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

January 26, 2024

Refer to NMFS No:
WCRO-2023-03033

Jason C. Golumbfskie-Jones
Fleet Environmental Director
Department of the Navy
Commander Navy Region Southwest
750 Pacific Highway
San Diego, California 92132-0058

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson–Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the San Diego Bay Eelgrass Habitat Expansion Project

Dear Mr. Golumbfskie-Jones:

Thank you for your letter of September 5, 2023, 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 San Diego Bay Eelgrass Habitat Expansion Project. 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.

The attached biological opinion analyzes the potential impacts of the U.S. Navy's proposed action to expand eelgrass habitat in San Diego Bay by opportunistically using dredged material to raise the bay bottom to elevations suited to support eelgrass and through eelgrass transplants. We determined that the threated East Pacific Distinct Population Segment of green sea turtles may be adversely affected as a result of disruption of normal foraging and behavior patterns over the course of the proposed project. Additionally, we conclude that Coastal Pelagic Species and Pacific Coast Groundfish EFH would be adversely affected by burial, sedimentation, and/or turbidity. However, NMFS determined the protective measures proposed by the Navy would adequately address anticipated adverse effects to EFH. Therefore, no EFH conservation recommendations were necessary.

As a result of these consultations, the Navy is required to comply with the Terms and Conditions of the ESA portion of the biological opinion that include development and submission of monitoring plans for assessing the impacts to green sea turtles and their preferred habitats within the action area during the proposed project, along with periodic reporting on the progress of the monitoring and project overall.

Please contact Bryant Chesney in our Long Beach, California, office at 562-980-4037 and/or Bryant.Chesney@noaa.gov, if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Chris Yates
Assistant Regional Administrator
for Protected Resources

Enclosure

cc: Jessica Curran, U.S. Navy
Administrative File: 151422WCR2023PR00255

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

San Diego Bay Eelgrass Habitat Expansion Project
NMFS Consultation Number: 2023-03033

Action Agency: Department of the Navy

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely to Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely to Destroy or Adversely Modify Critical Habitat?
Green sea turtle (*Chelonia mydas*)	Threatened	Yes	No	N/A	N/A

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

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

Issued By:

Chris Yates
Assistant Regional Administrator for Protected Resources
West Coast Region
National Marine Fisheries Service

Date: January 26, 2024

TABLE OF CONTENTS

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 Long Beach, California, office.

1.2. Consultation History

NMFS received a letter on September 6, 2023, from the Department of the Navy (Navy) requesting initiation of informal consultation under Section 7(a)(2) of the ESA regarding the effects of the Navy's proposed eelgrass habitat expansion project (Project) in San Diego Bay (SDB, or the Bay) on the federally ESA threatened East Pacific Distinct Population Segment (DPS) of green sea turtles (*Chelonia mydas*). The letter requested concurrence that the project is not likely to adversely affect green sea turtles under the ESA. In addition, the letter requested a conference in conjunction with Section 7 consultation, as critical habitat has been proposed within the action area for the green sea turtle. The letter also requested EFH consultation pursuant to section 305(b)(2) of the MSA. In support of these consultation requests, the Navy provided a Biological Assessment (BA) and an EFH Assessment.

In response to the Navy's consultation initiation request, NMFS staff indicated that the uncertainty associated with the nature, timing, and frequency of dredging and associated sediment placement efforts may make it difficult to conclude that all potential effects to ESA-listed species would be insignificant, discountable, and/or wholly beneficial, consistent with the Navy's "not likely to adversely affect" determination. In order to better understand the extent and duration of Project effects, NMFS staff requested additional information via conference call

on October 19 and 27, 2023. The Navy provided additional information via email on October 27, 2023. After additional discussion between Navy and NMFS staff, the Navy rescinded their request for an ESA conference on November 10, 2023, because the Navy concluded the action will not result in adverse modification of proposed critical habitat. The proposed action would impact benthic foraging and resting resources over the short term, but would ultimately increase eelgrass habitat, an important foraging resource for the East Pacific green sea turtle DPS. In addition, the areas impacted are small in scale compared to other areas in SDB that also provide underwater refugia and food resources of sufficient condition, distribution, diversity, abundance, and density necessary to support survival, development, growth, and/or reproduction of turtles in San Diego Bay.

After considering the information in the September 6, 2023, letter, BA, and additional information exchanges that have occurred through the interagency coordination process, NMFS responded via letter dated December 11, 2023, that we were not able to concur with the Navy's effect determination for East Pacific DPS green sea turtles, and that we would prepare a biological opinion on the Project, in accordance with the standards and procedures for formal consultation under section 7 of the ESA as described in 50 CFR §402 et seq. For the purposes of initiating and completing formal ESA consultation on the Project, we have evaluated the information provided by Navy through informal consultation and indicated that the Navy had satisfied the requirements for initiating formal consultation under 50 CFR §402.14(c), and we considered that formal consultation to have been initiated after receiving final clarification regarding the Navy's request on November 10, 2023. Subsequent to our December 2023 letter, NMFS requested additional information regarding the areal extent of potential turbidity impacts on eelgrass habitat, and the Navy provided a quantitative estimate (*i.e.,* 23.3 acres) of affected habitat based on the known maximum areal extent of eelgrass habitat.

On July 5, 2022, the U.S. District Court for the Northern District of California issued an order vacating the 2019 regulations that were revised or added to 50 CFR part 402 in 2019 ("2019 Regulations," see 84 FR 44976, August 27, 2019) without making a finding on the merits. On September 21, 2022, the U.S. Court of Appeals for the Ninth Circuit granted a temporary stay of the district court's July 5 order. On November 14, 2022, the Northern District of California issued an order granting the government's request for voluntary remand without vacating the 2019 regulations. The District Court issued a slightly amended order two days later on November 16, 2022. As a result, the 2019 regulations remain in effect, and we are applying the 2019 regulations here. For purposes of this consultation and in an abundance of caution, we considered whether the substantive analysis and conclusions articulated in the biological opinion and incidental take statement would be any different under the pre-2019 regulations. We have determined that our analysis and conclusions would not be any different.

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 purpose of the Project is to expand eelgrass habitat in San Diego Bay to support Navy mission requirements while ensuring the continued commitment to conservation of the San Diego Bay ecosystem. Given anticipated future needs for increased operations and infrastructure projects, the Navy has concluded that it is necessary to expand eelgrass habitat to provide additional credits within the existing Navy Region Southwest San Diego Bay Eelgrass Mitigation Bank (Bank). The Bank is used to compensate for unavoidable impacts to eelgrass habitat (*Zostera marina*), a special aquatic site defined at 40 CFR § 230.43. The Bank includes multiple eelgrass mitigation sites and allows for new sites to be added through a Bank amendment process. The Bank currently consists entirely of common eelgrass (*Zostera marina*). The Project seeks to expand the availability of banked common eelgrass and add a Bank site supporting the rarer Pacific eelgrass (*Zostera pacifica*). Adding Pacific eelgrass to the bank will improve the Navy's ability to match eelgrass species between impacts and mitigation. NMFS is a signatory party to the Bank and conceptually supports eelgrass habitat expansion to increase the amount of available Bank credits.

The Navy proposes to expand eelgrass habitat in San Diego Bay at one or more of the identified four sites grouped into three action alternatives as follows (Figure 1):

- Alternative 1: Ballast Point
- Alternative 2: Delta Beach to Homeport Island (2A)/Homeport Island Submerged Plateau (2B)
- Alternative 3: South Silver Strand

Of the four potential sites, three would support common eelgrass and would first require the placement of dredge material to raise the bay bottom to elevations suited to support eelgrass (Alternatives 2A, 2B, and 3). One site (Alternative 1 - Ballast Point) would support Pacific eelgrass and would not require the placement of dredge material prior to planting eelgrass shoots. Figures 2-4 show site context, historic eelgrass frequency within Project action areas and surroundings, site grading contours where applicable, and anticipated eelgrass yield from each alternative site. Table 1 summarizes the proposed alternative eelgrass expansion sites and their respective size, fill volume, and anticipated eelgrass yield characteristics. The Navy ultimately plans to add these sites to the Bank.

In the first phase of work, chemically and physically suitable dredged material derived from San Diego Bay (SDB) maintenance or new excavation projects would be deposited at the proposed common eelgrass site(s) as needed. The Project is designed to provide for opportunistic reuse of dredged materials derived from dredging conducted within SDB. As a result, it is expected that dredge material will be principally derived from recurrent maintenance dredging and potentially sites with new dredging for capital projects (e.g., channel deepening or widening, dry dock sump excavation). Specific dredging projects have not been identified to provide the fill sediments to raise sites 2A, 2B, and 3; however, the expected source of material would be maintenance

dredging conducted principally on Naval Base San Diego, Naval Base Coronado, and Naval Base Point Loma.

Projects generating fill materials for eelgrass expansion may include Navy pier berths and pier approach maintenance dredging, U.S. Coast Guard (USCG) Ballast Point maintenance dredging, or federal navigation channel dredging. Dredge material may also be derived from non-federal dredging projects such as dredging conducted by the Port, or private tenants. Projects similar to past maintenance dredging, and new dredging for navigation and berthing within San Diego Bay are expected to be the source of sediment to raise planting sites for eelgrass expansion. It is anticipated that future dredging projects will generally be conducted as they have in the past with clamshell dredging methodologies. The individual dredging projects are not known at this time, but would all occur within a radial distance of less than 8 miles from any of the receiver sites, and a maximum on-water distance of approximately 10.3 miles (Ballast Point to South Silver Strand, Site 3). It is expected that the majority of the source material available will likely be derived from urbanized areas of the bay where maintenance dredging is commonly required. Criteria to be applied for accepting dredge material are as follows:

1) Material must be derived from San Diego Bay and not from projects outside of the bay.
2) Material must be chemically and physically suitable for reuse in the proposed eelgrass expansion areas, having been demonstrated suitable through testing and having been determined compatible by the U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (USEPA).
3) Material must be derived from a project that is fully authorized for dredging and aquatic disposal including compliance with Clean Water Act, ESA, MSA, and other regulations applicable to the project. This may include projects with individual permit or consultation actions, or projects covered by programmatic consultations and permit approvals.
4) Material must be accepted for placement within the site by U.S. Navy Region Southwest.

Dredge material delivered to the eelgrass expansion site(s) would be limited to that material determined by USACE and USEPA to be physically and chemically suitable for unconfined aquatic disposal under Inland Testing Manual criteria (USEPA and USACE 1998). Barges, scows, and other vessels would transport the material to the selected site whereupon the material would be placed within the designated site boundaries.

Placement of sediment to shallow deeper bay environments will raise the bay floor to elevations of -5 feet Mean Lower Low Water (MLLW). This may require placement of one to three shoal marker pilings. If needed, these may be either impact, vibratory, and/or water jet driven. The Project includes the placement of sediment at the Alternative sites and does not include the dredging and transport of material to the sites. The sites are designed to be available for opportunistic reuse of sediment in order to raise the bay floor to provide resilience for eelgrass

under conditions of advanced sea level rise. As a result, it is not known what specific sites would be providing sediment for fill. The supplying dredge projects would be required to evaluate effects of their dredging and sediment transport actions under separate environmental review.

Suitable dredge material for site fills could be delivered in phases or all at once. If enough suitable material to fill the chosen alternative is not available, the project would enter an interim phase where the site has some dredge material but not enough to begin planting. The duration of the site preparation activities would depend upon how many different dredging projects the site would need to eventually contribute enough suitable material to reach the site's intended size.

Once sufficient sediment is placed at the eelgrass expansion sites, the Navy would grade the fill sites to prepare a smooth planting surface. This is expected to be performed by clamshell redistribution of sediment within the sites as may be necessary and sweeping the site with a clamshell dredge bucket or excavator on a deck barge to flatten high points and fill low points. A shallow draft barge would be navigated over the fill and the bottom would be systematically flattened to the desired site elevations. This final grading work effort is generally expected to require a few days to a few weeks to complete depending on the overall degree of variance in the height of the original fill placement events. Final site preparation for planting may be conducted with each fill placement over a portion of the site, or at the end of the placement.

Interim site conditions of a partial Alternative fill may exist for up to five years. Sites may require multiple periods of placement and are expected to require a final grading of the site prior to planting. This means that all or most of the site would likely be disturbed at least twice during filling, while some areas may be disturbed more frequently as material is delivered opportunistically. The Navy proposes to fill individual sites in a serial progression with as few sites being filled as possible at any given time. The management of fill progression in the sites must necessarily be adaptive in order to take full advantage of opportunistic availability of material of differing volumes, physical characteristics, and timing. However, to curtail the uncertainty about the extent of potential effects, the Navy commits to filling no more than 13 acres at any given time, and not filling within more than two sites at a given time. While activity at individual sites is expected to last up to five years, there is no definitive timeline for when fill activities across all Alternative sites will cease, given the uncertainty in when fill activities could begin at each site at this time.

Once a site has enough dredge material to reach the desired final elevations, diver biologists would revegetate the site following established standard practices of transplanting eelgrass from natural donor beds as anchored bare root planting units. Donor eelgrass beds are expected to be located within San Diego Bay. Diver biologists would hand-extract turions (leaf shoots with viable rhizomes) from existing donor eelgrass beds at a rate of 10 percent or less of the available shoots within the donor beds. The crews would then process planting units and then plant these into the expansion site at a density of 1 planting unit per square meter of the site. Once planting is complete the project will enter the post construction monitoring phase where the Navy would monitor the effectiveness of the eelgrass habitat expansion activities.

