Reinitiation of Consultation, Offshore Wind Lease Issuance, Site Characterization, and Site Assessment: Central and Northern California

Biological Assessment
and
Essential Fish Habitat Assessment

Prepared for the National Marine Fisheries Service

in Accordance with Section 7(c) of the Endangered Species Act of 1973, and the Magnuson-Stevens Fishery Conservation and Management Act, as Amended

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List of Abbreviations and Acronyms

ADCP Acoustic Doppler Current Profiler
AIS Automatic Identification System
AMP Alternative Monitoring Plan
ASV Automated Surface Vessel
AUV Autonomous Underwater Vehicle
BA Biological Assessment
BIA Biologically important area
BMP Best Management Practice
BOEM Bureau of Ocean Energy Management
BSEE Bureau of Safety and Environmental Enforcement
CA Call Area
CH Critical habitat
CNP Central North Pacific
COLOS Coastal Buoy and Coastal Oceanographic Line-of-Sight
CPT Cone penetration test
DOI Department of the Interior
DPS Distinct Population Segment
EFH Essential fish habitat
EFHA Essential Fish Habitat Assessment
ENP Eastern North Pacific
ESA Endangered Species Act
ESU Evolutionarily Separate Unit
ETRS Engineering Technical Review Section
FLiDAR Floating light detection and ranging
FMP Fishery Management Plan
FOSS Floating offshore substation
GPS Global Positioning
HAPC Habitat areas of particular concern
HOV Human Operated Vehicle
HRG High-resolution geophysical
IAC Inter array cable
IPF Impact producing factor
IWC International Whaling Commission
LiDAR Light detection and ranging
LLS Lateral line system
MISLE Marine Information for Safety and Law Enforcement
MMC Marine Mammal Commission
MMPA Marine Mammal Protection Act
MMS Minerals Management Service
MSFCMA Magnuson-Stevens Fishery Conservation and Management Act
NEPA National Environmental Policy Act
NMFS National Marine Fisheries Service
NOAA National Oceanic and Atmospheric Administration
NOMAD Naval Oceanographic and Meteorological Automated Devices

NWFSC Northwest Fisheries Science Center
OCSLA Outer Continental Shelf Lands Act
P.L. Public Law
PCFG Pacific Coast Feeding Group
PDC Project Design Criteria
PFMC Pacific Fishery Management Council
PNNL Pacific Northwest National Lab
PSO Protected Species Observer
PTS Permanent Threshold Shift
RFI Request for Information
ROV Remotely Operated Vehicle
ROW Rights of way
RUE Rights of use and easements
SAP Site Assessment Plan
SCBD Secretariat of the Convention on Biological Diversity
SCPA Southern California Planning Area
SOC Standard operating conditions
SPI Sediment profiling imagers
TOPP Tagging of Pacific Pelagics
TTS Temporary Threshold Shift
UME Unusual mortality event
USV Uncrewed Surface Vessel
UTP Underwater Transponder Positioning
WEA Wind Energy Area
WTG Wind turbine generator

1. Part I: Proposed Action

Summary

The Bureau of Ocean Energy Management (BOEM) is proposing to issue up to five (5) leases within the Morro Bay and Humboldt Wind Energy Areas (WEAs)—two leases in Humboldt WEA and three in Morro Bay WEA—and grant rights of way (ROWs) and rights of use and easements (RUEs) in support of wind energy development offshore Central and Northern California.

BOEM anticipates that site characterization will employ high-resolution geophysical (HRG) surveys that would be conducted using the following equipment: swath bathymetry system, magnetometer/gradiometer, side-scan sonar, and shallow and medium (seismic) sub-bottom profiler systems. This equipment does not come in contact with the seafloor and is typically towed from a moving survey vessel that does not require anchoring.

Geotechnical testing or sampling involves seafloor disturbing activities. Geotechnical investigation may include the use of gravity cores, piston cores, vibracores, deep borings, and cone penetration tests (CPT), among others. Site characterization will inform site assessment plans (SAPs) which are required to deploy and decommission metocean buoys.

The proposed Federal action includes project design criteria (PDC) and best management practices (BMPs) for any activities that BOEM has concluded in this BA to have a potentially adverse effect on protected species. BOEM derived these BMPs based on relevant experience on the Pacific OCS, as well as through coordination with NMFS Greater Atlantic Regional Office on SAPs submitted to BOEM for the Atlantic OCS. BOEM will implement BMPs through issuance of leases and review of proposed plans through standard operating conditions (SOCs).

In Part II of this document, the Biological Assessment (BA) is focused on federally listed threatened and endangered species listed under Endangered Species Act (ESA) that may occur in the project area and potential effects from the proposed site characterization surveys and site assessment activities in and around the Humboldt and Morro Bay WEAs. National Marine Fisheries Services (NMFS) Office of Protected Resources in Long Beach, CA provided technical input on the species list presented in this biological assessment.

Part III of this document contains an Essential Fish Habitat Assessment (EFHA) for all federal fishery management plans under the Pacific Fishery Management Council. This BA and EFHA are consistent with the revised Guidance for Combining EFH Consultations with ESA Section 7 Consultations (Guidance) within NMFS Policy Directive 03-201-05. Accordingly, pursuant to 50 CFR § 920(f)(3), NMFS finds that BOEM Regions 8, 9, 10, and 12, formerly known as the Pacific Region, procedures for ESA consultations can be used to satisfy the EFH consultation requirements of section 305(b)(2) and 305(b)(4) of the Magnuson-Stevens Fishery Conservation and Management Act (Rumsey 2022).

The primary impact-producing activities associated with the Proposed Action include geophysical and geotechnical surveys and deployment and decommissioning of metocean buoys. For ESA-listed species, the potential impact producing factors (IPFs) associated with the Proposed Action are noise from geophysical and geotechnical surveys and vessel noise, vessel collisions, entanglement, chemical and toxic pollution, bottom disturbance from geotechnical sampling, and marine debris. For Essential Fish Habitat, the potential IPFs associated with the Proposed Action are noise from geophysical and geotechnical surveys and marine vessel engines, and bottom disturbance from geotechnical sampling.

The analysis of potential impacts associated with the Proposed Action indicate that site characterization surveys and site assessment activities associated with offshore wind energy leases may affect, but are not likely to adversely affect, ESA-listed species and critical habitat.

Purpose

Under Section 7(c) of the ESA, as amended, federal agencies are required to ensure actions they authorize do not jeopardize the existence of any species listed under the ESA. The purpose of this Biological Assessment (BA) is to evaluate the effects survey and data collection activities associated with offshore renewable energy leasing may have on ESA-listed species of whales, pinnipeds, sea turtles, fishes, invertebrates, and their critical habitats. This analysis anticipates activities will occur in and around the two BOEM designated Wind Energy Areas (WEAs) offshore California, the Humboldt WEA and the Morro Bay WEA, including potential cable and transit routes. The Proposed Action is to conduct data collection activities in support of renewable energy development on the OCS. The need for the Proposed Action is to use the information obtained through data collection activities to make informed business and engineering decisions regarding the development of renewable energy projects. These activities are collectively referred to as site characterization and site assessment activities.

The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) (16 U.S.C. 1801 et seq.) require the identification of essential fish habitat (EFH) for federally managed fish species and the implementation of measures to conserve and enhance such habitat. In addition, the MSFCMA requires federal agencies that are undertaking activities to consult with the National Marine Fisheries Service (NMFS) if those activities may adversely affect EFH (MSFCMA section 305). The EFH regulations at 50 C.F.R. 600.920(f) encourage EFH consultations under the MSA to be consolidated or combined with existing environmental review procedures to satisfy the EFH consultation requirements, provided that NOAA has made a finding that such review procedures can be used for EFH compliance. On April 27, 2022, NMFS communicated to BOEM via email that it made such a finding.

This assessment document describes the Proposed Action, identifies those threatened and endangered species and essential fish habitat most likely to be affected by the action, identifies potential IPFs, and analyzes potential effects, including cumulative effects. We certify that we used the best scientific and commercial data available to obtain the information included in this BA.

Background

The Energy Policy Act (EPAct) of 2005, Public Law (P.L.). 109-58, added Section 8(p)(1)(C) to the Outer Continental Shelf Lands Act (OCSLA), which grants the Secretary the authority to issue leases, easements, or rights-of-way on the OCS for the purpose of renewable energy development (43 U.S.C. § 1337(p)(1)(C)). DOI announced the final regulations for the OCS Renewable Energy Program in April 2009, which was authorized by the EPAct. The OCSLA, as amended, mandates the Secretary of the Interior (Secretary), through BOEM, to manage the siting and development of OCS of renewable energy facilities. BOEM is delegated the responsibility for overseeing offshore renewable energy development in Federal waters (30 C.F.R. 585). Through these regulations, BOEM oversees responsible offshore renewable energy development.

BOEM does not consider the issuance of a lease to constitute an irreversible and irretrievable commitment of agency resources toward the authorization of a commercial wind power facility. This is primarily because the issuance of a lease only grants the lessee the exclusive right to use the leasehold to: (1) gather resource and site characterization information, (2) develop its plans, and (3) subsequently seek BOEM approval of its plans for the development of the leasehold.[1] The purpose of conducting the surveys and installing meteorological measurement devices is to assess the wind resources in the proposed lease area and to characterize the environmental and socioeconomic resources and conditions. A lessee collects this information to determine whether the site is suitable for commercial development and inform its plan submittals. Additional analyses under the National Environmental Policy Act (NEPA) and

[1] See the proposed renewable energy commercial lease form at 76 FR 55090.

consultation under the Endangered Species Act (ESA) would be required before BOEM makes any decisions made regarding construction of wind energy facilities on its leases.

Description of the Proposed Action

The Proposed Action (Action) is the issuance of up to three commercial leases within the Morro Bay WEA and up to two commercial leases within the Humboldt WEA (up to five leases total) and granting of rights of way (ROWs) and rights of use and easements (RUEs) in support of wind energy development. The Proposed Action also considers the execution of associated **site characterization** and **site assessment** activities on these leases or grants.

Site characterization typically includes geophysical and geotechnical surveys and collection of seafloor samples, and biological surveys conducted from a vessel. **Site assessment** Site assessment involves data collection on wind, typically through temporary placement of meteorological and oceanographic buoys (i.e., metocean or met buoys) within a lease area.

The following sections further describe assumptions about, and scenarios of, reasonably foreseeable site characterization and site assessment activities based on regulations, relevant experience on the Pacific OCS, and SAPs submitted to BOEM for the Atlantic OCS.

Description of the Action Area

The Action Area includes coastal and OCS waters from Astoria, Oregon south to Port Hueneme, California (Figure 1). This incorporates possible transit routes from larger ports to the Humboldt and Morro Bay WEAs. The boundary of the Humboldt WEA begins 34 kilometers (km, 21 miles (mi)) offshore the city of Eureka, measures 45 km (28 mi) north to south and 23 km (14 mi) east to west, totaling approximately 132,368 acres (ac) (206 mi^2). Water depths across the WEA range from approximately 500 to 1,100 meters ((m) 1,640–3,609 ft) (Figure 1). The Morro Bay WEA is approximately 240,898 ac (376 mi^2) and located approximately 20 mi from shore. Water depths across the WEA range from approximately 900 to 1,300 m (2,953–4,265 ft) (Figure 1).

Site characterization activities are anticipated to occur within the lease areas and along corridors that extend from the lease areas to the onshore energy grid. It is assumed that ROW/RUE routes would consist of a minimum 300-meter-wide corridor centered on any anticipated cable locations. While BOEM is uncertain of the exact location of cable corridor surveys, BOEM can anticipate their geographic extent. Power generated from potential Humboldt and Morro Bay lease areas would need to be transmitted directly to shore by individual export cables to onshore cable landings. BOEM assumes that cable site characterization activities would occur within discrete corridors between the Humboldt and Morro Bay leases and shore (Figure 1). BOEM does not have regulatory authority to approve any activities in state waters and onshore areas or apply mitigation measures outside of the OCS.

Figure 1. Map of the consultation Action Area which extends north and south of areas leased in 2022 (black striped polygons) in the Humboldt WEA offshore Eureka and the Morro Bay WEA to the south.

Vessel Traffic Assumptions

This BA assumes vessel traffic from 2017 is a reasonable level of activity for analysis. Traffic patterns based on 2017 Automatic Identification System (AIS) data are more concentrated further to sea and closer to shore than in the Humboldt and Morro Bay WEAs (Figure 2). Tug and tow vessels do traverse the Morro Bay and Humboldt WEAs; however, they are concentrated in the nearshore tow lane and further offshore. Cargo ships also traverse the WEAs, but use is concentrated further offshore. Tankers did not traverse the WEAs in 2017.

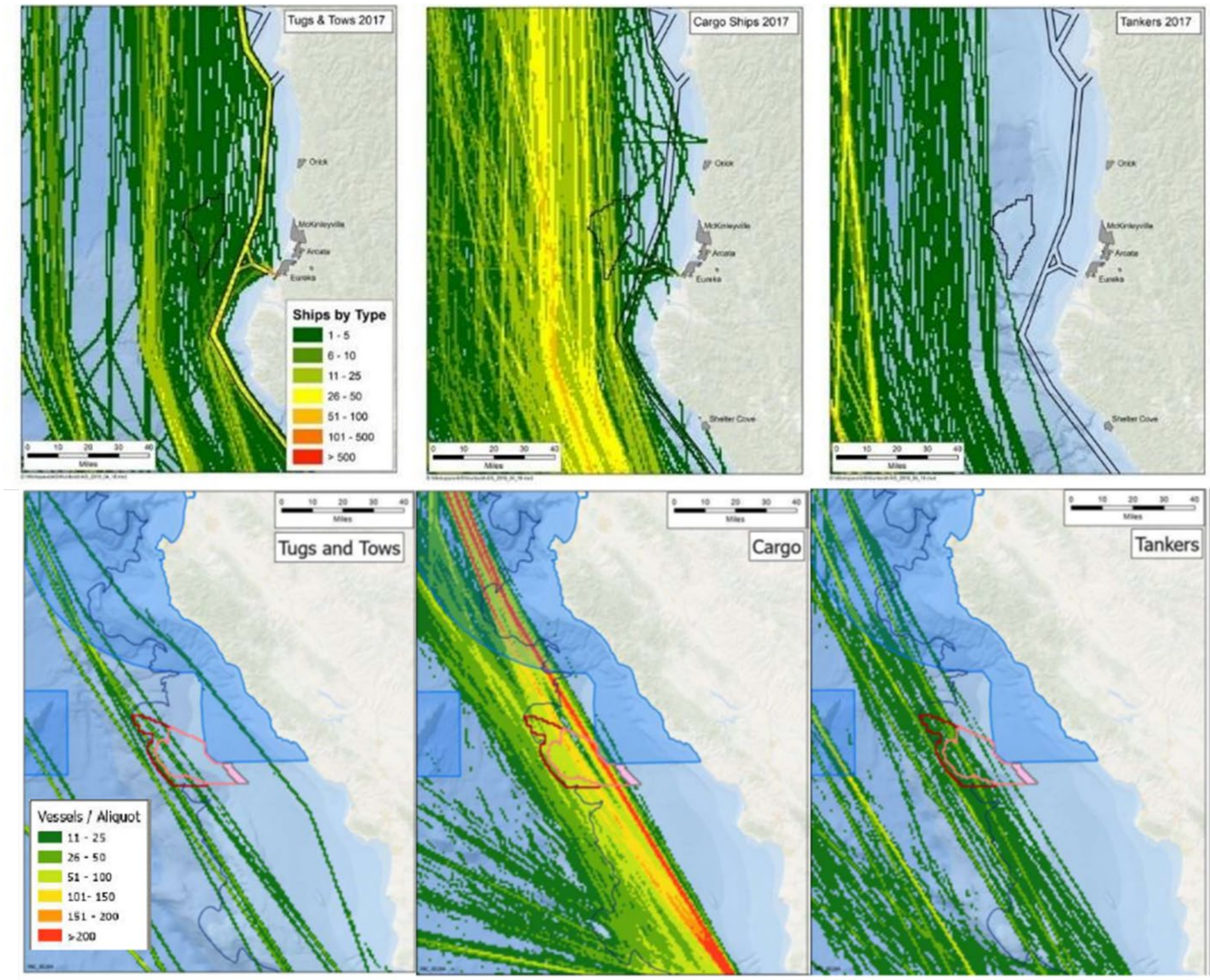

Figure 2. AIS-derived vessel traffic from 2017 for tugs and tows, cargo, and tankers in and near the Humboldt (top panels) and Morro Bay (bottom panels) Wind Energy Areas

Site Characterization Activities and Assumptions

Site characterization activities involve geological, geotechnical, and geophysical surveys and sampling of the seafloor, and biological surveys of marine habitats and animals. Surveys can be conducted before and after metocean buoy deployment to collect data for a Construction and Operation Plan (COP; 30 CFR 585.626).

Lessees would conduct HRG surveys and geotechnical sampling within lease areas and ROW/RUE routes (i.e., the corridors from WEAs to the onshore energy grid; potential cable easement routes) during the 5-year site assessment term. It is assumed that the ROW/RUE routes would consist of a minimum 300-meter-wide corridor centered on anticipated cable locations. Because any ROW or RUE grants considered as part of this undertaking have not been issued, BOEM is uncertain of the locations of cable corridor surveys.

Geophysical Information: High-Resolution Geophysical (HRG) Surveys

BOEM anticipates that site characterization will use high-resolution geophysical (HRG) surveys to chart bathymetry, archaeological resources, and benthic zone hazards (following BOEM's guidelines for geophysical data requirements: 30 CFR 585.610(b)(2) and 30 CFR 585.610(b)(3)). HRG surveys can inform site selection for geotechnical sampling and whether hazards will interfere with seabed support of the turbines.

HRG surveys use electrically-induced sonar transducers to emit and record acoustic pulses, and do not use air or water compression to generate sound. HRG sonar equipment may include swath bathymetry systems, magnetometers or gradiometers (two or more magnetometers to measure a gradient), side-scan sonar, shallow and medium (seismic) sub-bottom profiler systems, and multibeam echosounders from a vessel (Table 1). This equipment does not contact the seafloor. It may be towed from a moving survey vessel that does not require anchoring or onboard unmanned vehicles—Remotely Operated Vehicle (ROV), Autonomous Underwater Vehicle (AUV), and Human Operated Vehicle (HOV) types and may be used in conjunction with UTP technology. The equipment may be deployed and retrieved over the side or back of a vessel, or through a moon pool.

Better technologies may become available. If new technology is proposed by lessees for site characterization, and if the potential impacts from this new technology are similar or less than those analyzed for the equipment described in this document, lessees may use this technology without BOEM reinitiating consultation.

The line spacing for HRG surveys varies depending on the data purpose. To collect geophysical data for shallow hazards assessments (including multibeam echosounder, side-scan sonar, and sub-bottom profiler systems), BOEM recommends surveying at a 150-m (492-ft) primary line spacing and a 500-m (1,640-ft) tie-lines spacing over the proposed lease area and potential cable corridors. For the collection of geophysical data for archaeological resources assessments (including magnetometer, multibeam echosounder, side-scan sonar, and sub-bottom profiler systems), BOEM recommends surveying at a 30-m (98-ft) primary line spacing and a 500-m (1640-ft) tie-line spacing over potential pre-contact archaeological sites once part of the terrestrial landscape and since inundated by global sea level rise during the Pleistocene and Holocene, generally thought to be in waters less than 100 m depth, which is typically in cable landing areas.

Table 1. Proposed site characterization surveys

Survey Type	Survey Equipment and/or Method	Resource Surveyed or Information Used to Inform
High-resolution geophysical surveys	Side-scan sonar, sub-bottom profiler, magnetometer, multi-beam echosounder	Shallow hazards[1], archaeological[2], bathymetric charting, benthic habitat
Geotechnical/sub-bottom sampling[3]	Vibracores; piston; gravity cores; cone penetration tests	Geological[4]
Biological[5]	Grab sampling; towed camera sled; underwater imagery/ sediment profile imaging; Remotely Operated Vehicle (ROV); Autonomous Underwater Vehicle (AUV)	Benthic habitats
Biological[5]	Aerial digital imaging; visual observation from boat or airplane; radar; thermal and acoustic monitoring	Avian
Biological[5]	Ultrasonic detectors installed on buoy and survey vessels used for other surveys, radar, thermal monitoring	Bats
Biological[5]	Aerial and/or vessel-based surveys and passive acoustic monitoring	Marine mammals and sea turtles
Biological[5]	Direct underwater imagery; acoustic monitoring; genomics/environmental DNA	Fishes and some invertebrates

[1] 30 CFR § 585.610(b)(2); [2] 30 CFR § 585.610(b)(3); [3] 30 CFR § 585.610(b)(1); [4] 30 CFR § 585.610(b)(4); [5] 30 CFR § 585.610(b)(5)

Methods for HRG data collection

Several survey methods can be used to collect high resolution geophysical data. Typically, these methods are based on the water depth of the survey area. However, restrictions on available equipment may affect which survey methods are chosen. The following is a description of each of the possible decisions for these survey methods:

1. Autonomous Underwater Vehicle (AUV) survey. AUV surveys consist of an autonomous (non-tethered) submersible with its own power supply and basic navigation logic. An AUV can run many geophysical sensors at once and typically would consist of a multibeam echosounder, side-scan sonar, magnetometer, and a sub-bottom profiler. AUVs also have forward looking sonar for terrain avoidance, a doppler velocity logger for velocity information, an internal navigation system for positioning, an ultra-short baseline (USBL) pinger for positioning, and an acoustic modem for communication with a surface survey vessel. For single AUV operations, the surface survey vessel follows the AUV, keeps in communication via the acoustic modem, provides navigation information to the AUV, and monitors the operational status of the AUV. During multiple AUV surveys, several AUVs may be deployed at once. These AUVs run independently from the survey vessel. Navigation updates and modem communication are provided by a network of Underwater Transponder Positioning devices (UTPs). These transponders are deployed to the seabed in known locations that have been cleared for sensitive habitats. In both methods of operation, the survey vessel launches, maintains, and recovers the AUVs and UTPs (see also BOEM's EA for Oregon, Appendix F, BOEM 2024). A survey vessel may deploy AUVs and UTPs through a moon pool, which is a large opening through the hull from the deck and to the bottom of a vessel for lowering tools and instruments into the sea. The exact location, number deployed, and dimensions of UTPs/USBLs will be known once a lessee submits a survey plan.

2. Shallow multi-instrument towed surveys. Towed surveys typically happen in shallower waters. A survey vessel may tow side-scan sonar, magnetometers, or gradiometers with winches to provide altitude adjustments. In addition, passive acoustic monitoring and, if needed, medium penetration seismic (low powered sparkers, boomers, bubble guns) can be towed from hardpoints (e.g., cleats) on the vessel. The survey vessel usually has hull mounted multibeam echosounders, a sub-bottom profiler, and an ultra-short baseline system.
3. Deep-tow survey. Deep-tow surveys use towed methodology in deep waters (these survey types are rare). The vessel uses a large winch with thousands of meters of cable to tow the survey instruments at depth. The survey instruments usually consist of a large weight (depressor) followed by a side-scan, sub-bottom, and potentially a multibeam sonar mounted in a survey vehicle (no seismic devices will be used). In deep waters the survey vehicle might be 8–10 km behind the survey vessel, sometimes requiring the use of a chase vessel to provide ultra-short baseline navigation for the survey vehicle. Vessels maintain speeds of 4.5 knots or slower when towing equipment.
4. Uncrewed Surface Vessel survey. Uncrewed Surface Vessels (USV) or also known as Automated Surface Vessel (ASV) are remote controlled vessels that are controlled by operators on shore or from another vessel. USVs can be simple with a single instrument, designed for shallow waters, and controlled by an operator that maintains visual contact with the USV. USVs can also be larger, the size of a small survey vessel, are operated over the horizon, could tow instruments, and use radar and cameras to operate safely and monitor for protected species. USVs can be electrically powered with batteries, sail/solar powered, and/or use diesel motors and generators.

Geotechnical Surveys and Sampling

Geotechnical surveys measure the physical properties of shallow sediments through samples of the seafloor (30 CFR 585.610(b)(1), 30 CFR 585.610(b)(4)). These measurements can indicate the suitability of shallow foundation soils to support anchoring systems or transmission cable under operational and environmental conditions (including extreme events). Thus, the results inform the design of anchor systems and foundations, the armor level of export cables, and cable burial methods. The lease area and potential cable corridors will be surveyed and sampled. The exact locations for sampling will be known once a lessee submits a survey plan (see Collection of Geotechnical and Geophysical Assumptions below).

Seafloor samples for geotechnical evaluation are collected by direct sampling of the substrate or in-situ measurements of sediments. Direct sampling usually employs a grab sampler or corer off a survey vessel to retrieve a sediment sample from the seabed and return it to the deck of the vessel for further analysis. In-situ methods use a probe, that is pushed, or dropped into the seabed, and can record various properties of the sediment. Typical sampling sites include proposed anchor sites, cable touchdown points, regular intervals along proposed cable routes, and selected sites for slope stability studies. Data from HRG surveys are used to avoid archeological, geological, and benthic hazards in selection of sampling sites.

Geotechnical investigation may include the use of gravity cores, piston cores, vibracores, deep borings, and cone penetration tests (CPT), among others.

Deployments for geotechnical sampling typically use vessels with dynamic positioning capability which do not have seafloor anchoring impacts. Vessel anchoring is unlikely in deep waters. However, if a vessel needs to anchor, an anchoring plan must be submitted.

The Proposed Action does not include cable installation or connection to shore-based facilities, or consideration of commercial-scale wind energy facilities. Should a lessee propose to construct and operate a commercial-scale wind energy facility within their Humboldt or Morro Bay lease area, they would submit a Construction and Operations Plan (COP) to BOEM. Consideration of construction and operation of a wind facilities is a separate federal action under the National Environmental Policy Act and BOEM would consider under a separate consultation.

Surveying and Sampling Assumptions

- Lessees would perform high-resolution geophysical (HRG) surveys, which do not include the use of air guns.
- Survey vessels would travel at a speed of 4.5 knots during survey or sampling work
- Survey vessels would be sourced from within the California Current region

Collection of Geotechnical/Sub-bottom Information Assumptions

Site characterization activities include geotechnical surveys such as cone penetrometer testing, boring, vibracoring, and other geotechnical exploration methods such as grab samples and benthic videography with ROVs. Geotechnical surveys generally do use active acoustic sources and may have some low-level ancillary sounds associated with them. The G&G Final Programmatic EIS (BOEM 2014), which is hereby incorporated by reference, provides an overview of the geotechnical sampling techniques and devices such as bottom-sampling devices, vibracores, deep borings, and cone penetration tests (CPTs). Additional details describing methods common in geophysical and geotechnical investigations are found in Fugro Marine GeoServices Inc. (2017) and is incorporated here by reference. Geotechnical surveys are used to determine whether the seabed can support wind turbine generators and transmission cables, as well as to document the sediment characteristics necessary for design and installation techniques for all structures and cables. The information obtained from these samplings is used to inform future phases of lease development. The information from the G&G Final PEIS is summarized below.

Samples for geotechnical evaluation are collected using shallow-bottom coring and surface sediment sampling devices taken from a small marine drilling vessel. The methods to obtain samples to analyze physical and chemical properties of surface sediments are described in Table 2. CPTs and bore sampling are often used together because they provide different data on sediment characteristics. A CPT provides a fairly precise stratigraphy of the sampled interval, plus other geotechnical data, but does not allow for capture of an undisturbed soil sample. Bore holes can provide undisturbed samples but are most effectively used in conjunction with CPT-based stratigraphy so that sample depths can be pre-determined. A CPT is suitable for use in clay, silt, sand, and granule-sized sediments as well as some consolidated sediment and colluvium. Bore sampling methods can be used in any sediment type and in bedrock. Vibracores are suitable for extracting continuous sediment samples from unconsolidated sand, silt, and clay-sized sediment up to 33 ft (10 m) below the seafloor.

On May 10, 2024, the BOEM Pacific Regional Office issued a Request for Information (RFI) about planned site assessment activities to the five California lessees. The RFI asked lessees to provide the most conservative estimates of planned seafloor related sampling surveys (e.g., assume the maximum number of samples and maximum associated bottom disturbance to account for variations in equipment, seafloor conditions, wind turbine generator (WTG) layout, and floating offshore substation (FOSS) layout). Three of the five California lessees provided new information on their anticipated number of samples, sampling methods, and extent of potential bottom disturbance for each method to be employed. Some reported a greater number of samples than the original amount considered in the 2022 ESA EFH consultation for both geotechnical and benthic habitat surveys.

In response to the lessee-submitted information, the BOEM Pacific Regional Office Engineering Technical Review Section (ETRS) calculated a best estimate for total geotechnical and benthic habitat sampling efforts necessary to support required submissions of Construction and Operations Plans, Facility Design Reports, and Fabrication and Installation Reports. ETRS utilized the lessee information, new technical information on floating wind (Cooperman et al. unpublished; 2024), and existing guidelines (BOEM 2019; BOEM 2024) to develop a scenario and estimate the area of benthic disturbance that could result from surveys. ETRS made assumptions summarized in Table 2 and used the average bottom disturbance of each sample type from information submitted by three of the five lessees. The ETRS estimates were within range when compared to lessee-provided estimates.

The types of geotechnical sampling and the estimated diameter of direct disturbance and indirect sedimentation remain similar to the 2022 ESA EFH consultation. Geotechnical sampling consists of larger boring devices using a drill ship at WTG/FOSS anchor locations. Deep borings place a frame on the seabed and use water-based drilling mud; each boring location has an estimated disturbance of 25 m^2. CPTs, piston cores, and gravity cores are also used to understand sediment structure and stability at anchor locations down to 30 m below the seafloor. For these geotechnical sampling methods, ETRS estimated a disturbance diameter of 5 m^2, which was the average disturbance submitted by the lessees.

The types of benthic sampling and the estimated diameter of direct disturbance and indirect sedimentation remain similar to the 2022 ESA EFH consultation. Grab samples, box cores, or sediment profiling imagers (SPI) will likely be used for benthic habitat sampling. Grab samples and box cores have a similar bottom disturbance of around 0.5 m^2, which was used in the ETRS scenario. SPIs are cameras that insert into the substrate and take an image of the vertical profile of the material. While an individual push of the camera might have a small seabed disturbance, a lessee informed ETRS that typically four profiles are attempted at each sampling site. ETRS used 4 m^2 as the bottom disturbance for the SPI, as it would include the four profiles taken during a single station's occupation. In addition, the RFI responses indicate that the lessees will attempt to use the SPI on most of the sampling stations, with a split of about 70% SPI and 30% grab samples/box cores.

Table 2. ETRS assumptions of sample density for geotechnical and benthic habitat surveys.

Survey type	Lease area	Inter array cables (IAC)	Export cables
Geotechnical	1 boring at each WTG/FOSS mooring point (3 mooring points per WTG/FOSS)	3 geotechnical stations with either CPT or piston core along each IAC assuming all touch the seafloor	1 CPT or piston core each km down export cable route, 5 cables per export cable easement and 5 total routes sampled.
Benthic habitat	1 station for every 1 km^2 of lease area. Stations to be sampled eight times over two years; and Estimated 70% SPI, 30% grab sample/box core	NA	1 station for every 1 km of corridor length. Stations to be sampled eight times over two years. Estimated 70% SPI, 30% grab sample/box core

CPT = cone penetration test; FOSS = floating offshore substation; SPI = sediment profiling imagers; WTG = wind turbine generator

- **Potential Export Cable Pathway Sampling**

Most geotechnical and benthic sampling will occur within the five leases. Sampling outside the lease areas will occur to assess potential export cable pathways (Table 2). Total export cable lengths of approximately 318 km and 86 km were estimated for three lease areas near Morro Bay and two lease areas near Humboldt, respectively. These lengths include an extra 25% for potential hazard avoidance. One export cable route was estimated for each lease equaling 5 total. The exact length of inter array cables (IAC) is unknown so assumed to be all cables with three geotechnical sampling locations per cable (Table 2). Additional benthic sampling, at low levels, will likely occur outside of lease areas and export cable pathways as needed. Additional geotechnical sampling outside of lease and cable areas is much less likely but could occur. At this time, the number of samples and methods employed to collect samples in state waters for onshore cable landing are unknown, and thus these activities are not included in this analysis.

ETRS estimated that a total of approximately 638 WTGs and FOSSs may be proposed in the California lease areas (Cooperman et al. 2024). To support these facilities, an estimated total of 1,914 borings, 1,924

IAC samples, and 2,020 export cable samples may be necessary. Since this is an estimate, rounded numbers (to the nearest hundred) were used.

ETRS estimated that benthic habitat surveys may be conducted at about 1,900 sites and may necessitate up to 14,900 samples, with estimates rounded to the nearest 100 samples. When compared to the scenario estimates, ETRS finds that lessee calculations are reasonable. ETRS provides a worse-case scenario (i.e., maximum disturbance area) based on BOEM guidance for the Atlantic Ocean (BOEM 2014) and lease holder's responses. The total ETRS estimates for both the number of samples and bottom disturbance are greater than the total provided by the lessees.

The maximum total bottom disturbance for all survey activities is revised from 3,775 m^2 to an estimated 103,300 m^2 (Table 3: 68,000 m^2 geotechnical and Table 4: 35,300 m^2 benthic disturbance areas), which represents approximately 0.007% of the total area (1,511 km^2) of the five renewable energy leases and potential cable export pathways.

Table 3. Estimated total number of geotechnical sampling sites, area of bottom disturbance (m^2), and percentage of area disturbed for the Humboldt and Morro Bay lease areas.

Lease Areas	Geotechnical Sites	Geotechnical Bottom Disturbance (m^2)	% Bottom Disturbance
Morro Bay (3 leases)	4,000	46,000	0.005
Humboldt Bay (2 leases)	1,800	22,000	0.004
Total	5,800	68,000	0.005

Table 4. Estimated total number of benthic habitat sampling sites, area of bottom disturbance (m^2), and percentage of lease area disturbed for the Humboldt and Morro Bay lease areas.

Lease areas	Benthic habitat sampling sites	Benthic habitat bottom disturbance (m^2)	% Bottom Disturbance
Morro Bay (3 leases)	10,100	23,000	0.002
Humboldt (2 leases)	4,800	12,300	0.002
Total	14,900	35,300	0.002

Collection of Geophysical Information Assumptions

HRG surveys would be performed to obtain geophysical hazards information, including information to determine siting for geotechnical sampling, whether hazards will impact seabed support of the turbines, information pertaining to the presence or absence of archaeological and habitat resources, and to conduct bathymetric charting.

Assuming the lessee follows BOEM's guidelines to meet the geophysical data requirements at 30 CFR §§ 585.610–611, BOEM anticipates that the surveys would be undertaken using the equipment to collect the required data as described in Table 5. Vessel traffic assumptions for site characterization are shown in Table 6. Equivalent technologies to those shown in these tables may be used if their potential impacts are similar to those analyzed for the equipment described in the BA and are approved by BOEM prior to conducting surveys.

The line spacing for HRG surveys would vary depending on the data collection requirements of the different HRG survey types:

- For the collection of geophysical data for shallow hazards assessments (including magnetometer, side-scan sonar, and sub-bottom profiler systems), BOEM recommends surveying at a 150-m (492-ft) line spacing over the proposed lease area;
- For the collection of geophysical data for archaeological resources assessments, the lessee would likely use survey methods at a line spacing appropriate for the range of depths expected in the survey area, as long as the sonar system is capable of resolving small, discrete targets 0.5 m (20 inches) in length at maximum range; and

- For bathymetric charting, the lessee would likely use a multi-beam echosounder at a line spacing appropriate to the range of depths expected in the survey area.

Table 5. HRG survey equipment: types of geophysical sensors expected for use in the Action Area.

Equipment Type	Data Collection and/or Survey Types	Description of the Equipment
Bathymetry/depth sounder (multibeam echosounder)	Collection of geophysical data for shallow hazards, archaeological resources, benthic habitats, and bathymetric charting	A depth sounder is a microprocessor-controlled, high-resolution survey-grade system that measures precise water depths in both digital and graphic formats. The system would be used in such a manner as to record with a sweep appropriate to the range of water depths expected in the survey area. This EA assumes the use of multibeam bathymetry systems, which may be more appropriate than other tools for characterizing those lease areas containing complex bathymetric features or sensitive benthic habitats such as hardbottom areas.
Magnetometer	Collection of geophysical data for shallow hazards and archaeological resources assessments	Magnetometer surveys would be used to detect and aid in the identification of ferrous or other objects having a distinct magnetic signature. The magnetometer sensor is typically towed as near as possible to the seafloor and anticipated to be no more than approximately 6 m (20 ft) above the seafloor. This methodology will not be used in the Proposed Action, since lease-area depths are 500 m or greater, but will be used to survey potential cable routes that will occur in depths shallower than 500 m.
Side-scan sonar	Collection of geophysical data for shallow hazards and archaeological resource assessments	This survey technique is used to evaluate surface sediments, seafloor morphology, and potential surface obstructions (MMS 2007). A typical side-scan sonar system consists of a top-side processor, tow cable, and towfish with transducers (or "pingers") located on the sides which generate and record the returning sound that travels through the water column at a known speed. BOEM assumes that the lessee would use a digital dual-frequency side-scan sonar system with 300–500 kHz frequency ranges or greater to record continuous planimetric images of the seafloor.
Shallow and medium penetration sub-bottom profilers	Collection of geophysical data for shallow hazards and archaeological resource assessments and to characterize subsurface sediments	Typically, a high-resolution CHIRP System sub-bottom profiler is used to generate a profile view below the bottom of the seabed, which is interpreted to develop a geologic cross-section of subsurface sediment conditions under the track line surveyed. Another type of sub-bottom profiler that may be employed is a medium penetration system such as a boomer, bubble pulser or impulse-type system. Sub-bottom profilers are capable of penetrating sediment depth ranges of 3 m (10 ft) to greater than 100 m (328 ft), depending on frequency and bottom composition.

CHIRP = Compressed High Intensity Radar Pulse kHz = kilohertz

Vessel Trips for Site Characterization

Table 6. Projected maximum vessel trips in the Action Area for site characterization for (a) days at sea (DAS) and port round trips for geophysical (HRG) surveys and geotechnical sampling, and (b) day trips for biological resources. Per-lease trips were multiplied by 2 to represent estimates for two Humboldt leases, by 3 to represent three Morro Bay leases, and by 5 to provide an estimated upper limit across all leases (although vessel numbers are unlikely to scale with number of leases). Avian surveys are likely to be conducted on the same vessel trips as mammal and turtle surveys, but these surveys are counted separately here.

(a) number DAS and round trips to port for HRG surveys and geotechnical sampling

HRG Surveys and Geotechnical Sampling	1 Lease	2 Leases	3 Leases	5 Leases
# Days at Sea (DAS), assuming 2 yrs of operations per lease	730	1,460	2,190	3,650
# Round trips to ports, estimated for 2 years of operations per lease	50	100	150	250

(b) number of day trips for biological resources surveys

Biological Resource Surveys (usually 10-hr trips)	1 Lease	2 Leases (using upper estimate)	3 Leases (using upper estimate)	5 Leases (using upper estimate)
Avian surveys	30–60	120	180	300
Marine mammals, sea turtles	30–60	120	180	300
Fish surveys	8–370	740	1,110	1,850
Total Estimated # Trips	68–490	980	1,470	2,450

Site Assessment Activities and Assumptions

Site assessment involves the deployment and decommissioning of metocean buoys, which will be permitted by the USACE under the Nationwide Permit 5. Lessees have up to 5 years to perform site assessment activities before they must submit a COP (30 CFR 585.235(a)(2)).

