Office of National Marine Sanctuaries
National Oceanic and Atmospheric Administration

Programmatic Environmental Assessment of Field Operations in the West Coast National Marine Sanctuaries

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National Oceanic and
Atmospheric Administration

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Cover Photo
Bowling Ball Beach, which is part of Greater Farallones National Marine Sanctuary.
Photo: Matt McIntosh/NOAA National Marine Sanctuaries.

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Acknowledgments

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Introduction

The National Oceanic and Atmospheric Administration's (NOAA) Office of National Marine Sanctuaries (ONMS) serves as the trustee for the thirteen national marine sanctuaries and two marine national monuments (Figure 1). Together these protected areas encompass more than 600,000 square miles of ocean and Great Lakes waters from Washington State to the Florida Keys, and from New England to American Samoa. National marine sanctuaries are special areas set aside for long-term protection and conservation and are part of our nation's legacy to future generations. They contain deep ocean habitats of resplendent marine life, kelp forests, coral reefs, whale migration corridors, deep-sea canyons, historically significant shipwrecks, and other underwater archaeological sites. Each sanctuary is a unique place worthy of special protection. Because they serve as natural classrooms, cherished recreational spots and places for valuable commercial activities, national marine sanctuaries represent many things to many people. Organizationally, the national marine sanctuary system is divided into four regions: Northeast and Great Lakes; Southeast, Gulf of Mexico and Caribbean; West Coast; and Pacific Islands. This environmental assessment addresses field operations at the five national marine sanctuaries in the West Coast Region: Olympic Coast, Cordell Bank, Greater Farallones, Monterey Bay, and Channel Islands national marine sanctuaries.

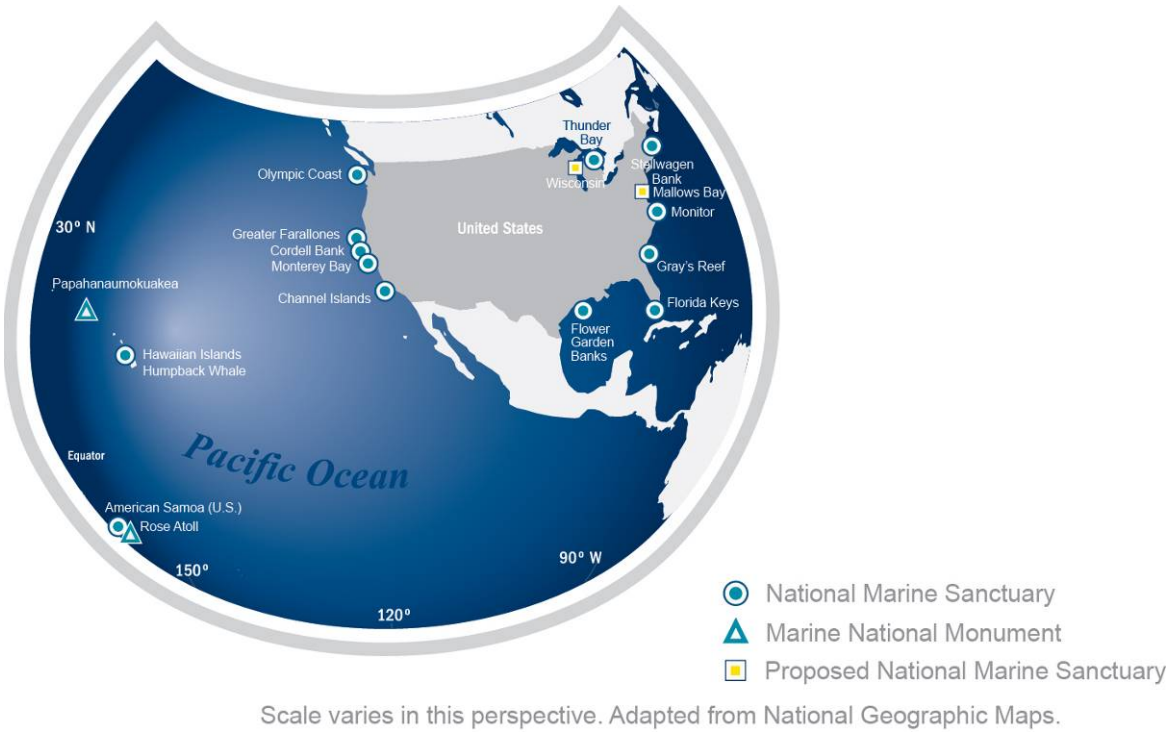
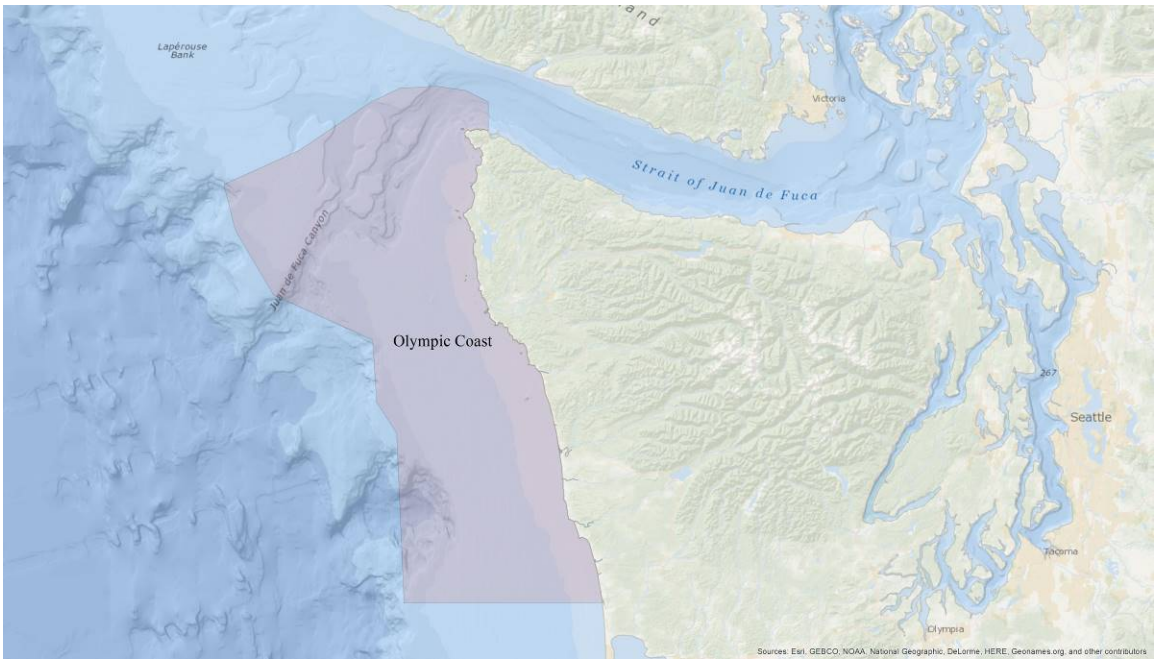


Figure 1: The National Marine Sanctuary System

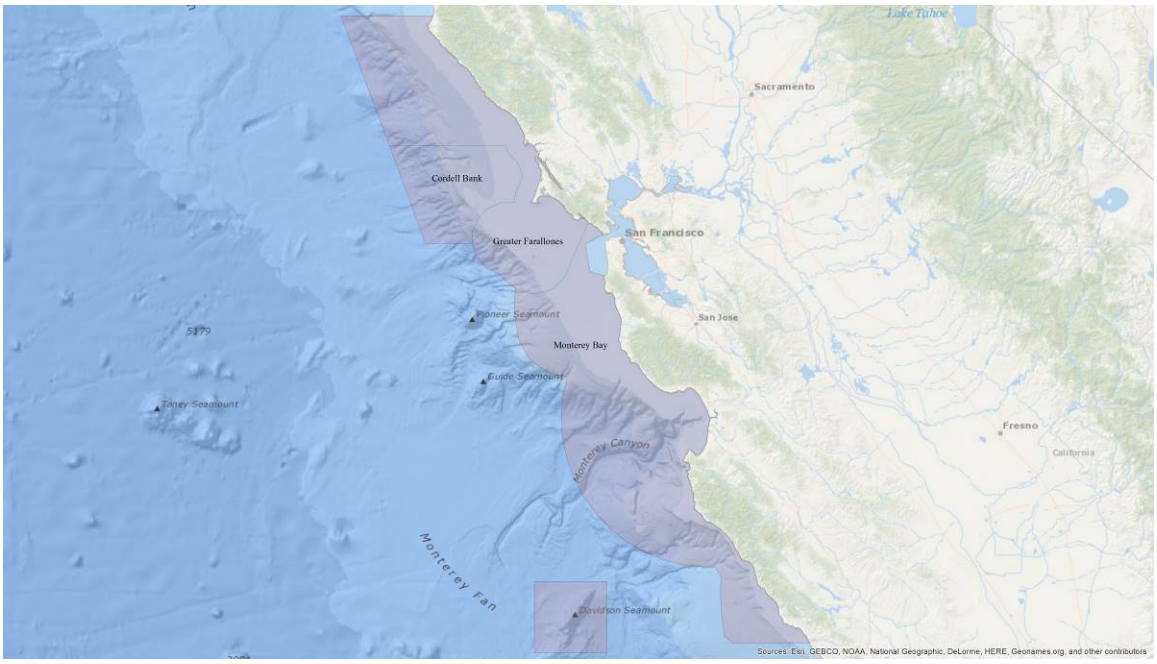
The NMSA requires that ONMS develop and periodically review the management plans for each national marine sanctuary (Sec. 304 (a)(2)(A) and (e)). Since revision of a management plan often constitutes a federal action, ONMS typically analyzes changes to the management plan under NEPA. In many cases, this analysis tends to be very broad and does not adequately analyze the consequences of routine field operations, such as vessel operations and ongoing research programs. This programmatic environmental assessment is designed to analyze these types of activities and to detail any other routine operations not previously adequately analyzed under NEPA during the management plan review process.

The National Marine Sanctuaries of the West Coast

NOAA designated **Olympic Coast National Marine Sanctuary** in 1994 (59 FR 24586), to protect ecologically and commercially important species of fish, seabirds, and marine mammals; a diversity of habitats supporting a great variety of biological communities; significant historical resources; and to support exceptional opportunities for scientific research and public education and awareness programs. Stretching 135mi (217 km) along the central and northern coasts of the State of Washington, the sanctuary encompasses approximately 3,188.9 square miles (mi2) (approximately 8,259.2 square kilometers (km2)) of coastal and ocean waters and the submerged lands thereunder. The sanctuary boundary extends from Koitlah Point due north to the United States/Canada international boundary seaward to the 100 fathom isobath. The seaward boundary of the sanctuary approximates the 100 fathom isobath in a southerly direction from the U.S./Canada international boundary to a point due west of the Copalis River, cutting across the heads of Nitnat, Juan de Fuca, and Quinault canyons. For additional details on how the sanctuary is managed, including details on the programs covered under this Environmental Assessment, see the Olympic Coast NMS Management Plan (NOAA 2011) at http://olympiccoast.noaa.gov/management/managementplan/managementplanwelcome.html.



NOAA designated **Cordell Bank National Marine Sanctuary** in 1989 (54 FR 22417), to provide comprehensive and coordinated conservation and management of the marine resources on the continental shelf due west of Point Reyes, California. The main feature of the 525.9 mi2 (1,362 km2) sanctuary is an offshore granite bank that is 4.3 miles (mi) (7 kilometer (km)) wide and 3.1 mi (15 km) long located just 50 mi northwest of the Golden Gate Bridge. The rocky bank emerges from the soft sediments of the continental shelf, with the upper pinnacles reaching within 115 feet of the ocean's surface. The combination of oceanographic conditions and undersea topography of Cordell Bank supports a diverse and productive marine ecosystem. A persistent upwelling plume projects southward and offshore from Point Arena and Point Reyes, transporting nutrients and organisms suspended in the water column into the bank's relatively shallow waters. This high local productivity supports abundant populations of invertebrates, fish, seabirds and marine mammals and attracts many migratory species. For additional details on how the sanctuary is managed, including details on the programs covered under this Environmental Assessment, see the Cordell Bank NMS website and Management Plan (NOAA 2008) at http://cordellbank.noaa.gov/management/plan.html.

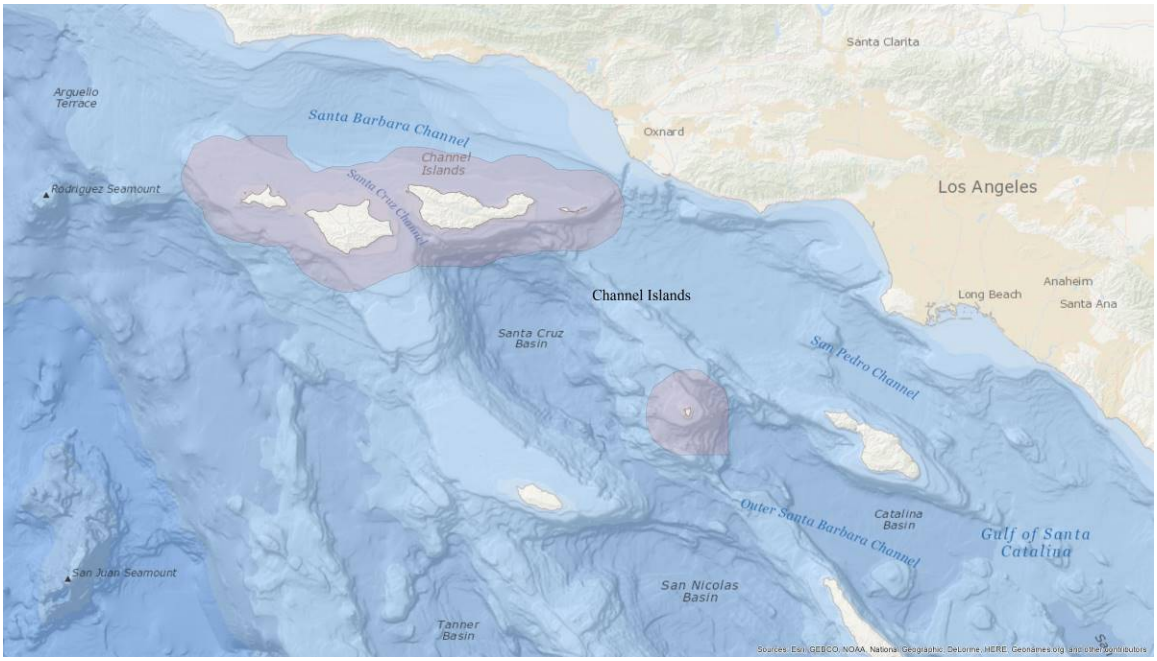


NOAA designated **Greater Farallones National Marine Sanctuary** in 1981 (46 FR 7936), to protect open ocean, nearshore tidal flats, rocky intertidal areas, estuarine wetlands, subtidal reefs, and coastal beaches within its boundaries. The sanctuary spans 3,295 mi2 (8,534 km2) just north and west of San Francisco Bay, and is located within the California Current ecosystem, one of four major eastern boundary currents in the world, that stretches along the western coast of North America from southern Canada to northern Mexico. Due to a high degree of wind-driven upwelling, there is a ready supply of nutrients to surface waters and the California Current ecosystem is one of the most biologically productive regions in the world. The sanctuary is a globally significant, extraordinarily diverse, and productive marine ecosystem that supports abundant wildlife and valuable fisheries. It provides breeding and feeding grounds for at least twenty-five endangered or threatened species; thirty-six marine mammal species, including blue, gray, and humpback whales, harbor seals, elephant seals, Pacific white-sided dolphins, and one of the last populations of threatened Steller sea lions; over a quarter-million breeding seabirds; and one of the most significant white shark populations on the planet. For additional details on how the sanctuary is managed, including details on the programs covered under this environmental assessment, see the Greater Farallones NMS website and Management Plan (NOAA 2008) at http://farallones.noaa.gov/manage/management_plan.html.

NOAA designated **Monterey Bay National Marine Sanctuary** in 1992 (57 FR 43309), to protect and manage the conservation, ecological, recreational, research, educational, historical and esthetic resources and qualities of the area. Stretching from Marin to Cambria, the sanctuary encompasses a shoreline length of 276 mi (444.2 km) and 6,094 mi2 (15,783.4 km2) of ocean, extending an average distance of 30 mi (48.3 km) from shore. At its deepest point, the sanctuary reaches down 12,713 feet (more than two miles). Its natural resources include one of our nation's

largest kelp forests, one of North America's largest underwater canyons and the closest-to-shore deep ocean environment in the continental United States. The sanctuary is home to one of the most diverse marine ecosystems in the world, including 33 species of marine mammals, 94 species of seabirds, 345 species of fish, and numerous invertebrates and plants. This remarkably productive marine environment is fringed by spectacular coastal scenery, including sandy beaches, rocky cliffs, rolling hills and steep mountains. For additional details on how the sanctuary is managed, including details on the programs covered under this environmental assessment, see the Monterey Bay NMS website and Management Plan (NOAA 2008) at http://montereybay.noaa.gov/intro/mp/welcome.html.

NOAA designated **Channel Islands National Marine Sanctuary** in 1980 (45 FR 65198), to conserve, protect, and enhance the biodiversity, ecological integrity, and cultural legacy of marine resources surrounding the Channel Islands for current and future generations. The sanctuary contains a rich and diverse range of marine life and habitats, unique and productive oceanographic processes and ecosystems, and culturally significant resources. The sanctuary is located offshore from Santa Barbara and Ventura counties in southern California and consists of an area of approximately 1,470 mi2 (3,807.3 km2) of coastal and ocean waters, and the submerged lands thereunder. The sanctuary boundary begins at the Mean High Water Line, and extends seaward to a distance of approximately six nautical miles (nm) from, the following islands and offshore rocks: San Miguel Island, Santa Cruz Island, Santa Rosa Island, Anacapa Island, Santa Barbara Island, Richardson Rock, and Castle Rock (the Islands). For additional details on how the sanctuary is managed, including details on the programs covered under this Environmental Assessment, see the Channel Islands NMS Management Plan (NOAA 2009) at http://channelislands.noaa.gov/manplan/overview.html.



This programmatic environmental assessment is designed to address the environmental impacts of ONMS field operations at the regional level. In some cases, a detailed description of field activities was not yet available at time of publication of this PEA, and therefore a full analysis of the environmental consequences of these activities was not developed. New activities may come up with time. When more details become available for activities included in this document or when new field operations activities come up, we will assess whether their effects are adequately addressed in this PEA. If they are not, we will conduct additional environmental reviews, either tiering from this PEA (for future actions within the scope of activities described in this PEA, pursuant to 40 CFR §1502.20) or developing independent environmental compliance documentation. The subsequent environmental compliance documentation, when tiered from this programmatic analysis, would need only summarize the issues discussed in the broader statement, incorporate discussions from the broader statement by reference and, concentrate on the issues specific to a subsequent, more detailed action. The subsequent document would state where the earlier document is available. In this programmatic EA, ONMS identified and prepared a qualitative analysis of environmental impacts for the broad scope of actions planned for field operations among the sanctuaries of the region.

Public Involvement

Under NEPA requirements, NOAA is not required to release a draft PEA for public comment. However, NOAA is soliciting public comment on this document for 45 days to ensure transparency and completeness of the final analysis. The input received as a result of both the public comments and the interagency consultations will be considered prior to publication of the final PEA. Public comment and consultation outcomes will be summarized in the final PEA.

1.0

PURPOSE AND NEED

1.1 Purpose for the Action

The purpose of the proposed action is to fulfill the requirements outlined in Section 301(b) of the NMSA in order to protect and manage the resources of each national marine sanctuary. Sanctuary field operations are one aspect of resource management that assists with the accomplishment of the goals, objectives and priorities of each sanctuary. Field operations are activities on, in or above the water that support NMSA's primary objective of resource protection, through direct management, research, and education. These field operations can include vessel, aircraft and scuba diving operations as well as deployment of instrumentation and presence of personnel. The field operations are evaluated on a regional basis taking into consideration the protected resources that may be present at each sanctuary.

1.2 Need for the Action

The need for the proposed action is to ensure that sanctuary resources are maintained and improved. Implementation of sanctuary field operations, as the proposed action, is one aspect of resource management that is needed to assist with the accomplishment of the goals, objectives and priorities of each sanctuary. The NMSA states that the System of National Marine Sanctuaries will "maintain for future generations the habitat and ecological services of the natural assemblage of living resources that inhabit [sanctuaries]" (16 U.S.C. § 1431(a)(4)(C)). The NMSA further recognizes that "while the need to control the effects of particular activities has led to enactment of resource-specific legislation, these laws cannot in all cases provide a coordinated and comprehensive approach to the conservation and management of the . . . marine environment." (16 U.S.C § 1431(a)(3)). Accordingly, the ONMS subscribes to a broad and comprehensive management approach to meet the NMSA's primary objective of resource protection. This comprehensive management approach differs from that of various other national and local agencies and laws directed at resource-specific management. Comprehensive sanctuary management serves as a framework for addressing long-term protection of a wide range of living and non-living marine resources, while allowing multiple uses of the sanctuary to the extent that they are compatible with the primary goal of resource protection. Sanctuary field operations are a part of this comprehensive management strategy and are necessary to support resource protection, research and education objectives, as described in the site-specific management plans outlining short- to mid-term priority management actions.

2.0

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

In accordance with NEPA, NOAA seeks to evaluate the proposed action and identify reasonable alternatives, which meet the purpose and need for the proposed action, discussed above. In accordance with NEPA, NOAA seeks to evaluate the proposed action and identify reasonable alternatives, including a no action alternative, which meet the purpose and need for the proposed action, discussed above. For the purposes of this PEA, the No Action Alternative has been considered in two ways. First, ONMS presents Alternative 1, which describes the No Action as a "no change" from current sanctuary management. Because this is a feasible alternative from a legal and practical standpoint, it has been carried forward for further analysis. The second approach presents the No Action as no field operations to be conducted within each sanctuary (see section 2.1). This alternative has not been considered for further analysis because it does not fit within the purpose and need for the proposed action (*i.e.*, does not meet the mandates of the National Marine Sanctuaries Act). Two options are considered in this Programmatic Environmental Assessment (PEA).

Alternative (1) (No Action) is to conduct field operations to support sanctuary goals and objectives in the same manner as they are currently conducted and to implement additional required mitigation measures as determined through consultations conducted and applicable permits issued as appropriate under the ESA, MMPA, National Historic Preservation Act (NHPA), and the Essential Fish Habitat (EFH) provisions of the Magnuson-Stevens Fishery Conservation Management Act (MSA). This is the "Status Quo" alternative for purposes of this analysis, because it would be a continuation of current field operations, even if this alternative contains some required mitigation measures not currently in place.

Alternative (2) is to conduct field operations as currently conducted with the exception of vessel operations. In Alternative 2, ONMS vessels would be operated in accordance with NOAA Small Boat Program standards (http://www.sbp.noaa.gov/policy/manual.html) and other applicable statutes and regulations but without the ONMS vessel operations best management practices described in greater detail below.

At this time, NOAA has not selected a preferred alternative, which is defined as the alternative which the agency believes would fulfill its statutory mission and responsibilities, giving

consideration to economic, environmental, technical and other factors. Consultation under the statutes mentioned above will begin upon publication of this draft PEA and the selection of the preferred alternative will be dependent upon the consultation process and informed by the public comments received. Therefore, NOAA will select a preferred alternative based on public comment received on this document as well as on consultation processes and will identify the preferred alternative in the final PEA.

2.1 Alternative Considered but Not Analyzed in Further Detail

NOAA considered an alternative in which no field operations would be conducted at OCNMS, CBNMS, GFNMS, MBNMS or the CINMS to support the implementation of the NMSA and the goals and objectives of the sanctuaries. Under this alternative, field operations occurring on, in, near or above the water conducted as part of projects and programs that support sanctuary management, research and education objectives would not occur. This alternative is not further analyzed in this PEA because it would neither meet the goals and objectives of the sanctuaries, nor the purposes and policies of the NMSA, and therefore would also not meet the purpose and need for this PEA.

2.2 Alternative 1: No Action/Status Quo

Under Alternative 1, there would be no change from current sanctuary management. This means that each of the sanctuaries in the region would annually conduct a number of field operations as part of projects that support the management, research and education objectives of each site. For the purposes of this PEA, it is assumed that the field operations at each site would continue to be conducted over the next five years. The field operations conducted would occur in the same manner as currently conducted, with the addition of any required mitigation measures as determined through consultations conducted, and applicable permits issued as appropriate, under the ESA, MMPA, NHPA, and the EFH provisions of the MSA. NOAA anticipates that mitigations arising from consultation with relevant authorities could include measures to minimize risk from vessel strikes, which may include reduced vessel speed, additional on-board observers, or restrictions on operating in adverse environmental conditions. In addition, NOAA is releasing this draft PEA to solicit public comment on the suite of ongoing field operations and the analysis of their potential environmental impact. NOAA could amend certain field operations (and the final PEA) based on required mitigations or monitoring that result from these permit and consultation processes and the public comment period.

With respect to current ONMS vessel operations, NOAA notes that all ONMS vessels follow the protocols and procedures of the NOAA Small Boats Program. Vessel operators are under the NOAA Small Boat Program (http://www.sbp.noaa.gov/policy/manual.html), and will follow its requirements as well as additional sanctuary standing orders and procedures to avoid direct impacts to sanctuary resources. In addition, the NOAA Small Boat Program mandates that all vessels longer than 40’ feet be operated by personnel with an appropriate tonnage U.S. Coast Guard (USCG) license or equivalent NOAA Corps Officer of the Deck rating. Site-specific

standing orders and procedures are described in further detail below, as applicable. In general, operators of sanctuary vessels employ ONMS best management practices to minimize impacts. And, because they are operating ONMS assets that are very visible to the public they are trained to serve as models of best practices to avoid harm to the environment.