The Navy committed to the following conservation measures to avoid and/or minimize effects to green sea turtles:

1. The Navy and its contractors shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles or marine mammals, which are protected under the Endangered Species Act and the Marine Mammal Protection Act.
2. All construction and environmental monitoring vessels at the Proposed Action alternative sites would adhere to the 5-mph speed limit and shall observe waters in the vessel path for potential turtle surfacing or basking.
3. If a sea turtle or marine mammal is seen within 130 meters of the active daily construction/dredge disposal operation or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 20 meters of a sea turtle or marine mammal. Operation of any mechanical construction equipment shall cease immediately if a sea turtle or marine mammal is seen within a 20-meter radius of the equipment. Activities may not resume until the protected species has departed the project area of its own volition, or has not been sighted for 15 minutes.
4. All work included under this assessment will occur during daylight hours that allow for sighting of protected species within all project areas and defined monitoring zones.
5. A dedicated monitor will be required for all pile driving activities.
6. Based on the expected maximum underwater acoustic levels that may be produced from pile driving activities, a standard monitoring distance of 130 meters will be implemented through dedicated monitoring before and during all pile driving activity, and after a break in pile driving of more than 30 minutes.
7. Monitoring will commence at least 15 minutes before pile driving commences.
8. If a sea turtle is seen in the project area out to a distance of 130 meters prior to or during pile driving, the activity will not commence until the animal has moved out of the area or at least 15 minutes has passed since the last sighting.
9. If a sea turtle is seen within the 130-meter zone after pile driving has commenced at full intensity, the Navy may continue driving that pile to completion, as long as that turtle is not within 20 meters of the project work area. The Navy may not initiate the driving of another pile until at least 15 minutes has passed since the last sighting.
10. Ramp-up procedures will be implemented to slowly increase the intensity of pile driving to allow undetected turtles in the area an opportunity to move away. Prior to the start of impact pile driving each day, or after each break of more than 30 minutes, a “soft-start” procedure will be used (i.e., three reduced energy hammer blows separated by 30 seconds). The procedure allows any animals in the area to voluntarily depart after brief exposures to Project-related noise.
11. If any sick, injured, or dead green turtles are identified, the NMFS West Coast Stranding Coordinator will be notified and the Sea World Rescue and Rehabilitation Program will be contacted for rescue or collection.

To minimize or mitigate anticipated impacts to EFH from the proposed work, the following protective measures associated with construction and operational activities will be incorporated into the proposed Project.

- A survey for the invasive alga *Caulerpa* would be conducted before initiating bottom-disturbing activities, consistent with *Caulerpa* Control Protocols (Version 5, October 2021; NMFS 2021). If *Caulerpa* is found in the action area during this survey, NMFS-approved *Caulerpa* Control Protocols would be followed.
- Pre- and post-construction eelgrass surveys would be conducted in accordance with the CEMP (NMFS 2014). Losses of eelgrass beyond the project footprint will be mitigated in accordance with the CEMP through extraction of eelgrass credits from an established Bank site.
- Impacts to eelgrass within the project footprint are to be addressed by discounting credit returns in accordance with calculations made in the wetland mitigation calculator after inserting an existing pre-restoration eelgrass value (King & Price 2004).
- Eelgrass harvest from donor sites to prepare planting units will be conducted at a 10 percent level based on pre-harvest shoot counts and bed areas calculations. Following completion of the transplant, post-harvest surveys will be repeated to verify harvesting has not resulted in a reduction in bed area or density.
- Eelgrass within 50 meters of an active restoration site (being filled, between fill phases, during grading, and over two years following planting) will be monitored annually to determine if any indirect impacts to eelgrass occurs. These impacts will be mitigated based on offsetting temporal losses by extraction of mitigation credit from established Bank sites as appropriate in adjacent areas.

Figure 1: Alternative Eelgrass Expansion Sites (Merkel and Associates, Inc., 2023)

Table 1. Potential Eelgrass Expansion Site Alternatives and Key Characteristics

Alt. #	Site Name	Est. Site Size (Acres)	Est. Fill Volume (CY)	Type of Eelgrass	Anticipated Max. Eelgrass Yield (acres)*
1	Ballast Point	10.1	0	Pacific	8.5
2A	Delta Beach to Homeport Island	9.0	63,000	Common	7.0
2B	Homeport Island Submerged Plateau	13.0	95,000	Common	12.6
3	South Silver Strand	10.0	130,000	Common	9.8
Total		**42.1**	**288,000**		**37.9**

*Maximum yield of a site reflects a value discounting related to the intermittent presence of some eelgrass within the alternative site.

Table 1: Potential Eelgrass Expansion Site Alternatives and Key Characteristics (Merkel and Associates, Inc., 2023)

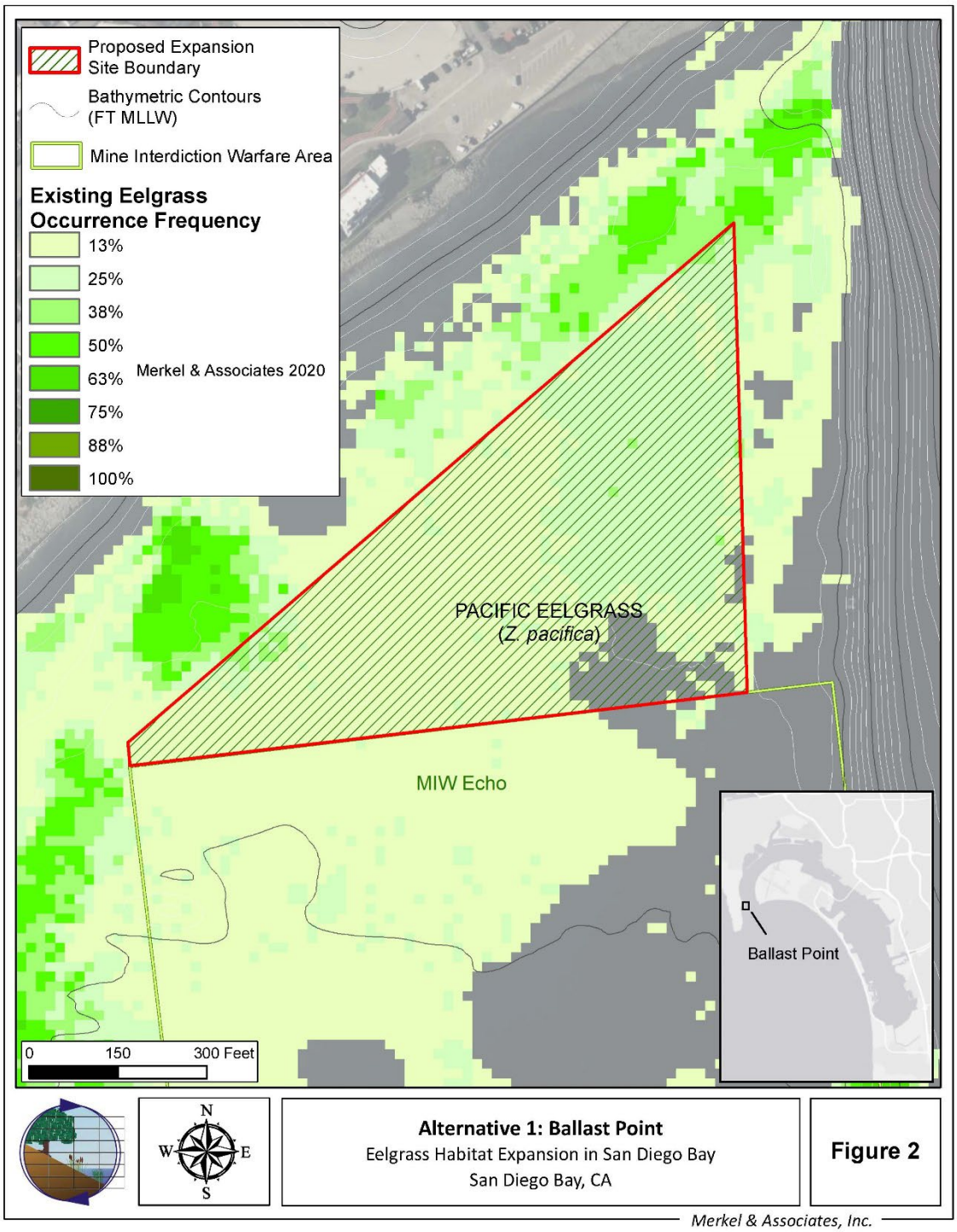

Figure 2: Alternative 1: Ballast Point (Merkel and Associates, Inc., 2023)

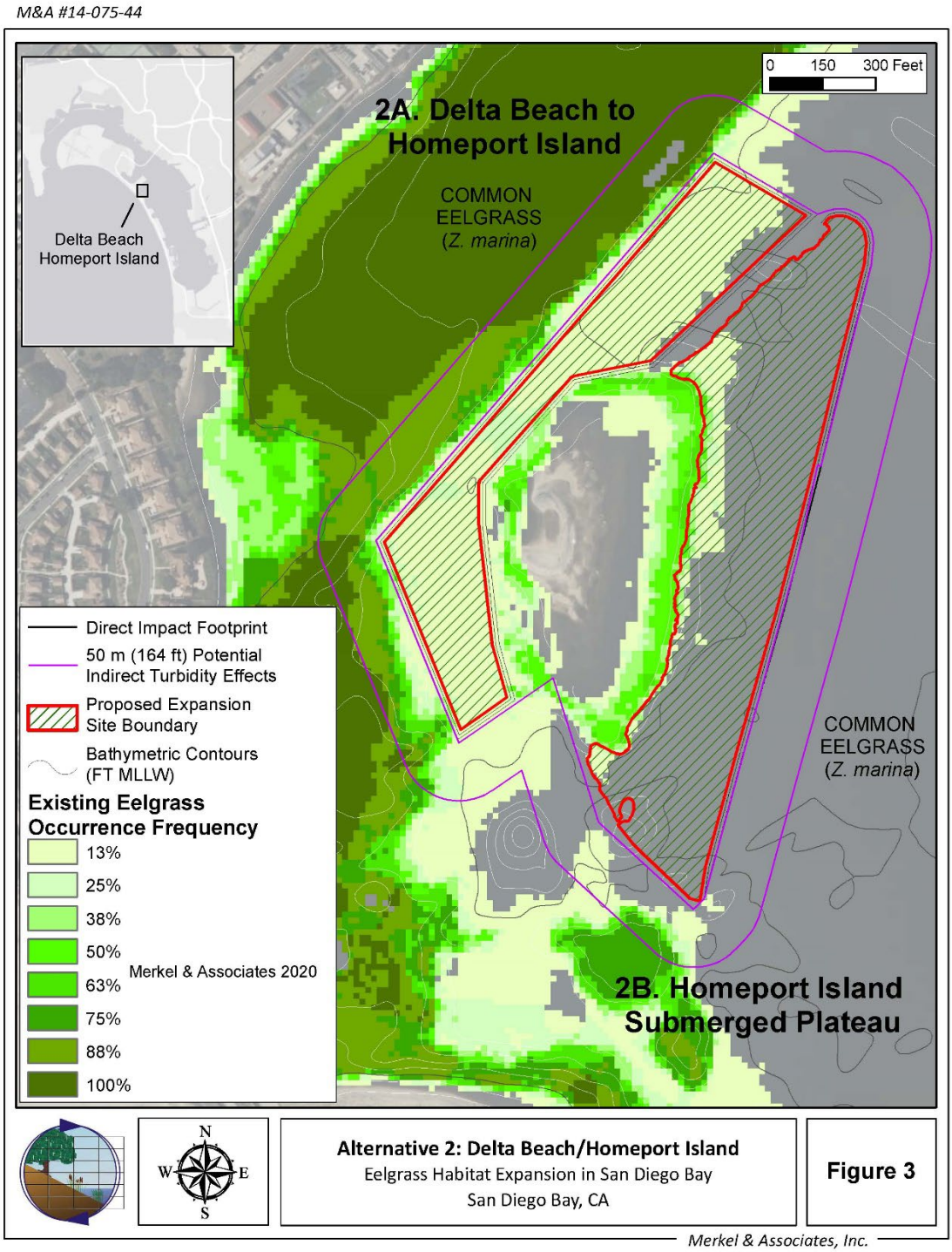

Figure 3: Alternative 2: Delta Beach/Homeport Island (Merkel and Associates, Inc., 2023)

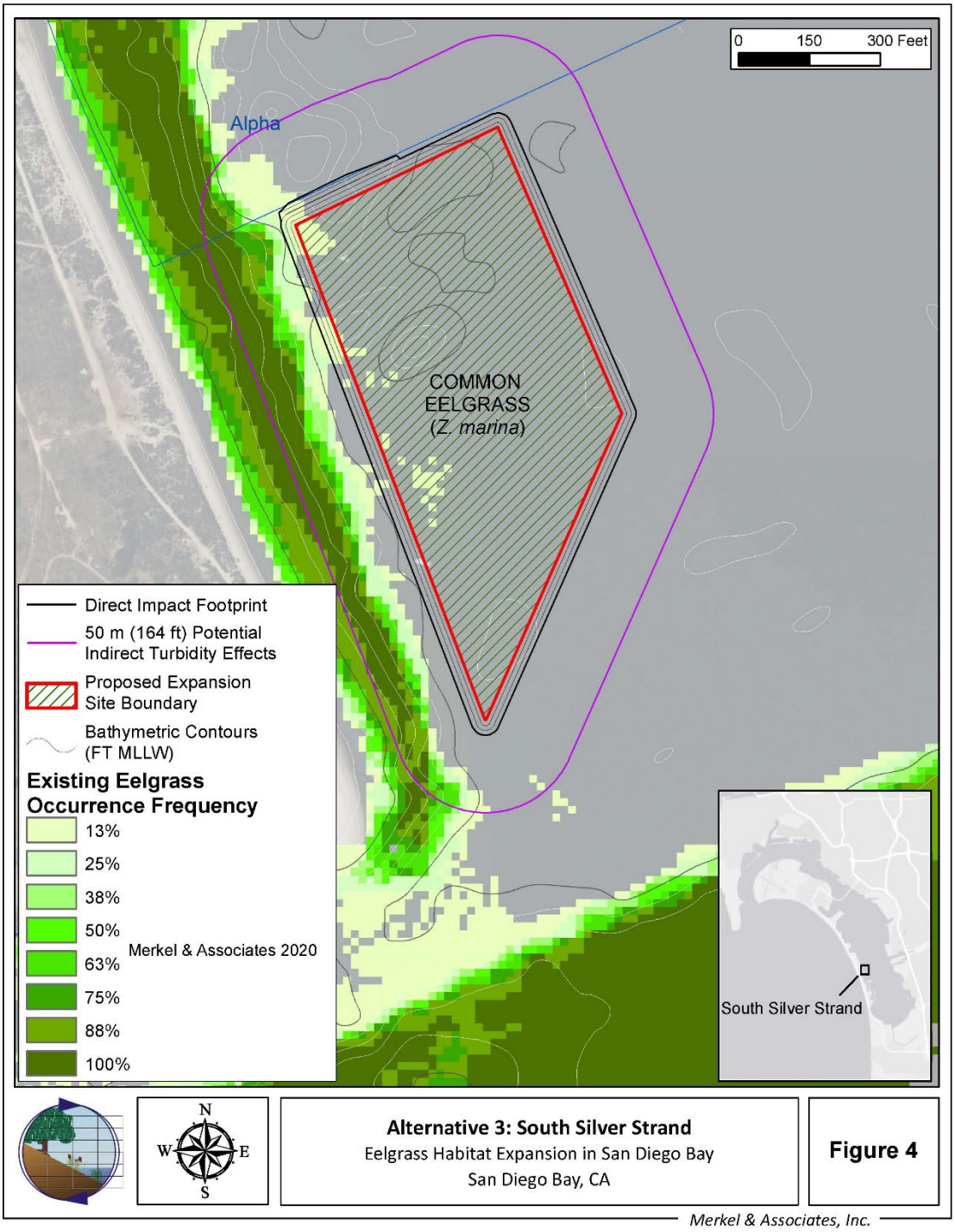

Figure 4: Alternative 3: South Silver Strand (Merkel and Associates, Inc., 2023)