Up to 6 metocean buoys may be placed in each lease area. Assumptions for estimates of benthic disturbance from metocean buoy anchors are derived from data from PNNL's 2019 LiDAR buoy deployments to the Humboldt and Morro Bay WEAs and modified in BOEM's 2022 Consistency Determination for Leasing Wind Energy Areas Offshore Morro Bay, California (BOEM 2022) to create conservative estimates of a potential maximal scenario: (1) metocean buoy weight in depths over 1,000 m may be distributed over 2 separate anchors, so the Proposed Action covers 12 potential anchoring events; (2) anchor radius is conservatively calculated by doubling the anchor radius of known metocean buoys to increase the area from 2.3 to 9.3 m^2; (3) maximum chain sweep area was estimated by tripling the current 1.8 m (6 ft) of chain used to 5.5 m (18 ft).

Buoy Instrumentation and Power Requirements

Metocean buoys are anchored at fixed locations in potential commercial lease areas to conduct site assessment activities to monitor and evaluate the wind as an energy source. The activities may include data gathering on wind velocity, barometric pressure, atmospheric and water temperatures, and current and wave measurements. To obtain these data, scientific measurement devices consisting of anemometers, vanes, barometers, and temperature transmitters would be mounted either directly on a buoy or on a buoy's instrument support arms. In addition to conventional anemometers, floating light detection and ranging (FLiDAR) and sonic detection and ranging equipment may be used to obtain meteorological data.

Buoys could also accommodate environmental monitoring equipment, such as bird and bat monitoring equipment (e.g., radar units, thermal imaging cameras), visual or acoustic monitoring equipment for marine mammals and fishes, data logging computers, power supplies, visibility sensors, water measurement equipment (e.g., temperature, salinity), communications equipment, material hoist, and storage containers.

This instrumentation, along with associated telemetry systems, will require a reliable energy source with a capacity for long autonomy offshore deployments. To supply this energy, the buoys may be equipped with some combination of solar arrays, lithium or lead acid batteries, and diesel generators. If diesel generators are used, they will require an onboard fuel storage container with appropriate spill protection and an environmentally sound method to perform refueling activities.

- **Acoustic Doppler Current Profilers (ADCPs)**

To measure the speed and direction of ocean currents, Acoustic Doppler Current Profilers (ADCPs) would most likely be installed. The ADCP is a remote sensing technology that transmits sound waves at a constant frequency and measures the ricochet of the sound wave off fine particles or zooplankton suspended in the water column. The ADCPs could be mounted independently on the seafloor, attached to a met buoy, or have multiple instruments deployed as a subsea current mooring. A seafloor-mounted ADCP would likely be mounted in a tripod or a trawl resistant mount. One subsea current mooring might have 8–10 ADCPs vertically suspended from an anchor combined with several floats made of syntactic foam. These moorings do not breach the surface. A typical ADCP has 3 to 4 acoustic transducers that emit and receive acoustical pulses from different directions, with frequencies ranging from 300–600 kilohertz (kHz) with a sampling rate of every 1 to 60 minutes. A typical ADCP is about one to two feet tall and one to two feet wide. Its mooring, base, or cage (surrounding frame) would be several feet wider.

Based on information from existing West Coast lessees, BOEM anticipates up to three ADCP moorings could be installed in a lease area, with approximately 10 additional moorings installed along potential export cable routes associated with a lease.

Buoy Hull Types and Anchoring Systems

To accommodate the required onboard instrumentation and power systems, the buoys must be properly sized and anchored. The National Oceanic and Atmospheric Administration (NOAA) has successfully used boat-shaped hull buoys (known as Naval Oceanographic and Meteorological Automated Devices (NOMAD)) and the newer Coastal Buoy and Coastal Oceanographic Line-of-Sight (COLOS) buoys, for weather data collection for many years (Figure 3).

The choice of hull type used usually depends on its intended installation location and measurement requirements. To ensure optimum performance, a specific mooring design is produced based on hull type, location, and water depth (National Data Buoy Center 2012). For example, a smaller buoy in shallow coastal waters may be moored using an all-chain mooring. On the OCS, a larger discus-type or boat-shaped hull buoy may require a combination of a chain, nylon, and buoyant polypropylene materials designed for many years of ocean service (National Data Buoy Center 2012). Moorings will be designed to minimize or remove entanglement risk for protected species.

Discus-shaped, boat-shaped, and spar buoys (Figure 3, Figure 4) are the buoy types most likely be adapted for offshore wind data collection. A large discus-shaped hull buoy has a circular hull 10 to 12 m (33 to 40 ft) in diameter (National Data Buoy Center 2012). The boat-shaped hull buoy is an aluminum-hulled buoy that provides long-term survivability in severe seas (National Data Buoy Center 2012).

Some deep ocean moorings have operated without failure for more than 10 years (NDBC 2012). In 2020, PNNL installed two LiDAR buoys off California that had a boat-shaped hull and were moored with a solid cast iron anchor weighing approximately 4,990 kgs (11,000 lbs.) with a 2.3 square meter (m^2) footprint. The mooring line was comprised of chain, jacketed wire, nylon rope, polypropylene rope and subsurface floats to keep the mooring line taut to semi-taut. The mooring line was approximately 1,200 m long in the Humboldt WEA (PNNL 2019). BOEM anticipates that LiDAR buoys deployed as part of the Proposed Action will be very similar to the LiDAR buoys deployed by PNNL.

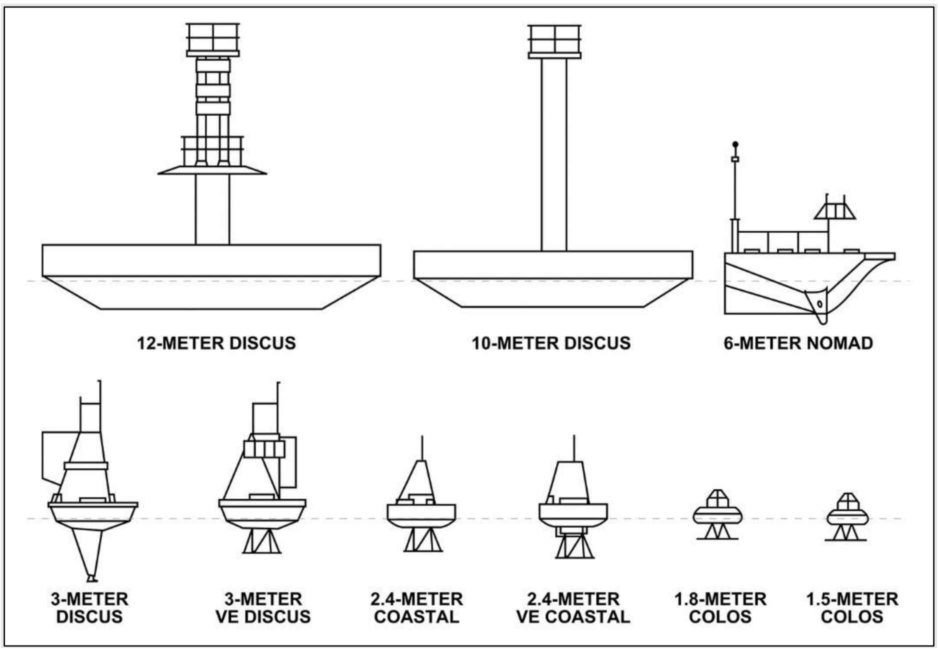

Figure 3. Buoy schematics (National Data Buoy Center 2008)

Figure 4. Buoy photographs showing a 10-meter discus-shaped hull buoy (left), and a 6-meter boat-shaped hull buoy (right) (National Data Buoy Center 2008).

Buoy Installation and Operation

Buoys would typically take approximately one day to install. Onshore activity (fabrication, staging, or launching of crew/cargo vessels) related to the installation of buoys is expected to use existing ports that can support this activity. Because buoy transport and deployment does not require the extensive large-scale infrastructure that would be required for construction of a full-scale offshore floating wind energy facility, there will be a much greater availability of port facilities for placing metocean buoys into service.

Boat-shaped and discus-shaped buoys are typically towed or carried aboard a vessel to the installation location. Once at the location site, the buoy would be either lowered to the surface from the deck of the transport vessel or placed over the final location, and then the mooring anchor dropped. After installation, the transport vessel would likely remain in the area for several hours while technicians configure proper operation of all systems. Transport and installation vessel anchoring for one day is anticipated for these types of buoys (PNNL 2019).

Monitoring information transmitted to shore would include systems performance information such as battery levels and charging systems output, the operational status of navigation lighting, and buoy positions. Additionally, all data gathered via sensors would be fed to an onboard radio system that transmits the data string to a receiver onshore (TetraTech EC Inc. 2010).

Limited space on the buoy would restrict the amount of equipment requiring a power source, therefore, this equipment may be powered by small solar panels or wind turbines. However, diesel generators may be used, which would require periodic vessel trips for refueling.

Buoy Decommissioning

For the purpose of analysis, decommissioning is assumed to be essentially the reverse of the installation process. Equipment recovery would be performed with the support of a vessel(s) equivalent in size and capability to that used for installation. The mooring chain would be recovered to the deck using a winching system, leaving the anchor on the seafloor. The buoy would then be transported to shore by towing (PNNL 2019).

Buoy decommissioning is expected to be completed within one day. Buoys would be returned to shore and disassembled or reused in other applications. BOEM anticipates that the mooring devices and hardware would be reused or recycled (PNNL 2019).

Decommissioning, which may occur in Year 6 or Year 7, is expected to be completed within one day per buoy and performed with the support of a vessel equivalent in size and capability to that used for installation. All buoys will be permitted by USACE under the Nationwide Permit 5.

Vessel Trips for Buoys

Projected vessel trips for buoys are based on assumptions about installation, decommissioning, and operations and maintenance. The Pacific Northwest National Laboratory (PNNL) deployed LiDAR (light detection and ranging) buoys off of California in the Humboldt and Morro Bay WEAs (PNNL 2019). A 65-foot tugboat was used to tow the LiDAR buoy, at 5 knots, to the WEAs where they lowered the anchor, mooring line, and attached the buoy and then traveled back to Humboldt/Morro Bay in one day. PNNL planned for 3 vessel trips for a 12-month deployment (deployment, mid-year maintenance, recovery).

1. Metocean buoy installation would take approximately one day (PNNL 2019).
5. One buoy maintenance trip each year per buoy (PNNL 2019).
6. Buoy decommissioning would take one day (PNNL 2019) and occur in Year 6 or Year 7 after lease execution.
7. On-site inspections and preventative maintenance (e.g., marine fouling, wear, or lens cleaning) are expected to occur yearly.

Table 7. Projected maximum vessel trips for buoy activities over a 5-yr period, based on each lease having up to six buoys. Per-lease trips were multiplied by 2 to represent estimates for two Humboldt leases, by 3 to represent three Morro Bay leases, and by 5 to provide an estimated upper limit across all leases.

Site Assessment Activity	# Round Trips for 1 Lease	# Round Trips for 2 Leases	# Round Trips for 3 Leases	# Round Trips for 5 Leases
Buoy installation	6	12	18	30
Buoy yearly maintenance at once per year per buoy for 5 years	30	60	90	150
Metocean buoy decommissioning (may occur after year 5)	6	12	18	30
Additional trips for maintenance, as needed (e.g., severe weather)	60	60	60	300
Total round trips	102	144	186	510

Project Design Criteria (PDC) and Best Management Practices (BMPs)

BOEM's primary strategy for minimizing adverse impacts is avoidance of the IPF. For impacts that cannot be entirely avoided, BOEM has developed PDCs to avoid and minimize the potential environmental risks to or conflicts with protected resources or EFH (Table 8). The PDCs and the associated BMPs that further describe how the PDCs will be implemented (Appendix A) are part of the Proposed Action to minimize or avoid impacts on threatened and endangered marine mammals, sea turtles, fishes, invertebrates, and EFH. These BMPs were developed by BOEM through consultation with NMFS and through coordination and feedback from stakeholders.

BOEM proposes to implement these BMPs through a combination of procedures including lease stipulations, individual plan reviews, and incidental take permit requirements for ESA-listed species under the Marine Mammal Protection Act (MMPA). Recommended BMPs may be updated in the future through coordination with the NMFS. The BMPs are proposed to be implemented until any future updates may occur. BMPs are described in Appendix A and discussed in relevant sections of this BA. BOEM's project-specific reviews may result in additional BMPs to clarify conditions or further minimize and avoid impacts to threatened or endangered species or their habitats.

Reinitiation of Consultation

BOEM will follow ESA Regulations for reinitiation of consultation: reinitiation may be triggered when the action agency retains jurisdiction over activities 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 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 (50 CFR 402.16).

Table 8. BOEM's proposed Project Design Criteria for listed species and EFH. These PDCs are in addition to existing statutory and regulatory requirements, review procedures, and other BMPs that may apply. See Appendix A for PDC and BMP details.

Project Design Criteria	Applicable to	Purpose
Hard Bottom Avoidance: Metocean Buoy Anchoring	Employees and all at-sea contract personnel and vessels	To protect rocky reefs, a Habitat of Particular Concern for Pacific Groundfish EFH which will reduce adverse effects associated with habitat alteration to minimally adverse levels.
Marine Debris Awareness and Elimination	All at-sea and dockside operations	To provide informational training to all employees and contract personnel on the proper storage and disposal practices at-sea to reduce the likelihood of accidental discharge of marine debris that can impact protected species through entanglement or incidental ingestion.
Minimize Interactions with ESA-listed Species During Geophysical Survey Operations	Survey vessels operating HRG equipment at or below 180 kHz	This PDC will avoid injury of ESA-listed species and minimize the likelihood of adverse effects associated with potential disturbance to discountable levels through the establishment of pre-clearance, exclusion zones, shut-downs, PSO monitoring, and other BMPs to avoid and reduce exposure of ESA-listed species to underwater survey noise.
Minimize Vessel Interactions with ESA-listed species	All vessels	To avoid injuring or disturbing ESA-listed species by establishing minimum separation distances between vessels and marine protected species; and operational protocols for vessels when animals are sighted.
Entanglement Avoidance	Mooring and anchoring systems for buoys and metocean data collection devices.	To use the best available mooring systems using anchors, chain, cable, or coated rope systems that prevent or reduce to discountable levels any potential entanglement of marine mammals and sea turtles.
Protected Species Observers	Geophysical surveys	To require PSO training; to require PSO approval requirements by NMFS prior to deployment on a project.
Reporting Requirements	PSOs and any project-related personnel who observe a dead and/or injured protected species.	To document and record monitoring requirements for geophysical surveys, project-related incidents involving ESA-listed species, and to report any impacts to protected species in a project area whether or not the impact is related to the project.
Prohibition of Trawling for Biological Surveys	Employees and all at-sea contract personnel and vessels	To reduce possibility of bycatch of protected fish species and to protect benthic habitats.

2. Part II: Biological Assessment

ESA-Listed Species

Overview of Marine Mammals and Sea Turtles

There are approximately 10 species/stocks/Distinct Population Segments (DPS) of marine mammal species listed under ESA that are known to occur in the Action Area, (Table 9). The two sub-species of sea otters (Northern and Southern) are also present within the Action Area but fall under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS) and will be reviewed separately.

Using critical habitat map coverages, we indicate areas of critical habitat (Figure 5) that overlap the Action Area.

Species descriptions, including state, habitat ranges, population trends, predator/ prey interactions, and species-specific threats are described in Argonne (2019), H.T. Harvey and Associates (2020), and U.S. Navy (2022). We summarize these descriptions for marine mammals likely and unlikely to occur in the Action Area. We then summarize descriptions of the five ESA-listed species/DPS of sea turtles that may occur in the Action Area.

Overview of Fishes and Invertebrates

Thirty-four fish and invertebrate taxa are listed (or are proposed for listing) under the ESA as either threatened or endangered.

Chinook salmon (9 Evolutionarily Separate Units (ESUs)), chum salmon (2 ESUs), Coho salmon (4 ESUs), steelhead trout (11 DPSs), eulachon (southern DPS), green sturgeon (southern DPS), oceanic whitetip shark, scalloped hammerhead shark (eastern Pacific DPS), giant manta ray, black abalone, white abalone, and sunflower sea star are protected fish and invertebrate species that may occur in the Action Area.

Table of ESA-Listed Marine Mammals, Sea Turtles, Fishes, and Invertebrates

Table 9. ESA-listed Species that may occur in the Action Area with citations, whether or not there is designated CH ("Yes" "No" "Proposed" or "Not prudent"), supporting Citations for CH, and if CH overlaps with the Action Area (CH Overlap: "Yes" for overlap; "No" if no overlap; "NA" for Not Applicable if no designated CH), for (a)marine mammals, (b) sea turtles, (c) salmonid fishes, (d) non-salmonid fishes, and (e) invertebrates.

(a) marine mammals

Common Name	Scientific Name	Stock or DPS	ESA Status	Occurrence	Citations for ESA Listing	CH	Citations for CH	CH Overlap
Blue whale	*Balaenoptera musculus*	Eastern North Pacific	Endangered	Late summer & fall	35 FR 18319; December 2, 1970. 2020 Recovery plan	No	NA	NA
Fin whale	*Balaenoptera physalus*	California, Oregon, Washington	Endangered	Year-round	35 FR 8491; June 2, 1970. 2010 Recovery plan	No	NA	NA
Sei whale	*Balaenoptera borealis*	Eastern North Pacific	Endangered	Uncommon	35 FR 12024; December 2, 1970. 2011 Recovery plan	No	NA	NA
Humpback whale	*Megaptera novaeangliae*	Central America DPS	Endangered	Spring to fall	81 FR 62260; September 8, 2016. 1991 Recovery plan	Yes	86 FR 21082, April 21, 2021	Yes
Humpback whale	*Megaptera novaeangliae*	Mexico DPS	Threatened	Spring to fall	81 FR 62260; September 8, 2016. 1991 Recovery plan	Yes	86 FR 21082, April 21, 2021	Yes
Gray whale	*Eschrichtius robustus*	Western North Pacific DPS	Endangered	Unclear	59 FR 31094, June 16, 1994	No	NA	NA
North Pacific right whale	*Eubalaena japonica*	Eastern North Pacific	Endangered	Uncommon	73 FR 12024; April 7, 2008. 2013 Recovery plan	Yes	73 FR 19000	No
Sperm whale	*Physeter macrocephalu s*	California, Oregon, Washington	Endangered	Year-round, except winter	35 FR 18319; December 2, 1970. 2010 Recovery plan; NMFS. 2023. Guidelines for Preparing Stock Assessment Reports Pursuant to the MMPA. Protected Resources Policy Directive 02-204-01	No	NA	NA
Killer whale	*Orcinus orca*	Eastern North Pacific Southern Resident	Endangered	April-Oct; limited sightings	79 FR 20802; April 14, 2014. 2008 Recovery Plan	Yes	86 FR 14668, August 2, 2021	Yes
Guadalupe fur seal	*Arctocephalus townsendi*	Throughout range	Threatened	Spring/ summer, seasonal low #s	NA	No	NA	NA

(b) sea turtles

Common Name	Scientific Name	DPS	ESA Status	Occurrence	Citations for ESA Listing	CH	Citations for CH	CH Overlap
Leatherback sea turtle	*Dermochelys coriacea*	Throughout range	Endangered	June-Nov; limited sightings (gillnet restriction through Nov. 15th in central CA/southern OR).	35 FR 8491; June 3, 1970. 1998 Recovery Plan	Yes	77 FR 4169, January 26, 2012	Yes
Loggerhead sea turtle	*Caretta caretta*	North Pacific Ocean DPS	Endangered	Uncommon	76 FR 58868; October 24, 2011. 1997 Recovery Plan	No	NA	NA
Green sea turtle	*Chelonia mydas*	East Pacific DPS	Threatened	Extralimital	81 FR 20057; May 6, 2016. Recovery Plan	Proposed	Proposed 88 FR 46572, July 19, 2023	NA
Olive ridley sea turtle	*Lepidochelys olivacea*	Mexico's Pacific Coast breeding population	Endangered	Extralimital	43 FR 32800; August 27, 1978. 1998 Recovery Plan	No	NA	NA
Olive ridley sea turtle	*Lepidochelys olivacea*	All other populations	Threatened	Extralimital	43 FR 32800; August 27, 1978. 1998 Recovery Plan	No	NA	NA

(c) salmonid fishes

Common Name	Scientific Name	ESU or DPS	ESA Status	Occurrence	Citations for ESA Listing	CH	Citations for CH	CH Overlap
Chinook salmon	*Oncorhynchus tshawytscha*	Sacramento River winter-run ESU	Endangered	See species description	Threatened 54 FR 32085, August 4, 1989; and 55 FR 46515, November 5, 1990; Endangered 59 FR 440, January 4, 1994 (50 CFR § 224.101)	Yes	58 FR 33212, June 16, 1993 (50 CFR § 226.204)	No
Chinook salmon	*Oncorhynchus tshawytscha*	Upper Columbia River spring-run ESU	Endangered	See species description	64 FR 14308, March 24, 1999; 70 FR 37159, June 28, 2005; 79 FR 20802, April 14, 2014 (50 CFR § 224.101)	Yes	70 FR 52630, September 2, 2005 (50 CFR § 226.212)	No
Chinook salmon	*Oncorhynchus tshawytscha*	California coastal ESU	Threatened	See species description	64 FR 50394, September 16, 1999; 70 FR 37159, April 14, 2014 (50 CFR § 223.102)	Yes	70 FR 52488, September 2, 2005 (50 CFR § 226.211)	No
Chinook salmon	*Oncorhynchus tshawytscha*	Central Valley spring-run ESU	Threatened	See species description	FR 64 50394, September 16, 1999; hatchery listing policy 70 FR 37204, June 28, 2005; reaffirmed status 70 FR 37159, June 28, 2005 (50 CFR § 223.102)	Yes	70 FR 52630, September 2, 2005 (50 CFR § 226.211)	No
Chinook salmon	*Oncorhynchus tshawytscha*	Lower Columbia River ESU	Threatened	See species description	64 FR 14308, May 24, 1999; 70 FR 37160, June 28, 2005; 79 FR 20802, April 14, 2014 (50 CFR § 223.102)	Yes	70 FR 52630, September 2, 2005 (50 CFR § 226.212)	No
Chinook salmon	*Oncorhynchus tshawytscha*	Puget Sound ESU	Threatened	See species description	64 FR 14308, March 24, 1999; 70 FR 37160, June 28, 2005; 79 FR 20802, April 14, 2014 (50 CFR § 223.102)	Yes	70 FR 52630, September 2, 2005 (50 CFR § 226.212)	No
Chinook salmon	*Oncorhynchus tshawytscha*	Snake River fall-run ESU	Threatened	See species description	57 FR 14653, April 22, 1992; 70 FR 37160, June 28, 2005; 79 FR 20802, April 14, 2014 (50 CFR § 223.102)	Yes	58 FR 68543, December 28, 1993 (50 CFR § 226.205)	No
Chinook salmon	*Oncorhynchus tshawytscha*	Snake River spring/summer -run ESU	Threatened	See species description	57 FR 14653, April 22, 1992; 70 FR 37160, June 28, 2005; 79 FR 20802, April 14, 2014 (50 CFR § 223.102)	Yes	64 FR 57399, October 25, 1999 (50 CFR § 226.205)	No
Chinook salmon	*Oncorhynchus tshawytscha*	Upper Willamette River ESU	Threatened	See species description	64 FR 14308, March 24, 1999; 70 FR 37160, June 28, 2005; 79 FR 20802, April 14, 2014 (50 CFR § 223.102)	Yes	70 FR 52630, September 2, 2005 (50 CFR § 226.212)	No

Common Name	Scientific Name	ESU or DPS	ESA Status	Occurrence	Citations for ESA Listing	CH	Citations for CH	CH Overlap
Chum salmon	*Oncorhynchus keta*	Columbia River ESU	Threatened	See species description	64 FR 14508, March 25, 1999; 70 FR 37160, June 28, 2005; 79 FR 20802, April 14, 2014 (50 CFR § 223.102)	Yes	70 FR 52630, September 2, 2005 (50 CFR § 226.212)	No
Chum salmon	*Oncorhynchus keta*	Hood Canal summer-run ESU	Threatened	See species description	64 FR 14508, March 25, 1999; 70 FR 37160, June 28, 2005; 79 FR 20802, April 14, 2014 (50 CFR § 223.102)	Yes	70 FR 52630, September 2, 2005 (50 CFR § 226.212)	No
Coho salmon	*Oncorhynchus kisutch*	Central California Coast ESU	Endangered	See species description	Threatened 61 FR 56138, October 31, 1996; endangered 70 FR 37160, June 28, 2005; 79 FR 20802, April 14, 2014 (50 CFR § 224.101)	Yes	64 FR 24049, May 5, 1999 (50 CFR § 226.210)	No
Coho salmon	*Oncorhynchus kisutch*	Lower Columbia River ESU	Threatened	See species description	70 FR 37160, June 28, 2005; 79 FR 20802, April 14, 2014 (50 CFR § 223.102)	Yes	81 FR 9251, February 24, 2016 (50 CFR § 226.212)	No
Coho salmon	*Oncorhynchus kisutch*	Oregon coast ESU	Threatened	See species description	63 FR 42587, August 10, 1998; 76 FR 35755, June 20, 2011; 79 FR 20802, April 14, 2014 (50 CFR § 223.102)	Yes	73 FR 7815, February 11, 2008 (50 CFR § 226.212)	No
Coho salmon	*Oncorhynchus kisutch*	Southern Oregon & Northern California coasts ESU	Threatened	See species description	62 FR 24588, May 6, 1997; 70 FR 37160, June 28, 2005; 79 FR 20802, April 14, 2014 (50 CFR § 223.102)	Yes	64 FR 24049, May 5, 1999 (50 CFR § 226.210)	No
Steelhead trout	*Oncorhynchus mykiss irideus*	Southern California DPS	Endangered	See species description	Endangered 62 FR 43937, August 18, 1997 and 71 FR 834, January 5, 2006; range extension 67 FR 21586, May 1, 2002; updated 79 FR 20802, April 14, 2014 (50 CFR § 224.101)	Yes	70 FR 52536, September 2, 2005 (50 CFR § 226.211)	No
Steelhead trout	*Oncorhynchus mykiss irideus*	California Central Valley DPS	Threatened	See species description	62 FR 13347, March 19, 1998; 71 FR 834, January 5, 2006 (50 CFR § 223.102)	Yes	70 FR 52630, September 2, 2005 (50 CFR § 226.211)	No
Steelhead trout	*Oncorhynchus mykiss irideus*	Central California Coast DPS	Threatened	See species description	62 FR 43937, August 18, 1997; 71 FR 834, January 5, 2006; 79 FR 20802, April 14, 2014 (50 CFR § 223.102)	Yes	70 FR 52488, September 2, 2005 (50 CFR § 226.211)	No

Common Name	Scientific Name	ESU or DPS	ESA Status	Occurrence	Citations for ESA Listing	CH	Citations for CH	CH Overlap
Steelhead trout	*Oncorhynchus mykiss irideus*	Lower Columbia River DPS	Threatened	See species description	63 FR 13347, March 19, 1998; 71 FR 834, January 5, 2006; 79 FR 20802, April 14, 2014 (50 CFR § 223.102)	Yes	70 FR 52630, September 2, 2005 (50 CFR § 226.212)	No
Steelhead trout	*Oncorhynchus mykiss irideus*	Middle Columbia River DPS	Threatened	See species description	64 FR 14517, March 25, 1999; 71 FR 834, January 5, 2006; 79 FR 20802, April 14, 2014 (50 CFR § 223.102)	Yes	70 FR 52630, September 2, 2005 (50 CFR § 226.212)	No
Steelhead trout	*Oncorhynchus mykiss irideus*	Northern California DPS	Threatened	See species description	65 FR 36074, June 7, 2000; 71 FR 834, January 5, 2006; 79 FR 20802, April 14, 2014 (50 CFR § 223.102)	Yes	70 FR 52630, September 2, 2005 (50 CFR § 226.211)	No
Steelhead trout	*Oncorhynchus mykiss irideus*	Puget Sound DPS	Threatened	See species description	72 FR 26722, May 11, 2007; 79 FR 20802, April 14, 2014 (50 CFR § 223.102)	Yes	81 FR 9252, February 24, 2016 (50 CFR § 226.212)	No
Steelhead trout	*Oncorhynchus mykiss irideus*	Snake River DPS	Threatened	See species description	62 FR 43937, August 18, 1997; 71 FR 834, January 5, 2006; 79 FR 20802; April 14, 2014 (50 CFR § 223.102)	Yes	70 FR 52630, September 2, 2005 (50 CFR § 226.212)	No
Steelhead trout	*Oncorhynchus mykiss irideus*	South-Central California Coast DPS	Threatened	See species description	62 FR 43937, August 18, 1997; 71 FR 834, January 5, 2006; 79 FR 20802, April 14, 2014 (50 CFR § 223.102)	Yes	70 FR 52488, September 2, 2005 (50 CFR § 226.211)	No
Steelhead trout	*Oncorhynchus mykiss irideus*	Upper Columbia River DPS	Threatened	See species description	Endangered 62 FR 43937, August 18, 1997; reclassified to Threatened 71 FR 834, January 5, 2006 and 74 FR 42605, August 24, 2009; 79 FR 20802, April 14, 2014 (50 CFR § 223.102)	Yes	70 FR 52630, September 2, 2005 (50 CFR § 226.212)	No
Steelhead trout	*Oncorhynchus mykiss irideus*	Upper Williamette River DPS	Threatened	See species description	64 FR 14517, March 25, 1999; 71 FR 834, January 5, 2006; 79 FR 20802, April 14, 2014 (50 CFR § 223.102)	Yes	70 FR 52630, September 2, 2005 (50 CFR § 226.212)	No

(d) non-salmonid fishes

Common Name	Scientific Name	ESU or DPS	ESA Status	Occurrence	Citations for ESA Listing	CH	Citations for CH	CH Overlap
Scalloped hammerhead shark	*Sphyrna lewini*	Eastern Pacific DPS	Endangered	See species description	79 FR 38214, July 3, 2014 (50 CFR § 224.101)	Not Prudent	80 FR 71774, November 17, 2015	NA
Green sturgeon	*Acipenser medirostris*	Southern DPS	Threatened	See species description	71 FR 17757, April 7, 2006 (50 CFR § 223.102)	Yes	74 FR 52300, October 9, 2009 (50 CFR § 226.219)	Yes, near Humboldt WEA
Oceanic whitetip shark	*Carcharhinus longimanus*	Throughout range	Threatened	See species description	83 FR 4153, January 30, 2018 (50 CFR § 223.102)	Not prudent	85 FR 12898, March 5, 2020	NA
Giant manta ray	*Mobula birostris*	Throughout range	Threatened	See species description	83 FR 2916, January 22, 2018; revised taxonomy 88 FR 81351, November 22, 2023 (50 CFR § 223.102)	Not prudent	84 FR 66652, December 5, 2019	NA
Eulachon	*Thaleichthys pacificus*	Southern DPS	Threatened	See species description	75 FR 13012, March 18, 2010 (50 CFR § 223.102)	Yes	76 FR 65324, October 20, 2011 (50 CFR § 226.222)	No

(e) invertebrates

Common Name	Scientific Name	ESU or DPS	ESA Status	Occurrence	Citations for ESA Listing	CH	Citations for CH	CH Overlap
Black abalone	*Haliotis cracherodii*	Throughout range	Endangered	See species description	74 FR 1937, January 14, 2009 (50 CFR § 224.101)	Yes	76 FR 66806, October 27, 2011 (50 CFR § 226.221)	Yes
White abalone	*Haliotis sorenseni*	Throughout range	Endangered	See species description	66 FR 29046, May 29, 2001 (50 CFR § 224.101)	Not Prudent	66 FR 29046, May 29, 2001	NA
Sunflower sea star	*Pycnopodia helianthoides*	NA	Proposed Threatened	See species description	Proposed 88 FR 16212, March 16, 2024	NA	NA	NA

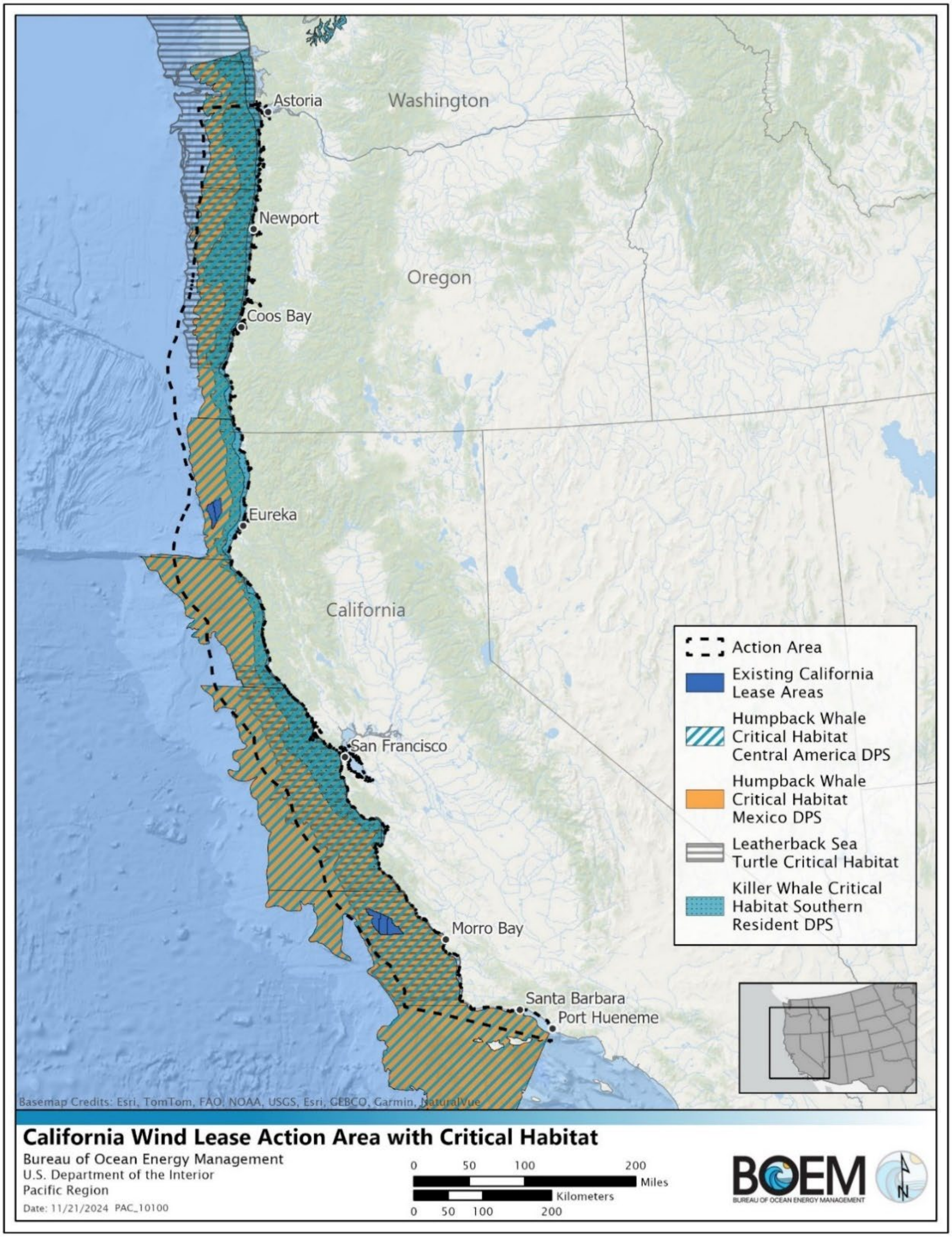

Figure 5. Locations of marine mammal and sea turtle critical habitats overlapping the Action Area.

Marine Mammals Likely to Occur in the Action Area

Blue Whale (*Balaenoptera musculus*)

Blue whale populations were greatly reduced by commercial whaling in the early 1900s, and the species was federally listed as endangered in 1970 (35 FR 18319). Two blue whale stocks are recognized in the North Pacific Ocean: the Eastern North Pacific Stock (ENP) and the Central North Pacific Stock (CNP) (Carretta et al. 2020).

The seasonal migration of the ENP population has been confirmed by long-term acoustic monitoring (Burtenshaw et al. 2004) and by movements of photo-identified individuals between southern California and the Gulf of Alaska (Calambokidis 2009). Blue whales travel northward as summer progresses in response to northward progressing spring transition, and subsequent increases in primary productivity (Burtenshaw et al. 2004; Calambokidis 2009). Blue whale biologically important areas (BIAs) are described in Calambokidis et al. (2015) and updated in Calambokidis et al. (2024). Both the blue whale feeding core and parent BIAs overlap with the Proposed Action Area (Figure 6). Blue whales identified in the area off northern California are re-sighted most frequently off Point St. George (Calambokidis et al. 2004; Calambokidis 2007). They are most commonly sighted along the continental shelf break but also occur farther inshore, in transit or feeding on surface swarms of krill. Satellite-tagged blue whales provided information on “core areas of use”, indicating a high area of overlap for individuals at the western part of the Channel Islands, and near the Gulf of the Farallones, and the northern part of Cape Mendocino (Irvine et al. 2014). Irvine et al. (2014) found that although the satellite tracks were widely distributed, these whales tended to occupy the area off northern California during the latter part of the feeding season in late October–November. Based on a series of aerial and summer/fall shipboard surveys off CA, OR, and WA from 1991–2018 sightings of blue whales in inshore and offshore waters off California decreased (Becker et al. 2020).

The most current information suggests that the Eastern North Pacific population may have recently recovered since commercial whaling ended in 1971, despite ship strikes, interactions with fishing gear, and increased levels of ambient sound in the Pacific Ocean (Barlow 1997; 2003; 2016; Calambokidis and Barlow 2013; Campbell et al. 2015; Carretta et al. 2020; International Whaling Commission 2016; Monnahan et al. 2015; Rockwood et al. 2017; Širović et al. 2015a; Valdivia et al. 2019). The population of eastern North Pacific blue whales may be near carrying capacity and the rate of change of the population size has declined (Carretta et al. 2020; International Whaling Commission 2016; Monnahan et al. 2015). Based on NMFS systematic ship surveys from 1991 to 2014, the abundance of blue whales in the area (the combined Oregon/Washington stratum and the Northern California stratum) is estimated at 1,496 whales (Barlow 2016). The annual entanglement rate of blue whales (observed) during 2013–2017 is the sum of observed annual entanglements (1.35/yr), plus species probability assignments from unidentified whales (0.09/yr), totaling 1.44 blue whales annually (Carretta et al. 2020). Most observed blue whale ship strikes have been in southern California or off San Francisco, CA, where the seasonal distribution of blue whales is in close proximity to shipping ports (Berman-Kowalewski et al. 2010). Using the moderate level of avoidance model from Rockwood et al. (2017), estimated ship strike deaths of blue whales are 18 annually. A comparison of average annual ship strikes observed over the period 2013–2017 (0.4/yr) versus estimated ship strikes (18/yr) indicates that the rate of detection for blue whale vessel strikes is approximately 2%. The observed and assigned annual incidental mortality and injury rate from ship strikes (0.4/yr) and commercial fisheries (≥ 1.44 /yr), totals 1.84 whales annually from 2013–2017. This exceeds the calculated potential biological removal of 1.23 for this stock of blue whales (Carretta et al. 2020).

No critical habitat is designated for blue whales in the North Pacific.