Table 1 describes the categories of field operations. Each sanctuary could have multiple projects that include a combination of the field operations listed below.

Table 1. ONMS Field Operations[1] for Alternative 1

Categories of Field Operations	Definition
Vessel Operations	Vessel operations include all activities conducted on the water from an ONMS small boat or sponsored mission such as, but not limited to, research, education, outreach, resource and habitat assessments, marine mammal disentanglement, and law enforcement. All ONMS vessels must comply with the operational protocols and procedures in the NOAA Small Boats Policy (NAO 209-125) and the best management practices identified in Appendix E. This category applies to all personnel, including crew, staff, visitors, volunteers, and students who may use or work upon any ONMS vessel, regardless of mission sponsor whether directly or indirectly involved. It includes vessel transiting to/from port, where to go, how long to stay there, what is needed to accomplish cruise purpose.
Vessel Maintenance	Regular activities are determined by the program engineer, vessel's crew and operations staff and performed on each vessel to ensure safety, compliance, and reduced risk. Includes vessel maintenance, disposal of waste, general ship operations and any standing orders that improve safety or reduce the potential for resource impacts.
Aircraft Operations	Activities include the use of motorized aircraft including unmanned aerial systems (UAS) for research and surveillance purposes.
Non-Motorized Craft	Activities include the use of any non-motorized craft, such as kayaks and canoes.
SCUBA or Snorkel Operations	Activities include any field work where personnel will be in the water. Includes numbers of divers, time underwater and location of dives.

[1] Vessel support for field operations includes ONMS-owned and -contracted vessels. Vessel maintenance includes only ONMS vessels. Aircraft operations include ONMS-contracted aircraft. Deployment of equipment includes ONMS-owned and -contracted equipment.

Tables 2 through 6 briefly summarize specific field operations at OCNMS, CBNMS, GFNMS, MBNMS and CINMS, respectively. Each project utilizes one or more of the categories of field operations defined in Table 1. The potential environmental consequences of these projects at each site are analyzed in Chapter 4 of this document.

All field operations conducted by ONMS are evaluated in this PEA, including those activities that would require a sanctuary-specific general permit for the purposes of management (referred to as the Superintendent's Permit). This PEA does not analyze field operations conducted as part of other ONMS permits. All permit applications are evaluated separately on a case-by-case basis and undergo a separate evaluation for compliance with NEPA and other environmental statutes at that time.

2.2.1 Olympic Coast National Marine Sanctuary Projects and Field Operations

Field operations at OCNMS focus on the several projects that support the mission of the sanctuary to protect the Olympic Coast's natural and cultural resources through responsible stewardship, to conduct and apply research to preserve the area's ecological integrity and maritime heritage, and to promote understanding through public outreach and education. Projects include seafloor mapping; monitoring of ocean conditions, populations, communities and ecosystems; training school teachers; and responding to marine mammal strandings.

Table 2. OCNMS Projects under Alternative 1

Project Title	Summary Description of Project	Categories of Field Operations
Vessel Operations	General vessel operations are not a project in and of themselves, but they support a great many of the sanctuary's projects including transits to and from project locations. ONMS small boats are operated according to all NOAA Small Boat Program guidelines (http://www.sbp.noaa.gov/policy/manual.html). In addition, the sanctuary vessel R/V *Tatoosh* follows additional, voluntary sanctuary standing orders to minimize impacts on sanctuary resources, particularly large whales, but also sea turtles and other smaller marine mammals. These standing orders are to be followed anytime large whales are known to be present or believed to be present in an area of operation, regardless of time of year. The general standing orders direct ONMS small boat operators to: • Follow NOAA National Marine Fisheries Service (NMFS) Whale Watching guidelines unless otherwise covered by a NMFS permit and only then with extreme caution.	Vessel Operations

	• Keep a sharp lookout. Vessel operators should always stay vigilant for marine mammals and other collision hazards. • Vessel speed. General operating speeds should not exceed 22 knots and not exceed 10 knots when large whales are visible within 1 nm of the vessel. • Stay near the helm controls. While in areas where large whales are likely to occur, operators should stay at the helm controls and be ready to take action immediately to avoid a whale. • Maintain distance. Once large whales are sighted, operators should stay at least 100 yards away, 200 yards away from killer whales and 50 yards away from sea turtles. • If large whales surface within 100 yards, operators should stop immediately and use prudent seamanship to decide to either move away slowly or wait for the animal to move away on its own. • When marine mammals are riding the bow wake, or porpoising nearby, operators should avoid drastic course or speed changes. • During night operations vessel speed should not exceed 10 knots, due to the increased chance of collisions. Lookouts should be posted, and the operator should use all means to enhance visibility (spotlights, night vision, FLIR, etc.). • Vessel crew should be trained to know the locations of, and avoid unnecessary transits within 0.5 nm of, known mammal haulout areas.	
Vessel maintenance and crew training	Vessel maintenance onboard the sanctuary R/V *Tatoosh* generally does not occur within the sanctuary. The sanctuary vessel, the R/V *Tatoosh* (41 feet, cruising speed of 22 knots[2]), is hauled out for dry dock maintenance annually. Minor maintenance such as oil changes and hull cleanings generally occur 1-2 times per year and may occur both in and out of the water in harbors and associated marine repair facilities outside the sanctuary. Fueling occurs dockside, in harbors outside of the sanctuary. Vessel crew training and safety drills occur at least 2 times per year inside and outside of sanctuary waters. Training activities may include fire drills, man overboard, SCUBA diver rescue, etc.	Vessel Operations Vessel Maintenance

[2] A table of all the ONMS vessels can be found in Appendix A.

Seafloor Habitat Characterization	Long-term effort to map seafloor habitat using sonar throughout OCNMS. Multibeam sonar surveys conducted from the sanctuary's research vessel with a goal of operating 10-15 field days per year. Sediment grab samples (approx. 50/year) are collected for ground truth of sonar. This program was initiated in 2000 and to date about 40% of the sanctuary seafloor habitat (3100 km2) has been mapped. Typically, the best weather for data collection falls in July and August although Tatoosh and the multibeam are prepared to collect data on any good weather day from May to October. OCNMS concentrates its mapping activities in less than 100m depths within 10 nautical miles of the rocky coast of the sanctuary. Surveys are typically conducted by the sanctuary vessel R/V *Tatoosh.* Seafloor data are collected with a hull-mounted Reson SeaBat 8101 Extended Range multibeam echosounder. The sounder has 150° maximum swath width (75° each side) and a 500m depth range capability. The Extended Range 8101 has a maximum transmit power of 220 dB µPa (micropascals) at 1m. The transmit pulse width is 21- 225 µS (micro-seconds) at 240 kHz. The ping rate range is 1-40 pings/second, governed by the 'round-trip transit and receive time' of the selected range. A typical OCNMS seafloor survey covers depths from 10-45 m; speed 6 kt; swath width maximum equal to 60°; transmit level 2 at 192 dB[3] (2 of 8 levels with Full power equal to 220dB); narrow transmit pulse 63 µS (between 21-225 µS); with ping rates from 18-40 pings/second over the course of a 12 hours survey day. If the survey is focused on shoals <15m, we may transmit up to 1M pings/sec. over an area of 3-4 miles within a survey day. Generally, throughout a 10 hour survey during daylight hours, we transmit less than 600K pings/sec. over an area that extends from shallow 10m nearshore to deeper 40m shelf where the ping rate is significantly less (18pps). The multibeam sonar is operated at the lowest power setting and is turned off when marine mammals have been sighted within 1nm of the vessel. Hydroacoustic activities may also be conducted by ONMS or by partners on behalf of ONMS, such as NOAA's Office of Coast Survey[4], and the may occur on ONMS vessels or	Vessel Operations Deployment of Remote Sensing Equipment Other Sampling Activities

[3] See page 3-6 of the SeaBat 8101 Operator's Manual. https://data.ngdc.noaa.gov/instruments/remote-sensing/active/profilers-sounders/acoustic-sounders/reson_seabat_8101_OpMan_302.pdf (accessed on June 25, 2018)

[4] The mission of NOAA's Office of Coast Survey (OCS) is to survey all navigationally significant waters of the U.S., including national marine sanctuaries, in order to produce navigational charts for the public. In 2013, OCS analyzed the impacts of their surveys and other field operations in a PEA which included analysis of their work in the southeastern U.S. and the Gulf of Mexico. NOS subsequently signed a Finding of No Significant Impact for OCS operations on May

	on NOAA ships, including but not limited to the *Rainier, Okeanos, Shimada*, etc.	
Coastal Oceanographic Moorings	Long term monitoring program utilizing the *R/V Tatoosh* to deploy, maintain, and recover moorings at 10-13 sites along the coast between May and October. Moorings are positioned along five transects in water depths ranging from 15 to 42 meters. Three people are needed to deploy/recover the moorings over the course of 3-4 days, and it takes 3-4 days to service all moorings. Distance travelled varies but a typical servicing, for all moorings, totals approximately 300-315nm round-trip, and moorings are typically serviced three times in a field season. 1-3 "winter" moorings have been deployed from October-May providing a unique winter dataset for temperature throughout the water column during the winter months. The monitoring program measures dissolved oxygen, temperature, conductivity, turbidity, and currents. These parameters can be used to assess and model climate change, larval dispersal, hypoxia, productivity, and harmful algal blooms throughout the sanctuary. Numerous partners utilize this data and/or request to put their instrumentation on OCNMS moorings.	Vessel Operations Deployment of Equipment on the Seafloor
Intertidal Monitoring	Long term monitoring of rocky and sandy sites on Makah and Quinault Indian reservations adjacent to OCNMS. Field work is four days per year with a team of four people conducting non-destructive monitoring of fixed plots. Standardized sampling protocols and database of observation can be found at www.MARINe.gov.	Onshore Fieldwork Other Sampling Activities
Marine Debris Monitoring	Coordination of citizen science project monitoring shoreline debris, with approx. 30 volunteers visiting 20 field sites one day per month. Average travel distance is 40 miles round trip. Data is provided to national database maintained by NOAA's Marine Debris Program.	Onshore Fieldwork
Marine Debris Cleanup	Two or more times per year, 1-day marine debris cleanup events are organized, in partnership with OCNMS, during which volunteers walk the shoreline to gather and remove debris. These cleanup events bring between 200 and 800 volunteers to the sanctuary shoreline for cleanup activities.	Onshore Fieldwork
Submarine Cable Habitat Recovery Monitoring	A seafloor habitat recovery survey of the Pacific Crossing-1 submarine cable routes through OCNMS is planned for 2016. A large vessel and deep sea research-grade ROV will	Vessel Operations Deployment of AUVs/ROVs/glide

29, 2013. OCS environmental compliance procedures require OCS to determine if each specific survey project falls within the scope of the OCS PEA.

	be contracted for this work, which is anticipated to include 7 days at sea.	rs/drifters
Pelagic Seabird Surveys	Monthly summer surveys of seabird distribution and abundance off the northern Washington Coast conducted from the sanctuary's research vessel. Between 2006 and 2012, an average of 2 surveys (one field day each) were completed per year along a 80 nm box transect. It is uncertain if these surveys will be conducted in the near future.	Vessel Operations
Seabird Colony Surveys	Tests were conducted in 2013 (7 field days) and 2014 (3 field days) to evaluate the use of UAS for video and photography capture for census of seabird colonies on USFWS refuge islands in OCNMS. A fixed wing UAS was launched from the sanctuary's vessel, and a quadracopter launched from shore sites. UAS overflights were as low as 200' above ground level during which professional wildlife biologists monitored for seabird and marine mammal disturbance. ESA Section 7 Biological Opinions were completed for these UAS activities. It is uncertain if these activities will be continued in the near future.	Aircraft Operations Vessel Operations
Ocean Literacy Teacher Workshops	Training of middle and high school teachers in ocean literacy, intertidal biology, and marine debris. The program is designed to integrate NOAA ocean literacy concepts and principles into western Washington formal and informal educational programs. Teacher professional development workshops provide content training in marine ecosystems, ocean conservation, and near shore field investigations, as well as pedagogical models for teaching inquiry science. The professional development training on the Outer Coast will also include content on traditional ecological knowledge, and we will work closely with the Makah Tribe and Quinault Nation cultural centers and the Quileute Tribal School, as well as with Tribal biologists. Approximately 25-50 teachers attend the multi-day workshop(s) annually.	Onshore Fieldwork
Marine Mammal Stranding Network	Respond to marine mammal stranding incidents to maximize survival of wildlife and to minimize interactions between wildlife and domestic animals (including humans). One or two OCNMS staff are involved, typically responding to 2 stranding events per year. Staff post signs, collect specimen data or retrieve carcasses for necropsy.	Onshore Fieldwork Other Sampling Activities

2.2.2 Cordell Bank National Marine Sanctuary Projects and Field Operations

Field operations at CBNMS focus on several projects that support the mission of the sanctuary to protect resources through responsible stewardship, to conduct and apply research to preserve the area's ecological integrity, and to promote understanding through public outreach and education. Projects include deepwater characterization using both ROVs and AUVs. In addition, the staff conducts monitoring of ocean conditions, populations, communities and ecosystems and collects baseline data for emerging management issues such as invasive species.

Table 3. CBNMS Projects under Alternative 1

Project Title	Summary Description of Project	Categories of Field Operations
Vessel Operations	General vessel operations are not a project in and of themselves, but they support a great many of the sanctuary's projects including transits to and from project locations. ONMS small boats are operated according to all NOAA Small Boat Program guidelines (http://www.sbp.noaa.gov/policy/manual.html). In addition, the sanctuary vessels *R/V Fulmar* and *R4107* follow additional, voluntary sanctuary standing orders to minimize impacts on sanctuary resources, particularly large whales, but also sea turtles and other smaller marine mammals. These standing orders are to be followed anytime large whales are known to be present or believed to be present in an area of operation, regardless of time of year. The general standing orders direct ONMS small boat operators to: • Follow NOAA NMFS Whale Watching guidelines unless otherwise covered by a NMFS permit and only then with extreme caution. • Keep a sharp lookout. Vessel operators should always stay vigilant for marine mammals and other collision hazards. • Vessel speed. General operating speeds should not exceed 22 knots and not exceed 10 knots when large whales are visible within 1 nm of the vessel. • Stay near the helm controls. While in areas where large whales are likely to occur, operators should stay at the helm controls and be ready to take action immediately to avoid a whale. • Maintain distance. Once large whales are sighted, operators should stay at least 100 yards away, 200 yards	Vessel Operations

	away from killer whales and 50 yards away from sea turtles. • If large whales surface within 100 yards, operators should stop immediately and use prudent seamanship to decide to either move away slowly or wait for the animal to move away on its own. • When marine mammals are riding the bow wake, or porpoising nearby, operators should avoid drastic course or speed changes. • During night operations vessel speed should not exceed 10 knots, due to the increased chance of collisions. Lookouts should be posted, and the operator should use all means to enhance visibility (spotlights, night vision, FLIR, etc). • Vessel crew should be trained to know the locations of, and avoid unnecessary transits within 0.5 nm of, known mammal haulout areas.	
Vessel maintenance and crew training	Vessel maintenance onboard the sanctuary R/V *Fulmar* and *R4107* generally does not occur within the Sanctuary. The R/V *Fulmar* (67 feet, cruising speed of 20 knots), and *R4107* (41 feet, cruising speed of 20kts[5]) are hauled out for dry dock maintenance annually. Minor maintenance such as oil changes and hull cleanings generally occur 6-8 times per year and may occur both in and out of the water in harbors and associated marine repair facilities outside the sanctuary. Fueling occurs dockside, in harbors outside of the sanctuary. Vessel crew training and safety drills occur at least 12 times per year inside and outside of sanctuary waters. Training activities may include fire drills, man overboard, SCUBA diver rescue, etc. Occasionally, training activities may involve other outside parties including USCG (towing, helicopter evacuation), and the large marine mammal entanglement team (grappling, tagging, kegging). *Note, the R/V Fulmar and R4107 are shared assets that work on behalf of CBNMS, GFNMS and MBNMS. The majority of maintenance and training activities occur in or near the vessel homeport in Monterey.*	Vessel Operations Vessel Maintenance
Applied California Current Ecosystem	A team of NOAA staff and partners conduct surveys 3-4 times a year in 8-day segments aboard the R/V *Fulmar*. Surveys started in May 2004, and to date 40 cruises have been completed. Observations of marine birds and mammals	Vessel operations Deployment of Remote Sensing Equipment Other

[5] See Appendix A.

Studies (ACCESS)	densities are counted along predetermined transect lines. The overall zooplankton community is sampled in the upper 50 meters using a hoop net, while the krill community from the ocean's surface down to 200 meters is assessed with targeted-sampling using a Tucker trawl. The hoop net data provide densities of zooplankton taxa, while the Tucker trawl data provide information on the species and age class composition of the krill population. In addition, acoustic backscatter data are collected to determine general abundance of krill. Phytoplankton community composition is assessed with vertical plankton net hauls; data are processed by California Department of Health as part of their state-wide program designed to detect toxin producing species of phytoplankton in ocean water before they form a potential toxic bloom and impact the public. At predetermined stations, water column data (salinity, temperature, fluorescence, dissolved oxygen) are collected using a Sea-Bird Electronics SBE 19Plus SEACAT CTD Profiler, Vessel operations equipped with a WET Labs WETStar fluorometer and a Sea-Bird Electronics dissolved oxygen sensor. Continuous underway data on surface temperature, salinity and fluorescence of chlorophyll-a are also collected. Marine mammal and bird surveys are conducted at speeds of 10kts along predetermined track lines. While conducting surveys there are at least 4 dedicated biologist observers recording animal sightings, species type and behavior. These observers are in addition to the vessel operators. The *Fulmar* is a single beam system. Acoustic backscatter data are collected at three different frequencies (38 kHz, 120 kHz, and 200 kHz) using the vessel's SIMRAD EK60 echosounder to determine general abundance of krill and fish while the vessel is underway on each survey day. Simultaneous use of several discrete echosounder frequencies facilitates accurate estimates of the abundance, and can also be used for species size and identification based on differences in frequency-dependent acoustic backscattering between species. Operations generally occur three times a year in middle to late May or June, middle to late July and middle to late-September. Each survey block is 6-10 days and is highly dependent on weather. Surveys are conducted from ½ nmi offshore to well offshore (about 45 nmi) Simrad's EK60 is a narrow beam scientific echo sounder system that operates in three frequencies 38, 120 and 200kHz. Each transducer has a nominal beam width of 7 degrees and has pulse duration of 1 millisecond. The system	Sampling Activities

	typically operates with a transmit power of 300W for 200kHz, 500W for 120 kHz, and 1000W for 38 kHz with a maximum source level of 229 dB referenced to 1 µPA. However, the system is not run at maximum power during operations.	
Deployment of AUVs/ROVs to Characterize the Sanctuary	A team of NOAA staff deploy a variety of Autonomous Underwater Vehicles (AUVs) and Remotely Operated Vehicles (ROVs) including a NOAA owned Phantom HD4 ROV and custom camera sled to explore and document unexplored habitats and significant archeologic sites. This project includes vessel operations aboard the sanctuary vessel R/V *Fulmar*, and deployment and retrieval of a variety of AUVs & ROVs. Operations are usually based out of Bodega Bay or Sausalito, sometimes involving transits to the far reaches of the sanctuary and usually last for several weeks. The video documentation of ecologically and culturally significant areas within the sanctuary has established a baseline of the seafloor habitats, associated taxa, and historic ship wrecks. The fall 2014 cruise found several historic ship wrecks and a species new to science.	Vessel operations Deployment of AUVs/ ROVs/ gliders/drifters

2.2.3 Greater Farallones National Marine Sanctuary Projects and Field Operations

Field operations at GFNMS focus on several projects that support the mission of the sanctuary to protect the Greater Farallones resources through responsible stewardship, to conduct and apply research to preserve the area's ecological integrity, and to promote understanding through public outreach and education. Projects include citizen science beach monitoring; partnering to monitor ocean conditions, populations, communities and ecosystems (refer to CBNMS ACCESS); training school teachers and educating students; and responding to vessel groundings and oil spills.

Table 4. GFNMS Projects under Alternative 1

Project Title	Summary Description of Project	Categories of Field Operations
Vessel Operations	General vessel operations are not a project in and of themselves, but they support a great many of the sanctuary's projects including transits to and from project locations. ONMS small boats are operated according to all NOAA Small Boat Program guidelines (http://www.sbp.noaa.gov/policy/manual.html). In addition, the sanctuary vessels *R/V Fulmar* and *R4107* follow additional, voluntary sanctuary standing orders to minimize	Vessel Operations

	impacts on sanctuary resources, particularly large whales, but also sea turtles and other smaller marine mammals. These standing orders are to be followed anytime large whales are known to be present or believed to be present in an area of operation, regardless of time of year. The general standing orders direct ONMS small boat operators to: • Follow NOAA NMFS Whale Watching guidelines unless otherwise covered by a NMFS permit and only then with extreme caution. • Keep a sharp lookout. Vessel operators should always stay vigilant for marine mammals and other collision hazards. • Vessel speed. General operating speeds should not exceed 22 knots and not exceed 10 knots when large whales are visible within 1 nm of the vessel. • Stay near the helm controls. While in areas where large whales are likely to occur, operators should stay at the helm controls and be ready to take action immediately to avoid a whale in your path. • Maintain distance. Once large whales are sighted, operators should stay at least 100 yards away, 200 yards away from killer whales and 50 yards away from sea turtles. • If large whales surface within 100 yards, operators should stop immediately and use prudent seamanship to decide to either move away slowly or wait for the animal to move away on its own. • When marine mammals are riding the bow wake, or porpoising nearby, operators should avoid drastic course or speed changes. • During night operations vessel speed should not exceed 10 knots, due to the increased chance of collisions. Lookouts should be posted, and the operator should use all means to enhance visibility (spotlights, night vision, FLIR, etc.). • Vessel crew should be trained to know the locations of, and avoid unnecessary transits within 0.5 nm of, known mammal haulout areas.	
Vessel maintenance and	Vessel maintenance onboard the sanctuary R/V *Fulmar* and *R4107* generally does not occur within the Sanctuary. The,	Vessel Operations Vessel Maintenance

crew training	R/V *Fulmar* (67 feet LOA, cruising speed of 20 knots), and *R4107* (41 feet LOA, cruising speed of 20kts[6]) are hauled out for dry dock maintenance annually. Minor maintenance such as oil changes and hull cleanings generally occur 6-8 times per year and may occur both in and out of the water in harbors and associated marine repair facilities outside the sanctuary. Fueling occurs dockside, in harbors outside of the sanctuary. Vessel crew training and safety drills occur at least 12 times per year inside and outside of sanctuary waters. Training activities may include fire drills, man overboard, SCUBA diver rescue, etc. Occasionally, training activities may involve other outside parties including USCG (towing, helicopter evacuation), and the large marine mammal entanglement team (grappling, tagging, kegging). *Note, the R/V Fulmar and R4107 are shared assets that work on behalf of CBNMS, GFNMS and MBNMS. The majority of maintenance and training activities occur in or near the vessel homeport in Monterey.*	
Beach Watch	Beach Watch is a long-term shoreline monitoring project that was founded over 20 years ago. This year-round assessment program is conducted by dedicated volunteers who survey an assigned beach twice per month within the Greater Farallones and Monterey Bay National Marine Sanctuaries. Volunteers collect data on live and dead species of birds and marine mammals. They also report violations, detect oil pollution, and collect oil samples. Since the fall of 1993, Beach Watch volunteers have conducted bi-monthly surveys of over 150 miles of coastal beaches from Point Año Nuevo in San Mateo County north to Bodega Head in Sonoma County. The program recently added an additional 15 beaches from Bodega to Point Arena, bringing the total number of beaches to 57. The evidence gathered by Beach Watch volunteers helps the federal government document the damage to wildlife and habitat from oil spills, determine clean up end points, identify birds and mammals at risk from oil pollution, and determine restoration projects. Data from Beach Watch has been used to secure more than $52 million in restoration funds to increase protection of natural resources and enhance lost recreational uses along the central and northern California coasts.	Onshore fieldwork Other Sampling
LiMPETS (Long-term Monitoring	LiMPETS (Long-term Monitoring Program and Experiential Training for Students) is an environmental	Onshore fieldwork

[6] See Appendix A.

Program and Experiential Training for Students)	monitoring and education program for students, educators, and volunteer groups. Two distinct monitoring programs make up the core of the LiMPETS network: since 2004, students and teachers have monitored 4 Rocky Intertidal sites an average of 5-10 times/yr; and since 2001 monitored 15 Sandy Beach sites an avg. 5-10 times/yr. The program is authorized under GFNMS and MBNMS multi-site research permit MULTI-13-008 for up to 19 permanent and temporary marker bolts (to establish monitoring transects).	
Responding to Vessel Groundings	Vessels run aground in the sanctuary on a regular basis (avg. 4-8 times per year). The US Coast Guard removes the fuel and hazardous materials, but leaves the grounded vessel on the shore. These can endanger wildlife. Usually these vessels are uninsured, and the responsible party does not have the resources to remove the vessels themselves. In either case, the sanctuary coordinates the emergency salvage, and oversees the operation to insure minimal disturbance to sanctuary resources. Salvage can take place from land, air, or sea, or a combination of these.	Onshore fieldwork Vessel operations

2.2.4 Monterey Bay National Marine Sanctuary Projects and Field Operations

Field operations at MBNMS focus on a variety of projects that support the mission of the sanctuary to understand and protect the coastal ecosystem and submerged cultural resources of central California. Projects include subtidal and kelp forest monitoring along the remote Big Sur coastline and deepwater characterization using ROVs. In addition, the staff conducts marine mammal and sea bird observations, tagging organisms, oceanographic monitoring, archeological/cultural research (primarily shipwrecks) and collecting baseline data for emerging management issues such as invasive species and marine reserves.

