

UNITEO STATES DEPARTMENT OF COMMERCE National Oceanic and Atmospheric Administration

NATIONAL MARINE FISHERIES SERVICE 1315 East-West Highway Silver Spring, Maryland 20910

March 14, 2022 Refer to NMFS No: OPR-2021-03453

Dr. Genene Fisher
Acting Director
National Oceanic and Atmospheric Administration
Office of Ocean Exploration and Research
1315 East-West Highway
Silver Spring, Maryland

RE: Programmatic Concurrence Letter for the Office of Ocean Exploration's Marine Operation Activities

Dear Dr. Fisher:

The National Oceanic and Atmospheric Administration (NOAA)'s National Marine Fisheries Service (NMFS) Endangered Species Act (ESA) Interagency Cooperation Division received the NOAA Office of Ocean Exploration's February 23, 2022 request for concurrence with your determination that the marine operation activities to collect oceanographic data described below may affect, but are not likely to adversely affect any ESA-listed species or designated critical habitat. This response to your request was prepared by NMFS Office of Protected Resources (OPR) ESA Interagency Cooperation Division pursuant to section 7(a)(2) of the ESA, implementing regulations at 50 C.F.R. §402, and agency guidance for preparation of letters of concurrence and programmatic consultation documents.

This letter underwent pre-dissemination review using standards for utility, integrity, and objectivity in compliance with agency guidelines issued under section 515 of the Treasury General Government Appropriations Act of 2001 (Data Quality Act; 44 U.S.C. 3504(d)(1) and 3516). A complete record of this consultation is on file at NMFS Office of Protected Resources in Silver Spring, Maryland.

1 Consultation History

Previous consultations for NOAA's Office of Ocean Exploration and Research's (OER) marine operation activity field seasons on the NOAA Ship *Okeanos Explorer* were concluded in 2018, 2019, 2020, and 2021 (FPR-2018-9276; FPR-2018-9284; OPR-2019-01058; OPR-2020-00374; OPR-2021-00095). A consultation for OER's marine operation activities on the NOAA ship *Nancy Foster* was concluded in July 2021 (OPR-2021-01739). Each of these consultations assessed OER's bathymetric mapping activities in the North Atlantic Ocean. Although similar in scope, these activities differed slightly by geographic location or species or critical habitat affected, or considered the effects of new sonar technologies. Due to the history of OER



requesting individual consultations for specific vessels and field seasons, NMFS proposed conducting a programmatic consultation on OER's marine operation activity program in May of 2021. A programmatic consultation addresses multiple actions by an agency on a program, region, or other basis usually over an extended period of time. Programmatic consultations allow the Services to consult on the effects of programmatic actions such as: (1) multiple similar, frequently occurring or routine actions expected to be implemented in particular geographic areas; and (2) a proposed program, plan, policy, or regulation providing a framework for future actions (50 C.F.R. §402.02). This approach facilitates working with the federal action agency to avoid and minimize impacts to ESA-listed resources in a manner that supports recovery. OER agreed to a programmatic approach for all of OER's marine operation activities. The history of this consultation is as follows:

- During the course of consulting on OER's marine operation activities on the NOAA ship *Okeanos Explorer* for its Fiscal Year (FY) 2021 field season, OPR and OER began informal discussions on the possibility of completing a national programmatic ESA section 7 consultation for future OER marine operation activities. In response to these discussion, OER shared its draft programmatic Environmental Assessment (PEA; NOAA OER 2020) for its marine operation activities with OPR on March 24, 2021
- On May 6, 2021, staff from OER and OPR met to discuss the potential for OER to conduct a programmatic ESA section 7 consultation on its marine operation activities. OPR staff provided OER staff with information pertaining to the process for conducting a programmatic consultation, the types of programmatic consultations that could be conducted, and the information that would be needed to initiate a consultation. On May 18, 2021, OER agreed to request a programmatic ESA Section 7 Consultation on its marine operation activities on the NOAA ship *Okeanos Explorer*.
- On July 1, 2021, staff from OPR shared OER's draft PEA with regional NMFS Protected Resources Division Section 7 coordinators for review and feedback. This feedback was incorporated into the Project Design Criteria (PDCs) noted in Section 2.8 of this letter.
- On July 20, 2021, OER requested an expedited informal ESA section 7 consultation for a mapping objective operation onboard the NOAA ship *Nancy Foster*. In response to OER requesting an expedited consultation for its survey on the NOAA ship *Nancy Foster* of the Blake Plateau, staff from the ESA Interagency Cooperation Division submitted a letter to OER on July 30, 2021. This letter requested that OER expand the scope of its programmatic request to include additional vessels and technology that may be used in future marine operation activities that OER supports.
- On August 11, 2021 OER stated they were tentatively in agreement with expanding the programmatic ESA section 7 consultation to encompass additional vessels, technologies, and activities that OER routinely supports. On August 26, 2021, OER staff stated that

they were working on obtaining information to broadly capture all OER activities that could be included in the programmatic ESA section 7 consultation. They noted that OER oversaw numerous sub-activities, meaning more time was needed to provide information regarding OER activities to NMFS for the consultation.

- On November 22, 2021, staff from OER and OPR met to review and discuss PDCs for the ESA section 7 programmatic (Section 2.8).
- On January 3, 2022, OER staff shared a draft initiation request letter for a programmatic ESA section 7 consultation on OER's marine operation activities with OPR for review and comment. The draft letter included additional OER vessels and platforms. The draft letter was updated by OER on January 31, 2022 to include additional information on remotely operated vehicles (ROV), autonomous underwater vehicles (AUVs), and autonomous surface vessels (ASVs). After NMFS review, additional information on the sonar devices for these vehicles was provided on February 9, 2022.
- On February 23, 2022, OER submitted a request for initiation of ESA section 7 consultation on OER's marine operation activities to the NMFS OPR ESA Interagency Cooperation Division.

2 Proposed Action and Action Area

OER's proposed marine operation activities are intended to support initiatives such as the Seabed 2030¹ and National Ocean Mapping, Exploration, and Characterization (NOMEC)² initiatives. To support these initiatives, OER will collect data to address gaps in the basic understanding of deep water and seafloor, deep-ocean, and overall awareness within the U.S. Economic Exclusion Zone (EEZ) and international waters. OER expects work to commence in March 2022 and extend through the foreseeable future.

Expeditions will provide real-time or near real-time, open access deep water oceanographic data that can benefit NOAA, research and educational institutions, and the general public. Four types of cruises will be conducted annually:

1. Mapping survey cruises: These are the majority of cruises that conduct seafloor mapping and conductivity-temperature-density (CTD) casts;

¹ Seabed 2030 is a collaborative project between the <u>Nippon Foundation of Japan</u> and the <u>General Bathymetric Chart of the Oceans</u> (GEBCO). It aims to bring together all available bathymetric data to produce the definitive map of the world ocean floor by 2030 and make it available to all.

² The Ocean Policy Committee established the National Ocean Mapping, Exploration, and Characterization (NOMEC) Council in June 2020 pursuant to the "National Strategy for Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone". The purpose of the NOMEC Council is to coordinate Federal agency policy and actions needed to advance ocean mapping, exploration, and characterization, and to support collaboration with both non-Federal and nongovernmental partners and stakeholders.

- 2. Telepresence-enabled ROV cruises: During these cruises, six to 128-hour ROV dives are conducted during daytime, along with overnight mapping and occasional CTD casts;
- 3. Shakedown cruises: These cruises are to test mapping, ROV, and CTD systems; and
- 4. Emerging technology cruises: These cruises are planned once or twice per year to test novel and emerging technologies.

Each year, approximately five 14 to 21-day cruises are dedicated to mapping, while up to four 16 to 24-day cruises combine ROV work and overnight mapping. Cruise duration ranges from seven to 45 days. Shakedown and emerging technology cruises are approximately seven to 30 days in duration, depending on operations. The expeditions typically occur between February to December, in uncharted or poorly charted deep waters off the U.S. and in international waters.

Using high-speed satellite and Internet connections, scientists can remain onshore at Exploration Command Centers (ECCs) and guide or contribute to exploration plans and observations, and communicate real-time with shipboard scientists and technicians. This is true for all cruise types (mapping, telepresence-enabled ROV and Emerging tech), although in some cases there is no shoreside participation for shakedown cruises. Currently, there are ten permanent ECCs situated in the following locations around the U.S.:

- o University of Rhode Island's Inner Space Center in Narragansett, RI
- o NOAA Pacific Marine Environmental Laboratory (PMEL) in Seattle, WA
- o NOAA PMEL in Newport, OR
- o NOAA Headquarters in Silver Spring, MD
- University of New Hampshire's Center for Coastal and Ocean Mapping in Durham, NH
- Woods Hole Oceanographic Institution (WHOI) in Woods Hole, MA
- Florida Atlantic University's Harbor Branch Oceanographic Institute in Fort Pierce, FL
- Stennis Space Center in Stennis, MS
- o NOAA's Inouye Regional Center in Honolulu, HI
- o University of Hawaii at Manoa in Honolulu, HI

In addition, "informal" ECCs can also be established as needed for specific expeditions.

The majority of surveys will take place in the U.S EEZ but track lines, locations, and timing may deviate for reasons such as the health and safety of those aboard, science drivers, poor data quality, inclement weather, or mechanical issues with the research vessel and/or equipment. All research cruises will focus on collecting critical baseline information in unknown and poorly known areas 200 meters (656 feet) and deeper to meet NOAA science and management goals as a part of the NOMEC strategy. During OER marine operation activities, expedition teams would conduct: seafloor and water column mapping using multibeam, split beam, sub-bottom profiler and acoustic Doppler current profiler (ADCP) sonar systems; oceanographic data collection primarily using the vessel's CTD rosette; and seafloor and water column data collection using an integrated, two-body ROV system.

The proposed marine operation activities will consist of acquiring high resolution seafloor mapping data essential for making significant biological, geological, archaeological, and oceanographic discoveries; collecting seafloor data; supplementing previous work where possible to form the template for selecting ROV dive targets; and contributing to global datasets of modern seafloor mapping data. Using ROV and AUV systems during cruises to visually investigate unknown and poorly known deep water habitats within and around priority areas will help to establish baseline habitat characterization and species' inventories for scientists and managers. CTD casts may be conducted two ways: 1) with a Castaway CTD to gather conductivity/temperature/depth measurements or sound velocity measurements to calibrate sonar data, and 2) using a CTD rosette to collect additional information about the physical and chemical properties of the water column, including at sites of interest identified from mapping and underwater vehicle investigation.

Information generated by OER will directly contribute to a better understanding of deep water habitats, ecosystems, and geologic history of the ocean by providing basic information about the biological and geological resources and habitats of these regions, assisting marine resource managers in making informed decisions.

2.1 Action Area

The action area is defined in 50 CFR §402.02 as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action." The proposed action area for OER's marine operation activities encompasses the marine environment in areas around the Gulf of Mexico, Caribbean, Greater Atlantic, Southeast Atlantic, North Pacific Ocean, Eastern Pacific Ocean, Central Pacific Ocean, and Alaska, and vessel transit areas between ports, including but not limited to ports of call located in North America (Figure 1). All mapping and ROV operations are expected to be in waters 200 meters (656 feet) and greater. Transit mapping operations are planned between all areas mentioned, including the high seas.

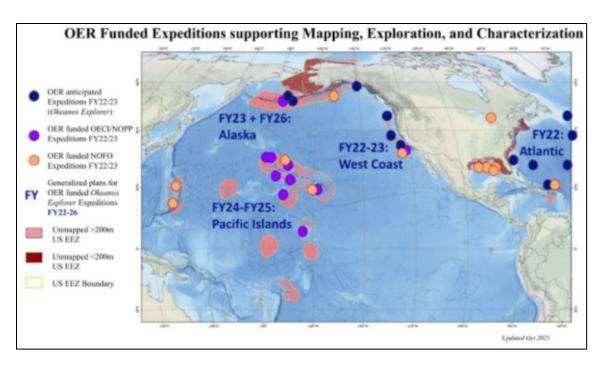


Figure 1. Operating area of OER's proposed marine operation activities and their respective fiscal years

The following details the geographical areas where OER research will be conducted within the next few years. Weather conditions and transit times may impact operations causing exact start and end dates to vary by a few days or weeks expanding the duration of corresponding expeditions.

North Atlantic

In the North Atlantic, OER's mapping priorities include areas of interest such as the Blake Plateau, the U.S. Caribbean, Canada, Portugal, high seas, and areas where the vessel will transit to reach ports and study sites. The Blake Plateau region is located offshore of the southern east coast of the U.S bounded by the Blake Escarpment and the Blake-Bahama Basin. U.S Caribbean marine operation activities will focus on mapping the northern and southern waters of Puerto Rico. Additional focal areas in the region include the deep waters surrounding Puerto Rico and the U.S. Virgin Islands, which include areas where more information is needed to support resource management and decision making priorities. The action area does not include green sea turtle critical habitat off the coast of Culebra Island, Puerto Rico or leatherback sea turtle critical habitat off the coast of Sandy Point, St. Croix, U.S. Virgin Islands. Furthermore, priority areas for the use of ROVs and AUVs include the U.S. Caribbean, Corner Rise Seamounts/Sargasso Sea, and various areas in the U.S. EEZ, international waters, and high seas. These areas include diverse pelagic communities and benthic communities that live on the seamounts found throughout the region.

Alaska

OER will focus on operations in support of the existing EXpanding Pacific Research and Exploration of Submerged Systems³ (EXPRESS) campaign while completing any necessary dockside repairs along the U.S. West Coast. OER mapping priorities in Alaska include gaps in mapping coverage offshore of the Gulf of Alaska and the Eastern Aleutian chain. Priorities for the use of ROVs include geological hazards, deep-sea corals, and critical minerals/seeps. OER plans to visit Alaskan waters for a concentrated effort in the Gulf of Alaska and the Eastern Aleutian chain.

U.S. West Coast

In the marine waters of the U.S. West Coast, OER anticipates spending the majority of its time along the U.S. Pacific Coast contributing to the EXPRESS campaign with input from the Consortium for Ocean Leadership (COL) workshop⁴ addressing the U.S. West Coast needs. Mapping priorities of the expeditions include filling in the gaps in current mapping coverage and addressing the needs in resolution/backscatter as appropriate. ROV priorities are to be determined in collaboration with partners.

Pacific Islands/Central Pacific

In the Pacific Islands and Central Pacific, OER will primarily target areas with lower percentage of mapping coverage. Complementary exploration opportunities (i.e., activities and operations that are conducted on non-OER vessels that are funded by OER) for OER will include systematic mapping in Howland/Baker, Jarvis (contract cruise in partnership with NOAA's Observing Systems Committee and Ocean Exploration Trust), Wake Island (contract cruise in partnership with NOAA's Observing Systems Committee and Ocean Exploration Trust), Johnston Atoll, and American Samoa. Focal areas for the NOAA ship *Okeanos Explorer* may include King/Palmyra and Johnston Atoll. The Northwest Hawaiian Islands would be the main focus for the NOAA ship *Okeanos Explorer* as features have yet to be explored. OER will work in the Pacific Islands before traveling north along the Emperor Seamount chain, which is an extremely remote area of connectivity between the North and South Pacific. The route would allow OER to explore the Western Aleutian chain before arriving in Alaska for the final summer cruises before docking in Washington State.

2.2 Mapping Operations

Vessels that OER will use for its proposed marine operation activities (Table 1) have a series of scientific ocean mapping sonars, each with a unique exploration application. All of these systems are routinely used by the ocean science community and have provided invaluable scientific data

³ The objective of the EXPRESS campaign is to provide valuable data designed to inform management decisions related to 1.) The use of living marine resources; 2.) Informing offshore wind energy and mineral resource decisions; and 3.) Improving offshore earthquake, landslide, tsunami, and nautical hazard assessment.

⁴ https://oceanleadership.org/

for oceanographers, marine researchers, and managers within many Federal agencies, including NOAA's Office of National Marine Sanctuaries (ONMS), the Bureau of Ocean Energy Management (BOEM) and the U.S. Geological Survey (USGS). Most of the mapping sonars listed in Table 2 have hull-mounted transducers that are downward facing, looking through the water column directly underneath the ship. These sonars include the Kongsberg EM710, EM304, EM302 multibeam system (Kongsberg Marine, Norway); Simrad EK60 and EK80 (Kongsberg Marine, Norway) split beam fisheries sonars (operated at 18 kilohertz [kHz], 38 kHz, 70 kHz, 120 kHz, 200 kHz, and 333 kHz); a Knudsen 3.5 kHz chirp sub-bottom profiler (Knudsen, Canada); and a 300 kHz and 38 kHz Teledyne ADCP; Teledyne Technologies, Inc., USA). A representative list of sonar devices used during OER's proposed mapping operations are shown in Table 2. Table 2 does not provide an exhaustive list of all active acoustic sources that will be used during OER's proposed activities; however, this list provides an average overview of the devices that will be used.

Table 1. Summary of Vessels used during OER's proposed marine operation activities. Other vessels of similar or smaller size may be used as well and information on vessel specification will be submitted to NMFS' ESA Interagency Cooperation Division.

Vessel	Size	Draft	Speed	Homeport	Max
					Endurance/Range
NOAA Ship	224 feet	17 feet	10 knots	North	40 days at sea/
Okeanos	(68	(5.1		Kingstown,	11,048 nautical
Explorer	meters) by	meters)		Rhode Island	miles (17,780
	43 feet (13				kilometers)
	meters)				
R/V Nautilus	211 feet	14.75 feet	10-12	San Pedro,	40 days at sea/
	(64.2	(4.9	knots	California	13,000 nautical
	meters) by	meters)			miles (24,000
	34.5 feet				kilometers)
	(10.5				
	meters)				
NOAA Ship	209 feet	29.7 feet	11-14	Newport, Rhode	40 days at sea/
Henry B.	(63.7	(9.1	knots	Island	12,000 nautical
Bigelow	meters) by	meters)			miles (22,220
	49 feet (15				kilometers)
	meters)				
NOAA Ship	187 feet	11.2 feet	10.5	Charleston,	15 days at sea/
Nancy Foster	(57	(3.4	knots	South Carolina	3,500 nautical
	meters) by	meters)			miles (16,482
	40 feet (12				kilometers)
	meters)				
NOAA Ship	274 feet	19 feet	11-15	Charleston,	60 days at sea/
Ronald H.	(83.5	(5.8	knots	South Carolina	11,300 nautical
Brown	meters) by	meters)			

52.5 feet		miles (20,925
(16		kilometers)
meters)		

Table 2. Active acoustic sources used during OER's proposed marine operation activities. Note: the list of equipment is representative. Surveys may use similar equipment. Actual source levels may be below those indicated.

Source	SELsp¹ (dB re 1 μPa-m)	SPLrms² (dB re 1μPa-m)	SPLpk³ (dB re 1µPa-m)	Frequency (kHz)	Pulse length (ms)	Beam width or swath angle (0)	Ping rate (Hz)
Kongsberg EM302 multibeam	180	214	241	30	200	140	6
Kongsberg EM304 multibeam	180	214	243	30	200	140	6
Kongsberg EM2040 multibeam sonar	180	243	NA	200-400	12	170 (single receiver) / 220 (dual receiver)	50
Kongsberg EM710 multibeam	NA	232	231	70-100	2	150	0.6
Kongsberg EM712 multibeam	NA	232	231	40 -100	120	140	30
Kongsberg Simrad EK60 split beam sonar 18-kHz	198	219	225	18	0.008192	11	10
Kongsberg Simrad EK60 split beam sonar 38-kHz	199	223	229	38	0.004096	7	10
Kongsberg Simrad EK60 split beam sonar 70-kHz	194	221	227	70	0.002048	7	10
Kongsberg Simrad EK60 split beam sonar 120-kHz	186	216	222	120	0.001024	7	10
Kongsberg Simrad EK60 split beam sonar 200-kHz	184	214	220	200	0.001024	7	10
Kongsberg Simrad EK60 split beam sonar 333- kHz	NA	206	212	333	NA	7	10
Kongsberg Simrad EK80 split beam sonar 18-kHz	198	219	225	18	0.008192	11	10

Kongsberg Simrad EK80 split beam sonar 38-kHz	199	223	229	38	0.004096	7	10
Kongsberg Simrad EK80 split beam sonar 70-kHz	194	221	227	70	0.002048	7	10
Kongsberg Simrad EK80 split beam sonar 120- kHz	186	216	222	120	0.001024	7	10
Kongsberg Simrad EK80 split beam sonar 200- kHz	184	214	220	200	0.001024	7	10
Kongsberg Simrad EK80 split beam sonar 333- kHz	NA	206	212	333	NA	7	10
Knudsen 3260 sub- bottom profiler	190	207	211	0.5 - 3.5	64	30	6
Teledyne Ocean Surveyor ADCP (38 kHz)	207	221	227	37.2 – 39.6	37	30	0.33
Teledyne Workhorse Mariner ADCP (300 kHz)	187	209	215	300	5.7	20	1.33
Ultra Short Baseline Surface transceiver EX, Tracklink model TL10000MA	178	181	187	7.5-12.5		120	2

¹ SELsp: single ping sound exposure level (SEL).

Each sonar source has a unique role in the mapping process. The multibeam sonars map broad sweeps along the seafloor for bathymetry/backscatter and water column feature detection (e.g. gaseous seeps). The split beam sonars gather calibrated target strength measurements of biologic and gaseous targets in the water column. The sub-bottom profiler provides data that are useful for interpreting sub-seafloor geology. ADCPs also provide information about current velocity and direction at various depths through a water column profile. The subsections below provide more detailed information for each sonar type.

When using the multibeam echosounders, the use of other sonar sources may not be feasible due to inter-sonar acoustic interference, particularly the 38 kHz EK60 and EK80, which are close to the 30 kHz central operating frequency of the EM302 and EM 304, and the ADCPs, which are not integrated into the ship's sonar synchronization hardware. To address potential interference, these sonars may be synced to ping at different times than multibeam echosounders, or may be

² SPLrms: root-mean-square (rms) sound pressure level (SPL).

³ SPLpk: peak SPL.

^{*}dB re 1 μ Pa-m = For underwater sounds the reference pressure preference is an rms pressure of 1 μ Pascal. Units for decibels are given as "dB re1 μ Pa-m" indicating that the reference pressure is 1 μ Pa rms at 1 meter

run by themselves. Mapping activities for all sonars, except for the ACDP, would occur continuously throughout the day and night, except when the ROV is deployed. For most operating areas that lack good multibeam bathymetry data, the multibeam sonar will be run and the ADCPs will be inactive. If there is a compelling scientific reason to collect ADCP data instead of multibeam data (e.g. assessing the current regime around a particular feature or region of the ocean), then the multibeam sonar would likely be turned off in order not to interfere with the quality of the ADCP dataset. The ADCPs are also run just prior to, and throughout the duration of, every ROV or AUV operation.

Multibeam Sonar:

During OER's proposed marine operation activities, multibeam sonar mapping will be conducted using Kongsberg EM710, EM304, and EM302 echosounders. The use of these sonars is planned to build upon previous mapping surveys as much as feasible. Multibeam sonar data are used to produce high-resolution bathymetry and acoustic backscatter maps. These maps will provide critical baseline information to scientists and resource managers interested in identifying and expanding OER's understanding of the geology and important biological habitats and ecological connections. Additionally, the data collected will help scientists better understand the size and character of seafloor habitats in the area, allowing for improved targeting of future exploration and research, including the selection of sites for further investigation with an ROV.

Split Beam Sonars:

OER's vessels will be equipped with split beam sonar transducers, including the EK60 and EK80 operated at the following frequencies: 18 kHz, 38 kHz, 70 kHz, 120 kHz, 200, and 333 kHz. Kongsberg Simrad EK60 and EK80 sonars are specifically designed to provide calibrated quantitative acoustic data useful for identifying marine life in the water column of the ocean. Additionally, they are used to map gaseous seep plumes and hydrothermal venting emitting from the seafloor. In many cases the ability to observe and measure the acoustic backscatter response of different types of marine life (fish, squid, plankton, etc.) is dependent upon the frequency of the sonar.

OER has received specific recommendations from marine acoustics and fisheries scientists on the power, pulse length, and frequencies of EK60 and EK80 data that will make its mapping data most useful for insights into biological assessment of the water column and evaluation of gaseous seep features. Therefore, OER gathers EK60 and EK80 data at multiple frequencies as much as possible. In addition to the EK60 topside units, known as narrowband general purpose transceivers (GPTs) normally operated by the ship, OER will use newer EK80 topside units, known as wideband transceivers (WBTs). EK80 WBTs utilize the same transducers on the hull of the ship for the transmission and reception of sound as the EK60 GPTs. When the EK80 pings, it sends a wider band frequency sweep ("chirp") that covers a small range of frequencies, whereas a narrowband EK60 is configured to send a signal at a particular frequency band.

Research results demonstrate that the simultaneous use of multiple echosounder transducer frequencies is useful for improving estimates of fish stocks; aiding in the discrimination of biological scattering layers or different species (Stanton et al. 2010); and mapping the location, density, and relative size of fish aggregations relative to benthic habitat features (Costa et al. 2014). Therefore, through its use of more frequencies, OER is able to gain a more complete picture and understanding of marine environment.

Sub-bottom Profiler:

A standard type of sub-bottom profiler that OER will use is the Knudsen Chirp 3260 (3.5 kHz). The primary purpose of the sub-bottom profiler is to provide echogram images of surficial geological sediment layers to a maximum depth of about 80 meters (262 feet) below the seafloor. The sub-bottom profiler is normally operated to provide information about the sedimentary features and the bottom topography that are simultaneously being mapped by the multibeam sonar. The data generated by this sonar are fundamental in helping geologists interpret the shallow geology of the seafloor. Collecting these data within the project areas will provide greatly improved insights into the geology of the region, and supplement existing magnetometer and gravity measurements obtained by other vessels.

Acoustic Doppler Current Profilers (ADCPs):

The type of ADCPs that OER will use are the Teledyne Ocean Surveyor (38 kHz) and the Teledyne Workhorse Mariner (300 kHz). Ship-mounted ADCPs characterize current speeds and direction at various depths directly below the ship. ADCP measurements are useful in characterizing the physical oceanography of an area, identifying small to mesoscale ocean current features, and even contribute to a better understanding of the climatology of a region with repeated measurements over time (Firing and Hummon 2010). In addition to these scientific benefits, OER uses ADCPs to assess currents near ROV dive locations to inform dive planning and ensure safe ROV deployment and recovery operations. Given these benefits, OER utilizes ADCPs as a useful data stream contributing to characterizing marine protected areas, providing new information on ocean currents to scientists and managers, and helping to plan effective and safe ROV exploration dives.

ADCP transducers project four beams into the water column to record backscatter and compare the Doppler shift between the four beams to generate profiles of water velocity. Like other sonars, the depth range of ADCPs is directly related to the frequency of the system – the lower the frequency, the greater the range capability of the sonar. However, lower frequencies provide less vertical resolution than higher frequencies. The 300 kHz ADCP has a typical range of approximately 110 meters (360.1 feet) and a maximum range of 165 meters (541.3 feet), while the 38 kHz system has a range between 900-1300 meters (2,952.7 to 4,265 feet) depending on operating mode and oceanographic conditions.

The ADCPs are typically operated when entering and leaving ports to ensure that the system's bottom tracking capability is working and to ensure that the heading alignment angle offset value

is accurate. The ADCPs are also run just prior to, and throughout the duration of, every ROV dive. No ADCP will be operated while the multibeam sonar is being run, as the ADCPs have been found to create interference with the multibeam data that is typically considered unacceptable.

2.3 Underway CTD for Sound Velocity Profiling

Accurate measurements of sound speed as a function of depth down to approximately 700 meters (2296.6 feet) are needed every three to six hours during multibeam sonar mapping operations. These sound speed measurements are essential for ray-tracing calculations used by multibeam sonar systems in order to collect accurate bathymetry and backscatter data. To obtain these data, OER can either use expendable bathythermographs (XBTs) or underway CTD (UCTD) equipped with a sound velocity probe.

<u>Underway Conductivity-Temperature-Density (UCTDs):</u>

The UCTD manufactured by Teledyne Ocean Science is a piece of equipment used to gather CTD measurements or sound velocity measurements while the ship is moving. This instrument is mounted on the stern railing and has a reusable probe that is dropped through the water column then retrieved by rewinding the line onto a motorized spool. The UCTD line is very thin (approximately three millimeters [0.03 inches]) but strong. It has a 500-pound test strength line, with 1,500 yards (1371.6 meters) total on the winch spool. OER would have no more than 1,300 yards (1188.72 meters) of line out at a given time. Once the probe reaches a target depth of about 750 meters (2460.63 feet), the line becomes taut and the probe is dragged by the ship as it is recovered. The unit would not touch the seafloor. The unit can be equipped with a CTD probe or a sound velocity probe. When equipped with the sound velocity probe, the UCTD can obtain water column profiles down to over 700 meters (2296.59 feet) while the ship is moving at eight knots. Eight knots is the ship's normal ocean mapping survey speed, so the UCTD can sample the water column while continuously mapping.

Expendable Bathythermographs (XBT):

XBTs are also deployed to obtain sound velocity profiles (SVPs) to obtain accurate multibeam bathymetry and backscatter data. XBT probe types used include the "Deep Blue" probe produced by Lockheed Martin Sippican. A single Deep Blue XBT (Lockheed Martin Corporation, USA) is 8.5-inches long (21.6 centimeters) and two inches wide (5.08 centimeters), and weighs 2.53 pounds (1.15 kilograms). It consists of a plastic spool, hair thin copper wire (less than one millimeter [0.03 inches] in thickness), zinc weight, and thermistor (composed of two short wires less than 8.5 inches [21.6 centimeters] long). The Deep Blue XBT contains no chemical solutions. During OER mapping cruises, XBTs or UCTD casts can be conducted every three to six hours to ensure accurate bathymetric data collection, resulting in a maximum of four to eight total XBT deployments in a 24-hour period. During OER cruises where ROV dives are conducted during the daytime and mapping operations are conducted overnight, XBTs will likely be deployed once every three to six hours to ensure accurate bathymetric data collection

(resulting in a maximum of two to four total XBT deployments in a 24-hour period). The very fine copper wire connecting the XBT probe to the instrument onboard the ship is extremely easy to break by hand and does not present an entanglement risk to ESA-listed species in the action area.

2.4 Remotely Operated Vehicle (ROV) Operations

OER's purpose for conducting ROV operations is to conduct interdisciplinary site characterization at priority targets identified by the scientific and management community. Interdisciplinary site characterization will be achieved by visually surveying priority targets while simultaneously acquiring environmental data within sensors mounted on the ROVs. These sensors measure CTD, dissolved oxygen (DO), light scattering, and oxidation reduction potential (ORP). ROV targets include but are not limited to seamounts, ridges, drowned reef terraces, submarine canyons, inter-canyon areas, slope areas, gas seeps, mud volcanoes, submerged cultural heritage sites, hydrothermal vents, and other types of topography where deep water coral and sponge communities are likely to occur. The combined dives will enable scientists and managers to have a better understanding of the diversity and distribution of deep water habitats in these regions. The ROVs noted below are representative of vehicles used during OER marine operation activities. Other ROVs of similar or smaller size may be used and information on ROV specification will be submitted to OPR in advance of their use to ensure coverage under this programmatic.

