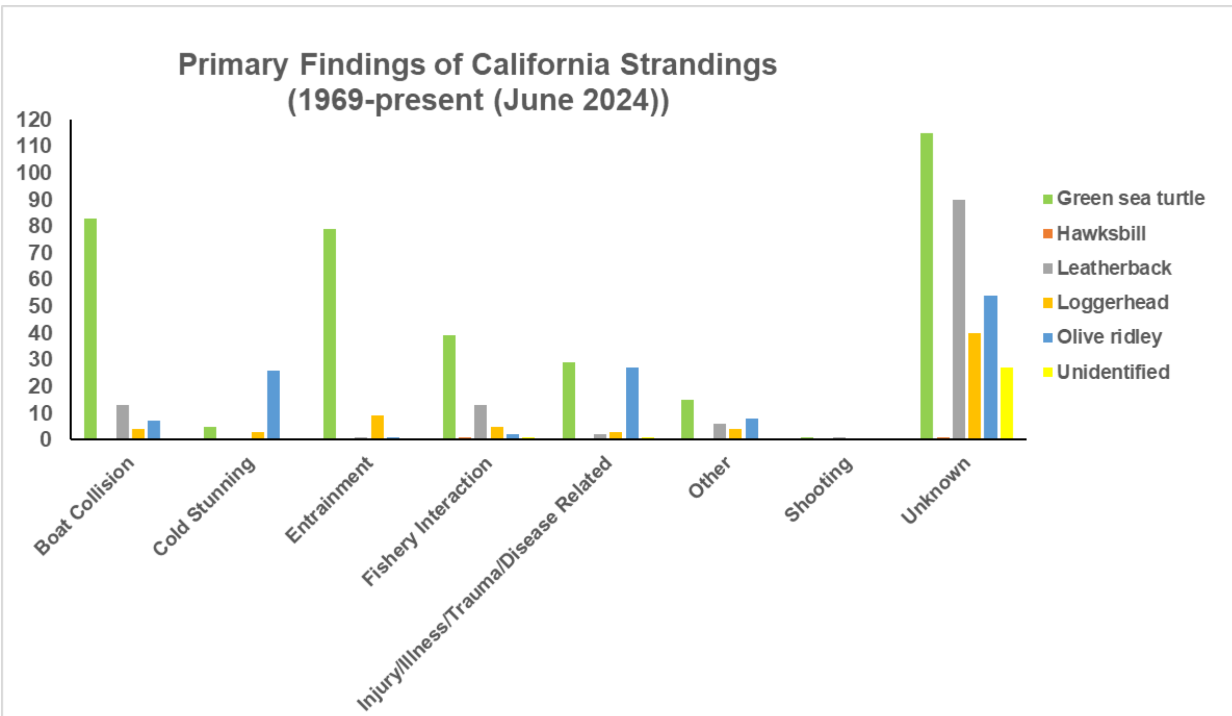

Figure 4. Known cause of sea turtle strandings in California, 1969-June, 2024 (NMFS-SWFSC, unpublished data).

Entrainment at the Intake Structure

In 2006, a biological opinion was completed that analyzed the effects of sea turtle entrainment in the two federally-regulated nuclear power plants located in California, DCNPP and the now decommissioned San Onofre Nuclear Generating Station located near San Clemente California (NMFS, 2006). Since DCNPP began operations in 1985, 14 green sea turtles and one loggerhead sea turtle have been entrained and collected at the Intake Structure (NRC, 2024a) (Figure 5). The first green sea turtle entrainment was reported in 1994, and the first (and only) loggerhead entrainment was recorded in June 2024 (NRC, 2024a). At most, up to two sea turtles have been entrained per year (in 1997 and 1999) (Table 1). As required under the 2006 biological opinion, PG&E personnel monitor the Intake Structure every 12 hours and rescue any entrained sea turtles using nets and/or platforms to lift individuals out of the water. PG&E personnel collect measurements, evaluate their health, and apply tags to entrained individuals prior to release. All sea turtles have been released back to the ocean alive and unharmed (NRC, 2024a).

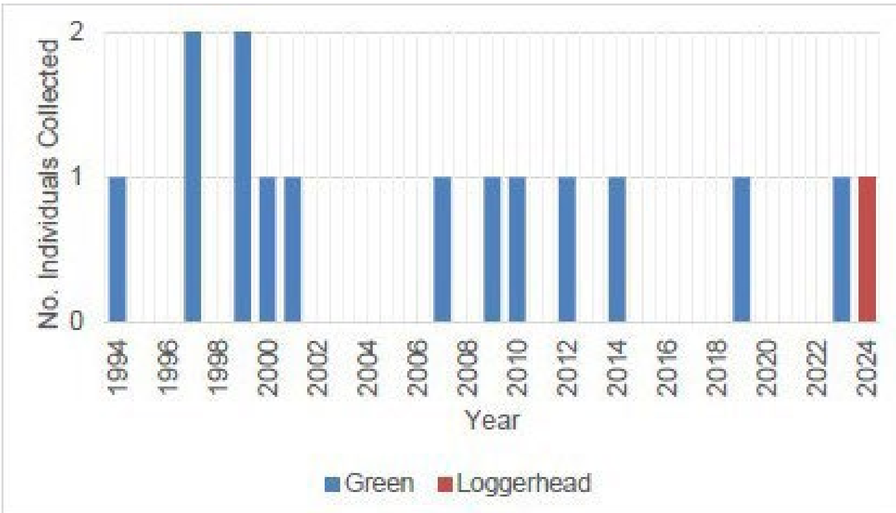

Figure 5. Sea turtles collected at the DCNPP Intake Structure from 1994 - 2024 (Figure 3.8 in NRC's 2024 DSEIS).

Table 1. Summary of sea turtle entrainments at the DCNPP from 1985 - 2024. Data from NRC 2005 and PG&E Sea Turtle Stranding Reports 2007 - 2024.

Capture Date	Species	Sex	CCL (cm)	Est Weight (pounds)	Description
4/26/1994	Green turtle	Female	97	50-60	Healthy, no abrasions
1/9/1997	Green turtle	Female	85	50	Healthy, minor abrasions on right front flipper
6/11/1997	Green turtle	Male	84	100	Healthy, no abrasions
5/28/1999	Green turtle	Male	69	50-75	Healthy, minor scrapes on the rear of the shell
8/23/1999	Green turtle	Male	68	40	Healthy, small scrapes on top of shell and minor abrasions on front flippers
4/15/2000	Green turtle	Unknown	52	20	Healthy, minor abrasions around edge of shell and on right front flipper
2/26/2001	Green turtle	Unknown	47	14	Healthy, minor abrasions on sides and front of head, and on ends of front flippers
7/23/2007	Green turtle	Male	76	85	Healthy, minor abrasions on flippers; two healed bite wounds on left rear flipper
9/8/2009	Green turtle	Unknown	36	8	Healthy, no abrasions
8/8/2010	Green turtle	Unknown	52	25	Healthy, no abrasions

Capture Date	Species	Sex	CCL (cm)	Est Weight (pounds)	Description
9/21/2012	Green turtle	Unknown	48	18	Healthy, no abrasions
9/22/2014	Green turtle	Unknown	51	20-30	Healthy, no abrasions
7/26/2019	Green turtle	Unknown	64.3	50	Healthy, no abrasions
12/11/2023	Green turtle	Unknown	44	21	Healthy, minor injury to tip of left front flipper (may be due to entrainment)
6/17/2024	Loggerhead	Unknown	62	51	Healthy, no abrasions; evidence of cold stunning

Fishery Interactions

Sea turtles have been observed or documented entangled or entrapped by both commercial and recreational fishing gear (Figure 4). Leatherbacks and green sea turtles are the two species which are most commonly reported as interacting with fishing gear, with leatherbacks historically entangled in drift gillnet gear and more recently in pot/trap gear and green sea turtles most commonly in recreational hook and line gear, particularly in bays and estuaries in the SCB (NMFS-WCR, unpublished stranding records). Historically, loggerheads were entangled in drift gillnet gear before dynamic time/area closures were put into place in 2003 (NMFS-WCR, unpublished stranding records). Although these fishery interactions occur outside of the action area, they may affect sea turtles that enter and use the action area.

Scientific Research

NMFS issues scientific research permits to allow research actions that involve the directed take of sea turtles within the California Current, including the action area. Currently there are two permits that allow directed research on sea turtles, typically involving either targeted capture or sampling of individuals that may have stranded or are incidentally taken in some other manner (#21111 and #28119). These permits allow a suite of activities that include tagging, tracking, and collection of biological data and samples. In addition, NMFS research activities along the U.S. west coast may result in the incidental take of sea turtles through research on other species, which has been analyzed in recent biological opinions. The most recent opinion involved the NWFSC's research program, which anticipates the incidental capture and release of up to one ESA-listed sea turtle per year from any of the four species (NMFS, 2024b). Another opinion involved the SWFSC's research program, which anticipates the incidental capture and release of up to two ESA-listed sea turtles per year (NMFS, 2020b). These activities are expected to be non-injurious, with only minimal short-term effects. For example, one leatherback was captured during a scientific trawl net survey in 2011 and was released alive (NMFS, 2015). The incidental take of sea turtles in these NMFS research activities may occur essentially anywhere off the California coast, including in the action area.

Vessel Collisions

Vessel collisions are occasionally a source of injury and mortality for sea turtles along the U.S. west coast. Vessel collisions with sea turtles have been reported from San Diego to San

Francisco and could occur within the action area. In many cases, vessel collisions are determined by examining sea turtle strandings; a cracked carapace or deep lacerations are usually good indicators of blunt force trauma with a vessel's hull or propeller. A review of the NMFS stranding database for the U.S. west coast indicates that green sea turtles and leatherbacks are the two species most frequently observed in vessel collisions (Figure 4).

The U.S. Coast Guard (USCG) is responsible for safe waterways under the Port and Waterways Safety Act (PWSA) and establishes shipping lanes and traffic separation schemes (TSSs). On June 5, 2023, the USCG announced the results of the Pacific Coast Port Access Route Study (88 FR 36607) to evaluate safe access routes for the movement of vessel traffic proceeding to or from ports or places along the western seaboard of the United States. As a result of this study, the USCG recommended establishing a number of voluntary vessel traffic fairways, including a coastwide fairway that follows existing vessel traffic patterns and connects with existing TSSs (Strait of Juan de Fuca, San Francisco, Santa Barbara, and Los Angeles – Long Beach) and key ports. This study also recommends a number of fairways in specific areas off the California coast (88 FR 36607). Voluntary or mandatory adoption of the proposed fairways could modify vessel traffic patterns in waters surrounding the action area, with possible impacts to the exposure of sea turtles to vessel interactions, although to what extent is uncertain at this time. Vessel access within the DCNPP action area is restricted by a 2,000 yard security zone (33 CFR § 165.1155).

El Niño/ Changing Climate

El Niño events occur with irregularity off the U.S. west coast and are associated with anomalously warm water incursions. Sea turtles may be affected by El Niño events through a change in distribution or abundance of their preferred prey, which may result in a change in sea turtle distribution or behavior. These warm water events often bring more tropical marine species into normally temperate waters and therefore may affect the local ecosystem and normal predator-prey relationships. For largely pelagic species that are wide ranging such as olive ridleys and Pacific leatherbacks, such events may not affect them in the waters off the U.S. west coast. Conversely, North Pacific loggerheads have been encountered off the U.S. west coast in large numbers during an El Niño (Eguchi et al., 2018). Loggerhead presence in the SCB was first documented in the California DGN fishery during the 1990s, when they were taken by the fishery during years associated with El Niño events (1992-93 and 1997-98) (NMFS, 2023b). Anomalously warm waters bring pelagic red crabs, a preferred prey item of loggerheads, and may have brought loggerheads into the area, although they have also been documented associating with pyrosomes during the 2014 incursion of warm water into the waters off California (Eguchi et al., 2018).

We considered the effect of warming ocean temperatures on sea turtles foraging in the action area and/or migrating to and from their nesting beaches or other areas of the Pacific Ocean. While effects of warming temperatures have been documented extensively on sea turtle nesting beaches, there is less information available on these effects on sea turtles specifically within the action area. Generally, we suspect that some sea turtle species may shift their distribution north as sea surface temperatures increase, which could bring them into more contact with human activities that occur along the U.S. west coast. The presence of loggerhead sea turtles should be expected to increase if warmer sea surface temperatures in the SCB occur and persist in the future (Eguchi et al., 2018; Welch et al., 2019). Similarly, it is expected that leatherback sea turtles would shift their distribution poleward and offshore of the U.S. west coast by the end of 2100 due to an increase in projected suitable habitat (57 percent gain in core habitat area) across the California Current System (Lezama-Ochoa et al., 2024). However, over the 20-year anticipated duration of the Proposed Action, it will be difficult to determine if these shifts result from warming water temperatures or are reflective of the already highly dynamic and variable marine environment off the U.S. west coast.

Other Threats

Strandings of sea turtles along the U.S. west coast reflect in part the nature of interactions between sea turtles and human activities, as many strandings are associated with human causes (Figure 4). Sea turtles have been documented stranded off California (and Oregon and Washington, though in less frequent numbers) through their encounters with marine debris, either through ingesting debris or becoming entangled in the debris. Studies documenting marine debris ingestion by sea turtles indicate impaired digestive capability, "floating syndrome," or reduced ability to swim, in addition to death (Casale et al., 2016).

A study by Harris et al. (2011) assessed the health of leatherbacks foraging off California and found elevated levels of cadmium. The authors note that hard-shelled turtles such as loggerheads, which have a more varied diet including crustaceans and bivalves, have shown high levels of polychlorinated biphenyls (PCBs) and dichlorodiphenyldichloroethene (DDE), when compared to more herbivorous consumers, such as green turtles. Some pesticides used in agriculture are known endocrine disruptors and, when washed into marine waters, interact with organisms in the surface waters, which can affect reproductive output in leatherbacks (Barraza et al., 2021; Kavlock et al., 1996). Leatherbacks foraging off the California coast are exposed to heavy metals due in part to terrestrial runoff. In addition to carrying a variety of contaminants, runoff introduces nutrients to coastal waters, which can cause eutrophication of nearshore waters. This can result in harmful algal blooms (HABs), depletion of oxygen in the water column, acidification of waters, and alteration of marine ecosystems from the bottom-up because of an increase in primary productivity. Domoic acid, which is a potent marine algal toxin that has been shown to cause neurologic disease in marine mammals and sea turtles, was found in a stranded dead leatherback in 2008 (Harris et al., 2011).

The potential effects on ESA-listed sea turtles from oil spills and other activities associated with oil and gas development off southern California have been evaluated in previous consultations with BOEM BSEE, including most recently in 2024 (NMFS, 2024c). NMFS concluded that offshore oil and gas reserves development and production off California may result in up to one vessel collision with an East Pacific DPS green turtle every 10 years, and exposure of a relatively small number of East Pacific DPS green turtles (and their proposed critical habitat) to an oil spill (NMFS, 2024c). The closest oil and gas platform to the action area is Platform Irene, located off the coast of Lompoc about 40 miles south of DCNPP. Based on this, the potential for an oil spill to affect the action area is low compared to other areas along the southern California coast that are in closer proximity to offshore oil and gas platforms (NMFS, 2024c).

The stranding data indicate that sea turtle strandings off California, including in the action area, may occur due to several different causes; however, within the action area, all strandings to date have been attributed to entrainment at DCNPP (NMFS-SWFSC, unpublished data).

2.4.2. Black Abalone and Black Abalone Critical Habitat

As discussed in the status section (Section 2.2.2) above, black abalone have declined due to disease-induced mass mortalities, including within the action area. In addition, the discharge of heated water as part of DCNPP operations since 1985 has affected black abalone and their critical habitat within the action area. Warming ocean temperatures and ocean acidification may have range-wide effects on black abalone and black abalone critical habitat; however, we do not have specific information about such effects within the action area. For example, data show that intake water temperatures have generally ranged from about 50 to 60˚C (10 to 15.5˚C) since 1985 (NRC, 2024a; PG&E, 2024b). We also do not have information to indicate that poaching or sedimentation events have affected black abalone and their critical habitat within the action area.

2.4.2.1 Black Abalone

Black abalone were once abundant in the action area in Diablo Cove and adjacent shorelines north and south of Diablo Cove. Black abalone surveys have been conducted in Diablo Cove since 1976, prior to the start of DCNPP operations in 1985 (Tenera, 2021). Black abalone surveys in Diablo Cove have been conducted as part of the DCNPP RWMP since 1981 (NRC, 2024a). Intertidal and subtidal monitoring stations are located within Diablo Cove as well as along the shorelines north and south of Diablo Cove.

Through the early 1980s, high densities of black abalone were observed in Diablo Cove and adjacent shorelines. Densities of up to 6.9 black abalone per m^2 were observed at monitoring stations in Diablo Cove, with the greatest densities in the northern part of the cove (Tenera, 2021). By the late 1980s, however, black abalone numbers in Diablo Cove declined to less than one per m^2 due to mass mortalities associated with withering syndrome (Tenera, 2021). Similar trends were observed at four long-term monitoring sites adjacent to Diablo Cove, also due to withering syndrome (VanBlaricom et al., 2009).

DCNPP Unit 1 began operating in November 1985, and Unit 2 began operating in August 1986 (NRC, 2024a). To assess the effects of the heated water discharge on black abalone, intertidal surveys were conducted in Diablo Cove in 1981-1982, 1983, and 1985-1986. Black abalone numbers throughout Diablo Cove declined from an estimated 11,240 individuals in 1981-1982 (mean density of 0.72 abalone per m^2) to an estimated 6,000 individuals in 1983 (mean density of 0.38 abalone per m^2) (Tenera, 1988). Estimated numbers increased to about 8,000 (mean density of 0.55 abalone per m^2) in 1985-1986 (Tenera, 1988). The decline in black abalone numbers was thought to be due to sea otter foraging or other causes, rather than power plant operations, given that the decline occurred between the 1981-1982 and the 1983 surveys, prior to the start of DCNPP operations (NRC, 2024a).

