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4 Cumulative Effects

4.1 Definition of Cumulative Effects

Cumulative effects are analyzed in accordance with the NEPA, CEQ regulations, and CEQ guidance. CEQ regulations (40 CFR sections 1500-1508) provide the implementing procedures for NEPA. The CEQ defines "effect or impacts" as "changes to the human environment from the proposed action or alternatives that are reasonably foreseeable" and include direct effects, indirect effects, and cumulative effects (40 CFR section 1508.1(i)). The regulations define "cumulative effects" as:

> *effects on the environment that result from the incremental effects of the action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from actions with individually minor but collectively significant effects taking place over a period of time.* (40 CFR 1508.1(i)(3)).

Per CEQ guidance on cumulative effects analysis in *Considering Cumulative Effects Under the National Environmental Policy Act* and in 40 CFR sections 1500-1508*,* the "levels of acceptable change used to determine the significance of effects will vary depending on the type of resource being analyzed, the condition of the resource, and the importance of the resource as an issue." (Council on Environmental Quality, 1997).

Furthermore, "this change is evaluated in terms of both the total threshold beyond which the resource degrades to unacceptable levels and the incremental contribution of the proposed action to reaching that threshold." In practice, "the analyst must determine the realistic potential for the resource to sustain itself in the future and whether the proposed action will affect this potential. Thus, for a proposed action to have a cumulatively significant effect on an environmental resource, two conditions must be met. First, the combined effects of all identified past, present, and reasonably foreseeable projects, activities, and processes on a resource, including the effects of the proposed action, must be significant. Second, the proposed action must make a measurable or meaningful contribution to that significant cumulative effect.

4.1.1 Scope of Cumulative Effects

The region of influence or geographic boundaries for the analyses of cumulative effects can vary for different resources and environmental media. CEQ guidance (Council on Environmental Quality, 1997) indicates that geographic boundaries for cumulative effects almost always should be expanded beyond those for the project-specific analyses. One method of evaluating geographic boundaries that is proposed by the CEQ guidance is to consider the distance an effect can travel and to identify potential cumulative assessment boundaries accordingly.

A region of influence for evaluating the cumulative effects of the Proposed Action is defined for each resource in Section 4.4 of the 2018 HSTT and 2022 PMSR EIS/OEISs[1]. The basic region of influence or geographic boundary for the majority of resources analyzed for cumulative effects in this EIS/OEIS is the entire HCTT Study Area (Figure 2-1). The geographic boundaries for cumulative effects analysis for some resources are expanded to include activities outside the Study Area that might affect migratory or wide-

[1] The 2018 HSTT and 2022 PMSR EIS/OEISs utilized the term "impact/impacts" to describe the cumulative effects analysis presented in Chapter 4. However, for purposes of this EIS/OEIS, "effects" is used in compliance with the May 2024 updates to the CEQ regulations.

ranging animals. Other activities potentially originating from outside the Study Area that are considered in this analysis include effects associated with maritime traffic (e.g., vessel strikes and underwater noise) and commercial fishing (e.g., bycatch and entanglement).

4.1.2 Past, Present, and Reasonably Foreseeable Future Actions

The 2018 HSTT and 2022 PMSR EIS/OEISs describe the process of analyzing cumulative effects associated with past, present, and reasonably foreseeable future actions. This process is consistent with and applicable to the cumulative analysis in the HCTT Study Area, which includes the extension of the SOCAL Range Complex, the inclusion of PMSR and NOCAL Range Complex, current studies, and updates to present and future projects within the Study Area.

The cumulative effects analysis makes use of the best available data, quantifying effects where possible and relying on qualitative description and best professional judgement where detailed measurement is unavailable. All likely future development or use of the region is considered to the greatest extent possible, even when a foreseeable future action is not planned in sufficient detail to permit complete analysis (Council on Environmental Quality, 1997). The cumulative effects analysis is not bounded by a specific future timeframe (e.g., five years). The Proposed Action includes general types of activities addressed by this EIS/OEIS that are expected to continue indefinitely, and the associated effects could occur indefinitely. While the training and testing requirements change over time in response to world events, it should be recognized that available information, uncertainties, and other practical constraints limit the ability to analyze cumulative effects for the indefinite future. New or supplemental environmental planning documents, including cumulative effects analyses, are prepared as needed, covering changes in military readiness activities in the Study Area.

Table 4-1 and Table 4-2 describe other actions that have had, continue to have, or would be expected to have some effect upon resources also affected by the Proposed Action within the Study Area and surrounding areas. Table 4-1 focuses on identifying past and reasonably foreseeable future actions (military mission, training, and testing; offshore energy development; ocean-dependent commercial industries; and research). Table 4-2 focuses on other major environmental stressors or trends that tend to be widespread and arise from routine human activities and multiple past, present, and future actions. For perspective of general project locations, please refer to Figure 2-1 and Figure 2-2 in Chapter 2, which depict the Study Area, boundaries of individual military readiness activity locations, and open-ocean areas within and adjacent to the Study Area.

4.2 Cumulative Effects on Environmental Resources

Since the information available on past, present, and reasonably foreseeable actions varies in quality and level of detail, effects of these actions were quantified where available data made it possible; otherwise, professional judgement and experience were used to make a qualitative assessment of effects. Due to the large scale of the Study Area and multiple activities and stressors interacting in the ocean environment (Table 4-1 and Table 4-2), the analysis for the incremental contribution to cumulative effects that the Proposed Action may have on a given resource is largely qualitative and speculative. Chapter 3 of the 2018 HSTT EIS/OEIS includes a robust discussion of the “general threats,” an analysis of aggregate project effects, and a broader-level analysis specific to areas where effects are concentrated (i.e., ranges/operating areas). Therefore, the Chapter 3 analysis of the 2018 HSTT EIS/OEIS is referenced and briefly summarized in Table 4-1 to provide context and perspective to the rationale for the conclusions that the Proposed Action would not contribute significantly to the cumulative stress

experienced by these resources when specific past, present, and reasonably foreseeable future actions are added to the analysis.

Effects from actions that occurred beyond 10 years in the past are considered part of the existing conditions and thus will not be included in the cumulative effects analysis. Further, the analysis was not separated by Alternative because the cumulative effects analysis data was mostly qualitative in nature and, from a landscape-level perspective, these qualitative effects are expected to be generally similar. Under Alternative 1 or Alternative 2 of the Proposed Action, the Action Proponents would implement the mitigation measures detailed in Chapter 5 to avoid or reduce potential effects on biological, socioeconomic, and cultural resources in the Study Area.

Table 4-1: Past, Present, and Reasonably Foreseeable Actions

Action	Geographic Overlap	Project Timeline	Description
Past[1]			
Port of Hueneme Deepening Project	CA Study Area	Past	Deepened Port Hueneme by dredging to provide efficient accommodation of larger, deep-draft vessels; increase cargo efficiency of product delivery; and reduce overall transit costs. The project also provided beneficial uses for most of the dredged sediments as nourishment at Hueneme Beach. The project was completed in 2021.
Naval Base Point Loma Fuel Pier Replacement and Dredging (2013)	CA Study Area	Past	Replaced the existing fuel pier and dredged approximately 87,000 cubic yards of sediment to facilitate ongoing navigation in the vicinity of the pier (U.S. Department of the Navy, 2013). Dredge material was disposed in SSTC Boat Lanes as beach nourishment. The project was completed in 2018.
SCI Replacement of the Fuel Storage and Distribution System	CA Study Area	Past	Retirement in place and replacement of the aging underground JP-5 jet fuel tanks and improvement of fuel receipt, storage, and delivery capabilities on San Clemente Island (U.S. Department of the Navy, 2012). The project was completed in 2016.
Pier 12 Replacement and Dredging at Naval Base San Diego	CA Study Area	Past	Demolition and replacement of Pier 12 and associated pier utilities, dredging in berthing and approach for the new pier, dredged material disposal at an approved ocean disposal site and permitted upland landfill, and reuse of demolition concrete to create fish enhancement structures (artificial reefs). The Navy completed this project in 2016 (U.S. Department of the Navy, 2011b).
Pier 8 Replacement at Naval Base San Diego	CA Study Area	Past	Demolition of Pier 8 and construction of a new pier and associated utilities with the infrastructure necessary to support modern Navy ship classes. (U.S. Department of the Navy, 2015a). The project was completed in 2022.
Long-Range Strike Weapons Systems Evaluation Program at Pacific Missile Range Facility (PMRF)	HI Study Area	Past	Tests were conducted from 2017-2021 and included live and inert weapon systems deployed from aircraft for detonation in the air as well as at and below the water surface (U.S. Air Force, 2016b). The program evaluation was complete in 2021.
Energy Storage Systems at PMRF	HI Study Area	Past	Involved the leasing of Navy land to construct and operate a utility scale photovoltaic (PV) array and battery energy storage system (BESS) on approximately 170 acres at PMRF, Kauai. The project was completed in 2020.