We considered, under the ESA, whether or not the proposed action would cause any other activities and determined that it would not. Given that dredging activities are an associated activity to the Project, we considered whether such activities would be a consequence of the Project. We determined that dredging is not a consequence, because the Project is opportunistically using sediment dredged for entirely different purposes, such as maintenance dredging to support navigation, which will occur regardless of whether or how this Project moves forward. We recognize that the dredging activities that will be taken advantage of to support Project activities will go through individual ESA and EFH consultation, as needed. In addition, we recognize that a large amount of the potential dredging activities that might support this Project involve maintenance dredging that has already undergone programmatic ESA and EFH consultation with NMFS (NMFS 2022), which covers 10 years of maintenance dredging throughout Navy facilities in San Diego Bay.

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, and 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.

2.1. Analytical Approach

This biological opinion includes a jeopardy 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.

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 expected to be adversely affected by the proposed action.
- Evaluate the environmental baseline of the species.
- Evaluate the effects of the proposed action on species 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, analyze whether the proposed action is likely to 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.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

Given that specific information regarding the dredging projects is not available, some basic assumptions were made regarding sediment placement. Placement of material is typically expected to occur over brief punctuated events. A typical maintenance dredging project in SDB may result in dredging of between 1,000 to 4,000 cubic yards (cy) of sediment per working day. If it is assumed that 1,000 to 2,000 cy of material is moved per work day, then the site with the greatest capacity of 130,000 cy at South Silver Strand, would be filled in approximately 65-130 work days, plus approximately 30 work days of rework to smooth the site for planting. This would mean that if a site were open for five years, filling activities would occur for a period of approximately 5-8% of that timeframe. A majority of the time the site is open it will be in an inactive condition awaiting a suitable project to complete the fill. The Navy assumes no more than 160 work days per site for sediment placement activity, of which these days will most likely not be continuous allowing recovery and use of the site between placement events. If all sites are filled within five years, only 26%, or slightly more than a quarter, of this timeframe may be subject potential impacts from placement activities.

While it is not certain that all fill placements will follow the same pattern, it is expected that most material will be placed by a progression of side-by-side windrows placed by bringing scows into the site and opening the bottom to drop material adjacent to the last drop. The fills would then progress one overlapping scow placement at a time working away from the active placement area. This means that the area being actively disturbed is a discrete footprint building outward from the active disturbance edge. Approximately one to six scow drops per day may occur with each drop affecting about 0.1 to 0.2 acre of bottom habitat, or a maximum of 1.2 acres/day. As the placement progresses, areas of activity will migrate versus expanding, thus leaving prior placement locations relatively undisturbed until the final fill/smoothing work.

2.2 Rangewide Status of the Species and Critical Habitat

This opinion examines the status of the East Pacific DPS of green sea turtle 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" as described in 50 CFR 402.02.

In 2016, NMFS finalized new listings for 11 green sea turtle DPSs, including listing the East Pacific DPS as threatened (81 FR 20057). The East Pacific DPS includes turtles that nest on the coast of Mexico which were historically listed under the ESA as endangered. All of the green turtles DPSs were listed as threatened, with the exception of the Central South Pacific DPS, Central West Pacific DPS, and the Mediterranean DPS, which were listed as endangered (Seminoff *et al.* 2015).[1] Recently the IUCN assessed the East Pacific regional management unit of green sea turtles as "vulnerable," which was downlisted from a previous "endangered" status (Seminoff and Glass 2020).

On July 19, 2023, NMFS and the U.S. Fish and Wildlife Service (USFWS) proposed designating critical habitat for the East Pacific green sea turtle DPS as well as several other (five) DPSs within U.S. jurisdiction (88 FR 46572). For the Eastern Pacific DPS of green sea turtle, and relevant to the Navy' proposed action, critical habitat was proposed for designation in areas in and around SDB from the mean high-water line to 20 meters depth (Figure 3c in the proposed rule). Areas within SDB, and primarily within the Central and South SDB, contain benthic foraging/resting essential features, which include "underwater refugia and food resources (i.e., seagrasses, macroalgae, and/or invertebrates) of sufficient condition, distribution, diversity, abundance, and density necessary to support survival, development, growth, and/or reproduction" (Section 226.208(a)(3) in the proposed rule). In addition, north and outer SDB contain a migratory essential feature, which includes "up to 10 km offshore, sufficiently unobstructed waters that allow for unrestricted transit between foraging and nesting areas for reproductive individuals. In general, federal projects and projects that are federally funded or authorized must ensure that they do not destroy or adversely modify designated critical habitat.

Green turtles are found throughout the world, occurring primarily in tropical, and to a lesser extent, subtropical and temperate waters and especially near the 64° F (18° C) isotherm (Seminoff and Wallace 2012). The species occurs in five major regions: the Pacific Ocean, Atlantic Ocean, Indian Ocean, Caribbean Sea, and Mediterranean Sea. Molecular genetic techniques have helped researchers gain insight into the distribution and ecology of migrating and nesting green turtles. Throughout the Pacific, nesting assemblages group into two distinct regional areas: 1) western Pacific and South Pacific islands, and 2) eastern Pacific and central

[1] The 2015 biological status report that was used to support the recent listing activities (Seminoff *et al.* 2015) can be found at: https://repository.library.noaa.gov/view/noaa/4922

Pacific, including the rookery at French Frigate Shoals, Hawaii. In the eastern Pacific, green turtles forage coastally from the U.S. West Coast (42°N) in the north, offshore in waters up to 1,000 miles from the coast and south to central Chile (40°S). The northern and southern boundaries of this DPS extend from the aforementioned locations in the U.S. and Chile to 143°W and 96°W, respectively (Seminoff *et al.* 2015). Green sea turtles in the east Pacific are migratory as adults, conducting reproductive migrations every three years on average between their natal nesting sites and foraging areas. Individuals show fidelity to foraging areas, often returning to the same areas after successive nesting seasons. In neritic foraging areas, green turtles in the eastern Pacific are omnivorous, consuming marine algae, seagrass, mangrove parts and invertebrates. Green turtles in the wild are estimated to attain maturity at 15-50 years (Avens and Snover 2013), with East Pacific green turtles averaging 30 years to maturity.

Population Status and Trends: NMFS and USFWS (2007) provided population estimates and trend status for 46 green turtle nesting sites around the world. Of these, twelve sites had increasing populations (based upon an increase in the number of nests over 20 or more years ago), four sites had decreasing populations, and ten sites were considered stable. For twenty sites there are insufficient data to make a trend determination or the most recently available information is too old (15 years or older). A complete review of the most current information on green sea turtles is available in the 2015 Status Review (Seminoff *et al.* 2015). The most recent IUCN assessment of the East Pacific population of green turtles was conducted in 2020 (Seminoff and Glass 2020).

Green turtles that may be found within the action area likely originate from the eastern Pacific Ocean area, and based on genetic analyses and satellite tracking of sea turtles foraging in San Diego Bay, likely originate from nesting sites in the Revillagigedo Archipelago and the coast of Michoacán, Mexico (Dutton *et al*. 2019). Green turtles in the eastern Pacific were historically considered one of the most depleted populations of green turtles in the world. The primary green turtle nesting grounds in the eastern Pacific are located in Michoacán, Mexico (Colola Beach (~74.4 percent of nesting in the state) and Maruata (24.1 percent of nesting in the state), and the Galapagos Islands, Ecuador (NMFS and USFWS 1998) which comprise approximately 71 percent of all nesting females, and linkages between these nesting sites and foraging areas from northwestern Mexico to Peru have been established via flipper tag recoveries and satellite telemetry (Seminoff and Glass 2020). Here, green turtles were widespread and abundant prior to commercial exploitation and uncontrolled subsistence harvest of nesters and eggs. Sporadic nesting occurs on the Pacific coast of Costa Rica. While shallow genetic substructure has been observed in East Pacific green turtles, manifesting as slight morphological differences, Dutton *et al.* (2014) suggest that green turtles from the Revillagigedos Archipelago are rooted in the broad eastern Pacific genetic clade.

The primary nesting beaches located in southern Mexico have been characterized by a substantial increase in annual nesting activity (Delgado-Trejo & Alvarado-Díaz 2012, Seminoff *et al.* 2015), which corresponds to an increase in green turtle abundance at foraging areas throughout this population range. Also, information has been suggesting steady increasing in

nesting at the main nesting sites in Michoacan, Mexico (Colola Beach), and in the Galapagos Islands since the 1990s (Delgado and Nichols 2005; Senko *et al.* 2011), although at some of these sites, they are still lower than past annual number of deposited clutches. Colola Beach is the most important green turtle nesting area in the eastern Pacific; it accounts for approximately 74 percent of total nesting in Michoacán and has the longest time series of monitoring data since 1981. Nesting trends at Colola (25,008 clutches/year based on data from 2015-2018) is 52 percent less than the past three generations ago (early 1980s; 51,781 clutches per year), while at Galapagos, albeit a smaller population, the mean annual number of deposited clutches increased by 70 percent (from 3,082 to 5,233 clutches per year) since the late 1970s to early 1980s (Seminoff and Glass 2020).

As mentioned above, most green turtles found off the U.S. West Coast and in the action area likely originate from the Revillagigedos Archipelago and the coast of Michoacán, Mexico. The most recent survey (2008) from Revillagigedos estimated that as many as 500 nests were laid over a 4-week period, which the most recent status review (Seminoff *et al.* 2015) used to estimate nester abundance at 500 females. Green sea turtle nesting in the eastern Pacific has increased steadily since the early 1980s, which is likely due to increased protection at nesting beaches, minimized threats to sea turtles in foraging areas, and advances in sea turtle fisheries bycatch reduction throughout the region. Seminoff *et al.* (2015) estimated the total abundance of mature females in the East Pacific DPS to be at least 20,062 females. Based on recent nesting beach monitoring efforts, through 2022/2023, the current adult female nester population for Colola, Michoacán is estimated to be 100,000 to 105,000 nesting females. At Maruata, a secondary nesting beach in Michoacán, researchers estimate there are between 4,000 and 6,000 nesting females (C. Delgado Trejo, Instituto de Investigaciones sobre los Recursos Nationale, personal communication, November, 2023).

Three resident foraging populations of green sea turtles are known to occur in southern California nearshore waters. Green turtles have been sighted in SDB since the mid-1800s (Stinson 1984, Benson and Dutton 2012). The SDB has been identified as an important foraging area for the East Pacific DPS of green turtles along the U.S. west coast, with the shallow waters providing valuable food resources such as seagrasses, mobile and sessile invertebrates, and marine algae (Lemons *et al.* 2011). While most of the SDB's green turtles are year-round residents, some adults leave SDB to migrate southward toward their breeding grounds in Michoacán, Mexico, and at the Revillagigedos Islands, offshore central Mexico (Seminoff *et al.* 2015). For example, four adults have been tracked swimming north off SDB and migrating south to waters off Mexico nesting beaches (Dutton *et al.* 2019; SWFSC unpublished data). There is also a population of green sea turtles in the San Gabriel River and surrounding coastal areas in the vicinity of Cities of Long Beach, Seal Beach, and Huntington Beach, California (Lawson *et al.* 2011; Crear *et al.* 2016; Crear *et al.* 2017; Hanna *et al.* 2020; Massey *et al.* 2023). Seasonal shifts in movement and distribution of green turtles in the Long Beach/Seal Beach area show that green turtles in the San Gabriel River (SGR) use warm effluent from two power plants as a thermal refuge, although the river sustains juveniles and adults year-round (Crear *et al.* 2016). Hanna *et al.* (2023) have observed increased use of Seal Beach National Wildlife Refuge and

adjacent shallow water habitat areas, and suggested the number of green turtles in the refuge will likely increase over time and their spatial distribution may expand. In addition, a small resident foraging population has been documented at La Jolla Shores (Hanna *et al.* 2021).

A stable isotope study on 718 green turtles foraging at 16 areas (including off the coast of California) indicates that turtles of the Eastern Pacific DPS are omnivorous (Seminoff *et al.* 2021). Results of both stomach content analysis and stable isotope analysis indicate that East Pacific green turtles in SDB forage primarily on invertebrates (50 percent) and seagrass (26 percent), while they can also consume red algae (*Polsiphonia* sp.) and sea lettuce (*Ulva* sp.) (McDonald and Dutton 1992, Lemons *et al.* 2011). These data are consistent with studies of East Pacific green turtles outside of U.S. jurisdiction (e.g., waters of Mexico, Colombia, and Galapagos Islands) that also demonstrate omnivorous diets (Seminoff *et al.* 2002; López-Mendilaharsu *et al.* 2005; Amorocho and Reina 2007; Carrión-Cortez *et al.* 2010). A study of green sea turtle diet to the south along the Pacific Coast of Baja California, Mexico, indicate that surfgrass was the most prevalent source of forage for green sea turtles in those coastal waters (Lopez-Mendilaharsu *et al.* 2005). Seagrass habitat, especially eelgrass (*Zostera marina*), is of great importance to the DPS because it provides a major food resource and serves as habitat for mobile and sessile invertebrate prey, such as sponges, tunicates, and mollusks (Lemons *et al.* 2011). Where eelgrass is not present, green turtles primarily forage on benthic algae and invertebrates (Crear *et al*. 2017). The main prey item consumed by turtles at the La Jolla Shores location was a filamentous species of Rhodophyta, red algae (Hanna *et al.* 2021).