At intertidal sites adjacent to the Discharge Structure, declines in black abalone were observed between the 1981-1982 and the 1985-1986 surveys due to a reduction in preferred habitats near the Discharge Structure or a natural decline (Tenera, 1988). Temperatures near the Discharge Structure may exceed the temperature range at which black abalone avoidance is observed (temperatures above 69.8 to 75.2˚F, or 21 to 24˚C) (Diaz et al., 2022; Hines et al., 1980; NRC, 2024a; Tenera, 1988). The elevated water temperatures and increased water velocity from the discharge likely caused black abalone to migrate out of the areas adjacent to the Discharge Structure (NRC, 2024a; Tenera, 1988). Black abalone numbers in most other areas of Diablo Cove either increased or remained the same in the years after operations began (Tenera, 1988). Evidence of recruitment events in Diablo Cove between 1985 and 1988 indicate that black abalone shifted their distribution within Diablo Cove to areas of preferred temperatures and acclimated to the altered thermal conditions (Tenera, 1988).

Black abalone mortalities due to withering syndrome were first observed in Diablo Cove in 1988 and eventually resulted in about a 90% decline in black abalone numbers throughout the cove (NRC, 2024a). Similar declines in black abalone numbers were observed in the early 1990s along the shorelines north and south of Diablo Cove (NRC, 2024a). Whether exposure to increased water temperatures due to the discharge contributed to increased black abalone mortality rates in Diablo Cove is uncertain. Elevated water temperatures appear to increase the onset of withering syndrome and mortality rates (Ben-Horin et al., 2013; Friedman et al., 1997; Raimondi et al., 2002; Rogers-Bennett et al., 2004; Vilchis et al., 2005); however, disease-induced declines in black abalone of similar or greater magnitude were observed throughout the region, including in areas outside of the influence of the thermal plume (Neuman et al., 2010; VanBlaricom et al., 2009).

Continued black abalone surveys under the RWMP confirm that black abalone remain present at low numbers within Diablo Cove and along adjacent shorelines (Tenera Environmental, 2023, 2021, 2016, 2015). Because the RWMP monitoring stations do not encompass intertidal areas adjacent to the Discharge Structure, targeted surveys for black abalone within these areas were conducted in 2020 (Tenera, 2021) (Figure 6). No black abalone were observed; however, the cryptic nature of black abalone means that individuals may be missed even in targeted surveys (Tenera, 2021). Tenera (2021) concluded that the presence of black abalone can be assumed in areas of suitable black abalone habitat. The 2020 surveys did not include the intertidal areas immediately adjacent to the Discharge Structure, where elevated water temperatures and increased water velocities due to the discharge inhibit recruitment of juveniles and occupation by older individuals (Tenera, 1988) (Figure 7). As stated above, black abalone likely migrated out of and continue to avoid these areas immediately adjacent to the Discharge Structure (Tenera, 1988).

Because RWMP monitoring does not encompass Intake Cove, targeted surveys for black abalone were conducted in the Intake Cove in 2020 and 2023 (SWCA Environmental Consultants, 2023; Tenera, 2021) (Figure 8). Although none were found within Intake Cove, four black abalone were found in 2020 on intertidal transects on the outer, seaward side of the breakwaters; one on the east breakwater and three on the west breakwater (Tenera, 2021). As stated above, Tenera (2021) concluded that black abalone may have been missed due to the species' cryptic nature and the presence of black abalone can be assumed in areas of suitable habitat. In particular, black abalone individuals may have been present but not observed on the breakwaters because the configuration of the tribars creates spaces that are difficult to survey (Tenera, 2021).

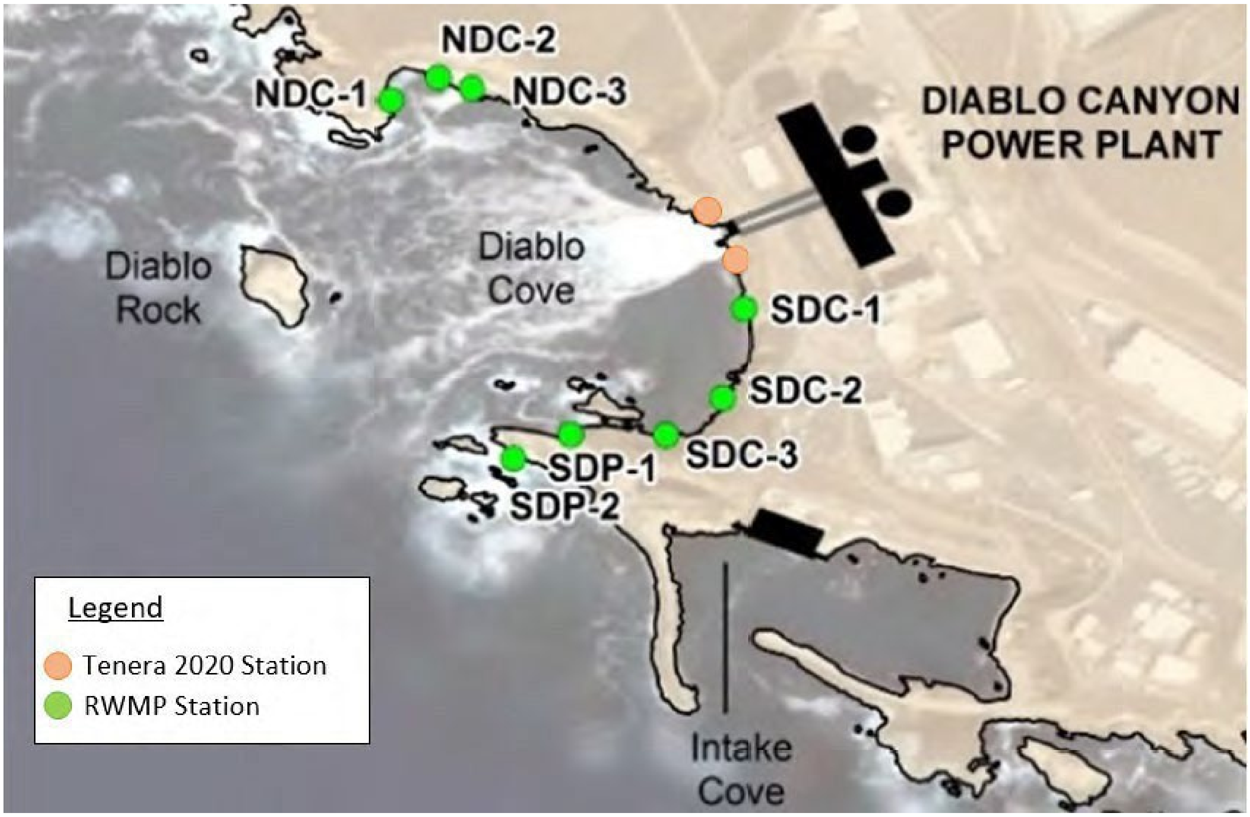

Figure 6. RWMP intertidal station locations and 2020 survey locations in Diablo Cove. Figure 3.1.1.1-1 in Tenera 2021.

Figure 7. Aerial view of the Discharge Structure and discharge into Diablo Cove. Figure 3.1.1.1-2 from Tenera 2021.

Figure 8. Aerial view of Intake Cove, showing the intertidal shoreline and breakwater areas that were surveyed in 2020 and 2023. Figure 3.1.5.1-1 in Tenera 2021.

2.4.2.2 Black Abalone Critical Habitat

The action area occurs within designated black abalone critical habitat, within Specific Area 10, the segment of coast from Montaña de Oro, San Luis Obispo County, to just south of Government Point, Santa Barbara County. At the time of the critical habitat designation, the conservation value of Specific Area 10 was rated as High, meaning the Specific Area contains good habitat to support black abalone (NMFS, 2011).

Within the action area, all of the PBFs are present and range from fair to excellent quality (NMFS, 2011; NRC, 2024a). Diablo Cove is a natural cove bounded by two rocky promontories, North Diablo Point and South Diablo Point, and Diablo Rock centered at the mouth of the cove (Tenera, 2021). Diablo Cove has an average depth of about 26 ft MLLW and a maximum depth of about 60 ft MLLW. Intertidal and subtidal areas consist of bedrock, boulder, and cobble fields, providing habitat for black abalone.

Discharge of heated water has affected the PBFs within Diablo Cove. The area directly in front of the Discharge Structure is heavily scoured due to high water velocities and shell hash from the DCNPP cooling system (Tenera, 2021). The temperature of the heated water discharge may be as high as 22˚F (12.2˚C) above the ambient intake water temperatures (NRC, 2024a; PG&E, 2024b; Tenera Environmental, 2023). Effects of this discharge on water temperatures and biological communities are greatest in the area directly in front of and immediately adjacent to the Discharge Structure. For example, elevated water temperatures preclude the settlement of giant kelp within approximately 575 feet from the Discharge Structure (Tenera, 2021). Black abalone have likely migrated out of and continue to avoid the area directly in front of and immediately adjacent to the Discharge Structure, where elevated water temperatures and high water velocities are unsuitable for black abalone (Tenera, 1988).

Outside of this area immediately surrounding the Discharge Structure, the effects of the discharge decrease with distance. In North Diablo Cove, the average increase in water temperature for intertidal stations has been approximately 6˚F (3.3˚C); in South Diablo Cove, the average increase has been slightly less (PG&E, 2008). At Field's Cove, to the north of Diablo Cove, the average increase in water temperatures for intertidal stations has been less than 2˚F (1.1˚C) (PG&E, 2008). Effects of this increase in water temperature include a shift in the kelp canopy within Diablo Cove from one that was dominated by bull kelp (*Nereocystis lutkeana*) prior to DCNPP operations to one that is now dominated by the more warm-water tolerant giant kelp (*Macrocystis pyrifera*) (Tenera, 2021). Bull kelp cover has also decreased outside of Diablo Cove, within an area 700 to 3,200 ft (213 to 975 m) northward along the coast beyond Field's Cove (Tenera, 1988).

Within Intake Cove, the habitat quality for black abalone varies. Intake Cove is an artificial embayment, created by construction of two breakwater structures to confine a natural stretch of coast. Giant kelp is present throughout Intake Cove (Tenera, 2021). Habitat within Intake Cove consists of rip rap (poor quality for black abalone), the breakwaters (tribars), and natural rocky intertidal and subtidal habitat (Tenera, 2021). About 246 feet of natural rocky reef occurs upcoast of the Intake Structure that contains red abalone, indicating suitable habitat for abalone (Tenera, 2021). No black abalone were found there in recent surveys in 2020 and 2023, potentially because the habitat consists of a near-vertical rock wall that is not characteristic of where black abalone are commonly found (SWCA Environmental Consultants, 2023; Tenera, 2021). Four black abalone were found on the outer, seaward side of the breakwaters, and none were found on the inner side of the breakwaters (Tenera, 2021).

2.5. Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action but that are not part of the action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.02).

For the Effects Analysis, we identified the following potential effects associated with continued operation of DCNPP Units 1 and 2 for an additional 20 years under the proposed license renewals:

- Impingement and entrainment of individuals and their prey/food resources due to intake of water from Intake Cove for the once-through cooling system.
- Thermal and water velocity effects due to discharge of heated water from the Discharge Structure into Diablo Cove.
- Exposure to chemical constituents in the discharge, including chlorine and heavy metals.

We use an exposure-response framework for our analysis. First, we evaluate exposure by considering the presence of ESA-listed species and critical habitat within the action area, and the potential exposure of these resources to the effects of the proposed action. Next, we evaluate how ESA-listed species and critical habitat may respond to this exposure. We consider how their responses may reduce the fitness of individuals (e.g., reproductive development, growth, survival) and/or the value of designated critical habitat within the action area. If a potential reduction in individual fitness is expected, then we consider how these effects on the individual level may affect fitness at the population level. We also evaluate how these effects may affect the population's recovery potential considering the importance of this population to the species' survival and recovery, as appropriate. If a potential reduction in the value of designated critical habitat is expected within the action area, then we consider how this reduction may affect the value of critical habitat as a whole. We also evaluate how these effects may affect the conservation value of designated critical habitat considering the importance of this area to the function and value of critical habitat as a whole.

2.5.1. Occurrence and Exposure

2.5.1.1 Sea Turtles

As described in Section 2.2 (Rangewide Status of the Species and Critical Habitat), ESA-listed green, loggerhead, olive ridley, and leatherback sea turtles may occur within the action area.

None are expected to be abundant, and no nesting habitat occurs on the U.S. west coast, but foraging and migrating sea turtles may be exposed to effects from DCNPP operations. As shown by previous records of entrainment at the DCNPP Intake Structure, green sea turtles are the most likely to be exposed to effects from the DCNPP intake, followed by loggerhead sea turtles. Although leatherbacks and olive ridley sea turtles have never been entrained at DCNPP, we consider their exposure and risk because they may occur within the action area.

Sea turtle distribution is closely linked to water temperature, with most species favoring warmer tropical and subtropical waters. However, during anomalously warm periods, such as El Niño events or marine heatwaves, turtles may extend their range into higher latitudes (Eguchi et al., 2018; Welch et al., 2019). Climate change is driving ocean warming, which may lead to more persistent northward range expansions. As sea surface temperatures rise, suitable thermal habitats for foraging and nesting shift poleward, allowing turtles to inhabit previously unsuitable areas. Additionally, changes in prey distribution, such as pelagic red crabs and jellyfish moving northward, may further influence turtle migration patterns and habitat use. The increase in abundance of East Pacific DPS green sea turtles may also contribute to some expansion of their range. The aggregation of green sea turtles in Alamitos Bay and the San Gabriel River may be an indicator of such an effect, as its formation supplanted San Diego Bay as the most northerly aggregation of this species. We therefore anticipate that sea turtle presence within the action area around DCNPP will remain rare, though it may increase during warming events and may trend upward throughout the 20 year duration of the proposed action.

Sea turtles occurring within the action area may be exposed to entrainment in the cooling water system (CWS) intake structure, as well as to thermal and chemical effects from the discharge. Among these potential stressors, entrainment in the CWS represents the primary risk to sea turtles in the action area. Entrainment can cause stress and minor injuries such as scrapes and abrasions, as well as forcible submergence, which could kill sea turtles. Since CWS operations began, a total of 15 sea turtles, including 14 green turtles and one loggerhead, have been recorded as entrained at the DCNPP Intake Structure, with an average rate of 0.37 turtles entrained per year (1994-2024; Figure 5; Table 1) (NRC, 2024a). A maximum of two sea turtles have been entrained in any given year, with only one sea turtle in most years when an entrainment has occurred (NRC, 2024a). As required in the 2006 biological opinion analyzing the effects of continued operations of DCNPP (NMFS, 2006), PG&E monitors the Intake Structure every 12 hours. If live sea turtles are entrained, PG&E personnel capture and remove the individuals, evaluate their health, collect measurements, and tag the individuals. Healthy, uninjured sea turtles are released back to the ocean, and those requiring additional care may be transferred to an animal care facility. PG&E personnel are trained to safely remove, handle, resuscitate (if needed), and release the entrained individuals. PG&E reports all sea turtles to NMFS in stranding reports and annual reports. To date, all sea turtles entrained at DCNPP have been released alive and unharmed back to the ocean (NRC, 2024a).

In addition to entrainment, sea turtles are likely to be exposed to heated water discharged from the CWS. As specified by the NPDES permit, daily average discharge temperatures are limited to no more than 22°F (12.2°C) above the daily average intake water temperature. This heated water mixes with ambient ocean water, resulting in elevated temperatures within Diablo Cove and adjacent areas. The extent of this thermal plume is influenced by tidal and current conditions. Historical surveys conducted under the NPDES Permit from 1986 to 1990 found that the thermal plume could be detected up to two miles (3.2 km) north or south of Diablo Cove, though it is typically less extensive (NRC, 2024a). Sea turtles are unlikely to be exposed to the highest discharge temperatures, as the high velocity and turbulence within Diablo Cove would resist a close approach. However, sea turtles occurring within the action area would be exposed to the moderately warmed waters in the thermal plume surrounding the DCNPP discharge.

Sea turtles may also encounter chemical constituents present in the discharge. These include chemical additives such as sodium hypochlorite and sodium bromide, which are used to control biofouling and corrosion within the CWS. Additionally, in-plant waste streams are disposed of through the discharge structure, contributing to the overall chemical composition of the effluent.

The thermal and chemical properties of the discharge are regulated under the NPDES permit, which establishes limits designed to minimize adverse effects on receiving water quality. To ensure compliance with these regulatory standards, PG&E conducts continuous intertidal and subtidal temperature monitoring at permanent stations along the Diablo Canyon coastline and performs weekly analyses of water samples to assess chemical concentrations.

In 2023, water sampling found that ammonia and most heavy metals were at low or non-detectable levels, while chlorine ranged from 0 to 197 µg/L (average 16–55 µg/L) (PG&E, 2024b). Detectable heavy metal concentrations were also low, with nickel averaging 10–18 µg/L, arsenic at 1.21 µg/L annually, and cadmium at 0.025 µg/L (PG&E, 2024b). Higher concentrations of copper (31–70 µg/L) and zinc (12–110 µg/L) were found in specific effluent streams, including Discharges 001D, 001F, and 001H (PG&E, 2024b). However, sea turtles are likely exposed only to diluted concentrations due to mixing of these effluent streams with the main circulating water before discharge. Once released into Diablo Cove, further dilution occurs, with a minimum initial dilution factor of 4.1:1 (seawater:effluent).