Table 4-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Action	Geographic Overlap	Project Timeline	Description
T-Pier Demolition at Kaneohe Bay, HI	HI Study Area	Past	Demolition of Facility 1662, the former Naval Ocean Systems Command Pier within Kaneohe Bay, to include removal of concrete decking, support pilings, and existing utility lines associated with the pier. Demolition was completed in 2022.
Naval Special Warfare Undersea Enterprise (NSWUE) Consolidation	HI Study Area	Past	Consolidation of the continental and Hawaii-based NSWUE units at JBPHH over 5-10 years from 2011. Adaptive reuse of historic properties provided additional working space and infrastructure.
United Launch Alliance Delta IV Rocket Program	CA Study Area	Past	The Delta IV rocket flew 45 missions since the first launch in 2002, 9 of which were from Vandenberg Air Force Base (now named Vandenberg Space Force Base [VSFB]). The launch system was available in three configurations, including the Delta IV Medium with two solid rocket motors, the Delta IV Medium with four solid rocket motors, and the Delta IV Heavy (United Launch Alliance, 2018). The Delta IV Heavy had its final west coast launch in September of 2022. There are currently no future Delta IV rocket launches scheduled to occur at VSFB.
Helicopter Realignment and Squadron Transition	CA Study Area	Past	Added four west coast helicopter squadrons, including three new squadrons and the relocation of one east coast squadron, to Naval Air Station North Island. The relocation of the squadrons was complete in 2016 and represented an increase in helicopter operations at Naval Air Station North Island (U.S. Department of the Navy, 2011a).
Hawaii-Southern California Training and Testing (HSTT) 2013 EIS/OEIS	HCTT Study Area	Past	The 2013 Phase II HSTT Final EIS/OEIS provided comprehensive analysis of the full geographic scope of areas where Navy training and testing activities have historically occurred as well as those projected for a 5-year range. It evaluated effects from past activities as well as present training and testing activities based on changing operational requirements, new platforms, and new systems. The Navy used these analyses to support incidental take authorizations under the Marine Mammal Protection Act (MMPA).
Submarine Drive-In Magnetic Silencing Facility	HI Study Area	Past	Completed in 2010, the project replaced existing submarine deperming piers and structures and constructed land-based support facilities for a new drive-in submarine silencing facility.

Table 4-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Action	Geographic Overlap	Project Timeline	Description
Honolulu Harbor Dredging	HI Study Area	Past	Completed in 2018, the U.S. Army Corps of Engineers conducted maintenance dredging of the federal entrance channel, turning basin, access channel, and areas near Sand Island Bridge of Honolulu Harbor in Oahu, Hawaii.
P-8 aircraft removal from Kaneohe Bay	HI Study Area	Past	A P-8 aircraft ran off the runway at Marine Corps Base Kaneohe Bay in Hawaii in November of 2023. The aircraft was removed in December 2023 and an emergency EA was conducted. Following the extraction, the Hawaii Department of Land and Natural Resources Division of Aquatic Resources conducted an impact assessment and subsequent restoration efforts were carried out by the Division of Aquatic Resources, the Navy, and other agencies.
Present			
Falcon 9 Testing	CA Study Area	Present	The Falcon 9 rocket, designed and manufactured by SpaceX, is the first orbital class rocket capable for reflight and transports satellites into orbit (SpaceX, 2024). The First Stage rocket, tested out of VSFB, is 12 feet in diameter and 160 feet in height and includes nine engines and two tanks holding 662,250 pounds of aluminum liquid oxygen and 260,760 pounds of rocket propellant. There are several options for First Stage testing: (Hemery et al.) it is dropped into the Pacific Ocean and is non-recoverable; (2) it is boosted-back and lands on concrete padding at SLC-4W; (30th Space Wing Public Affairs) it is landed on an autonomous barge located at least 27 nautical miles offshore of Vandenberg Air Force Base; and (Nambu & Hajime Ishikawa) it is boosted-back and lands on an autonomous barge within the Iridium Landing Area (U.S. Air Force, 2016a). It has launched approximately 40 times from Vandenberg Air Force Base since the first flight in 2006.
Seal Beach Ammunition Pier	CA Study Area	Present	Constructed a replacement ammunition pier with associated waterfront facilities. Construction included dredging for the pier, access channel, and turning basin.
Wave Energy Test Site, Kaneohe Bay	HI Study Area	Present	The U.S. Navy's Wave Energy Test Site (WETS), the United States' first grid-connected wave energy test site, was expanded to three test berths in 2015. Through a cooperative effort between the Navy and the U.S. Department of Energy, with the support of Hawaii Natural Energy Institute and the Hawaii National Marine Renewable Energy Center, WETS hosts companies seeking to test their pre-commercial wave energy convertor devices in an operational setting, enabling them to advance their device transition readiness level. Hawaii Natural

Table 4-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Action	Geographic Overlap	Project Timeline	Description
			Energy Institute provides performance analysis, numerical modeling of devices and moorings, wave measurement and forecasting, environmental monitoring (primarily acoustics), and logistics support to the Navy and the companies deploying at WETS.
JLOTS, Maritime Prepositioning Force, and Field Exercise Training	HCTT Study Area	Present	Would support up to twelve annual amphibious training activities, which consist of one Joint Logistics Over-the-Shore Training exercise every three years, one Maritime Prepositioning Force exercise every year, and up to 10 Field Exercise activities every year (U.S. Department of the Navy, 2015b). May be conducted jointly by the Navy, USMC, and Army.
Point Mugu Sea Range (PMSR) 2022 EIS/OEIS	CA Study Area	Present	Assesses the potential environmental consequences associated with continuing military readiness activities addressed in the March 2002 Naval Air Warfare Center Weapons Division PMSR EIS/OEIS, and Environmental Assessments completed at PMSR since 2002. In addition to consolidating previously analyzed actions, it also would address proposed increases in activity frequency.
Aircraft Transition at Fleet Logistics Centers	CA Study Area	Present	Would replace the C-2A Greyhound with the newer CMV-22B Osprey at either Naval Air Station North Island, California.
Hawaii-Southern California Training and Testing (HSTT) 2018 EIS/OEIS	HCTT Study Area	Present	The 2018 HSTT EIS/OEIS provides a comprehensive analysis of the full geographic scope of areas where Navy training and testing activities have historically occurred as well as those projected for a 5-year range. It assesses the effects from past activities as well as present training and testing activities based on changing operational requirements, new platforms, and new systems. The full breadth of activities, and their potential effects, of the 2018 Final HSTT EIS/OEIS, are similar in nature to those analyzed in the 2013 EIS/OEIS. The Navy used these analyses to support incidental take authorizations under the Marine Mammal Protection Act (MMPA).
Surveillance Towed Array Sensor System (SURTASS)	HCTT Study Area	Present	The Navy has been operating SURTASS Low-Frequency Active Sonar systems since 2002 in ocean areas largely outside of the Study Area, with the exception of part of the Hawaii Range Complex, and plans to continue the operation of systems for use in routine training, testing, and military operations (U.S. Department of the Navy, 2019) (U.S. Department of the Navy, 2016)