Vessels used during OER's marine operation activities may be equipped with dedicated, fully integrated, two-body ROV systems. One such ROV includes the *Deep Discoverer* (*D2*), a 3.2-meter-long (10.5 feet) by two-meter-wide (6.6 feet) by 2.6-meter-high (8.5 feet) vehicle weighing approximately 4,150.37 kilograms (9,150 pounds) in air, and capable of diving to 6,000 meters (19,685.04 feet) beneath the surface. *D2*'s primary dataset is high resolution video collected by two high-definition (HD) cameras. In addition to the HD video cameras, *D2* carries the environmental sensors (e.g., CTD, DO, etc.). The second body of the system is the camera platform *Seirios*, a 3.5 meter (11.5 feet) long by 1.19 meter (6.2 feet) wide by 1.23 meter (4.04 feet) high vehicle that weighs 1,327 kilograms (2,925 pounds) in air. *Seirios* provides additional lighting and an "aerial" view of *D2* while it investigates the seafloor. Like *D2*, *Seirios* carries two HD cameras and a Sea-Bird Electronics (SBE) 911plus CTD (SEA-BIRD Scientific, USA) with DO sensors. During operation, the two vehicles are connected to each other by a "soft" electro-optical tether 30 meters (98.42 feet) in length. *Seirios* is also attached to the ship by an 8,200-meter (26,903 feet) armored fiber optic cable that provides power and telemetry to the vehicles.

D2 is also used for collecting samples. This is done with the utmost care but cannot be done without some seafloor habitat disturbance. The extent of disturbance is very limited. The ROV is usually hovering neutrally buoyant in the water column just above the seafloor. The manipulator arm will reach out and snip a biological sample (often just a part of a larger specimen if they are

sampling a large coral, for instance) and put it into a biology box in an extendable drawer at the base of the ROV. When collecting a rock sample D2 will pick up a loose rock (about the size of something you can pick up with one hand) and place it into a rock collection compartment at the base of the ROV. If D2 is on a very steep slope, the pilot may stabilize the ROV by touching the front skids of the ROV to the seafloor to hold position while collecting a sample. However, the ROV never fully lands on the seafloor and aims for minimal disturbance of all areas. OER also samples Environmental DNA (eDNA) from the water, which does not disturb the seafloor because water is collected in canisters only while ROV is in the water column. For fragile biological specimens, D2 may use a suction sampler. The sampler has a vacuum hose that delicately suctions intact samples from the water column into storage jars. Occasionally, there is a little bit of fine sediment disturbance on the seafloor from the wash of the ROV propellers but pilots minimize this because it makes for poor video imagery. OER dos not collect small push cores of sediment using the ROV.

During sampling, D2 may also need to drop approximately four to five pieces of steel ballast, to offset the additional weight of the samples being collected. These pieces of steel, which are configured as eight-inch (20.32 centimeter) by seven-inch (17.78 centimeter) by three-inch (7.62 centimeter) blocks are very carefully jettisoned to minimize any disturbance or damage to sensitive areas. The ROV also has a temperature probe that may be inserted into the seafloor sediment to measure the depth or temperature of features of interest.

OER activities used during funded activities may also include the use of the ROV Hercules and ROV Argus which are located on board the research vessel(R/V) Nautilus. The ROV Hercules works in tandem with the ROV Argus to explore the geology, biology, archeology, and chemistry of the ocean while operating. The ROV Hercules includes two manipulator arms, a variety of sensors and samplers, HD video camera, LED lights, and high resolution mapping tools that receive power from the surface through a fiber optic cable that also transmits data and video. The ROV Argus is tethered to the R/V Nautilus by a 4,200-meter-long (13,800 feet) fiber optic cable made of steel, and connected to the ROV Hercules by a 36 meter (120 feet) yellow tether cable that contains three copper wires and fiber optics allowing for 2,700 volts of electricity to pass from the R/V Nautilus through the ROV Argus to reach the ROV Hercules. The ROV Hercules is able to deliver 113 kilograms (250 pounds) of samples or tools to and from the seafloor contained in collection boxes and acrylic jars. Sensors and samplers measure pressure, water temperature, depth, oxygen concentration, and salinity to accommodate requests from the scientific community. Further, the ROV Argus is equipped with multiple cameras to allow for real-time telepresence using HD cameras that are forward facing and stream data through the fiber optic cable from the ROV Argus to the R/V Nautilus. Due to the slight buoyancy of the ROV Argus and ROV Hercules, thrusters must be used to drive the vessel up and down below the surface. The ROVs are able to withstand pressures at 4,000 meters (13,123 feet) with more than 6,000 pound-force (2,721 kilogram) per square inch (psi) for up to three days. The ROV Hercules measures 1.8 meters (six feet) wide by 2.3 meters (7.5 feet) tall by 3.4

meters (11 feet) long, weighs 5,500 pounds (2,268 kilogram) in air, and can carry a payload of up to 113 kilograms (250 pounds). The ROV *Hercules* can be customized to include user-provided sensors and equipment. Previous equipment that has been added to the ROV included: mass and laser spectrometers, fluorometer, pH sensor, eH sensor, Kongsberg M3 multibeam sonar, 18 megapixel Ethernet-connected digital still camera, low-light camera (Canon ME20F-SH HD, 1080p at up to four million ISO, 24mm f1.4 prime lens), and modular soft grippers powered by an independent seawater-based hydraulic drive system.

The ROV *Argus* is equipped with an altimeter to measure the altitude, cameras (aimed downwards), LED lights, forward-looking sonar (Mesotech 1071, 675 kHz, 0.5–100 meter [1.64 to 328.1 feet] range typical), and a sub-bottom profiling sonar (TriTech SeaKing parametric Sub-bottom Profiler, 10–30 kHz). The ROV *Argus* is capable of operating as a standalone system for large scale survey missions like that done during the 2019 Search for the Samoan Clipper airplane. Movement of the ROV *Argus* is done using a control van aboard the R/V *Nautilus* to control the ROV *Argus*' 360 degree water movements using two Tecnadyne Model 1020 thrusters for heading control, moving of the vessel, or lowering and raising the attached cable. Weighing 2,100 kilograms (4,700 pounds) in air and 1,360 kilograms (3,000 pounds) in water, the ROV *Argus* is roughly the size of a minivan at 3.8 meters (12.5 feet) long by 1.2 meters (four feet) wide by 1.3 meters (4.3 feet) high. Electrical panels and wires found on the ROV *Argus* are protected from extreme pressures and saltwater corrosion through thick plastic boxes filled with mineral oil.

2.4.1 ROV Guidance

ROV operations are conducted primarily during daylight hours while vessels maintain a stationary location using dynamic positioning (DP). ROV operations will typically take place within several meters of the seafloor, and are conducted in a way to minimize seafloor disturbances as noted in the sampling procedures for *D2* above. On occasion, the ROV is set down on the seafloor in order to acquire very close imagery of habitats or features of interest. When this occurs, the common procedure is to visually scan the seafloor to ensure that the area where the ROV will set down does not include corals or other animals that can reasonably be avoided. However, some animals may reside beneath the sediment or may be too small to see. ROVs used during OER-supported projects are also expected to be deployed and recovered from oceanographic vessels that would adhere to the PDCs identified for ROV operations in Section 2.8.7.

2.4.2 ROV Sampling

Sampling operations will be conducted during ROV cruises to collect a limited number of specimens via ROV manipulators. Biological specimen collections will target animals suspected of being new species or a new record for the area, the dominant morphotype in a habitat, specimens that may contribute to connectivity studies, or other specimens with significant discovery potential. When possible, only a subsample will be taken of non ESA-listed biological

specimens (e.g., only a piece or branch of corals and sponges would be collected, not the entire entity) in as minimally destructive a manner as possible as noted in the sampling procedures for D2 above. Selective rock specimens that have the potential to contribute to scientific discoveries, as outlined in the expedition goals, will also be targeted. When possible, rock samples will be selected in a way to minimize the collection of attached organisms.

2.4.3 Ultra Short Baseline (USBL) Acoustic Navigation:

Ultra Short Baseline (USBL) acoustic navigation such as the Tracklink TL10000MA and Tracklink 5000 MA systems will be used to track and record the position of the ROVs during the course of a dive. USBL functions through the transmission of an impulsive acoustic pulse from the surface ship, which travels through the water column and triggers a responding acoustic pulse from the ROV. The measurement of the travel time and direction of arrival of the responding acoustic pulse from the ROV enables calculation of the position of the submerged ROV with respect to the surface ship. Integration of this relative position information with the surface ship position as determined by the shipboard Global Positioning System (GPS) allows the calculation of the position of the ROV on the seafloor. In this way, observations made by the ROV can be geo-referenced to standard latitude and longitude coordinates, and depth. The USBL is used during ROV operations, which are conducted daily and primarily during daylight hours while the ship holds station using DP.

The Tracklink operates at frequencies from 7.5 kHz to 12.5 kHz. Although such frequencies are within the hearing range of marine mammals, the USBL navigation system is commonly used by researchers and has no known adverse impact on marine life. Acoustic emissions by the USBL system occur at the surface from the hull of the ship, from the ROVs as they travel through the water column, and at the seafloor. The repetition rate of emissions is typically no faster than once every two seconds, increasing by 1.33 seconds for every 1,000 meters (3,281 feet) of depth of the ROVs. Examples of the character of these emissions is detailed below:

Surface transceiver

Tracklink model TL10000MA Frequency of operation: 7.5 kHz - 12.5 kHz Spread Spectrum Beam width: 120 degrees directed at nadir Peak electrical power: 100 watts (W) Peak acoustic power: 187 decibel (dB) in reference to one microPascal (μ Pa) at one meter (denoted as dB re: 1 μ Pa-m)

ROV transponder

Seirios:

Tracklink model TL10010C Frequency of operation: $7.5 \, \text{kHz}$ - $12.5 \, \text{kHz}$ Spread Spectrum Beam width: $210 \, \text{degrees}$ directed at zenith Peak electrical power: $200 \, \text{Watt}$ Peak acoustic power: $190 \, \text{dB}$ re: $1 \, \mu \text{Pa-m}$ ROV transponder

ROV transponder

Deep Discoverer (D2):

Tracklink model TL10015C Frequency of operation: 7.5 kHz - 12.5 kHz Spread Spectrum Beam width: 30 degrees directed at zenith Peak electrical power: 500 Watt Peak acoustic power: 200 dB re: $1\,\mu\text{Pa-m}$

2.4.4 CTD Operations:

Vessels used during OER-supported activities may be outfitted with a CTD rosette system such as the SBE 911plus CTD (SEA-BIRD Scientific, USA) rosette with water sampling capabilities. The SBE-911plus CTD is used to obtain conductivity, temperature, depth and other oceanographic data (DO, light scattering, and ORP). The instrument is attached to an open cylindrical steel frame approximately 1.16 meter (3.8 feet) in diameter and 1.6 meter (5.25 feet) in height with a 12-position rosette carousel containing twelve 10-liter (L) Niskin bottles for collecting water samples at specific depths. The system can be lowered to a maximum depth of 6,800 meters (22,301 feet) by an embedded Desh-5 scientific hydraulic winch and wire while the vessel is held stationary using DP. The average time to conduct a CTD cast varies from one to several hours depending on water depth (the CTD is lowered through the water column at 60 meters [197 feet] per minute). CTD casts will be conducted at selected sites, including locations identified by the scientific community, where ROV dives are conducted to allow for an improved understanding of the environmental conditions by measuring the physical or chemical properties of the water column overlying or hosting a particular habitat.

2.5 Autonomous Underwater Vehicles (AUVs)

The purpose of conducting AUV operations is to acquire higher resolution mapping data and oceanographic data that cannot typically be acquired with shipboard hull-mounted sonars. Interdisciplinary site characterization would be achieved by surveying oceanographic and seafloor areas of interest to the scientific community. The scientific payloads on AUVs vary, and typically contain: downward-looking sonars to acquire higher resolution seafloor data (i.e., bathymetry); *in situ* sensors mounted on the AUVs to acquire environmental data of the seawater immediately surrounding the vehicles (including, but not limited to CTD, optical and environmental deoxyribonucleic acid [eDNA] data); video and still cameras to image the seafloor and water column habitats and animals being surveyed; and navigation and communication equipment for safe vehicle navigation and communication with a surface vessel. Occasionally they will carry a sub-bottom profiler or ADCP, and the types mentioned earlier cover the range of size and frequencies employed. AUVs are expected to be tested and used going forward, and they would carry some of the active multibeam, side scan, sub-bottom profilers, USBLs, and ADCPs described in Section 2.2.

AUVs on OER-supported projects are expected to be deployed and recovered from oceanographic vessels that would adhere to the same guidance for ROV operation deployments and recoveries noted in Section 2.8.7 for deployments and recoveries. OER's AUVs acquire data

using passive sensor arrays, active and passive sonars, and flow through water samples from their immediate environment; they do not collect physical samples. AUVs conduct surveys ranging from approximately three to 70 meters (230 feet) above the seafloor. Some AUVs have the option of using a descent weight to facilitate descending to the seafloor (e.g. a 10 kilogram [22 pound] steel safety weight), or will drop a steel or lead weight in very rare cases of emergency to ascend to the surface. Use and deployment of these types of weights are standard practice for deep submergence vehicle operations.

Mapping surveys in poorly mapped areas are typically conducted higher off the bottom (e.g., 50 to 70 meters [164.04 to 230 feet]), while chemical, ultra-high resolution bathymetry, and imaging surveys are conducted closer to the seafloor (e.g., three to 10 meters [10 to 33 to feet] off the bottom). AUVs are outfitted with bottom detection and avoidance downward-looking sonars to ensure they operate at an appropriate altitude off bottom and avoid collision with the seafloor. The altitude off bottom is programmable and varies (e.g. 50 meters to 100 meters [230 to 328.08 feet]) depending on the environment being surveyed. The AUV seeks to maintain proper distance off the bottom, slowing down if the distance is not maintained, until it gets back to a proper altitude reading. In addition to bottom detection and avoidance capabilities, some AUVs are also outfitted with forward-looking sonars and have automated obstacle avoidance and detection capabilities. If an object is detected within range (e.g., 50 to 100 meters [230 to 328.08 feet]), the vehicle autonomously adjusts its mission to navigate around it. If obstacle avoidance efforts still result in potential collision, the AUV stops the mission and either awaits reprogramming from topside navigators, or floats to the surface.

Some survey operations are intentionally planned close to the seabed for data collection purposes; these surveys are conducted with lighter vehicles (e.g., the Mola Mola discussed below) that operate very slowly (approximately 0.4 knots) and are expected to occasionally bump on the seabed. The very slow survey speed means these collisions do not, or are highly unlikely to, cause any damage to the vehicle or surrounding environment.

AUV targets include but are not limited to seamounts, canyons, ridges, drowned reef terraces, submarine canyons, inter-canyon areas, slope areas, gas seeps, mud volcanoes, submerged cultural heritage sites, hydrothermal vents, abyssal plain, and other types of topography where deep water coral and sponge communities are likely to occur. The acquired data will help inform targeted site investigation with additional equipment such as ROVs, and/or enable scientists and managers to have a better understanding of the diversity and distribution of the seafloor and the oceanographic features and habitats in survey regions.

AUVs likely to be operated as part of OER-supported projects include, but are not limited to, the types described in the paragraphs below. The AUVs described below are representative of vehicles used during OER marine operation activities. Other AUVs of similar or smaller size may be used, and information on AUV specifications will be submitted to OPR in advance of their use to ensure coverage under this programmatic.

Gliders: An ocean glider is an AUV used for collecting oceanographic data such as chlorophyll levels, temperature and salinity, which are then transmitted back to the shore. They are very effective tools for gathering data from remote locations, safely and at relatively low cost. Gliders may be equipped with a wide variety of sensors to monitor temperature, salinity, currents, and other oceanographic conditions. This information creates a more complete picture of what is happening in the ocean, as well as trends scientists might not otherwise be able to detect from satellites or large research ships. While there are many glider designs that use different techniques to move through the water, all gliders share the ability to travel far distances over long periods, without servicing. Gliders are pre-programmed with travel waypoints and then set free to collect ocean data for days, weeks, or months. After collecting data for a set period of time, the glider surfaces and transmits its position to be retrieved.

Gliders rarely carry active sonar or transducers because the power consumption is too great. Very occasionally they will carry a sub-bottom profiler or ADCP, and the types mentioned earlier cover the range of sizes and frequencies. AUVs and ASVs will also be tested and used going forward, and they would carry some of the active multibeam, side scan, sub-bottom profilers, USBLs, and ADCPs previously described. In 2022, OER plans to have multiple platforms in the water simultaneously off the R/V *Nautilus*.

Mesobot: The Mesobot is a Midwater AUV with an endurance of greater than 24 hours. The standard sensor package includes a radiometer to measure light field, eDNA sampler, video, CTD, and USBL positioning. The Mesobot uses an acoustic modem for subsea communications. The Mesobot's operational configuration can be tethered or untethered allowing for diverse capabilities such as following slow-moving animals automatically to limit disturbance and interactions. The Mesobot was designed to avoid disturbing the animals it observes. Large, slow moving propellers allow it to hover and transit with minimal disturbance to the surrounding water. Additional design features include the usage of white and red lights, which many deep-sea species are unable to see. The Mesobot is designed to reach a maximum depth of 1,000 meters (3280.84 feet) and is approximately 1.5 meters (five feet) long, 1.5 meters (five feet) high, and one meter (three feet) wide, weighing 250 kilograms (551.2 pounds). An additional 20 kilograms (44.1 pounds) can be added for samplers and sensors.

The Mesobot is specifically designed to conduct operations in the water column; therefore, it will not reach the seafloor. Surveys in the water column are conducted at a speed of around two knots with the Mesobot being generally stationary. Ascents and descents to the seafloor or survey area, transits, and surveys are conducted at slow speeds above the seafloor ranging from 0.4 to four knots.

Eagle Ray: The Eagle Ray is a five meter (16.4 feet) long by 0.7 meter (2.3 feet) diameter AUV that follows a pre-programmed route to map the seafloor independent of its support vessel. This mapping AUV has an endurance of approximately 20 hours and a depth rating of 3,000 meters (9842.5 feet). The Eagle Ray AUV can ascend and descend at 1.25 meters (4.1 feet) per second

at approximately a 45 degree angle. The standard sensor package includes a multibeam sonar, Geo-Acoustic Preserving Polarity sub-bottom profiler (1.5 to 11.5 kHz), digital still camera, CTD, and USBL positioning. The AUV's navigation suite includes an IXblue Phins C7 inertial navigation system, Nortek 600 kHz Doppler velocity log, SOSI GPS receiver, Paroscientific depth sensor, and Kongsberg forward-looking altimeter. The Eagle Ray is launched from a supported ship-articulated ramp that lowers the AUV into the water. The vehicle can navigate using GPS and communicate by wireless Ethernet or by satellite for greater distances. Lowbandwidth acoustic communication and inertial navigation aided by the acoustic sensors are used when signals are passed through seawater. All data are recorded internally and downloaded upon recovering the vehicle. The Eagle Ray typically positions itself 50 to 70 meters (164.04 to 229.7 feet) above the seafloor following a grid pattern with spacing between 150 to 180 meters (492 to 591 feet) depending on the terrain. The AUV moves at a speed of 1.75 meters (5.7 meters) per second when it transits along the bottom. Depending on the varying conditions of the environment, the Eagle Ray can map approximately 25 square kilometers (9.65 square miles). The Eagle Ray has bottom and forward-looking sonars, which assist with the different levels of obstacle avoidance maneuvers. These maneuvers include: programming the Eagle Ray to always stay 50 meters (164 feet) from the seabed, but, if topography changes, the vehicle adjusts automatically to maintain distance; then, if the obstacle is still detected, performing a high pitch avoidance maneuver and, if successful, continuing with the mission. If the obstacle is detected within a 100-meter (328-foot) range, the Eagle Ray will stop the mission and float to the surface.

During the mission, the Eagle Ray is watched from the control station. The AUV does not discharge anything into the marine environment during missions except during an emergency, which has only occurred five times in the past 13 years (e.g., a steel weight in case of an emergency). Collisions with animals and/or habitat by the Eagle Ray have never occurred during a mapping mission.

Mola Mola: The Mola Mola is a small two meter (6.6 feet) long by 1.5 meter (five feet) high imaging AUV that has an endurance of eight hours and a depth rating of 2,000 meters (6561.68 feet). Typically ascending and descending vertically at 0.2 meters (0.66 feet) per second, the Mola Mola can increase the descend speed up to 0.7 meters (2.3 feet) per second when a drop weight is used. Due to its light build, slow speeds, and operation depth, it is expected to occasionally bump the seabed but this contact is not expected to result in damage to the vehicle and the surrounding environment. The Mola Mola is often used to study corals, geological features, deep-sea biological communities, and shipwrecks. The standard sensor package includes color still cameras, a laser bathymetry system, and USBL for navigation. The primary sensor is the centrally-mounted color camera. For deep dives, the Mola Mola can be launched with a 10 kilogram (22 pound) expendable drop weight. Once it has reached the seafloor, the vehicle travels to the area of interest usually three meters (10 feet) above the seafloor. The Mola Mola has a downward-looking 1,200 kHz RDI Workhorse DVL that provides vehicle altitude to its control system sonar for bottom detection and to avoid collision with the seafloor. When the

altitude of the Mola Mola is not in the range of the mission plan, the AUV will slow down until it returns to the proper altitude reading. A forward-looking 20 degree beam width, 200 kHz Tritech altimeter that is logged and made available to the control system for experimental forward avoidance is part of the Mola Mola but is not currently used in real-time.

2.5.1 Hybrid AUV/ROV

Nerid Under Ice (NUI): NUI is a deep-sea hybrid AUV/ROV with an endurance up to 20 hours and a depth rating of 5,000 meters (16,404 feet). The system can operate with a tether (ROV) or without (AUV). The standard sensor package includes a 200 kHz multibeam sonar, HD cameras, seven-function manipulator, CTD, and USBL for positioning. NUI uses an acoustic modem and an optical modem for subsea communications when untethered. NUI is a one-body deep-sea hybrid AUV/ROV that would also be deployed and recovered from oceanographic vessels. NUI can operate either in AUV mode or ROV mode. When operating in ROV mode, the descriptions of ROV operations and impacts apply (Section 2.4). OER supported NUI activities will focus on using a "virtual" tether via an optimal modem. If the fiber optic tether is used on a project (not currently planned for 2022), the fiber will stay attached to the vessel and is recovered after use. ROV surveys are conducted at very slow speeds above the seafloor or beneath the sea ice; approximately one knot when operated as an ROV, and approximately two knots when operated as an AUV. NUI is outfitted with an avoidance sonar that can be used to track and avoid objects or obstacles in AUV mode. In ROV mode, NUI can be piloted to avoid sensitive areas based on the science watch leader's direction from information gathered via sonar or visual means. When collecting samples, NUI may deploy expendable steel ballast (e.g. 15 kilogram [33 pound] steel plates about the size of a dinner plate, approximately half an inch [1.2 centimeters] thick) to modify its buoyancy and offset the additional weight of scientific samples added to the vehicle. This is standard practice for ROV operations and has not resulted in any known long-term impacts to the environment.

Sentry: The Sentry is an AUV that is part of the National Deep Submergence Facility (NDSF). The Sentry is capable of exploring up to 6,000 meters (19,685 feet) in depth. Built on the design of the Sentry predecessor Autonomous Benthic Explorer (ABE), which was used to explore ocean depths of 4,500 meters (14,763 feet), the Sentry is 2.9 meters (9.5 feet) in length, 2.2 meters (7.2 feet) in width, and has a height of 1.8 meters (six feet), and weighs nearly 1,250 kilograms (2,755.8 pounds) without extra scientific gear. The operating speed of the Sentry ranges from zero to two knots. Due to its hydrodynamic shape, the speed, range, and maneuverability of the AUV allows for faster ascents and descents. Descent and ascent speed is around 50 meters (164 feet) per minute reaching about 2,400 meters (7,874 feet) per hour. The science sensor suite allows for additional payloads for both mid-water and near-seabed oceanographic investigations. The Sentry produces bathymetric, side scan, sub-bottom, and magnetic maps of the seafloor and is capable of taking bottom photographs in a variety of deep-sea terrains like mid-ocean ridges, deep-sea vents, and cold seeps at ocean margins. Scientific sensors on the Sentry include the Nakamura redox potential probe, Australian Centre for Field

Robotics (ACFR) 3-D imaging system, and the Tethys *in situ* mass spectrometer. As part of the standard sensors, a Kongsberg 2040 and Blueview P900-90 multibeam sonar are included. The Sentry's navigation system uses Doppler velocity log and inertial navigation system, which is aided by an acoustic navigation system (USBL and long baseline [LBL]). The USBL provides acoustic communications that can be used to obtain the vehicle status, sensor status, and retask the vehicle while at the seafloor. The Sentry can be used as a standalone vehicle or in tandem with the Alvin or an ROV to increase the efficiency of deep submergence expeditions. The Sentry is outfitted with bottom and object detection and avoidance sonar and software to ensure it does not contact the seafloor or associated habitats, or run into objects in the water column. The Sentry has a high track record of success with over a decade of operation and no reported collisions. The Sentry may drop an expendable steel ballast (max of 75 pounds (34 kilograms) per dive) to facilitate descent and adjust buoyancy to return to the surface as necessary.

Orpheus: The Orpheus is an AUV that can reach depths below 6,000 meters (19,685 feet). The Orpheus design and technology minimizes construction, shipping, and operational costs allowing the AUV to be launched from a variety of vessels. Weighing up to 250 kilograms (551.2 pounds), the Orpheus allows for non-disruptive seafloor landing and sampling, visual terrain-relative navigation through the use of four cameras, and modular interchangeable payload options that include chemical and biological sensors and samplers. Orpheus is outfitted with bottom and object detection and avoidance sonar and software to ensure it does not contact the seafloor or associated habitats, or run into objects in the water column. Orpheus has a high track record of success with no reported collisions.

2.6 Autonomous Surface Vessels (ASVs)

The purpose of ASV operations is to acquire mapping data of the water column and seafloor from the ocean's surface, using some of the active sonars described previously. The scientific payloads on ASVs vary, and typically contain downward-looking sonars to acquire seafloor (i.e., bathymetry and backscatter) and water column data; in situ sensors mounted on the ASVs to acquire data of the immediate environment via permanently attached probes (e.g. wind speed, barometric pressure, CTD) or water sampling (eDNA); and cameras, navigation and communication equipment for safe vehicle navigation and communication with shore. Some ASVs (such as the DriX) used on OER-supported projects are expected to be deployed and recovered from oceanographic vessels. Other ASVs such as the Saildrone Surveyor are deployed from established ports and harbors on shore and conduct autonomous surveys sometimes for months at a time. In advance of and during operation, mariners are notified of autonomous vehicle operations and their vicinity via media such as notices to mariners and radio broadcasts. ASVs likely to be operated as part of OER-supported projects include, but are not limited to, the following described below. Other ASVs of similar or smaller size may be used, and information on ASV specification will be submitted to OPR in advance of their use to ensure coverage under this programmatic. ASVs are expected to be tested and used going forward, and they would carry some of the active multibeam, side scan, sub-bottom profilers, USBLs, and ADCPs described in Section 2.2.

DriX: The Drix is an ASV with endurance up to eight days. Its standard sensor package includes an EM2040 multibeam sonar capable of mapping to 500 meters (1,640 feet) in depth, EK80 sonar for water column imaging, subsea communications via acoustic modem, HF radio and Iridium satellite for in-air communications, and various topside sensors for situational awareness. Future operations are planned to include an EM712. DriX activities will either be conducted from shore or deployed from an oceanographic research vessel such as the R/V Nautilus. When deployed at sea, the DriX maintains telemetry connection within about 14 to 15 kilometers (8.7 to 9.3 miles) of the ship at all times. In future upgrades, the telemetry connection will be established via satellite communications. The vehicle is outfitted with 360 degree cameras, Lidar imaging capabilities to about 100 meters (328 feet), marine radar, a forward-looking infrared camera, and an Automated Identification System (AIS) receiver and transmitter (with a message that the vehicle is autonomous). The forward-looking infrared camera, AIS and Lidar all feed into the vehicle's collision avoidance systems. The vehicle can autonomously plan alternate routes for collision avoidance. Objects not announced on AIS can be detected out to about 100 meters (328 feet) of the vehicle, and, if a safe route cannot be determined, the vehicle will come to a stop and ask for help. Despite the DriX being physically autonomous, the vehicle is supervised 24/7 with someone monitoring the telemetry streams at all times. When vehicle support is needed, the vehicle supervisor can assess the situation and revise routes or operational plans accordingly. The DriX is also outfitted with a downward-looking camera on the hull (which is not part of the collision avoidance system).

The DriX operates at speeds from four to 14 knots; however, mapping and scientific surveys are typically conducted at eight knots. The DriX includes a winch-based system to acquire SVPs down to 200 meters (656 feet). All other sensors are probes permanently attached to the vehicle that acquire data passively. The DriX does not discharge anything into the marine environment except the exhaust from its diesel engine.

<u>Saildrone</u>: A saildrone is a wind and solar-powered ASV capable of up to 12-month data collection missions on the open ocean. The boat uses a 360 degree camera to record its surroundings. These images are then processed by graphics processing units running computer-vision neural networks to detect objects. There are several other types of sensors onboard, ranging from radar to infrared to navigate in the dark, and they are powered by wind and solar energy. The Saildrone ASVs are equipped with GPS and an onboard computer, enabling the vehicles to navigate following prescribed waypoints while staying in a safety corridor, taking winds and currents into consideration autonomously.

The vehicles can be stopped and the routes can be altered on the fly by scientists via the online Saildrone Mission Portal. To ensure safe operations at sea, each saildrone carries an AIS transceiver, enabling it to see surrounding vessel traffic. The vehicles are slow relative to other

marine users and are designed to be highly visible. Each is equipped with a radar reflector, high visibility colors for daytime visibility, and a bright navigation light for nighttime visibility. Each vehicle carries four onboard cameras to provide domain awareness to operators at Saildrone Mission Control. When the vehicle sensors detect a contact (e.g. another vessel) in the vicinity, the pilot on watch at mission control in Alameda is notified and can stop or take control of the vehicle immediately.

Each saildrone carries a payload of science-grade sensors to measure important atmospheric and oceanographic environmental variables in real-time. The primary goal of the Saildrone technology is to lower the cost of *in situ* ocean data collection, which in turn enables monitoring of much larger areas in real-time.