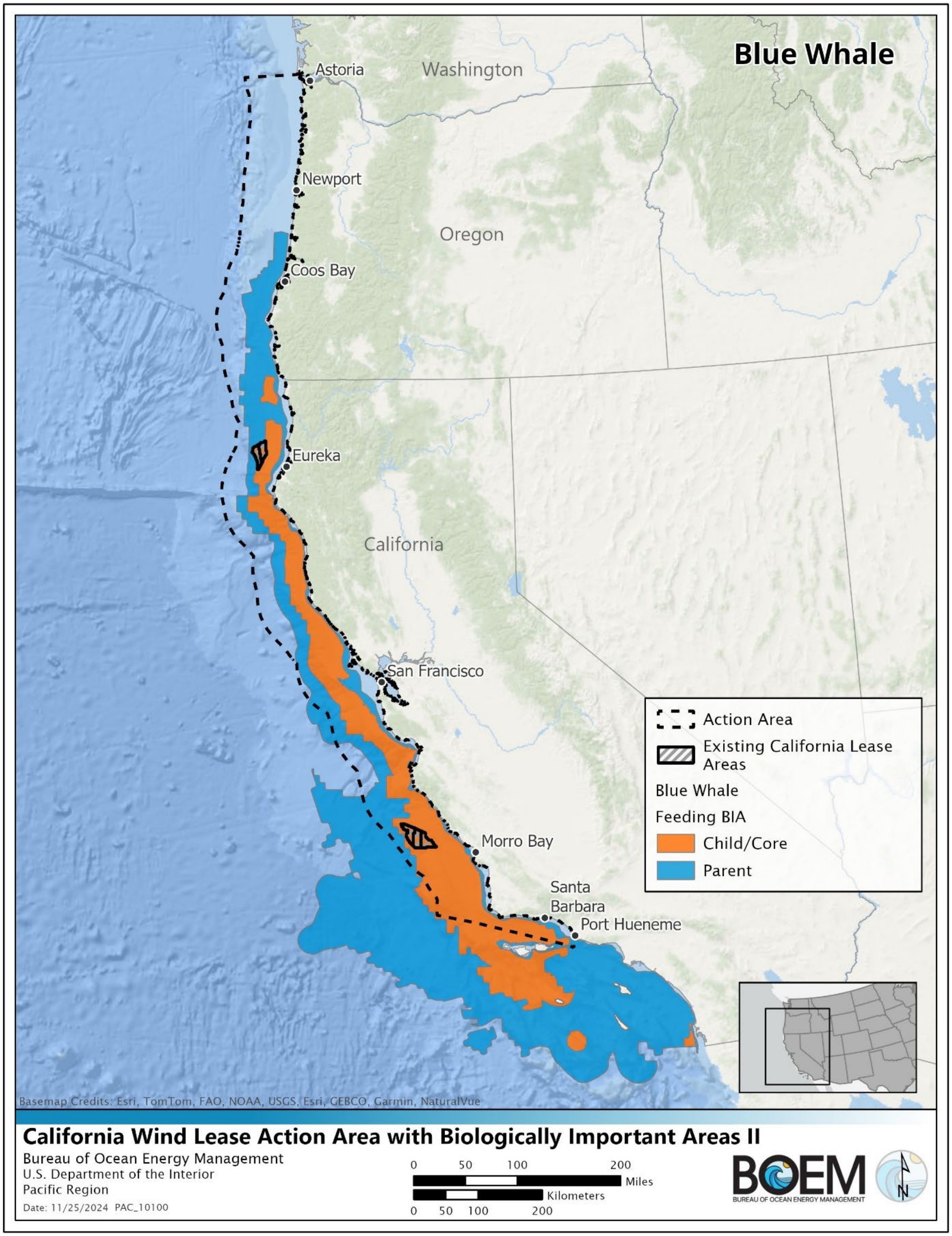

Figure 6. Feeding BIAs for blue whales (Calambokidis et al. 2024) relative to the Action Area.

Fin whale (*Balaenoptera physalus*)

Fin whales prefer temperate and polar waters (Jefferson et al. 2015; Reeves et al. 2002). This species has been documented from 60° N in Alaska waters to tropical waters off Hawaii, in Canadian waters both offshore and inland including some fjords, and they have frequently been recorded in waters within the Southern California Bight (Campbell et al. 2015; Jefferson et al. 2014; Mate et al. 2016; 2018; Širović et al. 2016). As demonstrated by satellite tags and discovery tags, fin whales make long-range movements along the entire U.S. West Coast (Falcone et al. 2011; 2016; 2018). Locations of breeding and calving grounds are largely unknown. The species is highly adaptable, following prey, typically off the continental shelf (Azzellino et al. 2008; Panigada et al. 2008). Survey and acoustic data indicate that fin whale distributions shift both seasonally as well as annually (Burnham et al. 2019; Calambokidis et al. 2015; Douglas et al. 2014; Jefferson et al. 2014).

During aerial surveys conducted within the 2,000 m isobath off southern Washington, Oregon, and Northern California in the spring, summer, and fall of 2011 and 2012, there were six sightings of 13 fin whales during winter and summer 2012 only in offshore waters over the continental slope (Adams et al. 2014). Sightings from systematic ship surveys out to 300 nmi off the U.S. West Coast, satellite tag data and habitat-based density models built with these data indicate that fin whales are more likely to be present seaward of the continental shelf in the offshore portion of the Action Area in late June to early December (Becker et al. 2020). Because fin whale abundance appears lower in winter/spring in California (Dohl et al. 1983; Forney et al. 1995) and in Oregon (Green et al. 1992), it is likely that the distribution of this stock extends seasonally outside these coastal waters.

The fin whale is listed as endangered under the ESA, but there is no designated critical habitat for this species. Fin whale population structure in the Pacific Ocean is not well known. During the 20th century more fin whales were taken by industrialized whaling than any other species (Rocha et al. 2014). NMFS recognizes three fin whale stocks: (1) the Northeast Pacific stock (Alaska); (2) the California, Oregon, and Washington stock, and (3) the Hawaii stock, all stocks are considered depleted under the MMPA and endangered under the ESA (Carretta et al. 2020). Analysis of genetic and acoustic data suggests that fin whales in the North Pacific interbreed and are a single population (Archer et al. 2019).

There has been a roughly 5-fold abundance increase between 1991 and 2014. Since 2005, the abundance increase has been driven by increases off northern California, Oregon, and Washington, while numbers off Central and Southern California have been stable (Nadeem et al. 2016). The best estimate of fin whale abundance in California, Oregon, and Washington waters out to 300 nmi is 9,029 (CV = 0.12) whales, based on a trend analysis of 1991–2014 line-transect data (Nadeem et al. 2016)

Total mean annual fishery-related serious injury and mortality is 0.67 fin whales annually (2014–2018) (Carretta et al. 2020). The average observed annual mortality and serious injury due to ship strikes is 1.6 fin whales per year during 2014–2018. Documented ship strike deaths and serious injuries are derived from direct counts of whale carcasses and represent minimum impacts (Carretta et al. 2020). The most conservative estimate of ship strike deaths from Rockwood et al. (2017) is 43 whales annually. The ratio of documented ship strike deaths (1.8/yr) to estimated annual deaths (43) implies a carcass recovery/documentation rate of 4.1%. There is uncertainty regarding the estimated number of ship strike deaths, however, it is apparent that carcass recovery rates of fin whales are quite low.

Although no fin whale entanglements have been observed 1990–2016 (Carretta et al. 2018a), some gillnet mortality may go unobserved because whales swim away with portion of the net (Carretta et al. 2020). The average observed annual mortality due to ship strikes is 0.2 sei whales per year for the period 2012–2016. Additional ship strike mortality probably goes unreported because the whales do not strand or, if they do, they may not have obvious signs of trauma.

BIAs for fin whales, including parent and core areas, were recently delineated due to the availability of additional data (see Calambokidis et al. 2024: Figure 6; Carlton et al. 2024: Figure 3.44). Both the fin whale parent and core feeding BIAs overlap with the Action Area (Figure 7).

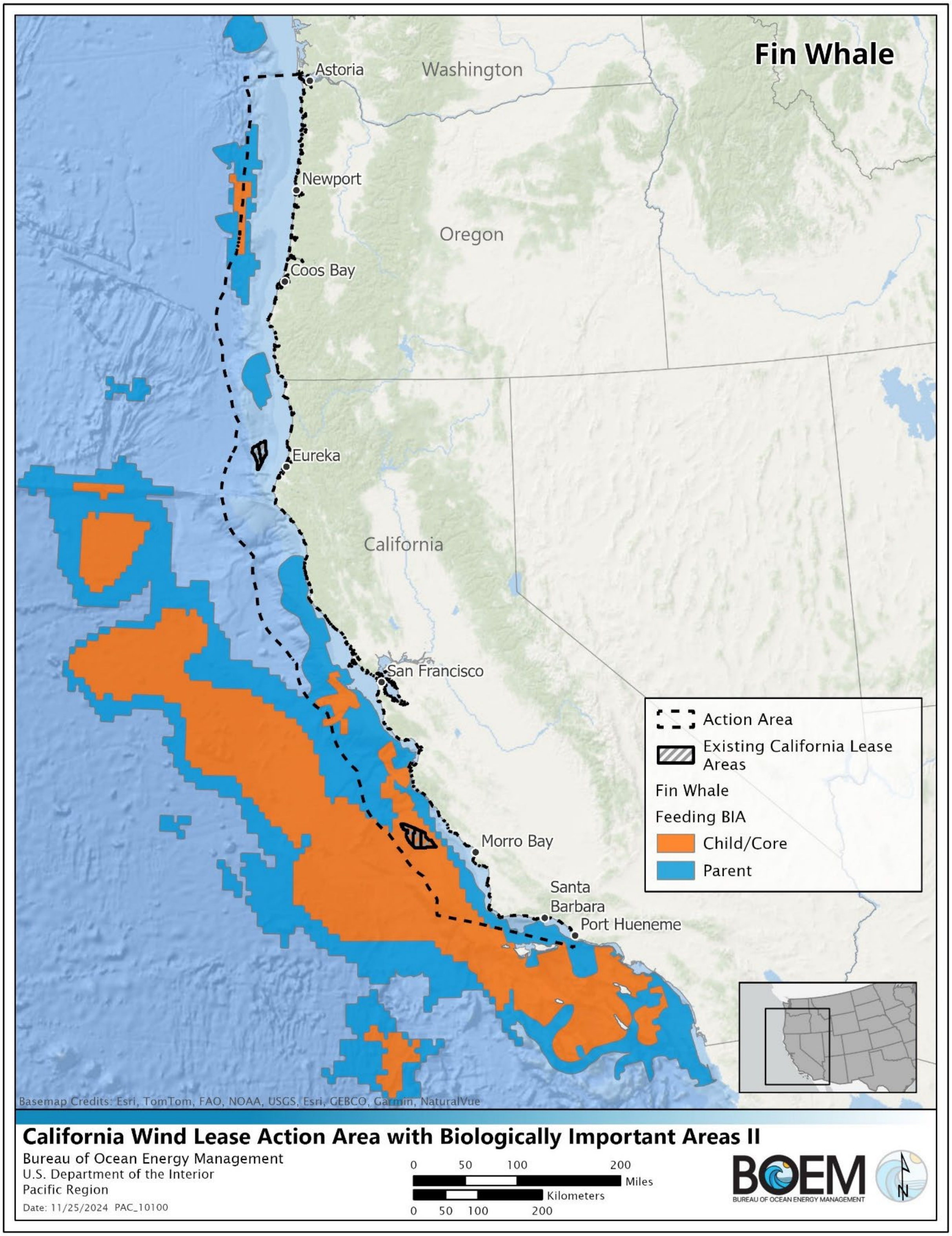

Figure 7. Feeding BIAs for fin whales (Calambokidis et al. 2024) relative to the Action Area.

Sei Whale (*Balaenoptera borealis*)

Sei whales have a worldwide distribution and are found primarily in cold temperate to subpolar latitudes across the North Pacific where there is steep bathymetric relief, such as the continental shelf break, canyons, or basins between banks and ledges (Best and Lockyer 2002; Burnham et al. 2019; Horwood 1987; Horwood 2009). Sei whales are migratory, spending the summer months feeding in the subpolar higher latitudes and returning to the lower latitudes to calve in the winter (Rone et al. 2017; Smultea 2014; Fulling et al. 2011). In the winter in the Pacific, sei whales have been detected as far south as the Mariana Islands, Hawaii, and Southern California (Fulling et al. 2011; Smultea 2014). Analysis of sei whale genetic samples from around the Pacific suggests a single stock present in the Pacific (Baker et al. 2006; Huijser et al. 2018). For the marine mammal stock assessment reports, sei whales within the Pacific U.S. EEZ are divided into two discrete areas: (1) California, Oregon, and Washington waters and (2) waters around Hawaii. The Eastern North Pacific stock includes animals found within the U.S. west coast EEZ and in adjacent high seas waters; however, because comprehensive data on abundance, distribution, and human-caused impacts are lacking for high seas regions, the status of this stock is evaluated based on data from U.S. EEZ waters of the California Current (NMFS 2005).

Sei whales are rare in the California Current (Dohl et al. 1983; Barlow 2016; Forney et al. 1995; Green et al. 1992) but were the fourth most common whale taken by California coastal whalers in the 1950s–1960s (Rice 1974). Shipboard surveys off California, Oregon, and Washington from 1991–2014 sighted approximately 17 sei whales from 35° N to 45° N (Barlow 2016).

The sei whale is listed as an endangered under the ESA, but there is no designated critical habitat for this species (Carretta et al. 2020). A single Eastern North Pacific stock is recognized in the U.S. EEZ and that stock is considered depleted under the MMPA (Carretta et al. 2020). No data on trends in sei whale abundance exist for the eastern North Pacific. Although the population in the North Pacific is expected to have grown since being given protected status in 1976, the possible effects of continued unauthorized takes (Yablokov 1994), vessel strikes and gillnet mortality make this uncertain. Barlow (2016) noted that an increase in sei whale abundance observed in 2014 in the California Current is partly due to recovery of the population from commercial whaling but may also involve distributional shifts in the population. The best estimate of abundance for California, Oregon, and Washington waters is the unweighted geometric mean of the 2008 and 2014 estimates, or 519 (CV = 0.40) sei whales (Barlow 2016).

The California swordfish drift gillnet fishery is the most likely U.S. fishery to interact with sei whales from this stock, but no entanglements have been observed from 8,845 monitored fishing sets from 1990–2016 (Carretta et al. 2018a). The average observed annual mortality due to ship strikes is 0.2 sei whales per year for the period 2012–2016. Increasing levels of anthropogenic sound in the world's oceans is a habitat concern for whales, particularly for baleen whales that may communicate using low-frequency sound (Croll et al. 2002).

Humpback Whale (*Megaptera novaeangliae*)

Humpback whales occur throughout the North Pacific, with multiple populations recognized based on low latitude winter breeding areas (Calambokidis et al. 2001; 2008, Barlow et al. 2011). Exchange of animals between breeding areas occurs rarely, based on photo-identification data of individual whales (Calambokidis et al. 2001; 2008). Photo-identification evidence also suggests strong site fidelity to feeding areas, but animals from multiple feeding areas converge on common winter breeding areas (Calambokidis et al. 2008).

Along the U.S. West Coast, NMFS currently recognizes one humpback whale stock that includes two separate feeding groups: (1) a California and Oregon feeding group of whales that includes whales from the endangered Central American and threatened Mexican distinct population segments (DPSs) defined under the ESA (NOAA 2016), and (2) a northern Washington and southern British Columbia feeding group that primarily includes whales from the threatened Mexican DPS, but also small numbers of whales from the unlisted Hawaii and endangered Central American DPSs (Calambokidis et al. 2008, Barlow et al. 2011, Wade et al. 2016, Wade 2017; 2021). Very few photographic matches between these feeding groups are documented (Calambokidis et al. 2008).

Both core and parent BIAs for humpback whale feeding areas were identified off the U.S. West Coast by Calambokidis et al. (2015) and updated by Calambokidis et al. (2024). Both the core and parent humpback whale feeding BIAs overlap with the Action Area (Figure 8). Effective May 21, 2021, NMFS issued an updated final rule to designate critical habitat for the endangered Central America Distinct Population Segment (DPS), and the threatened Mexico DPS of humpback whales (*Megaptera novaeangliae*) (86 FR 21082). Critical habitat for these DPSs serve as feeding habitat and contain the essential biological feature of humpback whale prey. Critical habitat for the Central America DPS of humpback whales contains approximately 48,521 square nautical miles (nmi^2) of marine habitat in the North Pacific Ocean within the portions of the California Current Ecosystem off the coasts of Washington, Oregon, and California. Specific areas designated as critical habitat for the Mexico DPS of humpback whales contain approximately 116,098 nmi^2 of marine habitat in the North Pacific Ocean, including areas within portions of the eastern Bering Sea, Gulf of Alaska, and California Current Ecosystem. The Humboldt and Morro Bay WEAs and associated Action Area overlap with humpback whale critical habitat.

For the marine mammal stock assessment reports, the California/Oregon/Washington Stock is defined to include humpback whales that feed off the west coast of the United States, including animals from both the California-Oregon and Washington-southern British Columbia feeding groups (Calambokidis et al. 2008, Barlow et al. 2011). Three other stocks are recognized in the Pacific region stock assessment reports: (1) Central North Pacific Stock (with feeding areas from Southeast Alaska to the Alaska Peninsula), (2) Western North Pacific Stock (with feeding areas from the Aleutian Islands, the Bering Sea, and Russia), and (3) American Samoa Stock in the South Pacific (with largely undocumented feeding areas as far south as the Antarctic Peninsula) (Carretta et al. 2020). Nearly all Central American whales migrate to California and Oregon to feed, but the California/Oregon feeding area represents a mix of whales from Mexico and Central America (Wade 2021).

From 2013-2017, mortality due to interactions with fisheries amounted to 17.3 whales per year (Carretta et al. 2020). Fourteen humpback whales (totaling eight deaths, 2.8 serious injuries, and two non-serious injuries) were reported struck by vessels between 2013 and 2017 (Carretta et al. 2019a). An encounter theory model estimated the number of annual ship strike deaths to be 22 humpback whales, though this includes only the period July–November when whales are most likely to be present in the U.S. West Coast EEZ and the time of year that overlaps with cetacean habitat models generated from line-transect surveys (Becker et al. 2016; Rockwood et al. 2017). A humpback whale was entangled in a research marine mooring buoy in 2014. The whale is estimated to have been entangled for three weeks and had substantial necrotic tissue around the caudal peduncle. Although the whale was fully disentangled, this animal was categorized as a serious injury because of the necrotic condition of the caudal peduncle and the possibility that the whale would lose its flukes due to the severity of the entanglement (Carretta et al. 2019a). Increasing levels of anthropogenic sound in the world's oceans (Andrew et al. 2002) has also been identified as a threat to humpback whales.

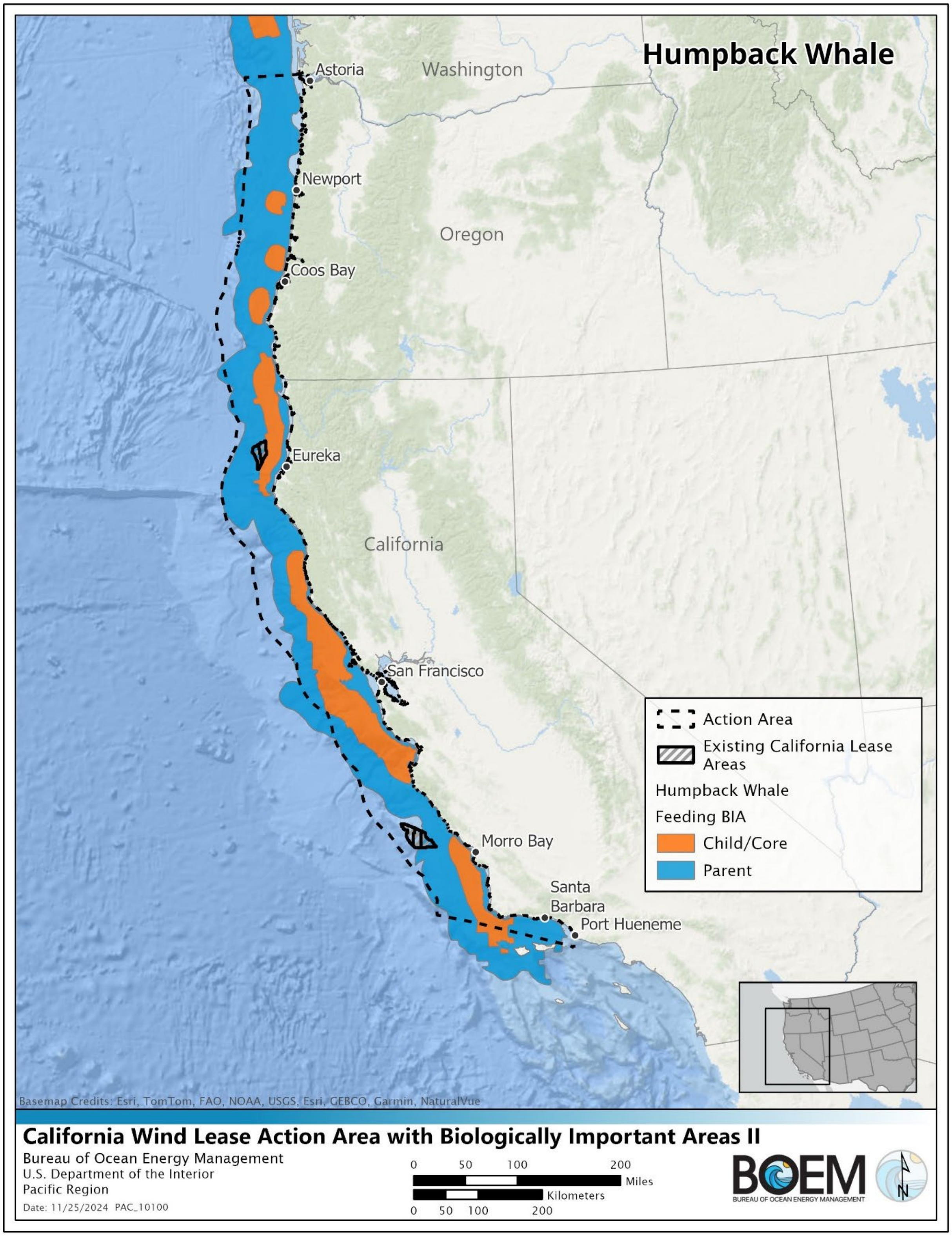

Figure 8. Feeding BIAs for humpback whales (Calambokidis et al. 2024) relative to the Action Area.

Gray Whale (*Eschrichtius robustus*)

There are two north Pacific stocks of gray whales: the Western stock (WNP)and the Eastern stock (ENP) designated in the Pacific SAR (Carretta et al. 2020). Gray whales of the WNP stock primarily occur in shallow waters over the U.S. West Coast, Russian, and Asian continental shelves, while the ENP stock whales primarily occur in shallow waters over the continental shelf of the U.S. West Coast and Mexico. This species is considered to be one of the most coastal of the great whales (Jefferson et al. 2015; Jones and Swartz 2009). The WNP stock primarily feed in the Okhotsk Sea off Sakhalin Island, Russia, and in the southeastern Kamchatka Peninsula in the southwestern Bering Sea in nearshore waters generally less than 225 ft deep (Jones and Swartz 2009; Weller and Brownell 2012). The breeding grounds consist of subtropical lagoons in Baja California, Mexico, and suspected wintering areas in southeast Asia (Alter et al. 2009; Jones and Swartz, 2009; Mate et al. 2015a; Urban-Ramirez et al. 2003; Weller et al. 2013). The ENP stock also feeds in nearshore waters in the Chukchi Sea, Bering Sea, Gulf of Alaska, the Pacific Northwest, and Northern California (Calambokidis et al. 2017; Lagerquist et al. 2019; Mate et al. 2010; 2013; 2015; Weller et al. 2013). The main breeding grounds consist of subtropical lagoons in Baja California, Mexico (Alter et al. 2009; Jones and Swartz 2009; Urban-Ramirez et al. 2003).

Some gray whales make the longest annual migration of any mammal (15,000–20,000 km roundtrip; Guazzo et al. 2019). Gray whales migrate along the Pacific coast twice a year between October and July (Calambokidis et al. 2015). Although they generally remain mostly over the shelf during migration, some gray whales may be found in more offshore waters to the west of San Clemente Island and the Channel Islands (Calambokidis et al. 2015; Guazzo et al. 2019; Mate and Urban-Ramirez 2003; Schorr et al. 2019; Smultea 2014). Recordings from a hydrophone array deployed offshore of central California (near Monterey) show that gray whales are acoustically active while migrating and that this acoustic behavior and their swimming behavior during migration changes on daily and seasonal time scales (Guazzo et al. 2017).

Information from tagging, photo-identification and genetic studies show that some whales identified in the Western North Pacific off Russia have been observed in the eastern North Pacific, including coastal waters of Canada, the U.S. and Mexico (Mate et al. 2015a; Urbán et al. 2019; Weller et al. 2012). The number of whales documented moving between the Western and Eastern North Pacific represents 14% of gray whales identified off Sakhalin Island and Kamchatka according to Urban et al. (2019). Some whales that feed off Sakhalin Island in summer migrate east across the Pacific to the west coast of North America in winter, while others migrate south to waters off Japan and China (Weller et al. 2016). The current stock structure for gray whales in the Pacific has been in the process of being re-examined for a number of years and remains uncertain as of the most recent Pacific SAR (Carretta et al. 2020). Genetic data reveal mixed stock aggregations of gray whales in the North Pacific Ocean and indicate that current population structure is not reflected by the current eastern and western stock or DPS designations based on geography (Brüniche-Olsen et al. 2018; Carretta et al. 2020).

The WNP is endangered, with an estimated population size from photo-ID data for Sakhalin and Kamchatka in 2016 of 290 whales (90% percentile intervals = 271–311) (Cooke et al. 2017; Cooke 2018). Their main wintering areas are in waters off Russia and Asia (Mate et al. 2015a; Moore and Weller, 2013; Weller et al. 2012; 2013). Recent analysis of the data available for 2005 through 2016 estimates the combined Sakhalin Island and Kamchatka populations are increasing (Cooke 2019).

The ENP has recovered from whaling exploitation, is not considered depleted, and was delisted under the ESA in 1994 (Carretta et al. 2020; Swartz et al. 2006). The most recent estimate of abundance for the ENP population is from the 2015/2016 southbound survey and is 26,960 (CV = 0.05) whales (Durban et al. 2017).

A few hundred gray whales that feed along the Pacific coast between southeastern Alaska and Northern California throughout the summer and fall are known as the Pacific Coast Feeding Group (PCFG) (Calambokidis et al. 2017; Carretta et al. 2017; Mate et al. 2013; Weller et al. 2013). The group has been identified as far north as Kodiak Island, Alaska (Gosho et al. 2011), and has generated uncertainty regarding the stock structure of the ENP (Carretta et al. 2017; Weller et al. 2012; 2013). Photo-identification, telemetry, and genetic studies suggest that the PCFG is demographically distinct from the ENP (Calambokidis et al. 2017; Frasier et al. 2011; Lagerquist et al. 2019; Mate et al. 2010). In 2012–2013, the Navy funded a satellite tracking study of PCFG gray whales (Mate 2013). Tags were attached to 11 gray whales near Crescent City, California in fall 2012. Good track histories were received from 9 of the 11 tags, which confirmed an exclusive nearshore (< 19 km) distribution and movement along the Northern California, Oregon, and Washington coasts (Mate 2013). Although the duration of the tags was limited, none of the PCFG whales moved south beyond Northern California.

Both stocks could be present in the Action Area during their northward and southward migration (Calambokidis et al. 2015; Cooke et al. 2015; Moore and Weller 2018; Weller et al. 2012; 2013). During surveys of the northern feeding grounds, the largest number of WNP gray whales was observed in late-August and early-September (Meier et al. 2007), suggesting those few gray whales that may migrate down the U.S. west coast will not be in California waters in general during those months.

Gray whale BIAs, including migratory, reproductive, and feeding BIAs were identified along the U.S. West Coast (Calambokidis et al. 2015; Calambokidis et al. 2024; Carlton et al. 2024, Figs. 3.39-3.42). Vessels transiting from Coos Bay, Crescent City, San Francisco Bay, and Morro Bay are likely to intersect with gray whale migratory BIAs. Vessels surveying potential cable routes are also likely to intersect with small portions of the migratory BIAs. The migration corridors used by the majority of gray whales are within 10 km of the U.S. West Coast (Calambokidis et al. 2015). However, some gray whales may take a migration path farther offshore, so an additional buffer extending 47 km from the coastline was added to the BIAs. The gray whale feeding (core and parent), migratory (core and parent), and reproductive (single) BIAs overlap with the Action Area (Figure 9, Figure 10, Figure 11).

There has been no critical habitat designated for this species.

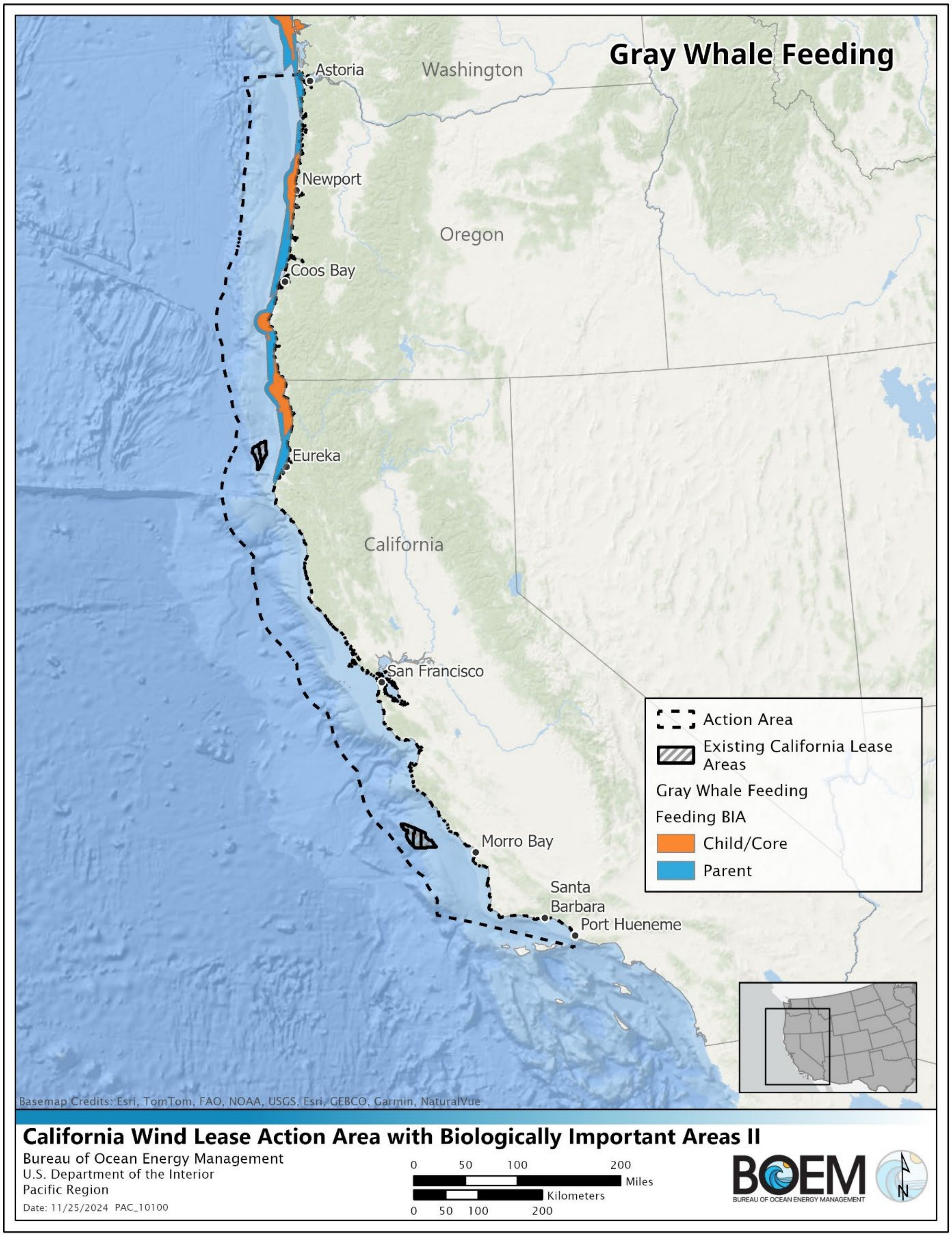

Figure 9. Feeding BIAs for gray whales (Calambokidis et al. 2024) relative to the Action Area.

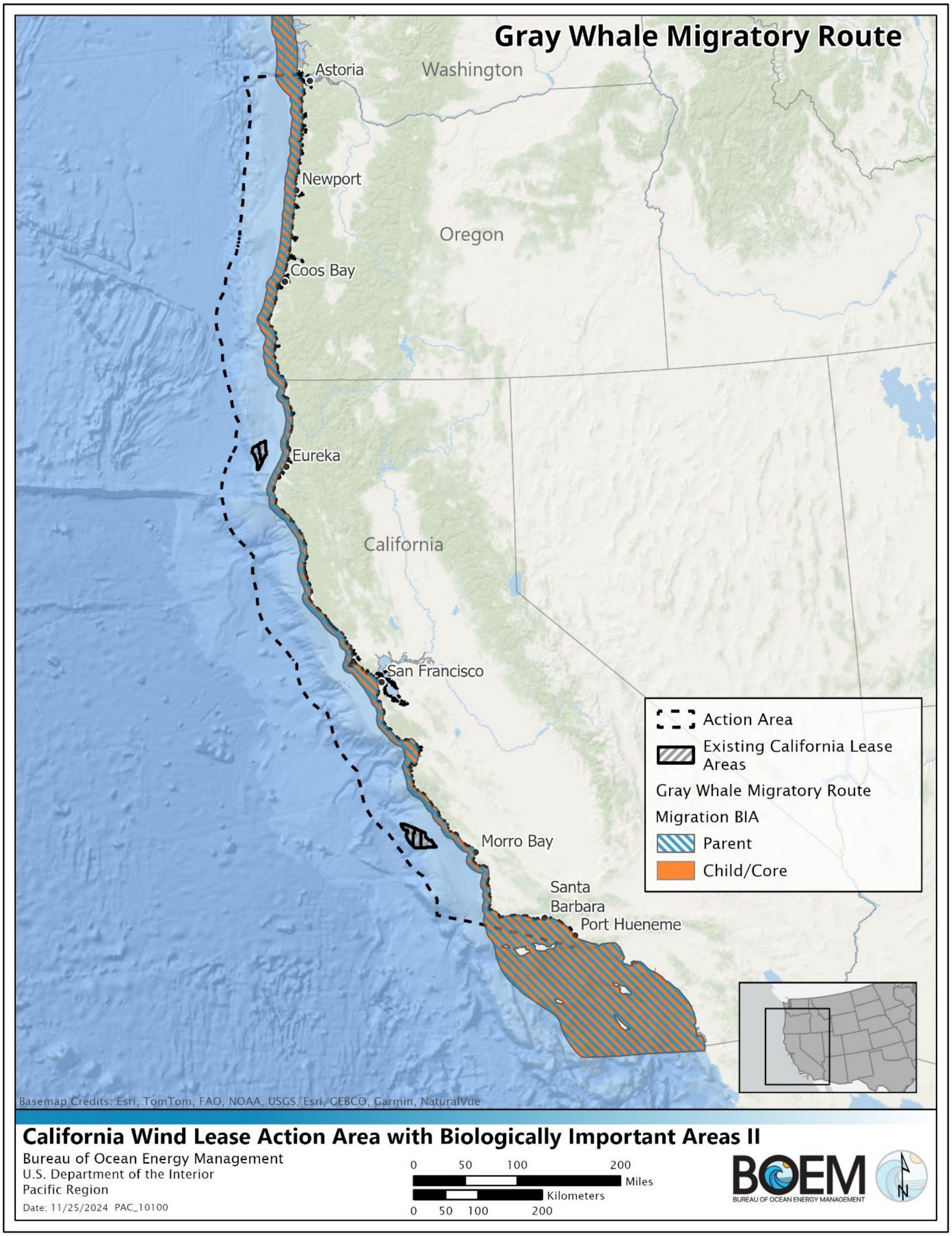

Figure 10. Migratory BIAs for gray whales (Calambokidis et al. 2024) relative to the Action Area.

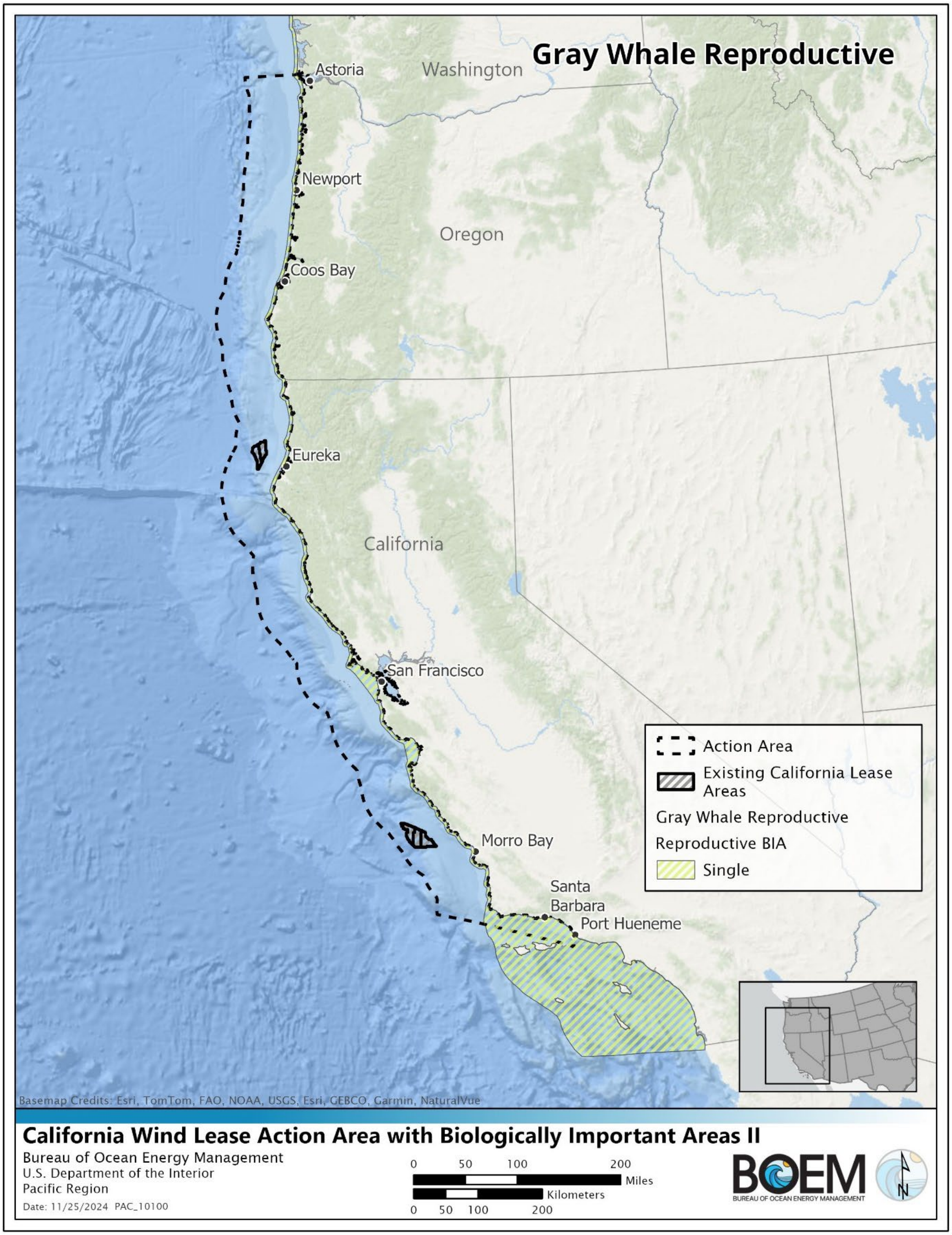

Figure 11. Reproductive BIA for gray whales (Calambokidis et al. 2024) relative to the Action Area.