Table 5. MBNMS Projects under Alternative 1

Project Title	Summary Description of Project	Categories of Field Operations
Vessel Operations	General vessel operations are not a project in and of themselves, but they support a great many of the sanctuary's projects including transits to and from project locations. ONMS small boats are operated according to all NOAA Small Boat Program guidelines (http://www.sbp.noaa.gov/policy/manual.html). In addition, the sanctuary vessels *R/V Fulmar* and *R4107* follow additional, voluntary sanctuary standing orders to minimize impacts on sanctuary resources, particularly large whales, but also sea turtles and other smaller marine mammals.	Vessel Operations

	These standing orders are to be followed anytime large whales are known to be present or believed to be present in an area of operation, regardless of time of year. The general standing orders direct ONMS small boat operators to: • Follow NOAA NMFS Whale Watching guidelines unless otherwise covered by a NMFS permit and only then with extreme caution. • Keep a sharp lookout. Vessel operators should always stay vigilant for marine mammals and other collision hazards. • Vessel speed. General operating speeds should not exceed 22 knots and not exceed 10 knots when large whales are visible within 1 nm of the vessel. • Stay near the helm controls. While in areas where large whales are likely to occur, operators should stay at the helm controls and be ready to take action immediately to avoid a whale in your path. • Maintain distance. Once large whales are sighted, operators should stay at least 100 yards away, 200 yards away from killer whales and 50 yards away from sea turtles. • If large whales surface within 100 yards, operators should stop immediately and use prudent seamanship to decide to either move away slowly or wait for the animal to move away on its own. • When marine mammals are riding the bow wake, or porpoising nearby, operators should avoid drastic course or speed changes. • During night operations vessel speed should not exceed 10 knots, due to the increased chance of collisions. Lookouts should be posted, and the operator should use all means to enhance visibility (spotlights, night vision, FLIR, etc.). • Vessel crew should be trained to know the locations of, and avoid unnecessary transits within 0.5 nm of, known mammal haulout areas.	
Vessel maintenance and crew training	Vessel maintenance onboard the sanctuary R/V *Fulmar* and *R4107* generally does not occur within the sanctuary. The R/V *Fulmar* (67 feet, cruising speed of 20 knots), and *R4107* (41 feet, cruising speed of 20kts[7]) are hauled out for	Vessel Operations Vessel

[7] See Appendix A.

	dry dock maintenance annually. Minor maintenance such as oil changes and hull cleanings generally occur 6-8 times per year and may occur both in and out of the water in harbors and associated marine repair facilities outside the sanctuary. Fueling occurs dockside, in harbors outside of the sanctuary. Vessel crew training and safety drills occur at least 12 times per year inside and outside of sanctuary waters. Training activities may include fire drills, man overboard, SCUBA diver rescue, etc. Occasionally, training activities may involve other outside parties including USCG (towing, helicopter evacuation), and the large marine mammal entanglement team (grappling, tagging, kegging). *Note, the R/V Fulmar and R4107 are shared assets that work on behalf of CBNMS, GFNMS and MBNMS. The majority of maintenance and training activities occur in or near the vessel homeport in Monterey.*	Maintenance
Response to Vessel Casualties	Grounded, sunken or drifting vessels, considered vessel casualties, are inspected using onshore and seaborne surveys, SCUBA and ROV. Vessels and their parts are assessed for removal, which can involve contracting a salvor. Areas impacted are also assessed (if feasible) to determine level of resource damage. These projects average about twenty per year in MBNMS. Mission range can vary from single day within Monterey Bay, to multi-day on Big Sur/San Luis Obispo coast. Salvors are required to develop a salvage plan subject to approval by MBNMS.	Vessel operations SCUBA or Snorkel operations Deployment of AUVs/ ROVs/ gliders/ drifters Onshore fieldwork
ROV Deepwater Characterization of Sanctuary Ecologically Significant Areas	Using an ROV, conduct underwater video documentation over areas that are deemed ecologically significant within the MBNMS to characterize and establish a baseline of the seafloor habitats and associated taxa. These missions usually involve multiple days depending upon number of sites to be assessed. The project involves an average of 10 sea days/year at operation depths of approximately 300 meters (m) and roundtrip distances from Monterey of 60 to 80 nm to/from Pt Sur.	Vessel operations Deployment of AUVs/ ROVs/ gliders/ drifters
Vessel support for non-ONMS buoy deployment	Vessel support for non-ONMS buoy deployments including scientific buoys and acoustic listening stations for migratory species. Average 2-3 deployments per year at a roundtrip distance of 60-120 nm. These activities require an individual research permit. The following are three examples of such non-OMNS buoys recently deployed with ONMS vessel support: Scripps Coastal Data Information Program (CDIP) buoy deployed under a 5-yr permit (MBNMS-2013-003); the Naval Post Graduate School students' sub-surface mooring with acoustic receivers (MBNMS-2013-018-A2);	Vessel Operations Deployment of Equipment on the Seafloor

	and the Stanford Block Lab's acoustic listening devices for white sharks (MULTI-2013-007).	
Vessel support for non-ONMS ROV/AUV/glider deployment	Vessel support for non-ONMS AUV and glider deployments. Average of 5-7 deployments per year at a roundtrip of 20 nm. Research permits are issued for these activities. An example is the Naval Post Graduate School students who deploy and retrieve autonomous gliders and temporarily deploy surface drifters (MBNMS-2013-018-A2).	Vessel Operations Deployment of AUVs/ ROVs/ gliders/drifters
Motorized Personal Watercraft (MPWC) Zone Marker Buoy Deployment & Maintenance	Recover, refurbish, and redeploy 13 Class IV ionomer foam-can marker buoys and moorings in sandy locations ranging in depth from 50 – 270 feet. MBNMS maintains buoys for three MPWC zones outside the harbors of Monterey, Moss Landing, and Santa Cruz. This maintenance activity is typically conducted for 6-7 buoys/year but can involve additional buoys if storms have caused buoy loss or chain breakage. Roundtrip transit distances from Monterey range from 8 to 40 nm. Each mooring consists of a buoy, a light (for Monterey moorings), ½" top chain, 1" nylon riser line (for deep moorings), ¾" chafe chain, additional ½" bottom chain (for deep moorings), a 200 lb steel DorMor anchor, and multiple steel shackles and swivels.	Vessel Operations Deployment of Equipment on the Seafloor
SCUBA Dive Operations	Science diving operations that include nearshore characterization studies, habitat studies, species studies, oceanographic studies, benthic studies, and natural resource damage assessments. along the Big Sur coast as well as proficiency dives in Monterey for 5 personnel. Big Sur dives are sometimes multi-day missions if in the southern region, otherwise they are conducted over the course of a single day. Averaging about 10-15 dive days per year. Depending on location and sea state, typically one to three dives occur per day. Roundtrip transit distance ranges from 4 to 160 nm.	Vessel Operations SCUBA or Snorkel operations
Team OCEAN Volunteers	Established in 2000, Team OCEAN (Ocean Conservation Education Action Network) has put approximately 50 trained, knowledgeable naturalists out on the water in about 15 sanctuary kayaks to greet and interact with fellow day kayakers. The naturalists serve as docents for the marine sanctuary, promoting respectful wildlife viewing, and protection of marine mammals from a disturbance. Naturalists tend to work around weekends for an average of 45 days of effort each spring and summer.	Non-motorized craft
Water Quality Monitoring	MBNMS has supported 3 voluntary water quality monitoring programs since 2000. The annual First Flush program utilizes 67 volunteers to collect water samples at	Onshore fieldwork

Volunteers	storm drain outfalls during the first significant rain event of the fall season for water quality analysis. Snapshot Day is a spring event where 200 volunteers collect water samples from creeks and rivers for analysis. Urban Watch is a summer dry-weather monitoring program, where some 30 volunteers collect effluent samples at key urban storm drain outfalls to test for chemical discharges into storm drains impacting MBNMS.	Other Sampling Activities
Beach COMBERS	Established in 1997, approximately 85 Beach COMBERS (Coastal Ocean Mammal / Bird Education and Research Surveys), collect baseline information on rates of beach stranding for all species of marine birds and mammals in Monterey Bay, as well as presence of tar and oil. Each volunteer surveys an assigned 5 km beach segment once per month. Some beaches are surveyed twice per month. The length of total shoreline surveyed each month is 44.6 miles. The long-term objectives of the program are to provide a baseline of information on the average presence of beachcast marine organisms and to assist the sanctuary in the early detection of mortality events triggered by natural and anthropogenic environmental perturbations such as harmful algal blooms and oil spills. Occasionally beachcast organisms and tar/oil samples are collected.	Onshore fieldwork Other sampling activities
Drifter Buoy Deployment	Deployment of drifter buoys in MBNMS. These buoys are deployed on an "as-needed" basis dependent on partner organization needs and funding. In 2010 and 2012, MBNMS participated with the NOAA Climate Program Office to deploy drifter buoys as part of an educational program for local high school students. The project was associated with the Blue Ocean Film Festival. For each demonstration, approximately 40 students were taken to sea on a 20-mile round trip to observe deployment of drifter buoys and learn about modern ocean observation systems. The students then tracked the telemetry for the drifter buoys for up to 6 months to learn about ocean surface currents and temperature.	Vessel operations Deployment of ROV/ AUV/ gliders/ drifters
Response to Whale Entanglement	Sanctuary vessels are occasionally called on to support response to marine mammal entanglement events in the Monterey Bay vicinity in close coordination with NMFS and the Whale Entanglement Team (WET). In the recent past this has equated to approximately one to two days at sea per year. Activities are covered under NMFS permit for large mammal disentanglement.	Vessel Operations Other Sampling Activities

2.2.5 Channel Islands National Marine Sanctuary Projects and Field Operations

Field operations at CINMS focus on a variety of projects that support the mission of the sanctuary to protect the Channel Islands' natural and cultural marine resources through responsible stewardship, to conduct and apply research to preserve the area's ecological integrity and maritime heritage, and to promote understanding through public outreach and education. Projects typically include monitoring of oceanographic conditions, water quality and sediment sampling, larval fish recruitment surveys, acoustic monitoring, aerial monitoring of marine mammals and vessel use, deep water habitat surveys, unmanned aircraft systems testing, and shipwreck reconnaissance expeditions.

Table 6. CINMS Projects under Alternative 1

Project Title	Summary Description of Project	Categories of Field Operations
Vessel Operations	General vessel operations are not a project in and of themselves, but they support a great many of the sanctuary's projects including transits to and from project locations. ONMS small boats are operated according to all NOAA Small Boat Program guidelines (http://www.sbp.noaa.gov/policy/manual.html). In addition, the sanctuary vessels *R/V Shearwater* and *Sharkcat* follow additional, voluntary sanctuary standing orders to minimize impacts on sanctuary resources, particularly large whales, but also sea turtles and other smaller marine mammals. These standing orders are to be followed anytime large whales are known to be present or believed to be present in an area of operation, regardless of time of year. The general standing orders direct ONMS small boat operators to: • Follow NOAA NMFS Whale Watching guidelines unless otherwise covered by a NMFS permit and only then with extreme caution. • Keep a sharp lookout. Vessel operators should always stay vigilant for marine mammals and other collision hazards. • Vessel speed. General operating speeds should not exceed 22 knots and not exceed 10 knots when large whales are visible within 1 nm of the vessel. • Stay near the helm controls. While in areas where large whales are likely to occur, operators should stay at the helm controls and be ready to take action immediately to avoid a whale in your path.	Vessel Operations

	• Maintain distance. Once large whales are sighted, operators should stay at least 100 yards away, 200 yards away from killer whales and 50 yards away from sea turtles. • If large whales surface within 100 yards, operators should stop immediately and use prudent seamanship to decide to either move away slowly or wait for the animal to move away on its own. • When marine mammals are riding the bow wake, or porpoising nearby, operators should avoid drastic course or speed changes • During night operations vessel speed should not exceed 10 knots, due to the increased chance of collisions. Lookouts should be posted, and the operator should use all means to enhance visibility (spotlights, night vision, FLIR, etc.). • Vessel crew should be trained to know the locations of, and avoid unnecessary transits within 0.5 nm of, known mammal haulout areas.	
Vessel maintenance and crew training	Vessel maintenance onboard the sanctuary R/V *Shearwater* and *Sharkcat* generally does not occur within the Sanctuary. The, R/V *Shearwater* (62 feet, cruising speed of 20 knots), and *Sharkcat* (28 feet, cruising speed of 30kts[8]) are hauled out for dry dock maintenance annually. Minor maintenance such as oil changes and hull cleanings generally occur 6-8 times per year and may occur both in and out of the water in harbors and associated marine repair facilities outside the sanctuary. Fueling occurs dockside, in harbors outside of the sanctuary. Vessel crew training and safety drills occur at least 12 times per year inside and outside of sanctuary waters. Training activities may include fire drills, man overboard, SCUBA diver rescue, etc. Occasionally, training activities may involve other outside parties including USCG (towing, helicopter evacuation), and the large marine mammal entanglement team (grappling, tagging, kegging).	Vessel Operations Vessel Maintenance
Oceanographic and acoustic moorings	13 moorings (single point anchor on soft bottom in roughly 60 feet of water, with sub-surface orange floats 10-20 feet below the surface) with temperature loggers, VR2 acoustic recorders, and SeaFET are installed in various locations around the Northern Channel Islands for long term tracking of fish movement, water temperature, pH, and marine debris	Vessel Operations Deployment of Equipment on the Seafloor SCUBA or

[8] See Appendix A.

	degradation testing. They are maintained (swapping out data loggers; inspection and cleaning of the moorings; replacing chain/moorings as needed) by CINMS divers 2-3 times per year, roughly 4 days at sea (DAS) per evolution. This requires simple hand tools. This project includes vessel operations aboard a sanctuary vessel, SCUBA operations, and deployment of marker buoys. Each day of operations, up to four sites can be completed equating up to 100nm. Three to five divers conduct up to four dives per day for a maximum of 40 minutes per dive.	Snorkel Operations
SAMSAP	The Sanctuary Aerial Monitoring Spatial Analysis Program (SAMSAP) has provided aerial assessments of visitor use and marine mammal sightings since 1997. When the program is operating, flights are conducted above the sanctuary 4-8 times per year (equating to one day per evolution) at a base altitude of 1000 feet. Two transects are flown: 1) one that follows a "figure eight" pattern near the shorelines between and around the five main islands in the sanctuary, and 2) one that flies a single loop around the sanctuary at a distance of 3 nm from island shores. The aircraft used for these operations is a Partenavia P68-OBS "Observer" light twin engine fixed wing aircraft chartered through Aspen Helicopters in Camarillo, California.	Aircraft Operations
ROV Surveys	Two major projects utilize the ROV *Beagle*, owned and operated by Marine Applied Research and Exploration (MARE). This observation class ROV is powered by 1,000 volts AC and has electrical thrusters. The ROV weighs 500 lbs., and the hardware connecting it to the vessel weighs 600 lbs. For the majority of this work, the ROV does not disturb the sea floor environment, using video and still photography for analysis; however, on occasion samples are collected. The projects are marine protected areas (MPA) monitoring and Deep Sea Coral monitoring. These are long term projects. Deep Sea Coral monitoring includes transect lines within the sanctuary from 150m to 600m water depth. This project supports the sanctuary by long term monitoring of benthic coral environments. The MPA monitoring project revisits the 10 MPA baseline sites (5 inside and 5 outside) sampled in 2003-2009 by MARE and California Department of Fish and Game (CDFW). Data collected during the project will be used to determine what changes, if any, have occurred in fish and invertebrate populations after 10 years of protection under MPA designation. These projects include vessel operations aboard a sanctuary vessel, ranging	Vessel Operations Deployment of Remote Sensing Equipment Other Sampling Activities

	from five to 20 DAS, many of which are overnight trips.	
Unmanned Aircraft Systems (UAS)	UAS operations encompass both land-based operations and vessel-based operations. Several aircraft platforms are also used, primarily using NOAA's PUMA aircraft[9]. These projects require significant lead time and approval through NOAA Aircraft Operations Center (AOC) and the Federal Aviation Administration in order to conduct operations. At least two pilots are required for each flight. Vessel and shore-based operations have been conducted to test the feasibility of using these UAS for oil spill response, for marine mammal and marine debris tracking/observation, sea bird habitat monitoring, etc. Sanctuary support of these operations have ranged from four to 10 days, approximately half of which are conducted at sea.	Aircraft Operations Vessel Operations
Plumes and Blooms	The goal of the Plume and Blooms project is to describe and monitor the seasonal, inter-annual, and long-term variability of the Santa Barbara Channel water components through the development and maintenance of consistent time series measurements. The field program consists of monthly observations of optical properties of the waters alongside physical, chemical, and biological characteristics. The repeated observations are performed at 7 stations distributed along a transect line running from Santa Rosa to Goleta Point. The data collected during the cruises include conductivity, temperature, depth and optical profiles, light absorption properties, phytoplankton pigments, nutrients, silica, alkalinity, organic and inorganic carbon, concentration and size distribution of suspended particles and harmful algal bloom monitoring. The development of this data set provides a framework for temporal and spatial variability analysis. It also represents a critical step for ocean color algorithm development and satellite measurement validation. The hydrographic observations from this project also provide an offshore end member sampling for the Santa Barbara Coastal Long-Term Ecological Research site (SBC-LTER). These projects include vessel operations aboard a sanctuary vessel, approximately 11 DAS per year, approximately 50 nm round trip per evolution.	Vessel Operations Other Sampling Activities
Algal bloom dynamics and the vertical transport	The goal of this project is to understand the mechanisms that promote the production and export of domoic acid, a toxin produced by harmful algal blooms, from surface waters to	Vessel Operations Other Sampling

[9] See Appendix A.

of domoic acid to depth in the Santa Barbara Channel (Sediment Trap)	depth in the Santa Barbara Basin by investigating the factors that promote domoic acid export from the surface waters, how rapidly domoic acid is released into the dissolved phase after production, and what controls the magnitude of this release on seasonal and annual time scales both in the water column and at the seafloor. This project interfaces with the ongoing Plumes and Blooms Program which uses the R/V *Shearwater* to collect monthly samples. This work collaborates with Plumes and Blooms, with the LTER Program, and with a USGS funded program, by looking at how long term changes in the ecology and chemistry of the Basin have impacted particle flux over time – including such issues as ocean acidification, changes in current circulation, upwelling intensity, etc. Two Mark VII automated sediment traps are attached to an 800-lb sacrificial anchor which attaches to the mooring chain by hydrostatic releases. The sediment traps are located at approximately 200 m and 540 m depth are currently deployed in the channel to provide continuous collection of sinking particles, the top most float is located 150 m below the surface, total water depth at the site, mid-channel, is roughly 600 m. This project includes vessel operations aboard a sanctuary vessel. The sediment traps and mooring are recovered and redeployed up to twice per year, approximately two to four DAS, approximately 30 nm round trip per evolution.	Activities
Monitoring of Juvenile Fish and Invertebrate Recruitment Variation (SMURF)	The goal of this project is to monitor the recruitment variation and larval transport of juvenile fish and invertebrates within the CINMS. Artificial substrates called SMURFs (Standard Monitoring Unit for the Recruitment of Fish) and specialized invertebrate collectors allow scientists to collect high resolution settlement data on many species important to CINMS. These SMURFs are located in triplets at 8 sites within CINMS. They are attached to single point moorings on soft substrate, usually at about 40 ft water depth, with the top float at the surface, close to shore. The long-term data set contains recruitment data from sites located throughout CINMS over the past 13 years. The SMURFs act as artificial kelp that provides structure for larvae being delivered to the reef giving relative abundance of individuals available for recruitment at that particular site and can be compared with the other sites. The invertebrate collectors also act in the same manner and provide insight into relative abundance of larval invertebrate pulses across CINMS (including commercially and ecologically important urchins). Collections usually require two days of Sanctuary boat time a month, utilizing the Sanctuary boat for up to 18 DAS per	Vessel Operations SCUBA or Snorkel Operations Other Sampling Activities

	year, approximately 80 nm to 100 nm per day. SMURF collections are done via snorkeling, with two snorkelers collecting SMURFs at up to 6 sites per day.	
Monitoring Ambient Noise in the Channel Islands National Marine Sanctuary (HARPs)	The goal of this project is to monitor ambient noise using High-frequency Acoustic Recording Packages (HARPs) near the Channel Islands National Marine Sanctuary (CINMS). The HARP Moorings are located in 500 m to 1000 m water depths. The 440 lb HARP frame is located on the sea floor with data loggers, hydrophone, and floatation totaling a height off the bottom of no more than 40 m. These instruments record acoustic data at high bandwidth (100 kHz) and for long time periods (up to 6 months) to provide information on ambient noise (including the presence of vessels) as well as the sounds of marine mammals. Five sites are currently occupied with HARPs, two of which are in the Santa Barbara Channel, one located off Santa Barbara Island, and two between San Nicholas and San Clemente Islands. This study monitors the contribution of vessel traffic to the ambient noise field of the CINMS, and potential impacts of noise on marine mammals in the area. This project includes vessel operations aboard a sanctuary vessel, up to 9 DAS per year.	Vessel Operations Other Sampling Activities
Channel Islands Shipwreck Reconnaissance Expedition	The goal of this project is to conduct SCUBA dive operations to continue ongoing site monitoring in evaluating environmental and human impacts to the CINMS submerged maritime heritage resources, and complete underwater drawings of artifacts not included on current underwater site maps. Conduct still photography and videography record of dive operations and wreck site artifacts for use in site management, underwater slate development, and museum exhibits. This allows for the management and protection of submerged archaeological sites within the Sanctuary in accordance with the National Marine Sanctuaries Act. This project includes vessel operations aboard a sanctuary vessel, approximately five overnight DAS per year. Five to six divers conduct up to four dives per day for a maximum of 60 minutes per dive.	Vessel Operations SCUBA or Snorkel Operations
Seafloor Habitat Characterization*	CINMS is conducting a long-term effort to map and characterize seafloor habitat using multibeam sonars and other active acoustic technology throughout sanctuary. This will be done through a variety of platforms across a number of missions in upcoming years. Multibeam sonar surveys are conducted from NOAA ships, mapping AUVs[10], or	Vessel Operations Deployment of Remote Sensing Equipment

[10] The AUV multibeam used in CINMS is an Office of Coast Survey owned piece of equipment.

	chartered vessels. Annual days of operation will vary with vessel availability and funding, but staff has a goal of operating 10-15 field days per year until the sanctuary is entirely mapped. Each field day will have up to 24 hours of continual mapping operations with the majority of effort being conducted from Spring until early Fall when seas are calmer (however, operations may occur outside of this time frame if vessel and technology becomes available and if seas state allows). This effort was initiated in 2015 and to date about 50% of the sanctuary seafloor habitat (about 3100 km^2) has been mapped (most of which was acquired prior to this project). As the majority of areas that require mapping are away from sensitive areas for marine mammals like haulouts, CINMS staff will work to minimize spatial overlap between mapping and sensitive areas during periods of high habitat use in summer months. Data collection is conducted primarily using the multibeam systems such as the Simrad ME70, Simrad EK60 and Kongsberg EM302. Speeds of collection for all systems can vary from 4 knots up to 8 knots. Simrad's ME70 operates in the 70-120 kHz range, has a 140 degree maximum swath width, has pulse duration of 64-5120 µs, and a maximum source level of 150 dB. Simrad's EK60 is a splitbeam multibeam system that operates in the 38-200 kHz range, has a 140 degree maximum swath width, has pulse duration of 64-16,384 µs, and a typically operates on a power of 750 W. The Kongsberg EM302 is a 30kHz multibeam system and has a swath width 5.5 times water depth up to a 8 km wide swath. Based on best professional judgement, ping rates will likely occur at 1 ping per second across these systems, leading to a maximum of approximately 86,000 pulses in a field day (for a 24 hour operation). This pulse rate may seem high, but pulses will typically be outside of the hearing range of most marine species. The *Shearwater* uses a single beam system. CINMS incorporates operational mitigation measures into its survey activities to reduce or avoid these impacts wherever practicable. Vessels operate at a slow speed (4-8 knots) during survey efforts. CINMS uses downward-facing, high frequency echosounders out of most species' hearing range. In addition, the sonars are operated at the lowest power setting and are turned off when marine mammals have been sighted within 1 nm of the vessel. CINMS requires that a designated lookout stand watch on the ship's bridge during transit and survey operations,	

	scanning the water for humans, animals, vessels, and other objects. Personnel on board NOAA ships and contractor vessels are required to monitor and report locations of marine mammal sightings as part of their regular operational protocol. Currently, the lookout records any sightings of marine mammals on either a paper marine mammal log or by an automated marine mammal report logging system such as SpotterPro, a smartphone application for filing reports. Regardless of format or mode of delivery, the observation report records the species, number of animals, behavior, time, and location of the sighting. Each year, NOAA ships are required to include 24 hours of "safety stand down" training activities for on-board personnel. NOAA is incorporating basic strategies for marine mammal detection and monitoring into standard ocean observatory roles for personnel.	
Acidification Studies	The goal of this project is to characterize the environmental conditions (pH, temperature) of three sites within the Channel Islands National Marine Sanctuary using autonomous pH sensors and CTD casts, and to collect planktonic calcifiers at sea using bongo tows[11]. The long-term data collected by these sensors allows scientists to design experimental perturbations to reflect the conditions experienced by these organisms, and the combination of these approaches allows them to "co-locate" environmental data from the sensors with the physiological performance of the study organisms. The continued efficacy of this project relies heavily on regular visits to field stations to perform necessary calibrations and replacements of the sensors. This project includes vessel operations aboard a sanctuary vessel, approximately four days at sea per year and approximately 60 nm to 80 nm round trip per day.	Vessel Operations Other Sampling Activities
Response to Vessel Groundings	Vessels that sink or, more commonly, run aground on island shores are inspected from island shores, aircraft, vessels, kayaks, or sometimes SCUBA and assessed for full removal, which usually involves contracting a salvor. The removal process involves shoreline debris cleanup by hand, and refloating and towing activities performed by contractors. For sanctuary vessel support, this is an as needed project requirement, equaling at most two days at sea per year.	Vessel Operations SCUBA or Snorkel Operations Onshore Fieldwork

[11] The Bongo tow is an oblique tow which is deployed at a 45 degree wire angle to approximately 210 meters (300 meters wire out). The Bongo frame is retrieved with same 45 degree wire angle.