Table 4-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Action	Geographic Overlap	Project Timeline	Description
U.S. Coast Guard (USCG)	HCTT Study Area	Present	The USCG performs maritime humanitarian, law enforcement, and safety services in estuarine, coastal, and offshore waters.
Introduction of Multi-Mission Maritime Aircraft into the U.S. Navy Fleet	HCTT Study Area	Present	Would provide facilities and operations to support the home basing of P-8A Mission Maritime Aircraft fleet and fleet replacement squadrons at NAS North Island and MCB Kaneohe Bay.
Basing of Aircraft Squadrons in Hawaii	HI Study Area	Present	Would base up to two Marine Medium Tiltrotor squadrons in MCB Kaneohe Bay to conduct aviation operations at training areas on the islands of Kauai, Oahu, Molokai, Maui, and Hawaii.
Cove Outdoor Recreation Center and Marina Improvements, and marine recreation in Kaneohe Bay	HI Study Area	Present	Would improve the Cove facilities to protect existing and proposed facilities and construction of additional onshore and offshore facilities (U.S. Marine Corps, 2010). Use of the recreational spaces within Kaneohe Bay would continue.
Naval Special Warfare Operations Training	HCTT Study Area	Present	Historical and proposed water and land based training activities for Special Operations forces.
Marine Recreation in Kaneohe Bay	HI Study Area	Present	Kaneohe Bay and marina provides recreational opportunities for marines and their guests, including various vessel and equipment rentals, water sports, and access to several beaches on base including North Beach, Pyramid Rock Beach, Hale Koa Beach, Pali Kilo Beach, and Ft. Hase Beach.
Oil and Gas Leasing Programs	CA Study Area	Present	Twenty-three oil and gas production facilities are located off the coast of California (Bureau of Ocean Energy Management, 2017). Activities include sonar surveys, exploration drilling, development and production wells, installation and operation of facilities, pipeline transport, and decommissioning.
Oil and Removal Operations	CA Study Area	Present	Decommissioning operations occur after lease expiration, when the well or facility is no longer deemed economically viable, or when the structure becomes unsafe or a navigation hindrance. It includes the explosive and non-explosive severing of structures and subsequent salvage and site-clearance operations (Minerals Management Service, 2005).
Maritime Traffic	HCTT Study Area	Present	Key ports in Hawaii and California facilitate the heavy commercial, recreational, and government marine traffic throughout the Study Area.

Table 4-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Action	Geographic Overlap	Project Timeline	Description
Commercial Fishing	HCTT Study Area	Present	There are over 59 commercial fisheries throughout the Study Area that have the potential to affect the coastal economies and marine habitats.
Recreational Fishing	HCTT Study Area	Present	Recreational fishing contributes significantly to the tourism economies of Hawaii and California and the potential to affect the coastal economies and marine habitats.
Coastal Land Development and Tourism	HCTT Study Area	Present	Coastlines within the Study Area are heavily developed and include extensive tourism.
Undersea Communications Cables	HCTT Study Area	Present	Submarine cables provide the primary means of voice, data, and Internet connectivity between the mainland United States and the rest of the world. Over 550,000 mi. of cables currently exist in the world's oceans and are installed by burying the cables in shallow areas.
Aquaculture	HCTT Study Area	Present	Farming of aquatic organisms is one of the fastest growing form of food production. The first commercial-scale offshore aquaculture project in federal waters is proposed to occur within the Study Area.
Geological and Geophysical Oil and Gas Survey Activities	HCTT Study Area	Present	Offshore geological and geophysical research may include seismic air gun surveys and high resolution geophysical surveys supporting oil and gas, renewable energy, and marine minerals exploration (Bureau of Ocean Energy Management, 2014; University of California San Diego, 2024)
Academic Research	HCTT Study Area	Present	Wide-scale academic research is conducted in the study area by federal entities, such as the Navy and the NOAA/NMFS, as well as state and private entities and other partnerships.
Field Operations at National Marine Sanctuaries and Marine National Monuments	HCTT Study Area	Present	NOAA conducts field operations within Marine Sanctuaries and Monuments that primarily support resource protection, research, and education objectives of the National Marine Sanctuaries Act.
Pier 302 Replacement, Naval Base Point Loma	CA Study Area	Present	Would include the demolition of Pier 302 and construction of a new pier and associated utilities with the infrastructure necessary to support modern Navy ship classes.

Table 4-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Action	Geographic Overlap	Project Timeline	Description
Naval Undersea Warfare Center Division Fixed Surface Ship Radiated Noise Measurement System, Barber's Point Oahu	HI Study Area	Present	Includes the installation and operation of a hydrophone array, undersea data transmission cable, and a shore station cable landing to measure underwater vessel noise (U.S. Department of the Navy, 2015c)
MQ-25A Stingray Home Basing	HCTT Study Area	Present	The Navy would establish facilities and operations, which include training and annual flight operations, of 20 Stingray CBUAS at NBVC Point Mugu.
Wind Energy	CA Study Area	Present	Development of offshore wind energy includes site characterization and assessment activities and installation activities. The Bureau of Ocean Energy Management (BOEM) auctioned its first West Coast leases in 2022; of the five total, three are within the HCTT Study Area off the coast of Morro Bay. The California State Lands Commission is currently working with the BOEM to develop a draft Programmatic EIS, anticipated in 2024. The steps following the environmental review and leasing include site characterization and assessment activities to inform project design, as well as construction and operations planning, environmental review, and implementation (California State Lands Commission, 2024).
	HI Study Area	Present	The BOEM received three unsolicited lease requests in 2014–2015 proposing the development of offshore floating wind energy facilities. In response, BOEM released a "Call for Information and Nominations" to investigate additional nominations from companies interested in floating offshore energy development within the call area and to solicit public feedback. The BOEM released a Notice of Intent to prepare an EA and solicited public comments on the proposed activities in 2016. In addition to funding resource studies to inform the development of offshore energy, the BOEM completed the Hawaii Floating Offshore Wind Regional Ports Assessment in 2024 that analyzed the compatibility of existing port infrastructure with offshore energy development requirements (Bureau of Ocean Energy Management, 2024a, 2024b).

Table 4-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Action	Geographic Overlap	Project Timeline	Description
Construction and Operation of Dry Dock 5, Pearl Harbor	HI Study Area	Present	The construction, operation, and maintenance of a graving dry dock (Dry Dock 5), associate auxiliary facilities, crane type wight-handling system, and upgraded utilities. Dry Dock 5 will be replacing the existing Dry Dock 3, which is not operational. Construction related activities will include dredging, filling, pile driving, installing new temporary and permanent in-water structures, in addition to demolishing and installation of new landside facilities. The project is anticipated to be completed by January 2028.
Reasonably Foreseeable			
Training and Testing of the Extra Large Unmanned Undersea Vehicles (XLUUVs) and Unmanned Surface Vessels (USVs)	CA Study Area	Reasonably Foreseeable	Construction of approximately 123,000 square feet of permanent facilities to support administrative, maintenance, and training and testing needs of the unmanned systems. Construction of permanent facilities and pierside renovations are anticipated to begin no earlier than 2026. The project would also include training and testing of the XLUUVs and USVs in the Pacific Ocean waters nearshore and offshore to the west of NBVC Port Hueneme. There are no explosive ordnance or detonation events anticipated as part of training and testing.
Pacific Deep Electromagnetic Research Measurement Array (PACDERMA)	HI Study Area	Reasonably Foreseeable	The Navy proposes to construct underwater electromagnetic measurement system to characterize a submarine's submerged electric signature in the water offshore the Pacific Missile Range Facility on Kauai, HI.
Berth G Extension at USCG Base Honolulu	HI Study Area	Reasonably Foreseeable	Would extend Berth G at USCG Base Honolulu by constructing a fixed, pile-supported pier extending approximately 110 feet eastward from Berth G. This extension would allow for mooring of the second Seagoing Buoy Tender, including fenders, mooring hardware, and services. The USCG would also demolish and dispose of the existing floating dock (Berth F), to include removal of foundations and piles, but excluding the floating gangway which may be reused.
Haleiwa Small Boat Harbor Maintenance Dredging and Beach Restoration, Oahu	HI Study Area	Reasonably Foreseeable	US Army Corps of Engineers would conduct maintenance dredging of the Haleiwa Small Boat Harbor. The project would include the disposal and possible reuse of the dredged material to combat beach erosion.