Sperm Whale (*Physeter macrocephalus*)

Sperm whales consume a variety of squid and fish; females feed mostly on deep-living species of squid, whereas males often forage for bottom-dwelling fish (Whitehead 2003; Whitehead et al. 2008). Based on habitat models derived from line-transect survey data collected between 1991 and 2008 off the U.S. West Coast, sperm whales show an apparent preference for deep waters (Barlow et al. 2009; Becker et al. 2012; Becker et al. 2010; Forney et al. 2012). Sperm whales are distributed across the entire North Pacific and into the southern Bering Sea in summer, but the majority are thought to be south of 40°N in winter (Rice 1974; 1989; Miyashita et al. 1995). Sperm whales are found year-round in California waters (Dohl et al. 1983; Barlow 1995; Forney et al. 1995), but they reach peak abundance from April through mid-June and from the end of August through mid-November (Rice 1974). Sperm whales are seen off Washington and Oregon in every season except winter (Green et al. 1992). Of 176 sperm whales that were marked with Discovery tags off southern California in winter between 1962 and 1970, only three were recovered by whalers: one off northern California in June, one off Washington in June, and one far off British Columbia in April (Rice 1974).

Since 1978, there have been accounts of at least three other stranded sperm whales, including two in 2008, recorded by the Humboldt State University Vertebrate Museum. No sperm whales were reported from 30 surveys conducted off Eureka in fall 1991–2007 (Calambokidis 2009). Only two sperm whales were observed in low-elevation aerial surveys, both at depths of 656–6,561 ft (200–2,000 m) (Adams et al. 2014); satellite tracking has indicated their migration occurs along the continental shelf break, and passive acoustic monitoring has detected them in the Eel River Canyon.

The sperm whale has been listed as endangered since 1970 under the precursor to the ESA (NMFS 2009), but there is no designated critical habitat for this species in the North Pacific. Sperm whales within the Pacific US EEZ are divided into three discrete, non-contiguous areas: California, Oregon, and Washington waters, waters around Hawaii, and Alaska waters (Carretta et al. 2020). Sperm whales in the California Current have been identified as demographically independent from animals in Hawaii and the Eastern Tropical Pacific (Mesnick et al. 2011). The best estimate of sperm whale abundance in the California Current is the trend-based estimate corresponding to the most recent 2014 survey, or 1,997 (CV = 0.57) whales (Moore and Barlow 2014).

The fishery most likely to injure or kill sperm whales from this stock is the California thresher shark/swordfish drift gillnet fishery (Julian and Beeson 1998, Carretta et al. 2019a; 2019b), although sablefish hook and line fishery, entanglements in unknown fisheries, ingestion of marine debris and vessel strikes are also threats to this species (Carretta et al. 2020). For the 1991–2014 study period, conclusions about whether the population has increased or decreased are uncertain (Moore and Barlow 2017).

Southern Resident Killer Whale (*Orcinus orca*)

The Eastern North Pacific Southern Resident stock of killer whales is composed of three matrilineal pods named J, K, and L (Bigg et al. 1990) and occur in the inland waterways of Puget Sound, Strait of Juan de Fuca, and southern Georgia Strait in spring, summer, and fall. Little is known about their fall, winter, and spring movements, but they have been reported in coastal waters off Oregon and Washington, especially in the area between Grays Harbor and the Columbia River (Ford et al. 2000, Hanson et al. 2017), and travel as far south as central California and as far north as the Southeast Alaska. Although less is known about the whales' movements in outer coastal waters, satellite tagging, opportunistic sighting, and acoustic recording data suggest that Southern Residents spend nearly all of their time on the continental shelf, within 34 km (21.1 mi) of shore in water less than 200 m (656.2 ft) deep (Hanson et al. 2017). Details of their winter range from satellite-tagging reveal whales use the entire Salish Sea (northern end of the Strait of Georgia and Puget Sound) in addition to coastal waters from the central west coast of Vancouver Island, British Columbia to Pt. Reyes in northern California (Carretta et al. 2020). Of the three pods comprising this stock, one (J) is commonly sighted in inshore waters in winter, while the other two (K and L) apparently spend more time offshore (Ford et al. 2000). Krahn et al. (2009) described sample pollutant ratios from K and L pod whales that were consistent with a hypothesis of time spent foraging in California waters, which is consistent with sightings of K and L pods as far south as Monterey Bay. On the basis of available information, it is likely that pods K and L of will travel by and perhaps through the nearshore portions of the Action Area (e.g., to depths of 656 ft [200 m] at infrequent intervals in winter or spring). They could forage for migrating Chinook salmon at the Klamath River mouth because of the abundance of prey. The two rivers closest to the Humboldt WEA, the Mad and Eel, have very few Chinook salmon in comparison, although Chinook salmon from the Sacramento River are regularly caught in nearshore fisheries in the Action Area (Bellinger et al. 2015).

Following the peak census count of 99 animals in 1995, the population size has declined approximately 1% annually and currently stands at 73 animals as of the 2019 census (Ford et al. 2000; Center for Whale Research 2020). A population viability analysis identified several risk factors to this population, including limitation of preferred Chinook salmon prey, anthropogenic noise and disturbance resulting in decreased foraging efficiency, vessel strikes and high levels of contaminants, including PCBs and DDT (Erbe 2002; Clark et al. 2009; Krahn et al. 2007; 2009; Lacy et al. 2017; Carretta et al. 2020).

The Southern Resident distinct population segment (DPS) was federally listed as endangered in 2005 (70 FR 69903). Critical habitat for this DPS was designated in the summer core area in Haro Strait and waters around the San Juan Islands, Puget Sound, and the Strait of Juan de Fuca (79 FR 69054). In August 2021, additional critical habitat was designated along the U.S. West Coast from the Canadian border to Point Sur, California, including offshore of Humboldt County between depths of 6.1–200 m (20–656 ft) (86 FR 41668). Critical habitat does not overlap with the Humboldt and Morro Bay WEAs; however, vessels transiting from Coos Bay, Crescent City, or San Francisco Bay would intersect critical habitat en route to the Humboldt WEA. Small and resident BIA (S-BIA) parent and core areas were delineated for Southern Resident Killer Whales (Calambokidis et al. 2024). The S-BIAs overlap with the Action Area (Figure 12).

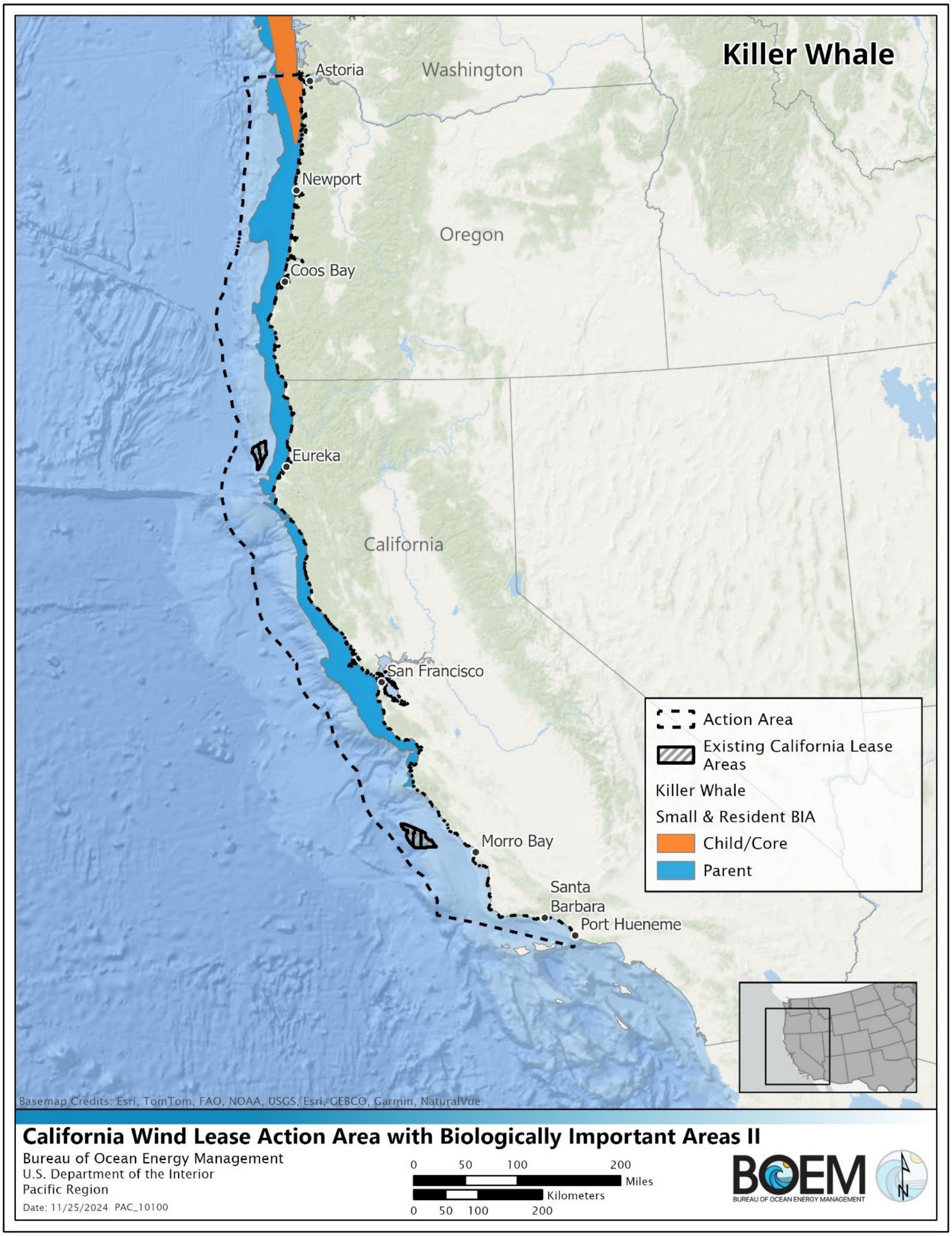

Figure 12. Small and resident BIAs of Southern Resident killer whales (Calambokidis et al. 2024) relative to the Action Area.

Guadalupe Fur Seal (*Arctocephalus townsendii*)

The Guadalupe fur seal is a pelagic species for most of the year, occurring in the subtropical waters of southern California and Mexico. Breeding occurs almost entirely on Isla de Guadalupe, Mexico, from May to July (CMLPAI 2009; NMFS 2019a). In recent years, several Guadalupe fur seals have been consistently observed at San Miguel Island. In 1997, a pup was observed there but no other pups were observed until 2008. Breeding colonies may occur on San Miguel and San Nicolas Islands (Pacific Marine Mammal Center 2023). Guadalupe fur seals are solitary, non-social animals, but males may mate with up to 12 females during the breeding season (NMFS 2019a). They feed in deep waters on krill, squid, and small schooling fish (CMLPAI 2009). Unusual mortality events (UME), in the form of increased strandings of Guadalupe fur seals, have occurred along the entire coast of California, beginning in January 2015 at eight times higher than the historical average. Strandings have continued since 2015 at well above average rates in California. Additionally, Guadalupe fur seal strandings in Oregon and Washington became elevated in 2019. Along the U.S. West Coast, strandings occur almost annually in California waters and animals are increasingly observed in Oregon and Washington waters (Carretta et al. 2020). Most stranded animals were less than 2 years old, malnourished with secondary bacterial and parasitic infections (NMFS 2019b; Carretta et al. 2020). Guadalupe fur seals that stranded in central California and treated at rehabilitation centers were fitted with satellite tags and documented to travel as far north as Graham Island and Vancouver Island, British Columbia, Canada (Norris et al. 2015). Some satellite-tagged animals traveled far offshore outside the U.S. EEZ to areas 700 nmi west of the California-Oregon border. The population is considered to be a single stock because all are recent descendants from one breeding colony at Isla Guadalupe, Mexico (Carretta et al. 2020).

Current threats include incidental mortality and serious injury in commercial and unidentified fisheries, entanglement in marine debris and shootings (Carretta et al. 2020).

The Guadalupe fur seal was federally listed as endangered in 1967 and then re-listed as threatened in 1985 (NOAA 1985). The main reason for listing was a severe population decline due to hunting. No critical habitat has been designated for the Guadalupe fur seal. Since their listing, Guadalupe fur seals have significantly increased in numbers with an estimated annual rate of increase of 5.9% (range 4.1–7.7%) (García-Aguilar et al. 2018). The minimum population size of 31,019 animals is taken as the lower bound of the estimate provided by García-Aguilar et al. (2018) in Muto et al. (2020).

Marine Mammal Unlikely to Occur in the Action Area

North Pacific Right Whale (*Balaena japonica*)

The likelihood of a North Pacific right whale being present in the Action Area is extremely low, as in recent years this species has only been routinely observed or acoustically detected in the Bering Sea (Brownell et al. 2001; Filatova et al. 2019; NMFS 2017a; Shelden et al. 2005; Wade et al. 2010; 2011; Wright et al. 2019; 2018; Zerbini et al. 2015; 2010), with occasional sightings of individuals in the Gulf of Alaska (Matsuoka et al. 2014; Širović et al. 2015b; Wade et al. 2011), waters off British Columbia and the border with Washington State (Ford et al. 2016; Širović et al. 2015a; U.S. Navy 2015), and Southern California (Muto et al. 2018). The most recent estimated population for the eastern North Pacific right whale is between 26 and 31 individuals (Muto et al. 2020). Although this estimate may be reflective of a Bering Sea subpopulation, the total eastern North Pacific population is unlikely to be much larger (Wade et al. 2010). There have been only four sightings, each of a single right whale, in Southern California waters over approximately the last 30 years (in 1988, 1990, 1992, and 2017) (Brownell et al. 2001; Carretta et al. 1994; NMFS 2017a). Sightings off California are rare, and there is no evidence that the western coast of the United States was ever highly frequented by this species (Brownell et al. 2001; NMFS 2017a; Scammon, 1874). Historically, even during the period of U.S. West Coast whaling through the 1800s, right whales were considered uncommon to rare off California (Reeves and Smith, 2010; Scammon, 1874). For the reasons presented above, North Pacific right whales are not expected to be present during any proposed activities in the Action Area and as a result are considered to have **no effects** from the Proposed Action and will not be further discussed.

Sea Turtles Likely to Occur in the Action Area

Detailed species descriptions, including state, habitat ranges, population trends, predator/ prey interactions, and species-specific threats are described in Argonne (2019), H.T. Harvey and Associates (2020), and U.S. Navy (2022), and are included by reference and summarized below.

Four ESA-listed species of sea turtles may occur in waters offshore the Action Area: leatherback sea turtle *(Dermochelys coriacea),* green sea turtle *(Chelonia mydas),* loggerhead sea turtle *(Caretta caretta)*, and olive ridley sea turtle *(Lepidochelys olivacea)*. Two species are federally endangered: leatherback and loggerhead sea turtle (North Pacific Ocean Distinct Population Segment [DPS]); and two species are federally threatened: the green sea turtle (East Pacific DPS) and olive ridley sea turtle (*Lepidochelys olivacea*). No known nesting habitat for any of these turtles occurs in the Action Area. Threats to sea turtles include climate change, incidental capture, entanglement, and injury/death from fishing gear; marine debris; environmental contamination; disease, loss, or degradation of nesting habitat; beach armoring; artificial lighting; non-native vegetation; and directed harvest (NMFS 2015).

Leatherback Sea Turtle (*Dermochelys coriacea*)

Leatherbacks may be the most common species of sea turtle in the Action Area, but they continue to be rarely seen. About 150 to 170 leatherback sea turtles occur annually off the California coast between Point Conception and Point Arena during the summer and fall (June and stay until mid-October) whereafter they move to waters off Hawaii. Diet is primarily jellyfish, but they also consume other invertebrates, small fish, and plant material (NMFS 2016a; Nafis 2018). They are typically observed in deeper waters over the continental slope, and while mostly pelagic, the leatherback sea turtle occasionally enters shallower waters of bays and estuaries (NMFS 2016b).

They are the most pelagic of the four sea turtle species that may occur along the California coast but occasionally enter shallower waters of bays and estuaries (NMFS 2016b). In the fall of 1990 to 2003, aerial line-transect surveys for marine mammals and sea turtles were conducted in waters less than 302 ft (92 m) depth, and within 21 mi (34 km) of the central and northern California shore, from Point Conception to the Oregon border (Benson et al. 2007). Two to 28 leatherback sea turtles per year were reported, for a total of 100 individuals during the 13-year survey period. The lowest densities were in south-central California and the northern coast (including Humboldt County), and the highest was along the central coast. None of the individuals reported from the northern coast were north of Cape Mendocino in Mendocino County. However, tagged leatherback sea turtles have been observed offshore of the northern California coast (Benson et al. 2011; TOPP 2019). In addition, recreational and commercial fishermen have reported sightings in the area and several sightings off Humboldt County, including Shelter Cove and Humboldt Bay, were reported in the 1970s.

Hazen et al. (2018) developed a habitat suitability model to predict leatherback occurrence in the California Current Ecosystem. The model incorporated satellite tracking data from 20 tagged leatherbacks to aid in characterizing the type of habitat coincident with leatherback occurrence. The bathymetry (i.e., water depth and seafloor features) and sea surface temperature were the most informative habitat features in predicting the occurrence of leatherbacks in the California Current Ecosystem and seems to align where persistent upwelling occurs. Although leatherback sea turtles are rarely sighted during surveys, and tend to occur in pelagic waters, of all four of the sea turtle species, the leatherback sea turtle is most likely to occur in the Action Area.

The leatherback sea turtle is currently listed as a single population and is classified as endangered under the ESA (35 FR 8491). However, USFWS and NMFS completed a review of the status of the leatherback in 2020 and have identified seven leatherback DPSs based on nesting locations and foraging distribution: Northwest Atlantic, Southwest Atlantic, Southeast Atlantic, Southwest Indian, Northeast Indian, West

Pacific, and East Pacific (NMFS and USFWS 2020a). While USFWS and NMFS have identified and defined the seven DPSs, the population has not been established and listed as DPSs under the ESA, which requires official rulemaking and publication in the Federal Register (16 United States Code 1533(a)(1)), and no effort to this extent is anticipated. Recent information on population structure (through genetic studies) and distribution (through telemetry, tagging, and genetic studies) have led to an increased understanding and refinement of the global population structure and supported the separation of the population into DPSs (NMFS and USFWS 2020a; Wallace et al. 2010). Only leatherbacks from the West Pacific DPS could occur in the Action Area.

Most leatherback nesting populations in the Pacific Ocean are faring poorly and have declined by more than 80 percent since the 1980s. Because the threats to smaller subpopulations have not been eliminated, the International Union for Conservation of Nature has predicted a decline of 96 percent for the western Pacific subpopulation and a decline of nearly 100 percent for the eastern Pacific subpopulation by 2040 (NMFS 2016a; Sarti-Martinez et al. 1996). Along the U.S. West Coast, which serves as a major foraging ground for leatherbacks, a recent study concluded that the number of leatherbacks foraging off the coast declined by 5.6 percent annually between 1990 and 2017, representing an 80 percent decline in the foraging population over that time period (Benson et al. 2020). From 1990 to 2003, Benson et al. (2020) estimated that an average of 128 leatherbacks foraged in Central California waters, whereas from 2004 to 2017, the number declined to an average of 55 leatherbacks. The decline in the number of foraging leatherbacks off California continued despite favorable foraging conditions and the availability of prey (brown sea nettle), suggesting other factors are perpetuating the long-term decline (Benson et al. 2020).

A total index of nesting female abundance of the West Pacific population was estimated to be 1,277 females. Leatherback turtles of the West Pacific DPS nest in tropical and subtropical latitudes primarily in Indonesia, Papua New Guinea, and Solomon Islands, and to a lesser extent in Vanuatu (Dutton et al. 2007; Benson et al. 2007a; Benson et al. 2007b; Benson et al. 2011). Oceanic currents help to structure the spatial and temporal distribution of juveniles which lead them to foraging and developmental habitats (e.g., the North Pacific Transition Zone); they undertake seasonal migrations seeking favorable oceanic habitats/temperatures and abundant foraging resources (Gaspar et al. 2012).

Causes for the decline in the Pacific include the intensive egg harvest at leatherback rookeries and high levels of mortality through the 1980s associated with bycatch in the gill net fisheries (NMFS and USFWS 2020a). The trend in the foraging population off Central California is similar to declines of about 6 percent annually in the nesting population on Indonesian beaches (Benson et al. 2020).

Critical habitat has been designated to include the waters from Cape Flattery, Washington to Winchester Bay, Oregon, out to the 2,000 m isobath (NMFS 2012). In California, critical habitat extends from Point Arena to Point Arguello, inshore of the 3,000 m depth contour (NMFS 2012), which overlaps with the entire Morro Bay WEA and associated Action Area (Figure 5). Critical habitat was not designated off Humboldt County (NMFS 2012) and does not overlap with the Humboldt WEA, however vessels transiting from San Francisco Bay would transit through the northern extent of leatherback critical habitat.

Loggerhead Sea Turtle (*Caretta caretta*)

In the eastern Pacific, loggerhead sea turtles are reported from Chile to Alaska. They are occasionally sited from the coasts of Washington and Oregon, but most records are of juveniles off the coast of California. The most important development habitats for juveniles along the eastern Pacific are off the west coast of Mexico, including the Baja Peninsula. The only known nesting areas in the North Pacific are found in southern Japan (NMFS 2017b) and do not nest within the Action Area. Sightings in California tend to occur from July to September but can occur over most of the year during El Niño years when ocean temperatures rise. The loggerhead sea turtle is primarily pelagic, but occasionally enters coastal bays, lagoons, salt marshes, estuaries, creeks, and mouths of large rivers (NMFS and USFWS 2020). Loggerhead sea turtles consume whelks and conchs, but also sponges, crustaceans, jellyfish, worms, squid, barnacles, fish, and plants (NMFS 2017b; NMFS and USFWS 2020). Loggerhead sea turtles have been observed at scattered locations from Point Conception to the U.S./Mexico border (NMFS and USFWS 2020).

In 2015, Eguchi et al. (2018) conducted an aerial survey of the southern California Bight extending approximately from Pt. Conception to south of the U.S.-Mexico border and offshore as far as 123 N. Over 200 loggerheads were encountered during the survey, which coincided with anomalously high sea surface temperatures and a strong El Niño. El Niño conditions in the eastern North Pacific coupled with other largescale ocean-atmosphere circulations in the western tropical Pacific resulted in anomalously warm sea surface temperatures in the region and affected the ranges of numerous marine species (Bond et al. 2015).

A previous survey in the same region conducted in 2011 during a La Niña (anomalously cold) year encountered no loggerheads. Eguchi et al. (2018) estimated an offshore density of 0.24 loggerheads per km^2, which is comparable to the density estimated off the Baja Peninsula (Seminoff et al. 2014) and suggests that loggerheads that typically forage off the Baja Peninsula may take advantage of productive foraging habitat to the north when anomalously warm water temperatures persist. It is also possible that loggerheads foraging off southern California are part of the Central Pacific foraging group, which may follow warmer waters eastward into the California Current Ecosystem (Abecassis et al. 2013; Allen et al. 2013; Eguchi et al. 2018). Increasing ocean temperatures associated with climate change may, over time, allow foraging loggerheads to expand their range north on a more regular basis (Eguchi et al. 2018).

While loggerheads, primarily juveniles, are known to occur at sea off central and southern California, they do not nest on California beaches. Based on multiple studies conducted in the North Pacific, loggerhead sea turtles are known to occur in areas where sea surface temperature ranges between 10 and 28.7°C; however, mean sea surface temperatures, which are more indicative of preferred habitat, ranged between 16.3 and 24°C (Eguchi et al. 2018). Below 15°C, loggerheads become lethargic and inactive, and when temperatures fall to 10°C, they become cold-stunned (Mrosovsky 1980). Sea surface temperatures in the Action Area are generally cooler than temperatures preferred by loggerhead sea turtles, except for periods (e.g., during El Niño conditions) when water temperatures can be as much as 4 to 5°C warmer than during “normal” conditions. Occurrence of loggerheads would only be expected during summer and fall when water temperatures are more likely to be within their preferred range.

In waters off of the U.S. West Coast, most records of loggerhead sightings, stranding events, and incidental bycatch have been of juveniles documented from the nearshore waters (Eguchi et al. 2018). In general, sea turtle sightings increase during the summer, peaking from July to September off Southern California and southwestern Baja California, with fewer loggerheads expected farther north in the Action Area (Eguchi et al. 2018). No loggerhead nesting occurs within the Action Area.

Despite historic long-term declines at nesting beaches in Japan of 50–90 percent since the year 2000 nesting populations in Japan appear to be gradually increasing or remaining stable (Chapman and Seminoff 2016; NMFS and USFWS 2007).

In 2009, a status review conducted for the loggerhead (the first turtle species subjected to a complete stock analysis) identified nine DPSs within the global population (Conant et al. 2009). In a September 2011 rulemaking, the NMFS and USFWS listed five of these DPSs as endangered and kept four as threatened under the ESA, effective as of October 24, 2011 (76 FR 58868). The North Pacific Ocean, South Pacific Ocean, North Indian Ocean, Northeast Atlantic Ocean, and Mediterranean Sea DPSs of the loggerhead sea turtle are classified as endangered under the ESA, and the Southeast Indo-Pacific Ocean, Southwest Indian Ocean, Northwest Atlantic Ocean, and South Atlantic Ocean DPSs are classified as threatened. Only the North Pacific Ocean DPS occurs within the Action Area; however, mixing is known to occur between other populations in the Pacific and Indian Oceans, enabling a limited amount of gene flow with other DPSs (Gaos 2011). A 5-year review was conducted on the North Pacific DPS, and no changes were made to the listing status (NMFS and USFWS 2020b)

There is no critical habitat designated for loggerhead sea turtles within the Action Area.

Green Sea Turtle (*Chelonia mydas*)

The green sea turtle occurs worldwide in surface waters that remain above 22°C (Van Houtan et al. 2015). In the eastern North Pacific, green sea turtles have been sighted as far north as Alaska, but most commonly occur from southern California to northwestern Mexico (Hanna et al. 2021; NMFS 2016c). Green sea turtles occur year-round off the Southern California coast with highest concentrations occurring duly July through September (BSEE 2011). The green sea turtle is usually seen in El Niño years when ocean temperatures are warmer than normal. Climate change and ocean warming trends may impact the habitat and range of this species over time (Fuentes et al. 2013). It inhabits shallow waters of lagoons, bays, estuaries, mangroves, eelgrass, and seaweed beds; it prefers areas with abundant vegetation in shallow, protected water. Green sea turtles are herbivorous, feeding primarily on algae and seagrasses (NMFS 2016c).

The green sea turtle was first listed under the ESA in 1978. In 2016, NMFS and USFWS reclassified the species into 11 “distinct population segments” (DPSs), which maintains federal protections while providing a more tailored approach for managers to address specific threats facing different populations (81 FR 20057). The geographic areas that include these DPSs are (1) North Atlantic Ocean, (2) Mediterranean Sea, (3) South Atlantic Ocean, (4) Southwest Indian Ocean, (5) North Indian Ocean, (6) East Indian Ocean – West Pacific Ocean, (7) Central West Pacific Ocean, (8) Southwest Pacific Ocean, (9) Central South Pacific Ocean, (10) Central North Pacific Ocean, and (11) East Pacific Ocean.

Only the East Pacific Ocean DPS could potentially overlap with the Action Area. This segment is listed as threatened under the ESA; however, it should be noted that minimal mixing may occur (gene flow) with other population segments (Seminoff et al. 2015). Counts of adult females at nesting sites in Mexico, Costa Rica, and Ecuador used by the East Pacific DPS were used to estimate an abundance of over 20,000 nesters (Seminoff et al. 2015).

Ocean waters off central and Southern California are considered areas of occurrence because of the presence of nearshore rocky ridges and channels and floating kelp habitats suitable for green sea turtle foraging and resting (Stinson 1984); however, these waters are often at temperatures below the thermal preferences of this primarily tropical species, and turtles found in these waters are likely transiting to warmer waters (Crear et al. 2016).

NOAA has proposed marine critical habitat for the East Pacific DPS from the Santa Monica Bay south to San Diego [88 FR 46572]. However, there is no critical habitat designated or proposed for the green sea turtle in the Action Area.

Olive Ridley Sea Turtle (*Lepidochelys olivacea*)

The olive ridley has a global tropical distribution, occurring in the Atlantic, Pacific, and Indian oceans (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2014). In the eastern Pacific, olive ridley typically occur in tropical and subtropical waters, as far south as Peru and as far north as California, but occasionally have been documented as far north as Alaska. The number of olive ridley sea turtles occurring in U.S. territorial waters is believed to be small (NMFS and USFWS 1998; 2014).

Studies from different populations of olive ridley sea turtles show a strong preference for neritic waters (shallow, nearshore waters overlying the continental shelf) (Plot et al. 2015; Polovina et al. 2004; Rees et al. 2018). However, deep water foraging has been documented in the North Pacific, where prey items are scattered and less predictable and migrate widely from nesting locations (Polovina et al. 2004). Comparing olive ridley habitat use in different regions, Plot et al. (2015) suggest that the differing migration patterns observed (i.e., oceanic migrations versus neritic movements) may be attributed to specific environmental conditions of the areas in close proximity to nesting sites. There are no known nesting sites within U.S. territory.

Olive ridley sea turtles primarily occupy areas where the sea surface temperature is between 23 and 28°C (Polovina et al. 2004) and most frequently around 27°C (Eguchi et al. 2007). Between 10 and 13.5°C, olive ridleys become cold stunned (Mrosovsky 1980). Sea surface temperatures in the Action Area are expected to be cooler than temperatures preferred by olive ridley sea turtles, and the occurrence of olive ridleys would only be expected during unusually warm temperatures, such as during an El Niño event (Spotila 2004).

Olive ridley sea turtles that nest along the Pacific coast of Mexico are listed as endangered under the ESA, while all other populations are listed under the ESA as threatened (43 FR 32800). Based on genetic data, the worldwide olive ridley population is composed of four main lineages: east India, Indo-Western Pacific, Atlantic, and eastern Pacific Ocean (NMFS and USFWS 2014; Shankar et al. 2004). Off of California, olive ridleys are thought to be within the eastern Pacific Ocean lineage (NMFS and USFWS 2014).

There is no critical habitat designated for olive ridley sea turtles in the Action Area.

Salmonid Fishes

Chinook Salmon (*Oncorhynchus tshawytscha*)

Chinook salmon are an anadromous fish species that are found along the Pacific coast and inland from Ventura River in California to Point Hope, Alaska and in northeast Asia. On occasion they have been found further south. Like other Pacific salmon species, they are semelparous and spawning occurs in freshwater from August through February. Chinook salmon can spend up to a year in freshwater before migrating downstream to the ocean. They spend 2 to 8 years in the ocean before migrating back to natal freshwater rivers and streams to spawn.

Given this widespread geographic distribution, Chinook salmon have developed diverse and complex life history strategies. Chinook salmon can be categorized as either “stream-type” or “ocean-type” strategists. Stream-type Chinook salmon reside in freshwater for a year or more following emergence, whereas “ocean-type” Chinook salmon migrate to the ocean predominantly within their first year. In addition to differences in freshwater life histories, there appears to be differing ocean use patterns between these stream-type and ocean-type Chinook salmon. Stream-type populations appear to undertake extensive offshore ocean migrations while ocean-type Chinook salmon undertake distinct, coastally oriented, ocean migrations (Good et al. 2005).

Juvenile Chinook salmon exhibit a patchy distribution in U.S. West Coast waters; in pelagic trawl surveys conducted in summer and fall along Oregon and Washington, half of all juvenile salmonids were collected in about 5 percent of the surveys, and none were collected in about 40 percent of the surveys (Peterson et al. 2010). In general, salmonids are low in abundance in U.S. West Coast waters when compared to other fish, as evidenced by: (1) the low numbers of juvenile salmonids captured in directed pelagic surface/ subsurface research trawls relative to other nekton (Brodeur et al. 2004, Brodeur et al. 2005, Fisher et al. 2014, Peterson et al. 2010, Trudel et al. 2009), and (2) the low numbers of adult and subadult salmonids captured as bycatch in midwater trawls (e.g., commercial trawls for whiting, see Lomeli and Wakefield 2014).

Juvenile salmonids are pelagic and typically surface-oriented, most often found in the upper 20 m of the water column (Emmett et al. 2004, Walker et al. 2007, Beamish et al. 2000). Adult coho salmon tend to occur at shallower depths (< 40 m) than adult Chinook salmon (Walker et al. 2007). Juvenile Chinook salmon tend to occur closer inshore than other juvenile salmonid species, generally within the 100-meter isobath (Brodeur et al. 2004, Peterson et al. 2010), and occasionally being found in the surf zone (Marin Jarrin et al. 2009). Once in the ocean, Chinook salmon feed upon small crustaceans, other invertebrates as juveniles, and larval and juvenile fish as adults (Love 1996).

Within the Action Area, nine evolutionary significant units (ESUs) may occur that are either threatened or endangered under the ESA.

Sacramento River winter-run Chinook ESU (Endangered)

The listing status for this Chinook salmon ESU was determined to be endangered on January 4, 1994, (59 FR 440). Critical habitat was designated on June 16, 1993, (58 33212) and does not overlap with the Action Area. This ESU includes winter-run Chinook salmon spawning naturally in the Sacramento River and its tributaries, as well as winter-run Chinook salmon that are part of the conservation hatchery program at the Livingston Stone National Fish Hatchery.

Upper Columbia River spring-run Chinook ESU (Endangered)

The listing status for this Chinook salmon ESU was determined to be endangered on March 24, 1999 (64 FR 14308) and June 28, 2005 (70 FR 37159); updated April 14, 2014 (79 FR 20802). Critical habitat was designated on September 2, 2005 (70 FR 52630) and does not overlap with the Action Area. This ESU includes naturally spawned spring-run Chinook salmon originating from Columbia River tributaries upstream of the Rock Island Dam and downstream of Chief Joseph Dam (excluding the Okanogan River subbasin). This ESU also includes Chinook salmon from several artificial propagation programs.

California coastal Chinook ESU (Threatened)

The listing status for this Chinook salmon ESU was determined to be threatened on September 16, 1999 (64 FR 50394). Critical habitat was designated on September 2, 2005 (70 FR 52488) and does not overlap with the Action Area. On June 28, 2005, (70 FR 159) NMFS confirmed the listing of California Coastal Chinook salmon as threatened under the ESA and also added seven artificially propagated populations from the following hatcheries or programs to the listing. This ESU includes all naturally spawned populations of Chinook salmon from rivers and streams south of the Klamath River (Humboldt County, CA.) to the Russian River (Sonoma County, CA).

Central Valley spring-run Chinook ESU (Threatened)

The listing status for this Chinook salmon ESU was determined to be endangered on September 16, 1999 (FR 64 50394). Critical habitat was designated on September 2, 2005 (70 FR 52630) and does not overlap with the Action Area. This ESU includes naturally spawned spring-run Chinook salmon originating from the Sacramento River and its tributaries, and also spring-run Chinook salmon from the Feather River Hatchery Spring-run Chinook Salmon Program.

Lower Columbia River Chinook ESU (Threatened)

The listing status for this Chinook salmon ESU was determined to be threatened on May 24, 1999 (64 FR 14308) and June 28, 2005 (70 FR 37160); updated April 14, 2014 (79 FR 20802). Critical habitat was designated on September 2, 2005 (70 FR 52630) and does not overlap with the Action Area. This ESU includes all includes naturally spawned Chinook salmon originating from the Columbia River and its tributaries downstream of a transitional point east of the Hood and White Salmon Rivers, and any such fish originating from the Willamette River and its tributaries below Willamette Falls. This ESU also includes Chinook salmon from several artificial propagation programs.

Puget Sound Chinook ESU (Threatened)

The listing status for this Chinook salmon ESU was determined to be threatened on March 24, 1999 (64 FR 14308) and June 28, 2005 (70 FR 37160); updated April 14, 2014 (79 FR 20802). Critical habitat was designated on September 2, 2005 (70 FR 52630) and does not overlap with the Action Area. This ESU includes naturally spawned Chinook salmon originating from rivers flowing into Puget Sound from the Elwha River (inclusive) eastward, including rivers in Hood Canal, South Sound, North Sound and the Strait of Georgia. This ESU also includes Chinook salmon from several artificial propagation programs.

Snake River fall-run Chinook ESU (Threatened)

The listing status for this Chinook salmon ESU was determined to be threatened on April 22, 1992 (57 FR 14653) and June 28, 2005 (70 FR 37160); updated April 14, 2014 (79 FR 20802). Critical habitat was designated on December 28, 1993 (58 FR 68543) and does not overlap with the Action Area. This ESU includes all naturally spawned fall-run Chinook salmon originating from the mainstem Snake River below Hells Canyon Dam and from the Tucannon River, Grande Ronde River, Imnaha River, Salmon River, and Clearwater River subbasins. This ESU also includes Chinook salmon from several artificial propagation programs.

Snake River spring/summer-run Chinook ESU (Threatened)

The listing status for this Chinook salmon ESU was determined to be threatened on April 22, 1992 (57 FR 14653) and June 28, 2005 (70 FR 37160); updated April 14, 2014 (79 FR 20802). Critical habitat was designated on October 25, 1999 (64 FR 57399) and does not overlap with the Action Area. This ESU includes all naturally spawned spring/summer-run Chinook salmon originating from the mainstem Snake River and the Tucannon River, Grande Ronde River, Imnaha River, and Salmon River sub-basins. This ESU also includes Chinook salmon from several artificial propagation programs.

Upper Willamette River Chinook ESU (Threatened)

The listing status for this Chinook salmon ESU was determined to be threatened on March 24, 1999 (64 FR 14308) and June 28, 2005 (70 FR 37160); updated April 14, 2014 (79 FR 20802). Critical habitat was designated on September 2, 2005 (70 FR 52629) and does not overlap with the Action Area. This ESU includes naturally spawned spring-run Chinook salmon originating from the Clackamas River and from the Willamette River and its tributaries above Willamette Falls. This DPS also includes Chinook salmon from several artificial propagation programs.

Chum Salmon (*Oncorhynchus keta*)

Chum salmon are found are found throughout the North Pacific Ocean and range from the Arctic coast of Canada and throughout the northern coastal regions of North America and Asia. In the United States, chum salmon are found throughout Alaska and as far south as Yaquina Bay, Oregon, on the West Coast.

They are anadromous—they hatch in freshwater streams and rivers then migrate out to the saltwater environment of the ocean to feed and grow. Chum salmon do not reside in fresh water for an extended period and young chum salmon (fry) typically migrate directly to estuarine and marine waters soon after they are born. As they grow larger, they migrate offshore across the North Pacific Ocean. As they approach sexual maturity, they migrate back into coastal waters and return to the freshwater area where they were born to spawn, typically spawn between the ages of three and six. They spawn from late summer to March, with peak spawning concentrated in early winter when the river flows are high. They usually nest in areas in the lowermost reaches of rivers and streams, within 60 miles of the ocean. Young chum salmon feed on insects as they migrate downriver and on insects and marine invertebrates in estuaries and near-shore marine habitats. Adults eat copepods, fishes, mollusks, squid, and tunicates.

Within the Action Area, two ESUs may occur that are threatened under the ESA.