Response to Whale Entanglement	Sanctuary vessels are occasionally called on to support response to marine mammal entanglement events in the Santa Barbara vicinity in close coordination with NMFS and the Whale Entanglement Team (WET). In the recent past this has equated to approximately two days at sea per year. Activities are covered under NMFS permit for large mammal entanglement.	Vessel Operations
Drifter Buoy Deployment	The goal of this project is to create an opportunity for K-12 teachers and students to understand how research and monitoring are used in management of marine resources, working in coordination with NOAA's "Adopt a Drifter" Program. This program establishes scientific partnerships between schools around the world in order to engage students in activities and communication about ocean climate science. Drifters are deployed from vessels throughout the NOAA Fleet, the surface float is approximately 1 foot in diameter with a sea temperature sensor is located on the bottom of the float with a sea anchor attached to stabilize the float. There are approximately 1250 drifters active in the ocean at any given time, feeding information to satellites and being tracked by classrooms around the world. This project includes vessel operations aboard a Sanctuary vessel, approximately one to two days at sea per year.	Deployment of AUVs/ROVs/gliders/drifters Vessel Operations
Vessel Operations Support for Partner Projects	Boat operations in support of a variety of projects led by partners, including personnel transfers, transport to the Channel Islands, and occasionally patrolling no entry zones at Vandenberg Air Force Base. This often requires use of sanctuary vessels, using anywhere from five to 15 days at sea per year.	Vessel Operations

Table 7 describes the specific field operations at OCNMS, CBNMS, GFNMS, MBNMS, and CINMS with respect to the projects described above. Field activities are estimated annually and projected for the next five years. The potential environmental consequences of these field operations will be analyzed in Chapter 4 of this document.

Table 7. Five year projection of ONMS West Coast Region Field Operations under Alternative 1

Categories of Field Operations	OCNMS Annual Activities	CBNMS Annual Activities	GFNMS Annual Activities	MBNMS Annual Activities	CINMS Annual Activities	Estimate for West Coast Region for the next 5 years

Vessel Operations (DAS/year)	Estimated 25-34 days at sea/year	Estimated 34-47 days at sea/year	0 (Included in CBNMS)	Estimated at 44-50 days at sea/year	Estimated 86-114 days at sea/year	270 days at sea/year, 1350 days at sea over the next five years.
Vessel Operations Maintenance (vessels maintained)	1 vessel maintained per year. Approx. 3 - 5 days at sea/year	0	0	2 vessels maintained per year. Approx. 15-20 days at sea/year	2 vessels maintained per year. Approx. 7-10 days at sea/year	6 vessels maintained per year, 30 vessels maintained over the next five year
Aircraft Operations (hours/year)	Unmanned Aerial Systems (UAS): 18-42 hours/year	No routine operations planned	No routine operations planned	No routine operations planned	Unmanned Aerial Systems (UAS): 60 hours/year Aerial monitoring program (SAMSAP): 4-5 flights/year at 6hrs duration each	UAS: 78-102 hrs/year. 390-510 hrs over the next five years. SAMSAP: 4-5 flights a year 6hrs duration for a total of 24-30hrs per year. 20-25 flights over the next five years for a total of 120-150 hrs over the next five years.
Non-motorized Craft (hrs/year)	0	0	0	TeamOCEAN 50 people for 1100hrs/yr	0	1100 hrs/year. 5,550 hrs over five years.
SCUBA or Snorkel Operations (dives/year)	0	0	0	50-225 dives/year	400-460 dives/year	450-685 dives/year, 3,425 dives over the next five years.
Onshore Fieldwork people x days	540 – 940 people days/year	0	Beach Watch: 100 volunteers x 24 surveys per year x .5 day = 1200 people days/yr	BeachCOMBER: 85 volunteers x 12 surveys x .5 day = 510 people days/yr WQ Volunteers 297 volunteers	Groundings: 2 person x 6 hours x 2 incidents = 3 people days/yr	3,650-3,690 people days/yr., 18,250-18,450 people days/yr over 5 years

			LiMPETS = 1500 students x .5 day = 750 people days/yr Groundings: 1 person x 2 days x 4 to 8 groundings = 8 to 16 person days/yr (highly variable)	x 3 surveys x .5day = 445 people days/yr Groundings: 1 person x 2 days x 20 groundings = 40 person days/yr (highly variable)		
Deployment of AUVs/ ROVs/ gliders/ drifters (deployments/ year)	7 days at sea x 2 deployments (1yr only)	10-15 days at sea x 2 deployments per day = 20-30 deployments/ yr	0	ROV Ops 10 days at sea x 2 deployments per day = 20 deployments/yr ONMS drifter buoys 1 deployment/yr Non-ONMS drifter buoys 2-3 deployments/yr Non-ONMS gliders 5-7 deployments/yr	12-42 deployments/ yr	67-110 deployments/yr, 335-550 deployments over 5 years
Deployment of Remote Sensing Equipment(days at sea/year)	10-15 days at sea/yr for multibeam surveys	ACCESS: 24-32 days/yr	0	0	Approx.10-15 days at sea/year for multibeam surveys from NOAA ships and vessels of	44-62 days at sea/yr, 220-310 days at sea over five years

					opportunity.	
Deployment of Equipment on the Seafloor (buoys/year)	10-13 buoys/yr	0	0	6-7 buoys/yr	13 buoys/yr Acoustic recording packages (HARP) deployment 10/yr; SMURF 8/yr	47-51 deployments of buoys/yr, 235-255 deployments over five years
Other Sampling Activities	Habitat Mapping Support: 50 grab samples over 10-15 days Intertidal Monitoring Samples: 4 days per year Marine Mammal Stranding: 2 days per year	ACCESS Samples: 24-32 days/yr	Beach Watch Sampling: 100 volunteers x 24 surveys per year x .5 day = 1200 people days/yr	BeachCOMBER Sampling: 85 volunteers x 12 surveys x .5 day = 510 people days/yr WQ Volunteers Sampling: 297 volunteers x 3 surveys x .5day = 445 people days/yr Whale disentanglement support: 2-4 days/yr	Whale disentanglement support 2 days/yr; Plumes and Blooms: 11 days/yr Sediment trap deployment 2-4 days/yr; ROV Samples: 12-42 deployments/yr Acidification sampling: 4 days/yr	2200-2275 days/yr, 11,000-11,375 days over five years

2.3 Alternative 2: Conduct Field Operations without Voluntary and Precautionary Procedures for Vessel Operations

Alternative 3 is identical to Alternative 1 identified above with the exception that certain status quo vessel operations would be modified. Specifically, in Alternative 2, ONMS vessels would be operated in accordance to NOAA Small Boat Program standards and other applicable statutes and regulations, but with the exception of ONMS vessel operations best practices.

The voluntary operating procedures and standing orders described in Section 2.2 would not be followed under this alternative, nor would any of the recommended additional mitigations be implemented. All required mitigations, however, would be implemented. Accordingly, ONMS vessel operations in the five West Coast national marine sanctuaries would not be subject to the additional vessel speed restrictions, the daylight operating restrictions, the prescribed distance from protected species requirements, or the nighttime marine mammal/other species lookout requirement.

3.0

AFFECTED ENVIRONMENT

This section includes a brief summary of the, physical, biological, socioeconomic and maritime heritage and cultural environments for the region that may be affected by the proposed action. For a more complete description of the affected environment at each of the sanctuaries in the West Coast Region, including references and citations, please see the following websites:

- Olympic Coast National Marine Sanctuary Final Management Plan and Environmental Assessment Section 6 p. 113-162 (OCNMS 2011)
  http://olympiccoast.noaa.gov/management/managementplan/managementplanwelcome.html

- Cordell Bank National Marine Sanctuary Final Management Plan and Environmental Impact Statement p. 8-15 and Chapter 4.1-4.9, respectively (CBNMS 2014)

  http://cordellbank.noaa.gov/management/plan.html

- Greater Farallones National Marine Sanctuary Final Management Plan and Environmental Impact Statement p. 13-32 (GFNMS 2014)

  http://farallones.noaa.gov/manage/management_plan.html

- Monterey Bay National Marine Sanctuary Final Management Plan and Environmental Impact Statement Section 1 p. 25-42 and Chapter 3.2-3.14, respectively (MBNMS 2008)

  http://montereybay.noaa.gov/intro/mp/mp.html

- Channel Islands National Marine Sanctuary Final Management Plan and Environmental Impact Statement Section 2 p. 15-54 (CINMS 2009)

  http://channelislands.noaa.gov/management/manplan/reports.html

3.1 Olympic Coast National Marine Sanctuary

3.1.1 Physical Environment

Physical Characteristics/Geology

The physical setting of the sanctuary is the structural and dynamic foundation for its biological processes. Through the physical setting, the linkages between its geography, geology, oceanography, water quality, air quality, acoustics and regional and large-scale ecosystem processes connect with and directly impact local productivity and biodiversity patterns in the sanctuary.

Extending seaward 25 to 40 nm (46 to 74 kilometers), the sanctuary borders a largely undeveloped coastline, enhancing the protection provided by both the 65 mile-long (104 kilometer) coastal strip of Olympic National Park (ONP) that includes 52 miles (87 kilometers) of designated wilderness coast, as well as the approximately 600 offshore islands and emergent rocks within the Washington Maritime National Wildlife Refuge Complex.

OCNMS lies in the northern portion of the Oregonian biogeographic province extending from Point Conception, California, to Cape Flattery, Washington. The province is characterized by a narrow continental shelf, mountainous shoreline, steep rocky headlands, sandy pocket beaches with sea stack islands, many small and a few large rivers, and small estuaries with barrier islands. The province is also noted as exhibiting the greatest volume of upwelling in North America. This nutrient-rich upwelling zone drives high primary productivity and supports a multitude of marine habitats. The sanctuary resides within the California Current System (CCS) and represents one of North America's most productive marine ecosystems.

The Olympic Coast is located at a tectonically active boundary known as the Cascadia Subduction Zone, where the edge of the North American continental plate meets and overrides the Juan de Fuca oceanic plate. The geologic activity in the area creates potential hazards such as earthquakes and associated submarine landslides, tsunamis and volcanic eruption.

Along the outer coast of Washington the continental shelf extends 7 to 35 nm (13 to 64 kilometers) and provides a relatively shallow coastal environment between the near shore and the shelf break at about the 100-fathom (180-meter) contour. The majority of the sanctuary overlays the continental shelf. The shelf is composed primarily of soft sediment and glacial deposits of cobble, gravel and boulders, punctuated by rock outcrops. The majority of the sanctuary seafloor has not yet been adequately mapped or characterized, so a full understanding of sediments and habitat distribution remains elusive.

The sanctuary includes portions of the Nitinat, Juan de Fuca, and Quinault submarine canyons that cut into the continental shelf along the western boundary of the sanctuary. The Quinault Canyon is the deepest, descending to 1,420 m (777 fathoms or 4,660 feet), the deepest point within the sanctuary. The Juan de Fuca Canyon transects the northern portion of the sanctuary

angling toward the Strait of Juan de Fuca. These canyons are dynamic areas where massive submarine landslides occur on the steep side walls and canyon bottoms collect sediment deposited from above.

Broad beaches, dunes, and ridges dominate the coastline from Cape Disappointment, on the north side of the Columbia River, to the Hoh River, and rocky shores with smaller stretches of beach dominate to the north. Wave action has eroded the shoreline through time to form steep, tall cliffs at various places along the coast. Forested hills and sloping terraces are found near river mouths. In many places, a wave-cut platform, underwater with the tides, fronts the ocean where small islands, sea stacks, and rocks dot the platform's surface.

Water and Air Quality in OCNMS

Water quality within OCNMS is largely representative of natural ocean conditions, with relatively minor influence from human activities at sea and on land (ONMS 2008). By conventional measures, marine water quality within OCNMS is not notably compromised, in part because there have been few point sources of pollution in the vicinity, such as sewage outfalls or industrial discharge sites, and because there are no large industrial developments or large population centers adjacent to OCNMS.

Another source of pollutants with potentially negative water quality impacts is intentional discharges from vessels (e.g., sewage, graywater, ballast and bilge water).

Most sources of air pollution in OCNMS are from vessels off the coast of Washington and from several small coastal communities. Air Pollution from shipping is mitigated by the International Maritime Organization's (IMO) Area to be Avoided (ATBA) which directs large commercial shipping to stay 25 nautical miles off the coast prior to their entrance into the Strait of Juan de Fuca. Further reductions in air pollution are expected as a result of the creation of an IMO Emission Control Area (ECA), which extends 200 nautical miles off the U.S. and Canadian coasts. Ships complying with the ECA will burn cleaner fuel within the ECA.

Acoustic Environment in OCNMS

The acoustic environment of OCNMS is made up of natural (both physical and biological) and man-made sound sources. While no specific studies describing the acoustic environment of the sanctuary have been conducted, this is a well-researched area of study, especially as it relates to impacts to marine mammals.

Underwater sound in the ocean can come from a variety of natural and anthropogenic sources. Anthropogenic sources include shipping, general vessel traffic, tour boats, aircraft, research, energy and mineral exploration, underwater construction, seismic devices, pingers, and navy activities such as use of sonar and underwater explosions. Potential impacts of sound on marine organisms can range from no or very little effect to various levels of behavioral reactions, physiological stress, threshold shifts, auditory masking, and direct trauma. Responses to sound generally fall into three categories: behavioral, acoustic, and physiological. Noise pollution can

be intense and acute or less intense and chronic. Commercial shipping is considered to be the major contributor to low frequency noise within the sanctuary.

In general, ambient sound levels in the ocean environment tend to be greatest in relatively shallow nearshore environments and appear to be directly related to wind speeds and indirectly related to sea-state (breaking waves). The seafloor also plays a role in either reflecting or absorbing sound, with that role being more influential in shallow waters. Ambient sound in the ocean environment includes intermittent sources such as lightning strikes, underwater volcanoes, earthquakes, and hydrothermal eruptions can also represent major contributions. The impacts of these intermittent events can be substantial.

Intermittent airborne noise sources also include those from manmade sources. In addition to the sounds produced from commercial shipping engines, other manmade sources of airborne noise include military, general aviation, and commercial aircraft; nearshore construction activities; military explosive use; recreational boating; mineral exploration and extraction; and scientific vessel engine noise.

3.1.2 Biological Environment

Biological Habitat/Oceanography in OCNMS

The area around the sanctuary is characterized by distinct patterns in oceanographic circulation, winter storms, and water flows influenced by topography and land-sea interactions. Large-scale processes are the predominant controlling factors for seasonal upwelling-downwelling fluctuations that produce a highly dynamic oceanographic environment. Large-scale movements of oceanic water masses, such as the California Current, which flows southward beyond the continental shelf, connect the sanctuary with the broader seascape of the eastern North Pacific Ocean and influence climate and marine productivity for the region.

On shore, the visible rise and fall of tides follow a mixed, semidiurnal pattern with two high-water and low-water phases per day. A mixed pattern means consecutive highs and lows have different tidal heights. The tidal range on the outer coast of Washington is large, averaging about 11.5 feet (3.5 m) between high and low tides. Ocean surface water temperatures average about 9°C (48°F) in winter and 15°C (58°F) in summer.

Habitats are where organisms make their lives, where they survive, find food, water, shelter, and space. The collected habitats of an area create the place for the living ecosystem. Healthy marine habitats are the foundation of healthy communities of marine life.

OCNMS is comprised of a broad diversity of habitats, some we can see from land, others hidden beneath the water, including rocky shores, sandy beaches, nearshore kelp forests, sea stacks and islands, open ocean or pelagic waters, as well as the continental shelf seafloor and submarine canyons. In addition to aquatic habitats in the sanctuary, islands and pinnacles, or sea stacks, along the coast provide nesting and resting sites for marine mammals and seabirds.

Intertidal Habitats in OCNMS

The habitat most accessible to people is the intertidal zone, a habitat alternating between the dry and wet worlds where rock benches, tide pools and surge channels are formed amid boulders and rocky outcrops. These substrates provide both temporary and permanent homes for an abundance of "seaweeds" (e.g., macroalgae and seagrasses), invertebrates such as sea stars, hermit crabs, nudibranchs, snails, sea anemones, and intertidal fish. Between rocky headlands are numerous sand-covered beaches and mixed rock/cobble benches hosting an array of intertidal invertebrates and fish. Surf smelt spawn at high tide on sand-gravel beaches where surf action bathes and aerates the eggs.

With limited exceptions, nearshore and intertidal habitats in the sanctuary are remarkably undisturbed by human use and development (e.g., armoring, wetlands alteration, dredging, and land-based construction) that have modified shorelines in more urbanized areas. The remote location, low levels of human habitation, protections provided by the wilderness designation of Olympic National Park's coast, and restricted access to tribal reservations have allowed these coastal habitats to persist largely intact. At the few locations where shoreline armoring has been employed or where human visitation has focused on intertidal areas for food collection and recreation, impacts do not appear to be dramatic or widespread.

In nearshore areas, canopy kelp beds form a productive, physically complex and protected habitat with a rich biological community association of fish, invertebrates and sea otters. Annual monitoring and quantification of the floating kelp canopy has been conducted since 1989 by the Washington Department of Natural Resources and in collaboration with OCNMS since 1995. Although the canopy changes every year, these kelp beds are generally considered stable.

Recently documented, widespread hypoxic, or low oxygen conditions in nearshore areas off Oregon and Washington coasts have stressed and killed marine life. Such hypoxic conditions appear to be increasing in severity and frequency and may result from anomalous weather and oceanographic patterns.

Nearshore habitats off sand beaches occurring all along the outer Olympic Coast and dominating the southern shores of the sanctuary tend to be less diverse, lacking macroalgae and physically complex substrate. These are high energy environments where the inshore shelf is relatively shallow. Nutrients delivered by upwelling currents support phytoplankton biomass that is grazed and recycled by zooplankton. Wind and wave action support transport and retention of productive waters near shore, which sustains sand beach infaunal communities of amphipods, worms, and razor clams.

The pelagic habitat, or water column of the open ocean, is the most extensive habitat of the sanctuary. Many fish, seabird, and marine mammal species are pelagic and have relatively little association with seafloor or nearshore habitats. Phytoplankton at the base of the food web is most abundant in the euphotic, or sunlit, layer near the surface of the water column. This primary productivity supports a food chain based on grazing zooplankton, fish, and marine bacteria.

Ocean productivity can be nutrient limited and is influenced by large-scale oceanographic currents and cycles.

The potential for contamination of pelagic habitats by petroleum products is a concern reinforced by experience and justified by the volume of large vessel traffic at the western end of the Strait of Juan de Fuca. Four of the five largest oil spills in Washington state history have occurred in or moved into the area now designated as the sanctuary. In the decade before sanctuary designation, two major oil spills released more than 325,000 gallons of petroleum products impacting marine ecosystems and human communities on the outer Washington coast.

Noise pollution, or the cumulative acoustic signature of human activities, is an aspect of the pelagic habitat of OCNMS not currently well characterized or evaluated for potential impacts on wildlife in the sanctuary.

The ocean floor of the sanctuary is comprised of a variety of physically and biologically complex habitats. These habitats are shaped by the geology and topography of the seafloor and enhanced by living organisms like corals and sponges. Prior to development of remote sensing techniques, water depth measurements and bottom samples provided spot data that was extrapolated to create crude seafloor maps. Modern exploration and detailed habitat mapping involves carefully planned and costly surveys from large vessels using sophisticated technology. Thus far, OCNMS has completed high resolution habitat mapping for about 25 percent of its seafloor, while information on remaining areas lacks resolution and specificity for development of accurate seafloor habitat maps. As a result, generalizations about the sanctuary's seafloor habitats and their biological communities are difficult to make.

The northern portion of the sanctuary is dominated by the Juan de Fuca Canyon and trough (the shallower extensions of the canyon closer to the Strait of Juan de Fuca), which are complex, glacially carved features containing a mixture of soft sediments, with significant cobble and boulder patches and scattered large glacial boulders deposited during ice retreat. High-relief, submerged topographic features serve as fish aggregation areas. Low-resolution surveys have revealed a generally wide and featureless continental shelf in the southern portion of the sanctuary dominated by soft substrates (sand and mud bottoms, to pebble and cobble) with scattered areas of rock outcrop and spires. The head of the Quinault Canyon also lies within the sanctuary boundary.

Essential Fish Habitat in OCNMS

The Olympic 2 area of the Groundfish Essential Fish Habitat (EFH) in the Pacific Coast Exclusive Economic Zone overlaps with the Olympic Coast National Marine Sanctuary. The Olympic 2 EFH area encloses 135,197 acres of ocean area. Within this area, fishing with bottom trawl gear is prohibited.

Birds in OCNMS

Seabirds are the most conspicuous members of the offshore fauna of the Olympic Coast. Sea stacks and islands provide important nesting habitat for 19 species of marine birds and marine-associated raptors and shorebirds, including seven alcid species (including murres, puffins, and murrelets), three cormorant species, four gull and tern species, two storm-petrel species, two raptors and one shorebird, the Black Oystercatcher. Productive offshore waters also attract large feeding aggregations of marine birds that breed in other regions of the world but travel great distances to "winter" in sanctuary waters. The Sooty Shearwater, for example, breeds off New Zealand and Chile in the austral summer and congregates along the Pacific coast in its non-breeding season. Black-footed and Laysan Albatross travel far from their breeding grounds in Hawaii and Japan to forage in the eastern Pacific. Nearer to shore, sand and gravel beaches are foraging areas for shorebirds, crows, gulls and a host of other birds. The coastline also forms an important migratory pathway for millions of birds that pass through each year, guiding waterfowl, cranes, shorebirds and raptors toward northern breeding areas during the spring and southward as winter approaches.

Fish and Invertebrates in OCNMS

Among the many species of fish inhabiting OCNMS are commercially important ones including at least 30 species of rockfish, 15 or more species of flatfish, Pacific halibut, Pacific whiting (or hake), sablefish, and salmon. Five species of Pacific salmon (chinook, sockeye, pink, chum and coho) occur along the outer coast of Washington and breed in the Olympic Peninsula's rivers and streams. Three similar salmonid species found in freshwater systems (sea-run cutthroat trout, bull trout, and steelhead) spend portions of their lives in nearshore marine waters. Nearshore habitats of the sanctuary presumably are important for salmon spawning in adjacent streams and rivers, but juvenile salmon use of nearshore habitats off the Olympic Coast is not well understood. The sanctuary also is part of the migration corridor of both juvenile and adult salmonids from California, Oregon, British Columbia, and Washington rivers beyond the Olympic Peninsula. Migratory species, such as sharks, albacore, sardines, mackerel, and anchovies, are important resources for tribal and non-tribal fishers that are found in the sanctuary seasonally.

The majority of the sanctuary's seafloor where bottom dwelling, or benthic invertebrates live is composed of sand and mud. This submerged habitat is home to a variety of invertebrates similar to those found in intertidal areas, including brittle stars, sea urchins, worms, snails, and shrimp. Dungeness crab and razor clams are also native to this area and have long sustained commercial and recreational harvest off the Olympic Coast.

Hard-bottom substrates harbor rich invertebrate assemblages, including deepwater coral and sponges. These living organisms with branching, upright structure are, in turn, habitat where other invertebrates and fish find hiding places, attachment sites, food sources, and breeding and nursery grounds in relatively inhospitable and otherwise featureless environment.

Protected Species in OCNMS

OCNMS provides habitat for 51 federally protected species[12], including 15 Federal Endangered species, 15 Federal Threatened species. In addition, OCNMS includes 1 State Endangered species and 1 State Threatened species. Please see Appendix D for more information.

The Federal endangered species are: Bocaccio (rockfish), scalloped hammerhead shark, the blue whale, dwarf sperm whale, false killer whale, fin whale, gray whale, North Pacific right whale, sei whale, southern resident killer whale, minke whale, short-tailed albatross, sperm whale, leatherback sea turtle, loggerhead sea turtle, and the short-tailed albatross. The Federal Threatened species are: Pacific smelt, canary rockfish, green sturgeon, Steller sea lion, Guadalupe fur seal, loggerhead turtle, green sea turtle, Pacific olive ridley, Sacramento River winter-run Chinook salmon, northern and southern sea otters, sockeye salmon, red knot, marbled murrelet, and western snowy plover.

Thirty-five species of marine mammals have been sighted in Olympic Coast National Marine Sanctuary. Whales, because of their size, abundance and visibility, are commonly seen in the sanctuary. Sea otters, harbor and elephant seals, and Steller and California sea lions aggregate along the shore and haul out on land at many locations along the coast throughout the year. The humpback whale[13] and the killer whale (also called orca) forage offshore, and some 20,000 gray whales travel through the sanctuary on their annual migrations between breeding and calving grounds off the Baja Peninsula and summer feeding grounds in the northern Pacific. Eleven marine mammal species are on either federal or state species of concern lists across their range, which include species listed as State Endangered, State Threatened, State Sensitive, or State Candidate, as well as species listed or proposed for listing by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service[14].