Wave Glider: OER's Wave Glider is an ASV that operates individually or in fleets delivering real-time data over long durations. The float is 10 feet (3.04 meters) long, with a nine inch (22.9 centimeters) height, and a 2.67 feet (0.8 meter) draft while the sub dimensions are 7.2 feet (2.2 meter) long, with a draft of 4.7 feet (1.44 meters), and a height of 0.9 feet (0.3 meter). Weighing up to 155 kilograms (341.7 pounds) without the seven modular payload units, the Wave Glider is a persistent mobile data-gathering platform. Powered by wave and solar energy, the Wave Glider gathers data in ways and locations that previously were unexplored due to cost and difficulty operating from larger vehicles and vessels. The Wave Glider offers an additional propulsion system using stored solar energy. The additional directional thrust increases mobility and precision and helps to navigate challenging ocean conditions (doldrums, high currents, and hurricanes/cyclones), or accommodate mission changes. Wave energy is the primary source used for propulsion, and it also recharges batteries that power sensors. Mission duration for the Wave Glider can last up to a year based on specific vehicle configuration cruising around 1.3 knots on average, but up to three knots. The Wave Glider carries a sophisticated array of instruments for both shallow and deep water ocean mapping. Sensors and payload integration allow unique customization for customers. There are six areas for sensor placements: mast, float, below float, mount to sub, tow from sub, and tow from winch (integration option). The eight meter (26.2 feet) umbilical cord offers continuous power and communications through the line to the payload at the sinker, making it ideal for subsea acoustics, CTD and fluorimetry casts, water sampling, and fish tracking.

Saildrone Surveyor: The Saildrone Surveyor is a 22-meter-long (72.2 feet), 13 meter (42.6 feet) wing height, and 13 meter (42.6 feet) draft ASV. It is predominantly powered by wind and solar technology; however, it has diesel/electric auxiliary power if necessary, and an endurance of less than 180 days. It is equipped for high-resolution mapping of the ocean seafloor and typically conducts mapping operations at four to six knots (5 knots on average) but cruises at speeds from six to 10 knots. The Surveyor carries a sophisticated array of acoustic instruments for both shallow and deep water ocean mapping. The Kongsberg EM 304 multibeam echosounder is capable of mapping the seafloor down to 7,000 meters (22,966 feet) below the surface. The Surveyor also carries two state-of-the-art ADCPs, the Teledyne Pinnacle 45 kHz ADCP and the

Simrad EC150-3C ADCP, to measure ocean currents and understand what is in the water column. The Surveyor is also equipped with the Simrad EK80 echosounder for fish stock assessments. It includes a winch-based system to acquire SVPs to 200 meters (656 feet). These SVPs are conducted at least twice (but as frequently as four to six times) every 24 hours for acquiring accurate sonar data. While conducting ocean mapping missions, the Surveyor will collect samples of eDNA from the water immediately surrounding the vehicle. The eDNA originates from the sloughed-off skin, mucus, and excrement of a wide variety of marine animals, and provides data that reveal the genetic composition of organisms inhabiting the water. All other sensors are probes permanently attached to the vehicle that acquire data passively. The Saildrone Surveyor does not discharge anything into the marine environment except the exhaust from its diesel engine.

2.7 Technology Demonstrations

OER will also work with partners to conduct a series of technology demonstrations. These technology demonstrations will provide sea trial time to test new technologies and novel applications as part of NOAA's commitment to increasing the pace and scope of ocean exploration. As part of advanced technology demonstrations, OER will work with partners to demonstrate several new technologies. These projects are currently still in development and will be evaluated individually for environmental impact per guidance provided in federal regulations and NOAA Administrative Order (NAO) 216-6A. The specifications for these technology demonstrations will be submitted to OPR in advance of their use to ensure coverage under this programmatic.

2.8 Project Design Criteria

Project design criteria (PDCs) are identified as part of a programmatic consultation and are applicable to future projects implemented under the program. In the case of this consultation, PDCs include best management practices (BMPs) developed by OER to limit the effects of its marine operation activities. These environmental protection measures will lead to avoidance and minimization of effects to ESA-listed species and designated and proposed critical habitat in the action area to assist in the conservation of these resources. OER's Expedition Coordinator (or the project's Principal Investigator) is responsible for ensuring all PDCs are shared and discussed with the Ship's command, department heads, and mission team leads, and those leads review and, as necessary, provide training to their staff on how to monitor and execute these protocols appropriately. PDCs include:

2.8.1 Protected Species Observers (PSO)

To ensure the protection of endangered and threatened species, the following PSO guidelines are required:

1) During daylight hours (i.e. from 30 minutes prior to sunrise and through 30 minutes following sunset), a minimum of one PSO must be on duty observing for listed species at all

- times the vessel is actively transiting, conducting acoustic sonar survey lines, sub-bottom profilers are operating, and/or when-over-the-side work is being conducted;
- 2) A watch schedule showing the number of PSOs on duty required to effectively monitor the affected area for the project (e.g., surveys) and record the required data must be included (see Reporting Requirements below). PSOs must not be on watch for more than four consecutive hours, with at least a 1-hour break between watches. PSOs must not be on active duty observing for more than 12 hours in any 24-hour period;
- 3) 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; and
- 4) Suitable equipment must be available to each PSO to adequately observe the full extent of the minimum separation distance 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 of appropriate quality (at least one per PSO, plus backups) to estimate distances to listed species located in proximity to the vessel and clearance and shutdown zone(s).

2.8.2 Minimize Collisions with Vessels

If PSOs observe ESA-listed marine mammals, sea turtles, or fishes, vessel operators and crew must slow down or stop the vessel or alter course if animals are within the distances described below, to avoid striking such animals. These requirements apply when the vessel is in transit and while conducting acoustic sonar survey lines, but do not apply when compliance will create an imminent and serious threat to a person or vessel or when a vessel is restricted in its ability to maneuver.

1) When ESA-listed marine mammals, sea turtles, or fishes are sighted while a vessel is underway, the vessel shall take action as necessary to avoid violating the relevant separation distances noted below (e.g., attempt to remain parallel to the animal's course, avoid excessive speed or abrupt changes in direction until the animal has left the area). If ESA-listed species are sighted within the relevant separation distance, the vessel must reduce speed and shift the engine to neutral. Engines will not resume until it is observed that the relevant separation distance is clear of any ESA-listed marine mammals, sea turtles, or fishes for at least 15 minutes. This does not apply to any vessel towing gear or any vessel that is navigationally constrained. Navigationally constrained means areas that are not considered open oceans such as ports, narrow passage areas, and any concerning traffic situation where halting engine operations puts the lives of those on board or the vessel's integrity in jeopardy;

- 2) If a large whale is identified within 457.2 meters (500 yards) of the forward path of a vessel, the vessel operator must steer a course away from the whale at 10 knots or less until the 457.2-meter (500 yards) minimum separation distance has been established. Vessel operators may also shift engines to neutral if feasible;
- 3) If a large whale is sighted within 91.44 meters (100 yards) 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 457.2 meters (500 yards). If stationary, the vessel must not engage engines until the large whale has moved beyond 457.2 meters (500 yards); and
- 4) When ESA-listed small marine mammals (e.g. pinnipeds), sea turtles, or fishes are sighted, attempt to maintain a distance of 91.44 meters (100 yards) for in-water pinnipeds and 45.72 meters (50 yards) for sea turtles and fishes whenever possible.
- 5) In the event of a vessel collision, OER will follow reporting PDCs in Section 2.8.9.

2.8.3 Species' Specific PDCs

- 1) Vessels entering North Atlantic right whale critical habitat are required to report into the Mandatory Ship Reporting System;
- 2) While conducting marine operation activities in the Atlantic, mariners shall check with various communication media for general information regarding avoiding ship strikes and specific information regarding North Atlantic right whale sighting locations. These include NOAA weather radio, U.S. Coast Guard (USCG) NAVTEX broadcasts, and Notices to Mariners; Commercial mariners calling on U.S. ports should view the most recent version of the NOAA/USCG-produced training CD entitled "A Prudent Mariner's Guide to Right Whale Protection" (contact the NMFS Southeast Region, Protected Resources Division for more information regarding the CD);
- 3) Injured, dead, or entangled North Atlantic right whales should be immediately reported to the USCG via VHF Channel 16. Injured, dead, or entangled North Pacific right whales should be immediately reported to NMFS' Alaska Marine Mammal Stranding Network at 877-925-7773;
- 4) Adherence to seasonal vessel speed restrictions of 10 knots or less as designated locations along the U.S. East Coast;
- 5) Adherence to NOAA Compliance Guide for Right Whale Ship Strike Reduction Rule (NMFS, 2013);
- 6) When in Washington inland waters, all vessels (including NOAA ships, R/Vs, ROVs, AUVs, and ASVs) approaching Southern Resident killer whales within 182.9 meters (200 yards) is prohibited (76 FR 20870);
- 7) All vessels (including NOAA ships, R/Vs, ROVs, AUVs, and ASVs) approaching North Atlantic right whales within 457.2 meters (500 yards) is prohibited (69 FR 69536 and 62 FR 6729);
- 8) Avoid transit through North Pacific right whale critical habitat;

- 9) Vessel transit and research activities (e.g., mapping) in the Rice's [formerly Bryde's] whale core habitat distribution area is restricted. If unavoidable, maintain a vessel speed of 10 knots or less during research activities and when transiting through the area. Vessel transit and non-stationary research activities must occur during daylight hours only (no nighttime transit or other non-stationary research activities to occur overnight in this area);
- 10) Vessel transit and research activities are also restricted within the boundaries of the currently known distribution of Rice's whales in the western and central Gulf of Mexico, between the 100 to 400 meter (328 to 1,312 foot) isobaths. If unavoidable, maintain a vessel speed of 10 knots or less during research activities and when transiting through the distribution area. Vessel transit and non-stationary research activities must occur only during daylight hours (no nighttime transit or other research activities to occur overnight in this area);
- 11) Avoid the use of High-Resolution Geophysical (HRG) sound sources (e.g., echosounders and sub-bottom profilers) in all areas north of the Forelands in Cook Inlet, Alaska;
- 12) Avoid the use of HRG sound sources that are <24 kHz in humpback whale feeding areas for the months of March through June. These include nearshore areas around Kodiak Island, Portlock Bank, Prince William Sound, Sitka Sound, Hoonah Sound, Tenakee Inlet, Craig, Ernest Sound, and Seymour Canal, Frederick Sound, Chatham Strait, Point Adolphus, Stephens Passage, and the Shumagin Islands;
- 13) Maintain a vessel separation distance 5.6 kilometers (three nautical miles) from Steller sea lion haulouts/critical habitat; and
- 14) To avoid disruption of bowhead whale foraging, while in the Beaufort and Chukchi Seas, avoid the use of HRG sound sources in areas where bowheads may be feeding (e.g., krill traps in Barrow Canyon)

2.8.4 Minimize Temporary Disturbance from Human Activity

- 1) All in-water work will be postponed when North Atlantic right whales are detected within 457.2 meters (500 yards), other ESA-listed cetaceans are detected within 91.44 meters (100 yards), or other ESA-listed species are detected within 45.72 meters (50 yards); and
- 2) No attempt will be made to feed, touch, ride, or otherwise intentionally interact with any marine ESA-listed species.

2.8.5 Minimize Entanglement

- 1) OER will postpone work when ESA-listed species are within the distances noted in #1 of Section 2.8.4 above; and
- 2) Individuals participating in the activity will closely monitor the instrument cables at all times while they are deployed.

2.8.6 Minimize Vessel Waste and Discharge & Prevent Invasive Species

1) All vessels operating in areas where ESA-listed species are known to be present in the region will continue to follow the International Convention for the Prevention of Pollution from

- Ships (MARPOL) discharge protocols, but will postpone any authorized discharge if any ESA-listed species are within 91.44 meters (100 yards) of the vessel;
- 2) Vessel crews will meet all Environmental Protection Agency (EPA) Vessel General Permits and USCG requirements;
- 3) Avoid discharge of ballast water in designated critical habitat;
- 4) All vessels will use anti-fouling coatings;
- 5) Clean hull regularly to remove aquatic nuisance species;
- 6) Avoid cleaning of hull in critical habitat; and
- 7) Avoid use of cleaners with nonylphenols.

2.8.7 Avoid or Minimize Impacts to Habitat and Species During In-Water Work

- 1) Instruments deployed to collect water samples and current data (except for expendable instruments) will not contact the seafloor;
- 2) ROVs/AUVs will be operated in a manner to avoid seafloor disturbance, and setting the ROV/AUV on the seafloor will be held to a minimum. For those situations when the ROV/AUV does make contact with the seafloor, visual observations will be made to confirm that the area where the ROV/AUV is set down does not include corals or other fragile animals that can reasonably be avoided;
- 3) ROVs/AUVs/ASV in operation will use will onboard cameras and detection devices to avoid possible interactions with animals. This includes when operating all sonar sound sources.
- 4) Sample collections will be limited to typically four to six total rocks and primary biological specimens per dive that represent new species, new records, the dominant morphotype animal in a community, or species to support connectivity studies. Whenever possible, sample collections will be made using the cutting implementation tool on the ROV, and only portions of organisms (<50 centimeters [19.7 inches)]) will be collected to avoid mortality. Clonal biological specimens (corals, sponges) will be subsampled;
- 5) When possible, rock samples will be selected in a way to minimize disturbance to the surrounding environment and to minimize the take of attached organisms;
- 6) After each ROV/AUV/ASV use, the vehicles are brought back onboard and thoroughly sprayed with freshwater and allowed to air dry before the next dive. Though marine organisms should not survive this process, the ROV/AUV/ASV is thoroughly inspected prior to every dive and checked for the presence of biological organisms to prevent the spread of invasive or non-endemic species from one location to another. In areas where Stony Coral Tissue Loss Disease (SCTLD) is present, the vehicles will be decontaminated following the procedures documented in NOAA's Office of National Marine Sanctuaries' Coral Disease Decontamination Protocol;
- 7) Instruments deployed to collect water samples and current data (except for expendable instruments) will not be allowed to contact the seafloor;
- 8) The use of detergents and other pollutants that may be washed from the ship or vehicle into the marine environment will be avoided or held to a minimum; and
- 9) Except in an emergency, the vessel will not anchor while at sea.

10) In the event of an ROV/AUV/ASV collision with an ESA-listed species, OER will follow reporting PDCs in Section 2.8.9.

2.8.8 Avoid Live Bottom Features

- 1) All vessels in coastal waters will operate in a manner to minimize propeller wash and seafloor disturbance, and transiting vessels should follow deep water routes (e.g., marked channels and shipping lanes), as practicable;
- 2) Avoid anchoring in hard-bottom and coral habitat
- 3) Avoid anchoring in black abalone critical habitat; and
- 4) Avoid anchoring in areas containing seagrass or eelgrass.

2.8.9 Program Reporting/Review Requirements

- 1) Report sightings of critically endangered cetaceans including North Atlantic right whale, North Pacific right whale, Southern Resident killer whale, Main Hawaiian Islands Insular false killer whale, Cook Inlet beluga whale, and Rice's whale.
 - a) If a critically endangered species is observed at any time by a PSO or project personnel during surveys or vessel transit, sightings will be reported to OPR within two hours of occurrence when practicable and no later than 24 hours after occurrence
- 2) In the event of a strike of an ESA-listed species by any survey vessel or vehicle (ROV, AUV, ASV), OER must immediately report the incident to the appropriate NMFS contact listed below, and to Cathy Tortorici, Chief, ESA Interagency Cooperation Division by e-mail at cathy.tortorici@noaa.gov:
 - a) For operations in the Gulf of Mexico and Atlantic Ocean: 727-824-5312 or via email to takereport.nmfsser@noaa.gov, and a hotline 1-877-WHALE HELP (942-5343).
 - b) For operations on the west coast/Pacific Ocean: 562-506-4315 or via email to Justin.Viezbicke@noaa.gov, and a hotline for whales in distress 877-767-9245.
 - c) For operations near Alaska, statewide hotline: 877-925-7773.
 - d) Additional regionally organized contact information is here: https://www.fisheries.noaa.gov/report.
 - e) Report information will include the following:
 - (1) Name, telephone, and email or the person providing the report;
 - (2) The vessel or vehicle's name;
 - (3) Time, date, and location (latitude/longitude) of the incident;
 - (4) Species identification (if known) or description of the animal(s) involved;
 - (5) Vessel's or vehicle's speed during and leading up to the incident;
 - (6) Vessel's or vehicle's course/heading and what operations were being conducted (if applicable);
 - (7) Status of all sound sources in use;
 - (8) 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;

- (9) Environmental conditions (wave height, wind speed, light, cloud cover, weather, water depth);
- (10) Estimated size and length of animal that was struck;
- (11) Description of the behavior of the species immediately preceding and following the strike;
- (12) If available, description of the presence and behavior of any other protected species immediately preceding the strike;
- (13) 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
- (14) To the extent practicable, photographs or video footage of the animal(s).
- 3) In the event of a sighting of a whale that is dead, injured, or entangled reports must occur immediately as possible to the appropriate <u>regional NOAA stranding hotline</u>. Right whale sightings in any location may also be reported to the USCG via channel 16 and through the WhaleAlert App (http://www.whalealert.org/).
 - a) Sightings of any injured or dead listed species must be immediately reported, regardless of whether the injury or death is related to survey operations, to NMFS and the appropriate regional NOAA stranding hotline. If the project proponent's activity is responsible for the injury or death, they must ensure that the vessel assists in any salvage effort as requested by NMFS. When reporting sightings of injured or dead listed species, the following information must be included:
 - 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.
- 4) Record the date, time, location, species, number of animals, distance and bearing from the vessel, and direction of travel for all sightings of ESA-listed species.

2.9 Project-Specific Review

Project-specific reviews for this programmatic consultation for OER's marine operation activities are not required as long as the activities are within the scope of the *Proposed Action*, within the action area, and comply with the PDCs. If operations are proposed that are not a part of the *Proposed Action* and/or are not in the *Action Area*, an individual consultation will be needed. If operations in the future include the use of new vessel platforms outside of the scope of those detailed in Table 1, mooring systems, active acoustics outside the scope of those detailed in Table 2, additional types of remotely operated or autonomous vehicles that are substantially different from those described in Section 2.4 and Section 1.1, novel sampling methods, or other substantial changes in technology and operations, an individual consultation or reinitiation of this

programmatic consultation may be required. OER should submit a request for project-specific review for projects that do not fully meet the requirements listed above, including being unable to implement the PDCs or being able to only partially implement the measures appropriate to the project, to the NMFS OPR ESA Interagency Cooperation Division. The request should be sent by email to cathy.tortorici@noaa.gov with the subject line "Project Specific Review Request, OPR-2021-03453, Programmatic Concurrence for OER Marine Operation Activities" and include the following information: a project description that details the operations, where and when they will occur, any criteria or measures that may not be fully implemented, and determination of effects to ESA-listed species and critical habitat that could result from the project.

NMFS will review the request to determine if the scope of the project is within this programmatic consultation, if a supplemental effects analysis is needed, or if an individual consultation is required. Requests for project-specific review should be submitted at least six months in advance of the proposed activity to allow time for completion of a formal ESA section 7 consultation if one is required.

2.10 Annual Review/Reporting

OER and NMFS will conduct an annual review of OER's marine operation activities. This review will evaluate, among other things, whether the scope of the activities are consistent with the description of the proposed action and action area, and whether the nature and scale of the effects predicted continue to be valid. An annual review meeting will be held consisting of an annual comprehensive review of the action agency's program.

At least one month before the Annual Review Meeting, the ESA Interagency Cooperation Division will send out a notice to the participants with the topics for discussion.

Participants would include members from the ESA Interagency Cooperation Division, representatives from OER, and other interested parties (if requested). The topics would include the following:

- New species, critical habitat (proposed, final rules)
- Evaluation of the effectiveness of the programmatic processes (e.g., PDCs, areas for improvement, etc.);
- Identification and discussion of "lessons learned" (e.g., if any new procedures/mitigation were undertaken, etc.);
- Topics where more data/information is needed (e.g., future research);
- Identification of any new literature, studies, etc. that change or support previous understandings of the degree of effects to ESA species, fish, habitat, prey species; does the analysis in the consultation still hold, does it need to be reviewed or revised?; and Topics noted in OER's annual report mentioned below.

In advance of the annual review meeting, OER will provide an annual report to NMFS to discuss and assess during the meeting. This report will include:

- Summary/description of the activities conducted during the year (regions, amount of survey days, etc.)
- Sighting logs with observations of ESA-listed species with date, time, location, species (if possible to identify), number of animals, distance and bearing from the vessel, and direction of travel.
- New or upcoming initiatives, technology demonstrations, equipment, policy directives, tech memos (and revisions to any such existing documents); potential implications to the programmatic analysis, framework, etc.

3 ESA-LISTED SPECIES AND DESIGNATED/PROPOSED CRITICAL HABITAT IN THE ACTION AREA

ESA-listed marine mammals (cetaceans and pinnipeds), sea turtles, fish, invertebrates, and designated and proposed critical habitat are present in the action area and may be affected by the proposed action (Table 3).

Table 3. ESA-listed species and designated/proposed critical habitat that may be affected by OER's proposed action.

Species	ESA Status	Critical Habitat	Recovery Plan				
Marine Mammals – Cetaceans							
Blue Whale (Balaenoptera	E – 35 FR 18319		07/1998				
musculus)			11/2020				
Bowhead Whale (Balaena mysticetus)	<u>E – 35 FR 18319</u>						
False Killer Whale (Pseudorca	E – 77 FR 70915	83 FR 35062	<u>Draft – 85 FR 65791</u>				
crassidens) – Main Hawaiian Islands Insular DPS			9/2020				
Fin Whale (Balaenoptera	E - 35 FR 18319		<u>75 FR 47538</u>				
physalus)			<u>07/2010</u>				
Gray Whale (Eschrichtius robustus) Western North Pacific Population	E – 35 FR 18319						
Rice's Whale (Balaenoptera	E – 84 FR 15446						
ricei)	$\underline{E-86\ FR\ 47022}$						
Humpback Whale (<i>Megaptera</i> novaeangliae) – Cape Verde Islands/Northwest Africa DPS	E – 81 FR 62259		11/1991				
Humpback Whale (Megaptera novaeangliae) – Central America DPS	E – 81 FR 62259	<u>86 FR 21082</u>	11/1991				

Species	ESA Status	Critical Habitat	Recovery Plan
Humpback Whale (<i>Megaptera novaeangliae</i>) – Mexico DPS	T – 81 FR 62259	86 FR 21082	11/1991
Humpback Whale (Megaptera novaeangliae) – Western North Pacific DPS	E – 81 FR 62259	86 FR 21082	11/1991
Killer Whale (Orcinus orca) –	E – 70 FR 69903	71 FR 69054	73 FR 4176
Southern Resident DPS	Amendment 80 FR 7380	86 FR 41668	01/2008
North Atlantic Right Whale (Eubalaena glacialis)	<u>E – 73 FR 12024</u>	81 FR 4837	70 FR 32293 08/2004
North Pacific Right Whale (Eubalaena japonica)	E – 73 FR 12024	73 FR 19000	78 FR 34347 06/2013
Sei Whale (Balaenoptera borealis)	E – 35 FR 18319		12/2011
Sperm Whale (Physeter	E – 35 FR 18319		75 FR 81584
macrocephalus)			<u>12/2010</u>
	Marine Mammals -	- Pinnipeds	
Bearded Seal (<i>Erignathus</i> barbatus) – Beringia DPS	<u>T – 77 FR 76739</u>	86 FR 1433 (Proposed)	
Bearded Seal (<i>Erignathus</i> barbatus) –Okhotsk DPS	<u>T – 77 FR 76739</u>		
Guadalupe Fur Seal (Arctocephalus townsendi)	<u>T – 50 FR 51252</u>		
Hawaiian Monk Seal (Neomonachus schauinslandi)	E – 41 FR 51611	80 FR 50925	72 FR 46966 2007
Ringed Seal (<i>Phoca hispida hispida</i>) –Arctic subspecies	<u>T – 77 FR 76706</u>	79 FR 73010 (Proposed) 86 FR 1452 (Revised Proposed)	
Steller Sea Lion (<i>Eumetopias jubatus</i>) – Western DPS	E – 55 FR 49204	58 FR 45269	73 FR 11872 2008
	Marine Rep	tiles	
Green Turtle (<i>Chelonia mydas</i>) – Central North Pacific DPS	<u>T – 81 FR 20057</u>		63 FR 28359 01/1998
Green Turtle (<i>Chelonia mydas</i>) – Central South Pacific DPS	E – 81 FR 20057		63 FR 28359 01/1998
Green Turtle (<i>Chelonia mydas</i>) – Central West Pacific DPS	E – 81 FR 20057		63 FR 28359 01/1998
Green Turtle (<i>Chelonia mydas</i>) – East Pacific DPS	<u>T – 81 FR 20057</u>		63 FR 28359 01/1998

Species	ESA Status	Critical Habitat	Recovery Plan
Green Turtle (<i>Chelonia mydas</i>) – North Atlantic DPS	T – 81 FR 20057	63 FR 46693	FR Not Available 10/1991 – U.S. Atlantic
Green Turtle (<i>Chelonia mydas</i>) – South Atlantic DPS	<u>T – 81 FR 20057</u>		
Hawksbill Turtle (Eretmochelys imbricata)	E – 35 FR 8491	63 FR 46693	57 FR 38818 08/1992 – U.S. Caribbean, Atlantic, and Gulf of Mexico 63 FR 28359 05/1998 – U.S. Pacific
Kemp's Ridley Turtle (Lepidochelys kempii)	E – 35 FR 18319		03/2010 – U.S. Caribbean, Atlantic, and Gulf of Mexico 09/2011
Leatherback Turtle (<i>Dermochelys coriacea</i>)	E – 35 FR 8491	44 FR 17710 and 77 FR 4170	10/1991 – U.S. Caribbean, Atlantic, and Gulf of Mexico 63 FR 28359 05/1998 – U.S. Pacific
Loggerhead Turtle (<i>Caretta</i> caretta) – North Pacific Ocean DPS	<u>E – 76 FR 58868</u>		63 FR 28359
Loggerhead Turtle (<i>Caretta</i> caretta) – Northeast Atlantic Ocean DPS	<u>E – 76 FR 58868</u>		
Loggerhead Turtle (<i>Caretta</i> caretta) – Northwest Atlantic Ocean DPS	<u>T – 76 FR 58868</u>	79 FR 39855	74 FR 2995 10/1991 – U.S. Caribbean, Atlantic, and Gulf of Mexico 05/1998 – U.S. Pacific 01/2009 – Northwest Atlantic
Loggerhead Turtle (<i>Caretta</i> caretta) – South Pacific Ocean DPS	E – 76 FR 58868		
Olive Ridley Turtle (<i>Lepidochelys</i> olivacea) All Other Areas/Not Mexico's Pacific Coast Breeding Colonies	<u>T – 43 FR 32800</u>		
Olive Ridley Turtle (<i>Lepidochelys</i> olivacea) Mexico's Pacific Coast Breeding Colonies	E – 43 FR 32800		63 FR 28359

Species	ESA Status	Critical Habitat	Recovery Plan
	Fishes		
Atlantic Salmon (Salmo salar) – Gulf of Maine DPS	E – 74 FR 29344 and 65 FR 69459	74 FR 39903	70 FR 75473 and 81 FR 18639 (Draft) 11/2005 03/2016 – Draft 2/2019- Final
Atlantic Sturgeon (<i>Acipenser</i> oxyrinchus oxyrinchus) – Carolina DPS	<u>E – 77 FR 5913</u>	82 FR 39160	
Atlantic Sturgeon (Acipenser oxyrinchus oxyrinchus) – Chesapeake DPS	E – 77 FR 5879	82 FR 39160	
Atlantic Sturgeon (Acipenser oxyrinchus oxyrinchus) – Gulf of Maine DPS	<u>T – 77 FR 5879</u>	82 FR 39160	
Atlantic Sturgeon (Acipenser oxyrinchus oxyrinchus) – New York Bight DPS	E – 77 FR 5879	82 FR 39160	
Atlantic Sturgeon (<i>Acipenser</i> oxyrinchus oxyrinchus) – South Atlantic DPS	E – 77 FR 5913	82 FR 39160	
Bocaccio (Sebastes paucispinis) – Puget Sound/Georgia Basin DPS	E – 75 FR 22276 and 82 FR 7711	<u>79 FR 68041</u>	81 FR 54556 (Draft) 10/2017
Chinook Salmon (<i>Oncorhynchus</i> tshawytscha) – California Coastal ESU	T – 70 FR 37160	70 FR 52488	81 FR 70666
Chinook Salmon (<i>Oncorhynchus</i> tshawytscha) – Central Valley Spring-Run ESU	<u>T – 70 FR 37160</u>	70 FR 52488	79 FR 42504
Chinook Salmon (<i>Oncorhynchus</i> tshawytscha) – Lower Columbia River ESU	T – 70 FR 37160	70 FR 52629	78 FR 41911
Chinook Salmon (<i>Oncorhynchus tshawytscha</i>) – Puget Sound ESU	T – 70 FR 37160	70 FR 52629	72 FR 2493
Chinook Salmon (<i>Oncorhynchus</i> tshawytscha) – Sacramento River Winter-Run ESU	E – 70 FR 37160	58 FR 33212	79 FR 42504
Chinook Salmon (<i>Oncorhynchus</i> tshawytscha) – Snake River Fall-Run ESU	<u>T – 70 FR 37160</u>	58 FR 68543	80 FR 67386 (Draft)
Chinook Salmon (<i>Oncorhynchus</i> tshawytscha) – Snake River Spring/Summer Run ESU	<u>T – 70 FR 37160</u>	64 FR 57399	81 FR 74770 (Draft) 11-2017-Final

Species	ESA Status	Critical Habitat	Recovery Plan
Chinook Salmon (<i>Oncorhynchus</i> tshawytscha) – Upper Columbia River Spring-Run ESU	E – 70 FR 37160	70 FR 52629	72 FR 57303
Chinook Salmon (<i>Oncorhynchus</i> tshawytscha) – Upper Willamette River ESU	<u>T – 70 FR 37160</u>	70 FR 52629	76 FR 52317
Chum Salmon (<i>Oncorhynchus keta</i>) – Columbia River ESU	<u>T – 70 FR 37160</u>	<u>70 FR 52629</u>	<u>78 FR 41911</u>
Chum Salmon (<i>Oncorhynchus keta</i>) – Hood Canal Summer-Run ESU	<u>T – 70 FR 37160</u>	70 FR 52629	72 FR 29121
Coho Salmon (<i>Oncorhynchus kisutch</i>) – Central California Coast ESU	E – 70 FR 37160	64 FR 24049	77 FR 54565
Coho Salmon (<i>Oncorhynchus</i> kisutch) – Lower Columbia River ESU	T – 70 FR 37160	81 FR 9251	78 FR 41911
Coho Salmon (<i>Oncorhynchus kisutch</i>) – Oregon Coast ESU	T – 73 FR 7816	73 FR 7816	81 FR 90780
Coho Salmon (<i>Oncorhynchus kisutch</i>) – Southern Oregon and Northern California Coasts ESU	T – 70 FR 37160	64 FR 24049	79 FR 58750
Common Angelshark (Squatina squatina)	E – 81 FR 50394		
Daggernose Shark (Isogomphodon oxyrhynchus)	E – 82 FR 21722		
Dwarf Sawfish (Pristis clavata)	<u>E – 79 FR 73977</u>		
Eulachon (<i>Thaleichthys pacificus</i>) –Southern DPS	<u>T – 75 FR 13012</u>	<u>76 FR 65323</u>	9/2017
Giant Manta Ray (Mobula birostris)	T – 83 FR 2916		
Green Sturgeon (Acipenser medirostris) – Southern DPS	<u>T – 71 FR 17757</u>	74 FR 52300	2010 (Outline) 8/2018- Final
Gulf Grouper (Mycteroperca jordani)	<u>E – 81 FR 72545</u>		
Gulf Sturgeon (Acipenser oxyrinchus desotoi)	T – 56 FR 49653	68 FR 13370	09/1995
Island Grouper (Mycteroperca fusca)	<u>T – 81 FR 72545</u>		
Largetooth Sawfish (Pristis pristis)	E – 76 FR 40822 and E - 79 FR 73977		
Narrow Sawfish (Anoxypristis cuspidata)	E – 79 FR 73977		