Columbia River Chum ESU (Threatened)

The listing status for this coho salmon ESU was determined to be threatened March 25, 1999 (64 FR 14508) and June 28, 2005 (70 FR 37160); updated April 14, 2014 (79 FR 20802). Critical habitat was designated on September 2, 2005 (70 FR 52630) and does not overlap with the Action Area. This ESU naturally spawned chum salmon originating from the Columbia River and its tributaries in Washington and Oregon. Coho salmon that originate from three artificial propagation programs are also included. This ESU also includes fish from a number of artificial propagation programs.

Hood Canal summer-run Chum ESU (Threatened)

The listing status for this coho salmon ESU was determined to be threatened on March 25, 1999 (64 FR 14508) and June 28, 2005 (70 FR 37160); updated April 14, 2014 (79 FR 20802). Critical habitat was designated on September 2, 2005 (70 FR 52630) and does not overlap with the Action Area. This ESU includes naturally spawned summer-run chum salmon originating from Hood Canal and its tributaries as well as from Olympic Peninsula rivers between Hood Canal and Dungeness Bay (inclusive). This ESU also includes fish from a number of artificial propagation programs.

Coho Salmon (*Oncorhynchus kisutch*)

Coho salmon are found in the North Pacific Ocean and inland from Monterey Bay, California to Point Hope, Alaska, and north Asia. They are semelparous and spawning takes place in freshwater from September through late January. Coho salmon typically exhibit a three-year life history, divided between 18 months in freshwater and 18 months in saltwater phases. In freshwater, coho salmon spawn and rear in small streams with stable gravels and complex habitat features, such as backwater pools, beaver dams, and side channels. Marine survival and growth of coho salmon are linked to food availability, environmental conditions, and stressors present in the nearshore environment. Juvenile coho salmon disperse from their natal streams to coastal waters; their ocean distribution changes with time, with juveniles typically moving northward or farther offshore (Brodeur et al. 2004). Ocean dispersal rates for yearling Columbia River coho salmon averaged between 3.2 and 6.6 km/d (Fisher et al. 2014). Juvenile salmonids are pelagic and typically surface-oriented, most often found in the upper 20 meters of the water column (Emmett et al. 2004, Walker et al. 2007, Beamish et al. 2000). Adult coho salmon tend to occur at shallower depths (< 40 meters) than adult Chinook salmon (Walker et al. 2007).

In general, juvenile salmonids are low in abundance in U.S. West Coast waters when compared to other fish, as evidenced by the low numbers of juvenile salmonids captured in directed pelagic surface/subsurface research trawls relative to other nekton (Brodeur et al. 2004, Brodeur et al. 2005, Fisher et al. 2014, Peterson et al. 2010). Juvenile coho salmon exhibit a patchy distribution in U.S. West Coast waters; in pelagic trawl surveys conducted in summer and fall along Oregon and Washington, half of all juvenile salmonids were collected in about 5 percent of the surveys, and none were collected in about 40 percent of the surveys (Peterson et al. 2010). Juvenile coho salmon occur in coastal waters, usually further offshore than juvenile Chinook salmon (Brodeur et al. 2004, Peterson et al. 2010). While in the ocean, coho salmon primarily feed upon fish and planktonic invertebrates (Love 1996).

Within the Action Area four ESUs may occur that are either threatened or endangered under the ESA.

Central California Coast Coho ESU (Endangered)

The listing status for this coho salmon ESU was determined to be threatened under the ESA on October 31, 1996 (64 FR 56138); NMFS re-classified the ESU as endangered on June 28, 2005 (70 FR 37160); updated April 14, 2014 (79 FR 20802). Critical habitat was designated on May 5, 1999 (64 FR 24049) and does not overlap with the Action Area. This ESU includes naturally spawned coho salmon originating from rivers south of Punta Gorda, California, up to and including Aptos Creek, as well as such coho salmon originating from tributaries to San Francisco Bay. Coho salmon from three artificial propagation programs are included in this ESU.

Lower Columbia River Coho ESU (Threatened)

The listing status for this coho salmon ESU was determined to be threatened under the ESA on June 28, 2005 (70 FR 37160); updated April 14, 2014 (79 FR 20802). Critical habitat was designated on February 24, 2016 (81 FR 9251) and does not overlap with the Action Area. This ESU includes naturally spawned coho salmon originating from the Columbia River and its tributaries downstream from the Big White Salmon and Hood Rivers (inclusive) and any such fish originating from the Willamette River and its tributaries below Willamette Falls. Coho salmon that originate from a number of artificial propagation programs are also included.

Oregon coast Coho ESU (Threatened)

The listing status for this coho salmon ESU was determined to be threatened on August 10, 1998 (63 FR 42587) and June 20, 2011 (76 FR 35755); updated April 14, 2014 (79 FR 20802). Critical habitat was designated on February 11, 2008 (73 FR 7815) and does not overlap with the Action Area. This ESU includes naturally spawned coho salmon originating from coastal rivers south of the Columbia

River and north of Cape Blanco. This ESU also includes coho salmon from the Cow Creek Hatchery Program.

Southern Oregon and Northern California coasts Coho ESU (Threatened)

The listing status for this coho salmon ESU was determined to be threatened under the ESA on May 6, 1997 (62 FR 24588). The listing was revisited and confirmed as threatened on June 28, 2005 (70 FR 37160); updated April 14, 2014 (79 FR 20802). Critical habitat was designated on May 5, 1999 (64 FR 24049) and does not overlap with the Action Area. This ESU includes naturally spawned coho salmon originating from coastal streams and rivers between Cape Blanco, Oregon, and Punta Gorda, California. Coho salmon that originate from three artificial propagation programs are also included.

Steelhead (*Oncorhynchus mykiss irideus*)

Steelhead originally ranged from northern Mexico to southeastern Alaska and inland. They are iteroparous and spawning takes place in the spring. Juveniles typically spend 2 years in freshwater before migrating downstream the ocean. While in the ocean, steelhead feed upon insects, mollusks, crustaceans, fish eggs, and other small fishes (Love 1996).

Steelhead are rainbow trout that exhibit an anadromous life history pattern. By migrating to the ocean, steelhead grow to much larger sizes than their resident rainbow trout cohorts. Anadromous steelhead and resident rainbow trout can be considered to be from the same population, as anadromous parents can produce resident offspring and resident parents can produce anadromous offspring. This adaptive life history makes steelhead flexible to changing habitat conditions. Also, unlike other Pacific salmonids, they can spawn more than one time.

After emergence, young steelhead rear in freshwater streams for 1 to 4 years before out migrating to the ocean. After reaching the ocean in the spring, juvenile steelhead tend to move offshore quickly rather than use nearshore waters like other salmon. For example, Daly et al. (2014) captured tagged juvenile steelhead that migrated greater than 55 km offshore of the Columbia River within 3 days. While as sea, steelhead are found in pelagic waters of the Gulf of Alaska principally within 10 meters from the surface, though they sometimes travel to greater depths (Light et al. 1989).

Within the Action Area eleven distinct population segments (DPSs) may occur that are either threatened or endangered under the ESA.

Southern California Steelhead DPS (Endangered)

The listing status for this steelhead DPS was determined to be endangered on August 18, 1997 (62 FR 43937) and January 5, 2006 (71 FR 834); range extension on May 1, 2002 (67 FR 21586); updated April 14, 2014 (79 FR 20802). Critical habitat was designated on September 2, 2005 (70 FR 52536) and does not overlap with the Action Area. The Southern California Coast Steelhead DPS is comprised of a suite of anadromous steelhead populations that inhabit coastal stream networks from the Santa Maria River system south to the U.S. border with Mexico.

California Central Valley Steelhead DPS (Threatened)

The ESA listing status for this steelhead DPS was threatened on March 19, 1998 (62 FR 13347); reaffirmed January 5, 2006 (71 FR 834). Critical habitat was designated September 2, 2005 (70 FR 52630) and does not overlap with the Action Area. This DPS includes naturally spawned anadromous populations originating below natural and manmade impassable barriers from the Sacramento and San Joaquin Rivers and their tributaries; excludes such fish originating from San Francisco and San Pablo Bays and their tributaries. Steelhead from the following artificial propagation programs are also included within the DPS: Coleman National Fish Hatchery Program, Feather River Fish Hatchery Program, and Mokelumne River Hatchery Program.

Central California Coast Steelhead DPS (Threatened)

The ESA listing status for this steelhead DPS was threatened on August 18, 1997 (62 FR 43937) and January 5, 2006 (71 FR 834); updated April 14, 2014 (79 FR 20802). Critical habitat was designated

September 2, 2005 (70 FR 52630) and does not overlap with the Action Area. This DPS includes naturally spawned anadromous populations originating below natural and manmade impassable barriers from the Russian River to and including Aptos Creek, and all drainages of San Francisco and San Pablo Bays eastward to Chipps Island at the confluence of the Sacramento and San Joaquin Rivers. Steelhead from the following artificial propagation programs are also included within the DPS: Don Clausen Fish Hatchery Program and Kingfisher Flat Hatchery Program (Monterey Bay Salmon and Trout Project).

Lower Columbia River Steelhead DPS (Threatened)

The ESA listing status for this steelhead DPS was threatened on March 19, 1998 (63 FR 13347) and January 5, 2006 (71 FR 834); updated April 14, 2014 (79 FR 20802). Critical habitat was designated September 2, 2005 (70 FR 52630) and does not overlap with the Action Area. This DPS includes naturally spawned anadromous O. mykiss (steelhead) originating below natural and manmade impassable barriers from rivers between the Cowlitz and Wind Rivers (inclusive) and the Willamette and Hood Rivers (inclusive); excludes such fish originating from the upper Willamette River basin above Willamette Falls. This DPS also includes fish from a number of artificial propagation programs.

Middle Columbia River Steelhead DPS (Threatened)

The ESA listing status for this steelhead DPS was threatened on March 25, 1999 (64 FR 14517) and January 5, 2006 (71 FR 834); updated April 14, 2014 (79 FR 20802). Critical habitat was designated September 2, 2005 (70 FR 52630) and does not overlap with the Action Area. This DPS includes naturally spawned anadromous O. mykiss (steelhead) originating below natural and manmade impassable barriers from the Columbia River and its tributaries upstream of the Wind and Hood Rivers (exclusive) to and including the Yakima River; excludes such fish originating from the Snake River basin. This DPS also includes fish from a number of artificial propagation programs.

Northern California Steelhead DPS (Threatened)

The ESA listing status for this steelhead DPS was threatened on June 07, 2000 (65 FR 36074) and January 5, 2006 (71 FR 834); updated April 14, 2014 (79 FR 20802). Critical habitat was designated on September 2, 2005 (70 FR 52630) and does not overlap with the Action Area. This DPS includes naturally spawned anadromous steelhead originating below natural and manmade impassable barriers in California coastal river basins from Redwood Creek to and including the Gualala River.

Puget Sound Steelhead DPS (Threatened)

The ESA listing status for this steelhead DPS was threatened on May 11, 2007 (72 FR 26722); updated April 14, 2014 (79 FR 20802). Critical habitat was designated February 24, 2016 (81 FR 9252) and does not overlap withing the Action Area. This DPS includes naturally spawned anadromous O. mykiss (steelhead) originating below natural and manmade impassable barriers from rivers flowing into Puget Sound from the Elwha River (inclusive) eastward, including rivers in Hood Canal, South Sound, North Sound, and the Strait of Georgia. This DPS also includes fish from a number of artificial propagation programs.

Snake River Steelhead DPS (Threatened)

The ESA listing status for this steelhead DPS was threatened on August 18, 1997 (62 FR 43937) and January 5, 2006 (71 FR 834); updated April 14, 2014 (79 FR 20802). Critical habitat was designated September 2, 2005 (70 FR 52630) and does not overlap with the Action Area. This DPS includes all naturally spawned anadromous O. mykiss (steelhead) originating below natural and manmade impassable barriers from the Snake River basin. This DPS also includes fish from a number of artificial propagation programs.

South-Central California Coast DPS (Threatened)

The ESA listing status for this steelhead DPS was threatened on August 18, 1997 (62 FR 43937) and January 5, 2006 (71 FR 834); updated April 14, 2014 (79 FR 20802). Critical habitat was designated September 2, 2005 (70 FR 52630) and does not overlap with the Action Area. This DPS includes naturally spawned anadromous steelhead originating below natural and manmade impassable barriers from the Pajaro River to (but not including) the Santa Maria River.

Upper Columbia River Steelhead DPS (Endangered)

The ESA listing status for this steelhead DPS was endangered on August 18, 1997 (62 FR 43937); reclassified to threatened on January 5, 2006 (71 FR 834) and August 24, 2009 (74 FR 42605); updated April 14, 2014 (79 FR 20802). Critical habitat was designated September 2, 2005 (70 FR 52630) and does not overlap withing the Action Area. This DPS includes naturally spawned anadromous O. mykiss (steelhead) originating below natural and manmade impassable barriers from the Columbia River and its tributaries upstream of the Yakima River to the U.S.-Canada border. This DPS also includes fish from a number of artificial propagation programs.

Upper Willamette River Steelhead DPS (Threatened)

The ESA listing status for this steelhead DPS was threatened on March 25, 1999 (64 FR 14517) and January 5, 2006 (71 FR 834); updated April 14, 2014 (79 FR 20802). Critical habitat was designated September 2, 2005 (70 FR 52630) and does not overlap with the Action Area. This DPS includes naturally spawned anadromous winter-run steelhead originating below natural and manmade impassable barriers from the Willamette River and its tributaries upstream of Willamette Falls, to and including the Calapooia River.

Non-Salmonid Fishes

Scalloped Hammerhead Shark (*Sphyrna lewini*) Eastern Pacific DPS (Endangered)

The scalloped hammerhead shark, (*Sphyrna lewini),* Eastern Pacific DPS, was listed as endangered under the ESA on July 3, 2014 (79 FR 38214). On November 17, 2015, NMFS found that there are no marine areas within the jurisdiction of the United States that meet the definition of critical habitat for the Eastern Pacific DPS of scalloped hammerhead shark (80 FR 71774).

Sphyrna lewini is a semi-oceanic and cosmopolitan species globally distributed throughout tropical and warm temperate seas. Distribution in the eastern Pacific Ocean extends from the coast of southern California (U.S.), including the Gulf of California, to Ecuador and possibly Peru, and off waters of Hawaii (U.S.) and Tahiti (Miller et al. 2014). As either solitary individuals or in aggregations, it occurs over continental and insular shelves, as well as adjacent deep waters, but is seldom found in waters cooler than 22° C (Miller et al. 2014). It ranges from the intertidal and surface to depths of up to 450-512 m, with occasional dives to even deeper waters. It has also been documented entering enclosed bays and estuaries (Miller et al. 2014). The scalloped hammerhead shark is an apex predator and opportunistic feeder with a diet that includes a wide variety of teleost fishes, cephalopods, crustaceans, and rays (Miller et al. 2014). Adult hammerhead sharks are threatened by commercial fishing, mainly for the shark fin trade. Juveniles may be threatened by pollution and degradation of water quality (Miller et al. 2014).

Green Sturgeon (*Acipenser medirostris*), Southern DPS (Threatened).

The North American green sturgeon is an anadromous fish that occurs in the nearshore Eastern Pacific Ocean from Alaska to Mexico (Huff et al. 2012). Green sturgeons are long-lived, late-maturing, iteroparous, anadromous species that spawn infrequently in natal streams, and spend substantial portions of their lives in marine waters. NMFS has identified two distinct population segments (DPS) of green sturgeon: northern and southern (Israel et al. 2009). In 2006, NMFS determined that the Southern DPS of green sturgeon warranted listing as a threatened species under the ESA (71 FR 17757). Green sturgeon have been observed in large concentrations in the summer and autumn within coastal bays and estuaries along the west coast of the US, including the Columbia River estuary, Willapa Bay, Grays Harbor, San Francisco Bay and Monterey Bay (Huff et al. 2012; Lindley et al. 2011; Lindley et al. 2008; Moser and Lindley 2007).

On October 9, 2009, NMFS designated critical habitat for the Southern DPS of green sturgeon (74 FR 52300). Critical habitat is designated in coastal U.S. marine waters within 110 m (60 fathoms) depth from Monterey Bay, California (including Monterey Bay), north to Cape Flattery, Washington, including the Strait of Juan de Fuca, Washington, to its United States boundary; the Sacramento River, lower Feather River, and lower Yuba River in California; the Sacramento-San Joaquin Delta and Suisun, San Pablo, and San Francisco bays in California; the lower Columbia River estuary; and certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay, Winchester Bay, Yaquina Bay, and Nehalem Bay), and Washington (Willapa Bay and Grays Harbor). The portion of the critical habitat that lies within marine coastal zone overlaps with the Action Area associated with the Humboldt WEA but not the Morro Bay WEA.

Oceanic Whitetip Shark (*Carcharhinus longimanus*) (Threatened)

The oceanic whitetip shark (*Carcharhinus longimanus*) was listed as endangered under the ESA on January 30, 2018 (83 FR 4153). NMFS determined on March 5, 2020, that a designation of critical habitat was not prudent at this time (85 FR 12898).

The oceanic whitetip shark is a highly mobile, large, open-ocean shark found in tropical and subtropical waters around the globe. It generally remains offshore in the open ocean, on the outer continental shelf, or around oceanic islands in water depths greater than 184 m, and occurs from the surface to at least 152 m depth. This species has a strong preference for warm waters above 20°C and is therefore a surface-dwelling species (NMFS 2024a). These sharks are apex predators in pelagic ecosystems and feed primarily on teleost fishes and cephalopods, although sometimes they may consume sea birds, marine mammals, other sharks and rays, molluscs, crustaceans, and garbage (NMFS 2024a). Bycatch and harvest for international trade threatens this species (NMFS 2024a).

Giant Manta Ray (*Mobula birostris*) (Threatened)

The giant manta ray (*Mobula birostris*) was listed as threatened throughout its range on January 22, 2018 (83 FR 2916; taxonomy revised on November 22, 2023, 88 FR 81351). NMFS determined on December 5, 2019, that a designation of critical habitat was not prudent at this time (84 FR 66652).

The giant manta ray is a migratory species and seasonal visitor along productive coastlines with regular upwelling, in oceanic island groups, and near offshore pinnacles and seamounts (Miller and Klimovich 2017). The timing of these visits varies by region and seems to correspond with the movement of zooplankton, current circulation and tidal patterns, seasonal upwelling, seawater temperature, and possibly mating behavior. While seeking zooplankton, its primary food source (Miller and Klimovich 2017), this manta species demonstrates a great deal of plasticity in depth distribution, ranging from the surface to about 1000 m (Weigmann 2016). Across its range the giant manta ray inhabits waters between 19-30°C (Miller and Klimovich 2017), although during deeper foraging ambits individuals will encounter water as cool as 12°C (Stewart et al. 2016).

Along the U.S. West Coast, the giant manta ray has not been formally recorded north of Santa Barbara, CA (Love et al. 2021). In the Morro Bay lease areas in 2024, shipborne marine mammal observers recorded one uncertain instance of one large and four small “manta rays” that were viewed using an infrared camera at the surface during nighttime (PSO report from: Marine Ventures International, Inc.2024: Appendix A). Until further documentation is secured, BOEM considers this observation unsubstantiated for the giant manta ray. These rays may be a closely related species, *Mobula mobular* (formerly *M. japonica*), which is very similar in appearance to the giant manta ray and which has a northern range limit that extends into central California and thus overlaps with the Morro Bay Lease areas (Love et al. 2021).

Bycatch and overutilization from commercial fishing activities threatens this species (Miller and Klimovich 2017).

Eulachon (*Thaleichthys pacificus*) Southern DPS (Threatened).

The eulachon is a small, cold-water species of anadromous smelt, occupying the eastern Pacific Ocean in nearshore waters to depths of about 300 m (1,000 ft) from California to the Bering Sea. Eulachon will return to their natal river spawn. Juveniles disperse from freshwater to marine habitats on the continental shelf within the first year of their life, residing near the bottom at depths of 50–200 m. The Southern DPS was first listed as threatened by NMFS on March 18, 2010 (75 FR 13012). On October 20, 2011, NMFS designated critical habitat for Southern DPS eulachon (76 FR 65324), with the designated areas being a combination of freshwater creeks and rivers and their associated estuaries which do not overlap with the Action Area. Southern DPS eulachon are those that spawn in rivers south of the Nass River in British Columbia to the Mad River in California (NMFS 2016). Eulachon eat krill, cumaceans, and copepods. Eulachon faces threats from climate change, dams and water diversions, bycatch, predation, and water quality (Gustafson et al. 2022).

Invertebrates

Black Abalone (*Haliotis cracherodii*) (Endangered)

The black abalone (*Haliotis cracherodii*) was listed as endangered under the ESA on January 14, 2009 (74 FR 1937), and critical habitat was designated by NMFS on November 28, 2011 (76 FR 66806).

The distribution of black abalone ranges from approximately Point Arena, Mendocino County, California, south to Bahia Tortugas and Isla Guadalupe in Mexico (VanBlaricom et al. 2009). This species primarily feeds on algae, is long-lived (up to 30 years), and possesses both a benthic stage and a planktonic larval stage (VanBlaricom et al. 2009). The majority of black abalone live on rocky substrates in the high to low intertidal zone, and it is rarely found deeper than 6 m of water (VanBlaricom et al. 2009). Critical habitat for black abalone consists of rocky intertidal zones and shallow subtidal areas (< 6m) along Coastal California where they find shelter and access to food (NMFS 2011). The spatial distribution of critical habitat is discontinuous (NMFS 2011) and does not include the area between Cayucos and Montaña De Oro State Park, (thereby excluding the Morro Bay harbor area), and does not extend above Del Mar Landing Ecological Reserve (which excludes the Humboldt Bay harbor area). The largest threats to the black abalone include suboptimal water temperatures, low density, disease, and illegal take (Neuman et al. 2010).

White Abalone (*Haliotis sorenseni*) (Endangered)

The white abalone (*Haliotis sorenseni*) was listed as endangered under the ESA on May 29, 2001 (FR 66 FR 29046). NMFS determined that designation of critical habitat for white abalone was not prudent, because a designation would not provide significant benefits that outweigh the increased risk of poaching that may result from identifying the species' critical habitat (66 FR 29046; May 29, 2001).

White abalone occur on the North American West Coast along offshore islands and banks (particularly Santa Catalina and San Clemente Islands) and along the mainland coast from Point Conception, California, south to Punta Abreojos, Baja California, Mexico (NMFS 2008, 2018). This species primarily feeds on algae, is long-lived (35-40 years), and possesses both a benthic stage and a planktonic larval stage that lasts for about two weeks (NMFS 2008, 2018). Adults occupy open, low relief rocky reefs or boulder habitat surrounded by sand. Because suitable habitat is patchy, the distribution of white abalone is also patchy (NMFS 2018). White abalone are the deepest living abalone species on the North American West Coast, occupying depths from 5-60m (NMFS 2008, 2018). Current remnant populations are most common between 30 and 60 meters in depth, and surveys found the highest densities at depths of 40-50 m. Threats to the white abalone include overfishing, low reproduction rates, habitat destruction, and disease (NMFS 2008, 2018).

Sunflower Sea Star (*Pycnopodia helianthoides*) (Proposed for Threatened Status)

The sunflower sea star was proposed to be listed as threatened under the ESA on March 16, 2023 (88 FR 16212). The species is a large, fast moving, many-armed sea star, native to the eastern Pacific Ocean from Baja California, Mexico to the Aleutian Islands, Alaska. The species is most abundant in the waters off eastern Alaska and British Columbia. Between 2013 and 2017, sea star wasting syndrome killed an estimated 90% of the population (Lowry et al. 2022).

The sunflower sea star has no clear associations with specific habitat types or features and is considered a habitat generalist (Lowry et al. 2022). Sunflower sea stars occupy a wide range of benthic substrates including mud, sand, shell, gravel, and rocky bottoms while roaming in search of prey (Lowry et al. 2022). The diet of adult sunflower sea stars generally consists of benthic and mobile epibenthic invertebrates, including sea urchins, snails, crab, sea cucumbers, and other sea stars (Lowry et al. 2022), and appears to be driven largely by prey availability.

Lowry et al. (2022) reviewed 27 datasets on the distribution and abundance of sunflower sea stars and described the depth distribution as the low intertidal and subtidal zones to a depth of 435 m but that these sea stars are most common at depths less than 25 m and rare in waters deeper than 120 m. However, M. Goldsworthy (personal communication, 2024) predicted that there may be data in the future that show a deeper distribution, possibly as deep as 1,158 m. Lowry et al. (2022, Appendix A) notes that, from all depths along the entire U.S. West Coast, *P. helianthoides* "density peaked in 2013, declined suddenly in 2014, and went to essentially zero in 2015 with no sign of recovery (Figure A3.15). The survey recorded 2,618 *P. helianthoides* from 2003–2014 but only seven individuals from 2015–2021. While there is some variation with latitude, the majority of hauls with *P. helianthoides* were from waters less than 250 m (Figure A3.14)." Due to extremely low sunflower sea star density at depths deeper than 250 m, these data were excluded from the multivariate autoregressive state space models that were used to estimate abundance trends. In agreement with this report of very low abundance, especially in depths deeper than 250 m, trawl catch data that span the entire U.S. West Coast and downloaded from NOAA's FRAM Data Warehouse (https://www.webapps.nwfsc.noaa.gov/data/map) from 1977 to 2023 yielded a single sunflower sea star at 227 m deep (in 2018). In summary, this abundance information suggests that, although there may be potential habitat in the Humboldt and Morro Bay Lease Areas, the probability of sunflower sea stars occurring there is extremely low. Furthermore, any individuals that could be found there would be exposed to mortality risk due to being trawled up by ongoing groundfish commercial fishers who operate in this area (Wang et al. 2022; 2024).

Threats to the sunflower sea star were broadly grouped into the five ESA Section 4(a)(1) categories of: 1) present or threatened destruction, modification, or curtailment of habitat or range; 2) overutilization for commercial, recreational, scientific, or educational purposes; 3) competition, disease, or predation; 4) adequacy of existing regulatory mechanisms; and 5) other natural or manmade factors affecting continued existence (Lowry et al. 2022).

Sources of Potential Impacts

Noise

- **Background on Animal Hearing and Potential for Injury**

In order for a sound to be potentially disturbing, it must be able to be heard by the animal. Effects on hearing ability or disturbance can result in disturbance of important biological behaviors such as migration, feeding, resting, communication, and breeding. Baleen whales hear lower frequencies; toothed whales hear high -frequencies; porpoise hear very high frequencies; true seals from 40 hertz (Hz) to 90 kHz, and sea lions/fur seals from 60 Hz to 68 kHz (Table 10; NMFS 2024b). Sea turtles are low frequency hearing specialists with a range of 30 Hz to 2kHz (Table 10; Anderson 2021; U.S. Navy 2017; Bartol et al. 1999; Bartol and Ketten 2006; Lenhardt 1994; Lenhardt 2002; Ridgway et al. 1969).

Cartilaginous fish are known to be sensitive to low frequency sounds up to 1.5 kHz, peaking between 200 and 600 Hz, depending on the species (Chapuis et al. 2019).

The assessment of potential hearing effects to marine mammals is based on NMFS' updated technical guidance for assessing the effects of anthropogenic sounds on marine mammal hearing (NMFS 2024b) (Table 10a). The methodology developed by the U.S. Navy is currently thought to be the best available data to evaluate the effects of exposure to the survey noise by sea turtles that could result in physical effects (Anderson 2021; U.S. Navy 2017).

Injury and mortality in fishes exposed to impulsive sources may vary depending on the presence or absence of, and type of swim bladder. Injury due to exposure of impulsive sources has not been observed in fishes without a swim bladder (Halvorsen et al. 2011; 2012a). Therefore, if any effects were to occur, they would likely occur above the given thresholds in Table 10b. Cumulative sound exposure thresholds for mortality and injury in fishes with a swim bladder were measured by investigators (Halvorsen et al. 2011; 2012a; 2012b). However, only the single strike peak sound pressure level was measured during these experiments; therefore, mortality and injury thresholds are assumed to be the same across all hearing groups with a swim bladder (Popper et al. 2014).

Although the Proposed Action does not include the use of air guns, since few data for fishes exists, as a proxy, exposure to sound produced from an air gun at a cumulative sound exposure level of 186 dB re 1 µPa2-s has resulted in Temporary Threshold Shifts (TTS) in fishes (Popper et al. 2005). TTS is not likely to occur in fishes without a swim bladder and would likely occur above the given threshold in Table 10b for fishes with a swim bladder not involved in hearing.

Table 10. Acoustic thresholds identifying the onset of auditory injury for (a) marine mammals (with cetaceans divided into hearing groups) and sea turtles from impulsive and non-impulsive sounds sources (Anderson 2021; NMFS 2024b; U.S. Navy 2017) and (b) fish with in terms of Permanent Threshold Shift (PTS) and Temporary Threshold Shift (TTS) where ">" indicates that the given effect would occur above the reported threshold.

(a) marine mammals and sea turtles

Hearing Group	Generalized Hearing Range	Onset of Auditory Injury from Impulsive Sound	Onset of Auditory Injury from Non-Impulsive Sound
Low frequency (e.g., Baleen Whales)	7 Hz to 36 kHz	222 dB Peak 183 dB cSEL	197 dB Peak
High-frequency (e.g., Toothed Whales)	150 Hz to 160 kHz	230 dB Peak 193 dB cSEL	201 dB Peak
Very High frequency (e.g., Porpoise)	200 Hz to 165 kHz	202 dB Peak 159 dB cSEL	181 dB Peak
Phocid pinnipeds (True Seals) (underwater)	40 Hz to 90 kHz	223 dB Peak 183 dB cSEL	195dB Peak
Otariid pinnipeds (Sea Lions and Fur Seals)	60 Hz to 68 kHz	230 dB Peak 185dB cSEL	199 dB Peak
Sea Turtles	30 Hz to 2 kHz	230 dB Peak 204 dB cSEL	226 dB Peak 189 dB cSEL

Calculated using NMFS (2024c)

Notes: cSEL = Cumulative sound exposure level (decibel referenced to 1 micropascal squared seconds [dB s]), Peak = Peak sound pressure level (decibel referenced to 1 micropascal [dB re 1 µPa]); dB = decibels Hz = hertz kHz = kilohertz

(b) fish

Species or Taxa Group	Generalized Hearing Range	Permanent Threshold Shift Onset	Temporary Threshold Shift Onset
Atlantic/shortnose sturgeon[1]	100 Hz to 800 Hz	>207 Peak[3] 203 dB cSEL	186 dB cSEL
Atlantic salmon[1]	< 380 Hz	>207 Peak[3] 203 dB cSEL	186 dB cSEL
Sharks[2]	<1.5 kHz	>213 dB Peak[3] >216 dB cSEL	NC

dB = decibels Hz = hertz kHz = kilohertz NC = effects not likely to occur

[1] Hawkins and Johnstone 1978, [2] Chapuis et al. 2019, [3] Popper et al. 2014

- **Vessel Noise**

For most of the world oceans, shipping and seismic exploration noise dominate the low-frequency portion of the spectrum (Hildebrand 2009). In particular, noise generated by shipping has increased as the number of ships on the high seas has increased. Along the west coast of North America, long-term monitoring data suggest an average increase of about 3 dB per decade in low-frequency ambient noise (Andrew et al. 2002; McDonald et al. 2006; 2008).

The sound generated from individual vessels can contribute to overall ambient noise levels in the marine environment on variable spatial scales. The survey vessels would contribute to the overall noise environment by transmitting noise through both air and water. Underwater noise produced by vessels is a combination of narrow-band (tonal) and broadband sound. Tones typically dominate up to about 50 Hz, whereas broadband sounds may extend to 100 kHz. According to Southall (2005) and Richardson et al. (1995), vessel noise typically falls within the range of 100–200 Hz.

In the frequency range of 20-500 Hz, distant shipping is the primary source of ambient noise (URI 2017). Spray and bubbles associated with breaking waves are the major contributions to ambient noise in the 500-100,000 Hz range. At frequencies greater than 100,000 Hz, “thermal noise” caused by the random motion of water molecules is the primary source. Ambient noise sources, especially noise from wave and tidal action, can cause coastal environments to have particularly high ambient noise levels.

Vessel noise can potentially mask vocalizations and other biologically important sounds (e.g., sounds of prey or predators) that marine mammals may rely on. Potential masking can vary depending on the ambient noise level within the environment, the received level and frequency of the vessel noise, and the received level and frequency of the sound of biological interest. For example, right whales were observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic noise (Parks et al. 2007) as well as increasing the amplitude (intensity) of their calls (Parks et al. 2011; Parks et al. 2009). Right whales also had their communication space reduced by up to 84 percent in the presence of vessels (Clark et al. 2009). Although humpback whales did not change the frequency or duration of their vocalizations in the presence of ship noise, their source levels were lower than expected, potentially indicating some signal masking (Dunlop 2016).

- **Noise from HRG surveys**

HRG surveys may be vessel-based or AUV-based to deploy active sound sources (listed in Table 5). These surveys may or may not make use of underwater transponder positioning (UTP) systems. UTP systems include an array of transponders placed temporarily on the seabed that communicate with AUVs to improve positioning accuracy.

For marine mammal species expected to occur in the Action Area, auditory injury distances are generally less than 40 m. However, when sparkers (2.7 kHz) and chirp sub-bottom profilers (5.7 kHz) are used, the auditory injury distance may range up to 130.5m and 102.9 m respectively for porpoise species, an upper limit estimated based on a unit operating in full power mode, using an omnidirectional source, and without accounting for absorption of sound over distance. Furthermore, the predicted distances from mobile sound sources indicate the sound sources are transitory and have no risk of exposure to levels of noise that could result in auditory injury for sea turtles (Anderson 2021).

The range of disturbance distances for all ESA-listed marine mammal and sea turtle species expected to occur in the Action Area is from 40–499 m, with sparkers (2.7 kHz) producing the upper limit of this range. No sparkers are currently being proposed to be used on AUVs. Using acoustic characteristics of HRG survey equipment operated from AUVs listed in the California 2024–2025 marine site characterization survey plans accepted to date and assuming that AUVs are flying at 40m, Level B disturbance distances (horizontal threshold ranges) were calculated using NOAA's Associated Level B Harassment Isopleth Calculator (NMFS 2024b) and are calculated to be 8.5 m or less from HRG devices on AUVs for marine mammals and sea turtles. The one exception is the Survey Support Ship USBL System, for which the maximum Level B disturbance distance is 185 m for marine mammals and 35 m for sea turtles, but those are maximum values since they were calculated using a 180-degree beam width (omnidirectional source), the largest beam width possible, when likely the beam width would be smaller. When a beam width of 24 degrees is used for the USBL system calculation, the largest beam width used for any of the other AUV survey equipment, the Level B disturbance distance is 8.5 m for marine mammals and 7.3 m for sea turtles.

Since the AUVs are transitory, and the mounted equipment is used intermittently for a few seconds at a time, acoustic impacts to marine mammals and sea turtles from AUVs are expected to be discountable.

A peer-reviewed paper by Ruppel et al. (2022), "Categorizing Active Marine Acoustic Sources Based on Their Potential to Affect Marine Animals" was recently published. Using physical criteria about various HRG sources, such as source level, transmission frequency, directionality, beamwidth, and pulse repetition rate, Ruppel et al. (2022) divided marine acoustic sources into four tiers that could inform regulatory evaluation. Tier 4 includes most high resolution geophysical, oceanographic, and communication/tracking sources, which are considered unlikely to result in incidental take of marine mammals and therefore termed *de minimis.* The majority of acoustic sources under this proposed activity fall into this *de minimis* category. For acoustic sources from vessel-based surveys that fall in Tier 3 (Table 11), PDC 3 (Appendix A) applies.

The overall acoustic impact to ESA-listed species is believed to be significantly reduced by deploying HRG equipment with AUVs when compared to ship mounted or towed HRG equipment. The impacts of noise to marine mammals and sea turtles from HRG sound sources operated from AUVs is minimal and therefore the use of HRG sound sources operated from AUVs does not require a specialized mitigation strategy and no additional conservation measures are recommended at this time.

Table 11. The ranked classification of active acoustic sources based on impacts to marine mammals, with the first three columns reproduced from Ruppel et al. (2022: Table 3). The other columns are for the activities from the Proposed Action.

Category (Ruppel et al. 2022)	Active Acoustic Sources: Short Descriptions (Ruppel at al. 2022)	Example Sources (Ruppel et al. 2022)	Proposed Action	Best Management Practices (BMPs)
Tier 1	*High-energy airgun surveys (includes GI guns)*	*Airguns–- arrays larger than 12 airguns*	Not applicable	Not applicable
Tier 2	*Low / intermediate energy airgun surveys (includes GI guns)*	*Airguns*	Not applicable	Not applicable
Tier 3	*HRG seismic sources (most)*	*Some sparkers, bubble guns, some boomers*	Medium (seismic) penetration sub-bottom profilers	PDC 3 applies to towed systems. PSOs required—clearance and shut down zones
Tier 4	*De minimis sources (not likely to result in incidental take)*	*MBES, SSS, hull-mounted SBP; towed SBP evaluated here; parametric SBP; SBES (EK60/80), lowest powered sparkers, 3-plate boomers, ADCP, pingers (locators), acoustic releases, seafloor/water column navigational/tracking acoustics for ROVs, AUVs, etc.*	AUVs, UTPs, USBLs, ADCPs, acoustic releases, ROVs, and similar technology	Not applicable

Vessel Interactions

- **Vessel Collisions**

Most vessel strikes of marine mammals reported involve commercial vessels and occur over or near the continental shelf (Laist et al. 2001). Reporting to NMFS of whale strikes by commercial vessels is not required, and reporting rates are therefore unknown but likely to be much lower than actual occurrences. Additionally, although the public is prohibited from harassing, harming, pursuing, wounding, killing, capturing, or collecting marine species protected by the ESA and MMPA, there are no national requirements for commercial vessels to mitigate for vessel strikes with protected species other than NOAA's Marine Life Viewing Guidelines (https://www.fisheries.noaa.gov/topic/marine-life-viewing-guidelines) and federal law that requires vessels to remain 100 yards away from humpback whales in Hawaii and Alaska waters, 200 yards from killer whales in Washington State inland waters, and 500 yards away from North Atlantic right whales anywhere in U.S. waters.

While some risk of a vessel strike exists for all the U.S. West Coast waters, 74 percent of blue whale, 82 percent of humpback whale, and 65 percent of fin whale known vessel strike mortalities occur in the shipping lanes associated with the ports of San Francisco and Los Angeles/Long Beach (Rockwood et al. 2017). A gray whale calf was severely injured offshore Morro Bay, California during installation of a trans-Pacific cable. The injury consisted of a severely cut tail stock and flukes completely severed off the animal. The extent of the injury (severing of the caudal peduncle) was consistent with a propeller strike (Burton and Harvey 2001). Vessel traffic within the U.S. West Coast EEZ continues to be a ship strike threat to all large whale populations (Redfern et al. 2013; Moore et al. 2018).

Vessels strikes pose a threat to the West Pacific DPS of leatherback sea turtles. Of leatherback strandings documented in central California between 1981 and 2016, 11 were determined to be the result of vessel strikes (7.3 percent of total; NMFS unpublished data). The range of the DPS overlaps with many high-density vessel traffic areas and it is possible that the vast majority of vessel strikes are undocumented. However, information on vessel strikes for other locations is not available (NMFS and USFWS 2020a). Additionally, vessel strikes (e.g., hull impacts and propeller lacerations) likely injure or kill loggerheads. However, few vessel strikes are documented, and no estimate of the frequency of occurrence if available. Therefore, the effect on the DPS is unknown (NMFS and USFWS 2020b).