The sea otter is often considered a keystone species because of the strong top-down influence they have on the nearshore kelp ecosystem. Sea otters are of high scientific interest because they were extirpated from Washington state by commercial pelt hunters by 1911, then were reintroduced in 1969 and 1970. This population has been counted annually since 1989 and has shown increases the past few years, with a peak of 1,121 animals in 2008. The rate of population growth, however, has been slower than expected. The sea otter remains a federal species of concern and an endangered species within Washington State, and the population remains vulnerable because of its small size, limited genetic diversity, existing exposure to pathogens, and extreme risks to oil spills.

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[12] "Protected species" refers to listed species on the Federal Endangered Species Act and Marine Mammal Protection Act.

[13] On April 21, 2015, NOAA's National Marine Fisheries Service completed a comprehensive status review under the Endangered Species Act for the Humpback Whale (80 FR 22304) and announced a proposal to revise the listing status of the species. Two proposed distinct population segments (DPS) have feeding grounds that intersect with West Coast national marine sanctuaries: Mexico DPS and Central America DPS. Under the terms of the proposal the Mexico DPS would not be listed under the ESA, and the Central America DPS would be listed as threatened.

[14] See http://wdfw.wa.gov/conservation/endangered/All/ for a list of all species of concern in the State of Washington.

Table 8. A list of selected marine mammals found around OCNMS, their ESA Status, and functional hearing ranges for three Cetacean functional groups. For a full list, see Appendix D.

Common Name	Scientific Name	Local Population Status	Functional Hearing Group	Functional Hearing Range[15]
Blue Whale	*Balaenoptera musculus*	Endangered	Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 35 kHz
Gray Whale	*Eschrichtius robustus*	Delisted		
Minke Whale	*Balaenoptera acutorostrata*	No ESA Listing		
Humpback Whale	*Megaptera novaeangliae*	Endangered		
Sei Whales	*Balaenoptera borealis*	Endangered		
Sperm Whales	*Physeter macrocephalus*	Endangered	Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 Hz to 160 kHz
Bottlenose Dolphin	*Tursiops truncates*	No ESA Listing		
Killer Whale	*Orcinus orca*	Endangered		
Long Beaked Common Dolphin	*Delphinus capensis*	No ESA listing		
Pacific White-Sided Dolphin	*Lagenorhynchus obliquidens*	No ESA Listing		
Short-Beaked Common Dolphin	*Delphinus delphis*	No ESA Listing		
Harbor Porpoise	*Phocoena phocoena*	No ESA Listing for local population	HF	275 Hz to 160 kHz
California Sea	*Zalophus*	No ESA Listing	OW[16]	60 Hz to 39 kHz

[15] Based on NMFS 2016 (http://www.nmfs.noaa.gov/pr/acoustics/Acoustic%20Guidance%20Files/opr-55_acoustic_guidance_tech_memo.pdf)
[16] OW mean Otariids in water

Lion	*californianus*			
Harbor Seal	*Phoca vitulina*	No ESA Listing	PW[17]	50 Hz to 86 kHz
Northern Elephant Seals	*Mirounga angustirostris*	No ESA Listing	PW	50 Hz to 86 kHz
Guadalupe Fur Seal	*Arctocephalus townsendi*	Threatened	OW	60 Hz to 39 kHz
Southern Sea Otter	*Enhydra lutris nereis*	Threatened	OW	60 Hz to 39 kHz
Stellar Sea Lion	*Eumetopias jubatus*	Threatened	OW	60 Hz to 39 kHz

3.1.3 Socioeconomic Environment in OCNMS

The Olympic Peninsula has a rich history supporting diverse commercial, recreational, cultural, research and education activities. Native American Indian populations alike, including the Hoh, Makah, Quileute, and Quinault peoples, utilize plant, fish, and shellfish resources, as well as the access and transportation routes within and adjacent to the sanctuary as an integral part of economic and socioeconomic activities. This section describes the character of the sanctuary and adjacent areas, including the population, overall economy, employment and housing. For the purposes of this analysis, the discussion of the affected environment is focused on those areas immediately adjacent to the sanctuary as those are the most likely to be impacted by ONMS operations. Additional discussion focuses on the commercial activity dependent on the sanctuary area.

Maritime Transportation/Traffic in OCNMS

The sanctuary lies at the entrance to the Strait of Juan de Fuca, a major international waterway linking the important North American ports of Seattle, Tacoma, and Vancouver, Canada, with trading partners all around the Pacific Rim. Every year, approximately 10,000 large commercial vessel transits occur at the western end of the Strait of Juan de Fuca. The uses of sanctuary waters for maritime transportation, along with commercial fishing, are the most significant commercial uses of the sanctuary.

Human Uses in OCNMS

Commercial fishing activity in the sanctuary includes both tribal and non-tribal fleets. The Makah, Quileute and Quinault fishers work respectively from the ports of Neah Bay, La Push and Grays Harbor. The Hoh Tribe does not currently have an ocean fishing fleet. Non-tribal fishermen work out of both Oregon and Washington ports. The commercial fishing industry in Washington state is structured around a multi-species fishery. Groundfish, halibut, albacore, salmon and

[17] PW means Phocids in water.

shellfish are all major species groups important to the industry. In 2006, non-tribal commercial fishing generated nearly $100 million in personal income and supported over 3,500 direct and indirect jobs in Washington state. These figures include only non-tribal fisheries conducted off the coast of Washington. When commercial fishing by Coastal Treaty Tribes is added, the harvest value is nearly $150 million. Though not directly correlated to the boundaries of the OCNMS, the Washington coast accounted for over 60% of the total harvest value of state commercial fisheries in 2006 (the remaining percentage includes vessels from Washington going to Canada, Alaska or Oregon and aquaculture). Including in-state processing, the wholesale value of fishery products caught in Washington waters was an estimated $101 million in 2006.

Fisheries management policies enacted on the West Coast and within the sanctuary have been progressive steps to incorporate ecosystem-based fishery management concepts and improve trends toward restoring historical population levels. A variety of recent fishery management actions off the Washington coast, such as trawl footrope gear restrictions, low-rise nets that reduce bycatch, monitoring of bycatch, protection of Essential Fish Habitat, implementation of stock rebuilding plans, and establishment of temporary area closures (i.e., Rockfish Conservation Areas) to promote recovery of species under rebuilding plans, have provided early indications that depleted stocks can recover and that these fisheries can be sustainably practiced. OCNMS' role in this management regime has been development of detailed seafloor habitat maps and participating in evaluation of essential fish habitat designations for groundfish.

Research and Education in OCNMS

Research in the sanctuary is conducted by numerous governments, tribes, agencies and academic institutions for a variety of purposes. Much of this research is "basic" research to gain understanding of marine populations and systems, yet some efforts relate to resource management issues, such as fishery management. Emergent issues, such as hypoxic conditions and ocean acidification, are receiving increased attention, for which the sanctuary may become a focus area for research. OCNMS' research program focuses on and supports scientific investigations to improve our understanding of the sanctuary's marine ecosystems and historical and cultural resources in order to provide managers with the information necessary to make informed decisions.

OCNMS is an important regional educational asset. It is used as a living classroom by many regional school groups and a training ground for many local educators. Part of the sanctuary's mission is to organize and present educational resources reflecting what is known about this place, with the goal of improving the understanding of future generations of citizens – students – now in school classrooms. ONMS assists teachers educating tomorrow's scientists and endeavors to help people in local communities and around the globe see their role in enjoying and protecting the Sanctuary.

3.1.4 Maritime Heritage and Cultural Environment

Maritime Heritage Resources in OCNMS

Olympic Coast National Marine Sanctuary has a rich maritime heritage where lives, languages, communities and cultures are continuously shaped by the sea. The native Makah, Quileute, Hoh and Quinault peoples traditionally lived at the water's edge, thriving on the riches of the ocean plants, fish, shellfish, seabirds and marine mammals. The waters off the Washington coast linked native peoples along the coast as they traveled by canoe. These waters were highways that were traversed by canoes and, more recently, ships supporting communities and industries along the shores of the Strait of Juan de Fuca and Puget Sound and beyond. Historically, local maritime activity ranged from fur hunting, whaling and fishing, to coastal trade with smaller coastal communities. The rugged Olympic Coast could be treacherous, especially during winter storms when high winds and strong currents pushed ships dangerously close to the rocky islands, reefs and shoreline. Fog, too, led to collisions with disastrous results. Over 180 ships were reported wrecked or lost at sea in or near sanctuary waters in the years between 1808 and 1972.

Since the mid-1990s, NOAA's Office of National Marine Sanctuaries has compiled and periodically updated a database of historic ship and military aircraft losses that includes known archaeological resources in the vicinity of Olympic Coast National Marine Sanctuary. Approximately 207 historic ships have been documented as lost in what is now the sanctuary between the early-nineteenth and mid-twentieth centuries. As the rate of shipping increased with the growing regional economy and settlement, so too did the rate of shipwreck increase off the Olympic Peninsula. An assessment of the database indicates the majority of losses were weather-related, including founderings, collisions and groundings. Many ships simply vanished after sailing past Tatoosh lighthouse, their resting place never known.

Cultural and Historic Resources in OCNMS

The modern shoreline of the Olympic Peninsula contains dozens of late prehistoric archaeological sites rich in materials documenting the character of the maritime environment and the use of this environment by the region's native peoples. Nearshore coastal forests adjacent to the sanctuary contain mid-Holocene shorelines and older prehistoric archaeological sites. These older sites are rich in materials documenting the character of maritime paleo-environments, the history of environmental change, and the record of use of these environments by the region's native peoples.

Historical-era resources are generally affiliated with archaeological remains of the western cultures that appeared in the region by the mid-nineteenth century. The term "historical" refers to cultures with written language. A combination of fierce weather, isolated and rocky shores, and thriving ship commerce have made the Olympic Coast a graveyard for ships of many descriptions. See the description of historic shipwrecks above.

3.2 Cordell Bank National Marine Sanctuary

3.2.1 Physical Environment

Physical Characteristics/Geology

Cordell Bank National Marine Sanctuary (CBNMS) protects an area of 1,286 mi2 (3,330.7 km2) off the northern California coast. The main feature of the sanctuary is Cordell Bank, an offshore granite bank located on the edge of the continental shelf, about 52 nautical miles west-northwest of the Golden Gate Bridge and San Francisco and 20 nautical miles west of the Point Reyes lighthouse. CBNMS is entirely offshore, in federal waters, and shares its southern and eastern boundary with the Greater Farallones National Marine Sanctuary. The CBNMS eastern boundary is seven miles west of shore at Bodega Head and the western boundary is the 1000 fathom isobath on the edge of the continental slope.

CBNMS is located in one of the world's four major coastal upwelling systems. The combination of oceanic conditions and undersea topography provides for a highly productive environment in a discrete, well-defined area. The vertical relief and hard substrate of the Bank provides benthic habitat with nearshore characteristics in an open ocean environment 20 nm from shore. The vigorous biological community flourishing at Cordell Bank and Bodega Canyon includes an exceptional assortment of invertebrates, fish, marine mammals and seabirds. Predators travel from thousands of miles away to feed in these productive waters.

Two distinctive geologic features characterize the geology of CBNMS: the shallow granitic Cordell Bank and the surrounding soft bottom of the continental shelf and slope.

Cordell Bank is composed of a granite block that was created as part of the southern Sierra Nevada range some 93 million years ago. The Bank is one of the few offshore areas where the granite block emerges from the newer sediments that make up most of the continental shelf. The Bank itself is about 4.5 miles wide by 9.5 miles long. The Bank meets the continental shelf in water depths between 300 and 400 feet. Jagged ridges and pinnacles rise abruptly from this plain and reach up to 115 feet below the sea surface. In many places, the sides of the ridges and pinnacles are extremely steep, often with slopes greater than 80 degrees. Six nautical miles to the west of the Bank, along the sanctuary boundary, the continental slope drops steeply to 6,000 feet and more. Just north of Cordell Bank lies Bodega Canyon, which is approximately 12 miles long and more than 5,000 feet deep.

The ocean bottom around the Bank and within the sanctuary contains few distinguishing features, except for Bodega Canyon, and is chiefly comprised of mud and sand deposits. Deposits of undifferentiated mud and sand extend in a plume to the south and a fan to the east of Cordell Bank. The complexity of the underwater topography and sediment distribution increases near the coast within GFNMS.

Water and Air Quality in CBNMS

Water quality within CBNMS is largely representative of natural ocean conditions, with relatively minor influence from human activities at sea and on land. By conventional measures, marine water quality within CBNMS is not notably compromised, in part because there have been few point sources of pollution in the vicinity, such as sewage outfalls or industrial discharge sites, and because there are no large industrial developments or large population centers adjacent to CBNMS.

Another source of pollutants with potentially negative water quality impacts is intentional discharges from vessels (e.g., sewage, graywater, ballast and bilge water).

Most sources of air pollution in CBNMS are from vessels off the coast of California. Reductions in air pollution are expected as a result of the creation of an IMO Emission Control Area, which extends 200 nautical miles off the U.S. and Canadian coasts. Ships complying with the ECA will burn cleaner fuel within the ECA.

Acoustic Environment in CBNMS

The acoustic environment of CBNMS is made up of natural (both physical and biological) and man-made sound sources. While no specific studies describing the acoustic environment of the sanctuary have been conducted, this is a well-researched area of study, especially as it relates to impacts to marine mammals.

Underwater sound in the ocean can come from a variety of natural and anthropogenic sources. Anthropogenic sources include shipping, general vessel traffic, tour boats, aircraft, research, energy and mineral exploration, underwater construction, seismic devices, pingers, and navy activities such as use of sonar and underwater explosions. Potential impacts of sound on marine organisms can range from no or very little effect to various levels of behavioral reactions, physiological stress, threshold shifts, auditory masking, and direct trauma. Responses to sound generally fall into three categories: behavioral, acoustic, and physiological. Noise pollution can be intense and acute or less intense and chronic. Commercial shipping is considered to be the major contributor to low frequency noise within the sanctuary.

In general, ambient sound levels in the ocean environment tend to be greatest in relatively shallow nearshore environments and appear to be directly related to wind speeds and indirectly related to sea-state (breaking waves). The seafloor also plays a role in either reflecting or absorbing sound, with that role being more influential in shallow waters. Ambient sound in the ocean environment includes intermittent sources such as lightning strikes, underwater volcanoes, earthquakes, and hydrothermal eruptions can also represent major contributions. The impacts of these intermittent events can be substantial.

Intermittent airborne noise sources also include those from manmade sources. In addition to the sounds produced from commercial shipping engines, other manmade sources of airborne noise

include military, general aviation, and commercial aircraft; military explosive use; recreational boating; and scientific vessel engine noise.

3.2.2 Biological Environment

Essential Fish Habitat in CBNMS

The Cordell Bank area of the Groundfish Essential Fish Habitat in the Pacific Coast Exclusive Economic Zone and the Cordell Bank Biogenic Area overlap with the Cordell Bank National Marine Sanctuary. These two areas enclose 16,910 and 95,383 acres, respectively, of Essential Fish Habitat in and around Cordell Bank. Within the Cordell Bank EFH area, fishing with bottom contact gear is prohibited. Within the Cordell Bank Biogenic Area, fishing with bottom contact gear is prohibited, with an exemption for demersal seine nets.

Birds in CBNMS

The waters around Cordell Bank provide critical foraging habitat for many species of seabirds. Seabird density over Cordell Bank can be among the highest of any area in central and northern California. Fifty-nine seabird species have been identified feeding in or near the sanctuary. The composition of seabirds found at Cordell Bank is a mix of local breeding birds and highly migratory, open-ocean species. While the local residents use the nearby Farallon Islands and Point Reyes areas to nest, some migrants nest thousands of miles away. A recent study using radio tags documented that Black-footed Albatross nesting in the northwest Hawaiian Islands were “commuting” to Cordell Bank waters to forage before returning to feed chicks on their nests on Midway Atoll.

Other migratory species use the productive waters around the Bank as a stopover on their annual migration route. Hundreds of thousands of Sooty Shearwaters can be seen on days when they are migrating through the sanctuary. Sanctuary waters are equally important to local breeders. Most of the world’s small population of Ashy Storm-petrels, which nest on Southeast Farallon Island, can be seen on the water near the Bank. More than 20,000 Cassin’s Auklets have been counted in a single day.

Other common sanctuary species include the Black-footed Albatross, Northern Fulmar, Sooty Shearwater, storm-petrels, Rhinoceros Auklet, phalaropes, and many species of gulls.

Fish and Invertebrates in CBNMS

More than 180 species of fish have been identified in the CBNMS. Many species of rockfish (Sebastes spp.) can be found at all depths and habitats on and around the Bank. The Bank provides critical habitat for young of the year, juvenile, and adult rockfish. Lingcod are especially conspicuous in the wintertime, when they move up onto the Bank to spawn. Many species of flatfish use the soft-bottom habitat around the Bank, and albacore tuna and salmon frequent the sanctuary on a seasonal basis. The recovery of the Pacific sardine population is apparent in the waters surrounding Cordell Bank.

An abundant cover of benthic organisms can be seen on the upper rock surfaces of Cordell Bank. The constant food supply washing the Bank combined with a hard substrate for attachment provide ideal conditions that support a rich assemblage of benthic invertebrates. The high light penetration allows for algal photosynthesis far deeper than in nearshore coastal waters. These conditions support benthic algae more commonly associated with shallow nearshore habitats. Space is the limiting factor on the upper pinnacles and ridges of Cordell Bank. Ridges are thickly covered with sponges, anemones, hydrocorals, gorgonian corals, hydroids, tunicates, and scattered crabs, holothurians, and gastropods. In some places, the cover is up to one foot thick and very brightly colored, mainly in white, pink, yellow, and red.

Protected Species in CBNMS

There are 60 federally protected species in CBNMS (see Appendix D). Federally listed endangered marine mammals in CBNMS include the: blue whale (*Balaenoptera musculus*), false killer whale (*Pseudorca crassidens*), fin whale (*Balaenoptera physalus*), killer whale (*Orcinus orca*), North Pacific right whale (*Eubalaena japonica*), sei whale (*Balaenoptera borealis*), Gray whale (*Eschrichtius robustus*) western North Pacific population, northern Pacific right whale (*Eubalaena japonica*), sperm whale (*Physeter macrocephalus*), and Stellar sea lion (*Eumetopias jubatus*). The humpback whale[18] (*Megaptera novaeangliae*) and the Guadalupe fur seal (*Arctocephalus townsendi*) are federally listed as threatened. Gray whales (*Eschrichtius robustus*), including, the listed Western North Pacific population) pass through the area during the winter and spring months on their annual migrations between Arctic feeding grounds and Mexican breeding areas. Large numbers of humpback whales and blue whales feed during the summer and fall months in the vicinity of Cordell Bank. Several fish listed as endangered or threatened are known to inhabit the area. They include tidewater goby (*Eucyclogobius newberryi*), Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), chum salmon (*O. keta*), steelhead trout (*O. mykiss*), and green sturgeon (*Acipenser medirostris*).

At least 149 species of seabirds and coastal birds, of which one endangered species and three threatened species, occur throughout the area. The federally listed endangered bird species is the short-tailed albatross (*Phoebastria albatrus*) and the federally listed threatened species are the red knot (*Calidris canutus rufa*), western snowy plover (*Charadrius alexandrinus nivosus*), and marbled murrelet (*Brachyramphus marmoratus*). Five species of federally listed sea turtles are known to exist within the area. Three species are listed as threatened: the green sea turtle (*Chelonia mydas*), loggerhead sea turtle (*Caretta caretta*), and olive (Pacific) ridley sea turtle (*Lepidochelys olivacea*). Two species are federally listed as endangered –the leatherback sea turtle (*Dermochelys coriacea*) and the hawksbill sea turtle (*Eretmochelys imbricata*). There are two species of endangered fish, bocaccio (rockfish, *Sebastes paucispinus*) and the scalloped hammerhead shark (*Sphyrna lewini*). Black abalone (*Haliotis cracherodii*) are a federally listed endangered marine invertebrate and range from Point Arena, CA to Bahia Tortugas and Isla Guadalupe, Mexico but are rare north of San Francisco.

[18] See footnote #12 above.

Thirty-eight species of marine mammals (a combination of resident and migratory species) have been observed within the sanctuary. The Dall's porpoise is one of the most frequently sighted marine mammals in the sanctuary, along with humpback and blue whales. Pacific white-sided dolphins and northern right whale dolphins are also abundant. Other cetaceans observed in the sanctuary include Risso's dolphins and killer whales and various species of pinnipeds.

Table 9. A list of selected marine mammals found around CBNMS, their ESA Status, and functional hearing ranges for three Cetacean functional groups. For a comprehensive list, please see Appendix D.

Common Name	Scientific Name	Local Population Status	Functional Hearing Group	Functional Hearing Range
Blue Whale	*Balaenoptera musculus*	Endangered	Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 35 kHz
Gray Whale	*Eschrichtius robustus*	Delisted		
Minke Whale	*Balaenoptera acutorostrata*	No ESA Listing		
Humpback Whale	*Megaptera novaeangliae*	Endangered		
Sei Whales	*Balaenoptera borealis*	Endangered		
Sperm Whales	*Physeter macrocephalus*	Endangered	Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 Hz to 160 kHz
Bottlenose Dolphin	*Tursiops truncates*	No ESA Listing		
Killer Whale	*Orcinus orca*	Endangered		
Long Beaked Common Dolphin	*Delphinus capensis*	No ESA listing		
Pacific White-Sided Dolphin	*Lagenorhynchus obliquidens*	No ESA Listing		
Short-Beaked Common Dolphin	*Delphinus delphis*	No ESA Listing		
Harbor	*Phocoena*	No ESA Listing	HF	275 Hz to 160

Porpoise	*phocoena*	for local population		kHz
California Sea Lion	*Zalophus californianus*	No ESA Listing	OW[19]	60 Hz to 39 kHz
Harbor Seals	*Phoca vitulina*	No ESA Listing	PW[20]	50 Hz to 86 kHz
Northern Elephant Seals	*Mirounga angustirostris*	No ESA Listing	PW	50 Hz to 86 kHz
Guadalupe Fur Seal	*Arctocephalus townsendi*	Threatened	OW	60 Hz to 39 kHz
Southern Sea Otter	*Enhydra lutris nereis*	Threatened	OW	60 Hz to 39 kHz
Stellar Sea Lion	*Eumetopias jubatus*	Threatened	OW	60 Hz to 39 kHz

3.2.3 Socioeconomic Environment

In 2013, the California Fish Harvester Model was used to estimate the economic impact of commercial fishing operations on a seven county area. According to the three-year average (measured in 2013 dollars, for years 2010-2012), 49 commercial fishing operations earned almost $993,000 in harvest revenue from catch in the sanctuary. This revenue generated almost $1.67 million in total output/sales, approximately $1 million in value-added, $929,000 in total income, and 48 full- and part-time jobs. If wholesaling, processing, retail and restaurant sector impacts were included, past studies suggest the total impacts could be two to three times greater. A sustainable community recognizes both ecosystem sustainability and economic sustainability as mutually beneficial. The coastal areas of west Marin and Sonoma counties are sparsely populated, with ranching, dairy farms, agriculture, and public open space maintaining their rural character. Most of the people in Marin and Sonoma live about an hour inland from the coast. Bodega Bay is an active fishing port that has the closest marinas to the sanctuary. This harbor also serves as the departure point for charter vessels that provide recreational fishing and wildlife viewing opportunities in the sanctuary. To the southeast of the sanctuary is the major San Francisco metropolitan area, with a population of about eight million people.

Maritime Transportation/Traffic in CBNMS

The northern shipping lanes that funnel commercial vessels into and out of San Francisco Bay bisect Cordell Bank National Marine Sanctuary. In 2012, 1966 ships used the Northern traffic lanes. Vessel spills are a major concern when considering potential threats to Cordell Bank's resources. Historically, the total number of oil spills from transiting vessels has been small, but

[19] OW mean Otariids in water
[20] PW means Phocids in water.

potential impacts could be enormous given the number and volume of vessels and the sensitivity of resources in the area. The Port of San Francisco reports it has approximately 60-80 cruise ship calls with a total of 200,000 passengers annually. Although partly constrained by the lack of local docking facilities, cruise ship visits to the area are likely to continue to grow as the fleet shifts from international to more domestic cruises, and due to a new cruise ship docking facility at Pier 27 in the Port of San Francisco, which opened in September 2014. Many of these ships have over 3,000 people on board and have the potential to severely impact water quality in localized areas if they are not responsibly operated. In addition to the threat of materials being deposited from vessels into the sanctuary, vessels themselves can directly affect various sanctuary resources. Vessels also injure or kill marine mammals through collisions. In the fall of 2007, there were at least three blue whale deaths off the coast of southern California that were attributed to ship strikes. This number of deaths so close together is considered a highly unusual event, and scientists are investigating potential contributing factors to these deaths. In 2010, two blue, one humpback and two fin whales were confirmed killed off the coast of northern California by vessel strikes, according to the NOAA Fisheries strandings database.

Human Uses in CBNMS

The Cordell Bank area supports an active commercial and recreational fishery. Commercial and recreational activity is regulated by the Pacific Fishery Management Council (PFMC) and the California Department of Fish and Game (CDFG). Commercial fisheries have generally targeted groundfish, flatfish, salmon, crab and albacore tuna. Recreational fisheries have generally focused on rockfish, lingcod, salmon, and albacore tuna.

Wildlife viewing is an increasingly popular activity at Cordell Bank. The birding community has traveled to the Bank for many years to observe species of open ocean seabirds. More species of albatross have been seen over Cordell Bank than anywhere else in the Northern Hemisphere.

Because of the abundance of food, the Cordell Bank area is also a destination feeding ground for leatherback sea turtles, humpback and blue whales. Beginning in early summer and continuing through fall, feeding turtles, humpback and blue whales frequent sanctuary waters.