Species	ESA Status	Critical Habitat	Recovery Plan
Narrownose Smoothhound Shark (Mustelus schmitti)	T – 82 FR 21722		
Nassau Grouper (Epinephelus striatus)	<u>T – 81 FR 42268</u>		<u>8/2018- Outline</u>
Oceanic Whitetip Shark (Carcharhinus longimanus)	<u>T – 83 FR 4153</u>		<u>9/2018- Outline</u>
Sawback Angelshark (Squatina aculeata)	<u>E – 81 FR 50394</u>		
Scalloped Hammerhead Shark (<i>Sphyrna lewini</i>) – Central and Southwest Atlantic DPS	<u>T – 79 FR 38213</u>		
Scalloped Hammerhead Shark (<i>Sphyrna lewini</i>) – Eastern Atlantic DPS	E – 79 FR 38213		
Scalloped Hammerhead Shark (Sphyrna lewini) – Eastern Pacific DPS	E – 79 FR 38213		
Scalloped Hammerhead Shark (Sphyrna lewini) – Indo-West Pacific DPS	<u>T – 79 FR 38213</u>		
Shortnose Sturgeon (Acipenser brevirostrum)	E – 32 FR 4001		63 FR 69613 12/1998
Smalltooth Sawfish (<i>Pristis</i> pectinata) – U.S. portion of range DPS	<u>E – 68 FR 15674</u>	74 FR 45353	74 FR 3566 01/2009
Smalltooth Sawfish (<i>Pristis</i> pectinata) – Non-U.S. portion of range DPS	E - 79 FR 73977		
Smoothback Angelshark (Squatina oculata)	E – 81 FR 50394		
Sockeye Salmon (<i>Oncorhynchus nerka</i>) – Ozette Lake ESU	<u>T – 70 FR 37160</u>	<u>70 FR 52630</u>	74 FR 25706
Sockeye Salmon (<i>Oncorhynchus nerka</i>) – Snake River ESU	<u>E – 70 FR 37160</u>	<u>58 FR 68543</u>	80 FR 32365
Steelhead Trout (<i>Oncorhynchus mykiss</i>) – California Central Valley DPS	<u>T – 71 FR 834</u>	<u>70 FR 52487</u>	79 FR 42504
Steelhead Trout (<i>Oncorhynchus mykiss</i>) – Central California Coast DPS	<u>T – 71 FR 834</u>	70 FR 52487	81 FR 70666
Steelhead Trout (<i>Oncorhynchus mykiss</i>) – Lower Columbia River DPS	<u>T – 71 FR 834</u>	70 FR 52629	78 FR 41911

Species	ESA Status	Critical Habitat	Recovery Plan
Steelhead Trout (<i>Oncorhynchus mykiss</i>) – Middle Columbia River DPS	T – 71 FR 834	70 FR 52629	74 FR 50165
Steelhead Trout (<i>Oncorhynchus mykiss</i>) – Northern California DPS	<u>T – 71 FR 834</u>	70 FR 52487	81 FR 70666
Steelhead Trout (<i>Oncorhynchus mykiss</i>) – Puget Sound DPS	<u>T – 72 FR 26722</u>	81 FR 9251	84 FR 71379
Steelhead Trout (<i>Oncorhynchus</i> mykiss) – Snake River Basin DPS	<u>T – 71 FR 834</u>	70 FR 52629	81 FR 74770 (Draft) 11-2017-Final
Steelhead Trout (<i>Oncorhynchus mykiss</i>) – South-Central California Coast DPS	T – 71 FR 834	70 FR 52487	78 FR 77430
Steelhead Trout (<i>Oncorhynchus mykiss</i>) – Southern California DPS	E – 71 FR 834	70 FR 52487	77 FR 1669
Steelhead Trout (<i>Oncorhynchus mykiss</i>) – Upper Columbia River DPS	<u>T – 71 FR 834</u>	70 FR 52629	72 FR 57303
Steelhead Trout (<i>Oncorhynchus mykiss</i>) – Upper Willamette River DPS	<u>T – 71 FR 834</u>	70 FR 52629	76 FR 52317
Striped Smoothhound Shark (Mustelus fasciatus)	E – 82 FR 21722		
Yelloweye Rockfish (<i>Sebastes</i> rubberimus) – Puget Sound/Georgia Basin DPS	T – 75 FR 22276 and 82 FR 7711	79 FR 68041	81 FR 54556 (Draft) 10/2017
	Marine Inverteb	orates	
Acropora globiceps Coral	T – 79 FR 53851	85 FR 76262 (Proposed)	
Acropora jacquelineae Coral	<u>T – 79 FR 53851</u>	85 FR 76262 (Proposed)	
Acropora lokani Coral	<u>T – 79 FR 53851</u>		
Acropora pharaonis Coral	<u>T – 79 FR 53851</u>		
Acropora retusa Coral	<u>T – 79 FR 53851</u>	85 FR 76262 (Proposed)	
Acropora rudis Coral	<u>T – 79 FR 53851</u>		
Acropora speciosa Coral	<u>T – 79 FR 53851</u>	85 FR 76262 (Proposed)	
Acropora tenella Coral	<u>T – 79 FR 53851</u>		
Anacropora spinosa Coral	<u>T – 79 FR 53851</u>		
			-

Species	ESA Status	Critical Habitat	Recovery Plan
Black Abalone (Haliotis cracherodii)	<u>E – 74 FR 1937</u>	76 FR 66805	85 FR 5396
Boulder Star Coral (Orbicella franksi)	<u>T – 79 FR 53851</u>	85 FR 76302 (Proposed)	
Cantharellus noumeae Coral	<u>E – 80 FR 60560</u>		
Chambered Nautilus (Nautilus pompilius)	<u>T – 83 FR 48976</u>		
Elkhorn Coral (Acropora palmata)	<u>T – 79 FR 53851</u>	73 FR 72210	80 FR 12146
Euphyllia paradivisa Coral	<u>T – 79 FR 53851</u>	85 FR 76262 (Proposed)	
Isopora crateriformis Coral	<u>T – 79 FR 53851</u>	85 FR 76262 (Proposed)	
Lobed Star Coral (Orbicella annularis)	<u>T – 79 FR 53851</u>	85 FR 76302 (Proposed)	
Montipora australiensis Coral	<u>T – 79 FR 53851</u>		
Mountainous Star Coral (Orbicella faveolata)	<u>T – 79 FR 53851</u>	85 FR 76302 (Proposed)	
Rough Cactus Coral (Mycetophyllia ferox)	<u>T – 79 FR 53851</u>	85 FR 76302 (Proposed)	
Pavona diffluens Coral	<u>T – 79 FR 53851</u>		
Pillar Coral (Dendrogyra cylindrus)	<u>T – 79 FR 53851</u>	85 FR 76302 (Proposed)	
Porites napopora Coral	<u>T – 79 FR 53851</u>		
Seriatopora aculeata Coral	<u>T – 79 FR 53851</u>	85 FR 76262 (Proposed)	
Staghorn Coral (Acropora cervicornis)	<u>T – 79 FR 53851</u>	73 FR 72210	80 FR 12146
Tubastraea floreana Coral	<u>E – 80 FR 60560</u>		
White Abalone (Haliotis sorenseni)	<u>E – 66 FR 29046</u>	66 FR 29046 (Not Prudent)	73 FR 62257
	Marine Plants		
Johnson's Seagrass (Halophila johnsonii)	<u>T – 63 FR 49035</u>	65 FR 17786	67 FR 62230

DPS=distinct population segment; ESU=evolutionarily significant unit; E=endangered; T=threatened; FR=*Federal Register*; *=designated critical habitat in the action area

OER determined that its marine operation activities may affect, but are not likely to adversely affect the ESA-listed species and designated and proposed critical habitat in Table 3.

3.1 ESA-Listed Marine Mammals in the Action Area

Blue whales, fin whales, and sei whales are widely distributed across the globe in all major oceans and within the action area. All of these species typically winter at low latitudes, where they mate, calve and nurse, and summer at high latitudes, where they feed. They are most common in offshore continental shelf and slope waters that support productive zooplankton blooms.

Humpback whales are also widely distributed and winter at low latitudes, where they calve and nurse, and summer at high latitudes, where they feed. The Western North Pacific DPS of humpback whales are known to breed/winter in the area of Okinawa and the Philippines, which borders the action area, and migrate to feeding grounds in the northern Pacific Ocean, primarily off the Russian outside of the action area, but also feeds near the Aleutian Islands and the Gulf of Alaska (81 FR 62259), in the action area. The Cape Verde Islands/Northwest Africa DPS of humpback whales are known to breed in the action area near the Cape Verde Islands in the Atlantic Ocean, and feed primarily near Iceland and Norway near possible transit routes within the action area (81 FR 62259). The Mexico DPS of humpback whales breed outside of the action area along the Pacific coast of mainland Mexico and the Revillagigedos Islands, and feed within the action area across a broad geographic range from California to the Aleutian Islands (81 FR 62259). The Central America DPS of humpback whales breed outside of the action area along the Pacific coast of Central America and feeds almost exclusively offshore of California and Oregon within the action area (81 FR 62259).

The Western North Pacific DPS of gray whales tend to feed near the bottom in productive waters closer to shore. Some Western North Pacific gray whales winter in the action area on the west coast of North America, while most others migrate outside of the action area south to winter in waters off Japan and China and summer in the Okhotsk Sea off northeast Sakhalin Island, Russia, and off southeastern Kamchatka in the Bering Sea (Burdin et al. 2013).

Bowhead whales inhabit areas in the action area including the Bering, Chukchi, and Beaufort Seas. They also occupy areas outside of the action area including Hudson Bay and Foxe Basin, Baffin Bay and Davis Strait, the Sea of Okhotsk, and in waters from eastern Greenland and Spitsbergen to eastern Siberia. The majority spend the winter near the southern limit of the pack ice and move north as the sea ice breaks up and recedes during spring (George et al. 2020).

The North Atlantic right whale is found in the action area primarily in the western North Atlantic Ocean, from shallow, coastal water breeding grounds in temperate latitudes off the coast of the southeastern U.S. during the winter and in summer, and feed on large concentrations of zooplankton in the sub-polar latitudes off the coast of Nova Scotia (Waring and et al. 2016).

North Pacific right whales mostly inhabit coastal and continental shelf waters in the North Pacific Ocean. They have been observed in temperate latitudes during winter (outside the action area off Japan and Mexico and inside the action area in California) where they likely calve and

nurse. In the summer, they feed in the action area on large concentrations of zooplankton in subpolar waters around Alaska.

Southern right whales are distributed in the Southern Hemisphere worldwide from 20 degrees to 60 degrees South. Southern right whales feed during the austral summer outside of the action area in high latitude feeding grounds in the Southern Ocean, where they use their baleen to "skim" copepods and krill from the water. Mating likely occurs in winter in the low latitude breeding and calving grounds. There is a slight potential for the range of Southern right whales to overlap with the action area within the Central Pacific Ocean.

The sperm whale is widely distributed globally, found in all major oceans and within the action area. Sperm whales mostly inhabit areas with a water depth of 600 meters (1968.5 feet) or more, and are uncommon in waters less than 300 meters (984.3 feet) deep. They winter at low latitudes, where they calve and nurse, and summer at high latitudes, where they feed primarily on squid and demersal fish.

False killer whales prefer waters more than 1,000 meters (3280.84 feet) deep, feeding on fishes and cephalopods. The Main Hawaiian Islands Insular DPS of false killer whale is considered resident within 40 kilometers (21.6 nautical miles) of the Main Hawaiian Islands, inside the action area.

Rice's whales in U.S. waters of the Gulf of Mexico have been consistently located in the northeastern Gulf of Mexico along the continental shelf between roughly 100 and 400 meters depth (328 to 1,312 feet) within the action area. A single Rice's whale was observed in the western Gulf of Mexico off the coast of Texas (within the action area), suggesting that their distribution may occasionally include waters elsewhere in the Gulf of Mexico (NMFS 2020b).

Guadalupe fur seals breed mainly on Guadalupe Island with another smaller breeding colony in the San Benito Archipelago, Baja California, Mexico (Belcher and T.E. Lee 2002). Guadalupe fur seals feed mainly on squid species (Esperon-Rodriguez and Gallo-Reynoso 2013) with foraging trips that can last between four to 24 days (average of 14 days) and cover great distances, with sightings occurring thousands of kilometers away from the main breeding colonies (Aurioles-Gamboa et al. 1999). Guadalupe fur seals are infrequently observed in U.S. waters but they can be found in the action area near California's Channel Islands.

The Southern Resident killer whale DPS can be found in the action area along the Pacific Coast of the U.S., and in the Salish Sea, Strait of Juan de Fuca and Puget Sound, and outside of the action area off the coast of Canada. Southern Resident killer whales are geographically, matrilineally, and behaviorally distinct from other killer whale populations (70 FR 69903). The DPS includes three large, stable pods (J, K, and L), which occasionally interact (Parsons et al. 2009). Most mating occurs outside natal pods, during temporary associations of pods, or as a result of the temporary dispersal of males (Pilot et al. 2010). Southern Resident killer whales prey upon salmonids, especially Chinook salmon (Hanson et al. 2010).

The entire range of the Hawaiian monk seal is located in the action area within U.S. waters. The main breeding subpopulations are in the Northwestern Hawaiian Islands, but there is also a small growing population found on the Main Hawaiian Islands. Hawaiian monk seals are considered foraging generalist that feed primarily on benthic and demersal prey such as fish, cephalopods, and crustaceans in subphotic zones (Parrish et al. 2000).

Bearded seals in the Pacific are distributed from 85 degrees North to Sakhalin Island (45 degrees North), including the Chukchi, Bering, and Okhotsk Seas. Bearded seals are boreoarctic with a circumpolar distribution and are closely associated with sea ice. Most seals move seasonally, following the extent of the sea ice; however, some remain near the coasts during the summer and early fall. Bearded seals in the Beringia DPS are found in the continental shelf waters throughout the Eastern Siberian (outside of the action area), Chukchi and Beaufort Seas (in the action area). The Okhotsk DPS includes bearded seals found in the Sea of Okhotsk, Russia.

Arctic ringed seals are widely distributed throughout the Arctic Ocean, in waters of Russia, Canada, Greenland, Finland, and the U.S. (Kelly et al. 2010). In the action area (i.e., U.S. waters), Arctic ringed seals are found around Alaska in the Bering, Chukchi and Beaufort Seas. Most seals move seasonally, following the extent of the sea ice (Kelly et al. 2010). Steller sea lions are distributed mainly around the coasts to the outer continental shelf along the North Pacific Ocean rim outside of the action area from northern Hokkaiddo, Japan through the Kuril Islands and Okhotsk Sea, and inside the action area in the throughout the Aleutian Islands, central Bering Sea, southern coast of Alaska, and south to California (Muto 2016). The Western DPS includes Steller sea lions that reside in the action area in the central and western Gulf of Alaska, Aleutian Islands, as well as those outside the action area that inhabit the coastal waters and breed in Asia (e.g., Japan and Russia) (Muto 2016).

3.2 ESA-Listed Sea Turtles in the Action Area

The green turtle has a circumglobal distribution, occurring throughout nearshore tropical, subtropical and, to a lesser extent, temperate waters. After emerging from the nest, hatchlings swim to offshore areas and go through a post-hatchling pelagic stage believed to last several years. Adult green turtles exhibit site fidelity and migrate hundreds to thousands of kilometers from nesting beaches to foraging areas. Green turtles spend the majority of their lives in coastal foraging grounds, which include open coastlines and protected bays and lagoons.

Green turtles from the North Atlantic DPS range are found outside of the action area off the coast of South and Central America in the south and New Brunswick, Canada in the north. The North Atlantic DPS is found in the action area throughout the Caribbean Sea, Gulf of Mexico, and the U.S. Atlantic coast. The range of the North Atlantic DPS of green turtle extends east to the western coasts of Europe and Africa, which borders the action area. The North Atlantic DPS of green turtle nesting occurs primarily near or inside the action area in Costa Rica, Mexico, Florida, and Cuba.

The Central North Pacific DPS of green turtle is found in the action area in the Pacific Ocean near the Hawaiian Archipelago and Johnston Atoll. The major nesting site for the Central North Pacific DPS of green turtle is in the action area at East Island, French Frigate Shoals, in the Northwestern Hawaiian Islands; lesser nesting sites are found in the action area throughout the Northwestern Hawaiian Islands and the Main Hawaiian Islands.

Green turtles in the Central West Pacific DPS are found throughout the western Pacific Ocean outside of the action area in Indonesia, the Philippines, and Papua New Guinea, and inside the action area in the Marshall Islands. The Central West Pacific DPS is composed of green turtle nesting assemblages outside the action area in the Federated States of Micronesia, the Japanese islands of Chichijima and Hahajima, and inside the action area in the Marshall Islands and Palau.

Green turtles in the East Pacific DPS are found inside the action area along the California/Oregon border south to central Chile, outside the action area. Major nesting sites occur outside the action area at Michoacán, Mexico, and the Galapagos Islands, Ecuador. Smaller nesting sites are found outside the action area in the Revillagigedos Archipelago, Mexico, and along the Pacific Coast of Costa Rica, Columbia, Ecuador, Guatemala, and Peru (Seminoff et al. 2015).

Green turtles in the South Atlantic DPS are located mostly outside the action area in the Atlantic Ocean from South America to the west coast of Africa. While conducting surveys in the U.S. Virgin Islands, there is a possibility that this DPS will overlap with OER's proposed marine operation activities. The South Atlantic DPS has 51 nesting sites, with an estimated nester abundance of 63,332. The largest nesting site is found bordering the action area near Poilão, Guinea-Bissau, which hosts 46 percent of nesting females for the DPS (Seminoff et al. 2015). Overall, there are 51 nesting sites for the South Atlantic DPS, and many have insufficient data to determine population growth rates or trends. Of the nesting sites where data are available, which are located near or outside the action area, such as Ascension Island, Suriname, Brazil, Venezuela, Equatorial Guinea, and Guinea-Bissau, there is evidence that population abundance is increasing (Seminoff et al. 2015).

Green turtles in the Central South Pacific DPS are found in the South Pacific Ocean throughout several island groups located between approximately 170 degrees East to 100 degrees West and 10 degrees North to 40 degrees South. The largest nesting site is within Scilly Atoll in French Polynesia, which hosts 36 percent of the nesting females for the DPS (Seminoff et al. 2015). This DPS is located near Jarvis Island, which is within the action area.

The hawksbill turtle has a circumglobal distribution throughout tropical and, to a lesser extent, subtropical waters inside the action area in the Atlantic and Pacific Oceans and outside the action area in the Indian Ocean. In their oceanic phase, juvenile hawksbill turtles can be found in *Sargassum* mats; post-oceanic hawksbills may occupy a range of habitats that include coral reefs

or other hard-bottom habitats, seagrass, algal beds, mangrove bays and creeks (Musick and Limpus 1997; Bjorndal and Bolten 2010).

The Kemp's ridley turtle occurs in the action area from the Gulf of Mexico and up along the Atlantic coast of the U.S. (TEWG 2000). The majority of Kemp's ridley turtles nest outside the action area at coastal Mexican beaches in the Gulf of Mexico. During spring and summer, juvenile Kemp's ridley occur in the action area in the shallow coastal waters of the northern Gulf of Mexico from south Texas to north Florida. In the fall, most Kemp's ridley migrate to deeper or more southern, warmer waters and remain there through the winter (Schmid 1998). As adults, many Kemp's ridley turtles remain in the Gulf of Mexico, with only occasional occurrence in the Atlantic Ocean (NMFS et al. 2010).

Globally, olive ridley sea turtles can be found in tropical and subtropical waters inside the action area in the Atlantic and Pacific Oceans and outside the action area in the Indian Ocean. Major nesting beaches are found outside the action area in Nicaragua, Costa Rica, Panama, India and Suriname. Olive ridleys may forage across ocean basins, primarily in pelagic habitats, on crustaceans, fish, mollusks, and tunicates. The range of the endangered Pacific coast breeding population extends as far south as Peru, outside of the action area, and up to California, inside the action area. Olive ridley turtles of the Pacific coast breeding colonies nest on arribada beaches outside the action area at Mismaloya, Ixtapilla and La Escobilla, Mexico. Solitary nesting takes place outside the action area all along the Pacific coast of Mexico (NMFS and USFWS 2014).

Loggerhead turtles are circumglobal, and are found in the temperate and tropical regions of the Atlantic, Indian, and Pacific Oceans. The post-hatchling stage uses pelagic waters and juveniles move from the oceanic zone to the neritic zone (i.e., coastal waters). While in their oceanic phase, loggerhead turtles undertake long migrations using ocean currents. Adults and sub-adults occupy nearshore habitat important for foraging and inter-nesting migration.

The Northeast Atlantic Ocean DPS of loggerhead turtles are found bordering the action area in the northeastern Atlantic Ocean, from Western Europe to western Africa, but they can also migrate west, into the action area, to feeding grounds. The Cape Verde Archipelago hosts the highest concentration of Northeast Atlantic Ocean DPS of loggerhead turtle nesting (NMFS and USFWS 2021).

Northwest Atlantic Ocean DPS loggerhead turtle hatchlings disperse widely, most likely using the Gulf Stream to drift throughout the Atlantic Ocean in the action area. Genetic evidence demonstrates that juvenile loggerheads from southern Florida nesting beaches comprise the vast majority (71 to 88 percent) of individuals found in foraging grounds throughout the western and eastern Atlantic (Masuda 2010).

The North Pacific Ocean DPS of loggerhead turtles are found throughout the Pacific Ocean, north of the equator. Their range is contained in the action area from the west coast of North

America to outside of the action area in eastern Asia. Nesting occurs outside of the action area in Japan, where the Sea Turtle Association of Japan (STAJ) and other entities collect nesting data (Schultz and Lauritsen 2020). Two major juvenile foraging areas have been identified in the North Pacific Basin: Central North Pacific and off of Mexico's Baja California Peninsula. Hatchlings from Japanese nesting beaches use the North Pacific Subtropical Gyre and the Kuroshio Extension to migrate to those foraging grounds (Abecassis et al. 2013; Seminoff et al. 2014).

The South Pacific Ocean DPS of loggerheads are found in the Pacific Ocean, south of the equator. Their range extends from eastern Australia to western South America. Jarvis Island, which is within the action area is contained in this range. Nesting for the South Pacific DPS occurs mostly near eastern Australia and New Caledonia. New Caledonia has about 60 to 70 nesting females annually (Limpus et al. 2006); more recent estimates indicate about 200 nesting females per year (Wabnitz and Andréfouët 2008). Major nesting beaches in Australia are in the central and south Queensland areas, with some small aggregations in New South Wales (Limpus 2008). Juveniles and sub-adults migrate to forage off South America, outside of the action area, and are known to occur in pelagic waters as far south as 32 degrees South off the coast of Chile, and are concentrated between 15 degrees South and 25 degrees South between southern Peru and northern Chile (NMFS and USFWS 2021). After migrating back to the western South Pacific Ocean to reproduce, loggerheads are known to forage near the action area in the eastern Arafura Sea, Gulf of Carpentaria, Torres Strait, Gulf of Papua, Coral Sea, and western Tasman Sea to southern New South Wales including the Great Barrier Reef, Hervey Bay, and Moreton Bay, eastern Indonesia, north-eastern Papua New Guinea (Trobriand Islands and Woodlark Islands), northeastern Solomon Islands and New Caledonia (Limpus 2008). Leatherbacks are globally distributed, with nesting beaches in the action area in the Pacific and Atlantic Oceans and outside the action area in the Indian Ocean. The leatherback turtle has the widest distribution of any reptile, with a global range extending from 71 degrees North, based on an at-sea capture off Norway, to 47 degrees South, based on an at-sea sighting off New Zealand (NMFS and USFWS 2020). Nesting is restricted to mainly tropical or subtropical beaches; however, nesting also occurs on temperate beaches outside the action area in the southwest Indian Ocean (NMFS and USFWS 2020). Leatherback turtles appear to prefer wide, long beaches with a steep slope, deep rock-free sand, and an unobstructed deep water or soft-bottom approach (NMFS and USFWS 2020).

3.3 ESA-Listed Fishes in the Action Area

The Gulf of Maine DPS of Atlantic salmon juveniles spend about two years feeding in freshwater until they migrate more than 4,000 kilometers (2,159.8 nautical miles) in the open ocean in the action area to reach feeding areas in the Davis Strait between Labrador and Greenland, outside the action area. The majority of Gulf of Maine DPS of Atlantic salmon spend two winters at sea before reaching maturity and returning to their natal rivers.

Atlantic sturgeon spawn in freshwater, but spend most of their adult life in the marine environment in the action area. Atlantic sturgeon occupy ocean waters and associated bays, estuaries, and coastal river systems from Hamilton Inlet, Labrador, Canada, to Cape Canaveral, Florida (Stein et al. 2004; ASMFC 2006). Five DPS's of Atlantic sturgeon are listed under the ESA: Gulf of Maine, New York Bight, Chesapeake Bay, Carolina, and South Atlantic, all of which are within the action area. Juveniles typically spend two to five years in freshwater before eventually becoming coastal residents as sub-adults (Smith 1985; Boreman 1997; Schueller and Peterson 2010). Atlantic sturgeon exhibit high fidelity to their natal rivers but can undergo extensive mixing in coastal waters (King et al. 2001; Waldman et al. 2002; Grunwald et al. 2008).

ESA-listed boccaccio are those that reside in the Puget Sound/Georgia Basin located in transit areas within the action area. Puget Sound/Georgia Basin DPS boccaccio larvae and young juveniles tend to be found in offshore regions (one to 148 kilometers offshore [0.5 to 80 nautical miles]), associated with the surface and occasionally with floating kelp mats (NMFS 2016). As adults, fish move into waters 18 to 30 meters (59 to 98.4 feet) deep and occupy rocky reefs (Feder et al. 1974; Carr 1983; Eschmeyer et al. 1983; Johnson 2006; Love and Yoklavich 2008). As adults, boccaccio may be found in depths of 12 to 478 meters (39 to 1,568 feet) in the action area, but tend to remain in shallow waters on the continental shelf (20 to 250 meters [65.6 to 820.2 feet]), mostly associated with reefs or other hard substrate, although they may move over mud flats.

The Pacific salmon (chinook, Coho, chum and sockeye) and steelhead trout are anadromous fishes and the ESA-listed DPSs and ESUs spawn in their natal rivers in Washington, Oregon and California. Juvenile Chinook may reside in freshwater for 12 to 16 months, but some migrate to the ocean (in the action area) as young-of-the-year within eight months of hatching. Chinook salmon spend a few years feeding in the ocean, and sexually mature between the ages of two and seven. Chinook salmon are typically three or four years old when they return to spawn, generally in summer or early fall. Coho salmon spend a year in freshwater and then migrate out to the ocean in the action area to spend about 1.5 years feeding before returning to spawn, generally in fall or early winter. Sockeye salmon rear in freshwater for one to three years, after which they reach the smolt stage and migrate to the ocean in the action area to feed and grow. They typically mature and return to freshwater to spawn in the summer or fall after two to three years at sea, but some return earlier or stay at sea longer, between four and five years. Steelhead trout typically migrate to open marine waters in the action area after spending two years in freshwater. They reside in marine waters for typically two or three years prior to returning to their natal stream as four- or five-year-olds to spawn shortly after river entry from December through April. Young chum salmon (fry) typically migrate directly to estuarine and within the action area in marine waters soon after they are born and do not reside in freshwater for an extended period. As chum salmon grow larger, they migrate offshore and as they approach maturity, typically between the ages of three and six, they migrate back to spawn in late summer through March.

Common angelsharks are found in coastal and outer continental shelf sediment habitats outside of the action area in the Mediterranean Sea, and in the action area in the eastern Atlantic. They may also be found in estuaries and brackish water. These sharks are nocturnal bottom dwellers occurring in depths of five to 150 meters (16. 4 to 492.1 feet) and prefer to spend most of their time buried in the sand or mud during the day (Miller 2016).

The eulachon is an anadromous fish, smaller than salmonids (8.5 inches [21.5 centimeters]), that can be found in the continental shelf waters of the eastern Pacific Ocean. Adult and juvenile Southern DPS eulachon typically occupy waters 50 to 200 meters deep (164 to 656 feet) (Gustafson 2016), and up to depths of about 300 meters (984.2 feet), from California to the Bering Sea in the action area. Southern DPS eulachon are those that return to spawn in rivers south of the Nass River in British Columbia to the Mad River in California.

The giant manta ray occupies tropical, subtropical, and temperate oceanic waters within the action area and productive coastlines where they feed on zooplankton. Giant manta rays are commonly found offshore in oceanic waters, but are sometimes found feeding in shallow waters (less than 10 meters [32.8 feet]) during the day. Giant manta rays can dive to depths of over 1,000 meters (3280.84 feet), and also conduct night descents to between 200 and 450 meters (656 and 1,476 feet) deep.

The green sturgeon is an anadromous fish found in the nearshore coastal waters to a depth of 110 meters (361 meters) from Baja California, Mexico (outside the action area) to the Bering Sea, Alaska (within the action area; Hightower 2007). Adult Southern DPS green sturgeon enter San Francisco Bay and migrate up the Sacramento River, within the action area, to spawn (Heublein et al. 2009).

The current range of the Gulf sturgeon extends from Lake Pontchartrain in Louisiana east to the Suwannee River system in Florida. Young-of-the-year slowly work their way downstream from where they hatched and arrive in estuaries and river mouths where they will spend their next six years developing (Sulak and Clugston 1999). After six years, Gulf sturgeon enter the marine environment, within the action area, to forage on benthic (bottom dwelling) invertebrates along the shallow nearshore (two to four meter [6.6 to 13.1 feet] depths), barrier island passes, and in unknown offshore locations within the action area in the Gulf of Mexico (Huff 1975, Carr et al. 1996, Fox et al. 2002, Ross et al. 2009).

The island grouper is a subtropical species (40 degrees North to 10 degrees North) that is endemic to volcanic archipelagos of Macaronesia within the action area: Canary (Spain), Madeira and Azores (Portugal), and Cape Verde (Salz 2015). One specimen was caught by a spear fisherman off Israel's coast (Heemstra et al. 2010), but there are no data confirming the existence of an island grouper population in the Mediterranean (Salz 2015).