Table 4-1: Past, Present, and Reasonably Foreseeable Actions (continued)

Action	Geographic Overlap	Project Timeline	Description
Homeport Facilities Improvements for Nimitz-Class Aircraft Carriers	CA Study Area	Reasonably Foreseeable	Updates to the carrier berths at NAS North Island would include routine pier-side maintenance activities and improved shoreside power infrastructure.
Extended Range Cannon Artillery II (ERCA), VSFB	HCTT Study Area	Reasonably Foreseeable	ERCA testing at Vandenberg Space Force Base (VSFB) would include firing projectiles over the Pacific Ocean from the shoreline of VSFB onto and over the PMSR.
Pacific Missile Range Facility (PMRF) Land-Based Training	HI Study Area	Reasonably Foreseeable	Land-based training and testing at PMRF would include firing projectiles over the Pacific Ocean from the shoreline of PMRF onto the HRC.
Marine Hydrokinetic	HCTT Study Area	Reasonably Foreseeable	No hydrokinetic development has occurred within the Study Area, however, significant research into the performance and applicability of water power technology is underway.

[1] Events categorized as "Past" in the table include actions from 2014 to present.

Notes: HCTT = Hawaii California Training and Testing, CBUAS = Carrier-Based Unmanned Aircraft System, UAS = Unmanned Aircraft System, NBVC = Naval Base Ventura County, USMC = U.S. Marine Corps, SSTC = Silver Strand Training Complex, SCI = San Clemente Island, NAS = Naval Air Station, MCB = Marine Corps Base, PMRF = Pacific Missile Range Facility, JBPHH = Joint Base Pearl Harbor Hickam, WETS = Wave Energy Test Site, NOAA = National Oceanic and Atmospheric Administration, NMFS = National Marine Fisheries Service

Table 4-2: Ocean Pollution and Ecosystem Alteration Trends

Stressor	*Location*	*Description*
Hypoxic zones	Global	Hypoxia, or low oxygen, is an environmental phenomenon where the concentration of dissolved oxygen in the water column decreases to a level that can no longer support living aquatic organisms. Hypoxia can occur from the rapid growth and decay of algal blooms in response to excess nutrient loading (primarily nitrogen and phosphorus from agriculture runoff, sewage treatment plants, bilge water, and atmospheric deposition), as well as waterbody stratification from differences in water salinity or temperature. Animals that encounter the Hypoxic Zones experience physiological stress, or suffocate. Hypoxic zones can be natural phenomena but are occurring in increasing size and frequency due to human-induced nonpoint source water pollution (National Oceanic and Atmospheric Administration, 2016, 2017).
	California	While the waters off coastal California are very productive, there is a varying degree of hypoxia along the California coast, mostly due to seasonal upwelling when deep oxygen-depleted waters replace warmer coastal waters due to changing seasonal factors.
Harmful algal blooms	Global	Elevated nutrient loading has also been identified as a potential contributing cause of the increased incidence of harmful algal blooms, proliferations of certain marine and freshwater toxin-producing algae (National Oceanic and Atmospheric Administration, 2016, 2017). Of the 5,000 known species of phytoplankton, there are about 100 species known to be toxic or harmful. Harmful algal blooms cause human illness and animal mortalities, including fish, bird, and marine mammals (Anderson et al., 2002; Corcoran et al., 2013; Sellner et al., 2003). Harmful algal blooms can be natural phenomena but are occurring in increasing size and frequency due to human-induced nonpoint source water pollution (National Oceanic and Atmospheric Administration, 2016, 2017). With the projection of warming ocean waters, these harmful blooms may become more prevalent beginning earlier, lasting longer, and covering larger geographic areas (Edwards, 2013; Moore et al., 2008).
	California	While no trend can be determined, algal bloom trends have been changing in the coastal waters and are known to be influenced by warmer water temperatures. Certain species of diatoms produce biotoxins that can significantly affect marine fisheries and wildlife.
	Hawaii	The most common causes of algae blooms in Hawaii include wastewater leaks, runoff containing agricultural fertilizer, or submarine groundwater discharge. Algae often grows faster and can outcompete corals on the surrounding coastal reefs. Lack of herbivores to control the growth of algae can also contribute to an algae overgrowth and causes a bloom.
Marine Invasive Species	Global	Species are considered invasive once enough individuals from an exotic species (those that are moved from their original location) establish and reproduce in a new area. Invasive species are pervasive throughout global waters and are most commonly found in areas that experience high vessel traffic, like ports. The introduction of invasive species can threaten and lead to the extinction of native species in an area through resource competition. As a result, the biodiversity and overall health of an ecosystem can be affected (National Oceanic and Atmospheric Administration, 2024).

Table 4-2: Ocean Pollution and Ecosystem Alteration Trends (continued)

Stressor	*Location*	*Description*
Marine Invasive Species (continued)	California	Invasive species documented within the California Study Area include Japanese seaweed (*Sargassum horneri*) and red algae (*Grateloupia turuturu*) in the California Bight, Mediterranean fanworm (*Sabella spallanzanii*) and clubbed tunicate (*Styela clava*) near the Channel Islands, as well as Asian kelp, or wakame (*Undaria pinnatifida*) along the California coastline (California Department of Fish and Wildlife, 2024b; National Oceanic and Atmospheric Administration, 2024). In coordination with the California State Lands Commission, the California Department of Fish and Wildlife monitors the introduction and management of invasive species throughout the state (California Department of Fish and Wildlife, 2024a).
	Hawaii	There are numerous invasive marine species within the Hawaii Study Area. Invasive octocoral species, such as stoloniferous fire coral (*Unomia stolonifera*), are known to outcompete and take over native coral species due to their quick reproduction. In 2023, 80 acres of stoloniferous fire coral were recorded in Pearl Harbor; 2024 surveys documented an increase to approximately 100 acres in 2024 (Hawaii Invasive Species Council, 2024b). Additional invasive marine species documented within the Hawaii Study Area include prickly seaweed (*Acanthophora spicifera*), hook weed (*Hypnea musciformis*), leather mudweed (*Avrainvillea lacerate*), gorilla ogo (*Gracilaria salicornia*), smothering seaweed (*Kappaphycus alvarezii and Echeumia spp.*), peacock grouper (*Cephalopholis argus*), upside-down jellyfish (*Cassiopea andromeda*), and keyhole sponge (*Mycale armata*) (Hawaii Department of Land and Natural Resources, 2024). The Hawaii Invasive Species Council was established in 2003 by the Hawaii State Legislature to provide policy-level coordination and planning among state and federal agencies to control current populations and prevent future introduction or invasive species (Hawaii Invasive Species Council, 2024a).
Major spill events	Global	Oil and other chemical spills related to oil and gas production activities have occurred along the Pacific coast of California.
	Pacific	There have been five major spills of the coast of California since 1969, resulting in approximately 5.5 million gallons of oil being spilled into the Pacific (California Coastal Commission, 2019). Environmental effects associated with oil spills include those that arise from direct exposure of marine life to oil and oil dispersants, habitat degradation, and disturbances caused by cleanup activities.
Marine Debris (Section 3.2.2.2.1)	Global	Marine debris is any anthropogenic object intentionally or unintentionally discarded, disposed of, or abandoned that enters the marine environment. An estimated 75% or more of marine debris consists of plastic (Hardesty & Wilcox, 2017). Approximately 80% of marine debris originates onshore and 20% from offshore sources. Marine debris is governed internationally by the 1972 London Convention and 1996 London Protocol and regulated in the United States through the Marine Protection, Research, and Sanctuaries Act. Marine debris has been discovered to be accumulating in gyres throughout the oceans, and two major accumulation zones exist in the Pacific Ocean and in the Atlantic east of Bermuda. Marine debris degrades marine habitat and water quality and poses ingestion and entanglement risks to marine life and birds (National Marine Fisheries Service, 2006).