Research and Education in CBNMS

One of the sanctuary's goals is to promote appreciation, public awareness, and understanding for the marine resources of Cordell Bank. The sanctuary education program sponsors a yearly lecture series; participates in many outreach events; hosts a monthly radio show; delivers programs at local schools; and trains teachers to educate about the sanctuary and the ecosystem it protects. Other opportunities for the public to learn about the sanctuary include: interpretive displays, brochures, websites, and field ecology outings.

The first research effort at Cordell Bank occurred in 1869 when Edward Cordell mapped the Bank. Early research was confined to geographic surveys and rock sampling. In the 1970s and 80s, Cordell Expeditions, a non-profit organization, initiated a process of exploration to describe

the Bank. Today, the majority of research and monitoring in the sanctuary is conducted by the sanctuary or in partnership with other state and federal agencies and nonprofit organizations. Every year, the National Marine Fisheries Service assesses juvenile rockfish recruitment and regularly conducts population surveys for adult fish. The sanctuary has been monitoring ocean conditions since 1997. These programs have included the investigation of oceanographic conditions and how they relate to the distribution and abundance of krill, seabirds, and whales. From 2001 to 2013, the sanctuary and partners characterized benthic habitats on Cordell Bank and monitored fish and invertebrates on and around the Bank.

3.2.4 Maritime Heritage and Cultural Environment

It is not believed that any shipwrecks rest on Cordell Bank and side-scan sonar surveys of the soft bottom continental shelf area have not detected any maritime archaeological resources in the sanctuary. However, only 18% of the sanctuary seafloor has been mapped with these remote sensing techniques.

3.3 Greater Farallones National Marine Sanctuary

3.3.1 Physical Environment

Physical Characteristics/Geology

GFNMS consists of an area of the waters and the submerged lands thereunder adjacent to the coast of California of approximately 2,488 square nautical miles (sq. nmi). The boundary extends seaward to a distance of 30 nmi west from the mainland at Manchester Beach and extends south approximately 45 nmi to the northwestern corner of CBNMS, and extends approximately 38 nmi east along the northern boundary of CBNMS, approximately 6 nmi west of Bodega Head. The boundary extends from Bodega Bay to Point Reyes and 12 nmi west from the Farallon Islands and Noonday Rock, and includes the intervening waters and submerged lands. The Sanctuary includes Bolinas Lagoon, Tomales Bay, Estero de San Antonio (to the tide gate at Valley Ford-Franklin School Road) and Estero Americano (to the bridge at Valley Ford-Estero Road), as well as Bodega Bay, but does not include Bodega Harbor, the Salmon Creek Estuary, the Russian River Estuary, the Gualala River Estuary, Arena Cove or the Garcia River Estuary.

This area of special significance was designated a national marine sanctuary and expanded in 2015 because these waters provide important marine and nearshore habitats for a diverse array of marine mammals and marine birds, as well as fishery, plant, algae, and benthic resources. The marine mammals and seabirds present in abundant numbers on the Farallon Islands and the mainland coast depend as much on the integrity and productivity of these adjacent ocean and estuarine waters as on the preservation of the shore areas they use for breeding, feeding, and hauling out.

The GFNMS is characterized by the widest continental shelf on the West Coast of the contiguous United States. In the Greater Farallones, the shelf reaches a width of 36.8 mi (59 km). Shoreward

of the Farallon Islands, the continental shelf is sandy and contains large underwater sand dunes. The shelf slopes gently to the west and north from the mainland shoreline and provides an especially large and relatively shallow (120 meters) foraging and habitat area for coastal and oceanic seabirds, marine mammals, and fish.

The Farallon Islands are seven islands and large rocks, which lie along the outer edge of the continental shelf, between 15.0 and 21.9 mi southwest of Point Reyes and roughly 29.9 mi due west of San Francisco. The islands are located on part of a larger submarine ridge that extends for approximately 34.5 mi between the Farallon Islands and Cordell Bank near the shelf break. The Farallon Islands provide secluded habitat that is essential for seabirds and marine mammals. Submarine rock outcrops surrounding the islands and extending to Cordell Bank provide rich habitat for a diverse rocky reef community.

The GFNMS coast includes sandy beaches, rocky cliffs, open bays (Bodega Bay, Drakes Bay, Bolinas Bay) and enclosed bays or estuaries (Bolinas Lagoon, Tomales Bay, Estero Americano, and Estero de San Antonio). High-energy waves typical of the winter storm season distribute sediment washed into the sanctuary by rivers and from shoreline erosion, and move sand down-coast from beach to beach. The two Esteros are typically closed during summer and fall by seasonally formed sand bars, isolating the Esteros from the ocean. Tomales Bay and Bolinas Lagoon, however, remain open to the ocean year-round. Water and water-borne materials in these bays and lagoon are exchanged with the open ocean through tidal currents, although inner bay and lagoon waters may take a long time to exchange. The open bays are sheltered from prevailing southerly currents by headlands and are important nutrient and plankton retention areas. Tomales Bay, Bolinas Lagoon and Bodega Bay lie directly on the San Andreas Fault.

3.3.2 Biological Environment

Biological Habitat/Oceanography in GFNMS

The Greater Farallones hosts a complex array of habitats from exposed rocky headlands to protected sandy beaches; from open bays to calm estuaries; from rocky intertidal habitats to productive mudflats; from offshore islands to submerged seamounts; and from the continental slope dissected by numerous submarine canyons to the deep sea.

Bays and estuaries are among the most productive natural systems. Their physical, chemical, and biological characteristics are critically important to sustaining living resources. Bays and estuaries are important nursery areas that provide food, refuge from predation and a variety of habitats. The four main estuaries within the sanctuary are Tomales Bay, Estero Americano, Estero de San Antonio, and Bolinas Lagoon.

Tomales Bay is located between the shores of West Marin and the Point Reyes National Seashore (PRNS). Tomales Bay is an example of a fault-controlled valley along the San Andreas Fault. Lagunitas Creek, which drains into Tomales Bay, supports a run of approximately 500 Coho salmon, or 10 percent of California's current Coho salmon population. Dense seagrass meadows

are found throughout Tomales Bay. Pacific herring use the seagrass beds for spawning. Tomales Bay also supports seasonal populations of salmon, steelhead, sardines, and lingcod. The shallow bay's sandy bottom attracts a variety of bottom-dwelling fish including sole, halibut, skates and rays. Leopard sharks are common in Tomales Bay and occasionally blue sharks are sighted. White sharks, although not found in enclosed bays or estuaries, do hunt for seals and sea lions that frequent the bays to haul out on the sandy beaches and rocks near the mouth of Tomales Bay. Over 20,000 shorebirds and seabirds, including loons, grebes, geese, cormorants, and ducks, spend the winter in Tomales Bay.

Seagrass beds occur on the extensive mudflats in Tomales Bay, Bolinas Lagoon and within the Esteros. Seagrass supports a unique and diverse assemblage of invertebrates and fish, including snails, shrimp, nudibranchs and sea hares. The structure of seagrass beds provides protection from predation, especially for juvenile invertebrates and fish. Pacific herring, invertebrates, and birds depend on seagrass beds in Tomales Bay to spawn and feed.

The soft bottom habitats associated with estuarine environments support large concentrations of burrowing organisms, such as clams, snails, worms, and crabs. Benthic invertebrates in estuaries have a large effect on community structure.

The rocky nearshore environment of northern California is characterized by dense forests of kelp growing at depths from 2 meters to more than 30 meters. The bull kelp, *Nereocystis luetkeana*, is the dominant canopy-forming kelp north of Santa Cruz to the Aleutian Islands. The shallow areas inshore of kelp forests are often characterized by canopies of the feather boa kelp, Egregia menziesii, and other Laminarials. Kelp forests are spatially complex communities. They alter turbulent flow patterns in the nearshore region through drag generated by their large size and frequently high densities. The biological ramifications of this type of hydrodynamic influence are potentially very important to a wide range of nearshore organisms. Disruption of flow by kelp forests is likely to have significant effects on feeding and growth (particularly in suspension and deposit feeders), dispersal and recruitment. Food and dispersal stages of many kelp forest organisms are passively dispersed, and their transport and settling characteristics will be determined largely by the movement of water in which they are suspended.

The habitat covering the largest area within the GFNMS is the open continental shelf and the pelagic (open ocean) habitat. This habitat is strongly influenced by the oceanographic patterns of the northern California coast (for more detail, see the Climate and Oceanography section above). The strong upwelling events stimulate the productivity of organisms at all levels of the marine food web. Cool, nutrient-rich, upwelled waters support high primary productivity.

All the food that drives the biology of the deep ocean originates in the very thin, near surface layer, the euphotic zone. Therefore, the feeding conditions of the ocean floor are linked with primary production. Deep-sea communities depend on the distribution and quantity of primary production, the rate of movement of organic material to the bottom, and the conditions of deposition and transformation of the organic matter in the sediment.

Distribution and abundance of zooplankton are related to the physical dynamics of the California Current system. Zooplankton are usually most abundant in neritic and inshore regions, as compared with waters of the offshore California Current. Large populations of zooplankton are associated with subarctic water and intense upwelling along the northern/central coast of California extending to Point Conception.

Crustacean larvae, euphausiids, and copepods are dominant groups in the epipelagic zone. Euphausiid swarms often concentrate near Cordell Bank, the Farallon Islands and in Monterey Bay, due to high local productivity and oceanographic characteristics of the regions (e.g., upwelling, fronts, canyons, and vertical walls). Distributions of the euphausiids, *Euphausia pacifica* and *Thysanoessa spinifera*, vary seasonally in response to both temperature and light availability. Changes in euphausiid behavior can reduce the availability of prey in surface waters to predators such as seabirds.

California blue whales respond to the seasonal patterns in productivity in foraging areas along the west coast of North America. Blue whales exhibit strong seasonal migration feeding primarily on euphausiids in the Gulf of the Farallones and migrating to the lower latitudes where they feed on "upwelling-modified" waters, mate and give birth. California humpback whales follow similar migration patterns as the blue whales and primarily feed on small schooling fish and euphausiid prey in the Gulf of the Farallones and migrate to Mexican waters to mate and give birth.

The composition of fish species in the pelagic zone varies throughout the year with migration and spawning and from year to year with environmental fluctuations. A small number of migratory pelagic species dominate the fisheries of central and northern California, including northern anchovy (*Engraulis mordax*), Pacific sardine (*Sardinops sagax*), Pacific hake (*Merluccius productus*), and jack mackerel (*Trachurus symmetricus*). These pelagic species spawn in the Southern California Bight and migrate into waters off central and northern California. However, the composition of larval fish species off central and northern California varies with oceanographic conditions.

The continental shelf off central and northern California is generally quite gradual, and the bottom substrate is a combination of varying amounts of sand, silt, and clay. Much of the mud and sand on the continental shelf was deposited by rivers that formed during the melting of the glaciers approximately 18,000 years ago. At water depths between about 40 to 90 meters, the continental shelf off central California is covered by a nearly continuous blanket of mud as much as 30 meters thick. In areas of high wave energy, mud and sand may be resuspended and transported away from the shore. A zone of outcropping bedrock and sands is located seaward of the mud accumulation zone, on the far outer shelf where water depth exceeds 90 meters.

Although sandy sediments may appear less productive than rocky reefs and kelp forests, numerous organisms are adapted to the shifting environments on the sandy shelf. Some animals find shelter by living in tubes and burrows. Clams lie permanently buried with their siphons extended to the surface of the sediment. Some crustaceans and mollusks live beneath the sand,

emerging at night to forage. Flatfish are camouflaged on the sandy surface of the sea floor. Ocean shrimp (*Pandalus jordani*) are found in California from depths of 240 to 750 feet. Spot prawns are found in depths of 150 to 1,600 feet and concentrate in the regions around the Farallon Islands and offshore banks. Many species of fish prey on ocean shrimp, including Pacific hake, arrowtooth flounder, petrale sole, sablefish, and several rockfish.

Many species of flatfish (Pleuronectidae and Bothidae) use the soft-bottom habitats along the continental shelf. English sole (*Paraphrys vetulus*) are distributed from northwest Alaska to San Cristobal Bay, Baja California, in waters as deep as 1,800 feet. Spawning of English sole generally occurs over sand and mud-sand bottoms at depths of 200 to 360 feet from September to April (Pearson et al. 2001).

Dungeness crabs (Cancer magister) are commonly found in a variety of habitats, but populations are concentrated on sandy to sandy-mud bottoms from the intertidal to a depth of 300 feet. Dungeness crabs are opportunistic feeders, consuming clams, fish, isopods, and amphipods.

Along the northern California coast, rocky reefs support extensive macroalgal growth and associated abalones, sea urchins, and rockfish. Juvenile red abalone settle as postlarvae on coralline algae in crevices between rock. Sea urchins are abundant subtidal herbivores that play an important ecological role in the structure of kelp forest communities. Red sea urchins (*Strongylocentrotus franciscanus*) are found on rocky shores of open coasts from the low-tide water line to 300 feet deep. Purple sea urchins (*S. purpuratus*) are found on rocky shores with moderately strong surf from the low-tide line to 525 feet deep.

Fish commonly found in the rocky habitats of the continental shelf include surfperches, rockfish (black and shortbelly), cabezon, and boccacio. The surfperches (Embiotocidae) are small abundant fish found predominantly in temperate eastern North Pacific waters. Schools of black rockfish (*Sebastes melanops*) frequently occur 10 to 20 feet above shallow rocky reefs. Shortbelly rockfish (*Sebastes jordani*) are found in greatest abundances between the Farallon Islands. The peak abundance of adults is over the bottom at depths of 400 to 700 feet. Adults commonly form very large schools often near or on the bottom during the day. At night, aggregations of shortbelly rockfish may loosen as the fish move up in the water column. Cabezon (*Scorpaenichthys marmoratus*) are found on hard bottoms in shallow water from intertidal pools to depths of 250 feet. Cabezon are common in subtidal habitats in and around rocky reefs and kelp beds. Bocaccio (*Sebastes paucispinis*) ranges from Kodiak Island, Alaska, to central Baja California and inhabits GFNMS.

At a depth of about 200 meters, the continental slope drops steeply to the sea floor. The deep waters of the continental slope are characterized by extremely low light conditions, nearly freezing temperatures, and very high pressures. The invertebrate infaunal and epifaunal communities along the continental slope include many species such as polychaete worms, pelecypod and scaphopod mollusks, shrimp, and brittle stars. Productive commercial fisheries for deep-sea fish operate on the continental slope.

Submarine banks and shoals are found near the shelf break along a submarine ridge that extends for approximately 30 nmi between the Farallon Islands and Cordell Bank. The vertical structure of Fanny Shoal, Rittenburg Bank, and the submerged rocky outcrops surrounding the Farallon Islands provide rich habitat for a diverse rocky reef community.

To the west of the Farallon Islands and the continental shelf, the seafloor drops precipitously to depths over 6,000 feet. Submarine canyons and gullies indent the steep continental slope of the Farallones Escarpment.

Essential Fish Habitat in GFNMS

The Farallon Islands/Fanny Shoal area of the Groundfish Essential Fish Habitat in the Pacific Coast Exclusive Economic Zone overlaps with the Greater Farallones National Marine Sanctuary. This EFH area encloses 35,402 acres of ocean area, within which bottom trawl gear other than demersal seine is prohibited.

Birds in GFNMS

One of the most spectacular components of the sanctuary's abundant and diverse marine life is its nesting and migratory birds. The Greater Farallones supports the largest concentration of breeding seabirds in the contiguous U.S. These birds forage in the Greater Farallones and are highly dependent on the productive waters of the sanctuary. Eleven of the sixteen species of seabirds known to breed along the U.S. Pacific coast have breeding colonies on the Farallon Islands and feed in the sanctuary. Breeding colonies include Ashy and Leach's Storm-Petrels; Brandt's, Pelagic, and Double-crested Cormorants; Western Gulls; Common Murres; Pigeon Guillemots; Tufted Puffins; and Cassin's and Rhinoceros Auklets. The Black Oystercatcher, a moderte-sized shorebird, also nests on the Farallon Islands.

The sanctuary also protects four estuaries, a lagoon, and one large coastal bay that provide foraging habitat for aquatic birds such as waterfowl, shorebirds, pelicans, loons, and grebes. These habitats are pristine compared to most coastal wetlands in California and provide habitat for thousands of migrating and wintering birds. More than 160 species of birds use the sanctuary for shelter, food, or as a migration corridor. Of these, over 50 species of birds are known to use the sanctuary during their breeding season.

Four marine and aquatic bird species that are federally listed as threatened or endangered can be found in the sanctuary. These include the Marbled Murrelet, Western Snowy Plover, Dark-rumped Petrel, and Short-tailed Albatross.

Fish and Invertebrates in GFNMS

Fish resources are abundant over a wide portion of the Greater Farallones. Because of the comparatively wide continental shelf and the configuration of the coastline, the sanctuary is vital to the health and existence of salmon (chinook and coho), northern anchovy, rockfish, and flatfish stocks. The extension of Point Reyes and the resulting current patterns tend to retain larval and

juvenile forms of these and other species within the sanctuary, thereby easing recruitment pressures and ensuring continuance of the stocks. Sanctuary waters offshore of the Farallon Islands act as a location for shallow and intertidal fish which further enhance finfish stocks.

The sanctuary includes many diverse habitats, thereby contributing to the region's high productivity. Bays and estuaries are especially important as feeding, spawning, and nursery areas for a wide variety of finfish. Common fish species of the major bays and estuaries include the Pacific herring, smelts, starry flounder, surfperch, sharks and rays, and coho salmon. The rocky intertidal zone supports a specialized group of fish adapted for life in tide pools, including monkey face eels, rock eels, dwarf surfperch, juvenile cabezon, sculpins, and blennies. Many of these stocks are important as forage for shorebirds and seabirds. Subtidal habitats support large populations of juvenile finfish (e.g., flatfish, rockfish). Nearshore pelagic environs are habitat to large predatory finfish such as sharks, tunas, and mackerel. Northern anchovies, Pacific mackerel, and market squid are abundant and can be commercially valuable. Pelagic fish resources in the study area generally parallel species living in the nearshore subtidal zone. At the mid-depth or meso-pelagic range over sand and mud bottoms, bocaccio, chilipepper, widow rockfish, and Pacific hake are abundant. Kelp beds substantially increase the useable habitat for pelagic and demersal species and offer protection to juvenile finfish.

Benthic fauna communities refer to invertebrates living directly on or in the seafloor. Benthic fauna communities differ according to habitat type and exist in all habitats of the sanctuary (bays and estuaries, intertidal zones, nearshore, and offshore). Generally, each habitat area supports differing benthic assemblages of most classes, (e.g., worms, clams, or crabs). The most conspicuous species include abalone, crabs, and sea urchins. Hundreds of other species (including sea stars, clams, amphipods, and shrimp) are critical links in the food chains of fish, birds, and mammals.

Protected Species in GFNMS

Federally listed endangered marine mammals in Greater Farallones National Marine Sanctuary include the blue whale (*Balaenoptera musculus*), false killer whale (*Pseudorca crassidens*), fin whale (*Balaenoptera physalus*), killer whale (*Orcinus orca*), North Pacific right whale (*Eubalaena japonica*), sei whale (*Balaenoptera borealis*), Gray whale (*Eschrichtius robustus*) western North Pacific population, Northern Pacific right whale (*Eubalaena japonica*), sei whale (*Balaenoptera borealis*), sperm whale (*Physeter macrocephalus*) and the steller sea lion (*Eumetopias jubatus*). The humpback whale (*Megaptera novaeangliae*)[21], Guadalupe fur seal (*Arctocephalus townsendi*), and the northern and southern sea otters (*Enhydra lutris kenyoni, Enhydra lutris nereis,* respectively) are federally listed as threatened. Gray whales (*Eschrichtius robustus*), including, the listed Western North Pacific population) pass through the area during the winter and spring months on their annual migrations between Arctic feeding grounds and Mexican breeding areas. Large numbers of humpback whales and blue whales feed during the

[21] See footnote #12.

summer and fall months in the vicinity of Greater Farallones. Several fish listed as endangered or threatened are known to inhabit the area. They include the: bocaccio (rockfish, *Sebastes paucispinus*) tidewater goby (*Eucyclogobius newberryi*), Chinook salmon (*Oncorhynchus tshawytscha*), coho salmon (*O. kisutch*), , steelhead trout (*O. mykiss*), scalloped hammerhead shark (*Sphyrna lewini*), and green sturgeon (*Acipenser medirostris*). Please refer to Appendix D for more information.

At least 149 species of seabirds and coastal birds, of which one endangered species and three threatened species, occur throughout the area. The federally listed endangered bird species is the short-tailed albatross (*Phoebastria albatrus*) and the federally listed threatened species are the western snowy plover (*Charadrius alexandrinus nivosus*), and marbled murrelet (*Brachyramphus marmoratus*). Four species of federally listed sea turtles are known to exist within the area. Three species are listed as threatened: the green sea turtle (*Chelonia mydas*), loggerhead sea turtle (*Caretta caretta*), and olive (Pacific) ridley sea turtle (*Lepidochelys olivacea*). One species is federally listed as endangered –the leatherback sea turtle (*Dermochelys coriacea*). Black abalone (*Haliotis cracherodii*) are a federally listed endangered marine invertebrate and range from Point Arena, CA to Bahia Tortugas and Isla Guadalupe, Mexico but are rare north of San Francisco.

Thirty-nine species of marine mammals have been observed in the GFNMS. This includes six species of pinnipeds (seals and sea lions), thirty-one species of cetaceans (whales, dolphins, and porpoises), and two species of otter. Many of these mammals occur in large concentrations and are dependent on the productive and secluded habitats for breeding, pupping, hauling out, feeding, and resting during migration. The Farallon Islands provide habitat for breeding populations of six species of pinnipeds, and support the largest concentrations of California sea lions and northern elephant seals within the sanctuary.

3.3.3 Socioeconomic Environment

A wide range of human-use activities occur in and around the waters of the GFNMS. The San Francisco Bay metropolitan area exerts considerable user influence on the scale and intensity of uses (often competitive) occurring in the area. The major near and offshore activities include commercial fishing and mariculture, commercial shipping, recreation, and research. Additional details on the extent of human-use activities in the sanctuary can be found in the introduction of each action plan in the sanctuary management plan.

Maritime Transport/Traffic in GFNMS

Three major shipping lanes converge in the sanctuary just west of the Golden Gate Bridge at the entrance to San Francisco Bay. The volume of traffic in and out of San Francisco Bay is large, totaling approximately 3,800 arrivals in 2013. This represents an average of over three tankers and ten other types of vessels per day. The port of San Francisco reports it receives approximately 60-80 cruise ship calls with a total of 200,000 passengers annually. Although partly constrained by the lack of local docking facilities, cruise ship visits to the area are likely to continue to grow

as the fleet shifts from international to more domestic cruises, and due to a new cruise ship docking facility at Pier 27 in the Port of San Francisco, which opened in September 2014.

Human Uses in GFNMS

As noted above, commercial fishing is a significant human use of the area. The most important commercial harvests include Pacific herring, salmon, flatfish, albacore, tuna, and Dungeness crab. As of the date of this publication, the offshore commercial groundfish fishery within the Gulf of the Farallones remains closed below 20 fathoms. Most of the commercial catches harvested in the sanctuary are landed in San Francisco, Bodega Bay, Oakland, Half Moon Bay, and Sausalito. A number of mariculture operations in Tomales Bay and Drakes Estero raise oysters, mussels, and other shellfish.

The sanctuary is a popular recreation area because of its many outstanding natural features and its proximity to the San Francisco Bay metropolitan area. More than 58 coastal access points in Sonoma, Marin, San Francisco, and San Mateo Counties provide direct access and views of the sanctuary. Most of these access points are located in federal, state, county, and local parks.

Sport fishing is one of the more popular activities in the sanctuary. King salmon and rockfish are the major species taken. Whale watching, Farallon Islands wildlife viewing, sailing, and oceanic birding excursions also account for several thousands of visitors venturing offshore. The major onshore recreational uses include beach-related activities, bird watching, coastal hiking, wildlife viewing, tide pooling, surfing, kayaking, canoeing, boardsailing, clamming, and surf fishing. On some weekend days, more than 1,000 clam diggers harvest geoduck, gaper, Washington, and littleneck clams.

Research and Education in GFNMS

The diversity of physical and biological habitats throughout the sanctuary offers an outstanding opportunity for scientific research on marine and estuarine ecosystems. Several academic institutions, government agencies and nongovernmental organizations have ongoing monitoring and research programs in the area. Research on the Farallon Islands (Farallon National Wildlife Refuge) is coordinated by the U.S. Fish and Wildlife Service (USFWS), through a Cooperative Agreement with Point Reyes Bird Observatory Conservation Science. The sanctuary collaborates with these and other institutions on conducting monitoring and research to help characterize the wildlife and habitats of the sanctuary and to help understand natural and human factors responsible for causing changes in the marine environment.

3.3.4 Maritime Heritage and Cultural Environment

Maritime Heritage Resources in GFNMS

The area encompassed by GFNMS is rich in cultural and historical resources, and has a long and interesting maritime history. The sea floor preserves remnants of the sites where people lived and of the vessels in which they conducted trade and fought wars. Ships, boats, wharves, lighthouses,

lifesaving stations, whaling stations, prehistoric sites, and myriad other heritage treasures lie covered by water, sand, and time.

The history of California's central coast is predominantly a maritime one. From the days of the early Ohlone inhabitants to the exploration and settlement of California to the present, coastal waterways remain a main route of travel, subsistence, and supply. Ocean-based commerce and industries (e.g., fisheries, shipping, military, recreation, tourism, extractive industries, exploration, and research) are important to the maritime history, the modern economy, and the social character of this region. These constantly changing human uses define the maritime heritage of these sanctuaries and help interpret our evolving relationship with the sanctuary resources. Ports such as San Francisco, and smaller coastal harbor towns, developed through fishing, shipping, and economic exchange. Today these have become major urban areas, bringing millions of people in proximity to national marine sanctuaries. Many of these people are connected to the sanctuaries through commercial and recreational activities such as surfing, boating, and diving.