Largetooth sawfish are found in coastal waters, being found in salinities ranging from 0 to 40 parts per thousand (Thorburn et al. 2007). In locations outside of the action area, the species has

been found far upriver, often occupying freshwater lakes and pools; they are associated with freshwater more than any other sawfish species. Largetooth sawfish were historically found in tropical and subtropical waters of all oceans around the globe. However, they are now considered extirpated or extremely rare in portions of their former range. Largetooth sawfish occurred from the Caribbean and Gulf of Mexico south through Brazil. In the U.S., largetooth sawfish were reported in the Gulf of Mexico, mainly along the Texas coast (NMFS, 2010a). Largetooth sawfish were rarely reported in U.S. waters and may have been long-distance migrants from the Caribbean or Brazil (Feldheim *et al.*, 2011 as cited in 79 FR 73977). The largest remaining population of largetooth sawfish is found outside of the action area in Australia and Amazonia, and near the action area in the Indo-Pacific region.

The Nassau grouper is distributed within the action area from south Florida throughout the Caribbean, and Bermuda. Juveniles inhabit microalgae, coral clumps, and seagrass beds, and are relatively solitary. As they grow, they occupy progressively deeper areas and offshore reefs, and can be in schools of up to 40 individuals. When not spawning, adults are most common in waters less than 100 meters (328 feet) deep.

The oceanic whitetip shark is a large pelagic shark distributed globally throughout open ocean waters, outer continental shelves, and around oceanic islands, primarily from 10 degrees North to 10 degrees South, but up to 30 degrees North and 35 degrees South (Young 2016). They occur within the action area from the surface to at least 152 meters (498.7 feet) deep, and display a preference for water temperatures above 20 degrees Celsius.

Sawback angelsharks are found in continental shelf and upper slope sediment habitats in the Mediterranean Sea (outside of the action area) and eastern Atlantic (inside the action area), but have never been recorded in Atlantic waters north of the Strait of Gibraltar. These sharks are nocturnal bottom dwellers, occurring in depths of 30 to 500 meters (98 to 1640 feet), and prefer to spend most of their time buried in the sand or mud during the day (Miller 2016).

The scalloped hammerhead shark is found throughout the world and the Central and Southwest Atlantic DPS, Eastern Atlantic DPS, Eastern Pacific DPS, and Indo-West Pacific DPS live in coastal warm temperate and tropical seas. All DPSs are located in the action area. It occurs over continental shelves and the shelves surrounding islands, as well as adjacent deep waters, but is seldom found in waters cooler than 22 degrees Celsius (Compagno 1984; Schulze-Haugen and Kohler 2003 as cited in 80 FR 71774). It ranges from the intertidal and surface to depths of up to 450 to 512 meters (1,476.4 to 1,679.8 feet), with occasional dives to even deeper waters. It has also been documented entering enclosed bays and estuaries. The Central and Southwest Atlantic DPS of scalloped hammerhead shark range extends from the southeast coast of Florida to Brazil, including the Caribbean Sea, but not the Gulf of Mexico. The Eastern Atlantic DPS of scalloped hammerhead shark range is from the Mediterranean Sea to Namibia. The range of the Eastern Pacific DPS of scalloped hammerhead shark extends from the coast of southern California, including the Gulf of California down to Ecuador and possibly Peru, and waters off of Tahiti.

The Indo-West Pacific DPS of scalloped hammerhead shark ranges from Japan down to Australia. The central Pacific Ocean waters near Hawaii are not included with the listed DPSs.

Shortnose sturgeon occur in estuaries, rivers, and the sea along the east coast of North America (Vladykov and Greeley 1963). Their northerly distribution extends north of the action area to the Saint John River, New Brunswick, Canada, and their southerly distribution historically extended to the Indian River, Florida (Evermann and Bean 1898; Scott and Scott 1988). Some populations rarely leave freshwater while others are known to migrate along the coast between river systems (Altenritter et al. 2017).

Historically within the U.S., smalltooth sawfish have been captured in estuarine and coastal waters from New York southward through Texas, with the largest number of recorded captures in Florida (NMFS 2010). Recent capture and encounter data suggest that the current distribution is primarily south and southwest Florida from Charlotte Harbor through the Dry Tortugas within the action area (Seitz and Poulakis 2002; Poulakis and Seitz 2004). Water temperatures (no lower than 16-18 degrees Celsius) and the availability of appropriate coastal habitat (shallow, euryhaline waters and red mangroves) are the major environmental constraints limiting the distribution of smalltooth sawfish (Bigalow and Schroeder 1953). Juvenile sawfish spend the first 2-3 years of their lives in the shallow waters provided in the lower reaches of rivers, estuaries, and coastal bays (Simpfendorfer et al. 2011). As smalltooth sawfish approach 250 centimeters (98.4 inches), they become less sensitive to salinity changes and begin to move out of the protected shallow water embayments and to the shorelines of barrier islands. Adult sawfish typically occur in more open water, marine habitats (Poulakis and Seitz 2004).

Smoothback angelshark historically occurred throughout the Mediterranean Sea (outside of the action area) and in the action area within the eastern Atlantic, from Morocco to Angola, in depths of 20 meters to 560 meters (65.6 to 1837.27 feet). Based on available historical information, anecdotal observations, and fisheries survey and catch data, it appears the species may be rare throughout most of its Mediterranean range, with the exception of the central Mediterranean and the Levantine Sea, where qualitative descriptions of the species characterize it as common. However, these characterizations date back almost 10 years and, as such, the current status of the population in these areas is unknown. The species is also thought to be extirpated in the Aegean Sea, Ligurian and Tyrrhenian Seas, off the Balearic Islands, and in the Catalan Sea. In the eastern Atlantic, the available data indicate the species may have been common off the west coast of Africa in the 1970s and 1980s, but has since undergone declines to the point where it is now rarely observed in these waters (Miller 2016).

Yelloweye rockfish occur throughout most of the eastern Pacific Ocean within the action area, ranging from northern Baja California to the Aleutian Islands, Alaska. The Puget Sound/Georgia Basin DPS of yelloweye rockfish is located in the action area along the coastal waters off the state of Washington and province of British Columbia (NMFS 2014).

3.4 Endangered Species Act-Listed Invertebrates in the Action Area

Acropora globiceps, Acropora jacquelineae, Acropora retusa, Acropora speciosa, Euphyllia paradivisa, Isopora crateriformis, and Seriatopora aculeata are found in the action area within the Indo-Pacific. Areas where these species are found in the action area include American Samoa, the Mariana Islands, and the Pacific Remote Island Area (85 FR 76262). The depth ranges for each species is noted in Table 4 below.

Table 4. Depth Ranges for ESA-listed Pacific Corals (85 FR 76262)

Listed Species	Location	Depth
Acropora globiceps	Tutuila and Ofu-Olosega	0-20 meters (0-65.6 feet)
	Guam, Rota, Aguihan, Tinian, Saipan, Farallon de Medinilla, Pagan, Maug	0-12 meters (0-39.4 feet)
	Rose, Palmyra, Johnston, Wake, French Frigate Shoals	0-10 meters (0-32.8 feet)
Acropora jacquelineae	Tutuila and Offshore Banks*	10-50 meters (32.8-164 feet)
Acropora retusa	Tutuila, Ofu-Olosega	0-20 meters (0-65.6 feet)
	Rose, Palmyra, Johnston, Wake, French Frigate Shoals	0-10 meters (0-32.8 feet)
Acropora speciosa	Tutuila:	20-50 meters (65.6-164 feet)
Euphyllia paradivisa	Tutuila	20-50 meters (65.6164 feet)
Isopora crateriformis	Tutuila and Ofu-Olosega	0-20 meters (0-65.6 feet)
Seriatopora aculeata	Guam and Saipan* (possibly extirpated)	3-40 meters (8.8-131.2 feet)

^{*}possibly extirpated in these locations (NMFS 2021)

Elkhorn coral, staghorn coral, pillar coral, lobed star coral, mountainous star coral, boulder star coral, and rough cactus coral are found in the action area off the coasts of Florida, Puerto Rico, and the U.S. Virgin Islands (85 FR 76302; NMFS 2015). Important areas for these species and their associated depth ranges are noted in Table 5 below.

Table 5. Average Depth Ranges and geographic distribution for ESA-listed Caribbean corals (85 FR 76302; NMFS 2015).

Species	Depth distribution	U.S. geographic distribution
Staghorn Coral	5 to 30 meters (16.4-98.4 feet)	Southeast Florida from Boynton Inlet in Palm Beach County to the Dry Tortugas; Puerto Rico; U.S. Virgin Islands (ASVI); Navassa Island
Elkhorn Coral	1 to 5 meters (1.64 to 16.4 feet)	Southeast Florida from Broward County to the Dry Tortugas; Flower Garden Banks; Puerto Rico; ASVI, Navassa

Species	Depth distribution	U.S. geographic distribution
Pillar Coral	1 to 25 meters (1.64 to 82 feet)	Southeast Florida from Lake Worth Inlet in Palm Beach County to the Dry Tortugas; Puerto Rico; ASVI; Navassa Island.
Rough Cactus Coral	0.5 to 90 meters (1.64 to 295 feet)	Southeast Florida from Broward County to the Dry Tortugas; Puerto Rico; ASVI; Navassa Island.
Lobed Star Coral	0.5 to 20 meters (1.64 to 65.6 feet)	Southeast Florida from Lake Worth Inlet in Palm Beach County to the Dry Tortugas; Flower Garden Banks; Puerto Rico; ASVI; Navassa Island.
Mountainous Star Coral	0.5 to 90 meters (1.64 to 295 feet)	Southeast Florida from St. Lucie Inlet in Martin County to the Dry Tortugas; Flower Garden Banks; Puerto Rico; ASVI; Navassa Island.
Boulder Star Coral	0.5 to 90 meters (1.64 to 295 feet)	Southeast Florida from Lake Worth Inlet in Palm Beach County to the Dry Tortugas; Flower Garden Banks; Puerto Rico; ASVI; Navassa Island.

Black abalone live on rocky substrates in intertidal and shallow subtidal reefs (to about 5.5 meters [18 feet] deep) along the coast. They typically occur in habitats with complex surfaces and deep crevices that provide shelter for juveniles and adults (NMFS 2020a). Because they occur in coastal habitats, black abalone can withstand extreme variations in temperature, salinity, moisture, and wave action. Black abalone range from about Point Arena, California (in the action area), to Bahia Tortugas and Isla Guadalupe, Mexico (outside of the action area). They are rarely found north of San Francisco and south of Punta Eugenia. In the mid-1900s, black abalone abundances were highest south of Monterey, particularly at the Channel Islands off southern California (NMFS 2020a).

White abalone live on rocky substrates alongside sand channels, which tend to accumulate the algae they eat. They are usually found at depths of 15.24 to 55 meters (50 to 180 feet), making them the deepest living abalone species. Historically, white abalone were found in the Pacific Ocean from Point Conception, California (in the action area), to Punta Abreojos (outside of the action area), Baja California, in Mexico (NMFS 2008). In California, they were most abundant at offshore islands (especially San Clemente and Santa Catalina Islands) and submerged banks (primarily Tanner and Cortes Banks). Since the mid-1990s, extremely low numbers of isolated animals have been identified along the mainland coast in Santa Barbara County and at some of the offshore islands and banks in the middle portion of the range, indicating the current range of white abalone in California may be similar to what it was historically (NMFS 2008).

3.5 Critical Habitat in the Action Area

This section discusses designated and proposed critical habitat that is either completely encompassed by the action area or is partially within the action area.

Black Abalone

Critical habitat was designated for black abalone on October 27, 2011 (76 FR 66805). Most of the designated critical habitat lies along the California coast north of the action area (Figure 2). Designated critical habitat includes rocky intertidal and subtidal habitats from the mean higher high water line to a depth of approximately 6 meters (20 feet), as well as the waters encompassed by these areas. Designated critical habitat extends from Del Mar Landing Ecological Reserve to the Palos Verdes Peninsula. Within the action area, critical habitat occurs on Santa Catalina and Santa Barbara Islands. The specific areas proposed for designation off San Nicolas and San Clemente Islands were determined to be ineligible for designation because the Navy's Integrated Natural Resources Management Plans provide benefits to black abalone in those areas. The PBFs for black abalone designated critical habitat are rocky substrate, food resources, juvenile settlement habitat, suitable water quality, and suitable nearshore circulation patterns.



Figure 2. Designated critical habitat for black abalone.

Caribbean Corals

Designated critical habitat for elkhorn coral and staghorn coral (Figure 3 and Figure 4) and proposed critical habitat for pillar coral, lobed star coral, mountainous star coral, boulder star coral, and rough cactus coral are found in the action area off the coasts of Florida, Puerto Rico, and the U.S. Virgin Islands (See Table 6). The PBFs for elkhorn and staghorn coral consist of substrate of suitable quality and availability to support successful larval settlement and recruitment, and reattachment and recruitment of fragments. Substrate of suitable quality and availability means natural consolidated hard substrate or dead coral skeleton that is free from fleshy or turf macroalgae cover and sediment cover. The proposed PBFs for pillar coral, lobed star coral, mountainous star coral, boulder star coral, and rough cactus coral are the following:

- Substrate with presence of crevices and holes that provide cryptic habitat, the presence of microbial biofilms, or presence of crustose coralline algae;
- Reefscape (all the visible features of an area of reef) with no more than a thin veneer of sediment and low occupancy by fleshy and turf microalgae;
- Marine water with levels of temperature, aragonite saturation, nutrients, and water clarity that have been observed to support any demographic function; and
- Marine water with levels of anthropogenically-introduced (from humans) chemical contaminants that do not preclude or inhibit any demographic function.

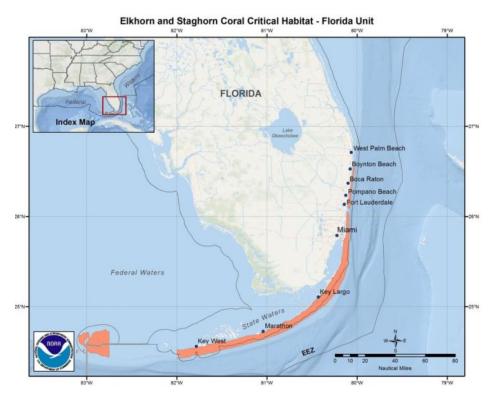


Figure 3. Map identifying Florida unit of designated critical habitat for threatened staghorn and Elkhorn coral



Figure 4. Map identifying Caribbean unit of designated critical habitat for threatened staghorn and Elkhorn coral

Table 6. Locations of the proposed critical habitat units for five species of Caribbean, Florida, and Gulf of Mexico corals.

Species	Critical Habitat Unit Name	Location	Geographic Extent	Water Depth Ranges
Lobed Star Coral (Orbicella annularis)	OANN-1	Florida	Lake Worth Inlet, Palm Beach County to Government Cut, Miami- Dade County	2 to 20 meters (6.6 to 65.6 feet)
	OANN-1	Florida	Government Cut, Miami- Dade County to Dry Tortugas, Monroe County	0.5 to 20 meters (1.6 to 65.6 feet)
	OANN-2	Puerto Rico	All Islands	0.5 to 20 meters (1.6 to 65.6 feet)
	OANN-3	U.S. Virgin Islands (ASVI)	All Islands of St. Thomas and St. John	0.5 to 20 meters (1.6 to 65.6 feet)

	OANN-4	ASVI	All Islands of St. Croix	0.5 to 20 meters (1.6 to 65.6 feet)
	OANN-5	Navassa	Navassa Island	0.5 to 20 meters (1.6 to 65.6 feet)
	OANN-6	Flower Gardens Bank (FGB)	East FGB and West FGB	17 to 90 meters (55.8 to 295.3 feet)
Mountainous Star Coral (Orbicella faveolata)	OFAV-1	Florida	St. Lucie Inlet, Martin County to Government Cut, Miami- Dade County	2 to 90 meters (6.6 to 295.2 feet)
	OFAV-1	Florida	Government Cut, Miami- Dade County to Dry Tortugas, Monroe County	0.5 to 90 meters (1.6 to 295.2 feet)
	OFAV-2	Puerto Rico	All Islands of Puerto Rico	0.5 to 90 meters (1.6 to 295.2 feet)
	OFAV-3	ASVI	All Islands of St. Thomas and St. John	0.5 to 90 meters (1.6 to 295.2 feet)
	OFAV-4	ASVI	All Islands of St. Croix	0.5 to 90 meters (1.6 to 295.2 feet)
	OFAV-5	Navassa	Navassa Island	0.5 to 90 meters (1.6 to 295.2 feet)
	OFAV-6	FGB	East FGB and West FGB	17 to 90 meters (55.8 to 295.2 feet)
Boulder Star Coral (<i>Orbicella</i> franksi)	OFRA-1	Florida	St. Lucie Inlet, Martin County to Government Cut, Miami- Dade County	2 to 90 meters (6.6 to 295.2 feet)
	OFRA-1	Florida	Government Cut, Miami- Dade County to Dry Tortugas, Monroe County	0.5 to 90 meters (1.6 to 295.2 feet)

	OFRA-2	Puerto Rico	All Islands of Puerto Rico	0.5 to 90 meters (1.6 to 295.2 feet)
	OFRA-3	ASVI	All Islands of St. Thomas and St. John	0.5 to 90 meters (1.6 to 295.2 feet)
	OFRA-4	ASVI	All Islands of St. Croix	0.5 to 90 meters (1.6 to 295.2 feet)
	OFRA-5	Navassa	Navassa Island	0.5 to 90 meters (1.6 to 295.2 feet)
	OFRA-6	FGB	East FGB and West FGB	17 to 90 meters (55.8 to 295.2 feet)
Pillar Coral (Dendrogyra cylindrus)	DCYL-1	Florida	Lake Worth Inlet, Palm Beach County to Government Cut, Miami- Dade County	2 to 25 meters (6.6 to 82 feet)
	DCYL-1	Florida	Government Cut, Miami- Dade County to Dry Tortugas, Monroe County	1 to 25 meters (3.2 to 82 feet)
	DCYL-2	Puerto Rico	All Islands	1 to 25 meters (3.2 to 82 feet)
	DCYL-3	ASVI	All Islands of St. Thomas and St. John	1 to 25 meters (3.2 to 82 feet)
	DCYL-4	ASVI	All Island of St. Croix	1 to 25 meters (3.2 to 82 feet)
	DCYL-5	Navassa	Navassa Island	1 to 25 meters (3.2 to 82 feet)
Rough Cactus Coral (Mycetophyllia	MFER-1	Florida	Broward County to Dry Tortugas, Monroe County	5 to 90 meters (6.6 to 295.2 feet)
ferox)	MFER-2	Puerto Rico	All Islands of Puerto Rico	5 to 90 meters (6.6 to 295.2 feet)

MFER-3	ASVI	All Islands of St. Thomas and St. John	5 to 90 meters (6.6 to 295.2 feet)
MFER-4	ASVI	All Islands of St. Croix	5 to 90 meters (6.6 to 295.2 feet)
MFER-5	Navassa	Navassa Island	5 to 90 meters (6.6 to 295.2 feet)

[•] m=meter, ASVI=U.S. Virgin Islands, FGB=Flower Garden Banks

Green Sturgeon

All marine areas of critical habitat for Southern DPS green sturgeon is contained in the action where vessel transit can occur (Figure 5). In marine waters, the designated critical habitat is up to the 110 meters (328 feet) depth isobath from Monterey Bay to the U.S.-Canada border. The PBFs essential for the conservation of the Southern DPS green sturgeon are:

- 1. **Migratory corridor:** A migratory pathway necessary for the safe and timely passage within marine and between estuarine and marine habitats.
- 2. Water quality: Nearshore marine waters with adequate dissolved oxygen levels and acceptably low levels of contaminants (e.g., pesticides, organochlorines, elevated levels of heavy metals) that may disrupt the normal behavior, growth, and viability of subadults and adults.
- 3. **Food resources:** Abundant prey items for sub-adults and adults, which may include benthic invertebrates and fishes.

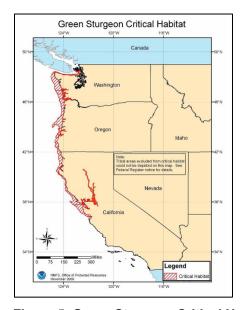


Figure 5. Green Sturgeon Critical Habitat

False Killer Whale

On July 24 2018, NOAA Fisheries designated critical habitat for the Main Hawaiian Islands Insular false killer whale DPS to include waters from the 45 meter (147.6 feet) depth contour to the 3,200 meter (10,498.7 feet) depth contour around the main Hawaiian Islands from Ni'ihau east to Hawai'i (Figure 6). Island-associated marine habitat is an essential feature for the conservation of the Main Hawaiian Islands Insular false killer whale. Main Hawaiian Islands Insular false killer whales are island-associated whales that rely entirely on the productive submerged habitat of the main Hawaiian Islands to support all of their life-history stages. The following characteristics of this habitat support insular false killer whales' ability to travel, forage, communicate, and move freely around and among the waters surrounding the main Hawaiian Islands:

- 1. Adequate space for movement and use within shelf and slope habitat;
- 2. Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth; and
- 3. Waters free of pollutants of a type and amount harmful to main Hawaiian Islands insular false killer whales; and Sound levels that would not significantly impair false killer whales' use or occupancy.

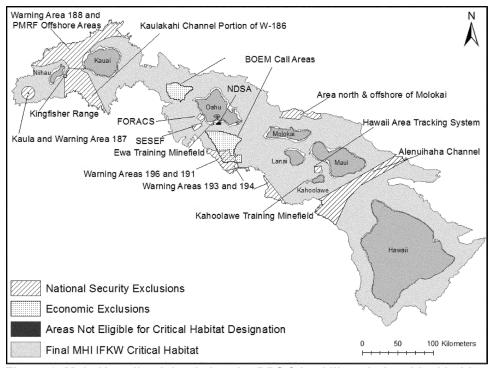


Figure 6. Main Hawaiian Islands insular DPS false killer whale critical habitat.

Gulf Sturgeon

All marine areas of Gulf sturgeon critical habitat are contained in the action area where vessel transit can occur (Figure 7). Most sub-adult and adult Gulf sturgeon spend cool months (October

or November through March or April) in estuarine areas, bays, or in the Gulf of Mexico. The PBFs relevant to the conservation of Gulf sturgeon in estuarine and marine areas are:

- 1. Abundant prey items within estuarine and marine habitats and substrates for juvenile, sub-adult, and adult life stages;
- 2. Water quality, including temperature, salinity, pH, hardness, turbidity, oxygen content, and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages;
- 3. Sediment quality, including texture and other chemical characteristics, necessary for normal behavior, growth, and viability of all life stages; and
- 4. Safe and unobstructed migratory pathways necessary for passage within and between riverine, estuarine, and marine habitats (e.g., a river unobstructed by any permanent structure, or a dammed river that still allows for passage).

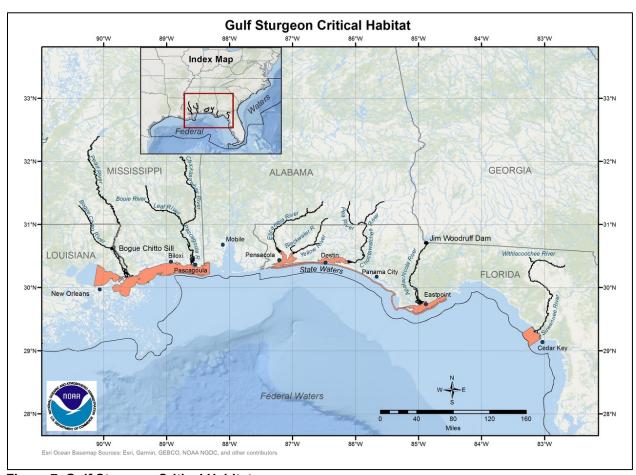


Figure 7. Gulf Sturgeon Critical Habitat

Hawksbill Sea Turtle

Critical habitat for hawksbill turtles is found in the action area around Mona and Monito Islands, Puerto Rico (Figure 8). Aspects of these areas that are important for hawksbill turtle survival and recovery include important natal development habitat, refuge from predation, shelter between foraging periods, and food for hawksbill turtle prey.

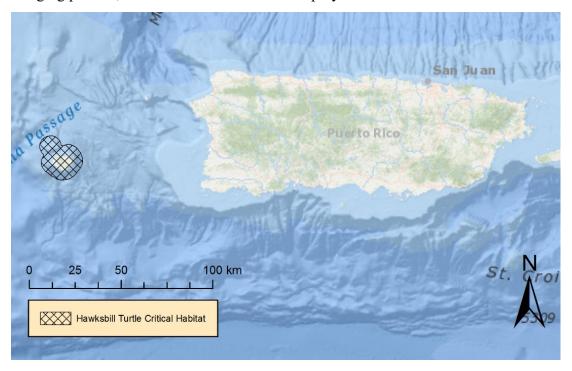


Figure 8. Map identifying designated critical habitat for the endangered hawksbill turtle.

Hawaiian Monk Seal

NOAA Fisheries designated Critical Habitat for the Hawaiian monk seal in sixteen occupied areas within the range of the species (see series of Critical Habitat maps at: https://www.fisheries.noaa.gov/resource/map/hawaiian-monk-seal-critical-habitat-map). These areas contain one or more PBFs essential to Hawaiian monk seal conservation, including: preferred pupping and nursing areas, significant haul-out areas, and/or marine foraging areas out to 200 meters (656 feet) in depth.

Northwestern Hawaiian Islands (Hawaiian names in parenthesis)

There are 10 designated Hawaiian monk seal critical habitat areas in the Northwestern Hawaiian Islands that include all beach areas, sand spits, and islets, including all beach crest vegetation to its deepest extent inland, as well as the seafloor and marine habitat 10 meters (32.8 feet) in height above the seafloor from the shoreline out to the 200 meter (656 feet) depth contour around:

- Kure Atoll (Hōlanikū)
- Midway Atoll (Kuaihelani)
- Pearl and Hermes Reef (Manawai)
- Lisianski Island (Kapou)
- Laysan Island (Kamole)

- Maro Reef (Kamokuokamohoali'i)
- Gardner Pinnacles ('Ōnūnui)
- French Frigate Shoals (Lalo)
- Necker Island (Mokumanamana)
- Nihoa Island

Main Hawaiian Islands

There are six designated Hawaiian monk seal critical habitat areas in the main Hawaiian Islands that include the seafloor and marine habitat to 10 meters (32.8 feet) above the seafloor from the 200 meters (656 feet) depth contour through the shoreline and extending into terrestrial habitat five meters inland from the shoreline between identified boundary points around the following islands:

- Kaula Island (includes marine habitat only)
- Ni'ihau (includes marine habitat from 10 to 200 meters (33 to 656 feet)in depth)
- Kaua'i
- Oʻahu
- Maui Nui (including Kaho'olawe, Lāna'i, Maui, and Moloka'i)
- Hawai'i Island

Humpback Whale

NOAA Fisheries designated critical habitat for the endangered Western North Pacific DPS, the endangered Central America DPS, and the threatened Mexico DPS of humpback whales on May 21, 2021 (86 FR 21082; Figures 9-11). The area designated as critical habitat for the Central America DPS contains approximately 125,668.8 square kilometers (48,521 square nautical miles) of marine habitat in the Pacific Ocean within the portions of the California Current Ecosystem off the coasts of Washington, Oregon, and California (Figure 9). Areas designated as critical habitat for the Mexico DPS contain approximately 325,480.7 (116,098 square nautical miles) of marine habitat in the North Pacific Ocean, including areas within portions of the eastern Bering Sea, Gulf of Alaska, and California Current Ecosystem (Figure 10). Areas designated as critical habitat for Western North Pacific DPS contain approximately 203,774.03 square kilometers (59,411 square nautical miles) of marine habitat in the North Pacific Ocean, including areas within the eastern Bering Sea and Gulf of Alaska (Figure 11). The following PBFs were identified as essential to the conservation of the DPSs as follows:

Central American DPS: prey species, primarily euphausiids and small pelagic schooling fishes, such as Pacific sardine, northern anchovy, and Pacific herring, of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth.

Mexico DPS: prey species, primarily euphausiids and small pelagic schooling fishes, such as Pacific sardine, northern anchovy, Pacific herring, capelin, juvenile walleye pollock, and Pacific

sand lance of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth.

Western North Pacific DPS: prey species, primarily euphausiids and small pelagic schooling fishes, such as Pacific herring, capelin, juvenile walleye pollock, and Pacific sand lance of sufficient quality, abundance, and accessibility within humpback whale feeding areas to support feeding and population growth.

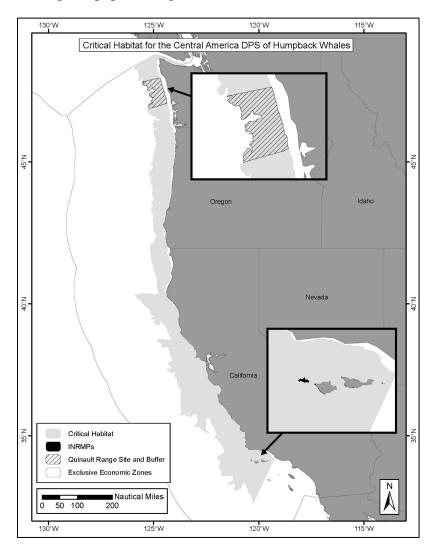


Figure 9. Critical Habitat for Central America DPS humpback whales

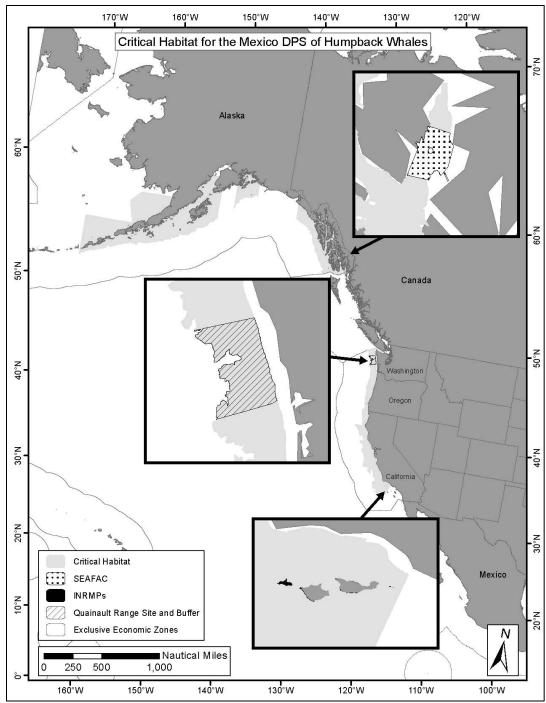


Figure 10. Critical Habitat for Mexico DPS humpback whales

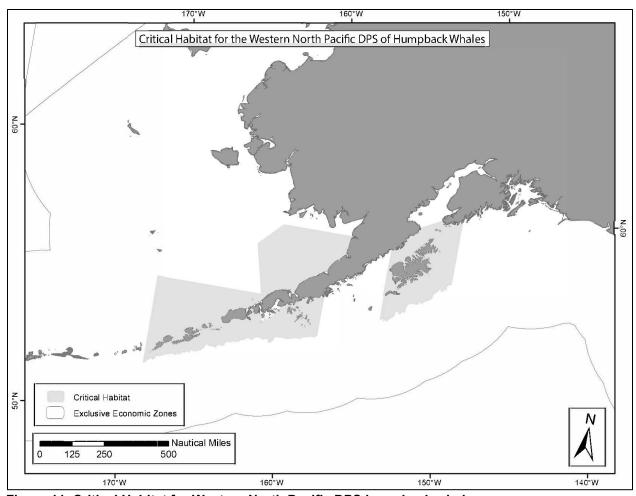


Figure 11. Critical Habitat for Western North Pacific DPS humpback whales

Leatherback Sea Turtle

The action area includes leatherback sea turtle critical habitat along the U.S. West Coast (Figure 12). This designation includes approximately 43,798 square kilometers (16,910.5 square miles) stretching along the California coast from Point Arena to Point Arguello east of the 3,000 meter (9,842.5 feet) depth contour; and 64,760 square kilometers (25,004 square miles) stretching from Cape Flattery, Washington to Cape Blanco, Oregon east of the 2,000 meters (6561.6 feet) depth contour. The designation includes waters from the ocean surface down to a maximum depth of 80 meter (262.5 feet). These waters were designated specifically because of the occurrence of prey species, primarily Scyphomedusae of the order Semaeostomeae (i.e., jellyfish), of sufficient condition, distribution, diversity, abundance and density necessary to support individual as well as population growth, reproduction, and development of leatherbacks.