2.5.1.2 Black Abalone

As described in the Environmental Baseline, black abalone were once abundant in the action area. Rocky intertidal surveys conducted in Diablo Cove and the adjacent shorelines since 1976 recorded high densities of black abalone, as high as 6.9 abalone per m^2 (NRC, 2024a; Tenera, 2021). Starting in 1988 through the 1990s, black abalone in Diablo Cove and adjacent shorelines within the action area experienced significant declines due to mass mortalities associated with withering syndrome (Tenera, 2021). These declines were part of region-wide declines observed throughout southern to south-central California in the 1980s through the early 2000s due to the disease (Neuman et al., 2010; VanBlaricom et al., 2009). Except for a few sites where numbers have increased, black abalone generally remain at low numbers and densities throughout this region. This is true within the action area, where low numbers of black abalone have persisted since the late 1990s (Tenera Environmental, 2023, 2021, 2016, 2015; VanBlaricom et al., 2009). Below, we describe the presence of black abalone within the Intake Cove, Diablo Cove, and along the shorelines north and south of Diablo Cove.

Intake Cove

In 2020, intertidal and subtidal surveys were conducted within Intake Cove and along the breakwaters associated with Intake Cove (Tenera, 2021). No black abalone were found within Intake Cove or along the inshore side of the breakwaters. Four black abalone were found in the intertidal zone on the outside of the breakwaters, one on the east breakwater and three on the west breakwater (Tenera, 2021). Tenera (2021) stated that the species' cryptic nature means that individual black abalone may have been missed during the surveys, particularly along the breakwaters where the shape of the interlocking tribars creates deep cracks and cave-like areas that could not be accessed. Tenera (2021) concluded that the presence of black abalone can be assumed in areas of suitable habitat.

In September 2023, another survey was conducted within Intake Cove, including the inner side of the west breakwater and rocky habitat adjacent to the Intake Structure. No black abalone were observed in the survey area within Intake Cove (SWCA Environmental Consultants, 2023)

Based on the 2020 and 2023 survey results, black abalone are confirmed to be present on the outside of the breakwaters but have not been recorded within Intake Cove. Tenera (2021) stated that black abalone may be present within Intake Cove based on the availability of suitable habitat. However, we conclude the likelihood of black abalone presence within Intake Cove is low. First, the shoreline within Intake Cove is sheltered from wave action and not immediately adjacent to extensive kelp areas like the outer, seaward portions of the breakwaters and adjacent intertidal coastline outside of Intake Cove (Tenera, 2021). Second, most of the shoreline within Intake Cove consists of the Intake Structure curtain wall and rip-rap armoring, providing poor-quality habitat for black abalone (Tenera, 2021). Third, black abalone presence within Intake Cove is most likely to occur within the approximately 246 ft long segment of natural rock just upcoast of the Intake Structure, where 22 red abalone were found during the 2020 surveys (Tenera, 2021). However, a large portion of this natural rocky reef consists of a near-vertical rock wall, which is not the type of rocky habitat where black abalone are commonly found (Tenera, 2021).

Overall, we conclude that black abalone are present on the outer, seaward portions of the two breakwaters associated with Intake Cove and have a low likelihood of occurring within Intake Cove, based on the available habitat. We do not expect the black abalone on the outer breakwaters to be exposed to the effects of the intake, but do expect these black abalone to be exposed to the effects of the discharge plume.

Diablo Cove and Adjacent Shoreline

Dedicated black abalone surveys were first conducted in Diablo Cove and the adjacent shorelines north and south of Diablo Cove in 1976, and have continued as part of the RWMP, in fulfillment of NPDES permit requirements (Tenera, 2021). Available data confirm black abalone presence at low numbers at least through 2022 in Diablo Cove and Field's Cove, located just north along the coast from Diablo Cove. RWMP reports since 2014 (Tenera Environmental, 2023, 2021, 2016, 2015) have documented low numbers of abalone at sampling locations within Diablo Cove and Field's Cove every year (PG&E, 2023).

Because RWMP sampling stations do not encompass intertidal areas adjacent to the Discharge Structure, Tenera (2021) conducted surveys in these intertidal areas in 2020. Although no black abalone were observed, both areas contain suitable habitat for black abalone (Tenera, 2021). The intertidal upcoast of the Discharge Structure consisted of a loose cobble and boulder field, whereas the area downcoast of the Discharge Structure consisted of a wide bench reef interspersed with boulder and cobble and supported a more diverse invertebrate and macroalgal community (Tenera, 2021). As discussed above, Tenera (2021) concluded that the presence of black abalone can be assumed in areas of suitable habitat, given the potential for individuals to be missed during surveys due to the species' cryptic nature.

Based on the available data summarized above, we conclude that black abalone are present at low numbers within Diablo Cove and adjacent shorelines outside of Diablo Cove within the action area. Monitoring data confirm the presence of black abalone at RWMP sampling stations in north and south Diablo Cove as well as at Field's Cove. Surveys in 2020 did not find any black abalone in the intertidal areas adjacent to the Discharge Structure, but black abalone presence is likely in areas of suitable habitat. We expect black abalone and their habitat in Diablo Cove and the adjacent shorelines to be exposed to effects from the discharge, namely elevated water temperatures and flow as well as chemical constituents in the effluent. We expect exposure to these effects to be greatest in the area directly in front of and adjacent to the Discharge Structure in Diablo Cove and to decrease with distance from the Discharge Structure.

2.5.1.3 Black Abalone Critical Habitat

As stated in Section 2.4 (Environmental Baseline), the action area occurs within designated black abalone critical habitat and all the PBFs are present. The action area within Diablo Cove and adjacent shorelines contains critical habitat of high conservation value to support black abalone (NMFS, 2011). Critical habitat within Intake Cove includes areas of lower quality (e.g., rip rap) and areas of higher quality (natural rocky intertidal and subtidal habitat) (Tenera, 2021).

Critical habitat within Diablo Cove would be exposed to the discharge plume. Based on the extent of the discharge plume, critical habitat along adjacent shorelines within about 2 miles of Diablo Cove would also be exposed to the discharge plume. Critical habitat within Intake Cove would not be exposed to the discharge plume, but would be exposed to effects from the intake of cooling water. All of the PBFs are likely to be exposed to the effects of the proposed action.

2.5.2. Response to Exposure

2.5.2.1 Sea Turtles

Intake Effects: Entrainment

Power plants with open cooling water systems can entrain sea turtles in their intake structures, posing risks of injury or mortality. At DCNPP, live sea turtles have been found trapped between the bar racks and the intake curtain wall. Similarly, at SONGS, both live and dead turtles have traveled through intake pipes and been discovered in the forebay. Entrainment can cause stress and forced submergence, which may lead to drowning. While sea turtles can naturally remain submerged for extended periods, stress reduces their ability to hold their breath, increasing the risk of drowning (NMFS, 2006). Forced submergence can also cause metabolic acidosis and other physiological imbalances, with impacts varying based on turtle size, water temperature, and species-specific metabolic differences (Gregory et al., 1996). Larger turtles, which can sustain longer voluntary dives, may have a greater capacity to survive forced submergence, while higher metabolic rates during warmer months could intensify stress effects (Gregory et al., 1996).

Sea turtles may also experience physiological stress responses when forcibly submerged. Studies on green and loggerhead turtles indicate that stress can disrupt endocrine function and potentially impact reproduction. Research has shown that male green turtles may abandon breeding behavior under stress, while females exhibit a limited stress response during nesting, likely as an adaptive mechanism to prioritize reproduction (Jessop et al., 2002). Additionally, gas embolism (decompression sickness) has been documented in green and Kemp's ridley sea turtles entrained in hopper dredges (Harms et al., 2020).

The physiological effects of forced submergence on sea turtles were studied by Stabenau and Vietti (2003), who found that an initial submergence induced severe metabolic and respiratory acidosis in loggerhead turtles. However, with repeated submergences, the acid-base imbalance was substantially reduced. While forced submergence led to significant changes in blood pH, PCO_2, and lactate levels, longer recovery periods between submergences allowed for greater restoration of blood homeostasis. Although sea turtles entrained in power plants are not typically subjected to successive submergences, this study indicates that turtles have some physiological capacity to recover from forced submergence, provided they are not exposed to prolonged or repeated events (Stabenau and Vietti, 2003).

At DCNPP, sea turtles likely enter the Intake Cove due to curiosity, prey pursuit, or seeking shelter. Once inside, water flow can draw them toward the intake bar racks. The opening between the curtain wall and the bar rack is approximately 7 ft by 12 ft, large enough for sea turtles to swim in and out as well as surface to breathe. The approach velocities at the curtain wall (0.8 fps or 0.2 m/s) and at the bar racks (1.1 fps or 0.3 m/s) are relatively low, but disorientation may hinder escape. Some turtles have been observed swimming freely under the curtain wall, while others require removal by plant personnel (NRC, 2024a). Although all previously entrained turtles at DCNPP have been released alive and unharmed (NRC, 2024a), a weakened turtle could potentially drown if pinned against the bar racks. To reduce this risk, the intake area is monitored daily, and when turtles are found, divers assist in their removal. Rescued turtles are assessed for injuries, and if necessary, transported for veterinary care as specified by NMFS. To date, all entrained sea turtles have been released healthy and alive, with no injuries or only minor scrapes or abrasions (Table 1). Entrained sea turtles likely experience stress due to activities associated with rescue, rehabilitation (when needed), and release, including capture, handling, holding, transport, and tagging prior to release.

Although not observed at DCNPP, dead sea turtles have been observed entrained at the SONGS Intake Structure (NMFS, 2006). Based on the stage of decomposition, the individuals were likely already dead prior to entering the SONGS Intake Structure. The dead sea turtles were disposed of after reporting them to NMFS and the NRC. The deaths were not attributed to entrainment effects.

Since DCNPP began operations in 1985, 15 sea turtles (14 green and 1 loggerhead) have been entrained, with an average rate of 0.37 turtles per year and a maximum of two turtles entrained in one year (in 1997 and 1999) (NRC, 2024a, 2005). Because this rate has remained stable over time (Figure 5), we expect that at least 0.37 turtles will be entrained per year on average under the proposed action, and that nearly all will be East Pacific DPS green sea turtles. We also anticipate that the frequency of green turtle occurrence within the action area may increase over the next 20 years, considering climate trends, recent increases in green sea turtle population numbers, and northward expansion of the green turtle foraging aggregation in southern California. Stranding data for California reflects this, showing an increase in the number of green sea turtle strandings over the last 20 years from an average of about 5 turtles per year in 1985-2004, to an average of about 13 turtles per year in 2005-2024 (Figure 9). To account for this increased frequency and risk of occurrence in the action area moving forward, we estimate the maximum number of future entrainments by doubling the historical rate (0.37 turtles per year x 2 = 0.74 turtles per year). Multiplying the resulting rate by the 20 year duration of the licensing period yields a maximum estimate of 15 (rounded from 14.8) sea turtle entrainments during the proposed action. Following along the same lines of reasoning, we also generally assume that the maximum number of sea turtle entrainments that could occur in any one year would double to four from the previous annual maximum observed of two.

Based on past entrainments at DCNPP, we expect that all or most of the 15 entrainments would involve green sea turtles, and a small number to involve loggerhead sea turtles. Given one loggerhead sea turtle was entrained at DCNPP in 2024 and warming water temperatures may increase the presence of loggerheads in the general area (e.g., Eguchi et al., 2018), we estimate the number of loggerheads that may be entrained at DCNPP over the 20-year license renewal period could increase from historical rates, doubling to a maximum of two individuals over the time period. Considering that we anticipate that the maximum number of all sea turtle entrainments that could occur in any one year would increase to four, we conclude it is possible that all four entrainments in any year could involve green sea turtles, or that up to two loggerheads could be entrained in the same year. To date, no leatherback or olive ridley sea turtles have been entrained at DCNPP; however, we cannot exclude the possibility of their entrainment over the 20-year license renewal period. Waters off central California have been identified as important foraging areas for leatherback sea turtles and stranding data indicate both leatherbacks and olive ridley sea turtles occur in the general area off San Luis Obispo County (NMFS, 2006). As discussed in Sections 2.4.1 and 2.5.1.1, warming water temperatures may cause shifts in distribution and increase the presence of all four sea turtle species in waters off central California, including within the action area. Therefore, although there is a very low probability that leatherback and olive ridley sea turtles will be entrained by DCNPP, the possibility exists due to their occurrence in the general area. To account for this possibility, we estimate that up to one leatherback and one olive ridley sea turtle may be entrained at DCNPP over the 20-year license renewal period. Overall, we expect the 15 entrainments to include a maximum of up to two loggerheads, one leatherback, and one olive ridley sea turtle.

Given that all sea turtles entrained at DCNPP were released unharmed, aside from minor scrapes or abrasions, we expect most future incidents to result in live releases, though the possibility of mortality due to forced submergence cannot be ruled out. Turtles weakened or injured prior to entrainment at DCNPP may be more severely impacted than healthy turtles. With no previous rate of mortality available on which to base our estimate of this possibility, we estimate that up to one green sea turtle mortality may result from entrainment at DCNPP. We anticipate a very low likelihood of mortality occurring, given sea turtles are able to surface and breathe when between the curtain wall and bar rack, are generally able to swim freely into and out of that space, and PG&E personnel regularly monitor the area for sea turtles. This estimate of one mortality accounts for the (very unlikely) possibility of a green sea turtle becoming entrapped, disoriented, forcibly submerged, and killed prior to being found and rescued by PG&E personnel. We do not expect any loggerhead, leatherback, or olive ridley sea turtles to be killed, based on their low abundance within the action area and low likelihood of entrainment at DCNPP. The overall likelihood of mortality for all sea turtle species is low, given frequent monitoring of the Intake Structure and measures in place to rescue, rehabilitate, and release entrained individuals.

Overall, NMFS anticipates that continued operation of DCNPP may result in the incidental entrainment of green, loggerhead, olive ridley, and leatherback sea turtles in the cooling water system. Based on the historical rate of sea turtle entrainment, the distribution of sea turtle species, the planned operations of the facility, and potential increases in frequency of sea turtle occurrence within the action area, NMFS anticipates that entrainment of up to 15 sea turtles may occur at DCNPP during the 20-year period covered by the license renewal. We expect most of the entrainments to involve green sea turtles, with up to two loggerheads, one leatherback, and one olive ridley sea turtle entrained. No sea turtle entrainments resulting in mortality have been reported at DCNPP, but maximum anticipated levels are included as the possibility cannot be eliminated. We project that among the 15 sea turtles that may be entrained, one green sea turtle may die. We do not expect any mortalities of loggerhead, leatherback, or olive ridley sea turtles.

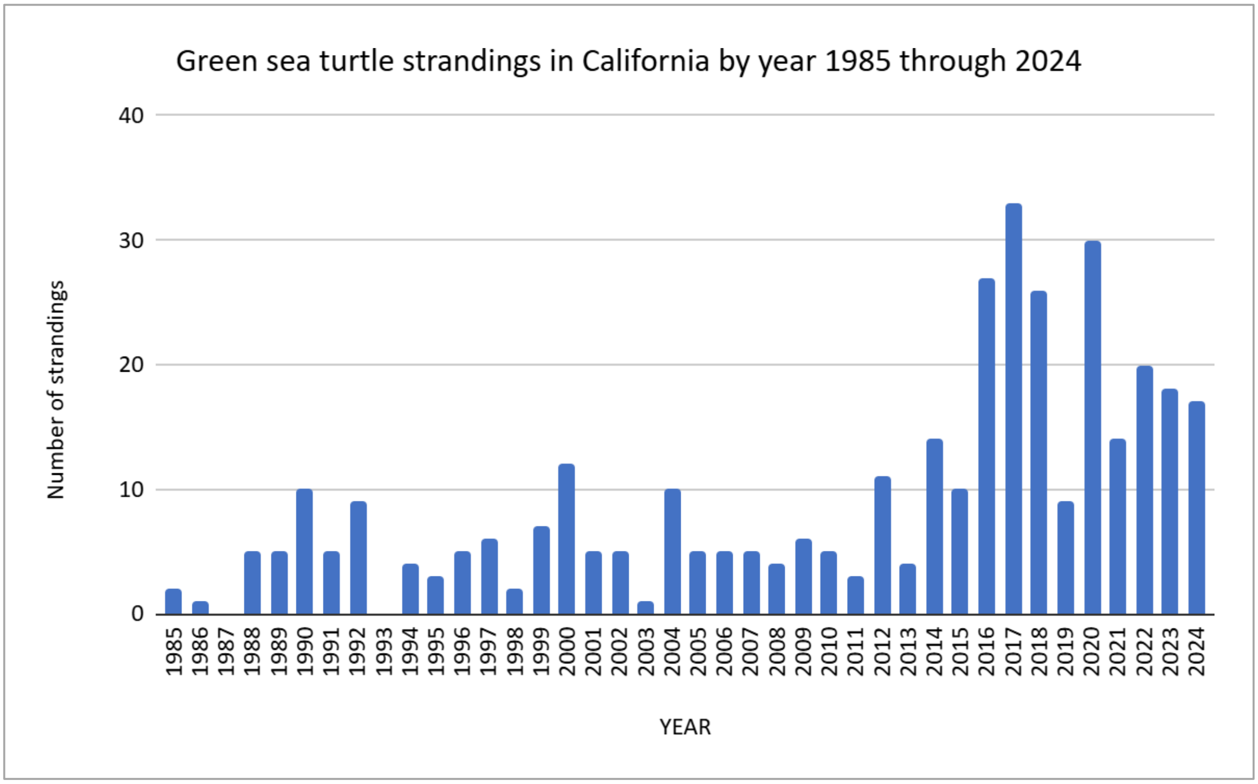

Figure 9. Green sea turtle strandings in California for 1985 through 2024 (NMFS SWFSC, unpublished data).

Discharge Effects: Water Temperatures

Sea turtles present within the action area may be exposed to elevated water temperatures resulting from thermal effluent discharged from DCNPP. With their global tendency toward warm tropical and subtropical waters, sea turtles are not likely to be harmed directly by the elevated water temperatures. However, behavioral changes have been observed in green sea turtles in response to the discharge of warm water effluent from power plants (Madrak et al., 2022) and there is potential for animals to become dependent on the thermal refugia produced by warm water discharges from power plants, as has been documented for manatees in Florida (Laist and Reynolds, 2005).