Records indicate that 430 vessel and aircraft losses were documented between 1595 and 1950 along California's central coast from Cambria north to Bodega Head, including the Farallones Islands, specifically, 173 in the GFNMS. Some sites have been located and inventoried by NOAA and the National Park Service (NPS) in the GFNMS region. GFNMS and MBNMS have collaborated with state and federal agencies, and the private sector to gather resource documentation and to create opportunities to locate and record submerged archaeological resources. These studies provide a foundation for an inventory of the historic resources in the sanctuaries.

GFNMS is also faced with the challenge of identifying and monitoring historic and non-historic shipwrecks posing environmental threats to sanctuary marine resources. Lurking in the deep are the hazardous cargoes, abandoned fuel, and unexploded ordnance inside sunken vessels that are slowly deteriorating in a corrosive marine environment. A shipwreck already identified as a concern is the C-3 freighter *Jacob Luckenbach* (GFNMS), containing Bunker-C fuel oil. In 2002, the U.S. Coast Guard contracted the removal of 85,000 gallons of Bunker-C fuel from the *Jacob Luckenbach*.

Cultural and Historic Resources in GFNMS

ONMS regulations mandate that archaeological resources are managed consistently with the Federal Archaeological Program. See 15 C.F.R. § 922.2(e). The ONMS's Marine Heritage Program (MHP) and NOAA Maritime Archeological Center (MAC) were established in 2002 and 2004 respectively to emphasize the need for research, education, outreach, and protection of maritime heritage resources. Issues to be addressed regarding the protection of submerged archaeological resources include site protection, permitting, and shipwrecks as environmental threats.

As submerged shipwreck sites are inventoried in GFNMS and become more visible to the public, they are also more at risk from divers wishing to remove artifacts. GFNMS has future plans to enhance visitor usage while mitigating damage to heritage resources by providing the sport and commercial diving communities and visitors to shoreline sites with interpretive information about archaeological sites and their protection. Sanctuary and California state regulations prohibit the un-permitted disturbance of submerged archaeological and historical resources. The ONMS and California State Lands Commission (CSLC) have an archaeological resource recovery permit system in place. Protection and monitoring of these sites will become a more pronounced responsibility in the sanctuaries' heritage resources management program. Partnerships will be established with local law enforcement agencies for site monitoring and compliance of public access to submerged sites. The sanctuaries will designate a contact person(s) to coordinate with the California State Historic Preservation Office (SHPO) to ensure that permit guidelines, under the Archaeological Resources Protection Act, are followed.

GFNMS has also partnered in the development of the West Coast Shipwreck Database online curriculum. The database serves to inform the public about the historical significance of shipwrecks, including those posing environmental threats to sanctuary marine resources (e.g., the *Jacob Luckenbach* story). The database is being expanded to include living journals assisting families searching for information about shipwrecked vessels their relatives may once have served on as crewmembers or passengers. Family members are encouraged to share with the public their living journals associated with the shipwreck histories for dissemination. GFNMS will identify partners to explore exhibit development at maritime or regional museums and learning centers that focus on the areas' maritime heritage history; shipwrecks, exploration, fishing, and fisheries; vessel trades, routes and nationalities; surfing, and boating; and shoreline structures such as lighthouses, lifesaving stations, canneries, whaling facilities.

3.4 Monterey Bay National Marine Sanctuary

3.4.1 Physical Environment

Physical Characteristics/Geology

Monterey Bay National Marine Sanctuary, established in 1992, is the largest national marine sanctuary administered by the Office of National Marine Sanctuaries. The sanctuary extends along the coast from Rocky Point (Marin County) to Cambria Rock (San Luis Obispo County), encompassing nearly 450 km of shoreline. As originally designated in 1992, MBNMS encompassed 13,780 km2 of ocean, extended 91.5 km offshore at its widest point, and reached a depth of 3,250 m at its deepest point. On March 9, 2009, MBNMS was expanded by 2,007 km2 to include the Davidson Seamount Management Zone (DSMZ). Davidson Seamount is one of the largest known underwater mountains in U.S. coastal waters; it is 2,280 m tall, 42 km long and 13 km wide. The shallowest point is 1,682 m below the ocean's surface and the deepest part of the DSMZ is 3,875 m.

The Davidson Seamount is a pristine undersea mountain habitat 128 km to the southwest of Monterey and 120 km west of San Simeon. The seamount is volcanic in origin, rising to considerable height from great depth on the continental rise. The vertical nature and rocky substrate on the seamount creates habitat that is vastly different from the surrounding soft-sediments on the seafloor. The seamount has been called "An Oasis in the Deep," hosting large coral forests, vast sponge fields, crabs, deep-sea fish, shrimp, basket stars, and high numbers of rare and unidentified benthic species.

The MBNMS contains one of the world's most geologically diverse and complex seafloors and continental margins. The MBNMS is located on a plate boundary that separates the North American Plate from the Pacific Plate, and is marked by the San Andreas Fault system. This is an active tectonic region with common occurrences of earthquakes, submarine landslides, turbidity currents, flood discharges and coastal erosion. It is also a region of extensive natural and economic resources.

Coastal topography varies greatly, encompassing steep bluffs with flat-topped terraces and pocket beaches to the north; large sandy beaches bordered by cliff and large dune fields mid- MBNMS; and predominately steep, rocky cliffs to the south. Low- to high-relief mountain ranges and broad, flat-floored valleys are prevalent farther inland.

3.4.2 Biological Environment

Essential Fish Habitat

The following areas of the Groundfish Essential Fish Habitat in the Pacific Exclusive Economic Zone overlap with MBNMS: Half Moon Bay, Monterey Bay/Canyon, Point Sur Deep and Davidson Seamount. These four EFH areas, which overlap with the sanctuary boundaries, comprise 31,780 acres, 533,171 acres, 54,106 acres and 497,347 acres, respectively. In the Davidson Seamount area, bottom trawl gear and gear deployed deeper than 500 fathoms is prohibited. In the other three areas, bottom trawl gear other than demersal seine is prohibited.

Birds

Sanctuary waters are among the most heavily utilized by seabirds worldwide. Ninety-four species of seabirds are known to occur regularly within and near the sanctuary. Approximately ninety species of tidal and wetland birds regularly occur on the shores, marshes and estuaries bordering on sanctuary waters. Their success depends, in part, on fluctuating marine conditions, specifically El Niño.

Fish and Invertebrates

In 2002, researchers examined the status of fish populations in the sanctuary from 1981-2000. (Starr et al., 2002) About 200 species are typically caught in commercial and recreational fisheries in the sanctuary, and most are landed at one of five main ports: Princeton/Half Moon Bay, Santa Cruz, Moss Landing, Monterey Bay, and Morro Bay/Avila/Port San Luis. More than

80 percent by weight of the commercial fish landings at these five harbors are comprised of squid, rockfish, Dover sole, anchovy, mackerel, sardines, sablefish, albacore, and salmon. In the last twenty years, catches of some pelagic species have increased (mainly sardine and squid), but landings of many other species have decreased. As noted above, EFH was designated by the PFMC in 2006, and includes all federal waters in the MBNMS out to the EEZ. EFH Conservation Areas, which are no trawl zones, are quite extensive and cover large expanses of the Sanctuary.

Invertebrate species in the MBNMS include squid, sponges, anemones, jellies, worms, corals, tunicates, snails, octopus, clams, and arthropods such as barnacles, crabs, and spot prawns. Thousands of various species of invertebrates populate the MBNMS. Most invertebrate species are not harvested commercially, with the exception of squid, spot prawn, and Dungeness crab, rock crab, and octopus. Various types of invertebrates are found in all habitats from the sandy beach to intertidal, mid-water, and deep sea.

Protected Species

Fifty-six federally protected species occur in MBNMS. Of those, 29 species are listed as threatened or endangered. These include: White abalone, Black abalone, Rockfish (bocaccio, canary, and yelloweye), Pacific smelt, Salmon (chinook, coho and sockeye), Steelhead trout, Scalloped hammerhead shark, Green and white sturgeon, Tidewater goby, Blue whale, False killer whale, Fin whale, Humpback whale[22], Gray whale, Killer whale, Sei whale, North Pacific Right whale, Short-tailed albatross, California clapper rail, California least tern, Sperm whale, Guadalupe fur seal, Steller sea lion, Northern and Southern sea otter, Leatherback sea turtle, Loggerhead sea turtle, Green sea turtle, Olive ridley sea turtle, and Hawks bill sea turtle. In addition there are seven species of shorebirds and two terrestrial species (please refer to Appendix D for a complete list).

The sanctuary has one of the most diverse and abundant assemblages of marine mammals in the world, including six species of pinnipeds (seals and sea lions), thirty-two species of cetaceans (whales, dolphins, and porpoises), and two species of fissiped (sea otter). California sea lions are the most common pinnipeds in the sanctuary, and their numbers continue to increase. During the El Niño event in 1997-1998, more sea lions were observed at Año Nuevo Island than ever before, and the number of pups born also increased. Probably the fastest growing population of marine mammals in the sanctuary is the northern elephant seal, with haul-out sites at Año Nuevo, Point Piedras Blancas, and isolated Big Sur beaches. The most dramatic increase in their population has occurred at beaches near Point Piedras Blancas, from 400 adults in 1991 to more than 20,000 in 2015, according to observations from the U.S. Geological Survey.

A common cetacean and visitor in the sanctuary, the gray whale has increased in number over the years (approximately 2.5 percent per year), resulting in the 1994 delisting of the California stock (or Eastern North Pacific stock) from the federal list of endangered and threatened species.

[22] See footnote #12.

Recent counts of the threatened California sea otter have made population trends difficult to interpret. In the late 1990's, sea otter numbers consistently declined, but in the spring of 2000 there was an apparent 10.9 percent increase from the spring 1999 counts. Surveys from fall 2000 reported a 4.7 percent decrease in adults from the previous fall, but pup production was up 22 percent. On a longer time scale, however, the sea otter population has increased by approximately 10 percent since sanctuary designation in 1992.

3.4.3 Socioeconomic Environment

Five counties border the MBNMS: Marin, San Mateo, Santa Cruz, Monterey and San Luis Obispo. Two additional inland counties, Santa Clara and San Benito, have watersheds, which drain directly into the MBNMS. Each is diverse in terms of population and economic base. The northern region borders Marin County and the San Francisco Peninsula, and north of the San Mateo County line, day-to-day operations of the sanctuary are managed by the GFNMS staff. In the southern region, Monterey County faces significant growth challenges. Agriculture is the leading industry, followed by tourism. San Luis Obispo County's economy focuses on agriculture, tourism, and education. These counties face significant economic and developmental challenges in addressing population growth. Limited infrastructure to accommodate the coastal population growth, a lack of labor for growing companies, a growing gap between the wealthy and other residents, and environmental pressures comprise the main constraints to urban expansion.

Human Uses in MBNMS

Travel and tourism is one of the most significant industries, with total travel-spending revenue in 2003 of $5.9 billion ($7 billion adjusted for 2010 dollars) for the five counties adjacent to the MBNMS. San Mateo leads in total spending at $2.0 billion, followed by Monterey at $1.8 billion, and San Luis Obispo at $ 930 million. (Source: Dean Runyan and Associates) Two of the main reasons given for travel to the coastal region are its natural and scenic beauty and recreational opportunities.

The fishing industry in this area constitutes a relatively small portion of the overall economy, both regionally and statewide. However, it reflects an important component to the historical, economic, and cultural fabric of the region. Most fish caught within the MBNMS are landed at one of five main ports: Princeton /Half Moon Bay, Santa Cruz, Moss Landing, Monterey Bay, or Morro Bay/Avila/Port San Luis. More than 600 commercial vessels fish within the MBNMS annually, and more than 80 percent of the commercial landings by weight are comprised of squid, rockfish, Dover sole, anchovy, mackerel, sardines, sablefish, albacore, and salmon. In 2003, ex-vessel revenues for all species within the MBNMS totaled almost $16.6 million dollars paid to commercial fishers in California. Additional revenue is also generated from the businesses associated with fishing operations, including marinas, maintenance operations, and equipment.

Research and Education in MBNMS

The rich biodiversity and close proximity of the deep sea also provide unparalleled research opportunities for approximately twenty-five marine science facilities that, in 2004, employed almost 2,000 people as staff and researchers with a combined budget of over $200,000,000. This includes government agencies, public and private university research institutions, and private facilities such as the Monterey Bay Aquarium and the Monterey Bay Aquarium Research Institute.

MBNMS has two visitor centers – the Sanctuary Exploration Center in Santa Cruz and the Coastal Discovery Center in San Simeon – both provide a variety of displays and activities. Programs range from monitoring water quality and studying tide pools to interacting with sanctuary visitors. A series of events are offered during the year including the Sanctuary Currents Symposium, and the Coastal Discovery Fair.

3.4.4 Maritime Heritage and Cultural Environment

Maritime Heritage Resources in MBNMS

Records indicate that 257 vessel and aircraft losses were documented between 1595 and 1950 along California's central coast, within the MBNMS. These wrecks were a result of the significant maritime exploration and commerce which historically occurred in the region, coupled with a coastline dotted with shallow, rocky headlands, largely exposed to prevailing winds, storms, and fog.

Cultural and Historic Resources in MBNMS

The sea floor preserves remnants of the sites where people lived and of the vessels in which they conducted trade and fought wars. Ships, boats, wharves, lighthouses, lifesaving stations, whaling stations, prehistoric sites, and myriad other heritage treasures lie covered by water, sand, and time.

Sanctuary staff has collaborated with state and federal agencies, and the private sector to gather resource documentation and to create opportunities to locate and record submerged archaeological resources. MBNMS recently commissioned a shipwreck inventory from established shipwreck databases, and review of primary and secondary source documentation. These studies provide a foundation for an inventory of the historic resources in the sanctuary.

3.5 Channel Islands National Marine Sanctuary

3.5.1 Physical Environment

Physical Characteristics/Geology

The Channel Islands National Marine Sanctuary (CINMS) boundary begins at the Mean High Water Line of and extends seaward to a distance of approximately six nm from, the following islands and offshore rocks: San Miguel Island, Santa Cruz Island, Santa Rosa Island, Anacapa Island, Santa Barbara Island, Richardson Rock, and Castle Rock (the Islands). The sanctuary resides within the upper portion of the Southern California Bight (SCB), which is formed by a transition in the California coastline wherein the north-south trending coast begins to trend east to west.

The Channel Islands are all located within a unique, 300-mile long oceanographic region of basins and elevated ridges known as the "Continental Borderland" (Norris and Webb 1990). The Channel Islands are the ridge portions rising above sea level. The highest point in the Channel Islands is the 2,450 foot Picacho Diablo on Santa Cruz Island. Lying parallel between the California coast and the Channel Islands is the 1,950-foot deep Santa Barbara Basin (Norris and Webb 1990).

3.5.2 Biological Environment

Biological Habitat/Oceanography in CINMS

The waters swirling around the five islands within CINMS combine warm and cool currents to create an exceptional breeding ground for many species of plants and animals. Forests of giant kelp are home to numerous populations of fish and invertebrates. Every year over 27 species of whales and dolphins visit or inhabit the sanctuary including the rare blue, humpback and sei whales. On the islands, seabird colonies and pinniped rookeries flourish while overhead brown pelicans and Western gulls search the water for food. This section describes some of the species and habitats in the sanctuary; for a more complete description, see the 2008 Final Environmental Impact Statement for the sanctuary's management plan (U.S. Dept. of Commerce 2008, Vol. II, Section 3.0, http://channelislands.noaa.gov/manplan/pdf/feis11-08.pdf).

Giant kelp, a keystone species, forms extensive underwater beds on rocky substrates (except *M. angustifolia* which occurs on sand) at shallow subtidal depths (9.9 to 99 feet) throughout the sanctuary region. These impressive, underwater forests are conspicuous features of the sanctuary and important not only to the regional ecology, but to recreational and commercial interests as well. Kelp beds in the sanctuary are productive habitats that provide food, attachment sites, and shelter for myriad invertebrates and fish. The dense thicket of kelp in the water column and at the surface is particularly important as a nursery habitat for juvenile fish.

The two types of marine flowering plants found in the sanctuary are surfgrass and eelgrass. Surfgrass beds are highly productive and complex microhabitats that support a wide variety of marine species. Eelgrass beds are ecologically important for primary production, nutrient cycling, and substrate stabilization (Phillips 1984). Eelgrass provides habitat and food for a unique assemblage of plants, invertebrates, and fish (den Hartog 1970; McConnaughey and McRoy 1979; Phillips 1984). The largest beds of eelgrass in the sanctuary occur at Smugglers Cove, Canada del Agua, and Prisoners Harbor on Santa Cruz Island and at Bechers Bay on Santa Rosa Island.

Intertidal zones consist of a variety of coastal habitats periodically covered and uncovered by waves and tides. Intertidal habitat within the sanctuary is composed of approximately 94.5 miles of rocky coastline interspersed with approximately 47 miles of sandy beaches. Rocky shores support a rich assortment of plants and animals, including numerous green, brown, and red algae, beds of surfgrass, sedentary invertebrates such as barnacles, limpets, and mussels, mobile invertebrates such as snails and crabs, and fish. Seabirds forage in the intertidal at low tide while some roost in aggregations on cliffs just above the shore. Seals and sea lions depend on many of the sanctuary's intertidal shores for hauling out, especially at San Miguel and Santa Rosa Islands.

Subtidal habitats include those marine habitats ranging from the lower limit of the intertidal zone down to 99 feet. Nearshore subtidal habitats include mud, sand, gravel, cobble, and bedrock substrates that are subject to dynamic physical processes, including wave exposure, coastal currents, upwelling, suspended sediments and variability in temperature, salinity and nutrients. Nearshore subtidal rocky habitats at the Islands are widespread, especially high relief volcanic reefs with walls, ledges, caves, and pinnacles. Typical shallow subtidal areas in the sanctuary contain assemblages of plants, invertebrates, and fish, with giant kelp dominating.

Deep-water habitats extend from 99 feet to greater than 660 feet deep. Well over 90 percent of deep-water benthic habitats in the sanctuary consist of fine sands in shallower portions, grading into silt and clay-dominated sediments in deeper portions. Coarse sediments occur near Point Conception, and north of San Miguel Island. Fine sediments occur on the sill at the western end of the Santa Barbara Channel, and in the Santa Barbara Basin. Deep rock bottoms often are located offshore from major headlands and islands, and on the highest parts of undersea ridges, banks, and pinnacles. High relief pinnacles and ridges occur in some areas, such as off the northwest end of San Miguel Island.

Water column, or pelagic, habitats consist of discrete portions of ocean waters categorized by variation among multiple factors, such as light penetration, temperature, oxygen concentration, and density. Based on variation among these factors the water column is divided into numerous vertical and horizontal sub-habitats: microlayer, photic zone (surface to 660 feet), mesopelagic zone (660 to 3,300 feet) and bathypelagic zone (3,300 to 11,500 feet). Water column habitats within the majority of the Sanctuary do not extend deeper than the mesopelagic zone, although the southern reaches of the Sanctuary boundary near the mouth of Santa Cruz Canyon (a

submarine canyon between and offshore from southeastern Santa Rosa Island and southwestern Santa Cruz Island) approach bathypelagic depths.

Essential Fish Habitat in CINMS

The following areas of the Groundfish Essential Fish Habitat in the Pacific Exclusive Economic Zone overlap with CINMS: Richardson Rock EFH (46,665 acres), Carrington Point (8,168 acres), Harris Point (32,152 acres), Judith Rock (2,945 acres), South Point State (9,583 acres), Skunk Point (884 acres), Gull Island (22,434 acres), Painted Cave (1,142 acres), Scorpion (11,955 acres), Anacapa Island (15,999 acres), Footprint (17,253 acres) and Santa Barbara Island 36,438 acres). In all twelve of these EFH areas, use of bottom contact gear is prohibited.

Birds in CINMS

Over 195 species of birds use open water, shore, or island habitats in the Southern California Bight. The Channel Islands region is located along the Pacific Flyway, a major migratory route for birds, and acts as a stopover during both north (April through May) and south (September through December) migrations. The months of June and July are peak months for transient shorebirds. The diversity of habitats provided both on- and offshore also contributes to the high species diversity in the region. Sandy beaches provide foraging and resting habitat for a number of shorebirds including Black-Bellied Plover, Willet, Whimbrel, Long-billed Curlew, gulls, and sanderlings. The upland potions of the beach provide kelp deposits that attract invertebrates where Black and Ruddy Turnstones, dowitchers, and other shorebird species forage. Several bird species within sanctuary region have special status (of concern, threatened or endangered) under federal or state law. The sanctuary provides important habitat for eight seabirds with special status under federal or state law: Ashy storm-petrel, Black storm-petrel, California brown pelican, California least tern, Double-crested cormorant, Rhinoceros auklet, Western snowy plover, and Scripps's murrelet.

Fish and Invertebrates in CINMS

About 481 species of fish inhabit the Southern California Bight (SCB). The great diversity of species in the area occurs for three principal reasons: 1) the ranges of many temperate and tropical species extend into and terminate in the SCB; 2) the area has complex bottom topography and a complex physical oceanographic regime that includes several water masses and a changeable marine climate; and 3) the islands and nearshore areas provide a diversity of habitats including soft bottom, rock reefs, extensive kelp beds, and estuaries, bays, and lagoons. The fish species found around the Channel Islands generally are representative of fish assemblages occurring along the southern California coast, with the addition of some central California species. Abundance of fish assemblages is greater at the northern Channel Islands than at nearby coastal regions of the southern California mainland.

Benthic invertebrates include species from nearly all phyla of invertebrates living in (infauna) or on (epifauna) the sea floor during most of their lives, though most also have pelagic larvae. Pelagic invertebrates (e.g., jellyfish and squid) also exist in the sanctuary water column. The

Channel Islands support a wide variety of invertebrates due to their transitional location between cold and warm bioregions and diversity of substrates. The substrates include sheltered and exposed coasts at depths from the intertidal to deep slopes, canyons and basins. The total number of species may well be in excess of 5,000, not including microinvertebrates. Select invertebrates in the sanctuary include multiple species of corals, prawns, spiny lobster, crabs, sea urchins, sea cucumbers, sea star, abalone, nudibranchs, scallops, mussels, squid, clams, barnacles, snails, salps, tunicates, jellyfish, sea slugs, and anemones. White abalone is protected as endangered species by the ESA.

Protected Species in CINMS

Four species of sea turtles have been reported in the offshore southern California region: green, loggerhead, olive ridley, and leatherback. Most information on sea turtle distribution in southern California is based on stranding data. This stranding data indicates all four species of sea turtle may be found within the sanctuary at any time of year. All sea turtles are protected by the ESA. The sub-populations of loggerhead and leatherback turtles found in the region are listed as ESA endangered, while the sub-populations of green and olive ridley turtles are threatened.

There are three marine mammal groups in the sanctuary: 1) whales, dolphins and porpoises (cetaceans); 2) seals and sea lions (pinnipeds); and 3) the southern sea otter.

At least 34 species of cetaceans have been reported in the sanctuary region. Common species found in the sanctuary include: long-beaked common dolphin, short-beaked common dolphin, Bottlenose dolphin, Pacific white-sided dolphin, Northern right whale dolphin, Risso's dolphin, California gray whale, Blue whale (endangered), and Humpback whale[23] (threatened). In winter and spring during the gray whale migrations, orcas are frequently reported in the region. Please refer to Appendix D for a full list of species.

The productive waters and relatively undisturbed environment of the sanctuary provide vital habitat for pinnipeds, offering important feeding areas, breeding sites, and haul outs. Three species commonly found throughout or in part of the sanctuary are the California sea lion, northern elephant seal, and Pacific harbor seal. Rare or uncommon species sighted within the sanctuary include the northern fur seal, Guadalupe fur seal (endangered), and Steller sea lion (threatened).

Sea otters (threatened) were common in the Channel Islands until prolonged periods of hunting led to local extinction at the Islands and severe depletion along the mainland California coast. An international treaty banning sea otter hunting was established in 1911 in order to protect the few remaining individuals. The California population slowly increased from a remnant colony off Bixby Creek in central California. The 2007 USGS Western Ecological Research Center sea otter spring survey found 106 independent sea otters and zero confirmed pups south of Point

[23] See footnote #12.

Conception. The Spring 2012 USFWS survey reported the highest number of pups on record observed southeast of Point Conception over the last few years. While sea otters have not yet recolonized areas within the Sanctuary, they will likely eventually reestablish their range within Sanctuary boundaries at some point in the future.

Table 10. A list of selected marine mammals found around CINMS, their ESA Status, and functional hearing ranges for three Cetacean functional groups. For a full list, please refer to Appendix D.

Common Name	Scientific Name	Local Population Status	Functional Hearing Group	Functional Hearing Range
Blue Whale	*Balaenoptera musculus*	Endangered	Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 35 kHz
Gray Whale	*Eschrichtius robustus*	Delisted		
Minke Whale	*Balaenoptera acutorostrata*	No ESA Listing		
Humpback Whale	*Megaptera novaeangliae*	Endangered		
Sei Whales	*Balaenoptera borealis*	Endangered		
Sperm Whales	*Physeter macrocephalus*	Endangered	Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 Hz to 160 kHz
Bottlenose Dolphin	*Tursiops truncates*	No ESA Listing		
Killer Whale	*Orcinus orca*	Endangered		
Long Beaked Common Dolphin	*Delphinus capensis*	No ESA listing		
Pacific White-Sided Dolphin	*Lagenorhynchus obliquidens*	No ESA Listing		
Short-Beaked Common Dolphin	*Delphinus delphis*	No ESA Listing		
Harbor Porpoise	*Phocoena phocoena*	No ESA Listing for local population	HF	275 Hz to 160 kHz

California Sea Lion	*Zalophus californianus*	No ESA Listing	OW	60 Hz to 39 kHz
Harbor Seals	*Phoca vitulina*	No ESA Listing		
Northern Elephant Seals	*Mirounga angustirostris*	No ESA Listing		
Guadalupe Fur Seal	*Arctocephalus townsendi*	Threatened		
Southern Sea Otter	*Enhydra lutris nereis*	Threatened		
Stellar Sea Lion	*Eumetopias jubatus*	Threatened	OW	60 Hz to 39 kHz

There are a number of other ESA species around the Channel Islands including 2 species of abalone, 6 species of birds, and the Green Sturgeon.