Threats: Major threats to green sea turtles worldwide, which can be found in the most recent status review (Seminoff *et al.* 2015), include: coastal development and loss of nesting and foraging habitat; incidental capture by fisheries; and the harvest of eggs, sub-adults and adults. Destruction, alteration, and/or degradation of nesting and near shore foraging habitat is occurring throughout the range of green turtles. These problems are particularly acute in areas with substantial or growing coastal development, beach armoring, beachfront lighting, and recreational use of beaches. In addition to damage to the nesting beaches, pollution and impacts to foraging habitat is a concern. Pollution run-off can degrade seagrass beds that are the primary forage of green turtles. The majority of turtles in coastal areas spend their time at depths less than 5 m below the surface (Schofield *et al.* 2007; Hazel *et al.* 2009), and hence are more vulnerable to vessel strikes. Collisions with boats are known to cause significant numbers of mortality every year (NMFS and USFWS 2007; Seminoff *et al.* 2015). Marine debris is also a source of concern for green sea turtles especially given their presence in nearshore coastal and estuarine habitats. In southern California, green turtles forage in urbanized environments and therefore are more exposed to anthropogenic contaminants and pollutants. Sea turtles captured in Seal Beach and SDB were found to have higher trace metal concentrations (e.g., selenium and cadmium) than green turtles that inhabit other non-urbanized areas in southern California (Barraza *et al.* 2019). A related study found that green sea turtles foraging in SDB had significantly higher concentrations of total polychlorinated biphenyls (PCBs) than turtles in Seal Beach, and that these non-dioxin-like PCB congeners may be associated with neurotoxicity (Barraza *et al.* 2020).

The bycatch of green sea turtles, especially in coastal fisheries, is a serious problem in the Pacific because many of the small-scale artisanal gillnet, setnet, and longline coastal fisheries throughout the Pacific are not well regulated. These are the fisheries that are active in areas with the highest densities of green turtles (NMFS and USFWS 2007). In the northern portions of the East Pacific DPS, bycatch in fisheries has been less well-documented. However, along the Baja California Peninsula (Mexico), hundreds of green turtles were reported stranded (suspected bycatch) in Bahia Magdalena (Koch *et al.* 2006). In Baja California Sur, Mexico, from 2006-2009, small-scale gillnet fisheries caused massive green sea turtle mortality at Laguna San Ignacio, where an estimated 1,000 turtle were captured each year in a fishery targeting guitar fish (Mancini *et al.* 2012). Bycatch of green turtles has also been reported in Peru and Chile. While the problem persists, innovated bycatch reduction techniques and monitoring approaches have likely reduced bycatch of all sea turtle species. The meat and eggs of green turtles has long been favored throughout much of the world that has interacted with this species. As late as the mid-1970s, upwards of 80,000 eggs were harvested every night during nesting season in Michoacán (Clifton *et al.* 1982). Even though Mexico has implemented bans on the harvest of all turtle species in its waters and on the beaches, poaching of eggs, females on the beach, and animals in coastal water continues to happen. In some places throughout Mexico and the whole of the eastern Pacific, consumption of green sea turtles remains a part of the cultural fabric and tradition (NMFS and USFWS 2007; Seminoff and Glass 2020).

Another key factor affecting the range-wide status of ESA-listed species, including the Eastern Pacific DPS of green sea turtles, and aquatic habitat at large is climate change. Climate change has received considerable attention in recent years, with growing concerns about global warming and the recognition of natural climatic oscillations on varying time scales, such as long-term shifts like the Pacific Decadal Oscillation or short-term shifts, like El Niño or La Niña. Evidence suggests that the productivity in the North Pacific (Mackas *et al.* 1989; Quinn and Niebauer 1995) and the California Current ecosystem (Harvey *et al.* 2022; Bell *et al.* 2023) could be affected by changes in the environment. Important ecological functions such as migration, feeding, and breeding locations may be influenced by factors such as ocean currents and water temperature. Any changes in these factors could render currently used habitat areas unsuitable and new use of previously unutilized or previously not existing habitats may be a necessity for displaced individuals. Changes to climate and oceanographic processes may also lead to decreased productivity in different patterns of prey distribution and availability. Such changes could affect individuals that are dependent on those affected prey.

Based upon available information, it is likely that sea turtles are being affected by climate change. Sea turtle species are likely to be affected by rising temperatures that may affect nesting success and skew sex ratios, as some rookeries are already showing a strong female bias as warmer temperatures in the nest chamber leads to more female hatchlings (Chan and Liew 1995; Kaska *et al.* 2006; Blechschmidt *et al.* 2022). Increased temperatures also lead to higher levels of embryonic mortality (Matsuzawa *et al.* 2002). Rising sea surface temperatures and sea levels may affect available nesting beach areas as well as ocean productivity (Fuentes and Hamann 2011). An increase in typhoon frequency and severity, a predicted consequence of climate

change (Webster *el al.* 2005), can cause erosion which leads to high nest failure (Van Houtan and Bass 2007). Rising sea levels can cause repeated inundation of nests and abrupt disruption of ocean currents used for natural dispersion during the green turtle life cycle. Feeding may also be affected by climate change as seagrasses, a major food source for green sea turtles, may be affected by changing water temperature and salinity (Short and Neckles 1999; Duarte 2002).

Based on climate change modeling efforts in the eastern tropical Pacific Ocean, for example, Saba *et al.* (2012) predicted that the Playa Grande (Costa Rica) sea turtle nesting populations would decline 7% per decade over the next 100 years. Changes in beach conditions are expected to be the primary driver of the decline, with hatchling success and emergence rates declining by 50-60% over the next 100 years in that area (Tomillo *et al.* 2012). Sea turtles are known to travel within specific isotherms and these could be affected by climate change and cause changes in their bioenergetics, thermoregulation, prey availability, and foraging success during the oceanic phase of their migration (Robinson *et al.* 2009; Saba *et al.* 2012). While our understanding of the effects of climate change on sea turtles is improving, there is still uncertainty and limitations surrounding the ability to make precise predictions about or quantify the threat of future effects of climate change on sea turtle populations (Hawkes *et al.* 2009). We consider the ongoing implications of climate change as part of the status of ESA-listed species. Where necessary or appropriate, we consider whether impacts to species resulting from the proposed action could potentially influence the resiliency or adaptability of those species to deal with climate change that we believe is likely over the foreseeable future.

Conservation: There have been important conservation initiatives and advances that have benefited East Pacific DPS green turtles. There are indications that wildlife enforcement branches of local and national governments are stepping up their efforts to enforce existing laws, although successes in stemming sea turtle exploitation through legal channels are infrequent. In addition, there are a multitude of non-profit organizations and conservation networks whose efforts are raising awareness about sea turtle conservation. When assessing conservation efforts, we assumed that all conservation efforts would remain in place at their current levels or improve.

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 (GTC), Permanent Commission of the South Pacific (CPPS), and the InterAmerican Convention for the Protection and Conservation of Sea Turtles (IAC). The Central American Regional Network resulted in the creation of a national sea turtle network in each country of the Central American region, as well as the development of firsthand tools, such as a regional diagnosis, a 10-year strategic plan, a manual of best practices, and regional training and information workshops for people in the region (e.g., Chacón and Arauz 2001). The GTC is a regional network in Mexico that brings together scientists, conservation practitioners, fishers, and local peoples to address sea turtle conservation issues. Perhaps the greatest achievement of this group was the large decrease in green turtle hunting and local consumption throughout northwestern Mexico. The IAC is the world's only binding international treaty on sea turtle conservation. Signatory nations in the Eastern Pacific include Chile, Peru, Ecuador, Panama,

Costa Rica, Honduras, Guatemala, Mexico, and the United States. This treaty endeavors to reduce fisheries bycatch and habitat destruction through a series of binding conservation agreements across these nations. All three of these initiatives work under the principle that benefits and achievements from working in alliance are much higher than those from working alone.

In southern California, NMFS has increased its outreach and education efforts to improve public awareness of the presence of green turtles and to reduce threats to foraging populations, particularly in SDB, the SGR and adjacent watershed, as well as estuaries such as Agua Hedionda and Mission Bay. Local threats to green turtles primarily include recreational fishing and vessel strikes, and NMFS has worked with partners to develop educational materials and signs to specifically address those threats.

NMFS and USFWS developed a recovery plan for U.S. Pacific populations of the East Pacific Green Sea Turtle that describes reasonable actions which are believed to be required to recover and/or protect the species (NMFS and USFWS 1998). One of the six major actions described in the Recovery Plan is to identify and protect primary foraging areas in U.S. jurisdiction. In addition, the Recovery Plan specifically recommends the prevention of degradation or destruction of marine habitats caused by dredging or disposal activities.

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 for this project includes specific sites within SDB: one located in the outer SDB waters (approximately 10.1 acres adjacent to the Point Loma peninsula); and three in the South Central SDB (approximately 32 acres when combined) (Figure 1). In addition, the action area includes the vessel paths between dredging operations within SDB and the disposal sites in South-central SDB, as well as the immediate areas surrounding the sediment placement footprint that may be subject to indirect turbidity effects.

Within the project area, the specific dredging to provide sediments to raise Sites 2A, 2B, and 3 have not been identified yet, as the project is designed to provide opportunistic reuse of dredged material derived from future dredging conducted within SDB. The expected source of dredged sediment would be obtained from future maintenance dredging conducted mainly on Naval Base San Diego, Naval Base Coronado, and Naval Base Point Loma.

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 consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

Status in the Action Area

The proposed action area occurs in SDB, which is known as a key residence and foraging area for green sea turtles. Green sea turtle adults and benthic-foraging juveniles generally occupy small home ranges that include foraging resources and underwater refugia. However, some individuals move long distances between foraging areas, including one individual tracked from SDB to a foraging area near Long Beach, California (SWFSC unpublished data 2016).

Based on capture-mark-recapture data between 1990 and 2009, Eguchi *et al.* (2010) estimated that SDB may support up to 60 green sea turtles with continuous recruitment of both juveniles and adults (Eguchi *et al.* 2020). Since that time, NMFS' Southwest Fisheries Science Center (SWFSC) has conducted additional capture-mark-recapture studies on individual green turtles in SDB in 2017, 2019, and most recently in 2023 (following the COVID-19 pandemic). They believe the abundance estimate is likely to be much higher than the 2010 estimate. During the most recent (2023) surveys, the SWFSC captured 42 individual turtles, 22 of which had never been previously recorded in SDB. Although the final mark-recapture analyses have yet to be completed, scientists note that it is very apparent that the green turtle population in SDB has increased substantially since capture efforts conducted in 2019. The vast range of sizes of turtles captured (~45 centimeters (cm) to 101 cm straight carapace length) reflects a population that includes a demographic spectrum from small, recently recruited juvenile turtles to very large multi-year adult male and female turtles in the Bay (SWFSC, unpublished data).

Green turtles are attracted to the shallow waters of SDB due to the relatively warmer water temperatures and presence of high quality foraging habitat. For example, eelgrass habitat appears to be of high value in the southern portion of SDB (Lemons *et al.* 2011; MacDonald *et al.* 2012). Since the South Bay Power Plant shut down its operations in 2010, results from monitoring and tracking data of green turtle movements throughout SDB have indicated a substantial shift in turtle activity outside of the southern portion of the Bay, even during winter and spring months, when water temperatures are cooler, typically with relatively short duration movements between other areas and back to south SDB (Madrak *et al.* 2014). Before the power plant decommissioning, results of telemetry studies showed that the core areas (50% Utilization Distributions [UDs]) of green turtle activity in SDB was mainly located within warm effluent water from the power plant as well as within areas distant from the power plant that are characterized by abundant seagrass resources (MacDonald *et al.* 2012). Results of recent tracking studies indicated that turtles have started to utilize areas of the Bay located farther north than their historically recognized foraging areas in South SDB (Bredvick *et al.* 2015). In a recent

study, there was a significant negative relationship between turtle size and water temperature after power plant closure, which suggests that green turtles exhibit clear responses in habitat use to changes in water temperature (Madrak *et al*. 2016). The resulting change in temperature from the power plant decommissioning coincided with an increase in turtle core use areas from 0.71 to 1.37 km^2 and a shift away from the former power plant site to areas with abundant presence of seagrass beds throughout the South SDB. This observed expansion of green turtle home ranges may increase the risk of turtle−human interactions (Eguchi *et al.* 2020).

The vast majority of the alternative sites occur within shallow subtidal habitat (-2.2 to -12 ft MLLW) that contain a combination of eelgrass habitat, unvegetated soft bottom, and a minor amount of artificial hard bottom. All of the proposed sites occur adjacent to current eelgrass habitats, with Alternatives 2A, 2B, and 3 occurring in areas adjacent to stable and persistent eelgrass beds. Alternative 3 occurs near the expansive eelgrass habitat of the South SDB where turtles have historically been most concentrated, and is in close proximity to core areas of habitat utilization (*e.g.,* Eguchi *et al.* 2020). In addition, long-term baywide surveys have demonstrated the occasional presence of eelgrass within all of the proposed sites, particularly sites 1 and 2A. Alternative sites 2A and 2B also contain submerged rock jetties previously used to contain placed sediment fill for construction of the elevated eelgrass sites. The rock jetties are heavily silted and support a limited amount of algae, but do support use by various sessile and mobile invertebrate species. Although the alternative sites occur outside the known core areas of utilization in south SDB, they likely support occasional green sea turtle foraging and/or resting behaviors.