Since the 1960s, green sea turtles have been found to aggregate in the warm water effluent discharged from power generating facilities, including the South Bay Power Plant in San Diego Bay (decommissioned) and in the San Gabriel River, which receives thermal effluent from the Alamitos Energy Center and Haynes Generating Station (Massey et al., 2023). The green sea turtles in the San Gabriel River and adjacent Seal Beach National Wildlife Refuge are the nearest foraging aggregation of sea turtles to DCNPP. These power plant-associated aggregations both occur in expansive vegetated shallows in bays that are insulated from ocean currents by land and breakwaters. In contrast, the Intake and Diablo Coves at DCNPP are much more exposed to the ocean. Stranding and sighting data indicate that sea turtles remain a rare occurrence within the DCNPP action area, with no known cases of sea turtles aggregating nearby.

Considering the limited occurrence of sea turtles in the action area, the thermal tolerance of sea turtles, the dilution of thermal effluent with cooler ambient seawater, and the lack of nearby aggregations, we anticipate that the impacts to sea turtles from thermal discharge will be minimal and unlikely to produce adverse effects.

Discharge Effects: Chemical Constituents

The DCNPP discharge may contain chemicals to which sea turtles within the action area may be exposed. Chemical contaminants have been detected in sea turtle tissue samples, but the toxicological effects of contaminants on sea turtle health remain poorly understood. Chemical exposure in marine turtles has been linked to abnormalities in embryonic development (van de Merwe et al., 2009), endocrine function (Ikonomopoulou et al., 2009), and other metabolic processes (Keller and McClellan-Green, 2004; Peden-Adams et al., 2002). Blood concentrations of lead, copper, and iron were found to be higher in green turtles afflicted with fibropapillomatosis (da Silva et al., 2016). However, a review of marine turtle toxicology found that many of the correlations between chemical exposures and physiology are inconsistent or confounded by factors such as body size, location, or the particular tissues used in analyses (Finlayson et al., 2016).

Diet is likely the primary means of contaminant intake for sea turtles, and their long lifespans put them at risk for bioaccumulation of trace metals and other anthropogenic pollutants. Aggregations of sea turtles in urbanized areas appear to be particularly susceptible owing to the prolonged exposures to the elevated contaminant loads associated with intensive human activity (Komoroske et al., 2011). For example, foraging aggregations of green sea turtles in San Diego Bay and Seal Beach National Wildlife Refuge were found to have higher levels of trace metals (including cobalt, arsenic, cadmium, nickel, and selenium) (Barraza et al., 2019) than a reference population occupying a comparatively pristine habitat in Australia (Villa et al., 2016). These contaminant loads reflect the history of industries like ship construction and maintenance in these areas but have not been conclusively associated with negative health outcomes.

Chemicals in the DCNPP discharge effluent are extensively diluted, both at the intake where they are introduced, and again when discharged and mixed with surrounding seawater, limiting the concentrations to which sea turtles may be exposed. As sea turtles are rare in the action area surrounding DCNPP and are not known to aggregate or spend prolonged periods of time there, their exposures to diluted effluents will be minor in comparison to those experienced by populations residing near power plants and other industrial facilities.

Considering the water quality monitoring protocols mandated by the NPDES permit, the dilution of discharge in seawater, and the limited occurrence of sea turtles within the action area, we expect that the concentration and duration of exposures to chemicals in the DCNPP discharge will be too low to produce detectable toxic effects in sea turtles.

2.5.2.2 Black Abalone

Black abalone within the action area would be exposed to the following effects of the proposed action:

- Effects from the intake of water for once-through cooling (e.g., impingement and entrainment).
- Effects from discharge of water for once-through cooling (e.g., thermal and flow effects, exposure to constituents such as heavy metals).

Intake Effects

The intake of water at the Intake Structure may affect black abalone through impingement and/or entrainment of individuals. Impingement and entrainment of juvenile and adult black abalone is very unlikely to occur, because juveniles and adults would be tightly adhered to hard substrates. The velocity of the intake (approximately 0.8 ft per second or 0.2 m/s) (PG&E, 2009) would not be great enough to dislodge a black abalone from the substrate, unless the individual was already dead or dying and unable to hold onto the substrate.

Early life stages of black abalone (i.e., gametes, larvae) may be susceptible to entrainment at the Intake Structure if present within Intake Cove. However, the likelihood is low that black abalone gametes and larvae would occur within Intake Cove and be entrained by the intake. As discussed in Section 2.5.1.2, black abalone are not likely to occur within Intake Cove. Although suitable habitat exists within Intake Cove, it is not characteristic of the habitat where black abalone are typically observed. In addition, no black abalone have ever been recorded within Intake Cove. Black abalone have been found on the seaward side of the two breakwaters; however, we expect any gametes and larvae produced by these black abalone to disperse offshore and alongshore, outside of Intake Cove and the influence of the intake.

Considering the low likelihood of black abalone presence within Intake Cove, the low likelihood for gametes and larvae produced by black abalone on the outer breakwaters to enter Intake Cove, and the limited influence of the intake on waters outside of Intake Cove, we conclude that impingement or entrainment of black abalone due to intake of water at the Intake Structure is very unlikely to occur.

Discharge Effects: Water Temperatures and Flow

The discharge of heated water at the Discharge Structure results in elevated water temperatures and water flows. We expect black abalone in Diablo Cove and adjacent shorelines to be exposed to these effects, including the black abalone found on the outside of the breakwaters associated with Intake Cove.

The effects of the discharge on water temperature and flow extend from Diablo Cove to about 1 mile (1.6 km) offshore and 2 miles (3.2 km) north and south along the coast, based on detection of the thermal plume (PG&E, 2008). Effects on water temperature and flow are greatest in the area directly in front of and immediately adjacent to the Discharge Structure in Diablo Cove and decrease with distance from the Discharge Structure. For example, increases in water temperature are greatest in the area directly in front of the Discharge Structure. Average discharge temperatures are 19.6˚F (10.9˚C) above the average intake water temperatures (maximum allowed discharge temperatures of 22˚F (12.2˚C) above the average intake temperatures) (PG&E, 2023). In comparison, the average increase in temperature for intertidal stations is approximately 6˚F (3.3˚C) in North Diablo Cove, slightly less than that in South Diablo Cove, and less than 2˚F (1.1˚C) at Field's Cove to the north (PG&E, 2008). In terms of flow, the area directly in front of the Discharge Structure appears to be heavily scoured due to the turbulence caused by the discharge plume (Tenera, 2021). The NPDES permit limits discharge rates to a maximum of 2,760 MGD of seawater from the Discharge Structure into Diablo Cove.

As discussed in Section 2.4 (Environmental Baseline), black abalone numbers at survey stations adjacent to the Discharge Structure declined between surveys conducted in 1981-1983 and 1985-1986 (DCNPP operations began in 1985). These declines may have been due to a natural decline or due to a reduction in preferred habitats near the Discharge Structure (Tenera, 2021). Black abalone appear to avoid temperatures greater than 69.8 to 75.2˚F (21-24˚C) (Tenera, 1988). Temperatures near the Discharge Structure (including the area directly in front of and immediately adjacent to the Discharge Structure) may exceed this range (Tenera, 1988). In addition, the discharge increases water velocities, resulting in water turbulence and scouring of habitat directly in front of the Discharge Structure (Tenera, 2021) (Figure 7). It is reasonable to conclude that the elevated water temperatures and increased water velocity from the discharge resulted in migration of black abalone from areas immediately surrounding the Discharge Structure and have also inhibited recruitment and migration of black abalone into these areas (Tenera, 2021, 1988).

Under the proposed action, DCNPP would continue to discharge heated water into Diablo Cove. We expect black abalone would continue to avoid the areas immediately surrounding the Discharge Structure, where elevated water temperatures and increased water velocity due to the discharge would continue to reduce habitat suitability for black abalone. This includes early life stages of black abalone, as water velocities in these areas directly in front of and adjacent to the Discharge Structure would preclude dispersal of gametes and/or larvae into these areas. We estimate that this area of reduced habitat suitability for black abalone would encompass about 80 meters of shoreline, including the Discharge Structure (Figure 7).

Outside of the area immediately surrounding the Discharge Structure, the effects of the discharge on water temperatures and velocities are reduced. In 2022, monthly intertidal temperatures in North and South Diablo Cove ranged from an average of 12.2 to 19.8˚C, compared to 10.4 to 15.7˚C at the North and South Control stations (PG&E, 2023). Black abalone continue to occupy intertidal areas in North and South Diablo Cove as well as shorelines adjacent to Diablo Cove, indicating that black abalone have shifted their distribution in response to the change in conditions (NRC, 2024a; Tenera, 1988). Long-term effects of the discharge on black abalone are difficult to determine, because withering syndrome hit the populations shortly after DCNPP began operations, causing significant declines throughout the region, including in Diablo Cove. However, recruitment events observed following DCNPP start up (NRC, 2024a; Tenera, 2021) indicate that conditions in Diablo Cove (except for the approximately 80 m area of shoreline immediately surrounding the Discharge Structure) and adjacent areas north and south of Diablo Cove remained suitable to support black abalone. It is reasonable to conclude that, under the proposed action, these areas would continue to provide suitable habitat to support black abalone, including reproduction and recruitment.

Considering the past effects of the DCNPP discharge temperatures and flows on black abalone and their habitat, the status and distribution of black abalone within the action area, and the species' thermal tolerance range, we conclude that continued discharge of heated water under the proposed action would adversely affect black abalone by continuing to degrade habitat conditions within the approximately 80 meters of shoreline surrounding and including the Discharge Structure, making the habitat unsuitable for black abalone. Outside of this area, we expect habitat conditions to remain suitable to support black abalone.

Discharge Effects: Chemical Constituents

The DCNPP discharge contains constituents to which black abalone within the action area may be exposed. We evaluated how different life stages of black abalone may be affected by exposure to the constituents in the discharge effluent.

PG&E regularly monitors constituents in the influent and in the discharge effluent. In 2023, levels of ammonia and most heavy metals were low and considered non-detects (ND, meaning levels were below the analytical detection limit) or DNQ (between the analytical detection limit and reporting, or quantitation, limits) (PG&E, 2024b). Chlorine levels ranged from 0 to 197 ug/L (average 16-55 ug/L) and detectable levels of heavy metals were low, with monthly averages ranging from 10 to 18 ug/L for nickel and annual values of 1.21 ug/L for Arsenic and 0.025 ug/L for cadmium (PG&E, 2024b). PG&E regularly analyzes sediment, algae, fish, and invertebrate samples for radiological contamination. Annual reports indicate that tritium and other radionuclides attributable to DCNPP were not detected in 2019-2023 (NRC, 2024a).

Higher concentrations of copper and zinc were reported in the effluent for the Liquid Radioactive Waste Treatment System (Discharge 001D), Turbine Building Sump (Discharge 001F), and Condensate Demineralizer Regenerant (Discharge 001H). Monthly averages ranged from 31 to 70 ug/L for Copper and 12 to 110 ug/L for zinc (PG&E, 2024b). These effluent concentrations of copper and zinc exceed the levels found to have harmful effects on abalone, including black abalone, at different life stages. For blacklip abalone (*Haliotis rubra*), larvae exhibited increased morphological abnormalities after 48-hour exposure to concentrations at or above 7ug/L for copper and 35 ug/L for zinc (Gorski and Nugegoda, 2006). Martin et al. (1977) found 96-hour LD50 values of 50 ug/L copper for adult black abalone.

We anticipate black abalone to be exposed to diluted concentrations of the effluent and these heavy metals, reducing the potential for harmful effects from this exposure. First, these higher concentrations of copper and zinc were reported in the effluent from Discharges 001D, 001F, and 001H. These effluent streams are mixed with the main circulating water and thus diluted prior to being discharged through the Discharge Structure into Diablo Cove, as described in the NPDES permit. Second, the effluent is further diluted once it exits the Discharge Structure and mixes with the receiving water in Diablo Cove. The minimum initial dilution factor is 4.1:1 (seawater: effluent).

Finally, the distribution of black abalone in Diablo Cove further reduces their exposure to harmful levels of these constituents. Black abalone juveniles and adults continue to be found in North and South Diablo Cove, where effluent concentrations would be diluted given the distance from the Discharge Structure. Due to their planktonic nature, any exposure of black abalone larvae to high effluent concentrations would be of limited duration and much less than 48 hours.

Considering the water quality monitoring protocols mandated by the NPDES permit, the dilution of discharge in seawater, and the distribution of black abalone within the action area, we expect black abalone to be exposed to reduced concentrations of copper, zinc, and other constituents in the DCNPP discharge effluent, below the levels found to have harmful effects on abalone.

2.5.2.3 Black Abalone Critical Habitat

Designated black abalone critical habitat within the action area would be exposed to the following effects of the proposed action:

- Effects from the intake of water for once-through cooling (e.g., effects on food resources and nearshore circulation patterns).
- Effects from discharge of water for once-through cooling (e.g., thermal and flow effects, exposure to constituents such as heavy metals).

Intake Effects

The intake of water at the Intake Structure may affect black abalone critical habitat through effects on two PBFs: food resources and nearshore circulation patterns. Impingement and entrainment effects of the intake could alter the availability of food resources by altering macroalgal communities within Intake Cove. Surveys conducted in 2020 documented diverse algal communities in both intertidal and subtidal areas of Intake Cove, including bull kelp and giant kelp, indicating that food resources for black abalone remain available and abundant within Intake Cove (Tenera, 2021). Based on these survey data, we expect the intake to have limited effects on the availability of food resources for black abalone within Intake Cove.

Suitable nearshore circulation patterns are necessary to support successful reproduction, given black abalone are broadcast spawners, and larval settlement in appropriate habitat. The approach velocity into the Intake Structure is approximately 0.8 ft per second (0.2 m/s) (PG&E, 2009). Abalone gametes and larvae are not free-swimming and would be entrained if present within the area affected by the intake. We expect that the area affected would be limited to the area directly in front of and adjacent to the Intake Structure. As discussed in Section 2.5.2.2, black abalone gametes and larvae are not likely to be present in Intake Cove, given that black abalone have not been observed within Intake Cove. Overall, we expect the effects of the intake on nearshore circulation patterns to be limited with little to no effects on black abalone gametes and larvae.

Discharge Effects: Water Temperatures and Flow

The discharge of heated water into Diablo Cove may affect black abalone critical habitat through effects on all of the PBFs: rocky substrate, food resources, juvenile settlement habitat, suitable water quality, and suitable nearshore circulation patterns.

We expect the effects of the discharge on black abalone critical habitat to be greatest in the area immediately in front of and adjacent to the Discharge Structure. Tenera (2021) states that the seabed immediately in front of the Discharge Structure is heavily scoured by shell hash and the turbulent action of the discharge, reducing the quality of rocky substrate and juvenile settlement habitat for black abalone. Discharge temperatures into the area directly in front of the Discharge Structure can be as high as 22˚F or 10˚C above the intake water temperatures, and at times exceed 77˚F (25˚C) (NRC, 2024a; PG&E, 2024b). The elevated water temperatures and flow rates in this area create unsuitable water quality and nearshore circulation patterns for black abalone. In addition, giant kelp (an important food resource for black abalone) is not able to settle within approximately 575 feet offshore from the Discharge Structure (Tenera, 2021). Overall, the discharge affects all PBFs and reduces the quality of black abalone critical habitat in the area immediately in front of and adjacent to the Discharge Structure.

We expect the effects of the discharge on black abalone critical habitat throughout the rest of Diablo Cove and adjacent shorelines to be reduced. For example, the average increase in water temperatures at intertidal stations was approximately 6˚F (3.3˚C) or less in North and South Diablo Cove, and less than 2˚F (1.1˚C) at Field's Cove (PG&E, 2008). Between 1985 and 1988 (after DCNPP operations began and before disease decimated the population), black abalone numbers increased at several locations in Diablo Cove and evidence of recruitment was observed (NRC, 2024a; Tenera, 2021). These observations and the continued presence of black abalone within Diablo Cove and adjacent shorelines (although at low numbers) indicate that the rocky substrate, juvenile settlement habitat, water quality, and nearshore circulation patterns remain of suitable quality to support black abalone.

The increase in water temperatures due to the DCNPP discharge has resulted in a shift in food resources within black abalone critical habitat in the action area. The kelp canopy in Diablo Cove was once dominated by bull kelp (*Nereocystis lutkeana*) (Tenera, 2021). However, bull kelp does not grow well at temperatures above 60.8˚F (16˚C) (Tenera, 1988). Due to the discharge, subtidal water temperatures within Diablo Cove and about one mile offshore exceed these temperatures for most of the year, resulting in a shift in bull kelp distribution (Tenera, 1988). The kelp canopy within Diablo Cove is now dominated by giant kelp (*Macrocystis pyrifera*), which is more tolerant of warmer water temperatures (Tenera, 2021). Both bull kelp and giant kelp are important food resources for black abalone; thus, the effects of the DCNPP discharge have shifted the composition, but not the availability, of food resources within black abalone critical habitat. Other macroalgal species are regularly observed in Diablo Cove and offshore, indicating diverse food resources remain available within the action area.

Overall, we expect the continued discharge of heated water under the proposed action to result in elevated water temperatures and water flows that would adversely affect all PBFs identified for black abalone critical habitat within Diablo Cove and adjacent shorelines. We expect the effects of the discharge to reduce the quality of black abalone critical habitat in the area directly in front of and adjacent to the Discharge Structure. Outside of this area, we expect the effects of the discharge on the PBFs to be reduced and the quality of black abalone critical habitat to remain suitable to support black abalone. This is consistent with the continued presence of black abalone in Diablo Cove and along adjacent shorelines.