Table 4-2: Ocean Pollution and Ecosystem Alteration Trends (continued)

Stressor	*Location*	*Description*
Coral Bleaching Events	Global	Coral bleaching occurs when coral polyps expel the algae that live within their tissue in response to environmental stressors such as changes in light, water temperature, or available nutrients. As a result, the coral's white calcium carbonate skeleton gets exposed, creating a "bleaching" effect. The bleaching of coral reefs across the globe is a response to higher water temperatures and carbon dioxide levels due to global warming, as well as increases in pollution and UV radiation, among others. While corals can survive a bleaching event, it does make them more susceptible to disease and starvation.
	Hawaii	There have been three major bleaching events in Hawaii since 2014, largely correlated with increased ocean temperatures. While prior bleaching events have occurred, there has been an increase in frequency within the past decade (National Oceanic and Atmospheric Administration, 2022)
Noise	Global	Ambient noise is the collection of ever-present sounds of both natural and human origin in the immediate surroundings of the receiver. Ambient noise in the ocean is generated by sources that are natural physical (earthquakes, rainfall, waves breaking, and lightning hitting the ocean); natural biological (snapping shrimp and the vocalizations of marine mammals), and anthropogenic (human-generated) sources. Anthropogenic sources have substantially increased ocean noise since the 1960s, and include commercial shipping, oil and gas exploration and production activities (including air gun, drilling, and explosive decommissioning), commercial and recreational fishing (including vessel noise, fish-finding sonar, fathometers, and acoustic deterrent and harassment devices), military (testing, training and mission activities), shoreline construction projects (including pile driving), recreational boating and whale watching activities, offshore power generation (including offshore windfarms), and research (including sound from air guns, sonar, and telemetry).
Climate Change	Global	Predictions of long-term negative environmental effects due to climate change include sea level rise; changes in ocean surface temperature, acidity/alkalinity, and salinity; changing weather patterns with increases in the severity of storms and droughts; changes to local and regional ecosystems (including the potential loss of species); shrinking glaciers and sea ice; thawing permafrost; a longer growing season; and shifts in plant and animal ranges, fecundity, and productivity. Anthropogenic greenhouse gas emissions (Section 3.1) have changed the physical and chemical properties of the oceans, including a 1 degree Celsius temperature rise, increased carbon dioxide absorption, decreased pH, alteration of carbonate chemistry, decline in dissolved oxygen, and disruption of ocean circulation (Poloczanska et al., 2016). Observations of species responses that have been linked to anthropogenic climate change are widespread, and trends include shifts in species distribution to higher latitudes and to deeper locations in the water column, earlier onset of spring and later arrival of fall, declines in calcification, and increases in the abundance of warm-water species. Climate change is likely to negatively affect the Study Area and would contribute added stressors to all resources in the Study Area (as noted in the discussion for each resource in the sections to follow).

Notes: % = percent; U.S. = United States

4.3 Resource-Specific Cumulative Effects

In accordance with CEQ guidance (Council on Environmental Quality, 1997), the following cumulative effects analysis focuses on effects that are "truly meaningful." The level of analysis for each resource is commensurate with the intensity of the effects identified in Chapter 3 or the level to which effects from the Proposed Action are expected to mingle with similar effects from existing activities.

4.3.1 Air Quality and Climate Change

The incremental contribution of the Proposed Action to cumulative effects would be low and would still be below applicable state, federal, and USEPA standards. The Proposed Action's contribution would not appreciably increase human health risks from hazardous air pollutant exposure in areas where sensitive receptors and/or public presence are expected, based on the analysis presented in Section 3.1 of this EIS/OEIS and the reasons summarized below.

- The Proposed Action would result in localized and temporarily elevated emissions, but criteria pollutant emissions in nonattainment or maintenance areas would not exceed *de minimis* thresholds. A signed Record of Non-Applicability is presented in Appendix G to document this determination.
- It is anticipated that the majority of emissions resulting from the Proposed Action would be released outside of state waters (outside 3 NM from shore) and would quickly disperse in the open ocean environment. Emissions released within state waters (within 3 NM of shore) would have a greater effect on areas where the public is present. However, since few activities are proposed to occur within state waters, the effect from emissions is expected to be minor.
- The military complies with the 0.5 percent sulfur cap on marine fuel emissions as established by the International Maritime Organization (IMO) in 2020 and the (International Maritime Organization, 2020). In addition, the military complies with the 2023 *IMO Strategy on Reduction of Greenhouse Gas Emissions from Ships,* which was adopted by the IMO in 2023 in accordance with agreed-upon follow up actions from a 2018 Initial Strategy to reduce greenhouse gas emissions from ships.
- The DoD has released multiple iterations of the Operational Energy Strategy: Implementation Plan, which will reduce demand, diversify energy sources, and integrate energy consideration into planning. The Navy has released an updated Operational Energy Strategy in 2012, 2016, and 2023 (U.S. Department of Defense, 2023). Improvement in fuel delivery systems, energy supply chains, and electrification of assets as outlined in the Operational Energy Strategy will result in more efficient military operations and a reduction in associated air emissions.

While emissions generated by military readiness activities alone would not be enough to cause global warming, in combination with past and future emissions from all other sources they would contribute incrementally to the global warming that produces the adverse effects of climate change. However, under the Proposed Action, the incremental additive effects from combined emissions, including greenhouse gases, occurring beyond state water boundaries would be minor, localized, intermittent, and unlikely to contribute to future degradation of the ocean atmosphere in a way that would harm ocean ecosystems or nearshore communities, or significantly contribute to global warming. Thus, based on the analysis presented in Section 3.1 and given the meteorology of the Study Area, the frequency and isolation of proposed military readiness activities, and the quantities of expected emissions, it is anticipated that the incremental contribution of the Proposed Action, when added to the effects of all other past, present and reasonably foreseeable future actions, would not result in measurable

additional effects to air quality in the Study Area or beyond. A cumulative analysis of greenhouse gas emissions and climate change is provided in Section 3.1.

4.3.2 Sediments and Water Quality

The incremental contribution of the Proposed Action to cumulative effects would be low and would be below applicable state, federal, and USEPA standards and guidelines based on the analysis presented in Section 3.2 of this EIS/OEIS and the reasons summarized below.