Strandings

Green turtle strandings are documented each year along the U.S. West Coast, with most of these strandings occurring in southern California. Causes of green turtle strandings in southern California include encounters with marine debris, boat collisions, illness, gunshot wounds, fishery interactions, and cold stunning. Because not all dead stranded sea turtles are necropsied and causes of death can be difficult to ascertain in many circumstances during the limited evaluations conducted, the causes of the majority of strandings are unspecified or unknown. The action area supports a significant amount of commercial, military, and recreational vessel traffic. Given the vessel traffic and that SDB supports a resident green sea turtle foraging population, it is not surprising that green sea turtle strandings are occasionally reported. From 2010-2023, a total of 74 green sea turtle strandings (64 dead and 10 alive) from the SDB area were reported to NMFS (NMFS unpublished data). Most of these strandings are of unknown origin, although boat collisions and interactions with recreational fishermen are likely the cause of many of these strandings. In the past, boat collisions and propeller injuries have caused up to 80% of turtle deaths reported in SDB and Mission Bay, combined (McDonald and Dutton 1992).

Fisheries Interactions

Along the west coast of the U.S., and specifically within the vicinity of the action area, green turtles have been occasionally reported and observed interacting with fishing gear; including hook and line recreational fishing gear (NMFS unpublished stranding data). While there is no commercial fishing within SDB, several fisheries do occur in the coastal and offshore waters near SDB and recreational fisheries are present. There are two state gillnet fisheries in California that may interact with sea turtles: the set gillnet fishery targeting halibut and white seabass; and the small mesh drift gillnet fishery targeting yellowtail, barracuda, and white seabass. No sea turtle interactions have been documented recently through sporadic observer coverage of those fisheries, although gillnets are believed to pose a threat to green turtles that are moving around in coastal California waters.

Coastal Development

SDB is a highly urbanized coastal embayment where a significant amount of coastal development has occurred and remains ongoing. A significant portion of this development activity involves federal permitting by the USACE under the authorities of the Clean Water Act and/or Rivers and Harbors Act. The majority of coastal development is associated with the Port of San Diego and the U.S. Navy. The Port of San Diego the Port oversees two maritime cargo terminals, a cruise ship terminal, 16 public parks, various wildlife reserves and environmental initiatives, a Harbor Police Department, and the leases of 600 tenant businesses around SDB. The U.S. Navy also has a significant presence within SDB. SDB is homeport to the Pacific Fleet Surface Navy with 56 U.S. Navy ships and two auxiliary vessels, and supports a variety of military, industrial, commercial, and residential uses in support of the U.S. Navy's mission (Navy and Port of San Diego, 2013). Common activities include, but are not limited to, pier and dock construction, pile driving, shoreline stabilization, dredging and fill. These activities have the potential to result in direct interactions with turtles and/or modify green sea turtle foraging and/or resting behavior.

In addition, the Port of San Diego and the City of Chula Vista are currently in the process of redeveloping the Chula Vista Bayfront in South San Diego Bay. Their Chula Vista Bayfront Master Plan includes the development of new parks, open space, a shoreline promenade, a hotel and convention center, various restaurant and retail facilities, mixed-use commercial buildings, and a parking facility. Various components of the Bayfront development and the associated increase in human use has the potential to result in direct interactions with turtles and/or modify green sea turtle foraging and/or resting behavior.

Climate Change

Increased storm intensity and frequency may increase the rate of disturbance to eelgrass, algae, and invertebrate communities that typically inhabit shallow habitats in SDB, which may reduce the quality of foraging resources for green sea turtles throughout their range, including in and

around the action area. In addition, increasing ocean temperatures may increase the frequency and duration of green sea turtles in the action area. Green sea turtles are dependent on the ambient ocean temperature to support physiological processes such as digestion and growth (Avery *et al.* 1993). As sea temperatures increase, we anticipate the thermal properties of the action area to allow for greater foraging access and use, and may allow for higher growth rates, as observed elsewhere in thermal refuges found in southern California (e.g., Eguchi *et al.* 2012). Increased use of the area may increase the risk of boat collisions and exposure to other potential harmful human interactions.

Scientific Research

NMFS issues scientific research permits to allow research actions that involve take of sea turtles along the U.S. west coast. Specifically within SDB, NMFS has issued Permit #16803 to the SWFSC to conduct long term monitoring of foraging green turtles in SDB to characterize population structure, foraging ecology, and movement patterns. This permit reflects a continuation of more than two decades of research conducted on the resident population of green turtles which has included numerous partners such as the U.S. Navy and the Port of San Diego. The permit allows a suite of activities that include targeted capture, tagging, tracking, and collection of biological data and samples. NMFS has also issued Permit #14510 which allows for directed research on green turtles stranded throughout southern California, including SDB. These activities are intended to be non-injurious, with only minimal short-term effects. But the risks of a green turtle incurring an injury or mortality cannot be discounted as a result of directed research. We expect that green turtle research in SDB will continue to occur into the foreseeable future, including within the proposed project area during the proposed project.

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 (see 50 CFR 402.02). 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 402.17). In our analysis, which describes the effects of the proposed action, we considered the factors set forth in 50 CFR 402.17(a) and (b).

Approach to the Effects Analysis

NMFS determines the effects of the action using a sequence of steps. In this analysis, the first step identifies stressors (or benefits) associated with the proposed action with regard to listed species. The second step identifies the magnitude of stressors (e.g., duration, extent, and frequency of the stressor and how many individuals of a listed species will be exposed to the stressors; *exposure analysis*). The third step describes how the exposed individuals are likely to respond to these stressors (e.g., behavioral changes or the injury or mortality rate of exposed

individuals; *response analysis*). The final step in determining the effect of the action is establishing the risks those responses pose to listed species (*risk analysis*). In this step of our analysis, we will relate information on the number and age (or life stage), if applicable, of the individuals likely to be exposed to the proposed action's effects, along with the likely responses of those individuals to the proposed action, to an expected impact on the populations or subpopulations those individuals represent.

2.5.1. Exposure and Response

The information presented above in Section 2.4 *Environmental Baseline: Status in the Action Area* suggests that green sea turtle occurrence in the action area is likely. Eguchi *et al.* (2020) previously estimated up to 60 green sea turtles may reside within or occasionally visit SDB, and with continuous recruitment of both juveniles and adults. However, results of the most recent surveys conducted in 2023 suggest that the abundance of green sea turtles in SDB is likely to be higher than previously estimated as evidenced by recent increase in new individual green turtles that had never been previously recorded by mark-recapture studies conducted in SDB (SWFSC, unpublished data).

Information produced from monitoring and tracking green turtle movements throughout SDB have indicated some green turtle activity outside of South SDB even during the winter and spring months when water temperatures are cooler, typically with relatively short duration movements between other areas and back to South SDB (Madrak *et al.* 2014). Since the early 1960s, sea turtles have been sighted aggregating in the vicinity of the former South Bay Power Plant, where warm water effluent was discharged throughout the year. During the warm summer months, the turtles generally moved out of the effluent channel and into the Bay, especially when temperatures within the channel exceed 90°F. However, after the recent decommissioning of the power plant, turtles have been reported to utilize foraging areas further north within the South SDB (Bredvick *et al.* 2015). Also, during incursions of warm equatorial currents (e.g., during El Niño events), more turtles have been found within SDB.

Although occurrence may be relatively less frequent during the early spring and winter months when water temperatures are coldest, NMFS has reasonable certainty that green sea turtles could occur within the action area at any time during the year, and the likelihood of occurrence by a number of sea turtles in the action area during significant portions of every year throughout the duration of the project is moderately high. As a result, the effects analysis herein considers the significance of the action area for green sea turtles throughout the entire year, and assumes that presence will occur in varying degrees throughout the year, and during all of the proposed project activities. Sediment placement and associated construction activities are not expected to persist longer than five years at any individual sites in South-central SDB, although some activity at any site may occur over a longer time period, depending on when fill activities may actually begin at any site.

Potential effects to green sea turtles from the proposed project would include: (1) direct contact injury associated with delivery and placement of dredged material, in-water construction, and vessel support operations; (2) general construction disturbance, including acoustic impact associated with in-water pile driving; and (3) impacts to foraging and resting habitat resulting from alteration or disturbance of benthic habitats from sediment placement activities, including increased turbidity. Below we describe the exposure of green sea turtles to general construction activity disturbances, direct contact with construction activities, and changes to foraging habitats and the resulting responses of exposed sea turtles to those consequences of the proposed action.

Direct contact injury

In assessing the risk of exposure to potential project effects to green sea turtles, and their response to this exposure, NMFS considers the location of project activities in relation to the probability that green turtles may occur in the action area. The alternative project sites lie in the outer SDB (for Ballast Point, Site 1) and the South-central portion of SDB (for Delta Beach to Homeport Island, Site 2A; Homeport Island Submerged Plateau, Site 2B; and South Silver Strand, Site 3) (Figure 1). Past research has indicated that Site 1 in outer SDB may not be frequently visited by green turtles, unlike South SDB where we expect regular occurrence and sustained presence of sea turtles for foraging and resting. Sites 2A, 2B, and 3 are also outside the core utilization area as we currently understand, but available information suggests that turtles likely occasionally use these sites for foraging and/or resting. In addition, NMFS anticipates that these areas may experience increased turtle use if the DPS continues its recovery trajectory and sea temperature continues to increase.

Given that green turtles will likely occur, albeit occasionally, at some of the alternative sites, the Project has the potential to result in direct contact injuries associated with vessel collisions. However, NMFS believes the risks of direct contact injury due to project associated vessel collision is extremely low given the proposed avoidance and minimization measures, and the anticipated response of green sea turtles that may occur in the action area. The Navy's proposed conservation measure to reduce the operating speed of all construction and environmental monitoring vessels to the maximum of 5 miles per hour (mph) will significantly reduce the likelihood of boat collisions and injuries to surfacing or basking turtles in the project area. In addition, a monitor will be on-site during construction activities to direct the cessation of any mechanical operation if a sea turtle is sighted within the 130 m buffer zone of the active daily construction/dredge operation and sediment placement, which will further reduce the risk of direct contact injury for green sea turtles.

The Project also has the potential to result in direct contact injuries associated with sediment burial over the proposed alternative sites. If green sea turtles were resting on the seafloor at the time of sediment placement, turtles could be buried by the discharged material. However, NMFS believes such an occurrence to be extremely unlikely given the noise and disturbance associated with vessel operations and anchoring. We anticipate that turtles would avoid the sediment placement area once the construction disturbance commences. The process of material placement

is slow and controlled with considerable surface activities to position a scow prior to sediment discharge. NMFS anticipates this level of overhead activity would result in turtles vacating the area prior to scow dumps. In addition, monitoring of the placement area prior to commencing activities will help detect the presence of any green sea turtles and avoid putting any individuals that may be in the area at risk of direct contact with sediment placement.

Given limited exposure to direct contact injury and implementation of the proposed avoidance and minimization measures, we conclude the risk of direct contact and injury or death as a result of the proposed action is extremely unlikely, and therefore discountable.

General construction disturbance

In general, all in-water construction projects present some risk of disturbance to any green sea turtles that may be present in the action area. In particular, proposed project activities that may involve the generation of loud underwater sounds have the potential to create disturbance for any green sea turtles in the vicinity. The Project involves installation of three navigation marker piles (either 12-inch (0.4 m) square piles or 10-12-inch (0.3-0.4 m) steel pipe piles) that could result in the introduction of underwater noise from impact or vibratory driving of the piles. As part of the proposed action, the Navy indicated that under a worst-case scenario, the navigation marker piles would be 12-inch steel pipe driven by impact hammer. At a distance of 33 feet (10 m) from the pile, underwater sound would reach an estimated peak between 177 and 192 dB with a root mean square (RMS) level of 165–177 dB_{rms} and a sound equivalency level (SEL) of approximately 152 to 176 dB based on surrogate pilings driven in waters at Sausalito, El Cerrito, and Oakley, California (California Department of Transportation 2012).

NMFS has developed acoustic thresholds for sea turtles, which include information on impulsive sound sources (e.g., impact pile driving) and non-impulsive and continuous sound sources (e.g., vibratory pile driving). Injury (i.e., an onset of permanent threshold shift (PTS)) for sea turtles receiving sound from impulse pile driving includes a peak sound pressure level of 232 dB re 1µPascal (Pa) and weighted cumulative sound exposure level of 204 dB re $1\mu Pa^2$-sec. For non-impulsive sound sources, sea turtles may be injured (onset-PTS) if exposed to sound pressure levels of 220 dB $1\mu Pa^2$-sec. Onset of a temporary threshold shift (TTS) in hearing may occur if sea turtles are exposed to 226 dB re 1µPa and weighted cumulative sound exposure level of 189 $1\mu Pa^2$-sec associated with impulsive sound sources, and weighted cumulative sound exposure level of 200 dB $1\mu Pa^2$-sec for non-impulsive sound sources. Data on behavioral reactions of sea turtles to sound sources is limited. However, in general, behavioral disturbance has been shown to occur at about 175 dB (root-mean-square) (NMFS 2023). Although experimental research on sea turtle response to loud underwater sound sources is limited, McCauley et al. (2000) documented increased swimming activity for loggerhead (*Caretta caretta*) in a caged environment during periods of received sound in excess of 165 dB RMS and increased erratic swimming behaviors at received sound pressure levels above 175 dB RMS. The researchers concluded that these behaviors were marking the relative point where avoidance would occur for unrestrained turtles in that acoustic environment.