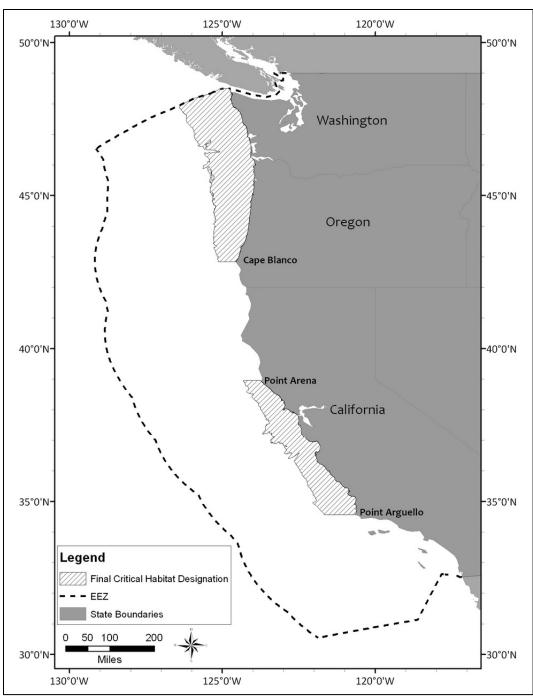


Figure 12. Pacific Leatherback Sea Turtle Critical Habitat

Loggerhead Sea Turtle

The action area includes Northwest Atlantic Ocean DPS loggerhead sea turtle critical habitat in the Gulf of Mexico and Atlantic Ocean (Figure 13). The designated critical habitat includes overlapping areas of nearshore reproductive habitat, constricted migratory habitat, breeding habitat, and *Sargassum* habitat (descriptions below).

- Nearshore reproductive habitat: The PBFs of nearshore reproductive habitat as a portion of the nearshore waters adjacent to nesting beaches that are used by hatchlings to egress to the open-water environment as well as by nesting females to transit between beach and open water during the nesting season. The following PBFs support this habitat: (i) nearshore waters directly off the highest density nesting beaches and their adjacent beaches, as identified in 50 CFR § 17.95(c), to 1.6 kilometers (one mile) offshore; (ii) waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water; and (iii) waters with minimal manmade structures that could promote predators (i.e., nearshore predator concentration caused by submerged and emergent offshore structures), disrupt wave patterns necessary for orientation, and/or create excessive longshore currents.
- Constricted migratory habitat: The PBFs of constricted migratory habitat as high use migratory corridors that are constricted (limited in width) by land on one side and the edge of the continental shelf and Gulf Stream on the other side. Primary constituent elements that support this habitat are the following: (i) constricted continental shelf area relative to nearby continental shelf waters that concentrate migratory pathways; and (ii) passage conditions to allow for migration to and from nesting, breeding, and/or foraging areas.
- **Breeding habitat:** The PBFs of concentrated breeding habitat as those sites with high densities of both male and female adult individuals during the breeding season. Primary constituent elements that support this habitat are the following: (i) high densities of reproductive male and female loggerheads; (ii) proximity to primary Florida migratory corridor; and (iii) proximity to Florida nesting grounds.
- Sargassum habitat: The PBFs of loggerhead Sargassum habitat as developmental and foraging habitat for young loggerheads where surface waters form accumulations of floating material, especially Sargassum. Primary constituent elements that support this habitat are the following: (i) convergence zones, surface-water downwelling areas, the margins of major boundary currents (Gulf Stream), and other locations where there are concentrated components of the Sargassum community in water temperatures suitable for the optimal growth of Sargassum and inhabitance of loggerheads; (ii) Sargassum in concentrations that support adequate prey abundance and cover; (iii) available prey and other material associated with Sargassum habitat including, but not limited to, plants and cyanobacteria and animals native to the Sargassum community such as hydroids and copepods; and (iv) sufficient water depth and proximity to available currents to ensure offshore transport (out of the surf zone), and foraging and cover requirements by Sargassum for post-hatchling loggerheads, i.e., >10 meter (32.8 feet) in depth.

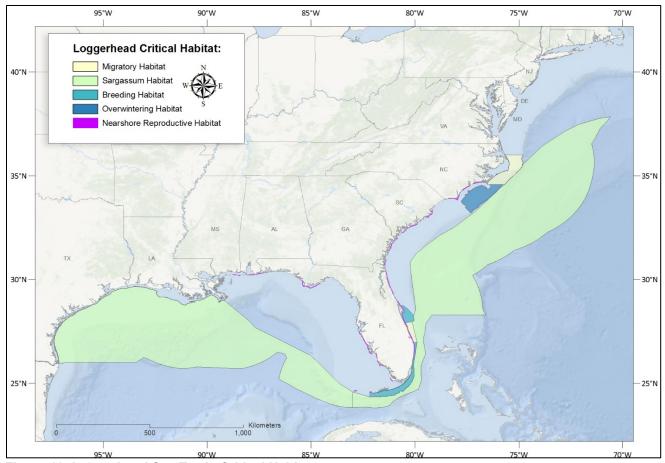


Figure 13. Loggerhead Sea Turtle Critical Habitat

North Atlantic Right Whale

NMFS designated two units of critical habitat for the North Atlantic right whale, which are both located in the action area. Unit 1 is for foraging habitat in the Gulf of Maine and Georges Bank region (Figure 14). Unit 2 is for calving, consisting of all marine waters from Cape Fear, North Carolina, southward to approximately 27 nautical miles (50 kilometers) below Cape Canaveral, Florida (Figure 14). The PBFs that are present in Unit 1 include:

- The physical oceanographic conditions and structures of the Gulf of Maine and Georges Bank region that combine to distribute and aggregate *Calanus finmarchicus* for right whale foraging, namely prevailing currents and circulation patterns, bathymetric features (basins, banks, and channels), oceanic fronts, density gradients, and temperature regimes;
- Low flow velocities in Jordan, Wilkinson, and Georges Basins that allow diapausing *Calanus finmarchicus* to aggregate passively below the convective layer so that the copepods are retained in the basins;
- Late stage *Calanus finmarchicus* in dense aggregations in the Gulf of Maine and Georges Bank region; and

• Diapausing *Calanus finmarchicus* in aggregations in the Gulf of Maine and Georges Bank region.

PBFs that are present in Unit 2 include:

- Sea surface conditions associated with Force 4 or less on the Beaufort Scale;
- Sea surface temperatures of seven degrees Celsius to 17 degrees Celsius; and
- Water depths of six to 28 meters (19.7 to 91.9 feet), where these features simultaneously co-occur over contiguous areas of at least 792.3 square kilometers (231 square nautical miles) of ocean waters during the months of November through April. When these features are available, they are selected by right whale cows and calves in dynamic combinations that are suitable for calving, nursing, and rearing, and which vary, within the ranges specified, depending on factors such as weather and age of the calves.

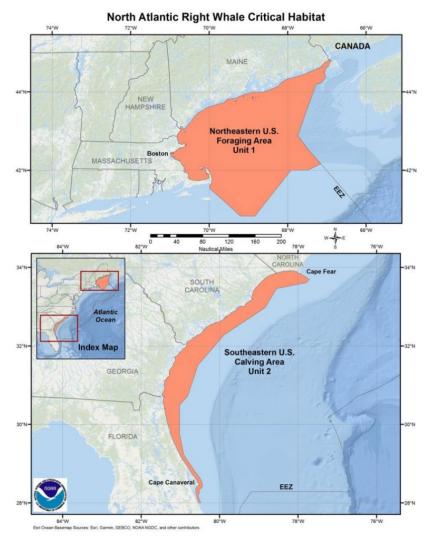


Figure 14. North Atlantic Right Whale Designated Critical Habitat

North Pacific Right Whale

Designated critical habitat for the North Pacific right whale includes an area in the Southeast Bering Sea, and an area south of Kodiak Island in the Gulf of Alaska (Figure 15), which is in the northern boundary of the action area in the Pacific. Both critical habitat areas support feeding by North Pacific right whales because they contain the designated PBFs, which include: nutrients, physical oceanographic processes, certain species of zooplankton (e.g. copepods *Calanus marshallae*, *Neocalanus cristatus*, and *N. plumchris*, and the euphausiid *Thysanoëssa raschii*), and a long photoperiod due to the high latitude (73 FR 19000).

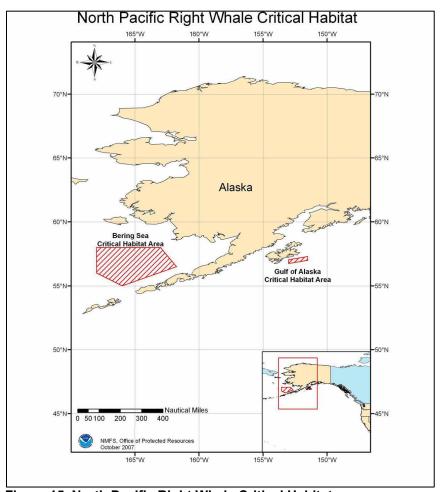


Figure 15. North Pacific Right Whale Critical Habitat

Indo-Pacific Corals

Proposed critical habitat for *Acropora globiceps*, *Acropora jacquelineae*, *Acropora retusa*, *Acropora speciosa*, *Euphyllia paradivisa*, *Isopora crateriformis*, and *Seriatopora aculeata* are found in the action area within the Indo-Pacific (See

Figure 16 through Figure 22). Minimum and maximum depth ranges for each species' habitat is shown in Table 4. The PBFs for the proposed critical habitat are the following:

- Substrate with presence of crevices and holes that provide cryptic habitat, the presence of microbial biofilms, or presence of crustose coralline algae;
- Reefscape (all the visible features of an area of reef) with no more than a thin veneer of sediment and low occupancy by fleshy and turf microalgae;
- Marine water with levels of temperature, aragonite saturation, nutrients, and water clarity that have been observed to support any demographic function; and
- Marine water with levels of anthropogenically-introduced (from humans) chemical contaminants that do not preclude or inhibit any demographic function.

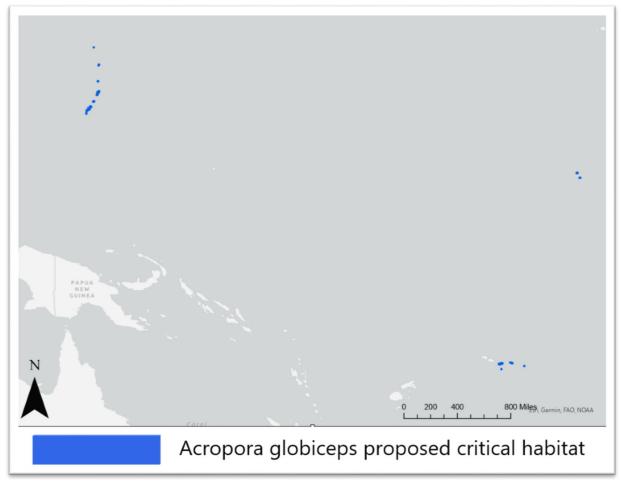


Figure 16. Critical habitat for *Acropora globiceps* within American Samoa, the Mariana Islands, and the Pacific Remote Island Area

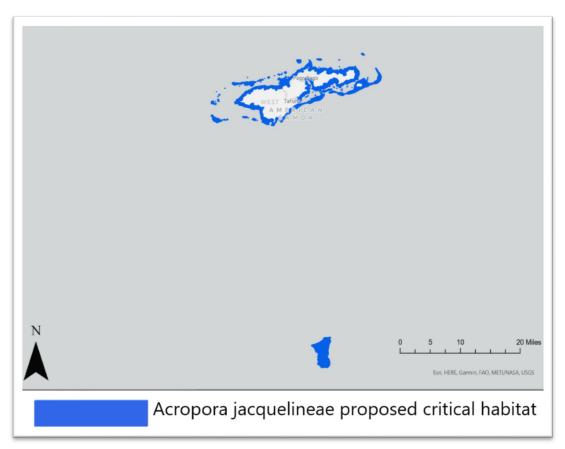


Figure 17. Proposed critical habitat for Acropora jacquelineae within American Samoa

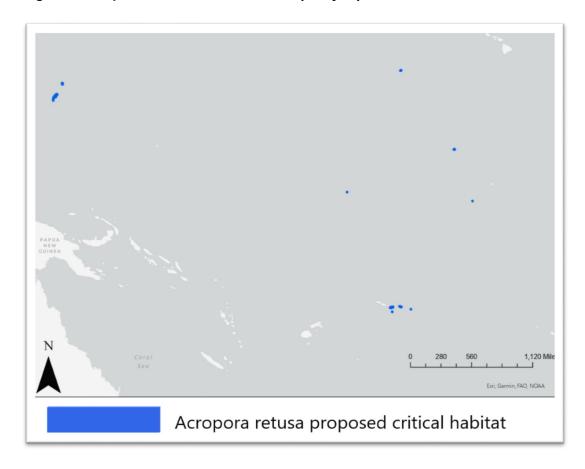


Figure 18. Proposed critical habitat for *Acropora retusa* within American Samoa, the Mariana Islands, and the Pacific Remote Island Area

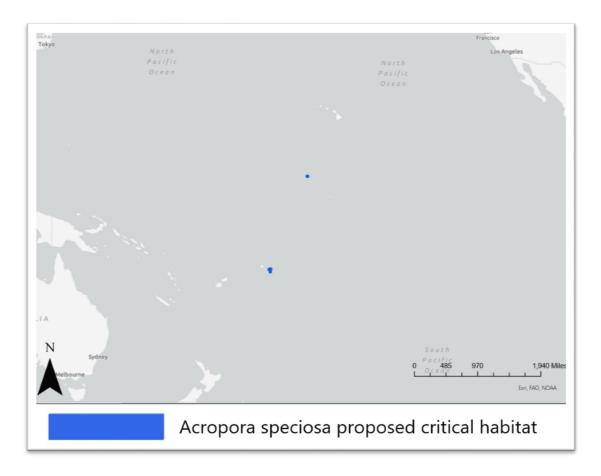


Figure 19. Proposed critical habitat for Acropora speciosa within American Samoa, and the Pacific Remote Island Area

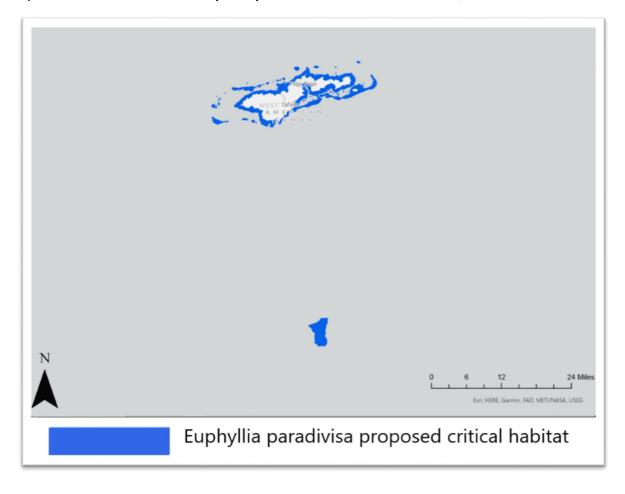


Figure 20. Proposed critical habitat for Euphyllia paradivisa within American Samoa

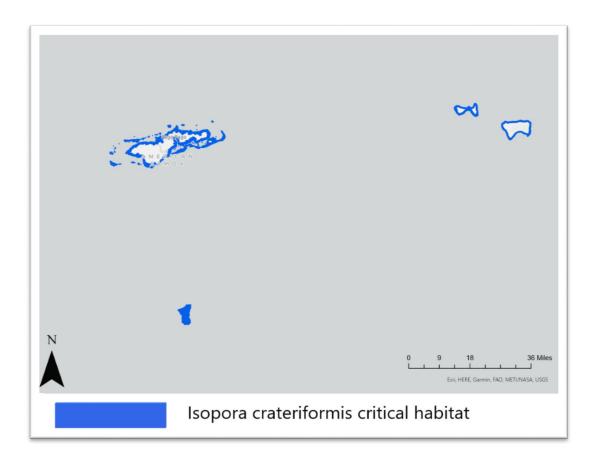


Figure 21. Proposed critical habitat for Isopora crateriformis within American Samoa

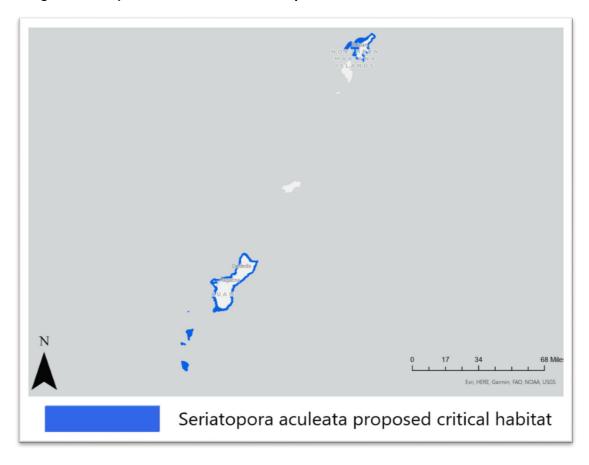


Figure 22. Proposed critical habitat for Seriatopora aculeata within the Pacific Remote Island Area

Southern Resident Killer Whale

In 2006, NMFS issued a final rule designating approximately 6,630 square kilometers (2,560 square miles) of inland waters of Washington State as critical habitat for the Southern Resident DPS killer whale. In August of 2021, NMFS issued a revised rule to the critical habitat designation by expanding it to include six new areas along the U.S. West Coast, while maintaining the whales' currently designated critical habitat in inland waters of Washington (Figure 23). The expanded critical habitat includes marine waters between the 6.1 meter (20 feet) depth contour and the 200 meter (656 feet) depth contour from the U.S. international border with Canada south to Point Sur, California. Critical habitat within the action area contains PBFs associated with water quality to support growth and development, prey availability for growth, reproduction and development, and overall population growth; and passage conditions to allow for migration, resting, and foraging.



Figure 23. Southern Resident Killer Whale Critical Habitat

Steller Sea Lion

Critical habitat for the Western DPS Steller sea lion includes specific rookeries, haul-outs, and associated areas, as well as three foraging areas that are considered to be essential for the health,

continued survival, and recovery of the species. Critical habitat includes terrestrial, air and aquatic areas that support reproduction, foraging, resting, and refuge. Critical habitat in Alaska includes a terrestrial zone extending 914.4 meters (3,000 feet) landward from each major rookery and haul-out; it also includes air zones extending 914.4 meters (3,000 feet) above these terrestrial zones and aquatic zones. Aquatic zones extend 914.4 meters (3,000 feet) seaward from the major rookeries and haul-outs east of 144 degrees West (Figure 24). West of 144 degrees West, where the Western DPS is located, the aquatic zone extends 20 nautical miles (37 kilometers) seaward from the baseline or basepoint of each major rookery and major haul-out (Figure 25). In addition, NMFS designated special aquatic foraging areas as critical habitat for the Steller sea lion. These areas include the Shelikof Strait (in the Gulf of Alaska), Bogoslof Island, and Seguam Pass (the latter two are in the Aleutians). These sites are located near Steller sea lion abundance centers and include important foraging areas with large concentrations of prey.

Although within the range of the now delisted Eastern DPS, the designated critical habitat in California and Oregon remains in effect (Figure 26). In California and Oregon, major Steller sea lion rookeries and associated air and aquatic zones are designated as critical habitat. Critical habitat includes an air zone extending 914.4 meters (3,000 feet) above rookery areas historically occupied by sea lions. Critical habitat also includes an aquatic zone extending 914.4 meters (3,000 feet) seaward.

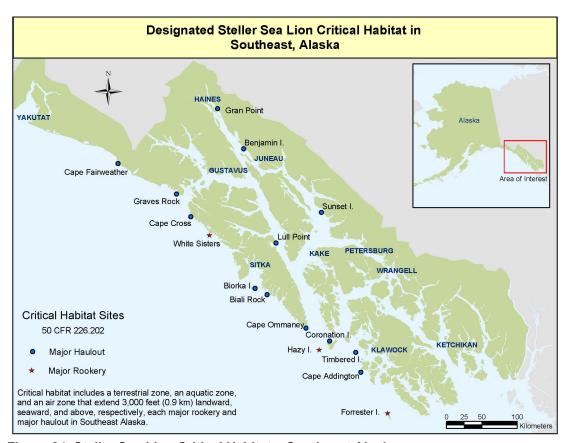


Figure 24. Steller Sea Lion Critical Habitat – Southeast Alaska

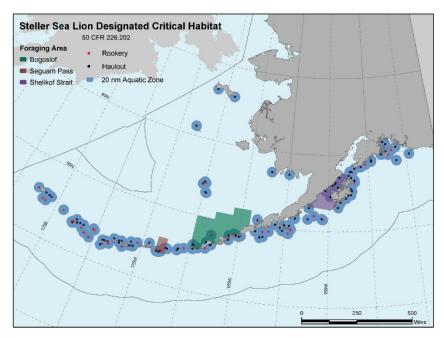


Figure 25. Steller Sea Lion Critical Habitat - Western Alaska

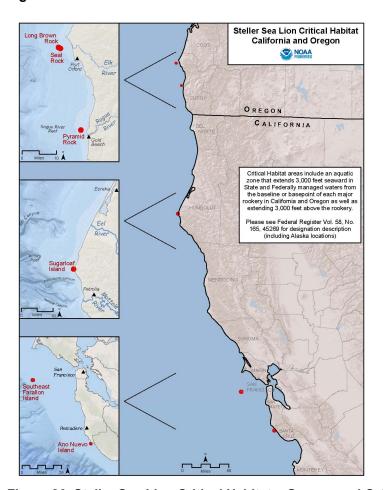


Figure 26. Steller Sea Lion Critical Habitat - Oregon and California

4 EFFECTS OF THE ACTION

"Effects of the action" means all consequences to ESA-listed species or designated critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 C.F.R. §402.2).

The applicable standard to find that a proposed action is not likely to adversely affect ESA-listed species or designated critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or wholly beneficial. Beneficial effects have an immediate positive effect without any adverse effects to the species or habitat. Insignificant effects relate to the size or severity of the impact and include those effects that are undetectable, not measurable, or so minor that they cannot be meaningfully evaluated. Insignificant is the appropriate effect conclusion when plausible effects are going to happen, but will not rise to the level of constituting an adverse effect. For an effect to be discountable, there must be a plausible adverse effect (i.e., a credible effect that could result from the action that would be an adverse effect if it did affect an ESA-listed species), but it is very unlikely to occur.

4.1 Potential Stressors to ESA-listed Species

Stressors are any physical, chemical, or biological agent, environmental condition, external stimulus, or event that may induce an adverse response in either an ESA-listed species or its designated critical habitat. Potential stressors to ESA-listed species from the proposed activities include the following:

- Operational noise and visual disturbance from vessels and equipment;
- Elevated sound pressure levels from the use of active acoustics;
- Vessel and vehicle strike:
- Entanglement in gear;
- Expending steel ballasts and lead weights; and
- Vessel waste and discharge.

4.2 Operational Noise and Visual Disturbance from Vessels and Equipment

The research vessels, ROVs, AUVs, and ASVs associated with OER's proposed action may cause visual or auditory disturbances to ESA-listed marine mammals, sea turtles, and fishes that could disrupt their normal behaviors. Studies have shown that vessel operations can result in changes in the behavior of marine mammals, sea turtles, and fishes (Patenaude et al. 2002; Richter et al. 2003; Hazel et al. 2007b; Smultea et al. 2008; Holt et al. 2009; Luksenburg and Parsons 2009; Noren et al. 2009; Thaler et al. 2019). In many cases, particularly when responses are observed at great distances, it is thought that animals likely respond to sound more than the visual presence of vessels (Evans et al. 1992; Blane and Jaakson 1994a; Evans et al. 1994).

Nonetheless, it is generally not possible to distinguish whether a response occurs due to the presence of a vessel or the operational noise of the vessel. Moreover, at close distances, animals may not differentiate between visual and acoustic disturbances created by vessels and simply respond to the combined disturbance.

Numerous studies of interactions between surface vessels, ROVs, and AUVs with marine mammals have demonstrated that free-ranging marine mammals engage in avoidance behavior when surface vessels move toward them. It is not clear whether these responses are caused by the physical presence of a surface vessel, the underwater noise generated by the vessel, or an interaction between the two (Bryant et al. 1984; Bauer 1986; Watkins 1986; Corkeron 1995; Wursig et al. 1998; Bejder et al. 1999; Au and Green 2000; Félix 2001; Nowacek et al. 2001; Erbe 2002; Magalhaes et al. 2002; Williams et al. 2002; Lusseau 2003; Richter et al. 2003; Goodwin and Cotton 2004; Scheidat et al. 2004; Amaral and Carlson 2005; Simmonds 2005; Bain et al. 2006; Lemon et al. 2006; Lusseau 2006; Bejder and Lusseau. 2008; Bejder et al. 2009). However, several authors suggest that the noise generated during motion is probably an important factor (Evans et al. 1992; Blane and Jaakson 1994b; Evans et al. 1994). These studies suggest that the behavioral responses of marine mammals to surface vessels are similar to their behavioral responses to predators. The hearing ranges of marine mammals considered in this consultation are listed in Table 7 below.

Table 7. Marine mammal hearing groups

Hearing Group	Generalized Hearing Range*
Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 35 kHz
Mid-frequency (MF) cetaceans (e.g., Southern Resident killer whale and sperm whale)	150 Hz to 160 kHz
Phocid pinnipeds (PW) (underwater) (ringed and bearded seals)	50 Hz to 86 kHz
Otariid pinnipeds (OW) (underwater) (Steller sea lions)	60 Hz to 39 kHz

Less is understood about the hearing sensitivities to anthropogenic sounds for other non-marine mammal ESA-listed species such as sea turtles and fishes. Given that much less is known about how they use sound, the impacts of anthropogenic sound are difficult to assess (Popper et al. 2014b; Nelms et al. 2016b). Nonetheless, depending on the circumstances, exposure to anthropogenic sounds may result in auditory injury; changes in hearing ability; masking of important sounds used for activities such as navigation, prey location, or predator avoidance (Piniak 2012); behavioral responses; and other physical and physiological responses.

The functional hearing ranges of ESA-listed sea turtles are not well understood and vary by species. Piniak et al. (2016) found juvenile green and hawksbill sea turtles capable of hearing underwater sounds at frequencies of 50 Hz to 1,600 Hz (maximum sensitivity at 200 to 400 Hz).

Loggerhead sea turtles are thought to have a functional hearing range of 250 to 750 Hz (Bartol et al. 1999), and Kemp's ridley sea turtles a range of 100 to 500 Hz. Piniak (2012) measured hearing of leatherback sea turtle hatchlings in water and in air and observed reactions to low frequency sounds, with responses to stimuli occurring between 50 Hz and 1.6 kHz in air and between 50 Hz and 1.2 kHz in water (lowest sensitivity recorded was 93 dB re: 1 µPa at 300 Hz).

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 suggests that sea turtles may habituate to vessel sound from vessels traveling two knots or greater 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. 2007b). Regardless of the specific stressor associated with vessels to which turtles are responding, they only appear to show responses (i.e., avoidance behavior) at approximately 10 meters (32.8 feet) or closer when vessels traveling at speeds two knots or greater (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.

All fish species can detect vessel noise due to its low-frequency content and their hearing capabilities. The functional hearing ranges of ESA-listed salmon and sturgeon are not well understood. Lake sturgeon are responsive to sounds ranging in frequency from 50 to 500 Hz. Information on the hearing ranges of shortnose and Atlantic sturgeon is unknown, but available information on lake sturgeon indicates that lake sturgeon can hear sounds from 100 to 800 Hz (Meyer et al. 2010). Experiments have shown Atlantic salmon to be sensitive to particle motion at low frequencies, ranging from 20 Hz to 380 Hz (Hawkins and Johnstone 1978b), which is similar to the 20 Hz to 500 Hz hearing range for Pacific salmon (Boyes 1982). The vast majority of fish species studied cannot hear sounds above 0.5-1.5 kHz (BOEM 2014). Fishes without swim bladders (e.g., elasmobranchs and eulachon) or those with swim bladders that do not extend forward to the inner ear (e.g., Pacific and Atlantic salmon, sturgeon, and rockfish) have lower hearing frequency ranges (Figure 27). For example, data for elasmobranch fishes, which do not have swim bladders and instead have oily livers to maintain buoyancy, suggest they are capable of only detecting sounds from approximately 20 Hz to one kHz with the highest sensitivity to sounds at lower ranges (Ladich and Fay 2013).

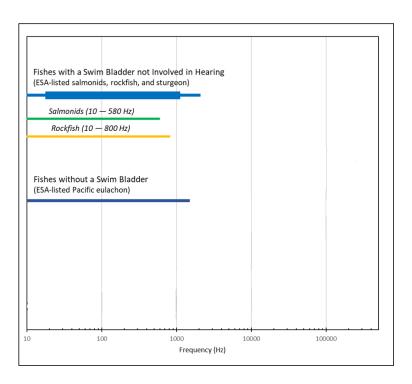


Figure 27. Frequency ranges of ESA-listed fishes affected in the action area. Sources: (Tavolga and Wodinsky 1963; Hawkins and Johnstone 1978a; Popper et al. 2007; Popper 2008; Popper et al. 2014a).