- **Vessel Features: Moon pools**

Moon pool usage presents a potential for marine mammals and sea turtles to become entrapped. Moon pools may be used offshore to deploy and/or retrieve equipment (e.g., ROVs, AUVs). Moon pools have been used for decades off the west coast and there is no known record of entrapment of protected species in the moon pools in the Pacific. MBARI regularly uses moon pools in launching ROVs and other instruments as it is safer for their staff and equipment. MBARI researchers and monitors have never had an animal trapped in their moon pool (MBARI staff, pers. comm.). With the limited occurrence of sea turtles in the Action Area, as well as BOEM's BMPs described in Appendix A, there is a low probability of animals intersecting with moon pools.

Habitat alteration

Geotechnical sampling (gravity cores, piston cores, vibracores, deep borings, cone penetration tests, etc.) and biological grab sampling may damage benthic habitats by removing soft sediments from the seabed. Collection of samples causes disturbance as sediment moves to fill the hole left by the removed core or grab, possibly exposing animals in the surrounding sediment to predators (Skilleter 1996). Sampling may also disrupt microbial assemblages in the sediments and breakdown biotic structures which help bind sediments (e.g., microbial mats). The distribution of these samples will occur throughout the leases, but the total spatial extent of sampling will be a small percentage compared to the overall area.

Habitat disturbance to seafloor sediments may occur during geotechnical investigations, biological grab sampling, and buoy emplacement/removal activities. Disturbance may cause sediments and benthic organic material to be introduced into the water column and may also increase local turbidity levels. Direct effects from sediment suspension and increased turbidity on fish populations may include exposure to contaminants, changes in feeding rates, reduction in predator-avoidance ability, or smothering of feeding and respiratory organs (Wilber and Clarke 2001; Utne-Palm 2002; Au et al. 2004). To avoid these consequences, fishes may choose to relocate until water clarity returns to levels similar to pre-disturbance conditions. Indirect effects on fish populations from sediment suspension and increased turbidity may occur by harming the populations of prey species on which the fishes depend (Airoldi 2003). Biological response to these potential impacts is often a function of concentration and exposure duration (Newcombe and Jensen 1996). The proposed activities from the project are predicted to generate only minimal and short-term impacts to benthic habitats and cause a negligible increase in suspended materials over a short time frame. Therefore, proposed activities associated will have minimal adverse effects to EFH.

Indirect effects from buoy emplacement may preserve habitat integrity as fishers may avoid these areas until buoys are decommissioned. The damage from bottom-contact gear would then be displaced to outside of the lease area.

Entanglement in ROV cables and metocean buoy mooring

Most entanglements are never observed, but those that are include many cases of entangled whales with unidentified gear (IWC 2016). There are reports of large whales (including humpback, right, and fin whales) interacting with anchor moorings of yachts and other vessels, towing small yachts from their moorings or becoming entangled in anchor chains, sometimes with lethal consequences (Richards 2012;

Love 2013; Saez et al. 2021). Animals may swim into moorings accidentally or actively seek out anchor chains or boats as a surface to scratch against (Benjamins et al. 2014)(Benjamins et al. 2014)

A total of 511 whale entanglements, 429 confirmed, along the U.S. West Coast have been reported from 1982-2017. The annual average of total entanglement reports received by NMFS for the same period was 14, with an average of 12 confirmed entanglement reports per year (Saez et al. 2021). There are no recorded events in the literature of ESA-listed species becoming entangled in ROV cables. The following gear types have been identified as involved in the entanglement of large whales off the U.S. West Coast between 1982 and 2017: netting, commercial and recreational fishing pots/traps, salmon troll line, steel cables, and one weather buoy (in 2014). Since 2000 (289 confirmed reports), pot/trap gear has become the most commonly identified gear type associated with entanglement reports (32 %).

Sea turtles have been documented to be entangled in a large variety of man-made items (Duncan et al. 2017; NMFS and USFWS 2008; Dodge et al. 2022). Sea turtle entanglements are an underestimate as not all entanglements are reported. In waters off the Northeast United States, the primary species entangled is the leatherback sea turtle, but loggerhead and green sea turtle entanglements also occur. Since the Sea Turtle Disentanglement Network was formed in 2002 and through 2014, there have been 275 entanglements in vertical lines (NMFS 2015). Turtles are usually entangled around the neck and/or front flippers. Sightings of leatherback sea turtles in the eastern North Pacific are most frequently encountered off the coast of central California (Benson et al. 2007). This species faces significant threats from bycatch in fisheries (entanglement and/or hooking) (Benson et al. 2020; Dodge et al. 2022). A leatherback was found dead, entangled in a 3/8” galvanized boat mooring chain, offshore Massachusetts (Dodge et al. 2022).

Accidental release of pollutants and marine debris

Oil and other chemical spills are a specific type of ocean contamination that can have damaging effects on some marine mammal species directly through exposure to oil or chemicals and indirectly due to pollutants’ impacts on prey and habitat quality (Engelhardt 1983; MMC 2010; Matkin et al. 2008). In the five-year period from 2013–2017 along the Pacific coast, there were 127 pinnipeds found stranded with a serious injury or mortality caused by oil or tar coating their body (Carretta et al. 2019a).

On a broader scale ocean contamination resulting from chemical pollutants inadvertently introduced into the environment by industrial, urban, and agricultural use is also a concern for marine mammal conservation and has been the subject of numerous studies (Cossaboon et al. 2019; Desforges et al. 2016; Fair et al. 2010; Krahn et al. 2007; 2009; Moon et al. 2010; Ocean Alliance 2010). For example, the chemical components of pesticides used on land flow as runoff into the marine environment and can accumulate in the bodies of marine mammals and be transferred to their young through mother’s milk (Fair et al. 2010). The presence of these chemicals in marine mammals has been assumed to put those animals at greater risk for adverse health effects and potential impact on their reproductive success given toxicology studies and results from laboratory animals (Fair et al. 2010; Goddard-Codding et al. 2011; Krahn et al. 2007; 2009; Peterson et al. 2014; 2015). Desforges et al. (2016) have suggested that exposure to chemical pollutants may act in an additive or synergistic manner with other stressors, resulting in significant population-level consequences. Although the general trend has been a decrease in chemical pollutants in the environment following their regulation, chemical pollutants remain important given their potential to impact marine mammals (Bonito et al. 2016; Jepson and Law 2016; Law et al. 2014).

Potential sources of chemical pollution related to the Proposed Action are from allisions with the metocean buoy and/or a spill during fuel transfer to the generator on the metocean buoy.

Ocean litter, or marine debris, is a persistent, well-documented problem of global scale. Anthropogenic (human-caused) litter has been observed on seafloors and in submarine canyons, in sediments, surface waters, and the water column, and on beaches and shorelines worldwide (Galgani et al. 2015). Most marine debris is thought to come from land-based sources, though ocean-based debris can be significant in some areas (e.g., Sheavly 2007; Jang et al. 2014). Ocean-based litter is generated by the intentional or unintentional discharge of debris directly into the ocean. Marine activities that generate ocean-based litter include commercial shipping, recreational and commercial fishing, aquaculture, research and military endeavors, and offshore drilling (Galgani et al. 2015; UN Environment & GRID-Arendal 2016). The vast majority of marine debris is made up of various forms of plastic that are highly persistent and often contain toxic chemicals or acquire them from the surrounding seawater. The fragmentation of plastics produces large numbers of microplastic particles that are easily taken up by a wide range of marine organisms (SCBD 2016).

Ocean litter has detrimental ecological, economic, and social impacts. Marine species, including seals, sea birds, sea turtles, whales, and dolphins can become entangled in debris, resulting in hindered movement, decreased feeding ability, injury, and death (Kühn et al. 2015; NOAA MDP 2014). Fish, crustaceans, shellfish, and zooplankton ingest microplastics, and some of these organisms consume less food and have decreased energy for growth as a result (Boerger et al. 2010; Cole et al. 2013; Murray and Cowie 2011; Watts et al. 2015). Furthermore, microplastics adsorb organic contaminants and trace metals from their surrounding environments (Holmes et al. 2012; Rochman et al. 2013).

There is a clear increase in the number of species, particularly marine mammals, known to be affected with 40 per cent of the taxa known to ingest marine debris, mainly attributable to a review of the impacts of marine debris on cetaceans (Baulch and Perry 2014). The number of marine fish and seabirds affected by ingestion or entanglement has also risen. New records for plastic ingestion by fish have been reported in a range of habitats, including open ocean, deep-water and temperate pelagic and demersal (See Appendix 1a in Secretariat SCBD 2016).

According to the 2007 National Marine Debris Monitoring Program Report, a total of 54.3 % of the ocean litter found on California's beaches is land-based, while about 10.2 % is ocean-based (Sheavly 2007). The remaining 35 % is characterized as general-source debris, or items that could be either land-based or ocean-based (Sheavly 2007).

Impacts to Marine Mammals and Sea Turtles

The potential IPFs for marine mammals and sea turtles associated with the Proposed Action include noise from HRG and geotechnical surveys, vessel noise, the potential for vessel interaction habitat alteration, and potential entanglement in mooring systems associated with the installation of a metocean buoy, as well as accidental release of pollutants and marine debris.

BOEM directs lessees to incorporate best management practices into their plans. These have been developed through years of conventional energy operations and refined through BOEM's renewable energy program and consultations with NMFS, including vessel strike avoidance measures, visual monitoring, and shutdown and reporting. These measures, which will minimize or eliminate potential effects from site characterization surveys and site assessment activities to protected marine mammal and sea turtle species, are found in Appendix A.

Project-Related Noise

- **High-Resolution Geophysical (HRG) Surveys**

Source levels and frequencies of HRG equipment were measured under controlled conditions and represent the best available information for HRG sources (Crocker and Fratantonio 2016). NOAA's 2024 user spreadsheet tool was used to calculate auditory injury exposure distance ranges for HRG sources for marine mammals, sea turtles and fishes (Table 12). To provide the maximum impact scenarios, the highest power levels and most sensitive frequency setting for each hearing group was used. A geometric spreading model, together with calculations of absorption of high frequency acoustic energy in sea water, when appropriate, was used to estimate injury and disturbance distances. The spreadsheet and geometric spreading models do not consider the tow depth and directionality of the sources; therefore, these are likely overestimates of actual injury and disturbance distances. All sources were analyzed at a tow speed of 2.315 meters per second (m/s) (4.5 knots).

Potential for injury

For marine mammal species expected to occur in the Action Area, auditory injury distances are generally small, ranging from 0–130.5 m (Table 12). The largest possible auditory injury distance is 130.5 m for porpoise species, only when sparkers (2.7 kHz) are used. However, this range is likely an overestimate since it assumes the unit is operated in full power mode, that it is an omnidirectional source, and absorption of sound over distance is not considered. With the vessel strike avoidance requirements, as well as requirements for qualified Protected Species Observers (PSOs) to monitor a 600 m clearance zone, for vessels to maintain 500 m from ESA-listed marine mammals, as well as the shutdown requirements when ESA-listed marine mammal species are sighted within 500 m, BOEM believes that the risk of auditory injury occurring for any ESA-listed marine mammal species from HRG surveys is discountable.

Auditory injury exposure thresholds (calculated for 204 cSEL and 230 dB peak criteria (U.S. Navy 2017)) are higher for sea turtles than for marine mammals, and based on the source characteristics, are not likely to result in auditory injury. The predicted distances from these mobile sound sources indicate the sound sources are transitory and have no risk of exposure to levels of noise that could result in auditory injury for sea turtles (Anderson 2021).

Table 12. Summary of auditory injury distances (in m) from mobile HRG sources towed at 4.5 knots for: (a) mobile, impulsive, intermittent sources, and (b) mobile, non-impulsive, intermittent sources

(a) Auditory injury distances (in m) from mobile, impulsive, intermittent sources

HRG Source	Highest Source Level (dB re 1 µPa)	Low Frequency (e.g., baleen whales)[1]	High Frequency (e.g., dolphins, sperm whales)[1]	Very High Frequency (e.g., porpoises)	Phocids (true seals)	Otariids (sea lions, fur seals)	Sea Turtles	Fishes
Boomers, Bubble Guns (4.3 kHz)	176 dB SEL 207 dB RMS 216 peak	1.2	.1	38.9 *	1.3	.7	0	3.2
Sparkers (2.7 kHz)	188 dB SEL 214 dB RMS 225 peak	20.9	1.4	130.5 *	19.8	6.7	0	9.0

(b) Auditory injury distances (in m) from mobile, non-impulsive, intermittent sources

HRG Source	Highest Source Level (dB re 1 µPa)	Low Frequency (e.g., baleen whales)[1]	High Frequency (e.g., dolphins, sperm whales)[1]	Very High Frequency (e.g., porpoises)	Phocids (true seals)	Otariids (sea lions, fur seals)	Sea Turtles	Fishes
Chirp Sub-Bottom Profilers (5.7 kHz)	193 dB SEL 209 dB RMS 214 peak	8.9	4.0	102.9 *	17.1	6.5	NA	NA
Multi-beam echosounder (100 kHz)	185 dB SEL 224 dB RMS 228 peak	0	0.1	23.4*	0.0	0.0	NA	NA
Multi-beam echosounder (>200 kHz)	182 dB SEL 218 dB RMS 223 peak	NA	NA	NA	NA	NA	NA	NA
Side-scan sonar (>200 kHz)	184 dB SEL 220 dB RMS 226 peak	NA	NA	NA	NA	NA	NA	NA

[1] PTS injury distances were calculated with NOAA's sound exposure spreadsheet tool (NMFS 2024c) using sound source characteristics for HRG sources in Crocker and Fratantonio (2016). Repetition rates used to calculate PTS injury distances using the NOAA tool were estimated for water depth of 100 m.

* This range is conservative as it assumes full power, an omnidirectional source, and does not consider absorption over distance.

NA = not applicable due to the sound source being out of the hearing range for the group.

RMS = root mean squareSEL = sound exposure level

Potential for disturbance

Using the same sound sources as for the auditory injury analysis, maximum disturbance distances to the non-frequency weighted 160 dB re 1 µPa RMS threshold for marine mammals, 175 dB re 1 µPa RMS for sea turtles, and 150 dB re 1 µPa RMS for fish were calculated using a spherical spreading model (20 LogR). These results describe maximum disturbance exposures for marine mammals, sea turtles, and fish to each potential sound source (Table 13).

Table 13. Summary of maximum disturbance distances (in m) from mobile HRG sources towed at 4.5 knots for: a) mobile, impulsive, intermittent sources, and (b) mobile, non-impulsive, intermittent sources

(a) Disturbance distances (in m) from mobile, impulsive, intermittent sources

HRG Source	Low Frequency (e.g., baleen whales)[1]	High (e.g., dolphins, sperm whales)[1]	Very High Frequency (e.g., porpoises)	Phocids (true seals)	Otariids (sea lions, fur seals)	Sea Turtles	Fishes
Boomers, Bubble Guns (4.3 kHz)	223	223	223	223	223	40	699
Sparkers (2.7 kHz)	499	499	499	499	499	89	1,567

(b) Disturbance distances (in m) from mobile, non-impulsive, intermittent sources

HRG Source	Low Frequency (e.g., baleen whales)[1]	High Frequency (e.g., dolphins, sperm whales)[1]	Very High Frequency (e.g., porpoises)	Phocids (true seals)	Otariids (sea lions, fur seals)	Sea Turtles	Fishes
Chirp Sub-bottom Profilers (5.7 kHz)	**279**	**279**	**279**	**279**	**279**	**50**	**NA**
Multi-beam Echosounder (100 kHz)	NA	369	369	NA	NA	NA	NA
Multi-beam Echosounder (>200 kHz)	NA	NA	NA	NA	NA	NA	NA
Side-scan Sonar (>200 kHz)	NA	NA	NA	NA	NA	NA	NA

[1]Auditory injury distances were calculated with NOAA's sound exposure spreadsheet tool (NMFS 2024d) using sound source characteristics for HRG sources in Crocker and Fratantonio (2016).
NA = not applicable due to the sound source being out of the hearing range for the group.

The disturbance distances depend on the equipment and the species present. The range of disturbance distances for all ESA-listed marine mammal and sea turtle species expected to occur in the Proposed Action Area is from 40–499 m (131–1,637 ft), with sparkers producing the upper limit of this range (Table 13). Visual monitoring requirements of a 600 m clearance zone for ESA-listed marine mammals and sea turtles will ensure that any potential impacts to these species from noise generated by HRG survey equipment will be reduced to insignificant levels.

The largest possible disturbance distance for sea turtles is 89 m from a HRG vessel. In a scenario where a vessel is approaching a turtle at 89 m, it will reach the turtle in 39 seconds at a speed of 4.5 knots (2.315

m/sec). Subsequently, a vessel could pass a turtle and be beyond the 89 m disturbance distance in another 38 sec. Therefore, the largest potential disturbance time is likely to be no longer than 76 seconds along any given survey line. BOEM believes that these brief, periodic disturbances will have discountable effects on sea turtles.

The purpose of the clearance zone is to monitor for behavioral disturbance when ESA-listed species are within the survey area and to watch for any animals heading toward the exclusion zone. For any animals sighted within the clearance zone, a shut-down would not be required unless adverse responses are observed or animals are in distress (e.g., an injured or entangled animal). The purpose of the clearance zones for all listed marine mammal species is to avoid or minimize the number of exposures by means of monitoring and HRG equipment shut-down provisions when listed marine mammals are sighted within the exclusion distance. A description of the PDCs and associated BMPs for PSOs, including clearance zones, exclusion zones, shut-downs, and ramp-up requirements can be found in Appendix A. Harm from periodic behavioral reactions to HRG survey noise is not expected to occur for any ESA-listed species with the implementation of the proposed PDCs.

Disturbance distances to ESA-listed marine mammal and sea turtle species are conservative, and any behavioral effects will be intermittent and short in duration and are expected to result in discountable to insignificant effects.

- **Geotechnical Survey Noise**

Geotechnical surveys (vibracores, piston cores, gravity cores) related to offshore renewable energy activities are typically numerous, but very brief, sampling activities that introduce relatively low levels of sound into the environment. General vessel noise is produced from vessel engines and dynamic positioning to keep the vessel stationary while equipment is deployed, and sampling conducted. Recent analyses of the potential impacts to protected species exposed to noise generated during geotechnical survey activities determined that effects to protected species from exposure to this noise source are extremely unlikely to occur (Anderson 2021).

- **Vessel Noise**

The vessels used for the Proposed Action will produce low-frequency, broadband underwater sound below 1 kHz (for larger vessels), and higher-frequency sound between 1 kHz to 50 kHz (for smaller vessels), although the exact level of sound produced varies by vessel type.

The general frequency range for vessel noise (10 to 1000 Hz; MMS 2007) overlaps with the generalized hearing range for blue, fin, sei, humpback (7 Hz to 35 kHz) and sperm whales (150 Hz to 160 kHz) and would therefore be audible. Vessels without ducted propeller thrusters would produce levels of noise of 150 to 170 dB re 1 μPa-1 meter at frequencies below 1,000 Hz, while the expected sound-source level for vessels with ducted propeller thrusters level is 177 dB (RMS) at 1 meter (BOEM 2015, Rudd et al. 2015). For ROVs, source levels may be as high as 160 dB (BOEM 2021). Given that the noise associated with the operation of project vessels is below the thresholds that could result in injury, no injury is expected.

In the open ocean, ambient noise levels are between about 60 and 80 dB re 1 μPa in the band between 10 Hz and 10 kHz due to a combination of natural (e.g., wind) and anthropogenic sources (Urick 1983), while inshore noise levels, especially around busy ports, can exceed 120 dB re 1 μPa. When the noise level is above the sound of interest, and in a similar frequency band, masking could occur. This analysis assumes that any sound that is above ambient noise levels and within an animal's hearing range may potentially cause masking. However, the degree of masking increases with increasing noise levels; a noise that is just detectable over ambient levels is unlikely to cause any substantial masking.

Vessel noise has the potential to disturb marine mammals and elicit an alerting, avoidance, or other behavioral reaction. These reactions are anticipated to be short-term, likely lasting the amount of time the vessel and the whale are in close proximity (Magalhães et al. 2002; Richardson et al. 1995; Watkins 1981), and not consequential to the animals. Additionally, short-term masking could occur. Masking by passing ships or other sound sources transiting the Action Area would be short term and intermittent, and therefore unlikely to result in any substantial costs or consequences to individual animals or populations. Areas with increased levels of ambient noise from anthropogenic noise sources such as areas around busy shipping lanes and near harbors and ports may cause sustained levels of masking for marine mammals, which could reduce an animal's ability to find prey, find mates, socialize, avoid predators, or navigate (Anderson 2021).

Based on the best available information, ESA-listed whales are either not likely to respond to vessel noise or are not likely to measurably respond in ways that would significantly disrupt normal behavior patterns that include, but are not limited to, breeding, feeding or sheltering. Therefore, the effects of vessel noise on ESA-listed whales are insignificant (i.e., so minor that the effect cannot be meaningfully evaluated or detected) (Anderson 2021).

Per Anderson (2021) ESA-listed turtles could be exposed to a range of vessel noises within their hearing abilities. Depending on the context of exposure, potential responses of leatherback and loggerhead sea turtles to vessel noise disturbance would include startle responses, avoidance, or other behavioral reactions, and physiological stress responses. Very little research exists on sea turtle responses to vessel noise disturbance. Currently, there is nothing in the available literature specifically aimed at studying and quantifying sea turtle response to vessel noise. However, a study examining vessel strike risk to green sea turtles suggested that sea turtles may habituate to vessel sound and may be more likely to respond to the sight of a vessel rather than the sound of a vessel, although both may play a role in prompting reactions (Hazel et al. 2007). Regardless of the specific stressor associated with vessels to which turtles are responding, they only appear to show responses (avoidance behavior) at approximately 10 m or closer (Hazel et al. 2007).

Therefore, the noise from vessels is not likely to affect sea turtles from further distances, and disturbance may only occur if a sea turtle hears a vessel nearby or sees it as it approaches. These responses appear limited to non-injurious, minor changes in behavior based on the limited information available on sea turtle response to vessel noise.

For these reasons, vessel noise is expected to cause minimal disturbance to sea turtles. If a sea turtle detects a vessel and avoids it or has a stress response from the noise disturbance, these responses are expected to be temporary and only endure while the vessel transits through the area where the sea turtle encountered it. Therefore, sea turtle responses to vessel noise disturbance are considered insignificant (i.e., so minor that the effect cannot be meaningfully evaluated), and a sea turtle would be expected to return to normal behaviors and stress levels shortly after the vessel passes by.

Vessel Collisions

The estimated number of days at sea (DAS) and round trips for project-related vessels over a 3-year period (Table 6) ranges from 1,460 DAS (24-hour operations) with an estimated 100 round trips to port for HRG surveys and geotechnical sampling, and 980 for 10-hour daily operations for biological surveys in the Humboldt project area. Based on three leases in the Morro Bay area, there are an estimated 2,190 DAS with 150 round trips to port and 1,470 for 10-hour daily operations in the Morro Bay project area. Vessel DAS and round trips have been updated based on CA lessee survey vessel activity, where there are fewer trip from and to port and the survey vessels stay in the project area for multiple weeks. An additional 102 round trips will be conducted over a 5-year period for the deployment, maintenance, and decommissioning of up to 6 metocean buoys per lease (Table 7).

According to industry practice, vessel speeds will be limited to less than 5 knots (2.57 m/s) during HRG surveys. BOEM's BMP states that all vessels transiting to and from ports, conducting site characterization studies, surveys, metocean buoy installation, maintenance, or decommissioning will travel at speeds no more than 10 knots during all related activities. If future consultation with NMFS, USFWS or other state or federal agency results in different vessel speed requirements, BOEM will work with California Coastal

Commission staff to ensure that any new requirements remain consistent and do not diminish the level of resource protection provided by this requirement.

BOEM and BSEE monitor for any takes that have occurred as a result of vessel strikes by requiring any operator of a vessel immediately report the striking of any ESA-listed marine animal. BOEM's proposed BMP for Vessel Strike Avoidance and Injured/Dead Protected Species Reporting requires operators to implement measures to minimize the risk of vessel strikes to protected species and report observations of injured or dead protected species. This BMP will be required for every applicable permit and plan that has associated vessel traffic that is approved by BOEM or BSEE. BOEM's BMP states that Lessees will have qualified PSOs on board, or dedicated crew on watch to monitor a vessel strike avoidance zone for protected species. All vessels will reduce travel speeds to 10 knots or less if whales are detected within 500 m of the forward path of any vessel, and the vessel will steer a course away from the whale at 10 knots or less or stop their vessel to avoid striking protected species. If a sea turtle is sighted within the operating vessel's forward path, the vessel operator must slow down to 4 knots (unless unsafe to do so) and steer away as possible. Crews must report sightings of any injured or dead protected species (marine mammals and sea turtles) immediately, regardless of whether the injury or death is caused by their vessel, to the West Coast Stranding Hotline. In addition, if it was the operator's vessel that collided with a protected species, BOEM and BSEE must be notified within 24 hours of the strike.

Lessees will also be directed to NMFS' Marine Life Viewing Guidelines, which highlight the importance of these measures for avoiding impacts to mother/calf pairs (https://www.fisheries.noaa.gov/topic/marine-life-viewing-guidelines#guidelines-&-distances). Additionally, wherever available, Lessees will ensure all vessel operators check for daily information regarding protected species sighting locations. These media may include, but are not limited to: Channel 16 broadcasts, whalesafe.com, and the Whale/Ocean Alert App.

The range of West Pacific leatherback sea turtles overlaps with high-density vessel traffic areas, and it is possible that the vast majority of vessel strikes are undocumented. However, information on vessel strikes for other locations is not available (NMFS and USFWS 2020a). Additionally, vessel strikes (e.g., hull impacts and propeller lacerations) likely injure or kill loggerheads. However, few vessel strikes are documented, and no estimate of the frequency of occurrence if available. Therefore, the effect on the DPS is unknown (NMFS and USFWS 2020b).

Rockwood et al. (2017) recommend types of enhanced conservation measures to decrease ship strike mortality. The potential for effects to all ESA-listed species from vessel traffic associated with data collection activities are expected to be reduced to discountable levels with the implementation of the BMP for vessel operations. Similar activities have taken place since at least 2012 in association with BOEM's renewable energy program in the Atlantic OCS and there have been no reports of any vessel strikes of marine mammals and sea turtles.

Entanglement or Entrapment in Cables, Moorings, Moon Pools or Other Potential Hazards

Reviews of entanglements of large whales and sea turtles have resulted in a number of recommendations to reduce the risk of entangling animals (IWC 2016; NMFS 2015), some of which are practicable for marine industries in general. General recommendations to reduce entanglement risks include reduced number of buoy lines, no floating line at the surface which have a high risk of interacting with turtles and whales that spend a good deal of time at the surface of the water. Other recommendations include reducing the amount of slack in line. Use sinking lines, rubber-coated lines, sheaths, chains, acoustic releases, weak links, and other potential solutions to lower entanglement risk. Weak links may not be feasible if there is a risk of the data buoy being lost, but they may be feasible on ancillary lines that will not affect the integrity of the buoy mooring. However, there are several best practices available that can reduce risks on all mooring types. BOEM's BMPs to use the best available technologies to reduce entanglement risks greatly reduce the risk of entanglement.

There are no recorded events of ESA-listed species becoming entangled in ROV cables, however, to minimize this risk, BOEM requires protected species observers to monitor a clearance zone (600 m for ESA-listed species) for 30 minutes before any ROVs are deployed to make sure no ROVs are deployed around ESA-listed species.

PNNL deployed two LiDAR metocean buoys–one in the Humboldt WEA and one in the Morro Bay WEA (PNNL 2019). Including the multiple metocean buoys deployed along the NE Atlantic coast associated with site assessment activities, no incidents of entanglement have been reported to date. BOEM continues to work with lessees and requires the use of the best available mooring systems, using the shortest practicable line lengths, anchors, chain, cable, or coated rope systems, to prevent or reduce to discountable levels any potential entanglement of marine mammals and sea turtles. BOEM reviews each buoy design to ensure that reasonable low-risk mooring designs are used. Potential impacts on ESA-listed species from entanglement related to buoy deployment and operation are thus expected to be discountable.

Lost or derelict fishing gear may become entangled in the metocean buoy lines and present an entanglement risk to protected species. Approximately 6 metocean buoys will be deployed as part of the Proposed Action. From 1982-2017, direct entanglements in fishing gear were most attributed to unidentifiable gear, netting and pot/traps (Saez et al. 2021). Changes in gillnet fishing regulations helped address the 1980's increase which was primarily gray whales entangled with gillnets (Saez et al. 2021). Considering the general inshore deployment (~200 ft water depth) and weight of pot traps, it is unlikely that these will be moved in such a way as to become entangled in metocean buoy lines and present an entanglement risk to protected species. Risk of secondary entanglement related to buoy deployment and operation are thus expected to be discountable.

Any potential displacement of fishing effort as a result of leasing and site characterization and site assessment activities are described in (BOEM 2022), and are expected to be limited in spatial scope, considering existing fishing grounds, and short-term. Entanglement impacts to marine mammals and sea turtles, as a result of displaced fishing effort, are expected to be discountable.

Moon pool usage presents a potential for marine mammals and sea turtles to become entrapped. Moon pools may be used in the Action Area to deploy and/or retrieve equipment (e.g., ROVs, AUVs). There is no known record of entrapment of protected species in the moon pools in the Pacific. The limited occurrence of sea turtles in the Action Area, as well as BOEM's BMPs described in Appendix A, reduce the potential impact from moon pools to discountable levels.

Accidental Release of Pollutants and Marine Debris

A spill of petroleum product could occur as a result of hull damage from allisions with a met buoy, collisions between vessels, accidents during the maintenance or transfer of offshore equipment and/or crew, or due to natural events (i.e., strong waves or storms). From 2000 to 2009, the average spill size for vessels other than tank ships and tank barges was 88 gallons (USCG 2011); should a spill from a vessel associated with the Proposed Action occur, BOEM anticipates that the volume would be similar. Diesel fuel is lighter than water and may float on the water's surface or be dispersed into the water column by waves. Diesel would be expected to dissipate very rapidly, evaporate, and biodegrade within a few days (MMS 2007). The NOAA's Automated Data Inquiry for Oil Spills (an oil weathering model) was used to predict dissipation of a maximum spill of 2,500 barrels, a spill far greater than what is assumed as a non-routine event during the Proposed Action. Results of the modelling analysis showed that dissipation of spilled diesel fuel is rapid. The amount of time it took to reach diesel fuel concentrations of less than 0.05 percent varied between 0.5 and 2.5 days, depending on ambient wind (TetraTech Inc. 2015), suggesting that 88 gallons would reach similar concentrations much faster and limit the environmental impact of such a spill.

Vessels are expected to comply with USCG requirements relating to prevention and control of oil spills, and most equipment on the met and buoys would be powered by batteries charged by small wind turbines and solar panels. BOEM expects that each of the vessels involved with site characterization and site assessment activities would minimize the potential for a release of oils and/or chemicals in accordance with 33 CFR Parts 151, 154, and 155, which contain guidelines for implementation and enforcement of vessel response plans, facility response plans, and shipboard oil pollution emergency plans. Based on the size of the spill, it would be expected to dissipate very rapidly and would then evaporate and biodegrade within a day or two (at most), limiting the potential impacts to a localized area for a short duration and result in discountable effects to ESA-listed marine mammal and sea turtle species.

Records of interactions between anthropogenic marine debris and wildlife have been increasing rapidly in recent decades and is a cumulative source of impacts on ESA-listed species and other marine life. In the marine environment alone, the number of species reported to be affected by debris increased by more than 159% during 1995–2015 (Fossi et al. 2018). Sea turtles are reported to be ingesting large amounts of debris worldwide (Schuyler et al. 2013). Lessees are prohibited from deliberately discharging containers and other similar materials (i.e., trash and debris) into the marine environment (30 C.F.R. 250.300(a) and (b)(6)) and are required to make durable identification markings on equipment, tools, containers (especially drums), and other material (30 C.F.R. 250.300(c)). The intentional jettisoning of trash has been the subject of strict laws such as MARPOL, Annex V and the Marine Plastic Pollution Research and Control Act, and regulations imposed by various agencies including USCG and EPA. As a BMP to reduce the anthropogenic impact of marine debris, BSEE NTL 2015-G03 “Marine Trash and Debris Awareness and Elimination” provides guidance to prevent intentional and/or accidental introduction of debris into the marine environment. BOEM also requires that operators ensure that all offshore employees and those contractors actively engaged in their offshore operations complete awareness training that includes viewing a training video or slide show (specific options are outlined in the NTL. With continued training and awareness, marine debris is not expected to be a significant concern from the Proposed Action and the effects to ESA-listed marine mammal and sea turtle species will be discountable.

Impacts to Fishes and Invertebrates

This section provides a general discussion of the potential effects of the identified IPFs that may affect listed fish and invertebrate species. BOEM has identified two potential IPFs generated by activities associated with site characterization and assessment: noise and habitat alteration/turbidity. A summary description of each impacting source are the resulting effects to ESA-listed species are discussed below.

Noise

Sound travels faster and farther in water than in air, given the greater density of water. Fishes possess two mechanoreception sensory systems to detect sound in their environment. The first is the lateral line system (LLS) which is a series of pore-receptors along the body of a fish. The LLS detects vibration and pressure gradients in the water within a few body lengths of the organism. The lateral line detects particle motion at low frequencies from below 1 hertz (Hz) up to at least 400 Hz (Hastings and Popper 2005; Higgs and Radford 2013).

The second hearing organ fish possess is an inner ear (Popper and Hastings 2019). For most species, the inner ear contains three dense otoliths (small calcareous bones) that sit atop many delicate hair cells, comparable to the hair cells found in the mammalian ear. Sound waves in water pass through the fish’s body, which has a composition similar to water, but will differentially affect the heavier otoliths. This causes a change in the relative motion between the otoliths and the surrounding body tissues and can be detected by the hair cells and sensed by the nervous system.

Some fishes possess additional morphological adaptations or specializations that can enhance their sensitivity to sound pressure, such as an anatomical extension that connects a gas-filled swim bladder to the auditory system (Astrup 1999; Popper and Fay 2010; Popper and Hastings 2019). The swim bladder can enhance sound detection by converting acoustic pressure into localized particle motion, which may then be detected by the inner ear (Radford et al, 2012). Fishes with a swim bladder generally have better sensitivity to sound and can detect higher frequencies than fishes without a swim bladder (Popper and Fay 2010; Popper et al. 2014). In addition, structures such as gas-filled bubbles near the ear or swim bladder also increase sensitivity and allow for high-frequency hearing capabilities and better sound pressure detection.

Many fishes use sound to (1) find food, habitat, and mates; (2) provide orientation cues for migration; (2) communicate during territorial defense, aggression, mating, and as a method of indicating alarm; and (3) detect and avoid predators (Popper and Hawkins 2019). Anthropogenic noise may mask, disrupt, or distract organisms that use sound as a source of information for these important activities. Noise at very high energy levels may affect fish directly by increasing stress levels, causing temporary or permanent loss of hearing, damage to body tissues, or increased mortality rates (Popper and Hawkins 2019).

Most native fishes on the Pacific Coast are hearing generalists, including all listed species (salmonids, green sturgeon, sharks, giant manta ray, and eulachon) discussed in this document. Salmonids and green sturgeon possess a swim bladder, but they lack the accessory organs that connect the swim bladder to the inner ear, and this makes them less able to detect sound pressure waves. Cartilaginous fishes (e.g., sharks and rays) lack swim bladders so their inner ears may use only particle displacement detection and not sound pressure waves to sense their acoustic environment (Chapuis and Collin 2022). Thus, sharks and rays will not be sensitive to noise impacts from project activities. Eulachon do not possess a swim bladder (Gustafson et al. 2022), which makes them comparatively insensitive to noise impacts as well. Although particle motion may be the more relevant exposure metric for many fish species, there are few data available that measure it due to a lack of standard measurement methodology and experience with particle motion detectors (Popper et al. 2014). Historically, studies that have investigated hearing in fishes and the consequences of anthropogenic noise have been carried out with sound pressure metrics. In these instances, particle motion can be inferred from pressure measurements (Nedelec et al. 2016).

Of the sources that may be used in geophysical surveys for offshore wind, only a handful (e.g., boomers, sparkers, bubble guns, and some sub-bottom profilers) emit sounds at frequencies that are within the hearing range of most fishes and invertebrates. This means that side-scan sonars, multibeam echosounders, and some sub-bottom profilers would not be audible, and thus would not affect these taxa. For the sources that are audible, it is important to consider other factors such as source level, beamwidth, and duty cycle (Ruppel et al. 2022). Boomers, sparkers, hull-mounted sub-bottom profilers, and bubble guns have source levels close to the threshold for injury for pressure-sensitive fishes, so unless a fish was within a few meters of the source, injury is highly unlikely (Crocker and Fratantonio 2016; Popper et al. 2014). Behavioral impacts could occur over slightly larger spatial scales. For example, if one assumes an SPL threshold of 150 dB re 1 μPa for behavioral disturbance GARFO (2020), sounds with source levels of 190 dB re μPa·m would fall below this threshold several hundred meters from the source (assuming 15*log(range) propagation loss). This means that the lowest-powered sparkers, boomers, and bubble guns would not result in behavioral disturbance beyond this distance, and this range would be even smaller for quieter sources like towed sub-bottom profilers (Crocker and Fratantonio 2016). It should be noted that these numbers are reported in terms of acoustic pressure because there are currently no behavioral disturbance thresholds for particle motion. It is expected that behavioral impact ranges would be even smaller for particle motion-sensitive species, including invertebrates. Because most HRG sources are typically “on” for short periods with silence in between, only a few “pings” emitted from an active acoustic source towed from a moving vessel would reach fish or invertebrates below, so behavioral effects would be intermittent and temporary.

Additional details about the noise expected to be produced from marine vessel operations have been discussed earlier (see Sources of Potential Impacts - Noise). In summary, noise produced by the project is expected to last for the duration of the activities that are producing the noise. For fish species capable of sensing the introduced noise, some individuals may alter their behavior and leave the affected area. Project activities may have temporary, largely undetectable consequences to the populations of listed fish species and are therefore **not likely to adversely affect** them due to the minimal influence project activities may have across larger spatial and temporal scales.

Because invertebrate species lack gas-filled structures within their bodies, they are less sensitive to anthropogenic noise sources compared to fishes, although many taxa appear to have morphological structures (e.g., hair cells) that can be sensitive to particle motion (Popper and Hawkins 2018). A recent review indicates that some invertebrates change their behavior when exposed to chronic shipping noise (Murchy et al. 2019). Much more research needs to be done to determine if such behavior changes translate into population-level effects. The low levels of expected anthropogenic noise are not known to permanently alter characteristics of pelagic or benthic habitats. Due to the shallow distribution of listed invertebrate species, it will be minimally exposed to noise from HRG surveys, buoy installation and retrieval, and geological and/or biological collections, and thus will have **no effect** on listed species.

Overall, the level of disturbance from geophysical and geotechnical surveys and marine vessel is **not likely to adversely affect** fishes and will **not effect** invertebrates due to the frequency range, the small spatial extent of sound propagation, and the short duration of exposure.

Habitat Alteration and Turbidity

Project activities that may alter habitats or increase turbidity in the Action Areas include geotechnical and biological sampling, and buoy emplacement, operation, and retrieval.