Regardless of the specific noise exposure that sea turtles might experience, we expect that any individual turtles in the action area will generally attempt to avoid the immediate area where in-water construction noise is occurring. Avoidance of the immediate project area for relatively short periods of time during the construction period is not likely to be significant, given the relatively limited spatial scope of in-water construction work compared to available habitat elsewhere in the action area, and in particular in the South SDB. In addition, the Navy has proposed several conservation measures that will be used to prevent and minimize any adverse effects to green sea turtles associated with increased noise due to construction. A dedicated monitor will be on site during all pile driving activities to monitor the construction area and work would only be conducted during daylight hours to allow for sighting of green turtles within the project area. During pile installation, the monitor will ensure that construction activities are stopped if a sea turtle is seen within a 130 m radius of the active daily construction area. In the event of a sighting of a green turtle within a 130 m radius of the construction area or equipment and activities within construction area, work would immediately cease and would not begin until the individual moves outside of the project area of its own volition or is not seen for 15 minutes within the construction area. In addition, a "soft start" procedure to begin pile installation would be implemented to allow sea turtles to detect the increased underwater sound pressure and leave the project vicinity before sound pressure levels increase to potentially harmful levels. Hence, we conclude that it is likely that any disturbance from this project would lead to turtles avoiding the immediate project area once the activity commences, reducing the likelihood of turtles remaining in the area long enough to experience hearing injury. We also conclude that acoustic disturbance is unlikely to significantly impact the foraging and movement activities of green turtles given the relatively short duration of pile driving activity.

Impacts to foraging and resting habitat

Suitable sediment from opportunistic dredging conducted across SDB will be placed at the three alternative sites in South-central SDB (i.e., Sites 2A, 2B, and 3) to raise the floor at each site to suitable elevations to support eelgrass planting and accommodate predicted sea level rise. This sediment placement will bury existing eelgrass and shallow water habitat that supports green sea turtle foraging behavior. After sufficient sediment exists at each expansion site, the benthos will be mechanically disturbed again by grading activities intended to support eelgrass transplant. The BA indicates that all or most of the site would likely be disturbed at least twice during filling, while some areas may be disturbed more frequently as material is opportunistically delivered. This recurrent disturbance can have adverse effects on the rate of habitat recovery. Given the uncertainty regarding the availability of suitable sediment, the timeline for sediment placement at each alternative site may take up to five years. Although NMFS anticipates some level of interim recovery, NMFS believes full recovery of foraging resources may take between 1 and 5 years depending upon forage resource type. For example, we anticipate invertebrate and algal communities to recover between 1-2 years, but eelgrass habitat may take up to five years. After considering the potential for recurrent benthic disturbance at each alternative site over the five year project placement timeline, and anticipated forage base recovery rates, NMFS

concludes that foraging habitat within the total disposal footprint (*i.e.,* 31 acres) may be degraded for up to a 6-10 year period, assuming that activities do occur at all sites, and generally at similar times.

All three sediment disposal sites are immediately adjacent to persistent, high quality eelgrass habitat. As the EFH Assessment indicates, eelgrass within 50 meters of all alternative sites requiring sediment placement may experience prolonged elevated water column turbidity, which may result in adverse impacts to eelgrass as a result of sedimentation on leaves and/or light reduction at canopy depths. Thus, NMFS concludes that high quality foraging habitat adjacent to the disposal sites may also be degraded. NMFS believe it is reasonable to assume with high confidence that indirect turbidity impacts would not exceed the known maximum area of eelgrass extent. Based on the best available information, NMFS concludes that an additional 23.3 acres of high quality foraging habitat surrounding the disposal footprint may be adversely affected by Project activities.

As mentioned above, green sea turtles are likely to occasionally forage and rest within the action area, particularly the alternative sites in South-central SDB. Due to the vicinity of these sites to more abundant eelgrass beds in South SDB, as well as recent evidence of increasing use of areas farther north than their historically recognized foraging areas in South SDB, green sea turtles may be found at any time during the year and take advantage of the available foraging and resting habitat in the project areas in South-central SDB. The sedimentation and burial of eelgrass and shallow water habitat associated with Project activities would likely reduce the quantity and quality of algae, invertebrates, and eelgrass, which would decrease the availability of foraging resources in the impact footprint. In addition, indirect impacts due to prolonged turbidity may also reduce the quantity and quality of eelgrass habitat immediately adjacent to the disposal sites. Based upon the above, NMFS concludes there will be persistent eelgrass and shallow water habitat degradation and loss of potential green sea turtle foraging habitat as a result of the Project over multiple years. Given the combined areal extent of direct and indirect impacts on foraging and resting habitat may be up to 54.3 acres, persisting over multiple years, NMFS concludes the reduction in available forage resources would likely disrupt foraging and/or resting behaviors. NMFS assumes the effects to foraging and/or resting behaviors would persist until the shallow water habitat recovers from the multiple benthic disturbances and turbidity effects associated with the Project.

Although disruption of normal behaviors and movements for green turtles in and around the vicinity of the project area is relatively straightforward to anticipate based on the project description and our general understanding of green turtle behavior, it is very difficult to quantify the impacts of this disruption on the health of individual green turtles. A search of the scientific literature suggests that virtually no directed studies of sea turtle health effects resulting from behavior disruption have been conducted, so we do not have available scientific information to directly point to for this analysis. Instead, we must rely upon general biological and ecological principles to understand what the results of these impacts could be. Conceptually, we recognize that disruptions of important functions and behavior such as regular foraging and resting patterns

can have adverse effects on the health of individual sea turtles. Possible adverse effects could include increased energy expenditures, reduced nutritional intake, temporary disorientation, or temporary abandonment of preferred habitat. It is possible that disruption could influence behavior patterns such that some individuals may discover or develop new areas of preferred habitat in other locations. Unfortunately, we also do not have any direct scientific information available to inform establishment of any thresholds for exactly how long or intense the disruptions have to be in order to produce some measurable reduction in overall health or fitness.

Currently, general characterizations of the health of individual sea turtles are not understood beyond obvious physical appearance without sophisticated veterinary examinations or laboratory analysis, typically conducted only on deceased individuals. The scale of possible impacts that occasional, sustained, or multiple disruptions of normal behavior and life functions over extensive periods could have on the near-term health or fitness of a green turtle is expected to be highly variable and unique to each individual and life stage. In other analyses of potential impacts from coastal development projects, disruptions of behavioral patterns in those instances generally would have occurred in areas away from where NMFS expects green turtles typically spend significant portions of their time. Therefore, potential disruptions of behaviors for any period of time in those areas was not likely to significantly impact or disrupt their regular foraging movement and behavior patterns. This expectation supported conclusions that any regular or sustained disruptions of behavior in those areas was unlikely to have any detectable effect on health.

However, for this proposed action we cannot reach the same conclusions. The proposed project occurs in an area where multiple individuals of the species are expected to spend time foraging, resting, and/or migrating, especially considering the extended duration of project activities and effects. We expect sedimentation and burial of foraging habitat will have some adverse effects to important biological and physical features that support normal foraging behaviors. Therefore, we conclude the project will likely result in adverse effects through a significant disruption of normal behavior patterns that creates the likelihood of injury to the exposed individuals, even if not permanent in nature.

In the long term, NMFS believes the Project may benefit green sea turtles by increasing the amount of high quality foraging habitat in SDB. If the DPS continues its positive trajectory and additional turtles recruit to SDB, NMFS anticipates that turtles may further expand their utilization of the Project areas in south central SDB. In addition, the Project may increase eelgrass resilience in SDB by creating eelgrass habitat at elevations that would likely be sustainable over sea level rise prediction scenarios of up to 3 feet of rise. This beneficial effect will help mitigate the risk of any long term or permanent adverse effects from the Project.

2.5.2 Risk

As described in Section 2.5.1 *Exposure and Response*, we conclude that disruption of normal behaviors resulting from the Project is likely to occur and result in adverse effects to any

individual sea turtles that reside or visit the action area where the proposed delivery and placement of dredged material prior to eelgrass planting will occur. The disruption of normal foraging and resting patterns can have adverse impacts on the relative health of individuals. The definition of "take" under the ESA includes the term "harass," but that term is not further defined in the ESA. For the purpose of this biological opinion, and under our Interim Guidance (NMFS 2016), we interpret harassment under the ESA to equate to significant disruption of normal behavior patterns (e.g., foraging) that could reasonably be expected, alone or in concert with other factors, to create or increase the risk of negatively affecting an ESA-listed animal's growth, health, reproductive success, and/or ability to survive (i.e., an effect that results from a more than inconsequential behavioral response). For the purposes of this analysis, we conclude that the proposed actions are expected to create or increase the risk of adversely affecting ESA-listed green sea turtles in the action area through significant disruption of normal behaviors patterns associated with repeated effects to foraging and resting habitat in South-central SDB that will last multiple years throughout the duration of the Project.

In Section 2.4 *Environmental Baseline: Status in the Action Area,* we reviewed the available information regarding the abundance of green sea turtles in the area. Previous estimates of green sea turtles suggested up to 60 turtles in SDB, but more recent evidence suggests the number of turtles may be much higher. Although we do not have a current specific estimate for the number of turtles that may reside within or occasionally visit the action area, NMFS assumes that potentially approximately 100 green sea turtles or more may occur within or adjacent to the action area at some point during the Project. We assume that all individuals and demographic types that may occur in the action area are equally vulnerable to exposure to the effects of the Project. We expect green sea turtles to be disrupted by project sedimentation effects, and/or be forced to move around or away from the Project area. We acknowledge that the overall impact of these behavioral disruptions on the growth, health, fitness, or reproduction of an individual sea turtle is very uncertain, and likely to vary by individual. Ultimately, we conclude that the likely responses for at least some exposed individuals would be reflective of adverse effects to health and behavior as a result of harassment due to expected Project activities and impacts.

The adverse effects identified are relevant to sediment disposal operations. Although there are risks of detectable impacts to individuals associated with burial and turbidity, we do not expect any significant long-term impacts that would result in the actual death or serious injury of any individual green turtles. The area affected by project activities is relatively small compared to the amount of SDB shallow water habitat elsewhere in the action area and general vicinity. Based on our general understanding of green sea turtle behavior, we expect turtles may avoid the sediment disposal sites during construction and the shallow water habitat affected by sediment disposal, and utilize other parts of the action area, as well as other locations in south SDB. While physical or physiological impacts associated with increased stress levels or reduced nutritional intake as a result of disruption in normal behaviors are likely to occur to some degree, we expect these affects to be temporary. Given that the affected shallow water habitat area is relatively small compared to the amount available elsewhere in the general vicinity, we conclude that adequate

habitat exists beyond the project area with sufficient carrying capacity to support green sea turtles without any risks of long-term reduction in their overall fitness.

Following the completion of the Project, we expect the green sea turtles will adjust and/or resume their normal and preferred behavior and movement patterns within the action area. Although the short-and-long term impacts of disturbance to sea turtles are not well documented, the available evidence suggests that the anticipated level of disturbance would not trigger significant long-term changes in behavior patterns on a large scale. Regardless of the exact extent of disturbance, avoidance, disruption, or displacement that occurs for any individual turtle during the Project, we expect the adverse effects associated with disruptions of important foraging and resting behaviors to be confined within the relatively small action area and duration of project construction and repeated disturbance events. As a result, there should be no detectable long-term impact of the Project on green sea turtles beyond disruptions that may occur during the proposed action. In addition, we recognize the long term beneficial effects are expected to improve foraging opportunities for green sea turtles in the future after the adverse effects of the Project have ceased.

In this opinion, we acknowledged that climate change could influence green sea turtle occurrence and their movement patterns, and the distribution of important habitat features within the action area. NMFS believes the recovering East Pacific DPS of green sea turtles will likely result in more turtles entering the action area in the future (*e.g.,* Eguchi *et al.* 2020). In addition, NMFS anticipates that increasing sea surface temperature associated with climate change may increase the frequency and duration of green sea turtle use of nearshore marine areas in southern California. The increasing population and sea surface temperature trends may increase the number of green sea turtles exposed to project impacts over the life of the proposed action.

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 and 402.17(a)]. 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 environmental baseline (Section 2.4).

Other than vessel traffic and recreational fishing, NMFS is not aware of any particular State or private activities not involving a Federal action that are reasonably certain to occur within the

action area. However, a potential unintended negative consequence of expanded turtle use into these areas over the long term is an increase in vessel collisions given the relatively higher frequency and speed of vessel traffic in these areas compared to south SDB. Eguchi *et al.* (2020) noted a similar consequence after the home range of the SDB turtles increased into areas with more exposure to human interactions after the power plant closure. As described above in Section 2.4 *Environmental Baseline*: boat collisions and propeller injuries have caused up to 80% of turtle deaths reported in SDB and Mission Bay, combined (McDonald and Dutton 1992). Hence, to the extent that an increase in high quality foraging habitat due to Project activities may attract additional turtle utilization, it is possible that an increase in green turtle movements to reach these new foraging sites in South-central SDB may expose these animals to a higher risk of boat collision and injury from vessel traffic. NMFS also notes that vessel traffic may generally increase in South-central and South SDB as a result of anticipated shore side development and improved recreational access associated with the Chula Vista Bayfront redevelopment. However, NMFS anticipates green sea turtles will likely expand their use regardless of the Project activities given the presence of existing high quality foraging habitat in the general area.

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 (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.

NMFS has determined green sea turtle occurrence in the action area is likely given the close proximity to an established population of green sea turtles in South SDB, occasional observations of turtles in the action area, generally high quality foraging habitat in the action area, and our expectation that turtles will expand their use of this area into the future. Based on the analysis of potential effects considered in this biological opinion, we determined that green sea turtles that are likely to occur in the action area would be incidentally harassed through significant disruption of normal behavior patterns over the duration of the proposed project due to burial, sedimentation and/or turbidity effects on shallow water habitat. NMFS has determined that approximately 100 individual green sea turtles or more could be incidentally harassed through significant disruption of normal behavior patterns. We have determined that affected turtles could be of any age or sex in this population.

Although we conclude that some turtles will experience adverse effects from disruption of normal behavior and movement patterns, we have also concluded that there is adequate habitat in the vicinity outside of the impact footprint to support green sea turtles during this time, and that all individual green turtles affected by sedimentation related effects will ultimately survive the

disturbance and resume normal behavior and movement patterns outside the localized impact footprint and/or after the project is complete. As a result, we have concluded the effects associated with shallow water habitat sedimentation and/or burial are ultimately not likely to have a detectable impact on the reproduction, numbers, or distribution of the foraging population of ESA-listed green sea turtles in the action area or Eastern Pacific DPS green turtle population structure and diversity. Given the expected lack of any significant long-term impacts on the population, we conclude that the proposed action is not likely to produce any detectable reduction in the ability of ESA-listed green sea turtles to adapt or be resilient to climate change in any way.