Discharge Effects: Chemical Constituents in Effluent

The DCNPP discharge contains constituents, including ammonia and heavy metals, that may affect black abalone critical habitat through effects on water quality. As discussed in Section 2.5.2.2, PG&E regularly monitors constituents in the influent and in the discharge effluent. In 2023, levels of ammonia and most heavy metals were low and considered ND or DNQ (PG&E, 2024b). Detectable levels of other constituents were generally low. Higher levels of some heavy metals were detected in other effluent streams (PG&E, 2024b); however, these effluent streams are diluted when mixed with the main circulating water prior to discharge. The effluent is further diluted when discharged and mixed with the receiving waters in Diablo Cove, at a minimum initial dilution rate of 4.1:1 (seawater: effluent). Analysis of sediment, algal, fish, and invertebrate samples did not detect radiological contamination (NRC, 2024a).

Based on these monitoring data, we expect black abalone critical habitat to be exposed to low concentrations of constituents in the DCNPP discharge effluent. We expect the effects of the DCNPP discharge effluent on water quality within black abalone critical habitat to be low.

2.5.3. Risks to Populations

2.5.3.1 Sea Turtles

We anticipate that up to 15 ESA-listed sea turtles would be entrained by the cooling water intake at DCNPP during the 20-year license period. Based on previous entrainments, we expect that most individuals would be East Pacific DPS green sea turtles, but that a small number of loggerheads (up to two individuals) may also be entrained. Olive ridley and leatherback turtles have not been entrained at DCNPP. Both species are primarily pelagic, spending most of their time foraging in the open ocean, but their occurrence within the action area exposes them to the possibility of entrainment. Therefore, we consider that up to one leatherback and one olive ridley may be entrained during the proposed action. In addition, we have anticipated that up to four sea turtle entrainments could occur during any one year, including the possibility that all could be East Pacific DPS green sea turtles, or that two could involve loggerhead sea turtles.

To date, all turtles entrained at DCNPP have been released alive and unharmed, indicating that the design of the CWS intake structure and entrainment response protocols are effective at preventing lethal impacts to these individuals. Mortality is still a possibility that must be accounted for, thus, we project that among the 15 sea turtles that may be entrained, one green sea turtle may die. We anticipate that a mortality will be extremely rare. We do not anticipate any mortalities of loggerheads, leatherbacks, and olive ridleys.

We expect entrained sea turtles to experience stress due to being trapped in the Intake Structure, as well as if they experience forcible submergence. Stabenau and Vietti (2003) showed that sea turtles can recover from this stress, as long as they are not exposed to prolonged or repeated events. Entrained sea turtles may also experience stress from activities associated with rescue, rehabilitation, and release. We expect this stress to be short-term and temporary, and that affected individuals will recover, based on stranding reports indicating that all entrained sea turtles rescued from the DCNPP Intake Structure were deemed healthy and released alive (Table 1). We do not expect entrained sea turtles to suffer injuries beyond minor scrapes and abrasions. Stranding reports indicate about half of the 15 sea turtles entrained at DCNPP between 1985 to 2024 had no injuries, and about half had minor scrapes or abrasions (Table 1).

We expect entrainment to affect a small number of East Pacific DPS green sea turtles (up to 15 entrained and one killed in total over 20 years), representing a very small proportion of this DPS. As discussed above, we expect entrained individuals to be released alive and to experience short-term, temporary stress and minor scrapes or abrasions that are not likely to have long-term effects on individual fitness. Should one green sea turtle be killed due to entrainment, the loss of that one individual would not be expected to result in a detectable effect on the numbers, reproduction, and distribution of East Pacific DPS green sea turtles. For example, even if the one individual that is killed is an adult female, this would represent the loss of a very small proportion of the estimated 105,000 adult females nesting throughout Michoacán (Delgado-Trejo and Bedolla-Ochoa, 2024).

We expect entrainment to affect a very small number of loggerhead sea turtles (up to two entrained in total over 20 years, with no mortalities). The entrainment of up to two individuals represents a very small proportion of the estimated population of loggerheads (about 342,000 individuals). We also expect entrainment to affect a very small number of leatherback and olive ridley sea turtles (up to one entrained per species in total over 20 years, with no mortalities). The entrainment of up to one individual represents a very small proportion of the estimated population of leatherbacks (about 100,000 individuals) and olive ridleys (about 1.15 to 1.62 million individuals). We expect entrained individuals to be released alive and to experience short-term, temporary stress and minor scrapes or abrasions that are not likely to have long-term effects on individual fitness, nor to result in any effect on the numbers, reproduction, or distribution of loggerhead, leatherback, or olive ridley sea turtles.

Overall, we expect the effects of the proposed action to pose a low risk to green, loggerhead, leatherback, and olive ridley sea turtle populations.

2.5.3.2 Black Abalone

The proposed action would primarily affect black abalone by allowing continued discharge of heated water from the Discharge Structure, resulting in elevated water temperatures and increased water velocities in Diablo Cove and adjacent shoreline areas north and south of Diablo Cove. We expect habitat conditions to remain suitable to support black abalone within most of this area, except for the approximately 80 meters of shoreline surrounding and including the Discharge Structure. We expect black abalone to continue to avoid this area immediately surrounding the Discharge Structure, where increased water temperatures and water velocities create unsuitable habitat conditions for black abalone.

We considered these effects on black abalone at the population and species level. These effects would be limited to a relatively small area, approximately 80 meters of shoreline out of the over 1,000 meters of shoreline available within Diablo Cove. Loss of suitable habitat in this area does not appear to have affected the ability of black abalone to reside in or reproduce in other areas within the action area, as black abalone continue to reside in other areas throughout Diablo Cove and in adjacent shorelines north and south of Diablo Cove. We do not have evidence to suggest that the discharge of heated water into Diablo Cove has affected the ability of black abalone to recover within the action area. Black abalone remain at low numbers and densities throughout the action area, similar to most other areas along the mainland California coast where black abalone have experienced mass mortalities due to withering syndrome. The lack of natural recovery for black abalone within the action area is likely due to a combination of their biology, life history, and additional factors that have yet to be identified, similar to other areas where black abalone have declined.

Overall, we expect the effects of the proposed action (continued loss of suitable habitat in an approximately 80 meter area of shoreline within Diablo Cove) to have limited effects on black abalone at the population and species level. We expect the loss of suitable habitat within this small area to pose a low risk to black abalone survival and recovery in the action area and elsewhere within the species' range.

2.5.3.3 Black Abalone Critical Habitat

The proposed action would primarily affect black abalone critical habitat within Diablo Cove and adjacent shorelines north and south of Diablo Cove through exposure to the discharge plume. We expect the discharge plume to result in elevated water temperatures and increased water flows that would affect all PBFs identified for black abalone critical habitat. Within most of Diablo Cove and the adjacent shorelines, we expect the effects to be low and the quality of black abalone critical habitat to remain suitable to support black abalone. However, within the area immediately surrounding the Discharge Structure, we expect the effects of the discharge to reduce the quality of black abalone critical habitat such that the area would be unsuitable for black abalone.

We considered how the alteration and reduced quality of black abalone critical habitat within this area surrounding the Discharge Structure would affect the value of critical habitat as a whole for black abalone. The area encompasses approximately 80 meters of shoreline, a fraction of the approximately 1,000+ meters of shoreline within Diablo Cove. We do not expect the reduced quality of critical habitat within this small area to affect the quality of critical habitat in other areas within and adjacent to Diablo Cove, as these areas continue to support low numbers of black abalone. Overall, we conclude that the effects of the proposed action on habitat suitability within this relatively small area would have limited effects on black abalone critical habitat as a whole.

2.6. Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving federal activities, that are reasonably certain to occur within the action area of the federal action subject to consultation [50 CFR 402.02]. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Some continuing non-federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described earlier in the discussion of the environmental baseline (Section 2.4).

Because DCNPP is located in a restricted area, there are very few State or private activities that are likely to contribute to cumulative effects within the action area. A potential project which may occur at DCNPP during the 20-year license renewal period is the development of ISFSI modifications to accommodate a new spent fuel storage system; however, there remains enough storage in the existing ISFSI to accommodate spent fuel generated during the license renewal period (NRC, 2024a). Furthermore, this action would not be expected to affect marine resources in the action area.

Of the very few activities that could potentially contribute to cumulative effects within the action area, it would be those projects that could impact water quality at Diablo Canyon. DCNPP withdraws saltwater exclusively from the Pacific Ocean for operational purposes, and through the use of its once-through cooling system, saltwater and other permitted effluent streams are discharged back into the Pacific Ocean via the shoreline discharge structure. A substantial regulatory framework overseen by the State of California exists to address current and potential future sources of Pacific Ocean water quality degradation in the vicinity of Diablo Canyon. All ongoing cooling water, process effluents, and stormwater discharges from DCNPP are subject to a CCRWQCB-issued NPDES permit, and would continue to be subject to these permit requirements during the license renewal term. Additionally, PG&E complies with the interim mitigation requirements in Section 2.C(3)(b) of California's OTC Policy by providing funding to the Ocean Protection Council or State Coastal Conservancy to fund appropriate mitigation projects (NRC, 2024a).

We did not identify additional non-Federal activities that are reasonably certain to occur within the action area that could result in cumulative effects on ESA-listed species or critical habitat.

2.7. Integration and Synthesis

The Integration and Synthesis section is the final step in assessing the risk that the proposed action poses to species and critical habitat. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

The proposed action is the NRC's renewal of the facility operating licenses for DCNPP Units 1 and 2. An expected consequence of the proposed action is continued operation of DCNPP Units 1 and 2 for an additional 20 years beyond the expiration date of the existing permits (through 2044 and 2045). PG&E does not expect changes to DCNPP operations under the license renewals.

2.7.1. ESA-listed Sea Turtles

We aggregate the Integration and Synthesis across the species group for sea turtles due to overall similarities in how ESA-listed sea turtles are exposed and respond to the proposed action at an individual and population level. We provide a general synthesis of our understanding of how the proposed action may affect ESA-listed sea turtles. Where appropriate and necessary, we consider and describe species-specific risks relevant to concluding this biological opinion.

The continued operation of DCNPP is likely to result in low levels of entrainment of green, loggerhead, leatherback, and olive ridley sea turtles, and very low levels of lethal entrainment of green sea turtles. The monitoring measures used by the personnel at DCNPP will ensure that turtle entrainments are observed and reported. The diligent implementation of the procedures and prompt response to entrained turtles would help to ensure that the entrained sea turtles remain alive and are able to be released as they have been previously.

The thermal discharge from both facilities may also directly and indirectly impact sea turtles by attracting turtles to the heated discharge and modifying their normal foraging and migration behavior. Based on the rarity of turtle sightings and stable rate of entrainments at DCNPP, no such modification is evident. In addition to the heated discharge, DCNPP uses chemical treatments to control biofouling and dispose of other chemical wastes through the CWS. Discharge water temperature and the chemical concentrations are monitored for compliance with an NPDES permit. The effects of both thermal and chemical effluent are reduced by dilution in seawater. Because of the low concentrations of chemical constituents discharged by DCNPP, it is unlikely that exposure to these constituents will adversely affect sea turtles. Given the limited turtle presence at DCNPP, their thermal tolerance, effluent dilution, and absence of nearby aggregations, thermal discharge impacts are expected to be minimal and unlikely to adversely affect sea turtles.

The greatest risk to sea turtles from the continued operation of the DCNPP CWS is entrainment in the intake structure. Entrained turtles may drown if they are injured, diseased, or otherwise incapacitated. Previously deceased turtles could be drawn into the intake system. Based on the previous entrainments at DCNPP, it is expected that at least 0.37 turtles will be entrained per year on average, and that nearly all will be East Pacific DPS green sea turtles. Considering climate trends and the recent increases in green sea turtle population, there is reason to anticipate that the frequency of green turtle occurrence at DCNPP may increase. The establishment of a foraging aggregation at the Seal Beach National Wildlife Refuge and in the adjacent San Gabriel River indicates that some northward expansion has occurred since the previous (2006) consultation on DCNPP (NMFS, 2006). In addition, stranding data for green sea turtles in California from 1985 through 2024 indicate the average number of strandings has increased over the last 20 years, to approximately double the average in 1985-2004 (NMFS SWFSC, unpublished data).

To account for this increased frequency of green turtle occurrence, we estimate an upper bound of likely entrainments in the future by doubling the historical rate. Multiplying the resulting rate (0.74 turtles per year) by the 20-year duration of the licensing period yields a maximum estimate of 15 (rounded from 14.8) turtle entrainments during the course of the proposed action. We also estimate that the maximum number of turtle entrainments that could occur in any one year would double from two (the previous annual maximum observed) to four.

Given the history of entrained turtles being released alive and in good condition, DCNPP operations are not expected to result in mortality of sea turtles, but the risk cannot be eliminated. Turtles weakened or injured prior to encounters with DCNPP may be more severely impacted by entrainment than healthy turtles. With no available rate of mortality on which to base our estimates of these possibilities, we estimate that up to one green sea turtle mortality may result from entrainment at DCNPP. Due to their exceptionally low abundance off the California coast, we anticipate that up to two loggerheads, one leatherback, and one olive ridley may be entrained, with no injuries or mortalities.

We considered these potential effects of the proposed action on ESA-listed sea turtles along with the status of the species, environmental baseline, and cumulative effects. As described in Section 2.2 (Rangewide Status of the Species and Critical Habitat) and 2.4 (Environmental Baseline), multiple factors affect the quality and health of ESA-listed sea turtles that may visit the action area. Warming ocean temperatures may expand the distribution of ESA-listed sea turtles and increase the number and/or frequency of sea turtles in the action area, particularly green and loggerhead sea turtles. We accounted for these factors by increasing the estimated number of sea turtle entrainments that may occur at DCNPP under the proposed action, as well as considering the (low) potential for a mortality to occur.

2.7.1.1 Green Sea Turtles, East Pacific DPS

Over the course of the proposed action, we anticipate that some green sea turtles may enter the action area and be entrained in the Intake Structure. Based on past entrainment records, we anticipate that up to a maximum of 15 green sea turtles may be entrained at DCNPP over the 20-year license renewal period, with no more than four individuals entrained in a year. We considered the potential for up to one of the entrained individuals to die, though the likelihood of mortality is very low, given all of the sea turtles entrained at DCNPP to date have been released alive and unharmed. DCNPP will continue to implement daily monitoring of the intake and best practices to rescue, handle, and release any entrained sea turtles, minimizing the potential for mortality. We expect entrained individuals to experience short-term, temporary stress due to entrainment, as well as rescue and release activities, with no long-term effects on individual health or fitness. We estimate up to one mortality would occur over the 20-year license renewal period, and do not expect the loss of this one individual to result in a detectable impact on the numbers, reproduction, and distribution of green sea turtles. Overall, we do not expect the proposed action to reduce the likelihood of survival and recovery of East Pacific DPS green sea turtles.

2.7.1.2 Loggerhead Sea Turtles

Over the course of the proposed action, we anticipate that a small number of loggerhead sea turtles may enter the action area and be entrained in the Intake Structure. In 2024, the first and only loggerhead sea turtle entrainment was recorded at DCNPP. This individual was released alive and unharmed. Based on this and the potential for warming temperatures to increase the number of loggerhead sea turtles in the action area, we anticipate that up to a maximum of two loggerhead sea turtles may be entrained at DCNPP over the 20-year license renewal period, with no more than two individuals entrained in a year. We do not expect any individuals to die, given all of the sea turtles entrained at DCNPP to date have been released alive and unharmed. DCNPP will continue to implement daily monitoring of the intake and best practices to handle and release any entrained sea turtles, minimizing the potential for mortality. We expect entrained individuals to experience short-term, temporary stress due to entrainment, as well as rescue and release activities, with no long-term effects on individual health or fitness. Given the low numbers of anticipated entrainment and that all are expected to be released alive, we do not expect the entrainment of this small number of individuals to result in a detectable impact on the numbers, reproduction, and distribution of loggerhead sea turtles. Overall, we do not expect the proposed action to reduce the likelihood of survival and recovery of loggerhead sea turtles.

2.7.1.3 Leatherback Sea Turtles

There are no records of leatherback sea turtle entrainment at DCNPP; however, we consider the possibility that up to one leatherback sea turtle may be entrained at DCNPP over the 20-year license renewal period. We expect entrained individuals to experience short-term, temporary stress due to entrainment, as well as rescue and release activities, with no long-term effects on individual health or fitness. To date, all entrained sea turtles at DCNPP have been released alive and unharmed. Based on this, we do not anticipate any mortality of leatherback sea turtles due to entrainment at DCNPP. DCNPP will continue to implement daily monitoring of the intake and best practices to handle and release any entrained sea turtles, minimizing the potential for mortality. We do not expect the entrainment and release of one individual to result in a detectable impact on the numbers, reproduction, and distribution of leatherback sea turtles. Overall, we do not expect the proposed action to reduce the likelihood of survival and recovery of leatherback sea turtles.

2.7.1.4 Olive Ridley Sea Turtles

There are no records of olive ridley sea turtle entrainment at DCNPP; however, we consider the possibility that up to one olive ridley sea turtle may be entrained at DCNPP over the 20-year license renewal period. We expect entrained individuals to experience short-term, temporary stress due to entrainment, as well as rescue and release activities, with no long-term effects on individual health or fitness. To date, all entrained sea turtles at DCNPP have been released alive and unharmed. Based on this, we do not anticipate any mortality of olive ridley sea turtles due to entrainment at DCNPP. DCNPP will continue to implement daily monitoring of the intake and best practices to handle and release any entrained sea turtles, minimizing the potential for mortality. We do not expect the entrainment and release of one individual to result in a detectable impact on the numbers, reproduction, and distribution of olive ridley sea turtles. Overall, we do not expect the proposed action to reduce the likelihood of survival and recovery of olive ridley sea turtles.