Therefore, ESA-listed fishes could be exposed to a range of vessel noises from OER's proposed action, depending on the source and context of the exposure. Because of the characteristics of vessel noise, sound produced from research vessels are unlikely to result in direct injury, hearing impairment, or other trauma to fishes. Moreover, fish in the near field, depending on their location in the water column, can detect water motion as well as visually locate an oncoming vessel. For example, fishes that are at or near the surface have an increased potential to detect vessels either visually, or via sound and motion in the water and would be capable of avoiding the vessel or move away from the area affected by vessel sound. Thus, these fish are more likely to react to vessel noise at close range than to vessel noise emanating from a greater distance away. Fishes that are deeper in the water column may be less likely to visually detect the vessel but would still be able to detect a vessel's low-frequency noise. Reactions to these sounds may include physiological stress responses, or avoidance behaviors that would not lead to significant disruptions to breeding, feeding, or sheltering.

Sounds emitted by large vessels can be characterized as low-frequency, continuous, or tonal, and sound pressure levels at a source will vary according to speed, burden, capacity, and length (Richardson et al. 1995; Kipple and Gabriele 2007; McKenna et al. 2012). Vessel noise levels for a single ship could vary five to 10 dB depending on transit conditions. The contribution of vessel noise by OER's marine operation activities is likely small in the overall regional sound field. The loudest sound from these operations would be vessel noise from the research vessel. Hatch et al.

(2008) measured noise levels from research vessels and reported average source level estimates (71 to 141 hertz, re: 1 μ Pa [rms] \pm standard error) for individual research vessels were 158 \pm 2 dB (research vessel). As a result, based on the low sources levels, temporary nature of the activities, and PDCs, noise levels from research vessels are not expected to rise to the level of behavioral harassment. Implementation of the PDCs in Section 2.8.7 will reduce the likelihood of visual and auditory disturbance of ESA-listed marine mammals, sea turtles, and fishes. Based on the PDCs, OER vessels will maintain a distance of at least 91.4 meters (100 yards) from cetaceans and 45.72 meters (50 yards) from pinnipeds, sea turtles, and fishes (2.8.2). Based on these measures and additional avoidance measures using species monitoring codified in Section 2.8.1, Vessel transit past an ESA-listed marine mammal or sea turtle, or fish will be brief and not likely to be significant in impacting any individual's ability to feed, reproduce, or avoid predators. Brief interruptions in communication via masking are possible, but unlikely given the habits of marine mammals and fish to move away from vessels, either as a result of engine noise, the physical presence of the vessel, or both (Mitson and Knudsen 2003; Lusseau 2006). Sea turtles are most likely to habituate and are shown to be less affected by vessel noise at distances greater than 10 meters (32.8 feet) when vessels travel at speeds greater than two knots (Hazel et al. 2007b). In addition, during research operations, OER vessels will be traveling at slow speeds (four to eight knots during mapping operations and 10 to fifteen knots during transit), reducing the amount of noise produced by the propulsion system (Kite-Powell et al. 2007; Vanderlaan and Taggart 2007a). The distance between the research vessel and observed marine mammals, sea turtles, and fishes per avoidance protocols, will also minimize the potential for acoustic disturbance from engine noise and visual disturbance from the research vessel.

Because the potential effect of vessel noise will be so minor that it cannot be meaningfully evaluated, we find that the risk from this potential stressor is insignificant. Further, due to the brief nature of activities, visual disturbance from vessels is also expected to be insignificant. Therefore, we conclude that vessel noise and visual disturbance from vessels are not likely to adversely affect ESA-listed marine mammals (Section 3.1), sea turtles (Section 3.2), and fishes (Section 3.3) in the action area.

In addition to vessel activities, OER's proposed action involves in-water activity in the marine environment where ESA-listed species are known to occur (e.g., eDNA sampling; biological sampling; CTD sampling; ROV, ASV, and AUV operations). Marine species may experience auditory or visual disturbance should they encounter equipment associated with OER's in-water activities. The reaction could range from an animal calmly approaching and investigating the vehicle or gear, to avoidance with the animal leaving the location temporarily.

Implementation of the PDCs associated with the Marine Wildlife Viewing Guidelines and Boat Operations and Diving Activities methods during OER marine operation activities will reduce the likelihood of interactions with ESA-listed species. These PDCs were developed for the NOAA ship *Okeanos Explorer*'s Papahanaumokuakea Marine National Monument, which will be used in the project area, and include:

- All in-water work will be postponed when whales are within 100 yards (91.44 meters), or other protected species are within 50 yards (45.72 meters);
- Should an ESA-listed species enter the area while in-water work is already in progress, the activity may continue only when that activity has no reasonable expectation to adversely affect the animal(s); and
- No attempts will be made to feed, touch, ride, or otherwise intentionally interact with any marine protected species.

It is expected that ESA-listed marine mammals, sea turtles, and fishes will avoid human activity. The most likely effect from exposure to OER activities will be the animal temporarily leaving the area to find refuge or forage elsewhere. Considering this avoidance behavior, in combination with the nature of the activities, and implementation of the PDCs, we have determined that visual and auditory disturbances related to in-water activity will be infrequent, temporary in nature, and will not rise to the level of a measurable effect on a listed animal. As a result, the effects of visual and auditory disturbance from OER's in-water activities are insignificant and thus may affect, but are not likely to adversely affect ESA-listed marine mammals (Section 3.1), sea turtles (Section 3.2), and fishes (Section 3.3) in the action area.

4.3 Elevated Noise Levels from the Use of Active Acoustics

The proposed action includes the operation of the OER mapping sonar systems presented in Table 2. The effects on ESA-listed species in the action area from exposure to high intensity noise vary with the frequency, intensity, duration of the sound source, and the physiology and hearing characteristics of the exposed animal. Exposure to very high levels of sound can cause soft tissue injuries that could directly result in mortality. Exposure to lower sound levels at frequencies within the animal's range of hearing may cause injury in the form of permanent hearing damage, also referred to as permanent threshold shift (PTS). Exposure to even lower sound levels may cause behavioral effects that include temporary threshold shifts (TTS), temporarily masked communications and/or acoustic environmental cues, alteration of ongoing behaviors, and areal avoidance.

Marine Mammals

The NOAA Technical Guidance for Assessing the Effects of Anthropogenic Sounds on Marine Mammal Hearing (NOAA 2018) established the current defined threshold for the onset of TTS, which varies by the hearing group, as:

- for low-frequency cetaceans (e.g., blue, fin, sei, and right whales) the exposure to inwater sounds is 179 dB re 1 microPa;
- for mid-frequency cetaceans (e.g., sperm whales) is 178 dB re 1μPa;
- for pinnipeds (e.g., ringed and bearded seals) is 180 dB re 1μPa; and
- for otariids pinnipeds (e.g., Steller sea lions) is 198 dB re 1µPa

The single pulse threshold for the onset of PTS also varies by hearing group:

- for low-frequency cetaceans 219 dB re 1μPa;
- for mid-frequency cetaceans is 230 dB re 1μPa;
- for pinnipeds is 218 dB re 1μPa; and
- for otariids (e.g., Steller sea lions) is 232 dB re 1μPa

Threshold values for cetaceans were evaluated against a variety of mapping sonar aboard OER vessels (including those with the highest source levels within each animal group's hearing range) using the methodology applied in the draft Programmatic Environmental Assessment for the NOAA Ship Okeanos Explorer's marine operation activities (NOAA OER 2020). Distances (isopleths) to these thresholds are noted in Table 8. This methodology accounts for beam width and absorption as multibeam and split beam systems are not simple omni-directional point sources but rather are focused sonar arrays that use "selective angular directivity" and furthermore transmit "very short pulses at limited ping rates" (Lurton and DeRuiter 2011). These characteristics of this type of sonar decrease the potential sound exposure level, as well as the probability of animals being subjected to PTS and TTS threshold intensity levels. Figure 28 provides diagrams excerpted from Lurton and DeRuiter (2011) showing the generalized ensonification volume of a generic multibeam sonar system from both horizontal and overhead (Figure 28) perspectives. Figure 28 also provides the variables used to estimate the exposure time of a stationary animal as the ship passes on its survey track. The exposure time can be estimated by ØR/V where Ø is the longitudinal transmitting lobe aperture in radians, R is the range from the source to the animal, and V is the speed of the ship.

The typical transmit aperture of the EM710, EM712, EM302, EM304, and EM2040 will be conservatively treated as one degree, yielding an Ø value of 0.02 radians. The ship or vehicle will be mapping at four to eight knots (two to four meters per second). At a 200 meter (656 feet) distance, the exposure times for a stationary animal caught in the ensonification plane of the EM710 are therefore calculated to be one second while surveying at eight knots and two seconds while surveying at four knots. This exposure time increases linearly with R so that at a 1,000 meter distance (3,281 feet), the exposure time increases to five seconds at eight knots and 10 seconds at four knots.

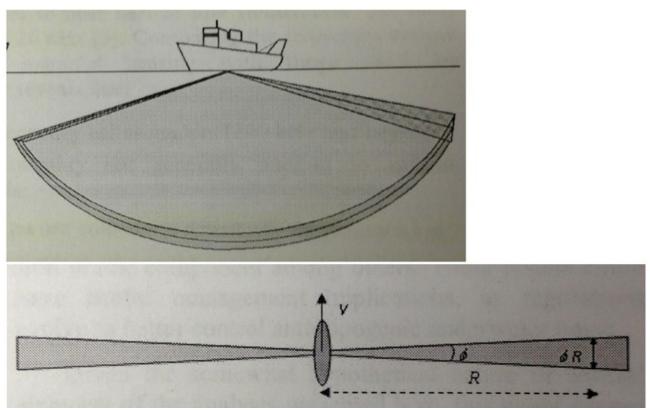


Figure 28. Diagrams showing a typical multibeam ensonification volume from the horizontal and the overhead prospective (Lurton and DeRuiter 2011)

As noted above, transmit pulse forms distinguish multibeam and split beam sonar from other types of sonar and acoustic sources and further reduce their potential threat to ESA-listed marine mammals. Sound is not transmitted continuously from these systems but rather in extremely short pulses (i.e., pings). Ping durations obtained from the EM710, EM712, EM302, and EM304 manual are very brief (approximately 0.2 to two milliseconds). The ping rate, in other words, how frequently pings are emitted, is depth-dependent and is provided for different depths with the longest pulse length expected for 1,000 meters (3,280 feet) of water being two milliseconds. Due to the characteristics of these sources (e.g., highly focused sound sources with narrow beamwidth and short pulse length), Lurton (2016) notes that the potential for PTS or TTS to marine mammals from these sources is small.

A comprehensive analysis of OER's onboard sonars and transducers show that different active sound sources will have varied distances (isopleths) to PTS and behavioral harassment for marine mammal hearing groups (Table 8). The acoustic footprint of OER's oceanographic research and seafloor mapping is small relative to the overall distribution of the animals in the area and their use of the area. As a result, the potential for exposure to active acoustics during OER activities is small. For example, marine mammal density estimates within North Atlantic Ocean modeled by Mannocci et al. (2017) show that maximum densities for marine mammals (both ESA and non ESA-listed) in depths greater than 200 meters are approximately 3.5 animals per square kilometer (0.39 square mile). With the low number of annual mapping surveys by

OER (approximately five 14 to 21-day cruises), there is a low probability for acoustic exposure of ESA-listed marine mammals to occur. Furthermore, feeding behavior is not likely to be impacted. Although marine mammal prey such as fish may show avoidance of lower frequency sound sources (e.g., sub-bottom profilers), these species are mobile and are broadly distributed throughout the study area. Other marine mammal prey species that are less mobile such as zooplankton have shown adverse effects to louder anthropogenic noise sources (e.g., airguns; Tremblay et al. 2019), but not from the sources used during OER's marine operation activities. Therefore, marine mammals are expected to be able to resume foraging once they have moved away from areas with disturbing levels of underwater noise. Because of the temporary nature of the disturbance from active acoustics used during OER operations and the availability of similar habitat and resources in the surrounding area, the impacts to marine mammals and the food sources that they utilize are not expected to have significant impacts on individual ESA-listed marine mammals or their populations.

Table 8. PTS and TTS/Behavioral Harassment distance (meters) of marine mammal hearing groups from different active sources onboard during OER's marine operation activities.

Source		PTS Dis	160 dB re: 1uPa rms Threshold ¹ meters (feet)		
	Low Frequency Cetaceans	Mid Frequency Cetaceans	Pinnipeds	Otariids	
Kongsberg EM710 and EM 712 multibeam	1 (3.3)	2	1 (3.3)	1 (3.3)	571 (1873)
Kongsberg EM304 & EM302 multibeam	1 (3.3)	1 (3.3)	1 (3.3)	1 (3.3)	351 (1152)
Kongsberg EM2040 multibeam sonar	NA	NA	NA	NA	NA
Kongsberg Simrad EK60 split beam sonar 18-kHz	1 (3.3)	1 (3.3)	1 (3.3)	1 (3.3)	68 (223)
Kongsberg Simrad EK60 split beam sonar 38-kHz	1 (3.3)	1 (3.3)	1 (3.3)	1 (3.3)	40 (131)
Kongsberg Simrad EK60 split beam sonar 70-kHz	1 (3.3)	1 (3.3)	1 (3.3)	1 (3.3)	24 (79)
Kongsberg Simrad EK60 split beam sonar 120-kHz	1 (3.3)	1 (3.3)	1 (3.3)	1 (3.3)	14 (46)
Kongsberg Simrad EK60 split beam sonar 200-kHz	NA	NA	NA	NA	NA

Kongsberg Simrad EK60 split beam sonar 333-kHz	NA	NA	NA	NA	NA
Kongsberg Simrad EK80 split beam sonar 18-kHz	1 (3.3)	1 (3.3)	1 (3.3)	1 (3.3)	68 (223)
Kongsberg Simrad EK80 split beam sonar 38-kHz	1 (3.3)	1 (3.3)	1 (3.3)	1 (3.3)	40 (131)
Kongsberg Simrad EK80 split beam sonar 70-kHz	1 (3.3)	1 (3.3)	1 (3.3)	1 (3.3)	24 (79)
Kongsberg Simrad EK80 split beam sonar 120-kHz	1 (3.3)	1 (3.3)	1 (3.3)	1 (3.3)	14 (46)
Kongsberg Simrad EK80 split beam sonar 200-kHz	NA	NA	NA	NA	NA
Kongsberg Simrad EK80 split beam sonar 333-kHz	NA	NA	NA	NA	NA
Knudsen 3260 sub- bottom profiler	1 (3.3)	1 (3.3)	1 (3.3)	1 (3.3)	58 (190)
Teledyne Ocean Surveyor ADCP (38 kHz)	1 (3.3)	1 (3.3)	1 (3.3)	1 (3.3)	150 (492)
Teledyne Workhorse Mariner ADCP (300 kHz)	NA	NA	NA	NA	NA
Ultra Short Baseline Surface transceiver EX, Tracklink model TL10000MA	6 (20)	6 (20)	5 (16.4)	1 (3.3)	10 (33)
Ultra Short Baseline ROV transceiver Seirios, Tracklink model TL10010C	4 (13)	4 (13)	4 (13)	1 (3.3)	15 (49)
Ultra Short Baseline ROV transceiver D2, Tracklink model TL10015C	8 (26)	8 (26)	8 (26)	1 (3.3)	27 (89)

¹Distance to the 160 dB re: 1uPa rms behavioral harassment threshold in meters (feet) (70 FR 1871) NA: No effects due to frequency beyond marine mammal hearing range.

As shown in Table 8, most distances to the 160 dB re: 1uPa rms threshold do not extend past 400 meters (1,312.34 feet). Only the Kongsberg EM 710 and EM 712 multibeam echosounders used during OER marine operation activities extend past 500 meters (1,640.42 feet). As a result, it is possible for ESA-listed marine mammals to be exposed to potentially disturbing levels of noise during the surveys considered here. However, we expect that exposure to active acoustics used on OER vessels will be highly unlikely. OER vessels will be required to implement a suite of

PDCs to minimize the potential impacts to ESA-listed species. These measures include steering away from large whales that are identified within 500 yards (457.2 meters) of the forward path of a vessel. Also, when ESA-listed pinnipeds are sighted, the vessel will attempt to maintain a distance of 100 yards (91.44 meters) for in-water pinnipeds. Further, as noted above, due to the remote nature of OER's activities compared to the dispersed nature of ESA-listed marine mammals in the action area, the likelihood of ESA-listed marine mammal exposure to active acoustics during the OER's activities is low.

If exposure of ESA-listed marine mammals were to occur during survey activities, it would be temporary due to the characteristics of the sound sources and the fact that the noise source itself will be moving. This means that any co-occurrence between a marine mammal, even if stationary, will be brief and temporary. Given that the noise signals themselves are short and intermittent and, because the vessel towing the noise source is moving, exposure is expected to last no more than a few seconds. Due to the short exposure time, the reaction to exposure is expected to be limited to changing course and swimming away from the noise source only enough to get out of the ensonified area (571 meters [1873 feet] or less, depending on the noise source). As a result, the potential for disruption of activities such as breeding, feeding (including nursing), resting, and migrating is extremely unlikely given the very brief exposure to any noise. Any brief interruptions of these behaviors are not anticipated to have any lasting effects. Given the short timeframe of exposure and the expected response of marine mammals to active acoustics used during OER marine operation activities, the effect of exposure and resulting response will be so small that it will not be able to be meaningfully detected, measured or evaluated and, therefore, is insignificant.

OER-supported AUV and ASV mapping activities occur continuously through the day and night. OER will program the vehicles to map continuously whenever possible to minimize potential startle responses to marine mammals caused by turning the sonars on and off. If primary sonars such as the EM304 or EM2040 do need to be turned off and restarted, they can be turned on in marine mammal protected mode (i.e., a decrease of active sonar sources by 20 dB) if the vehicle is operating in a sensitive marine area. For marine mammals with hearing sensitivities within the frequency range of scientific sonars, it is expected that the animal would be able to detect the sonar at a far enough distance to swim away. In order to get close enough to the ensonification area to cause behavioral harassment, TTS, or PTS, the animal would have to intentionally swim towards the sound source instead of away. While highly unlikely, even if this were to occur, sonar sensors and cameras on these vehicles would detect the animal and navigate away.

Given the dispersed nature of marine mammals, continuous operation of the sonars, brief and intermittent characteristics of the sound source, relatively slow speed of AUV and ASV operations (maximum of eight knots during mapping), and the motility of free-ranging marine mammals to avoid obtrusive sounds, the most likely response by marine mammals would be a mild alert and startle response and avoidance of the vehicle that would not lead significant disruptions to breeding, feeding, or sheltering. Therefore, we have determined the exposure to

elevated noise levels from the operation of mapping systems on remotely operated and autonomous vehicles is highly unlikely and would have discountable effects on marine mammal species in the action area.

In summary, the oceanographic research and seafloor mapping activities proposed by OER will have minimal, temporary, and localized effects on marine mammal species in the action area because exposures are expected to be unlikely and if they were to occur, would be short in duration and insignificant. As a result, effects to marine mammals from active sonar sources used during OER's proposed survey activities may affect, but are not likely to adversely affect ESA-listed marine mammals listed in Section 3.1.

Sea Turtles

Available data indicate that sea turtles hear in the low frequency range, with a functional hearing range of about 100 Hz to one kHz and an upper frequency limit of 1.6 to two kHz (Finneran and Jenkins 2012; Piniak et al. 2016). Response to underwater and aerial stimuli down to 50 Hz and vibrational stimuli down to 30 Hz has also been recorded (Nelms et al. 2016a). Only sub-bottom profilers operate in the functional hearing range of ESA-listed sea turtles. Therefore, sea turtles are not expected to detect or respond to sounds emitted by any of OER's sonar systems except sub-bottom profilers (Table 2). The current defined threshold for the onset of behavioral harassment of sea turtles is 175 dB re 1 μ Pa (McCauley et al. 2000). For PTS the threshold for sea turtles is 220 dB re 1 μ Pa²·s SEL_{cum}; (Navy 2017). Based on these thresholds, the maximum distance for behavioral harassment from OER's sub-bottom profiler is ten meters (32.8 feet) which is less than the minimum 50 meter (164.04 feet) distance that all vessels will maintain away from sea turtles. Further, the maximum distance to injury is one meter (three feet) which would require the sea turtle to be directly adjacent to the sound source to experience injury.

Sub-bottom profilers will be attached to and used on OER's AUVs and ASVs. As noted, OERsupported AUV and ASV operations are unable to implement the same suite of PDCs that it will conduct for vessels and ROVs. These mapping activities occur continuously through the day and night. OER will program the AUV and ASVs to map continuously whenever possible to minimize potential startle responses of sea turtles caused by turning the sub-bottom profiler on and off. Some AUV and ASV operations have the potential to cause a behavioral response if a sea turtle is within the behavioral threshold of 10 meters (32.8 feet) from the sub-bottom profiler attached to the vehicle. AUV and ASV operations are conducted very slowly near the bottom in deep water. An exception is the Mesobot, which is designed to work in the water column. In order to get close enough to the ensonification zone of the sonar to cause a behavioral response, the animal would have to intentionally swim towards the sound source instead of away. Sea turtles would be expected to detect the sub-bottom profiler from a slow-moving vehicle (i.e., less than two knots; Hazel et al. 2007a) at a far enough distance to allow the animal to swim away before being exposed to sound levels that could cause behavioral harassment. Furthermore, given the dispersed nature of these animals and the large action area, the probability for exposure to active acoustics from OER's marine operation activities is small. For example, sea turtle density

data from DiMatteo and Bartlett (2017) in the Atlantic show a maximum oceanic density of approximately three individuals per square kilometer (0.39 square mile). With the low number of annual mapping surveys by OER (approximately five 14 to 21-day cruises), there is a low probability for acoustic exposure of ESA-listed sea turtles to occur. However, if vehicles were in the vicinity of sea turtles during OER's proposed activities, the slow speed of AUV, ROV, and ASV operations, motility of free-ranging sea turtles, and the propensity for these animals to avoid obtrusive sounds, the most likely response would be a mild alert and startle response and avoidance of the vehicle. Therefore we have determined the exposure to elevated noise levels from the operation of active sonar sources is highly unlikely and would have insignificant effects on sea turtle species. As a result, effects to ESA-listed sea turtles from active sonar sources used during OER's proposed survey activities are insignificant and are not likely to adversely affect the ESA-listed sea turtles presented in Section 3.2.

Marine Fish

The functional hearing ranges of ESA-listed fishes in the action area are summarized in Section 4.2. The operating frequencies of all but one of the proposed sonar devices are much higher (See Table 2 for the operational frequencies) and outside the functional hearing range of ESA-listed fishes. Therefore ESA-listed fishes are not expected to detect or respond to sounds emitted by any of OER's sonar systems except for sub-bottom profilers. Direct injury from sonar and other transducers is highly unlikely because injury has not been documented in fish exposed to sonar based on numerous studies (Popper et al., 2007; Halvorsen et al., 2012c; Halvorsen et al., 2013; Popper et al., 2014). Using PTS and TTS thresholds from Popper et al. (2014b), it should be noted that the sub-bottom profiler used by OER has a source level (207 dB re 1µPa-m rms) that is not high enough to cause PTS or TTS in the ESA-listed fishes that overlap with the action area. Furthermore, behavioral effects are predicted to be less than two meters. As a result, ESAlisted fishes will most likely swim away from the vessel or vehicle before entering the two-meter ensonified zone for behavioral harassment. Due to the small behavioral harassment ensonified zone, the dispersed distribution of ESA-listed fish in the action area, and the low number of mapping surveys by OER (approximately five 14 to 21-day cruises), behavioral harassment of ESA-listed fishes from sub-bottom profilers used during OER's proposed survey activities is highly unlikely and thus discountable. Therefore, use of the sub-bottom profiler during OER's marine operation activities may affect, but is not likely to adversely affect the ESA-listed fishes listed in Section 3.3.

4.4 Vessel and Vehicle Collisions

Marine Mammals and Sea Turtles

Marine mammals and sea turtles both face risks to vessel strike and vessel collision. Cetaceans, pinnipeds, and sea turtles must surface to breathe and pinnipeds and sea turtles are known to rest or bask at the surface. This is particularly true for species or individuals that occupy coastal areas of the action area during specific life stages. For example, adult sea turtles have been observed to be at greater risk of vessel strike during the breeding and nesting season as they congregate near

nesting beaches, and often breed or rest near the surface. Also, mother and calf pairs of whales can be especially vulnerable. For instance, the main behaviors of North Atlantic right whale mother-calf pairs during a calf's first nine months is comprised of surface resting and near-surface feeding approximately 45–80 percent of time (Cusano et al., 2019 as cited in Schoeman et al. 2020). Vessel strike of pinnipeds (i.e., fur seals) has also been observed during foraging events (Schoeman et al. 2020).

Therefore, when at or near the surface, marine mammals and sea turtles are at risk of being struck by the vessel or its propellers during small boat operations and vessel transits to and from project operating areas. Potential injuries and their severity will depend on the speed of the vessel, the part of the vessel that strikes the animal, and the body part impacted. Injuries may include bruising, broken bones or carapaces, and lacerations that can often result in death.

Existing information about sea turtle sensory biology suggests that sea turtles rely more heavily on visual cues, rather than auditory signals, to initiate threat avoidance. Research also suggests that sea turtles cannot be expected to consistently notice and avoid vessels that are traveling faster than two knots (Hazel et al. 2007a). Vanderlaan and Taggart (2007b) report that the severity of injury to large whales is directly related to vessel speed. They found that the probability of lethal injury increased from 21 percent, for vessels traveling at 8.6 knots, to over 79 percent for vessels moving at 15 knots or more. Additionally, because collisions with whales have been reported for both slow and fast moving craft, it appears that, in at least some situations, whales may either be unaware of a vessel's presence or unable to resolve the vessel's proximity and/or vector of approach based on available acoustic cues. As a result, ship strike in general has been a noticeable contributor to marine mammal stranding events even for very small populations of critically endangered species. For example, in a study of 53 fatal stranding events of killer whales in the eastern Pacific Ocean and Hawaii between 2004 and 2013, Raverty et al. (2020) noted that vessel strike was the cause of six stranding events and two of those deaths were the critically endangered Southern Resident DPS killer whale. Vessel strike is not just a cause of cetacean standings in the action area but also pinnipeds. For example, there have been at least three documented cases of Steller sea lions being injured or killed due to nearshore vessel strikes in Alaska since 2007 (Allen and Angliss 2014; Muto et al. 2020).

During the proposed OER marine operation activities, vessel operators and crew will maintain a vigilant watch for all marine mammals and sea turtles and slow down or stop the vessel or alter course, as appropriate, to minimize the potential for striking an ESA-listed marine mammal or sea turtle (See Section 2.8.1 and 2.8.2 of PDCs above). Furthermore, during all ROV activities, in-water work will be postponed if ESA-listed marine mammals or sea turtles are observed within the vicinity of operations (See Section 2.8.4 of PDCs). As a result, vessel and ROV strike of an ESA-listed marine mammal or sea turtle is highly unlikely to occur and thus discountable. In regard to the use of ASVs, OER's vehicles such as the Saildrone Surveyor are equipped with detection capabilities to aid in avoiding collisions with objects. For example, the Saildrone Surveyor is outfitted with transponders, radar and a 44-foot tall mast ("wing") with a high-

definition camera on top (at about the same height as the bridge of a cargo ship). Real-time data from the vehicle, including images, are streamed to a cloud-based mission portal in real-time where a Pilot (human) is always overseeing the vehicle's status. Camera images are regularly captured and processed by a graphics processing unit running computer-vision neural networks to detect objects. If an object such as an ESA-listed species is detected, the Pilot on watch at mission control can take over and immediately stop the vehicle or adjust the vehicle's course accordingly. This combination of the Saildrone's high visibility design, relatively slow cruising and survey speed, inclusion of real-time monitoring and piloting, and excellent safety record make the likelihood and risk of vehicle collision with an ESA-listed marine mammal or sea turtle extremely unlikely to occur and thus discountable.

OER's use of IXBlue's DriX ASVs have more than 10,000 hours of operation around the world, including frequent operation in busy harbors and ocean areas, with no collisions reported. This safety record demonstrates the excellence and effectiveness of their collision avoidance system and operator training. The vehicle can autonomously detect and plan alternate routes for collision avoidance. Objects can be detected out to about 100 meters (328 feet) of the vehicle, and, if a safe route cannot be determined, the vehicle will come to a stop. DriX have someone monitoring the telemetry streams at all times, able to step in and assess the situation and revise routes or operational plans accordingly. The vehicle's collision avoidance system, its excellent safety record, and mode of defaulting to a stop and engage a human pilot immediately in real-time make the likelihood and risk of vehicle collision with an ESA-listed marine mammal or sea turtle extremely unlikely to occur and thus discountable.

In addition to ASVs, AUVs that will be used in OER-supported projects are outfitted with bottom detection and avoidance and downward-looking sonars to ensure they operate at an appropriate altitude off bottom and avoid collision with the seafloor. The altitude off bottom is programmable and varies (e.g. 50 meters to 100 meters [164 to 328 feet]) depending on the environment being surveyed. In addition to bottom detection and avoidance capabilities, some AUVs are also outfitted with forward-looking sonars and have automated obstacle avoidance and detection capabilities. If an object is detected within range (e.g. 50 to 100 m [164 to 328 feet]), the vehicle autonomously adjusts its mission to navigate around it. If obstacle avoidance efforts still result in potential collision, the AUV stops the mission and either awaits reprogramming from topside navigators, or floats to the surface. Some survey operations are intentionally planned close to the seabed for data collection purposes; these surveys are conducted with lighter vehicles (i.e., the Mola Mola) that operate very slowly (~0.4 knots) and are expected to occasionally bump on the seabed. The very slow survey speed means these collisions do not, or are highly unlikely, to cause any damage to the vehicle or surrounding environment.

As noted above in Section 4.3, marine mammals and sea turtles have sparse distributions throughout the action area with conservative estimates being approximately 3.5 individual marine mammals and three individual sea turtles per square kilometer (0.39 square mile). This, combined with the low number of mapping surveys by OER (approximately five 14 to 21-day

cruises), the combination of AUV detection and avoidance capabilities noted above, slow to very slow speed of AUV operations (0.4 to 4 knots), and the motility of free-ranging sea turtles and marine mammals make the likelihood and risk of AUV collision with an ESA-listed marine mammal or sea turtle extremely unlikely to occur and thus discountable.

As a result, effects to ESA-listed marine mammals and sea turtles from vessel or vehicle collision during OER's proposed survey activities may affect, but are not likely to adversely affect ESA-listed marine mammals (Section 3.1) or sea turtles (Section 3.2) in the action area.