When considering the effects of the Project to the status, environmental baseline, and cumulative effects of other activities, and the anticipated effects of climate change over the foreseeable future, NMFS anticipates a negligible reduction in the numbers, reproduction, or distribution of green sea turtles. Therefore, we conclude the Project will not appreciably reduce the likelihood of survival and recovery of the East Pacific DPS green sea turtles.

2.8. Conclusion

After reviewing and analyzing the current status of the listed species, 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.

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 interim 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.

As described earlier, NMFS has interpreted "harass" to mean creating 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."

2.9.1. Amount or Extent of Take

In the biological opinion, NMFS described harassment as a result of disruption of normal foraging and behavior patterns due to the Project. We expect approximately 100 green sea turtles or more may be exposed to the effects of the Project. We expect that affected individuals comprise an unknown mix of male and female juveniles and adults. Harassment as a result of disruption of normal foraging and behavior patterns may occur through changes in turtle movement, foraging, and resting behaviors due to avoidance of the project area, and reduction in habitat usage of affected shallow water habitat and biological communities. We acknowledge that the overall impact of these behavioral disruptions on the growth, health, fitness, or reproduction of an individual sea turtle is uncertain, and likely to vary by individual. We expect all of these individuals to survive, and to eventually resume normal patterns and health after the Project is completed.

Given the combined uncertainty associated with the number of exposed turtles and the biological effect of the anticipated behavioral disruptions, and because this harassment is expected to occur through the pathways of disturbed and degraded habitats or avoidance of certain areas, we will quantify the anticipated extent of incidental take through the use of surrogate indicators of habitat disturbance or avoidance. NMFS expects that up to 54.3 acres of shallow water habitat and associated biological communities in the sediment disposal footprint and adjacent eelgrass habitat, would be adversely affected by burial, sedimentation, and/or turbidity. If the Project results in greater impacts to shallow water habitat in the action area, then the extent of anticipated incidental take may have been exceeded. NMFS will also evaluate the results of any research conducted on green sea turtles in the area before, during, and after the proposed project that may inform our understanding of effects associated with reduced foraging and/or resting habitat in the action area to determine if the extent of take has occurred in excess of what has been considered in this biological opinion.

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 the species or destruction or adverse modification of critical habitat.

2.9.3. Reasonable and Prudent Measures

"Reasonable and prudent measures" are measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

1. The Navy shall implement measures to monitor, document, and report all incidental take of green sea turtles resulting from the Project.

2. The Navy shall implement measures to minimize the risk of injury associated with sediment disposal operations, and minimize the extent of disruption of normal foraging and behavior patterns of green sea turtles.

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 with the following terms and conditions. The Navy 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 Navy does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

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

1A. Prior to initiating the Project, the Navy shall provide NMFS West Coast Region (WCR) an updated schedule for the anticipated start and completion of project activities in tidally influenced areas. Commensurate with annual reporting requirements set forth in these Terms and Conditions, the Navy will provide NMFS WCR an updated schedule on the progress, anticipated start, and completion of project activities that have occurred, are occurring, or will occur under the remainder of the proposed action, on an annual basis.

1B. The Navy shall monitor the project area as described in section 1.3 and record the presence and behavior of green sea turtles that are observed by project monitors within and around the Project. On an annual basis, the Navy shall provide NMFS WCR a summary report on the observations collected during the previous calendar year, including at least the following information: number(s), estimated size/age class (if applicable), date, locations (latitude and longitude), and behaviors associated with the observations of any ESA-listed species under NMFS jurisdiction (e.g., sea turtles and ESA-listed marine mammals). To the extent possible, monitors shall attempt to photograph surfacing sea turtles (typically head photographs) observed in the action area and provide the images to NMFS. The Navy should also summarize all pertinent details regarding the progress and effectiveness of the monitoring and avoidance measures used during the Project, along with an assessment of potential impacts that may have occurred as a result of project activities based on what was observed. This report shall be provided by April 1 each year to the following address:

Dan Lawson, Branch Chief
NMFS West Coast Region Protected Resources Division
7600 Sand Point Way NE, Bldg. 1
Seattle, Washington 98115

Upon completion of the project, the Navy shall complete a report summarizing all data recorded during all monitoring throughout all phases of the Project, including all documentation and summary analysis of the presence and behavior of green sea turtles, effectiveness of the

monitoring and avoidance measures, and assessment of any potential impacts that may have occurred throughout the entire proposed action. The report shall be provided to NMFS WCR within 120 days following completion of all project activities at the same address listed above.

1C. The Navy shall require project monitors, key contractor and Navy project personnel to attend a project briefing prior to starting work the proposed project. The project briefing shall review the protocols for minimization and avoidance of impacts to sea turtles as described in section 1.3 and 2.9 of this biological opinion, as well as review the latest scientific information regarding green sea turtle ecology in SDB.

1E. The Navy shall report any incidents or observations of injuries and/or mortalities of green sea turtles to the NMFS West Coast Region Stranding Coordinator, Justin Viezbicke, at 562-980-3230 or Justin.Viezbicke@noaa.gov, as soon as practicable. In the event an injury or mortality of a green sea turtle occurs at any time during the Project, the Navy shall cease any activities that may have resulted in the injury or mortality until such time as they evaluate the cause of the harm and consider application of additional protective measures to address those circumstances, in consultation with NMFS.

1F. Prior to initiating the Project and in coordination with NMFS WCR, the Navy shall develop and provide NMFS WCR a final monitoring and mitigation reporting plan regarding project effects on eelgrass habitat and associated shallow water habitat biological communities. The final monitoring plan shall include pre- and post-construction eelgrass surveys of the sediment disposal sites including a 50 meter wide perimeter around the direct disposal footprint. The eelgrass surveys shall be conducted in accordance with the California Eelgrass Mitigation Policy (NMFS 2014). In addition, eelgrass within 50 meters of an active restoration site (being filled, between fill phases, during grading, and over two years following planting) will be monitored annually to determine if any indirect impacts to eelgrass occurs. Lastly, the final monitoring plan should include a qualitative or semi-quantitative evaluation of epibenthic invertebrates and macroalgae coverage of the active restoration sites to document recovery.

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

2A. The Navy shall implement the conservation measures as described in section 1.3 to minimize the potential for vessel collisions and construction disturbance.

2B. If green sea turtles are seen by project monitors adjacent to construction activities, the Navy shall contact NMFS to discuss implementation of any additional measures to reduce the risks of direct contact injuries or other adverse effects, along with potential modification of the green sea turtle monitoring plan to more specifically evaluate the impacts of the proposed project within this specific area.

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).

1. To the extent practical, the Navy should use a vibratory hammer for pile driving activities rather than an impact hammer. Vibratory hammers produce less underwater noise and would further minimize the potential adverse effects associated with noise exposure.

2. The Navy should develop signage and outreach materials to educate the boating community regarding turtle presence and risks of vessel collisions at the Project sites to help maintain the value of the established eelgrass habitat for green sea turtles and facilitate their recovery. Such education is consistent with objectives identified in both the San Diego Bay Integrated Natural Resources Management Plan and the Recovery Plan for East Pacific DPS of green sea turtles.

2.11. Reinitiation of Consultation

This concludes formal consultation for San Diego Bay Eelgrass Habitat Expansion Project.

Under 50 CFR 402.16(a): "Reinitiation of consultation is required and shall be requested by the Federal agency or by the Service where discretionary Federal agency 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."

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 physical, biological, and chemical 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 on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-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 [CFR 600.905(b)].

This analysis is based, in part, on the EFH assessment provided by the Navy and descriptions of EFH for Pacific Coast Groundfish (PCG) (Pacific Fishery Management Council (PFMC 2005)) and Coastal Pelagic Species (CPS) (PFMC 1998) contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1. Essential Fish Habitat Affected by the Project

The Project occurs within EFH for various federally managed fish species within the PCG and CPS FMPs. In addition, the project occurs in estuarine and eelgrass habitat, which are designated as habitat areas of particular concern (HAPC) for various federally managed fish species within the PCG 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 MSA; however, federal projects with potential adverse impacts to HAPC will be more carefully scrutinized during the consultation process.

3.2 Adverse Effects on Essential Fish Habitat

As described in the biological opinion, NMFS has determined that up to 54.3 acres of shallow water habitat and associated biological communities in the sediment disposal footprint and adjacent eelgrass habitat, would be adversely affected by burial, sedimentation, and/or turbidity. However, NMFS believes the protective measures identified in Section 1.3 adequately address these anticipated adverse effects to EFH and HAPC. Therefore, NMFS does not believe any additional conservation recommendations are necessary at this time.

3.3 Supplemental Consultation

The Navy 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 analysis [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 users of this opinion are the U.S. Navy. Other interested users could include the USACE. Individual copies of this opinion were provided to the Navy. The document will be available within 2 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, and reviewed in accordance with WCR ESA quality control and assurance processes.

5. REFERENCES

Amorocho, D.F., and R. Reina. 2007. Feeding ecology of the East Pacific green sea turtle Chelonia mydas agassiziiat Gorgona National Park, Colombia. *Endangered Species Research* 3: 43–51.

Avens, L. and M.L. Snover. 2013. Age and age estimation in sea turtles. In Wyneken, J., K.J. Lohmann and K.J. Musick (Eds.). The Biology of Sea Turtles Volume III. CRC Press Boca Raton, FL, pp. 97-133.

Avery, H.W., Spotila, J.R., Congdon, J.D., Fischer, R.U., Standora, E.A., and S.B. Avery. 1993. Roles of diet protein and temperature in the growth and nutritional energetics of juvenile Slider Turtles, *Trachemys scripta*. *Physiological Zoology* 66:902–925.

Barraza, A.D., Komoroske, L.M., Allen, C., Eguchi, T., Gossett, R., Holland, E., Lawson, D.D., LeRoux, R.A., Long, A., Seminoff, J.A., and C.G. Lowe. 2019. Trace metals in green sea turtles (Chelonia mydas) inhabiting two southern California coastal estuaries. *Chemosphere* 223:342–350.

Barraza, A., Allen, C., Eguchi, T., Gossett, R., Holland, E., Komoroske, L., Lawson, D., LeRoux, R., Lorenzi, V., Seminoff, J., and C. Lowe. 2020. Persistent organic pollutants in green sea turtles (*Chelonia mydas*) inhabiting two urbanized Southern California habitats. *Marine Pollution Bulletin* 153:110979.

Bell, R.J., Tableau, A., and J.S. Collie. 2023. Changes in the productivity of US West Coast fish stocks. *Fisheries Research* 264: 106712.

Benson, S.R., and P.H. Dutton. 2012. Sea turtles of the U.S. west coast. In: Seminoff J.A., Wallace B.P. (eds) Sea turtles of the Eastern Pacific: Advances in research and conservation. The University of Arizona Press, Tucson, AZ, p 88−110.

Blechschmidt, J., Wittmann, M.J., and C. Blüml. 2022. Climate change and green sea turtle sex ratio – Preventing possible extinction. *Genes* 11: 588.

Bredvik, J.J., Graham, S.E., and B. Saunders. 2015. Progress Report: Evaluation of Fine Scale Movements of East Pacific Green Sea Turtles in San Diego Bay. Prepared for Commander, Naval Installations Command and Commander, U.S. Pacific Fleet. Submitted to Naval Facilities Engineering Command (NAVFAC) Southwest, California, September 2015.

California Department of Transportation. 2012. Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish.

Carrión-Cortez, J.A., Zárate, P., and J.A. Seminoff. 2010. Feeding ecology of the green sea turtle (*Chelonia mydas*) in the Galapagos Islands. *Journal of the Marine Biological Association of the United Kingdom* 90: 1005-1013.

Chacón, D., and R. Arauz. 2001. Diagnostico regional y planificacion estrategica para la conservacion de las tortugas marinas en Centroamerica. *Red Reg. para la Conserv. las*

tortugas Mar. Centroam. 134.

Chan, E.H. and H.C. Liew. 1995. Incubation temperatures and sex ratios in the Malaysian leatherback turtle *Dermochelys coriacea*. *Biological Conservation* 74:169-174.

Clifton, K., Cornejo, D., and R. Felger. 1982. Sea turtles of the Pacific coast of Mexico. Pp: 199-209 In: K. Bjorndal (Ed.), Biology and Conservation of sea turtles. Smithsonian Inst. Press: Washington, D.C.

Crear, D.P., Lawson, D.D., Seminoff, J.A., Eguchi, T., LeRoux, R.A., and C.G. Lowe. 2016. Seasonal shifts in the movement and distribution of green sea turtles Chelonia mydas in response to anthropogenically altered water temperatures. *Marine Ecology Progress Series* 548:219-232.

Crear, D.P., Lawson, D.D., Seminoff, J.A., Eguchi, T., LeRoux, R.A., and C.G. Lowe. 2017. Habitat use and behavior of the east Pacific green turtle, Chelonia mydas in an urbanized system. *Bulletin of the Southern California Academy of Sciences*: 116:17-32.

Delgado S.G., and W.J. Nichols. 2005. Saving sea turtles from the ground up: awakening sea turtle conservation in northwestern Mexico. *Maritime Studies* 4:89-104.

Delgado-Trejo, C., and J. Alvarado-Figueroa. 2012. Current conservation status of the black sea turtle in Michoacán, Mexico. Pp. 364–378 In: *Sea Turtles of the Eastern Pacific* (Seminoff, J.A., and B.P. Wallace Eds.). University of Arizona Press.

Duarte, C.M. 2002. The future of seagrass meadows. *Environmental Conservation* 29:192-206.

Dutton, P. 2003. Molecular ecology of Chelonia mydas in the eastern Pacific Ocean. In: *Proceedings of the 22nd Annual Symposium on Sea Turtle Biology and Conservation*, April 4-7, 2002, Miami, Florida.

Dutton, P.H., Jensen, M.P., Frey, A., LaCasella, E., Balazs, G.H., Zarate, P., Chassin-Noria, O., Sarti-Martinez, S.A., and E. Velez. 2014. Population structure and phylogeography reveal pathways of colonization by a migratory marine reptile (*Chelonia mydas*) in the central and eastern Pacific. *Ecology and Evolution* 4:4317-4331.