2.7.2. Black Abalone

As described in Section 2.2 (Rangewide Status of the Species and Critical Habitat), black abalone have declined significantly throughout the southern portion of their range and face a high risk of extinction due to threats including disease, poaching, and sedimentation events. Black abalone also have a high recovery potential, with signs of natural recovery (increasing numbers) at a few Channel Island sites where densities remain high enough to support reproduction and recruitment.

As described in Section 2.4 (Environmental Baseline), black abalone were once abundant in the action area within Diablo Cove and along shorelines adjacent to Diablo Cove. In the years after DCNPP operations began (1985-1988), black abalone numbers increased at several sites in Diablo Cove and also showed signs of recruitment in the action area. However, starting in 1988 through the early 1990s, disease-induced mass mortalities significantly reduced black abalone numbers and densities within Diablo Cove and adjacent shorelines. Black abalone have not recovered within the action area and remain present at low numbers.

As described in Section 2.5 (Effects of the Action), the proposed action would allow continued discharge of heated water into Diablo Cove, resulting in continued degradation of black abalone habitat in the area immediately surrounding the Discharge Structure. The elevated water temperatures and increased water velocities due to the discharge would continue to make habitat conditions in the area unsuitable for black abalone of all life stages. We expect these adverse effects to be limited to approximately 80 meters of shoreline surrounding and including the Discharge Structure. The area affected is small compared to the over 1,000 meters of shoreline available throughout the rest of Diablo Cove. Outside of this area immediately surrounding the Discharge Structure, habitat conditions remain suitable to support black abalone, as evidenced by the continued presence of black abalone in Diablo Cove and adjacent shorelines.

We considered the effects of the proposed action on black abalone within the context of the species' status, the environmental baseline, and cumulative effects. The proposed action would perpetuate the effects of the discharge on black abalone and their habitat, which have been ongoing since DCNPP operations began in 1985. That elevated water temperatures due to the discharge contributed to increased disease and mortality rates is possible but uncertain, given withering syndrome caused similar declines in black abalone throughout southern and south-Central California (NMFS, 2018; VanBlaricom et al., 2009). It is also possible, but unlikely, that discharge effects have contributed to the lack of black abalone recovery in the action area, given similar trends in most other areas affected by disease-induced mass mortalities and the observations noted above indicating habitat conditions in Diablo Cove continue to support black abalone reproduction and recruitment.

Warm water events (e.g., marine heat waves, El Niño events) and projected increases in water temperatures (estimated at 2-3˚C by year 2100) (Burgess et al., 2023) would raise the initial intake water temperatures. Although the difference between the intake and discharge water temperatures may not increase, the overall average water temperatures in Diablo Cove and adjacent shorelines affected by the discharge plume would be expected to increase. Within the approximately 80 meters of shoreline immediately surrounding the Discharge Structure, such an increase would further exacerbate degradation of habitat conditions for black abalone because temperatures would be more likely to exceed 77˚F (24˚C) and more frequently. However, we do not expect an increase in the extent of this area or a change in the response of animals to these conditions (i.e., the area would continue to be unsuitable for black abalone).

Within the rest of Diablo Cove and adjacent shorelines, an increase in overall average water temperatures may result in additional areas with temperatures exceeding 77˚F (24˚C) and therefore becoming unsuitable for black abalone. However, intertidal temperature monitoring data for Diablo Cove indicate this outcome is unlikely. For example, in 2022, monthly intertidal temperatures in North and South Diablo Cove ranged from an average of 12.2 to 19.8˚C (PG&E, 2023). With an increase of 2-3˚C, average water temperatures would remain below 77˚F (24˚C). Continued monitoring of intertidal water temperatures in the action area will be important to track increases over time resulting from the combined effects of the discharge and warming ocean temperatures.

In summary, considering the status of the species, the environmental baseline, and cumulative effects, we do not expect the proposed action to reduce the likelihood of survival and recovery of black abalone. The proposed action would adversely affect black abalone by continuing to degrade habitat conditions within an approximately 80 meter length of shoreline immediately surrounding and including the Discharge Structure. This area is small compared to the total available habitat within the action area. We do not expect the continued degradation of this area of shoreline to affect habitat suitability in other areas of Diablo Cove and the rest of the action area, where black abalone remain present at low numbers, or to affect the ability of black abalone to recover within the action area. Continued monitoring of intake, discharge, and intertidal water temperatures as well as black abalone within the action area will be important to track trends in temperature and black abalone over time.

2.7.3. Black Abalone Critical Habitat

Black abalone critical habitat within the action area contains PBFs of good to excellent quality, providing an overall high conservation value to the species (NMFS, 2011). This is especially true within Diablo Cove and the adjacent shorelines north and south of Diablo Cove, which encompass rocky intertidal and shallow subtidal habitats which historically supported large numbers of black abalone. Within Intake Cove, the quality of critical habitat features varies and includes riprap armored shorelines, breakwaters, and natural rocky intertidal and subtidal habitat (Tenera, 2021).

We expect the proposed action to have limited effects on black abalone critical habitat within Intake Cove. Although impingement and entrainment effects from the intake could alter macroalgal communities within Intake Cove, surveys conducted in 2020 indicate food resources (including bull kelp and giant kelp) remain available and abundant within Intake Cove (Tenera, 2021). Effects of the intake on nearshore circulation patterns would be limited to the area directly in front of and adjacent to the Intake Structure, and are unlikely to affect circulation patterns necessary to support successful black abalone reproduction and larval settlement in appropriate habitat, given the low likelihood that black abalone of any life stage would occur within Intake Cove.

We expect the proposed action to affect all PBFs within Diablo Cove. Within the area directly in front of and adjacent to the Discharge Structure, the discharge of heated water has degraded and will continue to degrade all of the PBFs and reduce the quality of black abalone critical habitat. For example, the discharge has heavily scoured the habitat directly in front of the Discharge Structure (Tenera, 2021). Water temperatures at times exceed the temperature tolerance of black abalone, impeding juvenile settlement and recolonization of the area by adults. Elevated water temperatures and increased water velocities preclude the settlement of giant kelp within approximately 575 feet of the Discharge Structure (Tenera, 2021). Outside of the area immediately surrounding the Discharge Structure, we expect the effects of the discharge to be reduced and the PBFs to remain of suitable quality to support black abalone.

We considered the effects of the proposed action on black abalone critical habitat within the context of the status of black abalone critical habitat, the environmental baseline, and cumulative effects. The proposed action would perpetuate the ongoing effects of the intake and discharge on black abalone critical habitat as discussed in the Environmental Baseline (Section 2.4.3.2) and Effects of the Action (Section 2.5.2.3). We do not expect the effects on black abalone critical habitat to increase in severity or extent under the proposed action. Warm water events and projected increases in ocean temperatures could increase water temperatures throughout the action area, affecting suitable water quality in black abalone critical habitat. As discussed above in the Integration and Synthesis for Black Abalone (Section 2.7.2), we do not expect increased water temperatures to exceed the suitable ranges identified for black abalone critical habitat, except within the area immediately surrounding the Discharge Structure where temperatures already exceed these ranges at times. We expect black abalone critical habitat to be exposed to diluted, low concentrations of constituents in the DCNPP discharge effluent, with limited effects on water quality. We are not aware of additional discharges into the action area that would expose black abalone critical habitat to higher levels of heavy metals or other constituents.

In summary, considering the status of critical habitat, the environmental baseline, and cumulative effects, we do not expect the proposed action to appreciably reduce the value of critical habitat as a whole for the conservation of black abalone. The proposed action would reduce the quality of critical habitat within an approximately 80 meter length of shoreline immediately surrounding and encompassing the Discharge Structure. We do not expect the reduced quality of critical habitat within this area to affect the quality of critical habitat in other areas within the action area, given the area is only a fraction of the more than 1,000 meters of shoreline habitat available within Diablo Cove. The quality of critical habitat within the rest of Diablo Cove and adjacent areas remains suitable for black abalone. As stated in the Integration and Synthesis for Black Abalone (Section 2.7.2), continued monitoring of intake, discharge, and intertidal water temperatures and black abalone within the action area will be important to evaluate the effects of the proposed action on black abalone critical habitat.

2.8. Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and the cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of East Pacific DPS green sea turtles, leatherback sea turtles, North Pacific Ocean DPS loggerhead sea turtles, olive ridley sea turtles, or black abalone, or to destroy or adversely modify designated critical habitat for black abalone.

2.9. Incidental Take Statement

Section 9 of the ESA and federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Harass" is further defined by guidance as to "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering." "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.9.1. Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

2.9.1.1 Sea Turtles

We anticipate that the NRC's proposed license renewals and the continued operation of DCNPP for up to an additional 20 years will result in the incidental entrainment of ESA-listed sea turtles. Based on the historical rate of sea turtle entrainment, the distribution of sea turtle species, and the planned DCNPP operations, we anticipate that the DCNPP intake may entrain up to 15 sea turtles during the 20-year period covered by the license renewals, with a maximum of four sea turtle entrainments per year. We anticipate that most of these entrainments will involve green sea turtles, with up to a maximum of two loggerheads, one leatherback, and one olive ridley sea turtle. In any one year, we anticipate as many as four green sea turtles could be entrained, or as many as two loggerhead sea turtles could be entrained.

To date, all of the entrained sea turtles have been released alive; however, the possibility of mortality cannot be eliminated. We estimate that of the 15 sea turtles that may be entrained, up to one green sea turtle may die. We do not anticipate any mortality of loggerhead, leatherback, or olive ridley sea turtles.

To minimize mortality, all entrained sea turtles are removed from the Intake Structure, assessed for injuries and overall health, tagged, and released. If needed, rescued sea turtles are transferred to a care facility for rehabilitation prior to release. We expect entrained sea turtles to experience short-term, temporary stress due to activities associated with rescue, rehabilitation, and release, including capture, handling, holding, tagging, and transport.

The entrainment of sea turtles at DCNPP will be monitored through continued reporting via the NMFS Stranding Reports, tagging, and observations of sea turtles in the action area.

2.9.1.2 Black Abalone

We anticipate that the NRC's proposed license renewals and the continued operation of DCNPP for up to an additional 20 years will result in continued degradation of black abalone habitat within an approximately 80 meter segment of shoreline immediately surrounding and including the Discharge Structure, making this area unsuitable for black abalone. We consider the continued degradation of this habitat under the proposed action to "significantly disrupt normal behavioral patterns" such that black abalone would not be able to recolonize or reside in this area at any life stage. Therefore, the effects of the proposed action on black abalone meet NMFS' definition of "harass" and constitute "take" under the ESA.

We can reasonably expect black abalone to continue to avoid the approximately 80 meter area of shoreline immediately surrounding and including the Discharge Structure in Diablo Cove. However, we cannot estimate the number of black abalone that would be affected. We do not have specific data on the number of black abalone that previously occupied this stretch of shoreline and likely migrated out when heated water discharges began. Maximum densities of up to 6.9 black abalone per m^2 were observed at monitoring stations in Diablo Cove in the early 1980s (Tenera, 2021). Using these densities, we estimate up to 552 black abalone could occupy this 80 meter stretch of shoreline. This is an overestimate of the current numbers of black abalone that are being excluded from the area, given that black abalone declined by more than 90 percent in the late 1980s due to withering syndrome and less than 10 black abalone have been recorded in Diablo Cove in recent years.

Given uncertainties in the number of black abalone that may be subject to the effects of the proposed action, we can better describe the extent of take based on the estimated area of habitat degraded by the discharge, which is associated with the discharge water temperatures and volume. Consequently, we elect to use the discharge temperatures and volumes as a surrogate to describe the extent of take associated with the degradation of habitat for black abalone as a result of the proposed action. We have therefore quantified the potential incidental take of black abalone in terms of the maximum discharge temperatures and discharge volumes that we expect under the proposed action.

As described in Section 2.5.2.2 of the Effects of the Action, the NPDES permit limits discharge volumes to a maximum of 2,760 MGD and discharge temperatures to a maximum of 22˚F (12.2˚C) above the average daily intake water temperature, except during heat treatment for demusseling (maximum discharge temperature is 25˚F or 13.9˚C above the average daily intake water temperature). Therefore, for the proposed action, the incidental take of black abalone equates to the discharge of heated water up to the maximum discharge temperatures and discharge volumes as established under the NPDES permit.

Under the proposed action, PG&E would continue to monitor discharge temperatures and discharge volumes, as required under the NPDES Permit. Thus, we expect PG&E to be able to monitor the discharge temperatures and volumes to determine if they have exceeded the established maximum levels and provide annual reports to the NRC.

2.9.2. Effect of the Take

In the biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to East Pacific DPS green sea turtles, North Pacific DPS loggerhead sea turtles, leatherback sea turtles, olive ridley sea turtles, or black abalone, nor is it likely to result in the destruction or adverse modification of critical habitat for black abalone.

2.9.3. Reasonable and Prudent Measures

"Reasonable and prudent measures" refer to those actions the Director considers necessary or appropriate to minimize the impact of the incidental take on the species (50 CFR 402.02).

1. NRC shall monitor, document, report, and minimize the incidental take of sea turtles in the DCNPP cooling water intake.
2. NRC shall monitor, document, and report the extent of incidental take of black abalone resulting from continued operation of DCNPP, as described in Section 2.9.1 of this biological opinion.

2.9.4. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the federal action agency must comply (or must ensure that any applicant complies) with the following terms and conditions. The NRC or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

The following terms and conditions implement reasonable and prudent measure 1:

1a. NRC shall require PG&E to continue implementing a program to monitor and minimize the incidental take of sea turtles in the DCNPP cooling water intake. The program must include the following:

i. Every effort should be made to observe the area around the DCNPP CWS. Inspection of the CWS (area between the curtain wall and bar racks at the DCNPP Intake Structure) shall be conducted every 12 hours. Times of inspections must be recorded, including those when no turtles were sighted.
ii. Dip nets, cargo nets, and other equipment shall be available and shall be used to remove sea turtles from the DCNPP Intake Structure to reduce trauma.
iii. An attempt to resuscitate comatose sea turtles shall be made according to the procedures described in Appendix I. These procedures must be posted in appropriate areas.
iv. Training should be provided to relevant PG&E personnel on reporting requirements, safe handling and release requirements, resuscitation methods, and other relevant information (coordinate with NMFS for training and materials).
v. Live sea turtles should be inspected for injuries. If a turtle appears to be sick or seriously injured, contact the California Sea Turtle Stranding Network (CSTSN) rehabilitation facility immediately (The Marine Mammal Center, point of contact: Shelby Stoudt, 415-289-7350). Appropriate transport methods must be employed following the stranding facility’s protocols to transport the animal to the rehabilitation facility for evaluation, veterinary care, tagging, and release at an appropriate location. If the turtle is not injured, the turtle shall be tagged and released at an appropriate location.

1b. NRC shall require PG&E to notify the NMFS WCR Stranding Coordinator within 48 hours if any sea turtles (live or dead) are entrained at DCNPP. NRC shall also require PG&E to complete a NMFS Stranding Report (Appendix II) and submit it to the NMFS WCR Stranding Coordinator within 48 hours of the entrainment. NRC shall require that every sea turtle shall be photographed. NMFS may request that dead sea turtles be necropsied by CSTSN personnel. The current NMFS WCR Stranding Coordinator for incidents off the coast of California is Justin Viezbicke (562-506-4315 or Justin.Viezbicke@noaa.gov).

1c. NRC shall require PG&E to submit an annual report of incidental takes to NMFS by February 1st of the following year. The report shall include copies of the incidental take reports, photographs (if not previously submitted), a record of all turtle sightings in the vicinity of DCNPP, and a record of when inspections of the CWS were conducted for 24 hours prior to any entrainment. The report must also include any potential measures to reduce sea turtle entrainment or mortality by DCNPP. The report will be used to identify entrainment trends and further conservation measures necessary to minimize the incidental takes of sea turtles.

1d. NRC shall notify NMFS (or require PG&E to notify NMFS) when DCNPP reaches 50 percent of the incidental take level for any species of sea turtle. At that time, the NRC and NMFS will determine if additional measures are needed to minimize the entrainment of sea turtles at the CWS intake.

The following terms and conditions implement reasonable and prudent measure 2:

2a. NRC shall require PG&E to collect the necessary data to determine the temperature increase between the discharge water temperatures and the average intake water temperatures, to determine compliance with the maximum limits established under the NPDES Permit: a maximum discharge temperature of 22˚F (12.2˚C) above the average daily intake water temperature, or 25˚F (13.9˚C) above the average daily intake water temperature during heat treatment for demusseling. The NPDES permit requirement to continuously monitor influent and effluent water temperatures would satisfy this term and condition.

2b. NRC shall require PG&E to collect the necessary data to determine the maximum daily discharge volumes, to determine compliance with the maximum limits established under the NPDES Permit (up to 2,760 MGD of seawater). The NPDES permit requirement to daily monitor the discharge flows in MGD would satisfy this term and condition.

2c. NRC shall require PG&E to collect the necessary data to evaluate effects of the discharge on receiving water temperatures and black abalone within the action area. The NPDES permit requires PG&E to conduct an Ecological Monitoring Program as part of the Receiving Water Monitoring Program. The Ecological Monitoring Program includes monitoring of intertidal and subtidal water temperatures as well as black abalone surveys within Diablo Cove, Field's Cove, and reference stations located to the north and south of Diablo Canyon. The NPDES Permit requirement to conduct the Ecological Monitoring Program would satisfy this term and condition.

2d. NRC shall require PG&E to submit the DCNPP Receiving Water Monitoring Program and Discharge Self Monitoring annual reports to the NMFS WCR at the same time PG&E shares these reports with the NRC and the CA SWRCB, as required under the NPDES Permit. The reports shall be electronically submitted to the NMFS WCR Protected Resources Division's (PRD) Long Beach Office Branch Chief (Dan Lawson) at the following email address: Dan.Lawson@noaa.gov.