- Military stressors are expected to be isolated and short term, with disturbed sediments and particulate matter quickly dispersing within the water column or settling to the seafloor and turbidity conditions returning to background levels.
- Sediment quality of the Study Area is generally rated "good" by the USEPA with most instances of lower quality in nearshore waters adjacent to population centers or areas that are geologically more enclosed.
- Analysis of decades-old munitions dump sites in multiple locations, including Hawaii, indicated that concentrations of chemical contaminants in sediments in the immediate vicinity of the dumpsites (identified as "affected") were not substantially different from those found in non-affected sediments in the same general area. As such, munitions dumpsites have not had an appreciable effect on sediments.
- Most of the metals or chemicals that are not explosives that could affect sediments or water quality from munitions disposals are relatively benign, and those of potential concern make up a small percentage of expended munitions and other metal objects.
- Metals or chemicals from munitions that fail to explode are released through corrosion and would be diluted by currents or bound up and sequestered in adjacent sediment; any elevated concentrations of metals in sediments would be limited to the immediate area around the expended material.
- Practices, such as recovery of certain targets and associated items such as parachutes, would be implemented when practicable.
- The areas over which munitions and other metal or plastic components of military expended materials would be distributed are large; expended material are in relatively minute concentrations when compared to other materials found in the ocean (see Appendix C).

It is possible that stressors from military readiness activities would combine with non-military stressors, particularly in more heavily used nearshore areas and bays, such as Pearl Harbor and San Diego Bay, to exacerbate already affected water quality. Although effects may occur coincident with other stressors in areas with degraded existing conditions, the effects on water quality, such as increases in turbidity, are expected to be isolated and short term, with disturbed sediments and particulate matter quickly dispersing within the water column or settling to the seafloor and turbidity conditions returning to background levels. The Proposed Action could incrementally contribute to increases in persistent metal and plastic materials from military expended materials accumulating in the offshore marine environment. However, the relatively minute concentrations of stressors from military readiness activities are not likely to meaningfully contribute to sediment or water quality degradation. Based on the analysis in Section 3.2 and summarized above, it is anticipated that the incremental contribution of the Proposed Action when added to the effects of all other past, present, and reasonably foreseeable future actions would not result in measurable additional effects on sediments or water quality in the Study Area or beyond.

4.3.3 Vegetation

The incremental contribution of the Proposed Action to cumulative effects would be low and would still be below applicable USEPA standards and guidelines based on the analysis presented in Section 3.3 of this EIS/OEIS and the reasons summarized below.

- The coverage of seagrass in the Study Area has generally decreased over time; from 1879 to 2006 global seagrass coverage decreased by 75 percent (Waycott et al., 2009). However, there have been recent efforts to expand eelgrass coverage in certain areas, such as San Diego Bay. By comparison, algae includes a much greater diversity of species, forms, life histories, and environmental tolerances, and are thus resilient to stressors and able to rapidly recolonize disturbed environments (Levinton, 2009).
- Mitigation measures within the military's seafloor resource mitigation areas would avoid or reduce potential effects of the Proposed Action on vegetation species that are associated with shallow-water coral reefs, precious coral beds, live hard bottom, artificial reefs, and shipwrecks. Additionally, pre-activity observers monitor for the occurrence and avoidance of seagrasses, macroalgae, *Sargassum,* and detached (free-floating) kelp.
- The analysis presented in Section 3.3 indicates that effects on marine vegetation are limited to damage on individual plants; there would be no persistent or large-scale effects on the growth, survival, distribution, or structure of vegetation due to relatively fast growth, resilience, and abundance of the affected species in anticipated activity areas. Likewise, the short-term, localized nature of most activities further diminishes the potential effects on marine vegetation.

The effects of other past, present, and reasonably foreseeable actions on vegetation occur primarily in the coastal and nearshore waters and are associated with coastal development, maritime commerce/dredging, and the discharge of sediment and other pollutants. The Proposed Action is not expected to substantially contribute to losses of vegetation that would interfere with recovery in these regions. The incremental contribution of the Proposed Action would be insignificant as most of the proposed activities would occur in areas where seagrasses and other attached marine vegetation do not grow; effects would be localized; recovery would occur quickly; and the Proposed Action would not compound effects that have been historically significant to marine vegetation (loss of habitat due to development; nutrient loading; shading; turbidity; or changes in salinity, pH, or water temperature). Although vegetation is affected by stressors throughout the Study Area, the Proposed Action is not likely to incrementally contribute to population- or ecosystem-level changes in the resource, and it is anticipated that the incremental contribution of the Proposed Action, when added to the effects of all other past, present and reasonably foreseeable future actions, would not result in measurable additional effects on vegetation in the Study Area or beyond.

4.3.4 Invertebrates

The incremental contribution of the Proposed Action to cumulative effects would be low and would still be below applicable USEPA standards and guidelines based on the analysis presented in Section 3.4 of this EIS/OEIS and the reasons summarized below.

- Invertebrates are generally abundant and relatively short-lived. With the exception of sessile species located near areas of repeated military activities (e.g., pierside locations, established channels near large naval port facilities); few individuals would likely be affected repeatedly by the same event.

- With the exception of some species such as deep-water corals, invertebrates generally have high reproductive rates, short reproductive cycles, and resilient dispersal mechanisms; thus, local communities are likely to reestablish quickly.
- Most of the proposed activities would affect small, dispersed, deep water areas where marine invertebrates are more sparsely distributed. military activities may occur in the same general area (ranges), but do not occur at the same specific point each time and would therefore be unlikely to affect the same individual invertebrates.
- Marine invertebrates are not particularly susceptible to energy, entanglement, or ingestion stressors resulting from military activities, and none of the alternatives would result in or interact with effects that have been historically significant to marine invertebrates, such as overfishing, nutrient loading, disease, or the presence of invasive species.
- None of the alternatives would result in long-term or widespread changes in environmental conditions such as turbidity, salinity, pH, or water temperature that could affect marine habitats or interact with existing trends affecting these parameters.
- The military will not conduct certain activities within a specified distance of surveyed shallow-water coral reefs, precious coral beds, live hard bottom, artificial reefs, or shipwrecks. All features that have been identified are included in Chapter 5.

Although the aggregate effects of other non-military stressors in the ocean environment continue to have significant effects on some marine invertebrate species in the study area, particularly the effects of global climate change on corals, the Proposed Action is not likely to significantly incrementally contribute to population-level stress and decline of the resource. Due to the effects of global climate change, corals may be less resilient to additional stressors; however, it is not anticipated that direct effects to surveyed reef systems would occur. As effects would be isolated, localized, and indirect or not likely to overlap with other relevant stressors, it is anticipated that the incremental contribution of the Proposed Action, when added to the effects of all other past, present and reasonably foreseeable future actions, would not result in measurable additional effects on invertebrates in the Study Area or beyond.

4.3.5 Habitats

The incremental contribution of the Proposed Action to cumulative effects would be low and would still be below applicable USEPA standards and guidelines based on the analysis presented in Section 3.5 of this EIS/OEIS and the reasons summarized below.

Although some direct effects on habitats are expected, it is anticipated that the incremental contribution of the Proposed Action would be cumulatively insignificant for the following reasons:

- Most detonations would occur at or near the water surface and would not affect bottom habitats.
- Effects to soft bottom habitat from bottom-laid explosives would be confined to a limited area, and it is anticipated that soft bottom habitats would recover (fill in) quickly.
- Proposed Action activities are not likely to occur at the same time/place as other activities in the Study Area, including commercial fishing operations, which could potentially have a large effect on bottom habitats. Thus, it is likely that soft bottom habitats would have the opportunity to recover from the Proposed Action before effects from fishing or other operations could interact or compound additional stress to the ecosystems.
- The area of hard bottom potentially affected represents a negligible percentage in each of the range complexes (less than 0.1 percent) of the total hard bottom habitat in the Study Area.

Mitigation will be implemented to avoid or reduce potential effects from explosives, physical disturbance, and strike stressors on seafloor resources, including shallow-water coral reefs, live hard bottom, and artificial reefs, as described in Chapter 5. Potentially sensitive habitats such as artificial reefs, hard bottom, shallow water coral reefs, and shipwrecks are typically avoided. Services conducting military readiness activities are reminded of the presence of potentially sensitive areas through the PMAP program, which limits certain activities in these areas within the HCTT Study Area.