Geotechnical sampling (gravity cores, piston cores, vibracores, deep borings, cone penetration tests, etc.) and biological grab sampling may damage benthic habitats by permanently removing small amounts of sediments from the seabed. Animals within or on top of these samples will likely be killed. Collection of samples causes nearby disturbance as sediment moves to fill the hole left by the removed core or grab, possibly exposing animals in the surrounding sediment to predators (Skilleter 1996). Sampling may also disrupt microbial assemblages in the sediments and breakdown biotic structures which help bind sediments together (e.g., microbial mats; Skilleter 1996). Recovery rates of sampled areas to baseline conditions are mostly unknown but may exceed several weeks (Skilleter 1996). The distribution of these samples will occur throughout the leases, but the total spatial extent of sampling will be a very small percentage compared to the overall Action Area (Table 4).

Habitat disturbance may cause sediments and benthic organic material to be introduced into the water column and may also increase local turbidity levels. Direct effects from sediment suspension and increased turbidity on fish populations may include exposure to contaminants, changes in feeding rates, reduction in predator-avoidance ability, or smothering of feeding and respiratory organs (Wilber and Clarke 2001; Utne-Palm 2002; Au et al. 2004). To avoid these consequences, fishes may choose to relocate until water clarity returns to levels approximating pre-disturbance conditions. Indirect effects on fish populations from sediment suspension and increased turbidity may occur by harming the populations of prey species on which the fishes depend (Airoldi 2003). Biological response to these potential impacts is often a function of concentration and exposure duration (Newcombe and Jensen 1996). The proposed activities from the project are predicted to generate only minimal and short-term impacts to benthic habitats and cause a negligible increase in suspended materials over a short time frame. The offshore location of the WEAs suggests that terrestrial-based pollutants are not likely to be found in large concentrations within disturbed sediments. Salmon, eulachon, green sturgeon, sharks, giant manta ray, abalone, and sunflower sea star are not likely to occur or would be rare in the cold, deep seafloor habitats of the Action Area where the majority of benthic disturbance will occur. The location of potential cable routes is unknown at this time, but will avoid sensitive habitats. Impacts are expected to be short-term and temporary. Therefore, populations of listed fish and invertebrate species **are not likely to be adversely affected** by the proposed benthic sampling activities.

PNNL (2019) assessed potential effects from a data-collecting metocean buoy within the Morro Bay WEA. The consequences to ESA-listed species from buoy emplacement, operations, and retrieval from the proposed project is expected to be similar to those described in PNNL (2019). A buoy system may also function as a small de facto artificial reef, providing a minor amount of additional hard substrate within the WEAs from the anchor, mooring lines, and buoy structure. The environmental effects are expected to be similar to that produced by marine debris and generate local increases in biomass and species diversity (Caselle et al. 2002). Indirect effects from buoy emplacement may preserve habitat integrity of the seabed as fishers, especially trawlers, may avoid these areas until buoys are decommissioned. The damage from bottom-contact trawls would then be displaced to outside of the local buoy area. The spatial extent of environmental consequences from buoys will be a small percentage compared to the overall Action Area. Salmon, eulachon, green sturgeon, sharks, abalone, and sunflower sea star are not likely to occur in the cold, deep benthic habitats where habitat alteration due to metocean buoy deployment may occur. Therefore, populations of listed species **are not likely to be adversely affected** from these activities.

This analysis is consistent with the findings by NOAA in their Deep Seabed Mining Regulations for Exploration Licenses (15 CFR Part 970, Subpart G Environmental Effects) promulgated under the authority of 30 U.S.C. 1401 et seq. Activities identified to have no significant impact and require no further environmental assessment include: (1) Gravity and magnetometric observations and measurements; (2) Bottom and sub-bottom acoustic profiling or imaging without the use of explosives; (3) Mineral sampling of a limited nature such as those using either core, grab or basket samplers; (4) Water and biotic sampling, if the sampling does not adversely affect shellfish beds, marine mammals, or an endangered species, or if permitted by the National Marine Fisheries Service or another Federal agency; (5) Meteorological observations and measurements, including the setting of instruments; (6) Hydrographic and oceanographic observations and measurements, including the setting of instruments; (7) Sampling by box core, small diameter core or grab sampler, to determine seabed geological or geotechnical properties; (8) Television and still photographic observation and measurements; (9) Shipboard mineral assaying and analysis; and (10) Positioning systems, including bottom transponders and surface and subsurface buoys filed in Notices to Mariners (15 CFR§ 970.701(a)).

Impacts to Critical Habitat

Effective May 21, 2021, NMFS issued an updated final rule to designate critical habitat for the endangered Central America Distinct Population Segment (DPS), and the threatened Mexico DPS of humpback whales (*Megaptera novaeangliae*) (86 FR 21082). Critical habitat for these DPSs serve as feeding habitat and contain the essential biological feature of humpback whale prey. Critical habitat for the Central America DPS of humpback whales contains approximately 48,521 square nautical miles (nmi^2) of marine habitat in the North Pacific Ocean within the portions of the California Current Ecosystem off the coasts of Washington, Oregon, and California. Specific areas designated as critical habitat for the Mexico DPS of humpback whales contain approximately 116,098 nmi^2 of marine habitat in the North Pacific Ocean, including areas within portions of the eastern Bering Sea, Gulf of Alaska, and California Current Ecosystem. The Humboldt WEA consists of approximately 156 nmi^2 and the Morro Bay WEA consists of approximately 284 nmi^2 and both overlap with humpback whale critical habitat (Figure 5). Any displacement of prey species as a result of vessel transits and surveys conducted as part of the Proposed Action are anticipated to be short-term and temporary and are **not likely to adversely affect** the critical habitat of humpback whales.

The Southern Resident DPS of killer whales was federally listed as endangered in 2005 (70 FR 69903). Critical habitat for this DPS was designated in the summer core area in Haro Strait and waters around the San Juan Islands, Puget Sound, and the Strait of Juan de Fuca (79 FR 69054). In August 2021, additional critical habitat was designated along the U.S. West Coast from the Canadian border to Point Sur, California, including offshore of Humboldt County between depths of 6.1–200 m (20–656 ft) (86 FR 41668). Any displacement of prey species or individuals as a result of limited vessel transits, to and from the WEAs to their respective and/or alternative ports, conducted as part of the Proposed Action, are anticipated to be short-term and temporary and are **not likely to adversely affect** the critical habitat of killer whales.

Critical habitat (feeding) for leatherback sea turtles stretches along the California coast from Point Arena to Point Arguello east of the 3,000-meter depth contour; and 25,004 mi^2 (64,760 km^2) stretching from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000-m depth contour. During the critical habitat review, it was determined that the oceanographic features of the general area off Morro Bay produce prey of sufficient condition, distribution, abundance and density to provide for foraging that is essential to the conservation of leatherback sea turtles, i.e., “high” conservation value (NMFS 2012). The Morro Bay WEA (284 nmi^2) overlaps critical habitat for leatherback sea turtles. No sightings of leatherbacks have been recorded in the Morro Bay WEA, with limited sightings in the vicinity (NMFS 2012), and any displacement of prey species or individuals as a result of limited vessel surveys and transits, to and from the WEAs to their respective and/or alternative ports, conducted as part of the Proposed Action, are anticipated to be short-term and temporary and are **not likely to adversely affect** the critical habitat for leatherback sea turtles.

Critical habitat for listed green sturgeon overlaps with the Action Area nearby the Humboldt WEA. Any displacement of prey species or individuals as a result of noise, benthic sampling or vessel transits to and from the Humboldt WEA and ports conducted as part of the Proposed Action are anticipated to be short-term and temporary and are **not likely to adversely affect** the critical habitat of green sturgeon.

Black abalone critical habitat overlaps with a small proportion (0–6 m depth) of the Action Area. Very little to zero noise or benthic disturbance from project activities will occur at these shallow depths. Furthermore, black abalone inhabit rocky substrates where benthic sampling (e.g., grabs) activities will not occur. Therefore, project activities are **not likely to adversely affect** the critical habitat of black abalone.

Critical habitat for all salmonids is focused on fresh water habitats (e.g., river and stream channels and reaches, floodplains) and occasionally estuaries and not in marine ports or harbors. Therefore, there is no overlap with project activities and **no adverse effects** are expected to salmonid critical habitat.

Cumulative Effects

In addition to commercial vessel traffic levels and current commercial fishing activities, aquaculture operations (specifically in Humboldt Bay and Morro Bay), Department of Defense operations throughout the Pacific, there are 23 oil and gas platforms in the Southern California Planning Area (SCPA) (Argonne 2019).

Leasing, exploration, development and production of offshore oil and gas reserves on the outer continental shelf of the Pacific Coast began in the early 1960's and the last oil and gas platform was installed in southern California in 1989. There are no plans to conduct new lease sales at this time and no new platforms are expected to be installed in the foreseeable future. Emphasis has shifted from leasing new areas to maximizing the development of oil and gas resources within the range of existing platforms and infrastructure. Routine oil and gas development activities currently underway include seismic surveys, support vessel and operator aircraft activity, ongoing discharges, emissions, well simulation treatments, well conductor installations and removals, daily inspection flights by BSEE and oil spill response exercises. Potential impacts to protected species from these activities include noise, discharge of pollutants, vessel collisions, indirect effects of oil spills.

Seven platforms are currently shut-in and pending decommissioning, and well plugging operations on these platforms are underway. Thus, decommissioning of these platforms is expected to occur in the reasonably foreseeable future. In addition, decommissioning of an additional 8 platforms could occur within the next 10 years. It is currently unknown when decommissioning may be initiated for the 15 platforms still in production, though by regulation an initial platform removal application must be submitted at least 2 years before production is projected to cease.

ESA-listed protected species experience a variety of anthropogenic impacts, including collisions with vessels (ship strikes), entanglement with fishing gear, noise from human activities, pollution, disturbance of marine and coastal environments, climate change, effects on benthic habitat, waste discharge, and accidental fuel leaks or spills. Many marine mammals migrate long distances and are affected by these factors over very broad geographical scales. Potential effects associated with the Proposed Action are expected to be relatively minor. Vessel trips associated with the Proposed Action will not significantly increase vessel traffic in the Action Area. Vessels generally move slowly while surveying or remain stationary. Vessels may transit at higher speeds between surveys and departing/returning from ports and offshore areas. The Proposed Action would result in a minor incremental contribution to cumulative impacts. Adherence to BOEM's BMPs (Appendix A) regarding vessel strike avoidance measures and exclusion zones to minimize acoustic impacts would reduce the potential for cumulative impacts on listed marine mammals. Based on the analysis in this BA, BOEM has determined that the incremental contribution to cumulative impacts on marine mammals from the Proposed Action will be discountable.

Leatherback and loggerhead sea turtles are ESA-listed as threatened or endangered and are all highly migratory species that could occur within the Action Area. Human impacts on sea turtles in the U.S Pacific include collisions with vessels, entanglement with fishing gear, noise, pollution, disturbance of marine and coastal environments, disturbance of nesting habitat, and climate change. The most likely impacts on sea turtles as a result of the Proposed Action are minor disturbance at very close ranges through noise exposure, effects of vessel impacts, and the physical placement of metocean buoys. Based on this analysis that considers the low numbers of sightings of leatherbacks and loggerheads in the Action Area, as well as the adherence to BOEM's BMPs regarding vessel strike avoidance measures, marine debris training, mooring BMPs, and measures to reduce exposure to non-injurious sound, BOEM has determined that the incremental contribution to cumulative impacts on leatherback and loggerhead sea turtles from the Proposed Action will be discountable.

ESA-listed fishes are threatened or endangered and are all highly mobile or migratory species that could occur within the Action Area. The most likely impacts on fishes from the Proposed Action are minor disturbance at very close ranges through noise exposure and habitat disturbance. Based on this analysis, as well as the adherence to the BMPs described in Appendix A, BOEM has determined that the incremental contribution to cumulative impacts to marine fishes from the Proposed Action will be discountable.

The black abalone, white abalone, and sunflower sea star are primarily found in shallower waters within the Action Area. Most bottom disturbing activities will occur within the lease areas which are deeper than the preferred depth range of these species. However, sampling within proposed cable corridors may overlap with their distribution. There are no likely impacts as a result of the Proposed Action since there is minimal overlap in habitat, and noise impacts would not likely to be detectable by these invertebrates. Based on this analysis, as well as the adherence to the BMPs described in Appendix A, BOEM has determined that the incremental contribution to cumulative impacts to the sunflower sea star from the Proposed Action will be discountable.

Conclusion for ESA Species

Due to the nature of the proposed activities, as well as the PDCs and BMPs employed as part of the Proposed Action (Appendix A), BOEM has determined that the impacts to protected species and critical habitat from site characterization surveys and site assessment activities will be insignificant and may affect but **not likely to adversely affect** ESA-listed protected species or associated critical habitat. See Table 14 for a summary of effect determinations for the activities in the Proposed Action.

Table 14: Summary analysis of effects from the Proposed Action on ESA-listed species covered in this BA. NLAA = Not Likely to Adversely Affect; NE = No Effect

Activity	Route of Effect	Potential Effect	BMP	Effect Determination				
				Whales	Sea Turtles	Pinnipeds	Fish	Invertebrates
Metocean Buoy Installation								
Installation of metocean buoys, wave gliders, and other data collection devices	Habitat Alteration/Turbidity/	Foraging/prey availability	No	NE	NLAA	NLAA	NLAA	NLAA
	Physical presence of moorings/buoys	Entanglement	Yes	NLAA	NLAA	NLAA	NE	NE
Accidental release of pollutants	Onboard generators and fuel storage	Water Quality	No	NLAA	NLAA	NLAA	NLAA	NE
	Marine Debris	Ingestion, entanglement	Yes	NLAA	NLAA	NLAA	NE	NE
	HRG and Geotechnical Surveys							
HRG surveys	Noise	Disturbance	Yes	NLAA	NLAA	NLAA	NLAA	NE
Geotechnical surveys	Habitat Alteration/Turbidity	Disturbance	No	NE	NE	NLAA	NLAA	NLAA
	Noise	Disturbance	Yes	NLAA	NLAA	NLAA	NLAA	NE
	Side-scan sonar (≥200 kHz)	No effect	No	NE	NE	NE	NE	NE
	Vessel Operations							
Vessel transits and operations	Strikes	Injury	Yes	NLAA	NLAA	NLAA	NE	NE
	Moon pool	Injury	Yes	NLAA	NLAA	NLAA	NE	NE
	Noise	Disturbance	No	NLAA	NLAA	NLAA	NLAA	NE
Vessel Engines and Thrusters	Noise	Disturbance	Yes	NLAA	NLAA	NLAA	NLAA	NE
	Impingement	No Effect	No	NE	NE	NLAA	NE	NE

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3. Part III: Essential Fish Habitat Assessment:

Prepared by the Bureau of Ocean Energy Management for the National Marine Fisheries Service in Accordance with the Magnuson-Stevens Fishery Conservation and Management Act, as Amended in 1996.

Purpose

Under Section 305 (b) (2) of the Magnuson Fishery Conservation and Management Act (16 U.S.C. 1801 et seq.) as amended by the Sustainable Fisheries Act on October 11, 1996, Federal agencies are required to consult with the Secretary of Commerce on any actions that may adversely affect essential fish habitat (EFH). The Department of Commerce published an interim final rule (50 CFR Part 600) in the Federal Register (December 19, 1997, Volume 62, Number 244) that detailed the procedures under which Federal agencies would fulfill their consultation requirements. As set forth in the regulations, EFH Assessments must include: 1) a description of the Proposed Action; 2) an analysis of the effects, including cumulative effects, of the action on EFH, the managed species, and associated species by life history stage; 3) the Federal agency's views regarding the effects of the action on EFH; and 4) proposed mitigation if applicable.

Project Description

This EFH assessment covers lease issuance, site characterization and site assessment for the Humboldt and Morro Bay Wind Energy Areas (WEAs) and export cable routes. Details and maps of the Action Areas are provided in Part I of this document.

Managed Species

The Pacific Fishery Management Council (PFMC) manages or monitors (as ecosystem component species) numerous fishes and invertebrates under four Fishery Management Plans (FMPs): 1) Coastal Pelagic Fishery Management Plan; 2) Highly Migratory Species Fishery Management Plan; 3) Pacific Groundfish Fishery Management Plan; and 4) Pacific Salmon Fishery Management Plan (Table 15) (PFMC 2022a,b; PFMC 2023a,b). In addition to species identified under these four FMPS, a suite of shared ecosystem component species is also monitored.

Table 15. Fish and invertebrate species managed or monitored (as ecosystem component species or ecs) by the Pacific Fishery Management Council. Species distributions that overlap with the WEAs and nearby Action Area = X; species distributions that potentially overlap within the WEAs and nearby Action Area = ?; species distributions that do not overlap with the WEA or nearby Action Area = *. Distribution data obtained from Love et al. (2021).

Common Name	Scientific Species Name or Family	Humboldt WEA	Morro Bay WEA
Coastal Pelagic Species FMP			
Pacific sardine	*Sardinops sagax*	X	X
Pacific (chub) mackerel	*Scomber japonicus*	X	X
Northern anchovy	*Engraulis mordax*	X	X
Market squid	*Doryteuthis opalescens*	X	X
Jack mackerel	*Trachurus symmetricus*	X	X
All endemic krill and euphausiid species		X	X
Pacific herring (ecs)	*Clupea pallasii pallasii*	X	X

Common Name	Scientific Species Name or Family	Humboldt WEA	Morro Bay WEA
Jacksmelt (ecs)	*Atherinopsis californiensis*	X	X
Highly Migratory Species FMP			
North Pacific albacore	*Thunnus alalunga*	X	X
Yellowfin tuna	*Thunnus albacares*	X	X
Bigeye tuna	*Thunnus obesus*	X	X
Skipjack tuna	*Katsuwonus pelamis*	X	X
Pacific bluefin tuna	*Thunnus orientalis*	X	X
Common thresher shark	*Alopias vulpinus*	X	X
Shortfin mako	*Isurus oxyrinchus*	X	X
Blue shark	*Prionace glauca*	X	X
Striped marlin	*Kajikia (Tetrapturus) audax*	X	X
Swordfish	*Xiphias gladius*	X	X
Dorado	*Coryphaena hippurus*	X	X
Bigeye thresher shark (ecs)	*Alopias superciliosus*	*	X
Common mola (ecs)	*Mola mola*	X	X
Escolar (ecs)	*Lepidocybium flavobrunneum*	?	?
Lancetfishes (ecs)	Alepisauridae	X	X
Louvar (ecs)	*Luvarus imperialis*	X	X
Pelagic stingray (ecs)	*Pteroplatytrygon (Dasyetis) violacea*	X	X
Pelagic thresher shark (ecs)	*Alopias pelagicus*	*	*
Wahoo (ecs)	*Acathocybium solandri*	*	*
Pacific Groundfish FMP			
Big skate	*Raja binoculata*	X	X
Leopard shark	*Triakis semifasciata*	X	X
Longnose skate	*Raja rhina*	X	X
Spiny dogfish	*Squalus suckleyi*	X	X
Cabezon	*Scorpaenichthys marmoratus*	X	X
Kelp greenling	*Hexagrammos decagrammus*	X	X
Lingcod	*Ophiodon elongatus*	X	X
Pacific cod	*Gadus macrocephalus*	X	X
Pacific whiting (hake)	*Merluccius productus*	X	X
Sablefish	*Anoplopoma fimbria*	X	X
Aurora rockfish	*Sebastes aurora*	X	X
Bank rockfish	*Sebastes rufus*	X	X

Common Name	Scientific Species Name or Family	Humboldt WEA	Morro Bay WEA
Black rockfish	*Sebastes melanops*	X	X
Black-and-yellow rockfish	*Sebastes chrysomelas*	X	X
Blackgill rockfish	*Sebastes melanostomus*	X	X
Blackspotted rockfish	*Sebastes melanostictus*	X	X
Blue rockfish	*Sebastes mystinus*	X	X
Bocaccio	*Sebastes paucispinis*	X	X
Bronzespotted rockfish	*Sebastes gilli*	X	X
Brown rockfish	*Sebastes auriculatus*	X	X
Calico rockfish	*Sebastes dallii*	*	X
California scorpionfish	*Scorpaena guttata*	*	X
Canary rockfish	*Sebastes pinniger*	X	X
Chameleon rockfish	*Sebastes phillipsi*	X	X
Chilipepper rockfish	*Sebastes goodei*	X	X
China rockfish	*Sebastes nebulosus*	X	X
Copper rockfish	*Sebastes caurinus*	X	X
Cowcod	*Sebastes levis*	X	X
Darkblotched rockfish	*Sebastes crameri*	X	X
Deacon rockfish	*Sebastes diaconus*	X	X
Dusky rockfish	*Sebastes ciliatus*	*	*
Dwarf-red rockfish	*Sebastes rufinanus*	*	*
Flag rockfish	*Sebastes rubrivinctus*	X	X
Freckled rockfish	*Sebastes lentiginosus*	*	*
Gopher rockfish	*Sebastes carnatus*	X	X
Grass rockfish	*Sebastes rastrelliger*	X	X
Greenblotched rockfish	*Sebastes rosenblatti*	*	X
Greenspotted rockfish	*Sebastes chlorostictus*	X	X
Greenstriped rockfish	*Sebastes elongatus*	X	X
Halfbanded rockfish	*Sebastes semicinctus*	X	X
Harlequin rockfish	*Sebastes variegatus*	*	*
Honeycomb rockfish	*Sebastes umbrosus*	*	X
Kelp rockfish	*Sebastes atrovirens*	*	X
Longspine thornyhead	*Sebastolobus altivelis*	X	X
Mexican rockfish	*Sebastes macdonaldi*	*	X
Olive rockfish	*Sebastes serranoides*	X	X

Common Name	Scientific Species Name or Family	Humboldt WEA	Morro Bay WEA
Pink rockfish	*Sebastes eos*	X	X
Pinkrose rockfish	*Sebastes simulator*	*	X
Pygmy rockfish	*Sebastes wilsoni*	X	X
Pacific ocean perch	*Sebastes alutus*	X	X
Quillback rockfish	*Sebastes maliger*	X	X
Redbanded rockfish	*Sebastes babcocki*	X	X
Redstripe rockfish	*Sebastes proriger*	X	X
Rosethorn rockfish	*Sebastes helvomaculatus*	X	X
Rosy rockfish	*Sebastes rosaceus*	X	X
Rougheye rockfish	*Sebastes aleutianus*	*	?
Sharpchin rockfish	*Sebastes zacentrus*	X	X
Shortraker rockfish	*Sebastes borealis*	X	X
Shortspine thornyhead	*Sebastolobus alascanus*	X	X
Silvergray rockfish	*Sebastes brevispinis*	X	X
Speckled rockfish	*Sebastes ovalis*	X	X
Splitnose rockfish	*Sebastes diploproa*	X	X
Squarespot rockfish	*Sebastes hopkinsi*	X	X
Sunset rockfish	*Sebastes crocotulus*	?	X
Starry rockfish	*Sebastes constellatus*	*	X
Stripetail rockfish	*Sebastes saxicola*	X	X
Swordspine rockfish	*Sebastes ensifer*	X	X
Tiger rockfish	*Sebastes nigrocinctus*	X	X
Treefish	*Sebastes serriceps*	*	X
Vermilion rockfish	*Sebastes miniatus*	X	X
Widow rockfish	*Sebastes entomelas*	X	X
Yelloweye rockfish	*Sebastes ruberrimus*	X	X
Yellowmouth rockfish	*Sebastes reedi*	X	*
Yellowtail rockfish	*Sebastes flavidus*	X	X
Arrowtooth flounder (turbot)	*Atheresthes stomias*	X	X
Butter sole	*Isopsetta isolepis*	X	X
Curlfin sole	*Pleuronichthys decurrens*	X	X
Dover sole	*Microstomus pacificus*	X	X
English sole	*Parophrys vetulus*	X	X
Flathead sole	*Hippoglossoides elassodon*	X	*

Common Name	Scientific Species Name or Family	Humboldt WEA	Morro Bay WEA
Pacific sanddab	*Citharichthys sordidus*	X	X
Petrale sole	*Eopsetta jordani*	X	X
Rex sole	*Glyptocephalus zachirus*	X	X
Rock sole	*Lepidopsetta bilineata*	X	X
Sand sole	*Psettichthys melanostictus*	X	X
Starry flounder	*Platichthys stellatus*	X	X
Shortbelly rockfish	*Sebastes jordani (ecs)*	X	X
Aleutian skate	*Bathyraja aleutica (ecs)*	X	*
Bering/sandpaper skate	*Bathyraja interrupta (ecs)*	*	*
California skate	*Beringraja (Raja) inornata (ecs)*	X	X
Roughtail/black skate	*Bathyraja trachura (ecs)*	X	X
Endemic softnose skates	Arhynchobatidae *(ecs)*	X	X
Pacific grenadier	*Coryphaenoides acrolepis (ecs)*	X	X
Giant grenadier	*Coryphaenoides (Albatrossia) pectoralis (ecs)*	X	X
Endemic grenadiers	Macrouridae *(ecs)*	X	X
Fine scale codling/Pacific flatnose	*Antimora microlepis (ecs)*	X	X
Spotted ratfish	*Hydrolagus colliei (ecs)*	X	X
Soupfin shark	*Galeorhinus galeus (zyopterus) (ecs)*	X	X
Pacific Salmon FMP			
Chinook Salmon	*Oncorhynchus tshawytscha*	X	X
Coho Salmon	*Oncorhynchus kisutch*	X	X
Pink Salmon	*Oncorhynchus gorbuscha*	X	X
Shared Ecosystem Component Species			
Round herring	*Etrumeus (teres) acuminatus*	*	X
Thread herring	*Opisthonema libertate, O. medirastre*	*	*
Endemic mesopelagic fish species	Myctophidae, Bathylagidae, Paralepididae, and Gonostomatidae	X	X
Pacific sand lance	*Ammodytes hexapterus*	*	*
Pacific saury	*Cololabis saira*	X	X
Endemic silversides	Atherinopsidae	X	X
Endemic smelts	Osmeridae	X	X

Common Name	Scientific Species Name or Family	Humboldt WEA	Morro Bay WEA
Endemic squid species	Cranchiidae, Gonatidae, Histioteuthidae, Octopoteuthidae, Ommastrephidae except (*Dosidicus gigas*), Onychoteuthidae, and Thysanoteuthidae	X	X

The marine environment in the Humboldt and Morro Bay WEAs and nearby regions are rich in fish species due to the high productivity of the California Current System and the wide variety of habitats located therein. The vast majority of the species managed by the Council can be found within the project area during their life cycle (Love 1996). The PFMC has identified EFH and habitat areas of particular concern (HAPCs) for each of the four FMPs (PFMC 2022a,b; PFMC 2023a,b). EFH and HAPCs will be present within the Action Area and therefore this analysis will be broad in scope and will discuss the effects of the identified IPFs on a wide range of prey, habitats, and managed or monitored species.

Potential Impacting-Producing Factors

BOEM has identified two potential IPFs generated by activities associated with site characterization and assessment: noise and habitat alteration/turbidity. A summary description of each impacting source is included in the following section.

Effects on EFH

Noise

Being a dense medium, water transmits sound faster and for longer distances than air transmits sound. Aquatic organisms may use this phenomenon to quickly glean information about their environment over relatively large areas. Fishes possess two mechanoreception sensory systems to detect sound in their environment. The first is the lateral line system (LLS) which is a series of pore-receptors along the body of a fish. The LLS detects vibration and pressure gradients in the water within a few body lengths of the organism. The lateral line detects particle motion at low frequencies from below 1 hertz (Hz) up to at least 400 Hz (Hastings and Popper 2005; Higgs and Radford 2013).

The second hearing organ fish possess is an inner ear (Popper and Hastings 2019). For most species, the inner ear contains three dense otoliths (small calcareous bones) that sit atop many delicate hair cells, comparable to the hair cells found in the mammalian ear. Sound waves in water pass through the fish's body, which has a composition similar to water, but will differentially affect the heavier otoliths. This causes a change in the relative motion between the otoliths and the surrounding body tissues and can be detected by the hair cells and sensed by the nervous system.

Some fishes possess additional morphological adaptations or specializations that can enhance their sensitivity to sound pressure, such as an anatomical extension that connects a gas-filled swim bladder to the auditory system (Astrup 1999; Popper and Fay 2010; Popper and Hastings 2019). The swim bladder can enhance sound detection by converting acoustic pressure into localized particle motion, which may then be detected by the inner ear (Radford et al. 2012). Fishes with a swim bladder generally have better sensitivity to sound and can detect higher frequencies than fishes without a swim bladder (Popper and Fay 2010; Popper et al. 2014). In addition, structures such as gas-filled bubbles near the ear or swim bladder also increase sensitivity and allow for high-frequency hearing capabilities and better sound pressure detection.

Many fishes use sound to (1) find food, habitat, and mates; (2) provide orientation cues for migration; (2) communicate during territorial defense, aggression, mating, and as a method of indicating alarm; and (3) detect and avoid predators (Popper and Hawkins 2019). Anthropogenic noise may mask, disrupt or distract organisms that use sound as a source of information for these important activities. Noise at very high levels may affect fish directly by increasing stress levels, causing temporary or permanent loss of hearing, damage to body tissues, or increased mortality rates (Popper and Hawkins 2019). Fishes residing in environments where there is little light, such as the deep sea, may have a greater reliance on sound to sense their environments (Marshall 1966; Deng et al. 2011). Eggs and larval fish stages may be less sensitive due to their immature or undeveloped sensory organs (Kunc et al. 2016). The majority of the native fishes on the Pacific Coast are hearing generalists, although some species managed under the Coastal Pelagic Species FMP (e.g., Pacific sardine, northern anchovy) would be considered hearing specialists (Hastings and Popper 2005).

Although particle motion may be the more relevant exposure metric for many fish species, there are few data available that measure it due to a lack of standard measurement methodology and experience with particle motion detectors (Popper et al. 2014). Historically, studies that have investigated hearing in fishes and the consequences of anthropogenic noise were carried out with sound pressure metrics. In these instances, particle motion can be inferred from pressure measurements (Nedelec et al. 2016). In this analysis, impact assessment is expected to be conservative.

Of the sources that may be used in geophysical surveys for offshore wind, only a handful (e.g., boomers, sparkers, bubble guns, and some sub-bottom profilers) emit sounds at frequencies that are within the hearing range of most fishes and invertebrates. This means that side-scan sonars, multibeam echosounders, and some sub-bottom profilers would not be audible, and thus would not affect these taxa. For the sources that are audible, it is important to consider other factors such as source level, beamwidth, and duty cycle (Ruppel et al. 2022). Boomers, sparkers, hull-mounted sub-bottom profilers, and bubble guns have source levels close to the threshold for injury for pressure-sensitive fishes, so unless a fish was within a few meters of the source, injury is highly unlikely (Crocker and Fratantonio 2016; Popper et al. 2014b). Behavioral impacts could occur over slightly larger spatial scales. For example, if one assumes an SPL threshold of 150 dB re 1 μPa for behavioral disturbance GARFO (2020), sounds with source levels of 190 dB re μPa·m would fall below this threshold several hundred meters from the source (assuming 15*log(range) propagation loss). This means that the lowest-powered sparkers, boomers, and bubble guns would not result in behavioral disturbance beyond this distance, and this range would be even smaller for quieter sources like towed sub-bottom profilers (Crocker and Fratantonio 2016). It should be noted that these numbers are reported in terms of acoustic pressure because there are currently no behavioral disturbance thresholds for particle motion. It is expected that behavioral impact ranges would be even smaller for particle motion-sensitive species, including invertebrates. Because most HRG sources are typically "on" for short periods with silence in between, only a few "pings" emitted from an active acoustic source towed from a moving vessel would reach fish or invertebrates below, so behavioral effects would be intermittent and temporary.

Noise produced by project activities (see relevant sections in Part I and part II) result from the operation of marine vessels and from survey and biological collection activities. The adverse effects, if any, are expected to last for the duration of the activities that are producing the noise and are not expected to have long-lasting consequences. For fish species capable of sensing the introduced noise, they may alter their behavior and leave the affected area (e.g., the pelagic fish species within each FMP) or move closer to the seabed (e.g., demersal fishes within the Pacific Groundfish FMP). Adults may have greater sensitivity to noise impacts compared to larvae and eggs given their better developed hearing systems. No population-level effects are expected due to the minimal influence project activities may have across larger spatial and temporal scales. Project activities are likely to have temporary, minimally adverse impacts (minimally adverse being defined as no population-level effects) to managed species. Additional discussion on noise impacts to fishes stemming from High-Resolution Geophysical (HRG) Surveys is further discussed in Section II.

Because invertebrate species lack gas-filled structures within their bodies, they may be less sensitive to anthropogenic noise sources compared to fishes, although many taxa appear to have morphological structures (e.g., hair cells) that can be sensitive to particle motion (Popper and Hawkins 2018). A recent review indicates that some invertebrates change their behavior when exposed to chronic shipping noise (Murchy et al. 2019). Much more research needs to be done to determine if such behavior changes translate into population-level effects. The low levels of expected anthropogenic noise are not known to permanently alter characteristics of pelagic or benthic habitats. Therefore, project activities are expected to have no or minimally adverse effects to EFH (including HPACs) or to the invertebrate prey base of managed species.

Habitat Alteration and Turbidity

Project activities that may alter habitats or increase turbidity in the Action Areas include geotechnical and biological sampling, and buoy emplacement, operation, and retrieval.

Geotechnical sampling (gravity cores, piston cores, vibracores, deep borings, cone penetration tests, etc.) and biological grab sampling may damage benthic habitats by permanently removing small amounts of sediments from the seabed. Animals within or on top of these samples will likely be killed. Collection of samples causes nearby disturbance as sediment moves to fill the hole left by the removed core or grab, possibly exposing animals in the surrounding sediment to predators (Skilleter, 1996). Sampling may also disrupt microbial assemblages in the sediments and breakdown biotic structures which help bind sediments together (e.g., microbial mats; Skilleter, 1996). Recovery rates of sampled areas to baseline conditions are mostly unknown, but may exceed several weeks (Skilleter, 1996). The distribution of these samples will occur throughout the leases, but the total spatial extent of sampling will be a very small percentage compared to the overall Action Area so only minimally adverse effects to EFH are expected.

PNNL (2019) assessed potential effects from a data-collecting buoy within the Morro Bay WEA and determined that minimal and temporary adverse effects to EFH were expected. The consequences to EFH from buoy emplacement, operations, and retrieval from the proposed project is expected to be similar to those described in PNNL (2019). A buoy system may also function as a small de facto artificial reef, providing a minor amount of additional hard substrate within the WEAs from the anchor, mooring lines, and buoy structure. The environment effects are expected to be similar to that produced by marine debris and generate local increases in biomass and species diversity (Caselle et al. 2002). Indirect effects from buoy emplacement may preserve habitat integrity of the seabed as fishers, especially trawlers, may avoid these areas until buoys are decommissioned. The damage from bottom-contact trawls would then be displaced to outside of the local buoy area. The spatial extent of environmental consequences from buoys will be a small percentage compared to the overall Action Area so only minimal effects to managed species and EFH are expected.

Habitat disturbance may cause sediments and benthic organic material to be introduced into the water column and may also increase local turbidity levels. Direct effects from sediment suspension and increased turbidity on fish populations may include exposure to contaminants, changes in feeding rates, reduction in predator-avoidance ability, or smothering of feeding and respiratory organs (Wilber and Clarke 2001; Utne-Palm, 2002; Au et al. 2004). To avoid these consequences, fishes may choose to relocate until water clarity returns to levels approximating pre-disturbance conditions. Indirect effects on fish populations from sediment suspension and increased turbidity may occur by harming the populations of prey species on which the fishes depend (Airoldi, 2003). Biological response to these potential impacts is often a function of concentration and exposure duration (Newcombe and Jensen, 1996). The proposed activities from the project are predicted to generate only minimal and short-term impacts to benthic habitats and cause a negligible increase in suspended materials over a short time frame. The offshore location of the WEAs as well as the more rural areas of the coastline where a cable may connect to shore suggests that terrestrial-based pollutants are not likely to be found in large concentrations within disturbed sediments. The small number of sediment grabs made in nearshore environments where cable corridors may be will not be enough to affect water quality in the long term. Therefore, proposed activities associated will have minimal adverse effects to managed species and EFH.

This analysis is consistent with the findings by NOAA in their Deep Seabed Mining Regulations for Exploration Licenses (15 CFR Part 970, Subpart G Environmental Effects) promulgated under the authority of 30 U.S.C. 1401 et seq. Activities identified to have no significant impact and require no further environmental assessment include: (1) Gravity and magnetometric observations and measurements; (2) Bottom and sub-bottom acoustic profiling or imaging without the use of explosives; (3) Mineral sampling of a limited nature such as those using either core, grab or basket samplers; (4) Water and biotic sampling, if the sampling does not adversely affect shellfish beds, marine mammals, or an endangered species, or if permitted by the National Marine Fisheries Service or another Federal agency; (5) Meteorological observations and measurements, including the setting of instruments; (6) Hydrographic and oceanographic observations and measurements, including the setting of instruments; (7) Sampling by box core, small diameter core or grab sampler, to determine seabed geological or geotechnical properties; (8) Television and still photographic observation and measurements; (9) Shipboard mineral assaying and analysis; and (10) Positioning systems, including bottom transponders and surface and subsurface buoys filed in Notices to Mariners (15 CFR§ 970.701(a)).

Cumulative Analysis

This section describes the projects and activities considered in the cumulative analysis for the proposed action. Possible sources of cumulative impacts specific to managed species and EFH are those that degrade the environment via anthropogenic noise or habitat alteration/increased turbidity.

Sources of cumulative impacts include on-going and proposed oil and gas activities in Federal and State waters, commercial fishing marine vessel traffic, and non-point sources of ocean discharges. Climate change activities are also addressed. Potential cumulative impacts are discussed below.

Federal and State Offshore Energy Projects

Federal oil and gas operations do not spatially overlap with the Action Area but do occur within the larger region nearby the Morro Bay WEA. The cumulative effects of Federal structures and earlier development activities can be found in previous environmental analyses (MMS, 1995). Foreseeable ongoing oil and gas operations are not expected to include notable changes in baseline activities that may affect noise, habitats, or turbidity for the duration of project activities (M. Mitchell, Department of the Interior, Bureau of Safety and Environmental Enforcement, personal communication). Environmental consequences of foreseeable decommissioning (removal) of oil and gas platforms are being examined within a Programmatic Environmental Impact Statement that is under development and will include a description of potential impacts to managed fish species and EFH. However, it is likely these future decommissioning activities will not temporarily overlap with project activities. The proposed activities are only expected to produce a temporary and incrementally small increase in noise, habitat changes and turbidity within the regional environment.

The California State Lands Commission is processing two lease applications for offshore floating wind energy projects in California State waters, both located offshore central California near the Vandenberg Space Force Base. The two Project Applicants are CADEMO Corporation (CADEMO), a renewable energy development company, and IDEOL USA Inc. (IDEOL), a floating offshore wind technology company and project developer. CADEMO proposes to install and operate four offshore floating wind turbines. CADEMO proposes to examine the performance of two distinct floating foundation platforms (barge and tension-leg). Each wind turbine would be capable of producing 12 to 15 megawatts (MW) of renewable electricity. A combined maximum of 60 MW could be generated from the proposed four wind turbines, which would be connected in a series with electrical inter-array cables. The precise lease area and activities were initially evaluated through a preliminary environmental assessment released in

October, 2021. The State will evaluate further as part of a State Environmental Impact Report process (California State Lands Commission 2021).

Non-Energy Projects and Activities

- ***Commercial Fishing***

Commercial fishing activity is ubiquitous along the Pacific Coast (Miller et al. 2017), and is the most widespread human exploitative activity in the marine environment, generating significant impacts to habitats and populations (Jennings and Kaiser 1998). Proposed activities would only incrementally add to the impacts relative to fishing, and those impacts would be temporary.