Fishes

Many of the ESA-listed fish species that may be affected by OER's proposed activities spend at least some time in the upper portions of the water column where they may be susceptible to vessel strike. For example, oceanic whitetip sharks occur from the surface to at least 152 meters (498.7 feet) deep (Howey-Jordan et al. 2013; Howey et al. 2016). Further, scalloped hammerheads range from the intertidal and surface waters to depths of up to approximately 450 to 512 meters (1,475-1,675 feet; Miller et al. 2014). Other ESA-listed fishes, such as sturgeon and sawfish, are found in shallow waters and are more likely to be struck by vessels transiting in shallow waters of harbors due to the large size of the fish. Furthermore, fish behavior in the vicinity of a vessel can be variable, depending on several factors such as life stage, size, life history, and environmental parameters. For example, smaller fish may have a greater potential to be drawn into or struck by the vessel's propellers. The potential responses of fishes to a physical strike may include physical injury or mortality, physiological stress, or behavioral changes such as avoidance, and altered swimming speed and swimming orientation (direction). Fish are able to use a combination of sensory cues to detect approaching vessels, such as sight, hearing, and their lateral line (for nearby changes in water motion). A study on fish (i.e., capelin) behavioral responses to vessels showed that most adults exhibit avoidance responses to engine noise, sonar, depth finders, and fish finders (Jørgensen et al. 2004), reducing the potential for vessel strikes. Misund (1997) found that fish (e.g., herring, cod, capelin, and haddock ahead of a ship showed avoidance reactions at ranges of 50 to 350 meters (160 to 490 feet). When the vessel passed over them, some fish responded with sudden escape responses that included movement away from the vessel laterally or through downward compression of the school. In an early study conducted by Chapman and Hawkins (1973), the authors observed avoidance responses in herring from the low-frequency sounds of large vessels or accelerating small vessels. Avoidance responses ended within ten seconds after the vessel departed. Conversely, Rostad (2006) observed that some fish (e.g., whiting, herring, and sprat) are attracted to different types of vessels (e.g., research vessels, commercial vessels) of varying sizes, noise levels, and habitat locations.

During the proposed OER marine operation activities, vessel operators and crew will maintain a vigilant watch for ESA-listed fishes and will stop the vessel or alter course, as appropriate, to minimize the potential for striking an ESA-listed fish (See Sections 2.8.1 and 2.8.2 of PDCs). Furthermore, during all ROV activities, in-water work will be postponed if ESA-listed fishes are

observed within the vicinity of operations (See Section 2.8.4 of PDCs). Due to this, vessel and ROV collision with ESA-listed fishes is extremely unlikely to occur and thus discountable.

In regard to the use of ASVs, the vehicle's collision avoidance system, its excellent safety record, and mode of defaulting to a stop and engaging a human pilot in real-time make the likelihood and risk of vehicle collision with ESA-listed fishes extremely unlikely to occur and thus discountable. In addition, due to the low number of mapping surveys by OER (approximately five 14 to 21-day cruises), the combination of AUV detection and avoidance capabilities noted above, the slow to very slow speed of AUV operations (0.4 to 4 knots), and the motility/avoidance measures of free-ranging fishes make the likelihood and risk of AUV collision with an ESA-listed fishes extremely unlikely to occur and thus discountable. As a result, effects from vessel or vehicle collision during OER's proposed survey activities may affect, but are not likely to adversely affect ESA-listed fishes (Section 3.3) in the action area.

Invertebrates

Shallow water habitats used by ESA-listed invertebrate species such as black and white abalone and Indo-Pacific and Atlantic-Caribbean coral may be harmed by vessel collision during transit or due to accidental grounding (although grounding response may require an emergency consultation), propeller wash, scarring, and emergency anchoring during OER's marine operation activities. Collision from AUVs/ROVs/ASVs during OER marine operation activities are not expected to overlap with ESA-listed invertebrates because these vehicles are used in waters deeper than 200 meters (656 feet). Although rare, groundings of NOAA vessels in shallow water areas have occurred. For example, in 2018, the NOAA R/V Rainer made contact with the seafloor in Seattle, Washington (Clarridge and Lee 2018). Although no ESA-listed species were harmed during this incident, it is possible for groundings in other areas to cause harm to ESA-listed invertebrates in the action area. Impacts from propellers operating in water depths insufficient for the vessel draft or in places with coral heads near to the ocean surface, may affect ESA-listed corals and their designated or proposed critical habitat. The PDCs in Section 2.8 are meant to ensure safe navigation for vessel operators, even in shallow water locations, reducing the risk to benthic habitat and organisms. For example, as noted in Section 2.8.8, all vessels in coastal waters will operate in a manner to minimize propeller wash and seafloor disturbance, and transiting vessels should follow deep-water routes (e.g., marked channels and shipping lanes), as practicable. Furthermore, Section 2.8.7 states that vessels will not anchor at sea unless in emergency situations. Also, OER's use of nautical charts and depth finders for navigation reduces the risk of unintentional groundings, propeller wash, and scarring, especially in rough seas. Because unintentional grounding, propeller wash, scarring, and emergency anchoring are rare and unlikely to occur, we find that the risk from this potential stressor is discountable for ESA-listed invertebrates. Therefore, we conclude that vessel strike or collision may affect, but is not likely to adversely affect ESA-listed invertebrates (Section 3.4) in the action area.

4.5 Entanglement in Gear

The proposed marine operation activities include the deployment of a CTD/UCTD, which would be deployed from the side or rear of the vessel with a cable, and an ROV, which would be tethered to the vessel. These deployments create the potential for entanglement of ESA-listed marine mammals, sea turtles, and fishes considered in this consultation should any of those animals encounter the cable or tether. These activities would only occur in depths of 200 meters (656 feet) or greater and would not overlap with shallower depth ranges for ESA-listed invertebrates in the action area (Section 3.4).

The CTD/UCTD cables are approximately 0.375 inches (0.95 centimeters) in diameter and run over a pulley attached to a J-frame on the side of the ship and attached to the CTD Rosette. Use of the J-frame ensures the cable remains in close proximity to the ship, and the CTD rosette serves as a weight to keep the cable taut as it is lowered and retrieved. The most line OER would have out at any given time would be no more than 1,300 yards (1,188.72 meters). The line for the CTD/UCTD is not always taut during the initial probe drop, which is by design because the tailspool on the probe is meant to spool out line as the winch spools out line to minimize drag and freefall vertically as much as possible. Once the probe reaches a target depth of about 750 meters (2,460.6 feet) the line becomes taut and the probe is taut as it is dragged by the ship until it is recovered. The unit does not touch the seafloor and is operated while the ship is underway. There has never been an entanglement event observed during this activity and all CTD/UCTD cables will be monitored.

The cable (main umbilical) attaching the winch onboard the ship to the camera platform on the dual-body ROV system is 0.68 inches (1.7 centimeters) in diameter and provides all power and telemetry to the vehicles. This cable is run over a sheave on the ship's A-frame and attached to the camera platform. During operations, the two vehicles are connected to each other by a "soft" electro-optical cable (tether or leash) that is 30 meters (98.4 feet) in length. The use of the Aframe ensures that the 0.68 inch (1.7 centimeter) cable remains in close proximity to the ship. The 3,000 pound (1360.7 kilogram) camera platform is designed to serve as a depressor weight that keeps the 0.68 inch (1.7 centimeter) cable relatively rigid and taut during ROV operations. During a dive, the camera platform is lowered to within approximately 15-25 meters (49.2 to 82.02 feet) of the bottom (this depth is dependent on sea state). The ROV (Deep Discoverer) is operated close to the bottom (within zero to one meters [0 to 3.3 feet] normally) and free swims within a radius allowed by the 30 meter (98.4 feet) soft tether, which attaches it to the camera sled. Because the 0.68 inch (1.7 centimeter) cable hangs straight down, and the tether between the vehicles is short and closely managed, there is very little possibility of entanglement. Additionally, both vehicles are outfitted with multiple cameras and powerful lighting, and several cameras on the vehicles provide real-time footage of the cables during the duration of the dives. The ROV pilots and onboard engineers continuously monitor these cables during undersea operations to prevent entanglement of the vehicles or cable. The ROV is outfitted with six thrusters: two axial, two vertical and two lateral that enable precise control and movement of the

vehicle in all directions. The camera platform is also outfitted with forward and aft thrusters, enabling similar control and movement. In summary, continuous monitoring of the movement of the cables and vehicles reduces the potential for tether entanglement and thus ensures risks to marine mammals, sea turtles, and fish are minimal. Cable entanglements during ROV operations are rare, and OER has never heard of an animal being entangled during these types of operations.

The proposed ASV operations include the deployment of SVP probes down to 200 and 250 meters (656 feet) using a winch-based system from the Drix and Saildrone. The SVP probe is rated to 500 meters (1,640 feet) but, at this time, the deployment is only conducted to approximately 250 meters (820 feet) due to limitations of cable length. Future deployments may be conducted to 500 meters and include transitioning to use of an optical modem, providing high-bandwidth communication for multi-vehicle operations. During these optical modem or AUV-tending deployments, the DriX will orbit slowly in a tight, 40 meter (131 feet) diameter, circle during a several hour deployment. For the Drix, the entire deployment and recovery process for the SVP probe to 500 meter depths is less than 10 minutes. For the Saildrone, a normal SVP cast will take approximately 20 minutes at a descent speed of one meter per second. During SVP deployment, the Drix and Saildrone will move at slow speeds to ensure the SVP probe line remains taut. The line used during SVP deployment for DriX's current winch-based system, and future optical modem tether, is approximately two millimeters (0.07 inch) in diameter. The SVP probe attached to DriX is a cylinder 26 millimeter (1.02 inches) long and 7.8 millimeter (0.30 inches) in diameter that weighs 1.8 kilograms (3.96 pounds) in water. The current SVP probe attached to the Saildrone is similar in size and weight to that of the DriX. These SVPs are cylindrical in shape with no sharp edges or protruding parts, and are unlikely to cause harm to any sea creature. Once SVP operations are started, the pilot is unlikely to see a marine mammal, sea turtle or fish beyond 50 meters (164 feet) from the vehicle so still images are used to assess the area. While capturing still images of ESA-listed species within this range is very unlikely, if an animal were detected, the profiler will be retrieved immediately rather than risking the chance of entanglement by continuing operations.

No entanglement events have been observed during past Saildrone or the DriX's SVP operations. Hydrographers around the world, the NOAA Office of Coast Survey, OER, OET, and other organizations have conducted similar operations on a regular basis during all hydrographic and bathymetric mapping operations for decades. OER is not aware of, nor experienced any entanglement of an instrument while engaged in profiling operations.

Project activities will comply with the guidelines listed in Section 2.8.5 that include maintaining watch for and avoiding protected marine species prior to vehicle deployment (from ship or shore), and postponing deployment of these vehicles when cetaceans are detected within 100 yards (91.44 meters) of the vessel, and when other ESA-listed marine mammals, sea turtles, and fishes in Table 3 are detected within 50 yards (45.72 meters) of the vessel. Once ASVs are deployed and underway; however, the ability to detect ESA-listed species in the vicinity of the vehicle prior to SVP deployment is extremely limited. Based on the expected compliance with

the required protective measures, the safety record, the lack of entanglement events for similar types of routine scientific operations conducted over decades, the short duration of deployments, the slow or stopped speed of vehicle operations during SVP profiles, the propensity for the cable to remain taut during these operations, and the expectation that protected marine species would be widely scattered throughout the proposed areas of operation and not likely to be exposed to potential entanglement, we consider it extremely unlikely that any ESA-listed species presented in Table 3 would come into contact with any of the cables from OERs marine operation activities, and have determined that the risk of entanglement would be discountable. Therefore, we find that the effects of entanglement during OER's marine operation activities may affect, but are not likely to adversely affect ESA-listed marine mammals (Section 3.1), sea turtles (Section 3.2), and fishes (Section 3.3) in the action area.

4.6 Expending Steel Ballasts and Lead Weights

Expending steel ballasts or lead weights into the marine environment is a standard practice for ROV and AUV operations and has not resulted in any known long-term impacts to the environment. Although these ballasts can be considered debris, we do not believe they pose a risk for ESA-listed species. Steel is a relatively environmentally safe material (Ramos et al. 2011). Lead weights produce environmental toxicity (Church et al. 2017) but the expending of lead weights into the environment would be rare and is only used in emergency scenarios. As a result, the amount of toxic leachate from the use of these weights would be minimal. The small amount of debris created by the ballasts as a result of the proposed action compared to the relative size of the available habitat used by ESA-listed marine mammals, sea turtles, and fishes will not result in measurable effects to species as a result of impacts to habitat and are thus insignificant. The most likely impact may be deployments on top of, or adjacent to, deep-sea coral and sponge habitats. AUV and ROV dives are conducted at depths of 200 meters (656 feet) or more, which are beyond the depth range of ESA-listed coral species. ROV and AUV ballast or weight deployments occur while the vehicle is operating relatively close to the seafloor. However, deployments may occur from AUVs approximately 100 meters (328 feet) off the seafloor. It is possible, but extremely unlikely, that a deployment could hit or fall on an ESAlisted marine mammal, sea turtle, or fish swimming or resting in the vicinity. Given the depths of OER's operations; the distributed nature of ESA-listed species relative to OER's operating areas; the short duration of OER's operations in the marine environment; the mobility of sea turtles, fish and marine mammals; and the propensity for these animals to avoid or swim away from these types of activities, we consider the likelihood for steel/lead ballast deployments to adversely affect ESA-listed marine mammals, sea turtles and fish to be extremely unlikely to occur and thus discountable. As a result, OER's expending of steel ballasts and lead weights may affect, but is not likely to adversely affect ESA-listed marine mammals (Section 3.1), sea turtles (Section 3.2), and fishes (Section 3.3) in the action area.

4.7 Vessel Waste and Discharge

NOAA vessels adhere to MARPOL regulations and discharge protocols unless operating in sensitive marine habitats (e.g. a marine protected area), which prompts the implementation of additional guidance and regulations. NOAA guidance for vessel operations in the presence of an ESA-listed species and other marine wildlife includes:

- All vessels operating in areas where ESA-listed species are present will continue to follow MARPOL discharge protocols, but will postpone any authorized discharge if any ESA-listed species are within 100 yards (91.44 meters) of the vessel.
- Meet all EPA Vessel General Permits and USCG requirements.
- Avoid discharge of ballast water in designated critical habitat.
- Avoid cleaners with nonylphenols.
- Use anti-fouling coatings.
- Clean hull regularly to remove aquatic nuisance species.
- Avoid cleaning of hull in critical habitat.

Autonomous and unmanned vehicles used during OER-supported projects do not discharge anything (besides engine exhaust, steel ballasts, or lead weights) into the marine environment. Vehicles that operate out of established piers, ports and harbors receive diver-based hull cleanings in ports, including removing biofouling and invasive species. Vehicles deployed and recovered from ships are fully checked prior to each deployment, including checking for potential leakage of oil, gas, or other chemicals. They are also thoroughly sprayed with freshwater and allowed to air dry between dives or deployments. Furthermore, protocols aimed at reducing potential exposure of disease-causing agents are also applied (See PDCs in Section 2.8.7). For example, the ROV/AUV/ASV is thoroughly inspected prior to every dive and checked for the presence of biological organisms to prevent the spread of invasive or non-endemic species from one location to another. In areas where Stony Coral Tissue Loss Disease (SCTLD) is present, the vehicles will be decontaminated following the procedures documented in NOAA's Office of National Marine Sanctuaries' Coral Disease Decontamination Protocol.

An accidental discharge of oil, garbage and/or untreated sewage, or other noxious substances associated with the operation of vessels and equipment may occur that might put ESA-listed species at risk of exposure to toxic chemicals. However, OER has never reported an accidental discharge or spill. Due to this, and based on the short duration of the project activities, the strict adherence to the MARPOL protocols, expected adherence to EPA and USCG regulations during all project operations, we have determined that the risk of ESA-listed species being exposed to vessel waste and discharge would be highly unlikely and thus discountable. As a result, effects to from vessel waste/discharge during OER's proposed action may affect, but are not likely to adversely affect ESA-listed marine mammals (Section 3.1), sea turtles (Section 3.2), fishes (Section 3.3), and invertebrates (Section 3.4) in the action area.

4.8 Effects to Designated and Proposed Critical Habitats in the Action Area

Effects to Prey and Foraging Areas

Availability of adequate prey and foraging areas is a common PBF across several of the designated and proposed critical habitats in this consultation: Black abalone; Southern DPS green sturgeon; Gulf sturgeon; leatherback sea turtle; Southern Resident DPS killer whale; Main Hawaiian Islands Insular DPS false killer whale; North Pacific right whale; Western North Pacific; Central America, and Mexico DPSs of humpback whales; Hawaiian monk seal; and Western DPS Steller sea lion. While active acoustics, visual/acoustic disturbance from vessels/AUVs/ROVs/ASVs, and in-water work could disperse prey, the impact is anticipated to be extremely localized, temporary, and of short duration (only occurring during ensonification or activity duration, with a return to normal conditions after the activity has ceased in an area) and of negligible magnitude (in terms of area size and proportion of available forage). It is highly unlikely that mortality or injury will occur from the activity's active acoustic sources because most of the active acoustic sources used during OER's proposed action are outside of the hearing range of many prey species. PBFs for marine mammal, leatherback sea turtle, and sturgeon critical habitat include prey such as fish and invertebrates (Section 3.5). The prey of ESA-listed marine mammals, sea turtles, and fishes may exhibit behavioral responses if exposed to active acoustics. Based on the available data, as reviewed by Carroll et al. (2017) on impacts from seismic (a more impactful sound source than those used by OER that are considered in this consultation) activities, considerable variation exists in how fishes behaviorally respond to noise, with some studies indicating no response and others noting startle or alarm responses and/or avoidance behavior. However, no effects to foraging or reproduction were documented. Similarly, data on the behavioral response of invertebrates suggests that some species may exhibit a startle response, but most studies do not suggest strong behavioral responses.

Given the limited amount of vessel activity associated with OER's activities, we expect that any such interactions will only result in a temporary and slight displacement of prey with prey returning to the area soon after activities are concluded. In regards to vessel strike, if prey were to be drawn into or struck by the vessel's propellers, it is possible that individual prey can be killed. While unlikely, even if this occurred, the removal of small amounts of prey from vessel strike by a research vessel would have a limited impact on the overall abundance of prey resources. OER's activities will not lead to a noticeable increase in vessel traffic and, as a result, are not likely to cause higher rates of vessel strike to prey species. Furthermore, due to the low rates of activity and the fact that OER will be focused on depths greater than 200 meters for its mapping operations, it is highly unlikely for foraging areas to be impacted during OER's marine operation activities because most critical habitat is located in shallower depths (Section 3.5). For these reasons, impacts to prey and foraging areas from OER's marine operation activities are expected to be insignificant and not likely to adversely affect designated critical habitat of black abalone; Southern DPS green sturgeon; Gulf sturgeon; leatherback sea turtle; Southern Resident DPS killer whale; Main Hawaiian Islands Insular DPS false killer whale; North Pacific right

whale; Western North Pacific, Central America, and Mexico DPSs of humpback whales; Hawaiian monk seal; and Western DPS Steller sea lion.

Water Quality

Suitable water quality is a common PBF across several of the designated and proposed critical habitats in this consultation: black abalone, Southern DPS green sturgeon, Gulf sturgeon, Southern Resident DPS killer whale, Main Hawaiian Islands Insular DPS false killer whale, and Caribbean and Pacific coral critical habitat. The potential for vessel waste and discharge from OER activities is low. As noted earlier, while we understand that discharges and spills could occur, they are expected to be extremely infrequent, small, and quickly cleaned based on the PDCs. Further, OER has never reported an accidental discharge or spill and Federal regulations prohibit the intentional discharge of pollutants into the marine environment. Autonomous and unmanned vehicles used during OER-supported projects do not discharge anything (besides engine exhaust and steel/lead ballasts) into the marine environment. Expending steel/lead ballasts into the marine environment is a standard practice for AUV/ROV operations and has not resulted in any known long-term impacts to the environment. Lead ballasts are only used in case of emergency and both lead and steel ballasts will only be used in areas greater than 200 meters (656 feet), which is outside the range of designated and proposed critical habitat for black abalone, Southern DPS green sturgeon, Gulf sturgeon, Southern Resident DPS killer whale, Main Hawaiian Islands Insular DPS false killer whale, and Atlantic-Caribbean and Indo-Pacific coral critical habitat. Therefore, we find that the effects of vessel waste/discharge exposure on designated and proposed critical habitat are discountable and may affect, but are not likely to adversely affect designated and proposed critical habitat for black abalone, Southern DPS green sturgeon, Gulf sturgeon, Southern Resident DPS killer whale, Main Hawaiian Islands Insular DPS false killer whale, and Caribbean and Indo-Pacific coral.

Migratory Passage

Migratory passage and adequate space for movement are features common to Gulf sturgeon, Southern DPS green sturgeon, Southern Resident DPS killer whale, Main Hawaiian Islands Insular DPS false killer whale, and Northwest Atlantic Ocean DPS loggerhead sea turtle critical habitats. Each of these migratory pathways are located in shallow waters less than 200 meters (656 feet). Marine operation activities will be focused on water depths of 200 meters (656 feet) or deeper and are thus expected to avoid these critical habitats when mapping. While OER's marine operation activities have a small potential to affect passage conditions during transit, these activities involve the use of individual vessels that will not interfere with migratory routes. Vessel transit through any migratory routes are expected to be temporary, highly localized, and short-term. Thus, disruption to migratory pathways in designated critical habitat from OER's marine operation activities is expected to be insignificant. Therefore, disruption to migratory pathways from OER activities may affect, but are not likely to adversely affect designated critical habitat in the action area foe Southern DPS green sturgeon, Southern Resident DPS killer

whale, Main Hawaiian Islands Insular DPS false killer whale, and Northwest Atlantic Ocean DPS loggerhead sea turtle.

Habitat with Sound Levels that will not Cause Impairment

A unique PBF for the Main Hawaiian Islands Insular DPS false killer whale designated critical habitat is sound levels that would not significantly impair false killer whales' use or occupancy. As previously stated, sound of any intensity that would create meaningful disturbance underwater is not an expected effect from the proposed marine operation activities. Therefore, noise disturbance from OER's marine operation activities may affect, but are not likely to adversely affect designated critical habitat for Main Hawaiian Islands Insular DPS false killer.

Sargassum Habitat

Oceanographic conditions supporting *Sargassum* habitat having adequate abundance and cover for post hatchlings and prey is a PBF for Northwest Atlantic Ocean DPS loggerhead sea turtle critical habitat. Due to the low number of yearly mapping surveys (approximately five 14 to 21-day surveys), the scale of operations are not large enough to affect boundary currents or areas of convergence that promote the aggregation of *Sargassum*. Any potential impacts to these features from OER's mapping activities such as increased vessel traffic or noise pollution are expected to be too small to be measurable, and therefore insignificant. Thus, OER's marine operation activities may affect, but are not likely to adversely affect Northwest Atlantic Ocean DPS loggerhead sea turtle critical habitat.

Rocky Substrate, Suitable Nearshore Circulation Patterns and Juvenile Settlement Habitat

Critical habitat for black abalone includes the PBFs of rocky substrate, suitable nearshore circulation patterns, and juvenile settlement habitat. The only activity that has the potential to overlap with black abalone critical habitat is vessel transit as OER vessels go in and out of port. OER-supported vessels will use designated shipping lanes while transiting in and out of ports, and will avoid live bottom features, including avoiding anchoring in critical habitat for black abalone (Section 2.8.8). Due to this, the only potential for OER vessels to overlap with black abalone critical habitat would be in emergency situations. Effects to black abalone critical habitat as a result of OER activities will be highly unlikely to occur and thus discountable. Therefore, OER's marine operation activities may affect, but are not likely to adversely affect the PBFs of black abalone critical habitat.

Hawksbill Sea Turtle Habitat

Critical habitat has been designated for hawksbill sea turtles in Puerto Rico around Mona and Monito Islands. No PBFs were identified in the designation, but several activities were identified as requiring special management considerations. These include vessel traffic, coastal construction, point and non-point source pollution, fishing activities, dredge and fill activities, and habitat restoration. The proposed action will include vessel activity, and therefore does require special management consideration with regard to hawksbill designated critical habitat.

The rule includes a discussion of vessel traffic potentially affecting designated critical habitat, specifically, propeller dredging and anchor mooring disrupting benthic habitats by crushing coral, breaking seagrass root systems, and severing rhizomes. OER-supported vessels addressed in this consultation use DP to hold station and will not deploy an anchor in these areas unless an unplanned emergency occurs. In addition, because OER operations occur in deep waters outside the depth range of corals and sponges that provide shelter and foraging for hawksbill sea turtles in the critical habitat unit, it is unlikely that the activities considered in this consultation will affect this habitat. ROV or AUV dives would be conducted using the PDCs described above in Section 2.8.7 in order to minimize any potential adverse effects. The ROV would be operated to avoid hitting bottom, and AUVs have bottom detection and avoidance capabilities. ASV, ROV and AUV dives would be focused on 200-meter (656-feet) water depths and deeper. We believe it is extremely unlikely that the large research vessels typically used for OER-supported projects, with 11 to 21-foot (3.3 to 6.4 meter) drafts, would be in such shallow waters as to damage benthic habitats with their propellers. OER-supported vessels will use designated shipping lanes while transiting in and out of ports, and avoid live bottom features (Section 2.8.8). We conclude that the proposed action is not likely to adversely affect designated critical habitat for hawksbill sea turtles.

Atlantic-Caribbean and Indo-Pacific Coral Critical Habitat

The only portion of the action that would overlap with designated or proposed critical habitat for ESA-listed Indo-Pacific and Atlantic-Caribbean corals is vessel transit. Therefore, the only stressors that may impact PBFs (e.g., suitable substrate and water quality) are vessel collision and vessel waste/discharge from the ship. As noted, Federal regulations prohibit the intentional discharge of pollutants into the marine environment. While we understand that discharges and spills could occur, they are expected to be extremely infrequent, small, and quickly cleaned based on OER's PDCs. Furthermore, OER has never reported an accidental discharge or spill. All OER-supported vessels will use designated shipping lanes while transiting in and out of ports, and avoid live bottom features (Section 2.8.8) minimizing chances for grounding in designated and proposed coral critical habitat. All mapping activities that involve the use of ASVs/AUVs/ROVs will only be conducted in waters deeper than 200 meters (656 feet) and will not overlap with any designated or proposed critical habitat for ESA-listed Indo-Pacific and Atlantic-Caribbean corals. We find that the effects of vessel collision and vessel water/discharge on designated and proposed critical habitat for ESA-listed Pacific and Caribbean corals are extremely unlikely to occur and thus discountable. Therefore, these stressors may affect, but are not likely to adversely affect designated critical habitat for elkhorn and staghorn coral, or proposed critical habitat for Acropora globiceps, Acropora jacquelineae, Acropora retusa, Acropora speciosa, boulder star coral, Euphyllia paradivisa, Isopora crateriformis, lobed star coral, mountainous star coral, rough cactus coral, pillar coral, and Seriatopora aculeata in the action area.

4.9 Additive Effects

We have concluded that OER's proposed marine operation activities, when in compliance with the requirements of this programmatic, may affect, but are not likely to adversely affect ESAlisted marine mammals, sea turtles, fishes, and invertebrates or designated and proposed critical habitat for black abalone; Caribbean and Indo-Pacific corals,; green sea turtle; Southern DPS green sturgeon; Gulf sturgeon; leatherback sea turtles in the Pacific; Northwest Atlantic Ocean DPS loggerhead sea turtle; North Atlantic right whale; North Pacific right whale; hawksbill sea turtle; Western North Pacific DPS, Central America DPS, and Mexico DPS of humpback whales; Southern Resident DPS killer whale; Main Hawaiian Islands Insular DPS false killer whale; Hawaiian monk seal; Arctic subspecies of ringed seal; Western DPS Steller sea lion. Programmatic consultations often involve actions that may occur with some frequency over many years and possibly continue for an indefinite time. As a result, we evaluate the potential for the effects of the stressors to ESA-listed species and designated critical habitat over the lifetime of the proposed action to result in additive effects due to chronic stress or cumulative effects. Therefore, we determine if, when considered additively, the effects of stressors associated with the OER's marine operation activities in the marine environment that are part of the proposed action are likely to adversely affect the aforementioned ESA-listed species and designated and proposed critical habitat.

OER has conducted the marine operation activities described in this document with little documented impact to the marine environment as a whole, including a lack of reported incidences affecting ESA-listed species and designated and proposed critical habitats in the action area. The activities considered in this programmatic consultation will occur across large expanses of open water in the Atlantic and Pacific Oceans, and the Gulf of Mexico and Caribbean. Each of the stressor categories (see *Effects of the Action*) were determined to have effects that are extremely unlikely to occur and therefore discountable, or to result in effects that are so small as to be insignificant. The possibility of the discountable effects overlapping in time and space and having a cumulative effect to ESA-listed species and designated and proposed critical habitat in the action area does not seem plausible. Chronic stress from activities whose effects are considered insignificant occurring across vast areas also does not seem plausible. Therefore, additive effects from the activities considered in this consultation are extremely unlikely and thus discountable.

5 CONCLUSION

Based on this analysis, NMFS ESA Interagency Cooperation Division concurs with OER that the proposed action may affect, but is not likely to adversely affect ESA-listed species and designated and proposed critical habitat in the action area.

6 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on ESA-listed species or critical habitat, to help implement recovery plans or develop information (50 C.F.R. §402.02).

We recommend the following discretionary measures that we believe are consistent with this obligation and therefore may be considered by OER in relation to their 7(a)(1) responsibilities. These recommendations will provide information for future consultations involving marine operation activities that may affect ESA-listed species:

- 1. We recommend that OER promote and fund research examining the potential effects of its marine operation activities on ESA-listed species.
- 2. We recommend OER use thermal imaging cameras, in addition to binoculars (Big-Eye and handheld) and the naked eye, for use during daytime and nighttime visual observations and test their effectiveness at detecting ESA-listed species.
- 3. We recommend the vessel operator and other relevant vessel personnel (e.g., crewmembers) on OER vessels take the U.S. Navy's marine species awareness training available online at: https://www.youtube.com/watch?v=KKo3r1yVBBA in order to detect ESA-listed species and relay information to PSOs.

In order for NMFS' Office of Protected Resources ESA Interagency Cooperation Division to be kept informed of actions minimizing or avoiding adverse effects on, or benefiting, ESA-listed species or their critical habitat, OER should notify OPR of any conservation recommendations implemented as part of activities included in this programmatic consultation. This information can be included in the annual programmatic reviews.

7 REINITIATION OF CONSULTATION

Reinitiation of consultation is required and shall be requested by the federal agency, where discretionary federal involvement or control over the action has been retained or is authorized by law and:

- 1. New information reveals effects of the action that may affect an ESA-listed species or designated critical habitat in a manner or to an extent not previously considered;
- 2. The identified action is subsequently modified in a manner that causes an effect to the ESA-listed species or designated critical habitat that was not considered in this concurrence letter;
- 3. Take of an ESA-listed species occurs; or
- 4. A new species is listed or critical habitat designated that may be affected by the identified action (50 C.F.R. §402.16).

Please direct questions regarding this letter to Jonathan Molineaux, Consulting Biologist, at (301) 427-8440, or me at (301) 427-8495, or by email at cathy.tortorici@noaa.gov.

Sincerely,

Cathryn E. Tortorici Chief, ESA Interagency Cooperation Division Office of Protected Resources

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