2e. NRC shall require PG&E to notify the NMFS WCR if, during the permit term, the DCNPP's discharge temperatures and/or discharge volumes exceed the maximum levels established above. NRC shall require PG&E to notify the NMFS WCR PRD Long Beach Office Branch Chief (Dan Lawson) at Dan.Lawson@noaa.gov within the 24 hours when monitoring results indicate this has occurred.

2.10. Conservation Recommendations

Section 7(a)(1) of the ESA directs federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, "conservation recommendations" are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

We recommend that the NRC implement the following conservation measure to further evaluate the adverse effects of the proposed action on black abalone and black abalone critical habitat:

1. The NRC should request PG&E to support incorporation of the black abalone monitoring data into the MARINe (Multi-Agency Rocky Intertidal Network) database to ensure the data are properly managed, maintained, and accessible to resource managers, for example, to inform and update assessments of the species' status over time.

2.11. Reinitiation of Consultation

This concludes formal consultation for NRC's decision to renew the facility operating licenses for DCNPP Units 1 and 2 for an additional 20 years.

Under 50 CFR 402.16(a): "Reinitiation of consultation is required and shall be requested by the federal agency, where discretionary federal involvement or control over the action has been retained or is authorized by law and: (1) If the amount or extent of taking specified in the incidental take statement is exceeded; (2) If new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion or written concurrence; or (4) If a new species is listed or critical habitat designated that may be affected by the identified action."

In this biological opinion, we anticipate incidental take via entrainment of up to 15 ESA-listed sea turtles, most of which would be green sea turtles and include up to two loggerheads, one leatherback, and one olive ridley. Of these 15 sea turtles, we anticipate up to one green sea turtle may die. We do not anticipate any mortality of loggerheads, leatherbacks, or olive ridleys. If the incidental take exceeds these amounts, then the NRC should immediately reinitiate consultation with NMFS. The NRC must provide an explanation of the causes of the taking and review with NMFS the need for modification of the reasonable and prudent measures.

We also anticipate incidental take of black abalone and describe the extent of this take in terms of the maximum discharge water temperatures and discharge volumes, as a surrogate for the amount of black abalone habitat degraded by the discharge. If the discharge temperatures and/or volumes exceed the maximums established under the NPDES permit (maximum discharge temperatures of 22˚F (12.2˚C) above the average daily intake water temperature and maximum discharge volume of 2,760 MGD), then we may determine that the extent of incidental take under the proposed action that has been anticipated in this biological opinion has been exceeded.

2.12. "Not Likely to Adversely Affect" Determinations

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (50 CFR 402.02). When evaluating whether the proposed action is not likely to adversely affect listed species or critical habitat, NMFS considers whether the effects are expected to be completely beneficial, insignificant, or discountable. Completely beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Effects are considered discountable if they are extremely unlikely to occur.

We do not expect the proposed action to adversely affect ESA-listed gray whales (Western North Pacific DPS) or humpback whales (Central America DPS and Mexico DPS). We also do not expect the proposed action to adversely affect designated critical habitat for humpback whales or leatherback sea turtles.

In our effects analysis, we identified three potential stressors of the proposed action: (1) impingement and entrainment of individuals and their prey at the Intake Structure; (2) thermal and flow effects due to discharge of heated water; and (3) exposure to constituents in the discharge. We analyze the potential for these stressors to adversely affect each species and designated critical habitat.

2.12.1. ESA-listed Whales

2.12.1.1 Gray Whales, Western North Pacific DPS

Western North Pacific (WNP) DPS gray whales were originally listed as endangered under the Endangered Species Conservation Act in June 1970 (35 FR 18319), and remain listed under the ESA (35 FR 8491). There are two recognized gray whale stocks in the North Pacific: the WNP and the Eastern North Pacific (ENP), which is no longer listed under the ESA after being delisted in 1994 (59 FR 31094). Gray whales are bottom feeders, consuming a wide range of benthic and epibenthic invertebrates, including amphipods.

WNP gray whales were considered geographically isolated from the ENP stock; however, recent information suggests overlap between these two stocks, with WNP gray whales migrating along the U.S. west coast along with ENP gray whales. The probability that any gray whale observed along the U.S. west coast would be a WNP gray whale is extremely small, i.e., less than one percent even if the entire population of WNP gray whales were part of the annual gray whale migration in the ENP (Carretta et al., 2021).

Gray whales occur in the action area seasonally, with individuals observed near Diablo Canyon during their southbound migration from December to February, and during their northbound migration from February to May (Tenera, 2021). From 2017 to 2020, 37 individual gray whales were observed off the coast of Diablo Canyon (Tenera, 2021).

2.12.1.2 Humpback whales, Central America DPS and Mexico DPS

Humpback whales were originally listed as endangered under the Endangered Species Conservation Act in June 1870 (35 FR 18319), and remain listed under the ESA (35 FR 8491). On September 8, 2016, NMFS published a final rule dividing the globally listed endangered humpback whale into 14 DPSs; categorizing four DPSs as endangered and one as threatened (81 FR 62259). Humpback whales in the action area belong to the Central America DPS (listed as endangered) and the Mexico DPS (listed as threatened).

Humpback whales are regularly observed in the action area in waters offshore of Diablo Canyon, with sightings most common in late summer to early winter (NRC, 2024a). From 2017 through 2020, seven humpback whales were observed in the action area (PG&E, 2024c). A humpback whale was observed feeding as close as 1,640 ft (500 m) from the discharge, though none have been observed within the Intake or Diablo Coves (PG&E, 2023). Humpback whale diets consist of krill and small schooling fish, including herring, mackerel, sand lance, sardines, anchovies, and capelin.

2.12.1.3 Effects on ESA-listed Whales

Humpback and gray whales may be exposed to increased water temperatures resulting from the discharge plume and chemical constituents associated with the plume. Due to their size, humpback and gray whales are not themselves at risk of impingement or entrainment at the Intake Structure. However, their prey may be affected by impingement or entrainment. We analyze these effects of the proposed action on ESA-listed humpback and gray whales.

Based on past observations, we would not expect humpback or gray whales to enter or feed in the Intake Cove or Diablo Cove, but to use waters outside of these coves within the action area, limiting their exposure to the effects of the DCNPP intake and discharge. Although humpback and gray whales may be exposed to increased temperatures in the discharge plume outside of Diablo Cove, we do not expect these increased temperatures to exceed the species' thermal tolerance. Subtidal temperatures at Field's Cove, located north of Diablo Cove, ranged from 9 to 19.5°C in 2022 (PG&E, 2024b). Humpback and gray whales have wide thermal tolerances, and undertake long migrations across oceans. A worldwide survey found that humpback wintering areas occur in waters where temperatures range from 21 to 28°C (Rasmussen et al., 2007). Gray whales tend to occupy cooler waters ranging from 14 to 19°C, and appear to avoid temperatures greater than 22°C (Molina-Carrasco et al., 2024). Based on the available data, we expect water temperatures within the thermal plume to be within the species' natural temperature range.

Although humpback and gray whales may be exposed to chemical constituents in the discharge plume, we anticipate their exposure to be limited to diluted concentrations below levels that would have harmful effects. As discussed in Section 2.5 (Effects of the Action**),** levels of most chemical constituents (e.g., ammonia, heavy metals) in the discharge effluent were non-detectable or low (PG&E, 2024b). Higher concentrations of heavy metals were detected in some effluent streams; however, these effluent streams are mixed with the main circulating water and thus diluted prior to being discharged into Diablo Cove. The effluent is further diluted once discharged into Diablo Cove. Given their distribution within the action area, we expect humpback and gray whales to be exposed to highly diluted, low concentrations of the discharge effluent and any chemical constituents contained in the effluent.

Available data indicate ESA-listed whales are generally not at risk of health effects from the constituents found in the discharge effluent. Some constituents are essential elements for nutrition (e.g., nickel and zinc) (Das et al., 2003; Pugh and Becker, 2001) and are generally found in low levels in marine mammals distributed throughout the world's oceans (O'Shea, 1999; Pugh and Becker, 2001). While metals can bioaccumulate in the aquatic environment, most metals (except methylmercury) do not appear to biomagnify and are regulated and excreted by a host of marine life (Gray, 2002). Therefore, limited increases in uptake of these essential elements found in low concentrations in whales are not anticipated to cause adverse health effects. Other heavy metals (e.g., arsenic, chromium, copper, lead) have been measured at low levels in marine mammal tissues, but those low levels do not appear to pose a health risk (O'Shea, 1999). For these reasons, we do not anticipate that humpback and gray whales will experience any toxic health effects due to occasional exposure to the constituents in the discharge effluent when foraging in the action area.

Prey species may also be affected by exposure to the thermal plume and constituents in the effluent. Based on the levels of constituents in the effluent, we expect prey species to be exposed to diluted, low concentrations of any chemical constituents due to the discharge. Exposure to the thermal plume has resulted in shifts in intertidal and subtidal communities, with some species increasing and some decreasing (NRC, 2024a). Regular intertidal and subtidal monitoring confirms that the action area continues to support diverse fish and invertebrate communities (PG&E, 2024b), indicating the effects of the discharge have not reduced the availability of prey species for humpback and gray whales in the action area.

Gray whale prey species would most likely be affected by entrainment. Past entrainment studies did not specifically focus on prey species for gray whales, but results generally indicate greater entrainment impacts on nearshore fish and larvae inhabiting intertidal habitat compared to offshore, deeper-water species (PG&E, 2009). We expect limited effects of entrainment on benthic prey species outside of Intake Cove. In terms of prey species for humpback whales, past and ongoing aquatic studies indicate a high likelihood of coastal pelagic species (e.g., sardines, anchovies, mackerel) and a low likelihood of krill occurring within the action area (NRC, 2024a). PG&E (2009) states that the design and placement of the Intake Structure reduces the occurrence of schooling fish and their susceptibility to impingement. In addition, the water flow in the Intake Structure is slower than the burst swimming speed of most fish species, allowing fish to swim away and avoid impingement (Tenera, 2000). Tenera (2000) collected sardines and anchovies in entrainment samples, but estimated a low proportional loss (< 1%) of these species due to entrainment. PG&E (2009)'s long-term monitoring of fish populations in the area around Diablo Canyon do not indicate declines associated with entrainment impacts. Overall, the results of past impingement and entrainment studies indicate limited effects of impingement and entrainment that are unlikely to reduce the availability of prey species for humpback and gray whales in the action area.

In summary, the effects of the proposed action on humpback whales and gray whales would include exposure to elevated water temperatures within the species' temperature range, exposure to diluted concentrations of constituents in the discharge effluent below levels expected to cause harmful effects, and low proportional losses of prey species that are not expected to reduce availability of prey. Based on this analysis, we find that the potential effects of the proposed action on Western North Pacific DPS gray whales, Central America DPS humpback whales, and Mexico DPS humpback whales are insignificant and determine that the proposed action may affect, but is not likely to adversely affect, these ESA-listed whale species.

2.12.2. Designated critical habitat for humpback whales, Central America DPS and Mexico DPS

On April 21, 2021 (86 FR 21082), NMFS designated critical habitat for the Central America and Mexico DPSs of humpback whales, including marine waters off the coast of California. One PBF was identified and defined as "prey species, primarily euphausiids and small pelagic schooling fishes of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth."

The nearest boundary of the designated critical habitat for humpback whales is approximately 1.3 km from DCNPP, making it likely that the thermal plume will sometimes extend into this area. The plume is largest during ebb tides, with the 2 to 4°F (1 to 2°C) isotherm enclosing up to 2,000 acres (809 hectares) and extending up to 3.2 km (2 mi) from the discharge (PG&E, 2008).

Two prey species, Pacific sardine (*Sardinops sagax*) and northern anchovy (*Engraulis mordax*), have been documented in nearshore areas within the action area. The remaining humpback prey species have not been specifically documented in aquatic surveys at DCNPP, but would be expected to respond similarly to the effects of the proposed action.

Pacific sardine and northern anchovy primarily occur offshore, but larvae of both species have been collected during fish entrainment studies (NRC, 2024a; Tenera, 2000). For both species, Tenera (2000) estimated that less than one percent of the larvae in the area surrounding Diablo Canyon are entrained annually, resulting in a low proportional entrainment loss that is not likely to reduce the availability of these prey species for humpback whales in the action area.

These prey species are likely to be exposed to thermal effects from the discharge plume; however, their exposure is limited by their pelagic distribution. Temperatures within the thermal plume are much lower than the discharge itself due to extensive mixing with seawater. Prey species encountering the thermal plume within the action area will likely be exposed to temperatures only a few degrees above ambient and well within their temperature tolerances. For example, Pacific sardines can tolerate temperatures up to 30°C (Martinez-Porchas et al., 2009), and northern anchovy can tolerate temperatures up to 28°C (Brewer, 1976).

Similarly, prey species are likely to be exposed to constituents in the discharge plume, but the species' pelagic distribution would limit their exposure to highly diluted, low concentrations of these constituents. The levels of most constituents in the discharge effluent were non-detectable or very low (PG&E, 2024b). Although greater levels were found in other effluent streams, these effluent streams would be mixed with the main circulating water and further diluted upon discharge into Diablo Cove, with even lower levels in the discharge plume outside of Diablo Cove (PG&E, 2024b).

Overall, we do not expect the effects of the intake or discharge of cooling water to detectably alter prey abundance, quality, or distribution in the action area. Based on this analysis, we find that potential effects of the proposed action on designated critical habitat for humpback whales are insignificant and determine that the proposed action may affect, but is not likely to adversely affect, this critical habitat.

2.12.3. Designated critical habitat for leatherback sea turtles

On January 26, 2012 (77 FR 4170), NMFS designated critical habitat for leatherback sea turtles along the U.S. west coast, including the action area. NMFS identified one essential habitat feature for leatherback critical habitat: "the occurrence of prey species, primarily scyphomedusae of the order Semaeostomeae (e.g., *Chrysaura, Aurelia, Phacellophora,* and *Cyanea*), of sufficient condition, distribution, diversity, abundance, and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks."

Jellyfish that have been observed in the action area include *Pelagia* spp., *Phacellophora* spp., *Cyanea* spp., *Aurelia aurita*, and *Chrysaora* spp. (NRC, 2024b, 2024a). These species are observed occasionally and seasonally offshore during the summer and fall months, with *Aurelia aurita* the only species seen in very large numbers. Jellyfish in the action area may be exposed to limited increases in water temperatures due to the thermal plume, which may actually increase jellyfish abundance; increases in response to warming events have been observed for several jellyfish species (Purcell et al., 2007). Jellyfish may also be exposed to constituents in the discharge effluent; however, as discussed above, exposure would be limited to low, diluted concentrations of the effluent and its constituents that would not be expected to reduce the quality of jellyfish. If jellyfish are observed near the Intake Cove, PG&E has measures in place to avoid the impingement of jellyfish, including the use of bubble curtains to deflect jellyfish away from the entrance to Intake Cove (NRC, 2024b).

Overall, we do not expect the continued DCNPP operations under the proposed action to measurably affect jellyfish populations and the availability, quality, or distribution of this prey resource for leatherback sea turtles. We find that the potential effects of exposure to the discharge on jellyfish are insignificant and the potential for impingement and entrainment of jellyfish at the Intake Structure is discountable. Based on this analysis, we determine that the proposed action may affect, but is not likely to adversely affect, designated critical habitat for leatherback sea turtles.

3. MAGNUSON–STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE

Section 305(b) of the MSA directs federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the associated physical, chemical, and biological properties that are used by fish (50 CFR 600.10). Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects may result from actions occurring within EFH or outside of it and may include direct, indirect, site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH (50 CFR 600.905(b)).

This analysis is based, in part, on the EFH assessment provided by the NRC in its DSEIS (NRC, 2024a) and descriptions of EFH contained in the fishery management plans for Pacific Coast groundfish (PFMC, 2005), coastal pelagic species (PFMC, 1998), and highly migratory species (PFMC, 2007).

3.1. EFH Affected by the Proposed Action

The proposed project occurs within EFH for various federally managed fish species within the Pacific Coast Groundfish, Coastal Pelagic Species (CPS), and Highly Migratory Species (HMS) Fishery Management Plans (FMPs). The EFH assessment provided by the NRC identified all marine waters within the action area of DCNPP as EFH for all life stages of CPS (including Euphasiids/krill), all life stages of Pacific Coast Groundfish, and all life stages of the common thresher shark, an HMS species.

In addition, the project occurs within, or in the vicinity of rocky reef and canopy kelp habitats, which are designated as habitat areas of particular concern (HAPC) for various federally managed fish species within the Pacific Coast Groundfish FMP. HAPC are described in the regulations as subsets of EFH which are rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area. Designated HAPC are not afforded any additional regulatory protection under the MSA; however, federal projects with potential adverse impacts on HAPC will be more carefully scrutinized during the consultation process.

3.2. Adverse Effects on EFH

NMFS determined the proposed action would adversely affect EFH as follows:

Impingement and Entrainment

Impingement occurs when organisms are trapped against the outer part of an intake structure's screening device (79 FR 48300-TN4488). Organisms become trapped against the screen and are unable to escape due to the force of intake water. Impingement can kill organisms immediately, or it can cause exhaustion, suffocation, injury, and other physical stresses that can contribute to eventual mortality. An impinged organism's potential for injury or death is related to the organism's amount of time impinged, the organism's fragility, and the physical characteristics of the intake structure(s).

Entrainment occurs when organisms pass through a screening device and travel through the entire cooling system. Organisms susceptible to entrainment are smaller in size, and include ichthyoplankton, larval stages of shellfish and other macroinvertebrates, zooplankton, and phytoplankton. As a result, susceptibility of entrainment is highly dependent on life history traits, such as swimming ability or whether organisms are adhesive during egg stages. Entrained organisms experience physical trauma and stress, pressure changes, excess heat, and chemical exposure during travel through the cooling system. Because entrained organisms are typically of fragile life stages, such as eggs or early larvae, the EPA has determined that, for the purposes of assessing the impacts of a cooling water intake system on the aquatic environment, all entrained organisms die (79 FR 48300-TN4488).