Although it is anticipated that damage to abiotic soft bottom habitat resulting from the Proposed Action would be limited and would recover, many other activities in the ocean are also affecting ocean bottom habitat. However, it is not likely that past, present, and future effects would overlap Proposed Action activities in place or time before the craters or other impressions in soft bottom substrate fill in. Likewise, hard bottom habitat would be avoided to the greatest extent possible. Based on the analysis presented in Section 3.5 and the reasons summarized above, it is anticipated that the incremental contribution of the Proposed Action, when added to the effects of all other past, present, and reasonably foreseeable future actions, would not result in measurable additional effects on habitats, including National Marine Sanctuaries, in the Study Area or beyond.

4.3.6 Fishes

The incremental contribution of the Proposed Action to cumulative effects would be low and would still be below applicable USEPA standards and guidelines based on the analysis presented in Section 3.6 of this EIS/OEIS and the reasons summarized below.

- While effects to a small number of individuals could occur as a result of military readiness activities, long-term effects on fish populations are unlikely because exposures from the majority of stressors are intermittent, transient, and unlikely to repeat over short periods.
- Military readiness activities are generally isolated from other activities in space and time and the majority of the proposed military readiness activities occur in well-known, previously established training range areas; are not generally concentrated in any one location for any extended period of time; have few stressor-producing elements; and are of a short duration.

Although it is possible that the Proposed Action could contribute incremental stressors to a small number of individuals, which would further compound effects on a given individual already experiencing stress, it is not anticipated that the Proposed Action has the potential to put additional stress on entire populations. Therefore, it is anticipated that the incremental contribution of the Proposed Action, when added to the effects of all other past, present, and reasonably foreseeable future actions, would not result in measurable additional significant effects on fishes in the Study Area or beyond.

4.3.7 Marine Mammals

In general, bycatch, vessel strikes, and entanglement are leading causes of injury and direct mortality to marine mammals throughout the region of influence, and, although mitigated to the greatest extent practicable, the Proposed Action could also result in injury and mortality to individuals of some marine mammal species from underwater explosions, vessel strikes, and potential auditory injury (i.e., permanent threshold shift) from sonar. Implementation of measures discussed in Chapter 5 would help avoid or reduce, but not absolutely eliminate, the risk for potential effects, and any incidence of injury and mortality that might occur under the Proposed Action could be additive to injury and mortality associated with other actions in the region of influence. While it is more likely that an individual of an

abundant common stock or species would be affected, there is a chance that a less abundant stock could be affected.

The incremental contribution of the Proposed Action to cumulative effects would be low and would still be below applicable USEPA standards and guidelines based on the analysis presented in Section 3.7 of this EIS/OEIS and the reasons summarized below.

- Activities emitting noise that could result in acoustic effects are widely dispersed, the sound sources are intermittent, and mitigation measures would be implemented. Safety, security, and operational considerations would preclude some military readiness activities in the immediate vicinity of other actions, reducing the likelihood of simultaneous or overlapping exposure to acoustic stressors.
- The potential for effects relating to vessels strikes is reduced through implementation of the extensive standard operating procedures and mitigation, including a large whale aggregation notification system, in which personnel must issue real-time notifications to Navy vessels of aggregations of four or more whales within 1 NM of a Navy vessel within a certain geographic area.
- The regulatory process administered by NMFS, which includes Stock Assessments for all marine mammals and a 5-year review for all ESA-listed species, provides a backstop that informs decisions on take authorizations and Biological Opinions. MMPA take authorizations require that the proposed action have no more than a negligible effects on species or stocks, and that the proposed action imposes the least practicable adverse effects on the species.
- The majority of the proposed activities are unit level training and small testing activities, which are conducted in the open ocean. Unit level events occur over a small spatial scale (one to a few square miles) and with few participants (usually one or two) or short duration (the order of a few hours or less). Additionally, military readiness activities are generally separated in space and time in such a way that it would be unlikely that any individual marine mammal would be exposed to stressors from multiple military activities within a short timeframe.
- To date, the findings from research and monitoring (U.S. Department of the Navy, 2017) and the regulatory conclusions from previous analyses by NMFS (National Marine Fisheries Service, 2015; National Oceanic and Atmospheric Administration, 2013) are that the majority of military readiness activities are not expected to have deleterious effects on the fitness of any individuals or long-term consequences to populations of marine mammals.

In summary, the aggregate effects of past, present, and other reasonably foreseeable future actions continue to have significant effects on some marine mammal species in the Study Area. The Proposed Action could contribute incremental stressors to individuals, which would further compound effects on a given individual already experiencing stress. However, with the implementation of standard operating procedures reducing the likelihood of overlap in time and space with other stressors and the implementation of mitigation measures reducing the likelihood of effects, the incremental stressors anticipated from the Proposed Action are not anticipated to be significant. Additionally, the NMFS regulatory process includes Stock Assessments and five-year reviews for all ESA-listed species, which provides a backstop that informs decisions on take authorizations and Biological Opinions. Biological Opinions for federal and non-federal actions are grounded in status reviews and conditioned to avoid jeopardy and to allow continued progress toward recovery. This process helps to ensure that, through compliance with these regulatory requirements, the military's proposed actions have the least effect possible.

4.3.8 Reptiles

The fact that all five species of sea turtles occurring in the Study Area are ESA-listed provides a clear indication that the current aggregate effects of past human activities are significant for sea turtles. Due to standard operating procedures and mitigation measures most effects associated with the Proposed Action are not anticipated to interact with or increase similar stressors experienced throughout the region of influence. The incremental contribution of the Proposed Action to cumulative effects would be below applicable USEPA standards and guidelines based on the analysis presented in Section 3.8 of this EIS/OEIS and the reasons summarized below.

- Although sea turtles could be exposed to sound and energy from explosive detonations throughout the Study Area, the estimated effects on individual sea turtles are unlikely to affect populations. Contaminants and debris discharged into the marine environment are expected to be negligible and not persistent.
- The Proposed Action would not introduce significant light sources that would disorient nesting turtles or their hatchlings.
- Most individuals are not likely to experience long-term consequences from behavioral reactions because exposures would be intermittent and spatially distributed, allowing exposed individuals to recover. Since long-term consequences for most individuals are unlikely, long-term consequences for populations are not expected.
- Due to the wide dispersion of stressors and dynamic movement of many military readiness activities, it is unlikely that a sea turtle or sea snake would remain in the potential effect range of multiple sources or sequential exercises.
- The majority of the proposed activities are unit-level training and small testing activities, which occur over a small spatial scale (one to a few square miles) and with few participants (usually one or two) or short duration (the order of a few hours or less). Likewise, military readiness activities are generally separated in space and time in such a way that it would be unlikely that any individual sea turtle or sea snake would be exposed to stressors from multiple activities within a short timeframe.
- Ongoing research and monitoring efforts have included before, during, and after-event observations and surveys, data collection through conducting long-term studies in areas of military activity, occurrence surveys over large geographic areas, biopsy of animals occurring in areas of military activity, and tagging studies where animals are exposed to military stressors. To date, the findings from the research and monitoring and the regulatory conclusions from previous analyses by NMFS (National Marine Fisheries Service, 2015; National Oceanic and Atmospheric Administration, 2013) are that the majority of effects from military readiness activities are not expected to have deleterious effects on the fitness of any individuals or long-term consequences to populations of sea turtles.

In summary, the aggregate effects of past, present, and other reasonably foreseeable future actions continue to have significant effects on all reptile species in the Study Area. The Proposed Action could contribute incremental stressors to individuals, which would further compound effects on a given individual already experiencing stress. However, with the implementation of standard operating procedures reducing the likelihood of overlap in time and space with other stressors and the implementation of mitigation measures reducing the likelihood of effects, the incremental stressors anticipated from the Proposed Action are not anticipated to be significant. Additionally, the NMFS

regulatory process, as described in 4.3.7, helps to ensure that, through compliance with regulatory requirements, the military's proposed actions have the least effect possible.