- ***Marine Vessel Traffic***

Commercial shipping has seen rapid growth in recent years and is expected to increase (Kaplan and Solomon 2016). The Action Area is adjacent to a maritime traffic corridor (Figure 2, Figure 3). Noise from this shipping traffic can vary considerably according to regulatory and economic events (McKenna et al. 2012), but it is an ongoing activity that occurs throughout the year. The proposed activities are only expected to produce a temporary increase in anthropogenic sound in the Action Area.

- ***Nonpoint Source (NPS) Discharges***

Turbidity can increase in marine environments from terrestrial runoff, especially during storm events. The nearest nonpoint sources of pollution are rivers and creeks which empty into the ocean along the mainland coast. Because water flow rate varies seasonally, most of the pollution enters the ocean in the winter months and, given the distance of the WEAs from the coast, turbidity plumes from NPS discharges may not overlap with the Action Area. The proposed activities are only expected to produce a temporary and incrementally small increase in turbidity within the Action Area.

Climate Change Conditions

Climate change conditions may have significant impacts to marine life stemming from large shifts in ocean temperature, circulation, stratification, nutrient input, oxygen content, and ocean acidification (Doney et al. 2012; Penn and Deutsch 2022). In the short term, the minimally adverse consequences from project activities shall incrementally and temporarily increase the negative pressures faced by marine life and habitats that are experiencing climate change. In the long term, a societal shift to renewable energy resources will lessen the degree and speed of climate change conditions and improve environmental conditions overall.

Cumulative Conclusion

The impacts from additional noise from project activities would be temporary and incremental and not generate population-level consequences to managed species or lasting negative effects to EFH. The short-term impact from habitat alteration/turbidity from the proposed activities would only contribute an incremental and temporary impact to managed species and EFH.

EFH Conservation Recommendations and Mitigation

Although project activities are expected to generate temporary and minimal adverse effects to EFH, BOEM proposes the following two conservation measures to further minimize impacts to EFH. These two measures will be project design criteria and serve to protect rocky reefs, a habitat of particular concern for Pacific Groundfish EFH that may be present in either the Morro Bay or Humboldt WEAs.

Project Design Criterion 1: Hard Bottom Avoidance and Metocean Buoy Anchoring Plan

Lessees and their contractors shall avoid intentional contact within hard substrate, rock outcroppings, seamounts, or deep-sea coral/sponge habitat and include a buffer that fully protects these habitats from bottom contact during the deployment of metocean buoy moorings. As part of any site assessment plan (SAP), the lessee shall submit to BOEM the details of how these activities will avoid contact with hard bottom. The Plan shall describe how the lessee will avoid placing anchors on sensitive ocean floor habitats and shall include the following information: 1) Detailed maps showing proposed anchoring sites that are located at least 12 m (40 ft) from hard substrate and other anthropogenic features (e.g., power cables), if present; 2) A description of the navigation equipment that would be used to ensure anchors are accurately set; and 3) Anchor handling procedures that would be followed to prevent or minimize anchor dragging, such as placing and removing all anchors vertically.

Project Design Criterion 8: Prohibition of Bottom Trawling During Project Activities

Lessees will characterize site-specific parameters within the WEAs to inform their site assessment plan and to generally describe local conditions, including biological attributes. Lessees and their contractors may employ a range of methods to accomplish these goals (BOEM 2022), but may not employ trawling methodology (as defined by 50 CFR § 660.11 (11)) to conduct these activities.

Overall EFH Conclusion

Project activities are expected to have temporary and minimally adverse impacts to managed species and EFH. Two proposed conservation recommendations, (1) Hard Bottom Avoidance and Metocean Buoy Anchoring Plan, and (2) Prohibition of Bottom Trawling during Project Activities, will further reduce the level of expected effects.

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Appendix A

Project Design Criteria (PDC) and Best Management Practices (BMPs) that Minimize Effects to Threatened and Endangered Species and Essential Fish Habitat for Site Characterization and Site Assessment Activities to Support Offshore Wind Development

In line with BOEM's regulatory authorities, the following PDCs and BMPs apply in Federal waters. Additionally, in line with California Coastal Zone Management's Consistency Determination, BOEM's BMP states that all vessels transiting to and from ports, conducting site characterization studies, surveys, metocean buoy installation, maintenance, or decommissioning will travel at speeds no more than 10 knots during all related activities. If future consultation with NMFS, USFWS or other state or federal agency results in different vessel speed requirements, BOEM will work with California Coastal Commission staff to ensure that any new requirements remain consistent and do not diminish the level of resource protection provided by this requirement.

Any survey monitoring plan must meet the following minimum requirements specified below, except when complying with these requirements would put the safety of the vessel or crew at risk.

PDC 1: Hard Bottom Avoidance and Metocean Buoy Anchoring Plan

BMPs

1. Lessees and their contractors shall avoid intentional contact within hard substrate, rock outcroppings, seamounts, or deep-sea coral/sponge habitat and include a buffer that protects these habitats from bottom contact during the deployment of metocean buoy moorings. As part of any site assessment plan (SAP), the lessee shall submit to BOEM the details of how these activities will avoid contact with hard bottom. The Plan shall describe how the lessee will avoid placing anchors on sensitive ocean floor habitats and shall include the following information:1) Detailed maps showing proposed anchoring sites that are located at least 12 m (40 ft) from hard substrate and other anthropogenic features (e.g., power cables), if present; 2) A description of the navigation equipment that would be used to ensure anchors are accurately set; and 3) Anchor handling procedures that would be followed to prevent or minimize anchor dragging, such as placing and removing all anchors vertically.

PDC 2: Marine Debris Awareness and Prevention

"Marine debris" is defined as any object or fragment of wood, metal, glass, rubber, plastic, cloth, paper or any other solid, man-made item or material that is lost or discarded in the marine environment by the Lessee or an authorized representative of the Lessee (collectively, the "Lessee") while conducting activities on the OCS in connection with a lease, grant, or approval issued by the Department of the Interior (DOI). The Lessee must practice trash and debris reduction and handling practices to reduce the amount of offshore trash that could potentially be lost into the marine environment. These trash management practices include substituting paper and ceramic cups and dishes for those made of Styrofoam or other extruded polystyrene foam, recycling offshore trash, and transporting and storing supplies and materials in bulk containers when feasible and have resulted in a reduction of accidental loss of trash and debris. Vessel operators will comply with pollution regulations outlined in 33 CFR 151.51-77.

To understand the type and amount of marine debris generated, and to minimize the risk of entanglement in and/or ingestion of marine debris by protected species, lessees must implement the following BMPs.

BMPs

1. **Training**: All vessel operators, employees, and contractors performing OCS survey activities on behalf of the Lessee (collectively, "Lessee Representatives") must complete marine trash and debris awareness training annually. The training consists of two parts: (1) viewing a marine trash and debris training video or slide show (described below); and (2) receiving an explanation from management personnel that emphasizes their commitment to the requirements. The marine trash and debris training videos, training slide packs, and other marine debris related educational material may be obtained at https://www.bsee.gov/debris. The training videos, slides, and related material may be downloaded directly from the website. Lessee Representatives engaged in OCS survey activities must continue to develop and use a marine trash and debris awareness training and certification process that reasonably assures that they, as well as their respective employees, contractors, and subcontractors, are in fact trained. The training process must include the following elements:
    a. Viewing of either a video or slide show by the personnel specified above;
    b. An explanation from management personnel that emphasizes their commitment to the requirements;
    c. Attendance measures (initial and annual); and
    d. Recordkeeping and availability of records for inspection by DOI.

    By January 31 of each year, the Lessee must submit to DOI an annual report signed by the Lessee that describes its marine trash and debris awareness training process and certifies that the training process has been followed for the previous calendar year. The Lessee must send the reports via email to *marinedebris@bsee.gov*.
2. **Marking**: Materials, equipment, tools, containers, and other items used in OCS activities which are of such shape or configuration that they are likely to snag or damage fishing devices, and could be lost or discarded overboard, must be clearly marked with the vessel or facility identification and properly secured to prevent loss overboard. All markings must clearly identify the owner and must be durable enough to resist the effects of the environmental conditions to which they may be exposed.
3. **Recovery**: Lessees must recover marine trash and debris that is lost or discarded in the marine environment while performing OCS activities when such incident is likely to: (a) cause undue harm or damage to natural resources, including their physical, atmospheric, and biological components, with particular attention to those that could result in the entanglement of or ingestion by marine protected species; or (b) significantly interfere with OCS uses (e.g., are likely to snag or damage fishing equipment, or present a hazard to navigation). Lessees must notify DOI when recovery activities are (i) not possible because conditions are unsafe; or (ii) not practicable because the marine trash and debris released is not likely to result in any of the conditions listed in (a) or (b) above. The lessee must recover the marine trash and debris lost or discarded if DOI does not agree with the reasons provided by the Lessee to be relieved from the obligation to recover the marine trash and debris. If the marine trash and debris is located within the boundaries of a potential archaeological resource/avoidance area, or a sensitive ecological/benthic resource area, the Lessee must contact DOI for approval prior to conducting any recovery efforts.

    Recovery of the marine trash and debris should be completed immediately, but no later than 30 days from the date in which the incident occurred. If the Lessee is not able to recover the marine trash or debris within 48 hours (See BMP 4. Reporting), the Lessee must submit a recovery plan to DOI explaining the recovery activities to recover the marine trash or debris ("Recovery Plan"). The Recovery Plan must be submitted no later than 10 calendar days from the date in which the incident occurred. Unless otherwise objected by DOI within 48 hours of the filing of the Recovery Plan, the Lessee can proceed with the activities described in the Recovery Plan. The Lessee must request and obtain approval of a time extension if recovery activities cannot be completed within 30 days from the date in which the incident occurred. The Lessee must enact steps to prevent similar incidents and must submit a description of these actions to BOEM and BSEE within 30 days from the date in which the incident occurred.

4. **Reporting**: The Lessee must report all marine trash and debris lost or discarded to DOI (using the email address listed on DOI's most recent incident reporting guidance).

   This report applies to all marine trash and debris lost or discarded, and must be made monthly, no later than the fifth day of the following month. The report must include the following:

   a. Project identification and contact information for the lessee, operator, and/or contractor;
   b. The date and time of the incident;
   c. The lease number, OCS area and block, and coordinates of the object's location (latitude and longitude in decimal degrees);
   d. A detailed description of the dropped object to include dimensions (approximate length, width, height, and weight) and composition (e.g., plastic, aluminum, steel, wood, paper, hazardous substances, or defined pollutants);
   e. Pictures, data imagery, data streams, and/or a schematic/illustration of the object, if available;
   f. Indication of whether the lost or discarded item could be a magnetic anomaly of greater than 50 nanoTesla (nT), a seafloor target of greater than 0.5 meters (m), or a sub-bottom anomaly of greater than 0.5m when operating a magnetometer or gradiometer, side scan sonar, or sub-bottom profile in accordance with DOI's applicable guidance;
   g. An explanation of how the object was lost; and
   h. A description of immediate recovery efforts and results, including photos.

   In addition to the foregoing, the Lessee must submit a report within 48 hours of the incident ("48-hour Report") if the marine trash or debris could (a) cause undue harm or damage to natural resources, including their physical, atmospheric, and biological components, with particular attention to those that could result in the ingestion by or entanglement of marine protected species; or (b) significantly interfere with OCS uses (e.g., are likely to snag or damage fishing equipment, or present a hazard to navigation). The information in the 48-hour Report would be the same as that listed above, but just for the incident that triggered the 48-hour Report. The Lessee must report to DOI if the object is recovered and, as applicable, any substantial variation in the activities described in the Recovery Plan that were required during the recovery efforts.

   Information on unrecovered marine trash and debris must be included and addressed in the description of the site clearance activities provided in the decommissioning application required under 30 CFR § 585.906. The Lessee is not required to submit a report for those months in which no marine trash and debris was lost or discarded.

PDC 3: Minimize Interactions with ESA-listed species during Geophysical Survey Operations

To avoid injury of ESA-listed species and minimize any potential disturbance, the following measures will be implemented for all vessels operating impulsive survey equipment that emits sound at frequency ranges <180 kHz (within the functional hearing range of marine mammals) as well as CHIRP sub bottom profilers (this does not apply to Parametric Sub-bottom Profilers, Ultra Short Baseline, echosounders or side scan sonar; the acoustic characteristics (frequency, narrow beam width, rapid attenuation) are such that no effects to ESA-listed species are anticipated). The Clearance Zone is defined as the area around the sound source that needs to be visually cleared of ESA-listed species for 30 minutes before the sound source is turned on. The Clearance Zone is equivalent to a minimum visibility zone for survey operations to begin (*See* BMP 6). The Shutdown Zone is defined as the area around the sound source that must be monitored for possible shutdown upon detection of ESA-listed whale species within or entering that zone. For both the Clearance and Shutdown Zones, these are minimum visibility distances and for situational awareness PSOs should observe beyond this area when possible. This applies to all sound sources on towed systems that emit sound at frequency ranges < 180 kHz (within the functional hearing range of marine mammals).

BMPs

1. For situational awareness a Clearance Zone extending at least (600 m in all directions) must be established around all vessels operating sources <180 kHz.
    a. The Clearance Zone must be monitored by approved third-party PSOs at all times and any observed ESA-listed species must be recorded (see reporting requirements below).
    b. For monitoring around the autonomous surface vessel (ASV) or Uncrewed Surface Vessels (USVs) where remote PSO monitoring must occur from the mother vessel, a dual thermal/HD camera must be installed on the mother vessel facing forward and angled in a direction so as to provide a field of view ahead of the vessel and around the ASV. PSOs must be able to monitor the real-time output of the camera on hand-held computer tablets. Images from the cameras must be able to be captured and reviewed to assist in verifying species identification. A monitor must also be installed in the bridge displaying the real-time images from the thermal/HD camera installed on the front of the ASV itself, providing a further forward view of the craft. In addition, night-vision goggles with thermal clip-ons and a handheld spotlight must be provided and used such that PSOs can focus observations in any direction around the mother vessel and/or the ASV.
2. To minimize exposure to noise that could be disturbing, Shutdown Zone(s) (500 m for ESA-listed whales visible at the surface) must be established around the sources operating at <180 kHz being towed from the vessel.
    a. The Shutdown Zone(s) must be monitored by third-party PSOs at all times when noise-producing equipment (<180 kHz) is being operated and all observed ESA-listed species must be recorded (see reporting requirements below).
    b. If an ESA-listed whale species is detected within or entering the respective Shutdown Zone, any noise-producing equipment operating below 180 kHz must be shut off until the minimum separation distance from the source is re-established and the measures in (5) are carried out.
        i. A PSO must notify the survey crew that a shutdown of all active boomer, sparker, and bubble gun acoustic sources below 180 kHz is immediately required. The vessel operator and crew must comply immediately with any call

for a shutdown by the PSO. Any disagreement or discussion must occur only after shutdown.

- **c.** If the Shutdown Zone(s) cannot be adequately monitored for ESA-listed whale species presence (i.e., a PSO determines conditions, including at night or other low-visibility conditions, are such that ESA-listed species cannot be reliably sighted within the Shutdown Zone(s), no equipment operating at <180 kHz can be deployed until such time that the Shutdown Zone(s) can be reliably monitored.

3. Before any noise-producing survey equipment (operating at <180 kHz) is deployed, the Clearance Zone (600 m for all ESA-listed species) must be monitored for 30 minutes of pre-clearance observation.

- **a.** If any ESA-listed species is observed within the Clearance Zone during the 30-minute pre-clearance period, the 30-minute clock must be paused. If the PSO confirms the animal has exited the zone and headed away from the survey vessel, the 30-minute clock that was paused may resume. The pre-clearance clock will reset to 30 minutes if the animal dives or visual contact is otherwise lost.

4. When technically feasible, a “ramp up” of the electromechanical survey equipment must occur at the start or re-start of geophysical survey activities. A ramp up must begin with the power of the smallest acoustic equipment for the geophysical survey at its lowest power output. When technically feasible the power will then be gradually turned up and other acoustic sources added in a way such that the source level would increase gradually.

5. Following a shutdown for any reason, ramp up of the equipment may begin immediately only if: (a) the shutdown is less than 30 minutes, (b) visual monitoring of the Shutdown Zone(s) continued throughout the shutdown, (c) the animal(s) causing the shutdown was visually followed and confirmed by PSOs to be outside of the Shutdown Zone(s) (500 m for ESA-listed whale species, and heading away from the vessel, and (d) the Shutdown Zone(s) remains clear of all ESA-listed whale species. If all (a, b, c, and d) the conditions are not met, the Clearance Zone (600 m for all ESA-listed species) must be monitored for 30 minutes of pre-clearance observation before noise-producing equipment can be turned back on.

6. In order for geophysical surveys to be conducted at night or during low-visibility conditions, PSOs must be able to effectively monitor the Clearance and Shutdown Zone(s). No geophysical surveys may occur if the Shutdown Zone(s) cannot be reliably monitored for the presence of ESA-listed whale species to ensure avoidance of impact to those species.

- **a.** An Alternative Monitoring Plan (AMP) must be submitted to BOEM (or the federal agency authorizing, funding, or permitting the survey) detailing the monitoring methodology that will be used during nighttime and low visibility conditions and an explanation of how it will be effective at ensuring that the Shutdown Zone(s) can be maintained during nighttime and low-visibility survey operations. The plan must be submitted 60 days before survey operations are set to begin.
- **b.** The plan must include technologies that have the technical feasibility to detect all ESA-listed whales out to 600 m and leatherback sea turtles out to 100 m.
- **c.** PSOs should be trained and experienced with the proposed alternative monitoring technology.
- **d.** The AMP must describe how calibration will be performed, for example, by including observations of known objects at set distances and under various lighting conditions.

This calibration should be performed during mobilization and periodically throughout the survey operation.

   e. PSOs shall make nighttime observations from a platform with no visual barriers, due to the potential for the reflectivity from bridge windows or other structures to interfere with the use of the night vision optics.

7. At times when multiple survey vessels are operating within a lease area, adjacent lease areas, or exploratory cable routes, a minimum separation distance (to be determined on a survey specific basis, dependent on equipment being used) must be maintained between survey vessels to ensure that sound sources do not overlap.

8. Any visual observations of ESA-listed species by crew or project personnel must be communicated to PSOs on-duty.

9. During good conditions (e.g., daylight hours; Beaufort scale 3 or less) when survey equipment is not operating, to the maximum extent practicable, PSOs must conduct observations for protected species for comparison of sighting rates and behavior with and without use of active geophysical survey equipment. Any observed ESA-listed species must be recorded regardless of any mitigation actions required.

PDC 4: Minimize Vessel Interactions with ESA-listed species

All vessels associated with survey activities (transiting [i.e., travelling between a port and the survey site] or actively surveying) must comply with the vessel strike avoidance measures specified below. The only exception is when the safety of the vessel or crew necessitates deviation from these requirements. If any such incidents occur, they must be reported as outlined below under Reporting Requirements (PDC 7). The Vessel Strike Avoidance Zone is defined as 500 m or greater from any sighted ESA-listed marine mammal species or other unidentified large marine mammal and 100 m from any sea turtle visible at the surface.

BMPs

1. Vessel captain and crew must maintain a vigilant watch for all protected species and slow down, stop their vessel, or alter course, as appropriate and regardless of vessel size, to avoid striking any ESA-listed species. The presence of a single individual at the surface may indicate the presence of submerged animals in the vicinity; therefore, precautionary measures should always be exercised. If pinnipeds or small delphinids of the following genera: Delphinus, Lagenorhynchus, Tursiops and Phocoena are visually detected approaching the vessel (i.e., to bow ride) or towed equipment, vessel strike avoidance and shutdown is not required.

2. Any time a survey vessel is underway (transiting or surveying), the vessel must maintain a 500 m minimum separation distance and a PSO must monitor a Vessel Strike Avoidance Zone (500 m or greater from any sighted ESA-listed whale species or other unidentified large marine mammal, or 100 m from any sea turtle visible at the surface) to ensure detection of that animal in time to take necessary measures to avoid striking the animal. If the survey vessel does not require a PSO for the type of survey equipment used, a trained crew lookout may be used (see #3). For monitoring around the autonomous surface vessels, regardless of the equipment it may be operating, a dual thermal/HD camera must be installed on the mother vessel facing forward and angled in a direction so as to provide a field of view ahead of the vessel and around the ASV. A dedicated operator must be able to monitor the real-time output of the camera on hand-held computer tablets. Images from the cameras must be able to be captured and reviewed to assist in verifying species identification. A monitor must also be installed in the bridge displaying the real-time images from the thermal/HD camera installed on the front of the ASV itself, providing a further forward view of the craft.

- **a.** Survey plans must include identification of vessel strike avoidance measures, including procedures for equipment shut down and retrieval, communication between PSOs/crew lookouts, equipment operators, and the captain, and other measures necessary to avoid vessel strike while maintaining vessel and crew safety. If any circumstances are anticipated that may preclude the implementation of this PDC, they must be clearly identified in the survey plan and alternative procedures outlined in the plan to ensure minimum distances are maintained and vessel strikes can be avoided.
- **b.** All vessel crew members must be briefed in the identification of protected species that may occur in the survey area and in regulations and best practices for avoiding vessel collisions. Reference materials must be available aboard all project vessels for identification of ESA-listed species. The expectation and process for reporting of protected species sighted during surveys must be clearly communicated and posted in highly visible locations aboard all project vessels, so that there is an expectation for reporting to the designated vessel contact (such as the lookout or the vessel captain), as well as a communication channel and process for crew members to do so.
- **c.** The Vessel Strike Avoidance Zone(s) are a minimum and must be maintained around all surface vessels at all times.
- **d.** If a large whale is identified within 500 m of the forward path of any vessel, the vessel operator must steer a course away from the whale at 10 knots (18.5 km/hr) or less until the 500 m minimum separation distance has been established. Vessels may also shift to idle if feasible.
- **e.** If a large whale is sighted within 200 m of the forward path of a vessel, the vessel operator must reduce speed and shift the engine to neutral. Engines must not be engaged until the whale has moved outside of the vessel's path and beyond 500 m. If stationary, the vessel must not engage engines until the large whale has moved beyond 500 m.
- **f.** If a sea turtle is sighted within the operating vessel's forward path, the vessel operator must slow down to 4 knots (unless unsafe to do so) and steer away as possible. The vessel may resume normal operations once the vessel has passed the individual.
- **g.** During times of year when sea turtles are known to occur in the survey area, vessels must avoid transiting through areas of visible jellyfish aggregations. In the event that operational safety prevents avoidance of such areas, vessels must slow to 4 knots while transiting through such areas.

3. To monitor the Vessel Strike Avoidance Zone, a PSO (or crew lookout if PSOs are not required) must be posted during all times a vessel is underway (transiting or surveying) to monitor for ESA-listed species in all directions.

- **a.** Visual observers monitoring the vessel strike avoidance zone can be either PSOs or crew members (if PSOs are not required). If the trained lookout is a vessel crew member, this must be their designated role and primary responsibility while the vessel is transiting. Any designated crew lookouts must receive training on protected species identification, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements. All observations must be recorded per reporting requirements.

b. Regardless of monitoring duties, all crew members responsible for navigation duties must receive site-specific training on ESA-listed species sighting/reporting and vessel strike avoidance measures.

4. Vessels underway must not divert their course to approach any ESA-listed species.

5. Lessees are directed to NMFS' Marine Life Viewing Guidelines, which highlight the importance of these measures for avoiding impacts to mother/calf pairs (https://www.fisheries.noaa.gov/topic/marine-life-viewing-guidelines#guidelines-&-distances).

6. Wherever available, Lessees will ensure all vessel operators check for daily information regarding protected species sighting locations. These media may include, but are not limited to: Channel 16 broadcasts, whalesafe.com, and the Whale/Ocean Alert App.

7. Use of a Moon Pool: During times of year when sea turtles are known to occur in the survey area and there is an intention to utilize a moon pool for the required activities, the following BMPs need to be followed:

a. *Closure of the Hull Door*

i. Should the moon pool have a hull door that can be closed, the operator(s) should keep the doors closed as much as reasonably practicable when no activity is occurring within the moon pool, unless the safety of crew or vessel require otherwise. This will prevent protected species from entering the confined area during periods of non-activity.

ii. Should the moon pool have a hull door that can be closed then prior to and following closure, the moon pool must be monitored continuously by a dedicated crew observer with no other tasks to ensure that no individual protected species is present in the moon pool area. If visibility is not clear to the hull door from above (e.g., turbidity or low light), 30 minutes of monitoring is required prior to hull door closure.

iii. If a protected species is observed in the moon pool prior to closure of the hull door, the hull door must not be closed, to the extent practicable. If the observed animal leaves the moon pool, the operator may commence closure. If the observed animal remains in the moon pool, contact BSEE prior to closure of the hull doors according to reporting requirements (see *below* under *Protected Species within an Enclosed Moon Pool Reporting)*.

b. *Movement of the vessel (no hull door) and equipment deployment/retrieval*

i. Prior to movement of the vessel and/or deployment/retrieval of equipment, the moon pool must be monitored continuously for a minimum of 30 minutes, by a dedicated crew observer with no other tasks, to ensure no individual protected species is present in the moon pool area.

ii. If a protected species is observed in the moon pool prior to movement of the vessel, the vessel must not be moved and equipment must not be deployed or retrieved, except for human safety considerations. If the observed animal leaves the moon pool, the operator may commence activities. If the observed animal remains in the moon pool, contact BSEE prior to planned movement of the vessel according to reporting requirements (see Reporting Requirements under Protected Species within an Enclosed Moon Pool Reporting).

c. *BOEM does not advocate the lowering of crew members into the moon pool to free protected species. NMFS should be contacted if protected species are encountered in the moon pool.*

PDC 5: Minimize Risk During ROV usage, Buoy Deployment, Operations, and Retrieval

Any mooring systems used during ROV usage, buoy deployment, operations, equipment retrieval, and any survey activities prevent any potential entanglement of ESA-listed species, and in the unlikely event that entanglement does occur, ensure proper reporting of entanglement events according to the measures specified below.

BMPs

1. ROVs: A Clearance Zone (600 m for all ESA-listed marine mammals and sea turtle species) must be monitored for 30 minutes of pre-clearance observation by PSOs before ROVs are deployed.
    a. If any ESA-listed species is observed within the Clearance Zone during the 30-minute pre-clearance period, the 30-minute clock must be paused. If the PSO confirms the animal has exited the zone and headed away from the survey vessel, the 30-minute clock that was paused may resume. The pre-clearance clock will reset to 30 minutes if the animal dives or visual contact is otherwise lost.
2. Ensure that any buoys attached to the seafloor use the best available mooring systems. Buoys, lines (chains, cables, or coated rope systems), swivels, shackles, and anchor designs must prevent any potential entanglement of ESA-listed species while ensuring the safety and integrity of the structure or device.
3. All mooring lines and ancillary attachment lines must use one or more of the following measures to reduce entanglement risk: shortest practicable line length, rubber sleeves, weak-links, chains, cables or similar equipment types that prevent lines from looping, wrapping, or entrapping protected species.
4. Any equipment must be attached by a line within a rubber sleeve for rigidity. The length of the line must be as short as necessary to meet its intended purpose.
5. During all buoy deployment and retrieval operations, buoys should be lowered and raised slowly to minimize risk to ESA-listed species and benthic habitat. Additionally, PSOs or trained project personnel (if PSOs are not required) should monitor for ESA-listed species in the area prior to and during deployment and retrieval and work should be stopped if ESA-listed species are observed within 500 m of the vessel to minimize entanglement risk.
6. If a live or dead marine protected species becomes entangled, you must immediately contact the applicable NMFS stranding coordinator using the reporting contact details (see Reporting Requirements section) and provide any on-water assistance requested.
7. All buoys must be properly labeled with owner and contact information.

PDC 6: Protected Species Observers

Qualified third-party PSOs to observe Clearance and Shutdown Zones must be used as outlined in the conditions above.

BMPs

1. All PSOs must have completed an approved PSO training program and must receive NMFS approval to act as a PSO for geophysical surveys. Documentation of NMFS approval for geophysical survey activities in the Pacific and copies of the most recent training certificates of individual PSOs' successful completion of a commercial PSO training course with an overall examination score of 80% or greater must be provided upon request. Instructions and application requirements to become a NMFS-approved PSO can be found at: *www.fisheries.noaa.gov/national/endangered-species-conservation/protected-species-observers*.
2. In situations where third-party party PSOs are not required, crew members serving as lookouts must receive training on protected species identification, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements.
3. PSOs deployed for geophysical survey activities must be employed by a third-party observer provider. While the vessel is underway, they must have no other tasks than to conduct observational effort, record data, and communicate with and instruct relevant vessel crew to the presence of ESA-listed species and associated mitigation requirements. PSOs on duty must be clearly listed on daily data logs for each shift. a. Non-third-party observers may be approved by NMFS on a case-by-case basis for limited, specific duties in support of approved, third-party PSOs.
4. A minimum of one PSO (assuming condition 5 is met) must be on duty observing for ESA-listed species at all times that noise-producing equipment <180 kHz is operating, or the survey vessel is actively transiting during daylight hours (i.e., from 30 minutes prior to sunrise and through 30 minutes following sunset). Two PSOs must be on duty during nighttime operations. A PSO schedule showing that the number of PSOs used is sufficient to effectively monitor the affected area for the project (e.g., surveys) and record the required data must be included. PSOs must not be on watch for more than 4 consecutive hours, with at least a 2-hour break after a 4-hour watch. PSOs must not be on active duty observing for more than 12 hours in any 24-hour period.
5. Visual monitoring must occur from the most appropriate vantage point on the associated operational platform that allows for 360-degree visual coverage around the vessel. If 360-degree visual coverage is not possible from a single vantage point, multiple PSOs must be on watch to ensure such coverage.
6. Suitable equipment must be available to each PSO to adequately observe the full extent of the Clearance and Shutdown Zones during all vessel operations and meet all reporting requirements.
    a. Visual observations must be conducted using binoculars and the naked eye while free from distractions and in a consistent, systematic, and diligent manner.
    b. Rangefinders (at least one per PSO, plus backups) or reticle binoculars (e.g., 7 x 50) of appropriate quality (at least one per PSO, plus backups) to estimate distances to ESA-listed species located in proximity to the vessel and Clearance and Shutdown Zone(s).

c. Digital full frame cameras with a telephoto lens that is at least 300 mm or equivalent. The camera or lens should also have an image stabilization system. Used to record sightings and verify species identification whenever possible.

d. A laptop or tablet to collect and record data electronically.

e. Global Positioning Units (GPS) if data collection/reporting software does not have built-in positioning functionality.

f. PSO data must be collected in accordance with standard data reporting, software tools, and electronic data submission standards approved by BOEM and NMFS for the particular activity.

g. Any other tools deemed necessary to adequately perform PSO tasks.

PDCs 7: Reporting Requirements

To ensure compliance and evaluate effectiveness of mitigation measures, regular reporting of survey activities and information on all protected and ESA-listed species will be required as follows.

BMPs

1. Data from all PSO observations must be recorded based on standard PSO collection and reporting requirements. PSOs must use standardized electronic data forms to record data. The following information must be reported electronically in a format approved by BOEM and NMFS:

Visual Effort:

a. Vessel name;
b. Dates of departures and returns to port with port name;
c. Lease number;
d. PSO names and affiliations;
e. PSO ID (if applicable);
f. PSO location on vessel;
g. Height of observation deck above water surface (in meters);
h. Visual monitoring equipment used;
i. Dates and times (Greenwich Mean Time) of survey on/off effort and times corresponding with PSO on/off effort;
j. Vessel location (latitude/longitude, decimal degrees) when survey effort begins and ends; vessel location at beginning and end of visual PSO duty shifts; recorded at 30 second intervals if obtainable from data collection software, otherwise at practical regular interval;
k. Vessel heading and speed at beginning and end of visual PSO duty shifts and upon any change;
l. Water depth (if obtainable from data collection software) (in meters);
m. Environmental conditions while on visual survey (at beginning and end of PSO shift and whenever conditions change significantly), including wind speed and direction, Beaufort scale, Beaufort wind force, swell height (in meters), swell angle, precipitation, cloud cover, sun glare, and overall visibility to the horizon;
n. Factors that may be contributing to impaired observations during each PSO shift change or as needed as environmental conditions change (e.g., vessel traffic, equipment malfunctions);
o. Survey activity information, such as type of survey equipment in operation, acoustic source power output while in operation, and any other notes of significance (i.e., pre-clearance survey, ramp-up, shutdown, end of operations, etc.);

Visual Sighting (all Visual Effort fields plus):

a. Watch status (sighting made by PSO on/off effort, opportunistic, crew, alternate vessel/platform);
b. Vessel/survey activity at time of sighting;
c. PSO/PSO ID who sighted the animal;
d. Time of sighting;
e. Initial detection method;
f. Sighting's cue;
g. Vessel location at time of sighting (decimal degrees);
h. Direction of vessel's travel (compass direction);

- **i.** Direction of animal's travel relative to the vessel;
- **j.** Identification of the animal (e.g., genus/species, lowest possible taxonomic level, or unidentified); also note the composition of the group if there is a mix of species;
- **k.** Species reliability;
- **l.** Radial distance;
- **m.** Distance method;
- **n.** Group size; Estimated number of animals (high/low/best);
- **o.** Estimated number of animals by cohort (adults, yearlings, juveniles, calves, group composition, etc.);
- **p.** Description (as many distinguishing features as possible of each individual seen, including length, shape, color, pattern, scars or markings, shape and size of dorsal fin, shape of head, and blow characteristics);
- **q.** Detailed behavior observations (e.g., number of blows, number of surfaces, breaching, spyhopping, diving, feeding, traveling; as explicit and detailed as possible; note any observed changes in behavior);
- **r.** Mitigation Action; Description of any actions implemented in response to the sighting (e.g., delays, shutdown, ramp-up, speed or course alteration, etc.) and time and location of the action.
- **s.** Behavioral observation to mitigation;
- **t.** Equipment operating during sighting;
- **u.** Source depth (in meters);
- **v.** Source frequency;
- **w.** Animal's closest point of approach and/or closest distance from the center point of the acoustic source;
- **x.** Time entered shutdown zone;
- **y.** Time exited shutdown zone;
- **z.** Time in shutdown zone;
- **aa.** Photos/Video

2. **Final report**: The project proponent must submit a final monitoring report to BOEM and NMFS (details to be provided) within 90 days after completion of survey activities. The report must fully document the methods and monitoring protocols, summarizes the survey activities and the data recorded during monitoring, estimates of the number of protected and/or ESA-listed species that may have been taken during survey activities, describes, assesses and compares the effectiveness of monitoring and mitigation measures. PSO sightings and effort data and trackline data in Excel spreadsheet format must also be provided with the final monitoring report.
3. **Vessel strike**: In the event of a vessel strike of a protected species by any survey vessel, the project proponent must immediately report the incident to BOEM (details to be provided) and NMFS (details to be provided) and for marine mammals to the NOAA West Coast stranding hotline at 1-866-767-6114 and 562-506-4315. The report must include the following information:
   - **a.** Name, telephone, and email or the person providing the report;
   - **b.** The vessel name;
   - **c.** The Lease Number;
   - **d.** Time, date, and location (latitude/longitude) of the incident;
   - **e.** Species identification (if known) or description of the animal(s) involved;
   - **f.** Vessel's speed during and leading up to the incident;
   - **g.** Vessel's course/heading and what operations were being conducted (if applicable);

- **h.** Status of all sound sources in use;
- **i.** Description of avoidance measures/requirements that were in place at the time of the strike and what additional measures were taken, if any, to avoid strike;
- **j.** Environmental conditions (wave height, wind speed, light, cloud cover, weather, water depth);
- **k.** Estimated size and length of animal that was struck;
- **l.** Description of the behavior of the species immediately preceding and following the strike;
- **m.** If available, description of the presence and behavior of any other protected species immediately preceding the strike;
- **n.** Disposition of the animal (e.g., dead, injured but alive, injured and moving, blood or tissue observed in the water, last sighted direction of travel, status unknown, disappeared); and
- **o.** To the extent practicable, photographs or video footage of the animal(s).

4. **Protected Species within an Enclosed Moon Pool**: It is unlikely that a protected species would come in contact with a moon pool, but the following applies: If a protected species is observed within an enclosed moon pool and does not demonstrate any signs of distress or injury or an inability to leave the moon pool of its own volition, measures described in this section must be followed (only in cases where they do not jeopardize human safety). Although this particular situation may not require immediate assistance and reporting, a protected species could potentially become disoriented with their surroundings and may not be able to leave the enclosed moon pool of their own volition. Within 24 hours of any observation, and daily after that for as long as an individual protected species remains within a moon pool (i.e., in cases where an ESA-listed species has entered a moon pool, but entrapment or injury has not been observed), reporting is required.
   a. For initial reporting, the following information is required:
      i. Time, date, and location (latitude/longitude) of the first discovery (and updated location information if known and applicable);
      ii. Species identification (if known) or description of the animal(s) involved;
      iii. Condition of the animal(s) (including carcass condition if the animal is dead);
      iv. Observed behaviors of the animal(s), if alive;
      v. If available, photographs or video footage of the animal(s); and
      vi. General circumstances under which the animal was discovered.
   b. After the initial report (see above), the following reporting measures must be followed, and information must be reported to BSEE (contact details to be provided) for operations requiring use of a moon pool to continue:
      i. Describe the animal's status to include external body condition (e.g., note any injuries or noticeable features), behaviors (e.g., floating at surface, chasing fish, diving, lethargic, etc.), and movement (e.g., has the animal left the moon pool and returned on multiple occasions?);
      ii. Description of current moon pool activities, if the animal is in the moon pool (e.g., drilling, preparation for demobilization, etc.);
      iii. Description of planned activities in the immediate future related to vessel movement or deployment of equipment;
      iv. Any additional photographs or video footage of the animal, if possible;
      v. Guidance received and followed from NMFS liaison or stranding hotline that was contacted for assistance;
      vi. Whether activities in the moon pool were halted or changed upon observation of the animal; and

vii. Whether the animal remains in the pool at the time of the report, or if not, the time/date the animal was last observed.

5. Sightings of any injured or dead protected species must be immediately reported, regardless of whether the injury or death is related to survey operations, to BOEM (details to be provided), and the NOAA West Coast stranding hotline at 1-866-767-6114 and 562-506-4315. If the project proponent's activity is responsible for the injury or death, they must ensure that the vessel assist in any salvage effort as requested by NMFS. When reporting sightings of injured or dead protected species, the following information must be included:

- **a.** Time, date, and location (latitude/longitude) of the first discovery (and updated location information if known and applicable);
- **b.** Species identification (if known) or description of the animal(s) involved;
- **c.** Condition of the animal(s) (including carcass condition if the animal is dead);
- **d.** Observed behaviors of the animal(s), if alive;
- **e.** If available, photographs or video footage of the animal(s); and
- **f.** General circumstances under which the animal was discovered.

6. Reporting and Contact Information:

- **c.** Injurious Takes of Endangered and Threatened Species:
  - **i.** NOAA West Coast stranding hotline at 1-866-767-6114 and 562-506-4315.
- **b.** Injurious Takes of Endangered and Threatened Species:
  - **i.** NOAA NMFS Long Beach Office, Protected Resources Division (details to be provided).
  - **ii.** BOEM Office of Environment, Pacific Region (details to be provided).

PDC 8: Prohibition of Trawling During Project Activities

Lessees will characterize site-specific parameters within the WEAs to inform their site assessment plan and to generally describe local conditions, including biological attributes. Lessees and their contractors may employ a range of methods to accomplish these goals, but may not employ trawling methodology (as defined by 50 CFR§ 660.11 (11)) to conduct these activities.