Dutton, P.H., LeRoux, R.A., LaCasella, E.L., Seminoff, J.A., Eguchi, T., and D.L. Dutton. 2019. Genetic analysis and satellite tracking reveal origin of the green turtles in San Diego Bay. *Marine Biology*. 166:3.

Eguchi, T., Seminoff, J.A., LeRoux, R.A., Dutton, P.H., and D.L. Dutton. 2010. Abundance and survival rates of green turtles in an urban environment: coexistence of humans and an endangered species. *Marine Biology* 157:1869-1877.

Eguchi, T., Seminoff, J.A., LeRoux, R.A., Prosperi, D., Dutton, D.L., and P.H. Dutton. 2012. Morphology and growth rates of the green sea turtle (*Chelonia mydas*) in a northern-most temperate foraging ground. *Herpetologica* 68: 76-87.

Eguchi, T., Bredvik, J., Graham, S., LeRoux, R., Saunderss, B., and J.A. Seminoff. 2020. Effects of a power plant closure on home ranges of green turtles in an urban foraging area. *Endangered Species Research* 41:265-77.

Fuentes, M.M.P.B., Limpus, C.J., and M. Hamann. 2011. Vulnerability of sea turtle nesting grounds to climate change. *Global Change Biology* 17:140-153.

Hanna, M.E., Bredvik J., Graham S.E., Saunders B., Seminoff J.A., Eguchi T., and C. Turner Tomaszewicz. 2020. Movements and habitat use of green sea turtles at the Seal Beach National Wildlife Refuge, CA. Prepared for Naval Weapons Station Seal Beach, California, September 2020.

Hanna M.E., Chandler E.M., Semmens B.X., Eguchi T, Lemons G.E., and Seminoff J.A. 2021. Citizen-Sourced Sightings and Underwater Photography Reveal Novel Insights About Green Sea Turtle Distribution and Ecology in Southern California. *Frontiers in Marine Sciences* 8:671061.

Hanna, M.E., Seminoff, J.A., Curran, J.J., Saunders, B.P., and Pollard, E.A. 2023. Movements and habitat use of green sea turtles in support of the Naval Weapons Station Seal Beach Ammunition Pier and Turning Basin: Second Comprehensive Report (November 2021-May 2023), Prepared for National Marine Fisheries Service, West Coast Region. Submitted to Naval Weapons Station Seal Beach, October 2023.

Harvey, C., Garfield, T., Williams, G., and N. Tolimieri. 2022. 2021–2022 California Current Ecosystem Status Report: A report of the NOAA California Current Integrated Ecosystem Assessment Team (CCIEA) to the Pacific Fishery Management Council, March 13, 2022.

Hawkes, L.A., Brodeaick, A.C., Godfrey, M.H., and B.J. Godley. 2009. Climate change and marine turtles. *Endangered Species Research* 7:137-154.

Hazel, J., Lawler, I.R. and M. Hamann. 2009. Diving at the shallow end: green turtle behavior in near-shore foraging habitat. *Journal of Experimental Marine Biology and Ecology* 371:84-92.

Kaska, Y., Ilgaz, C., Ozdemir, A., Baskale, E., Ttirkozan, O., Baran, I., and M. Stachowitsch. 2006. Sex ratio estimations of loggerhead sea turtle hatchlings by histological examination and nest temperatures at Fethiye beach, Turkey. *Naturwissenschaften* 93:338-343.

Koch, V., Nichols, W.J., Peckham, H., and V. de la Toba. 2006. Estimates of sea turtle mortality from poaching and bycatch in Bahía Magdalena, Baja California Sur, Mexico. *Biological Conservation* 128: 327–334.

Lawson, D., Fahy, C., Seminoff, J., Eguchi, T., LeRoux, R., Ryono, P., Adams, L., and M. Henderson. 2011. A report on recent green sea turtle presence and activity in the San Gabriel River and vicinity of Long Beach, California. Poster presentation at the 31st Annual Symposium on Sea Turtle Biology and Conservation in San Diego, California.

Lemmons, G., Lewison, R., Komoroske, L., Goas, A., Lai, C.T., Dutton, P., Eguchi, T., LeRoux, R., and J. Seminoff. 2011. Trophic ecology of green sea turtles in a highly urbanized bay: Insights from stable isotopes and mixing models. *Journal of Experimental Marine Biology and Ecology* 405:25-32.

Lopez-Mendilaharsu, M., Gardner, S.C., Seminoff, J.A., and R. Riosmena-Rodriguez. 2004. Identifying critical foraging habitats of the green turtle (*Chelonia mydas*) along the Pacific coast of the Baja California peninsula, Mexico.

MacDonald, D., and P.H. Dutton. 1992. Status of sea turtles in San Diego Bay, 1992. Report to the U.S. Fish and Wildlife Service. 15 pp.

MacDonald, B.D., Lewison, R.L., Madrak, S.V., Seminoff, J.A., and T. Eguchi. 2012. Home ranges of East Pacific green turtles *Chelonia mydas* in a highly urbanized temperate foraging ground. *Marine Ecology Progress Series* 461:211-221.

Madrak, S.V., Lewison, R.L., Graham, S.E., and J.J. Bredvik. 2014. Monitoring local movement of east Pacific green turtles in San Diego Bay, San Diego, California. U.S. Navy. February, 2014. 45 p.

Madrak S.V., Lewison, R.L., Seminoff, J.A., and T. Eguchi. 2016. Characterizing response of East Pacific green turtles to changing temperatures: using acoustic telemetry in a highly urbanized environment. *Animal Biotelemetry* 4:22.

Madrak, S.V., Lewison, R.L., Eguchi, T., Klimley, A.P., and J.A. Seminoff. 2022. Effects of ambient temperature on dive behavior of East Pacific green turtles before and after a power plant closure. *Marine Ecology Progress Series* 683:157-168

Mackas, D.L., Goldblatt, R., and A.G. Lewis. 1989. Importance of walleye Pollack in the diets of marine mammals in the Gulf of Alaska and Bering Sea and implications for fishery management, Pages 701–726 in Proceedings of the international symposium on the biology and management of walleye Pollack, November 14-16,1988, Anchorage, AK. Univ. AK Sea Grant Rep. AK-SG-89-01.

Mancini, A., Koch, V., Seminoff, J., and Madon, B. 2012. Small-scale gill-net fisheries cause massive green turtle Chelonia mydas mortality in Baja California Sur, Mexico. *Oryx* 46:69-77.

Massey, L.M., Penna, S., Zahn, E., Lawson, D., and C.M. Davis. 2023. Monitoring green sea turtles in the San Gabriel River of Southern California. *Animals* 13: 434.
NMFS and USFWS. 1998. Recovery Plan for U.S. Pacific Populations of the East Pacific Green Turtle (Chelonia mydas). National Marine Fisheries Service, Silver Spring, MD.

Matsuzawa, Y., Sato, K., Sakamoto, W., and K.A. Bjorndal. 2002. Seasonal fluctuations in sand temperature: effects of the incubation period and mortality of loggerhead sea turtle (*Caretta caretta*) pre-emergent hatchlings in Minabe, Japan. *Marine Biology* 140:629-646.

McCauley, R.D., Fewtrell, J., Duncan, A.J., Jenner, C., Jenner, M.N., Penrose, J.D., Prince, R.I.T., Adhitya, A., Murdoch, J., and K. McCabe. 2000. Marine seismic surveys—A study of environmental implications. *Journal of the Australian Petroleum Production & Exploration Association* 40:692–708.

NMFS. 2016. Interim Guidance on the Endangered Species Act Term "Harass". National Marine Fisheries Service Procedural Instruction 02-110-19. December 21, 2016.
https://media.fisheries.noaa.gov/dam-migration/02-110-19.pdf

NMFS. 2020. South Atlantic Regional Biological Opinion for Dredging and Material Placement Activities in the Southeast United States. Provided to U.S. Army Corps of Engineers and Bureau of Ocean Energy Management.

NMFS. 2022. Programmatic Consultation under Endangered Species Act Section 7(a)(2) and Magnuson-Stevens Fishery Conservation and Management Act 305(b)(4)(A) for waterfront structure maintenance and new construction projects occurring in San Diego Bay conducted by the Navy. WCR-2022-00940. NMFS West Coast Region, Long Beach, CA. June 9, 2022.

NMFS. 2023. National Marine Fisheries Service: Summary of Endangered Species Act Acoustic Thresholds (Marine Mammals, Fishes, and Sea Turtles).
https://www.fisheries.noaa.gov/s3/2023-02/ESA%20all%20species%20threshold%20summary_508_OPR1.pdf

NMFS and USFWS. 2007. Green Sea Turtle (Chelonia mydas). 5-Year Review: Summary and Evaluation. 105 p.

NMFS and USFWS. 1998. Recovery Plan for U.S. Pacific Populations of the East Pacific Green Turtle (*Chelonia mydas*). National Marine Fisheries Service, Silver Spring, MD.

PFMC (Pacific Fishery Management Council). 1998. Description and identification of essential fish habitat for the Coastal Pelagic Species Fishery Management Plan. Appendix D to

Amendment 8 to the Coastal Pelagic Species Fishery Management Plan. Pacific Fishery Management Council, Portland, Oregon. December.

PFMC. 2005. Amendment 18 (bycatch mitigation program), Amendment 19 (essential fish habitat) to the Pacific Coast Groundfish Fishery Management Plan for the California, Oregon, and Washington groundfish fishery. Pacific Fishery Management Council, Portland, Oregon. November.

Quinn, T.J., and H.J. Niebauer. 1995. Relation of eastern Bering Sea walleye pollock (*Theragra chalcogramma*) recruitment to environmental and oceanographic variables. In: *Canadian Special Publication of Fisheries and Aquatic Sciences* (*Climate Change and Northern Fish Populations*, Victoria, B.C., 19 October, 1992-24 October, 1992) (ed. R.J. Beamish) 121, National Research Council, Ottawa, 497-507.

Robinson, R.A., Crick, H., Learmonth, J.A., Maclean, I., Thomas, C.D., Bairlein, F., Forchhammer, M.C., Francis, C.M., Gill, J.A., Godley, B.J., Harwood, J., Hays, G.C., Huntley, B., Hutson, A.M., Pierce, G.J., Rehfisch, M.M., Sims, D.W., Santos, M.B., Sparks, T.H., Stroud, D.A., and M.E. Visser. 2009. Traveling through a warming world: climate change and migratory species. *Endangered Species Research* 7:87-99.

Saba, V.S., Stock, C.A., Spotila, J.R., Paladino, F.V. and P. Santidrian Tomillo. 2012. Projected response of an endangered marine turtle population to climate change. *Nature Climate Change* 2: 814-820.

Schofield., G., Bishop, C.M., MacLean, G., Brown, P., Baker, M., Katselidis, K.A., Dimopoulos, P., Pantis, J.D., and G.C. Hays. 2007. Novel GPS tracking of sea turtles as a tool for conservation management. *Journal of Experimental Marine Biology and Ecology* 347:58-68.

Seminoff, J.A., Resendiz, A., and W.J. Nichols. 2002. Diet of East Pacific Green Turtles (*Chelonia mydas*) in the Central Gulf of California, México. *J. Herpetol.* 36: 447–453.

Seminoff, J.A., Allen, C.D., Balazs, G.H., Dutton, P.H., Eguchi, T., Haas, H.L., Hargrove, S.A., Jensen, M.P., Klemm, D.L., Lauritsen, A.M., MacPherson, S.L., Opay, P., Possardt, E.E., Pultz, S.L., Seney, E.E., Van Houtan, K.S., and R.S. Waples. 2015. Status Review of the Green Turtle (Chelonia mydas) Under the U.S. Endangered Species Act. NOAA Technical Memorandum, NOAA-NMFS-SWFSC-539. 571pp.

Seminoff, J.A. and M. Glass. 2020. Red List Assessment. Green turtle, Chelonia mydas, Eastern Pacific Region. IUCN Marine Turtle Specialist Group. 24 pp.

Seminoff, J.A., Komoroske, L.M., Amorocho, D., Arauz, R., Chacón-Chaverrí, D., de Paz, N., Dutton, P.H., Donoso, M., Heidemeyer, M., Hoeffer, G., Todd Jones, T., Kelez, S., Lemons, G.E., Rguez-Baron, J.M., Sampson, L., Santos Baca, L., Steiner, T., Vejar Rubio, M., Zárate, P.,

Zavala-Norzagaray, A., and B.N. Popp. 2021. Large-scale patterns of green turtle trophic ecology in the eastern Pacific Ocean. *Ecosphere* 12:e03479.

Senko, J, Schneller, A.J., Solis, J., Ollervides, F., and W.J. Nichols. 2011. People helping turtles, turtles helping people: Understanding resident attitudes towards sea turtle conservation and opportunities for enhanced community participation in Bahia Magdalena, Mexico. *Ocean and Coastal Management* 54:148-157.

Short, F.T., and H.A. Neckles. 1999. The effects of climate change on seagrasses. *Aquatic Botany* 63:169-196.

Stinson, M.L. 1984. Biology of sea turtles in San Diego Bay, California, and in the northeastern Pacific Ocean. MS thesis. San Diego State University, San Diego, CA.

Tomillo, S.T., Saba, V.S., Blanco, G.S., Stock, C.A., Paladino, F.V., and J.R. Spotila. 2012. Climate Driven Egg and Hatchling Mortality Threatens Survival of Eastern. Pacific Leatherback Turtles. *PLoS ONE* 7(5): e37602.

U.S. Department of the Navy, Naval Facilities Engineering Command Southwest and Port of San Diego. 2013. San Diego Bay Integrated Natural Resources Management Plan, Final September 2013. San Diego, California. Prepared by Tierra Data Inc., Escondido, California.

Van Houtan K.S., and O.L. Bass. 2007. Stormy Oceans are associated with declines in sea turtle hatching. *Current Biology* 17: R590-R591.

Webster, P J., Holland, G.J., Curry, J.A., and H.-R. Chang. 2005. Changes in tropical cyclone number, duration, and intensity in a warming environment. *Science* 309:1844-1846.