4.3.9 Birds

The incremental contribution of the Proposed Action to cumulative effects would be below applicable USEPA standards and guidelines based on the analysis presented in Section 3.9 of this EIS/OEIS and the reasons summarized below.

- The vast majority of effects are expected to be nonlethal: the most likely responses to military readiness activities are short-term behavioral or physiological, such as alert response, startle response, cessation of feeding, fleeing the immediate area, and a temporary increase in heart rate. Recovery from the effects of most stressor exposures that elicit such short-term behavioral or physiological responses would occur quickly.
- Projects in the Study Area, such as this EIS/OEIS, that affect protected species are subject to regulatory processes and permitting; as a result, agencies are able to assess the overall effects on a species resulting from various projects and address them accordingly.
- Most of the proposed activities would be widely dispersed in offshore areas where bird distribution is patchy and concentrations of individuals are often low; therefore, the potential for interactions between birds and military readiness activities is low. Likewise, for most stressors associated with the Proposed Action, effects would be short term and localized.
- It is unlikely that military readiness activities would influence nesting because most activities take place in water and away from nesting habitats on land.

Although other past, present, and reasonably foreseeable actions individually and collectively cause widespread disturbance and mortality of bird populations across the ocean landscape, the Proposed Action is not expected to substantially contribute to their diminishing abundance, induce widespread behavioral or physiological stress, or interfere with recovery from other stressors. It is anticipated that the incremental contribution of the Proposed Action, when added to the effects of all other past, present and reasonably foreseeable future actions, would not result in measurable additional effects on birds in the Study Area or beyond.

4.3.10 Cultural Resources

As discussed in Section 3.10, stressors, including explosive and physical disturbance and strike stressors, associated with the Proposed Action would not affect submerged prehistoric sites and submerged historic resources in accordance with Section 106 of the NHPA because mitigation measures have been implemented to protect and avoid these resources (Chapter 5). Furthermore, several Programmatic Agreements are in place between the Navy and State Historic Preservation Offices to address the protection and management of historic properties in specific areas of the Study Area. Further detail on these agreements can be found in Section 3.10.2.5.2 of this EIS/OEIS, as well as sections 3.10.2.5 of the 2018 HSTT EIS/OEIS and 3.10.3 of the 2022 PMSR EIS/OEIS.

The Proposed Action is not expected to result in effects on cultural resources in the Study Area and likewise would not contribute incrementally to cumulative effects on cultural resources. Therefore, further analysis of cumulative effects on cultural resources is not warranted.

4.3.11 Socioeconomic Resources and Environmental Justice

Socioeconomics. The incremental contribution of the Proposed Action to cumulative effects would be below applicable state, federal, and USEPA standards and guidelines based on the analysis presented in Section 3.11 of this EIS/OEIS and the reasons summarized below.

- Effects may occur from limits on accessibility to marine areas used by the public (e.g., for fishing and tourism); however, most limitations on accessibility are temporary and would be lifted upon completion of military readiness activities.
- The public may intermittently hear airborne noise from transiting ships or aircraft overflights if they are in the general vicinity of a training or testing activity. These occurrences would be of short duration (seconds to minutes) and infrequent, and other than transiting vessels and aircraft, most training and testing that generates airborne noise occurs farther from shore than most recreational and tourism activities.
- Most military readiness activities that pose a risk of a physical disturbance or strike (e.g., activities using munitions or military expended materials) occur farther from shore than most fishing or tourism activities. The military's standard operating procedures also require that an area is clear of non-participating vessels and aircraft before an activity using munitions or expended materials occurs.

Population-level effects on fishes, marine mammals, and invertebrates, which are the primary resources indirectly affecting socioeconomics in the Study Area, are not anticipated. No cumulative effects on commercial transportation and shipping are anticipated because commercial vessels and aircraft are primarily transiting through the Study Area along well-established navigable routes or air traffic corridors that are avoided by military vessels and aircraft conducting military readiness activities. Temporary limitations on accessibility to marine areas and the infrequent exposure to airborne noise would not result in a direct loss of income, revenue or employment, resource availability, or quality of experience. Short-term effects, should they occur, would not contribute incrementally to cumulative effects on the socioeconomic resources in the Study Area. Therefore, further analysis of cumulative effects on socioeconomic resources is not warranted.

Environmental Justice. Limited military readiness activities would be conducted within 3 NM, where most subsistence fishing would occur. Population-level effects on fishes and invertebrates, including species targeting by subsistence fishers, are not anticipated. Short-term effects, should they occur, would not contribute incrementally to cumulative effects on communities with environmental justice concerns that engage in subsistence fishing practices in the Study Area.

Based on emissions calculations in Section 3.1, limited military readiness activities conducted within 3NM nearshore of the Study Area would be below de minimis threshold levels in the San Diego Air Basin and South Coast Air Basin. The entire State of Hawaii is in attainment of the NAAQS for all criteria air pollutants. As a result, the Proposed Action would not contribute incrementally to cumulative effects on air quality in the Study Area.

As described in Section 3.1, the Proposed Action would not be enough to cause or contribute incrementally to contribute to climate change. However, in combination with past and future emissions from all other sources, military readiness activities would contribute incrementally to the global warming that produces the adverse effects of climate change. Although impacts are distributed at a global scale, communities with environmental justice concerns generally have a greater sensitivity to the effects of climate change and may lack the resources needed to adapt to changing environments.

4.3.12 Public Health and Safety

All proposed actions would be accomplished by technically qualified personnel and would be conducted in accordance with applicable military, state, and federal safety standards and requirements. The analysis presented in Section 3.12 indicates that the Proposed Action is not expected to result in effects on public health and safety and thus would not contribute incrementally to or combine with other effects on health and safety within the Study Area. Therefore, further analysis of cumulative effects on public health and safety is not warranted.

4.4 Summary of Cumulative Effects

The Proposed Action would contribute incremental effects on the ocean ecosystem, which is already experiencing and absorbing a multitude of stressors to a variety of receptors. In general, it is not anticipated that the implementation of the Proposed Action would have a meaningful contribution to the ongoing stress or cause significant collapse of any particular marine resource, but it would contribute minute effects on resources that are already experiencing various degrees of interference and degradation. The mitigation measures described in Chapter 5 will reduce the potential effects of the Proposed Action in such a way that they are avoided to the maximum extent practicable and to ensure that effects do not become cumulatively significant to any marine resource.

Marine mammals and sea turtles are the primary resources of concern for cumulative effects analysis; however, the incremental contributions of the Proposed Action are not anticipated to meaningfully contribute to the decline of these populations or affect the stabilization and recovery thereof. The military proposes to follow standard operating procedures that reduce the likelihood of overlap of military stressors in time and space with non-military stressors, and mitigation measures as described in Chapter 5 reduce the risk of direct effects of the Proposed Action to individual animals. The aggregate effects of past, present, and other reasonably foreseeable future actions (Table 4-1 and Table 4-2) have resulted in significant effects on some marine mammal and all sea turtle species in the Study Area. However, the decline of these species is chiefly attributable to other non-military stressors in the environment, including the synergistic effect of bycatch, entanglement, vessel traffic, ocean pollution, recreation and tourism, and coastal zone development. The analysis presented in this chapter and Chapter 3 indicates that the incremental contribution of the Proposed Action to cumulative effects on air quality, sediments and water quality, vegetation, invertebrates, habitats, fishes, birds, cultural resources, socioeconomic resources and environmental justice, and public health and safety would not significantly contribute to cumulative stress on those resources.

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