Under the proposed action, we expect continued operation of DCNPP to result in impingement and entrainment that would adversely affect EFH for CPS, HMS, and Pacific Coast Groundfish. Studies have documented the impingement and entrainment of diverse fish and invertebrate species at the Intake Structure, including early life stages and juveniles of CPS, HMS, and groundfish species and their prey (PG&E, 2010; Tenera, 2000). For example, multiple rockfish species (*Sebastes* spp.), sharks, and rays have been observed in impingement studies for the DCNPP intake (Tenera, 2000). Entrainment studies identified several species from the CPS and Pacific Coast Groundfish FMPs, including Pacific sardine, northern anchovy, multiple rockfish and sculpin species, and multiple crab species (Steinbeck, 2008). The vast majority of individuals impinged or entrained were larvae and non-reproductive juveniles, and overall rates of impingement and entrainment were low (Steinbeck, 2008; Tenera, 2000). For example, the estimated annual proportion of larvae entrained was less than 1-2 percent of the larvae within the area surrounding Diablo Canyon for rockfish, Pacific sardines, and northern anchovies (Tenera, 2000). PG&E (2009) conducted long-term adult fish monitoring and did not detect declines over the 30 year period, indicating no significant impacts to fish populations from entrainment and impingement effects.

Thermal discharge

DCNPP discharges heated effluent into Diablo Cove, which then flows into the Pacific Ocean. The primary thermal impact of concern from this discharge is heat shock, which occurs when water temperature meets or exceeds the thermal tolerance of an aquatic species for some duration of the exposure. Many fish can avoid areas that exceed their thermal tolerance; however, some aquatic organisms or life stages lack the mobility to do so. In addition to the threat of heat shock, thermal plumes discharged from DCNPP can create barriers to fish passage, which is of particular concern for migratory species. Thermal discharge can also alter or reduce the amount of available habitat for many fish species.

Under the proposed action, we expect continued operation of DCNPP and continued discharge of heated water to adversely affect EFH for CPS, HMS, and Pacific Coast Groundfish. The effects of the thermal discharge would be greatest within Diablo Cove in areas directly in front of and adjacent to the Discharge Structure, where water temperatures and water flows are greatest. Outside of Diablo Cove, the effects of the discharge on water temperature and flow extend about 1-2 miles offshore and along the coast, but are much reduced (NRC, 2024a). Most of the EFH species that occur within the action area do not occupy the epipelagic region of the water column where effects from the thermal plume would be experienced. Common thresher sharks can occupy the upper parts of the water column, but their depth range can extend to 2,460 ft (750 m) in depth (Carlson, 2019). Thresher sharks can easily avoid areas of heated water due to their agility, and the relatively small area affected by the thermal plume would not meaningfully affect habitat for this highly mobile species.

Exposure to Chemical Constituents in the Discharge Effluent

DCNPP is required by the NPDES permit to operate within established instantaneous maximum, daily maximum, and 6-month median concentration limits for heavy metals, chlorine, ammonia, toxicity, non-chlorinated phenolic compounds, chlorinated phenolics, and radioactivity. Although there have not been any discharge permit violations associated with wastewater discharges from 2018-2022, the discharge of these constituents into the marine environment can still adversely affect aquatic organisms and their habitats. Many of these constituents can negatively impact the development of aquatic organisms throughout various life stages. They can also alter or reduce the amount of available habitat for many fish species.

Under the proposed action, we expect the continued operation of DCNPP and continued discharge of constituents to adversely affect EFH for CPS, HMS, and Pacific Coast Groundfish by altering water quality. PG&E regularly monitors constituents in the influent and discharge as required by the NPDES permit. In 2023, levels of most constituents were low, with many below the analytical detection limit (PG&E, 2024b). Higher concentrations of some heavy metals were detected in other effluent streams (PG&E, 2024b), but are diluted when mixed with the main circulating water prior to discharge through the Discharge Structure. The effluent is further diluted once it is discharged and mixed with the receiving water in Diablo Cove, with a minimum initial dilution factor of 4.1:1 (seawater: effluent). Thus, we expect CPS, HMS, and Pacific Coast Groundfish to be exposed to low levels of these constituents due to the discharge, with limited effects on their growth, survival, and reproduction.

PG&E has also analyzed samples of algae, fish, invertebrates, and sediments and has not detected tritium or any other radionuclides attributable to DCNPP from 2019 to 2023 (NRC, 2024a). These results indicate it is unlikely that EFH in the action area would be exposed to radiological contamination from the DCNPP discharge.

3.3. EFH Adverse Effects Determination

Based on the above effects analysis, NMFS has determined that the activities covered under the proposed action would adversely affect EFH for various federally managed fish species under the CPS, Pacific Coast Groundfish, and HMS FMPs. The primary activities NMFS has determined would adversely affect EFH within the action area are impingement, entrainment, thermal discharge, and constituent exposure.

Impingement and entrainment studies concluded that DCNPP had the lowest impingement rate of all the power plants that use the Pacific Ocean as a source of cooling water (Steinbeck, 2008). The design of the Intake Cove likely reduces the occurrence and susceptibility of schooling fishes to impingement (and entrainment), and the water flow in and around the Intake Structure is likely below the burst swim speed of most adult fish, allowing fish to swim away from the intake (PG&E, 2009; Tenera, 2000). DCNPP also reduces impingement and entrainment through the use of technology which gently excludes organisms from becoming impinged or entrained, including a curtain wall, bar racks, and travelling screens. Although the intake system does not include a fish handling-and-return system, some fish should be able to escape impingement through the use of cut-outs between the closure gate forebays and the two bar rack bays at each end of the intake structure. Additionally, PG&E pays an annual mitigation fee based on the volume of water withdrawn from the Pacific Ocean. This mitigation fee is paid to the Ocean Protection Council or State Coastal Conservancy to fund appropriate mitigation projects.

Thermal monitoring in the action area began several years before the start of DCNPP operations, to understand changes in the aquatic environment resulting from thermal discharge. The NPDES Permit establishes maximum discharge temperatures to limit effects on intertidal and subtidal environments in and around Diablo Cove. The NPDES also requires implementation of the RWMP, which consists of continuous monitoring of intertidal and subtidal temperatures as well as quarterly intertidal and subtidal biological assessments. Annual RWMP reports indicate that DCNPP discharge temperatures remain below the established maximums and that thermal effects dissipate with distance from the Discharge Structure, reducing the effects of the thermal plume on the marine environment in North and South Diablo Cove and outside of Diablo Cove (Tenera Environmental, 2023, 2021, 2016, 2015). Diverse intertidal and subtidal communities remain within and around Diablo Cove, although shifts have occurred, including a shift from bull kelp to giant kelp within Diablo Cove and increases/decreases in other algal and invertebrate species (NRC, 2024a; PG&E, 2023; Tenera, 2021).

Diablo Canyon is required by the NPDES permit to operate within established instantaneous maximum, daily maximum, and 6-month median concentration limits for the aforementioned constituents. There have not been any discharge permit violations associated with wastewater discharges from 2018-2022 (NRC, 2024a). Data from the latest discharge monitoring report indicate most constituents in the effluent are at low or non-detectable levels (PG&E, 2024b).

Based on our analysis of the potential effects of the proposed action on EFH and the measures to minimize these effects, NMFS has no additional EFH conservation recommendations to provide at this time. This concludes the EFH consultation.

3.4. Supplemental Consultation

The NRC must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH conservation recommendations (50 CFR 600.920(l)).

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1. Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended user of this opinion is the NRC. Other interested users could include PG&E (the license renewal applicant) and those interested in the effects of nuclear power plants on conservation of ESA-listed species. Individual copies of this opinion were provided to the NRC. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adhere to conventional standards for style.

4.2. Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

4.3. Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR part 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion and EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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6. Appendices

APPENDIX I. Sea Turtle Handling and Resuscitation Procedures

General Handling Guidelines:

- All sea turtles should be handled with care.
- Pick up sea turtles by the front and back of the top of the carapace or using the flippers. Do not pick up sea turtles by the head or tail.
- Dip nets, cargo nets, and other equipment should be used to lift and move turtles whenever possible.
- If a sea turtle is actively moving, it should be retained until it is released or picked up by the CSTSN.

Sea Turtle Resuscitation Regulations (50 CFR 223.206(d)(1)):

If a turtle appears to be comatose, contact a CSTSN rehabilitation facility immediately. Once the rehabilitation facility has been contacted, attempts should be made to revive the turtle. Sea turtles have been known to revive up to 24 hours after resuscitation procedures have been followed.

- Place the animal on its bottom shell (plastron) so that the turtle is right side up. Elevate the hindquarters at least 6 inches for a period no less than 4 hours and no more than 24 hours.
- A reflex test, performed by gently touching the eye and pinching the tail, must be administered by a vessel operator at least every 3 hours to determine if the sea turtle is responsive.
- Keep the turtle in a safe, contained place, shaded and moist (e.g., with a watersoaked towel over the eyes, carapace, and flippers). Observe the turtle for up to 24 hours.
- If the turtle begins actively moving, retain the turtle until CSTSN can evaluate the animal.
- If the turtle fails to move within 24 hours, it should be transported to a CSTSN facility for necropsy.

APPENDIX II. Sea Turtle Stranding Report Form

Two-page form (attached).

Revised 01/27/1

U.S. WEST COAST SEA TURTLE STRANDING REPORT

FIELD #________________ **NMFS REGIONAL #**________________ **Other #**________________

DATE INITIALLY OBSERVED: _____ Month _____ Day 20_____ Year

DATE EXAMINED: _____ Month _____ Day 20_____ Year **RESTRANDER?** ☐

INITALLY OBSERVED BY: ________________
Phone ( )_____ -_________ Email ________________
☐ Private citizen ☐ Beach official ☐ Stranding network member

EXAMINED BY:________________
Phone ( )_____ -_________ Email ________________
Affiliation________________

SPECIES: ☐ Unidentified
____
Common name
________ ________
Genus **Species**
Digital photos taken: ☐ Yes ☐ No
Verified by:________________

LOCATION: ***Check one option.*** ☐ Beached ☐ Floating in water
City________________ County________________ State________
Locality details (be specific):________________
____
____
Latitude _____ . _________ ° N Longitude _______ . _________ ° W ***Record in decimal degrees.***
How determined (check one): ☐ GPS ☐ Map ☐ Internet/software________________

AGE: ***(NMFS Use Only)***
☐ Hatchling ☐ Immature
☐ Adult ☐ Unknown

CONDITION:
☐ 1 = Alive
☐ 2 = Fresh dead
☐ 3 = Moderate decomposition
☐ 4 = Advanced decomposition
☐ 5 = Dried mummified/ skeleton
☐ 6 = Unknown condition

SEX: ☐ Male ☐ Female ☐ Unknown
Does tail extend beyond carapace?
☐ Yes ☐ No
How was sex determined?
☐ Tail length ☐ Penis ☐ Necropsy

BODY CONDITION:
☐ 1 = Poor ☐ 4 = Good
☐ 2 = Fair ☐ 5 = Excellent
☐ 3 = Average ☐ 6 = Unknown

MEASUREMENTS: ☐ Whole carcass ☐ Partial/ scavenged
Body weight ☐ Actual ☐ Estimate ________ kg
CARAPACE:
Curved Carapace Length (nuchal notch to tip) _________cm
Curved Carapace Width (at widest point) _________cm
Straight Carapace Length ☐ Calipers ☐ Tape _________cm
Straight Carapace Width ☐ Calipers ☐ Tape _________cm
TAIL:
End of plastron to tail tip (ventral side) _________cm
Cloaca to tail tip (ventral side) _________cm

TAGS: ***Contact NMFS before disposing of any tagged animal!!***
FLIPPER: Existing metal tags present? ☐ Yes ☐ No
Tag #________________ Left/ Right Front/ Rear
Tag #________________ Left/ Right Front/ Rear
Return address:________________
Evidence of old tag holes/ rips in flippers ☐ Yes ☐ No
If yes, draw on diagram on back of page.
PIT: Existing PIT tags present? ☐ Yes ☐ No
Scanner type: ☐ AVID ☐ Universal tag reader
PIT tag #________________
Location: Left/ Right Front/ Rear
PIT tag #________________
Location: Left/ Right Front/ Rear
APPLIED NEW TAGS (live turtle): ☐ Yes ☐ No
Tag #________________ Left/ Right Front/ Rear
Tag #________________ Left/ Right Front/ Rear
PIT tag #________________
Location: Left/ Right Front/ Rear
PIT tag #________________
Location: Left/ Right Front/ Rear

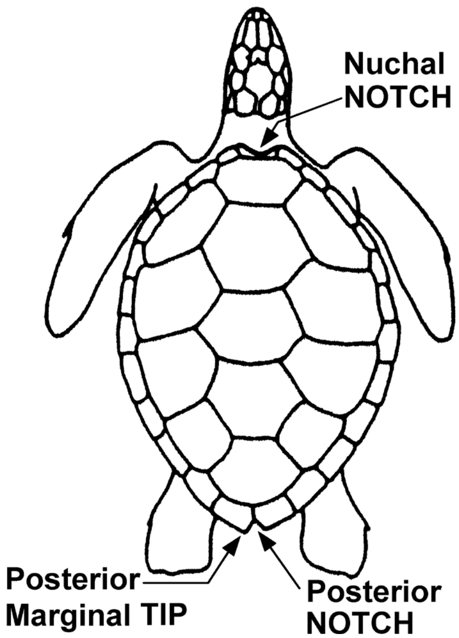
HUMAN INTERACTION: ☐ Yes ☐ No ☐ Cannot Be Determined
If yes, choose one or more. Describe and draw on diagram on back of page.
☐ 1 = Boat collision________________
☐ 2 = Shot ________________
☐ 3 = Fishery interaction ☐ Hook ☐ Monofilament ☐ Braided line ☐ Netting
☐ 4 = Oiled ________________
☐ 5 = Power plant entrainment________________
☐ 6 = Other ________________
How determined? ☐ External exam ☐ Internal exam ☐ Necropsy
Evidence collected? ☐ Yes ☐ No Describe___
Storage location________________
Digital photos sent to NMFS coordinator? ☐ Yes ☐ No

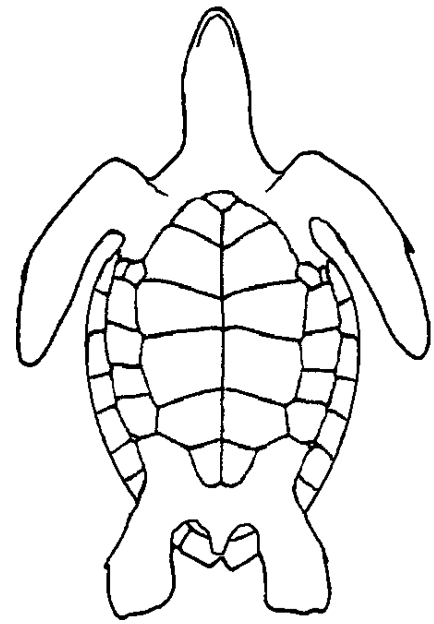
OTHER FINDINGS: ☐ Yes ☐ No ☐ Cannot Be Determined
If yes, choose one or more. Describe and draw on diagram on back of page.
☐ 1 = Disease________________
☐ 2 = Trauma________________
☐ 3 = Cold stunning________________
☐ 4 = Other________________
How determined? ☐ External exam ☐ Internal exam ☐ Necropsy

FINAL DISPOSITION: ***Check all that apply.***
☐ 1 = Alive, released ☐ At site ☐ Relocated________________ If fishery interaction, disentangled prior to release? ☐ Yes ☐ No
☐ 2 = Alive, transferred to rehabilitation Date____________ Facility________________
☐ 3 = Euthanized at site By ________________ Carcass disposition________________
☐ 4 = Dead, left at site Marked? ☐ Yes ☐ No How?________________
☐ 5 = Dead, buried: ☐ On beach ☐ Off beach Where?________________
☐ 6 = Dead, salvaged: ☐ Whole carcass ☐ Part(s) ☐ Frozen for later exam ***Please note all specimens collected and disposition on back.***
☐ 7 = Necropsied: ☐ Field ☐ Laboratory________________ Date________________ By________________
☐ 8 = Left floating, not recovered Why?________________
☐ 9 = Disposition unknown Explain: ________________

ADDITIONAL COMMENTS

Revised 01/27/1





Please mark wounds/ abnormalities on diagrams above and describe them below. Be sure to measure all wounds/ lesions and document with digital photos. Note tar or oil, gear or debris entanglements, epibiota, masses, papillomas, emaciation, etc.

Please note if no wounds or abnormalities are found. Digital photos taken? ☐ Yes ☐ No

____

____

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Additional Attachments (e.g. Level A, Pathology): ______________________________

____

SPECIMEN DISPOSITION: ***Check all that apply.*** ☐ Scientific collection ☐ Education ☐ Other__________

List all samples/ parts collected (note tissue and storage medium): Storage location__________

____

____

____

NMFS Sample Requests:

Skin (All species): ☐ DMSO ☐ Saturated salt

Scleral ossicles (Leatherbacks only): ☐ Left eye ☐ Right eye

Front flipper (Green turtles only): ☐ Left flipper ☐ Right flipper

SHIP TO: Robin LeRoux
NMFS-SWFSC
8901 La Jolla Shores Drive
La Jolla, CA 92037
Robin.LeRoux@noaa.gov

Other Samples: ______________________________

SWFSC Animal ID: ______________________ **Other ID:** ______________________

PLEASE MAIL <u>ORIGINAL</u> FORMS TO:

Justin Viezbicke, Stranding Coordinator, National Marine Fisheries Service- Southwest Regional Office
501 W. Ocean Blvd., Suite 4200, Long Beach, CA 90802-4213
Office: (562) 980-3230, Hotline Cell: (562) 506-4315, Fax: (562) 980-4027, Justin.Viezbicke@noaa.gov