3.5.3 Socioeconomic Environment

The unique nature of the sanctuary region has attracted many commercial and recreational uses. The proximity of the northern Channel Islands and Santa Barbara Island to the mainland coast makes them uniquely accessible from Santa Barbara, Ventura, Port Hueneme, and Channel Islands Harbors as well as ports in Los Angeles County (primarily San Pedro and Terminal Island). Human use of the sanctuary is not limited to regional residents; almost 20 percent of those who use California's coastal areas for recreation are interstate or international visitors.

Within the sanctuary region, population growth has risen sharply over the last twenty years. The population of southern California is nearly 20 million, including a combined population of over 1.1 million for the two counties adjacent to the sanctuary, Santa Barbara and Ventura. This represents a regional increase in population of approximately 43% since 1980. As the numbers of people increase, so do the number of sanctuary users involved in a wide variety of activities. Today the number of regional sanctuary users is growing exponentially.

Maritime Transportation/Traffic in CINMS

CINMS is located in close proximity to Los Angeles/Long Beach Harbor, the second busiest port in the United States, and Port Hueneme, a deep-water international port. These ports generate extensive commercial shipping traffic transiting the Santa Barbara Channel using shipping lanes passing through the sanctuary at its northeast boundary (an average of 6,500 cargo vessels travel through the Santa Barbara Channel each year). CINMS is one of only two internationally accepted "areas to be avoided" (ATBAs) for oil tankers on the Eastern Pacific. As a result, oil tankers often voluntarily reroute to the outer Santa Barbara Channel, outside the sanctuary.

Military Operations in CINMS

Currently, CINMS maintains a positive and important working relationship with the regional representatives of United States military, which maintains a strong presence in the CINMS region. The U.S. Air Force and U.S. Navy, individually and together, conduct training exercises, and support military testing and evaluation projects for aircraft, ship, and missile programs. Both support commercial space launch missions as well. The Vandenberg Air Force Base (VAFB), Point Mugu Sea Range and Port Hueneme coastal and marine areas are the primary locations for these military activities. The USCG, which operates a Marine Safety Detachment and Coastal Patrol Boat at Santa Barbara, California, and a Station and Coastal Patrol Boat at Oxnard, California, conducts several activities in the sanctuary region, such as search-and-rescue, migrant and drug interdiction, fisheries enforcement, marine environmental protection, marine mammal protection and monitoring and inspection of all international vessels experiencing mechanical difficulty and distress.

Human Uses in CINMS

Recreational and tourist-related activities occur throughout the waters of the Channel Islands National Marine Sanctuary. Many activities are more heavily concentrated close to the islands and on the eastern half of the CINMS. Sportfishing, diving, whale watching, pleasure boating, kayaking, surfing, and sightseeing are all popular pastimes within the Sanctuary. The recreation and tourism businesses represent over 490,000 person-days of annual activity within the CINMS annually.

Due to its relatively mild weather, the Channel Islands region is a leading year-round sportfishing (or recreational fishing) area along the West Coast. In 1999, sportfishing and consumptive diving activity in the sanctuary generated approximately $24 million in income and supported 654 full and part-time jobs in Santa Barbara, Ventura and Los Angeles counties. Recreational (or sport) fishing is typically done with hook-and-line, nets and spearguns and may be conducted from shore, from vessels, or using SCUBA equipment (consumptive diving). Both sportfishing and consumptive diving (including SCUBA and free-diving) in the sanctuary take place primarily from private and chartered commercial passenger fishing vessels (CPFVs). Sport fisheries in the region access both nearshore and offshore areas, targeting bottom and mid-water fish species, primarily in the eastern half of the sanctuary. Types of fish landed on CPFVs include kelp bass, mackerel, California sheephead, halfmoon, and whitefish. Species commonly targeted by consumptive divers, who travel from all over the world to dive in the sanctuary, include many rockfish species and kelp bass, halibut, yellowtail and white seabass, as well as lobster and scallops. Offshore fishing focuses on mobile species like yellowtail, tuna, white seabass, barracuda, broadbill swordfish, marlin, and mako shark.

Wildlife viewing in the sanctuary, especially whale watching, is very popular due to the high frequency of sightings and diversity of marine life. Day trips are offered from several area landings including Santa Barbara, Ventura and Channel Islands harbors. In 1999, eight whale

watch operations accounted for almost 26 thousand person-days of activity and about $1.5 million in revenue from CINMS activity.

Boating is another popular recreational activity within the sanctuary, which, due to its numerous protected anchorages and scenic coastlines, is a highly sought-after destination for both sail and powered boats. The Channel Islands are within reach of several ports for single or multiple day trips and Channel Islands, Ventura, and Santa Barbara Harbors contain over 5,000 slips used by recreational, commercial, and research vessels. Due to abundant marine life and the presence of large sea caves and rock formations, the Channel Islands are considered a primary destination of interest for sea kayakers in California. Several regional operations offer sea kayaking excursions in the sanctuary region. In 1999, eight for-hire operators provided over 4000 person-days of sailing in the sanctuary, and four businesses provided over 1200 person-days of kayaking and sightseeing in the sanctuary. Surfing occurs year-round within the sanctuary, but is generally most popular during the summer months. The number of surfers visiting the sanctuary has risen steadily over the past several years, with the most popular destinations being closer to mainland ports.

The sanctuary region is considered to have some of the most highly sought after diving locations in the world. There is great interest in non-consumptive diving in the Sanctuary due to the diversity and beauty of the marine habitat, shipwrecks, and other underwater historical sites. Of the over 140 wrecks in the Channel Islands National Park and National Marine Sanctuary combined, 21 of these have been located and are popular dive sites. In 1999, seven charters operators accounted for almost 11 thousand person-days of nonconsumptive diving in the sanctuary and generated approximately $685,000 in revenue.

The sanctuary also has extremely productive commercial fishing grounds. Commercial fishing gear used in the sanctuary includes nets, traps, lines, and dive equipment. The majority of target species are caught in nearshore waters containing giant kelp beds, an important habitat for numerous species. Key target species include: squid, sea urchin, spiny lobster, prawn, nearshore and offshore finfish (e.g., rockfish and California sheephead), coastal pelagic species (e.g., anchovy, sardine, and mackerel), flatfish (e.g., California halibut, starry flounder, and sanddabs), rock crab, sea cucumber, tuna, and kelp. Live fish trapping for rockfish, California sheephead, California scorpionfish and other shallow water species occurs primarily near the coastlines of the Channel Islands. In addition, trap gear is used to take shrimp and prawns, California spiny lobster, and three types of rock crab (red, brown and yellow). Other fisheries include shark and swordfish drift netting, squid seining, urchin diving, ocean (or pink) shrimp trawling, and diving or trawling for sea cucumbers. Most of California’s commercial dive sea cucumber catch is from the four northern Channel Islands. Abalone, once one of the most valuable fisheries in the sanctuary (over $2.5 million harvested between 1988 and 1997) and state, was closed to commercial harvest by the state legislature in 1997. There is a small but increasing fishery for turban snails and whelks, which is not currently regulated.

For over 50 years, giant kelp harvesting occurred near Point Conception, San Miguel Island, Santa Rosa Island and near Point Mugu and was, prior to 2005, another of the sanctuary's most valuable harvested species. In 1999, kelp harvested from the CINMS had a processed value of about $6 million. Commercial kelp harvesting ended in 2005 for economic reasons.

Research and Education in CINMS

The Channel Islands are the subject of extensive scientific interest as thousands of academic and professional researchers conduct research activities within CINMS and produce myriad sanctuary-focused articles, academic papers, and other products. The Channel Islands are the subject of extensive research activities, most of which fall under the following categories: physical and biological science research; socioeconomic, cultural, and historic research; and political science research.

Solid Waste and Pollution in CINMS

The Santa Barbara Channel is rich in oil and gas resources. As a result, numerous oil and gas activities have occurred in this region for over a century and oil has been extracted from the Santa Barbara Channel region since 1896 (Lima 1994). In 1969, a blowout at the Unocal platform off the California coast near the town of Summerland caused a significant oil spill along the south central California coast. The impacts resulting from this accident were one of the major factors contributing to the designation of the CINMS in 1980. Since designation all new oil and gas exploration, development, and production activities have been prohibited in the Sanctuary. Currently, there are 79 remaining federal outer continental shelf (OCS) active leases off the coast of Southern California. Of these 79 federal leases there are a total of 43 developed (producing) leases, 39 of which are in the Channel Islands region. In May of 2015, NOAA responded to a pipeline rupture that spilled 21,000 gallons (500 barrels) of oil and occurred near Refugio State Beach in Santa Barbara County. The oil spill consisted of patches and streaks of various sizes and thicknesses, broken up and spread over approximately 20 miles of coast and up to 5 miles offshore. The work on the Natural Resource Damage Assessment and development of a restoration plan are ongoing.

3.5.4 Maritime Heritage and Cultural Environment

Maritime Heritage Resources in CINMS

For 13,000 or more years before European contact, the ancestors of today's Chumash peoples lived and thrived on the Channel Islands and surrounding waters that we now call a National Park and National Marine Sanctuary. In early historic times, maritime activities resulted in many ships running aground or sinking within the dangerous waters surrounding the Channel Islands, leaving us today with hundreds of historic shipwrecks, some discovered and many still lost. This rich maritime heritage of the Channel Islands region stands as a testament to the cultural importance and historic value of the sanctuary. Maritime heritage resources (MHRs) consist of paleontological remains, prehistoric archaeological sites and associated artifacts, shipwrecks,

aircraft wrecks, and material associated with wharves, piers and landings. These resources represent a broad time-span of the Santa Barbara Channel's cultural history. Early human remains of a woman ("Arlington Springs Woman") were discovered at Arlington Canyon on Santa Rosa Island, dating back to the end of the Pleistocene, approximately 13,000 years ago. Historical remains may exist from as early as Juan Rodriguez Cabrillo's voyage of 1542 to 1543, through modern times.

For hundreds of years, mariners transiting this region have been faced with prevailing winds, extreme weather conditions and natural hazards. Between the years 1853 to 1980, an inventory of over 140 shipwrecks and aircraft wrecks has been documented in the sanctuary. To date about twenty of these sites have been located. These wrecks reveal the diverse range of activities and nationalities that traversed the Santa Barbara Channel. They include vessels engaged in various trades; California Gold-Rush, passenger and cargo, lumber, international coal and grain, fisheries, military and island commerce. These American and European shipwrecks depict a remarkable diversity in sail and steam propulsion. The sanctuary has a very active shipwreck reconnaissance program working in partnership with the Channel Islands National Park and Coastal Maritime Archaeology Resources (CMAR) avocational group. Several of the submerged shipwreck sites have been recorded through the development of underwater maps.

Cultural and Historic Resources in CINMS

The coastal portion of the original Chumash homeland stretches along the California coast from north of Morro Bay to Malibu Point in the south, and encompasses the Northern Channel Islands. Occupying hundreds of villages within this area in sophisticated and complex societies, the ancestral Chumash people spoke several related languages throughout the region and relied on a diverse array of natural resources. Island Chumash produced the majority of shell bead money used by peoples throughout southern California and beyond. In fact, the modern designation of "Chumash" is derived from Mi'čumaš (or Mi'chumash), a Chumash word for "makers of shell bead money."

The abundance of prehistoric Chumash artifacts found in the Santa Barbara Channel attests to the thriving life ways of the Island Chumash before their forced removal from the Islands due to European incursions. Study of those artifacts may help us understand the long-term viability of those life ways by determining the relative effects of subsistence and environmental fluctuation on prehistoric faunal assemblages in the Santa Barbara Channel. As the descendants of those early people, today's Chumash continue to have a deep spiritual and cultural connection to the sanctuary, regularly journeying across the Santa Barbara Channel in tomols (seaworthy redwood plank canoes) traditionally used for thousands of years for inter-village and inter-island trade and travel as well as for offshore fishing.

Recently discovered paleontological remains have also contributed to the rich record of the area. In 1994, for example, a relatively complete pygmy mammoth was discovered on a coastal bluff on the north shore of Santa Rosa Island. This discovery represents the most complete pygmy

mammoth discovered in the world to date and suggests a high probability of the existence of submerged paleontological remains within the sanctuary.

4.0

ENVIRONMENTAL CONSEQUENCES

This section evaluates the environmental consequences of the No Action (status quo) alternative and the other alternative as described in Chapter 2. The environmental effects of these alternatives are evaluated within the context of the physical, biological, socioeconomic and historic and cultural sanctuary setting. Information about the physical, biological, socioeconomic and historic and cultural sanctuary setting can be found in Chapter 3 (Affected Environment).

Characterizing Effects

NEPA requires consideration of the effects of major federal actions on the quality of the human environment (42 U.S.C. § 4332(I)). Effects are characterized as negligible, less than significant, or significant, and are also characterized by type (adverse or beneficial), context, intensity and duration (short- or long-term). Effects can be further characterized by whether they affect resources directly or indirectly. The following definitions and characterizations were used for this analysis:

- **Negligible effects** – effects for which virtually no effect to a resource can be detected (whether beneficial or adverse), essentially "neutral" effects.
- **Less than significant effects** – effects that do not rise to the level of significant as defined below, or these can be thought of as "minor" effects.
- **Significant effects** – effects resulting in an alteration in the health of a physical, biological, historic/cultural or socioeconomic resource. Long-term or permanent effects with a high intensity of alteration to a resource, whether beneficial or adverse would be considered significant. The significance threshold is evaluated on a case-by-case basis, taking into consideration the context and intensity of each action.
- **Direct effects** – effects that are caused by the action and occur at the same time and place.
- **Indirect effects** – effects that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land

use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.

4.1 Alternative 1: No Action/Status Quo

Under the No Action Alternative, ONMS would continue to conduct field operations to support sanctuary goals and objectives, and implement required mitigations. Certain activities would be modified as a result of intra- and inter-agency consultation with NMFS and FWS pursuant to the MMPA and ESA, in order to minimize impact on protected species. While the specific mitigation measures required by the consulting or permitting agencies (if any) are not known at this time, NOAA assumes that adverse environmental impacts of field operations would be reduced. NOAA will complete consultation with NMFS and FWS prior to publishing the final EA. The final EA will clearly describe any mitigation measures issued as a result of this consultation process and will contain an additional analysis of the environmental consequences of this alternative at that juncture.

4.1.1 Physical Environment

Geology

Activities with less than significant beneficial, less than significant adverse and negligible impacts

Onshore Fieldwork

Onshore fieldwork consisting of the removal or relocation of large items such as grounded vessels or large amounts of marine debris is expected to have less than significant beneficial impacts to the physical environment by ensuring the prompt removal of grounded vessels or marine debris. Such activities ensure large and potentially damaging items are no longer a threat to the marine and nearshore environment. The beneficial impacts are expected to be less than significant because the scope of work in this category is limited.

Onshore fieldwork that consists of the removal or relocation of large items such as grounded vessels or large amounts of marine debris may have less than significant adverse impacts to the physical environment when removing or moving large items from a shoreline area. For example, the removal of grounded vessels may require motorized equipment that may alter the surrounding environment and the relocation of large items may adversely impact the substrate upon which the vessel or marine debris was originally found during the removal or relocation process. However, adverse impacts to the physical environment of the area are expected to be less than significant because they are conducted infrequently, within a localized area, for a short duration, amounting to a low impact and short term effect on the physical geological surrounding environment.

Onshore fieldwork that is limited to beach-walk and intertidal surveys through the movement of personnel engaged in collection and identification studies is expected to have negligible impacts

one the geological environment. Short term and insignificant disturbance to the geological environment may occur during fieldwork sampling activities through incidental and unavoidable contact with physical resources from feet and hand-operated equipment. However, the effects of this contact are expected to be negligible as any contact with the geological environment is localized and short term (activities likely to occur a few days per year in any one area).

Activities with both less than significant beneficial and less than significant adverse impacts

Deployment of Buoys

The scientific data generated through the deployment of buoys with measuring equipment helps create a better characterization of the geologic and oceanographic processes within a sanctuary, thus increasing our understanding of biological sanctuary resources and their associated relationship to the physical environment, (e.g., the physical habitat use by fish) marine mammal behavior, and aiding the development of education and outreach materials. This aids management of these geological resources and the sanctuary as a whole, resulting in less than significant beneficial impacts.

In addition, buoys contribute to geological resource protection in other ways. For example, vessel moorings prevent anchor damage to the seafloor; and the use of weighted marker buoys for dive operations supports science and education projects that help managers take action to protect sanctuary physical resources. Also, incident response operations that may occasionally require use of marker buoys benefit physical resources through the removal of hazardous material and pollution threats. Thus, deployment of buoys and other seabed deployed instruments in sanctuaries is expected to provide less than significant, direct and indirect, short-term and long-term beneficial effects to the geological environment.

The deployment of some scientific, safety and monitoring equipment attached to the seafloor via weights or embedded anchors poses a chance of adversely affecting the physical environment through its direct contact with the bottom. Usually, the transitory nature of these devices (although some are placed on the seabed for a long period of time), their limited local effects, as well as the narrow scope of each study with regards to the size of the area are expected to keep these adverse effects less than significant. For example, the deployment of ARU buoys on the seafloor may have a short-term, direct but slightly adverse effect on a small area ($<3m^2$) and any associated resources of the seafloor.

Although efforts are made to secure buoys on open bottoms, storms and other physical events can move anchors into biologically sensitive areas. Overall, however, fixed buoy deployments are expected to have less than significant adverse effects on affected geological resources because of the nature of ground-secured buoys.

Drifter buoys, though only 30-40 cm in diameter, remain at sea in the physical environment as a long-term effect. However, the low number of permanent drifting buoys per year and the short-term nature of anchored buoys is expected to result in less than significant adverse impacts.

Dive marker weights are deployed in sandy areas of the bottom, attached to a line with a buoy at the surface. Marker buoys are removed at the termination of dive operations at each site visited and at the end of each diving day. The adverse effects on the physical environment are expected to be less than significant, direct, localized and short-term because the weight of the buoy is light (10 pounds or less), and they are designed to quick release to prevent damage to ledge habitat if the current carries the line attached to the weight.

Deployment of Remote Sensing Equipment

The scientific data generated through remote sensing efforts help create a better characterization of the geologic and oceanographic processes within a sanctuary, thus increasing our understanding of sanctuary resources and their associated relationship to the physical environment, (e.g., the physical habitat use by fish), and aiding the development of education and outreach materials. This aids protection and management of these resources and the sanctuary as a whole. For example, the development of bathymetric maps is beneficial in developing better strategies for managing both living and cultural resources found on the seabed. The beneficial impacts are expected to be less than significant because the scope of work in this category is limited.

The deployment of some remote sensing arrays pose a slight chance of directly affecting the physical environment through direct contact with the bottom, either planned or unplanned although normal operations usually preclude this possibility. Usually, the transitory nature of these devices (although some are placed on the seabed for a long period of time), their limited local effects, as well as the limited scope of each study with regards to the size of the region, are expected to keep these adverse effects less than significant.

Other Sampling Activities

The scientific and monitoring data generated through other sampling activities help create a better characterization of the geologic and oceanographic processes within a sanctuary, thus increasing our understanding of sanctuary resources and their associated relationship to the geological environment. This also raises public awareness of the nature and importance of the physical environment and the need to protect it; helps deduce potential impacts from human and natural sources; and aids protection and management of these resources and the sanctuary as a whole. For example, whale disentanglement activities in sanctuaries serve to remove foreign objects such as lines and boys from the geological environment. The benefits are expected to be indirect, long-term and less than significant.

The deployment of some other sampling activities pose a slight chance of directly affecting the physical environment through direct contact with the bottom, either planned or unplanned. For example, research projects that require sampling devices such as small PVC pipe quadrats placed on the seafloor to document species diversity, or sediment sampling procedures may directly affect the physical habitat of a sanctuary and its resources, but due to the small, localized area

impacted and the brief time frame for the operation. Therefore, the adverse effects are expected to be less than significant.

Activities with only less than significant adverse impacts

Vessel Operations

The operation of vessels has the potential to have adverse but less than significant direct impacts to geological resources from anchoring and from unintentional striking or groundings. Fixed moorings are used whenever possible to avoid impacts from anchoring. Vessel operations are episodic and low intensity. Vessel operators are highly trained and will apply the NOAA Small Boat Program and sanctuary standing orders and procedures to avoid direct impacts to physical resources. In addition, the NOAA Small Boat program mandates that all sanctuary vessels longer than 40' feet be operated by personnel with an appropriate tonnage USCG license or equivalent NOAA Corps experience for the vessel size. In general, operators of sanctuary vessels will apply ONMS vessel operations best management practices. And, because they are operating assets that are very visible to the public they serve as models of best practices to avoid harm to geological resources.

Activities with negligible impacts

Aircraft Operations

Under typical circumstances, operation of unmanned aerial systems and other remote aerial systems are expected to have negligible impacts to the physical environment due to their small size and remote aerial operation. UAS and other remote aerial systems are used for survey and monitoring activities. In the unlikely event a remotely operated aerial system requires an unintentionally or emergency landing, care would be taken to ensure minimal impact to the surrounding geological environment. In compliance with FAA regulations and NOAA standing orders, all remote aerial system operators are highly trained and licensed to operate such systems prior to operation within sanctuary boundaries. Similarly, under typical circumstances, operation of manned aircrafts are expected to have negligible effects to the geological environment due to the low frequency in which operations occur throughout the year. In addition, aircraft pilots are highly skilled and trained, maintaining compliance with FAA regulations. In the unlikely event a manned aircraft requires an emergency landing, immediate action would be taken to mitigate the situation and ensure the health and safety of individuals and the surrounding environment. As such, manned aircraft operations conducted by ONMS staff and contractors are expected to have negligible effects on sanctuary's geological environment. In the very rare event an aircraft operation is contracted by ONMS, such operations are limited to transit across sanctuary boundaries and are extremely limited, therefore, effects from aircraft operations to the geological environment are expected to be negligible.

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters is considered a discharge and most national marine sanctuaries have regulations restricting certain discharges. In those cases, a permit from the sanctuary superintendent will be required. Deployment of AUV/ROV/gliders/drifters are expected to result in negligible effects on geological and oceanographic resources due to the unlikely disturbance of the water column or submerged lands in each sanctuary. While intentional or accidental improper operator techniques are possible, trained operators are utilizing assets that are very visible to the public and operators serve as models of best practices. Thus, these activities expected to result in negligible effects.

Non-Motorized Crafts

Operation of non-motorized crafts are expected to have negligible effects on the geology of an area because they are small, lightweight, slow and maneuverable and therefore are generally not capable of inflicting damage on geological features or altering oceanography features.

SCUBA/Snorkel Operations

SCUBA/snorkel operations are expected to result in negligible effects on geologic resources due to very limited disturbance of sediments and other submerged lands of each sanctuary. While intentional or accidental improper techniques and overuse of specific locations can result in damage to these resources, sanctuary dive sites vary according to the different projects throughout each sanctuary preventing overuse of any specific location. In addition, sanctuary divers and snorkelers are highly trained and will employ ONMS best management practices to avoid harm to physical habitat. Thus, these operations are expected to result in negligible effects.

Vessel Maintenance

The routine maintenance of sanctuary owned vessels is episodic, low intensity and accomplished by trained NOAA personnel and contractors to avoid impacts to the physical environment. Routine maintenance includes cleaning, fluid changes, and some repairs. It is highly unlikely that routine vessel maintenance will have any detectable effect on geological resources. Because sanctuary vessels are relatively small, heavy maintenance (e.g., welding, grinding, painting) is typically accomplished on land in self-contained contractor's facilities which are highly regulated for industrial safety and environmental compliance by local, state and other federal entities. Therefore the effects of vessel maintenance on geologic resources are expected to be negligible.

Water Quality

Activities with only less than significant adverse impacts

Onshore Fieldwork

Onshore fieldwork activities includes grounded vessel response efforts which may result in inadvertent fuel or other spills. These activities, however, are conducted by experienced ONMS

staff and care is taken to avoid additional spills. As a result, any adverse effect to water quality is expected to be less than significant.

Vessel Operations

The general operation of vessels has the potential to have adverse but less than significant direct impacts on water quality from unintended fuel, lubricant, sewage and garbage spills from sanctuary vessels. Because there are existing state and federal regulations and in many cases sanctuary regulations prohibiting most discharges, impacts to water quality are highly unlikely as they would only occur as a result of accidental discharge. As stated above, sanctuary vessel operators are highly trained and will apply the NOAA Small Boat Program mandates and sanctuary standing orders to avoid impacts to water quality.

Activities with negligible impacts

Aircraft Operations

The operation of UAS and other remote aerial systems may require a water landing, in which the operator lands and retrieves the aerial system in the ocean. Many remote aerial systems are capable of landing on both land and water. In such instances, negligible effects to water quality are anticipated due to the fact that the systems are battery operated and sealed to ensure water does not enter the system when surrounded by water. In the unlikely event a remote aerial system unintentionally lands in the ocean and sustains damage, the damage to the system would likely outweigh the damage to the surrounding environment because per NOAA standing orders, the systems must be within eyesight of the remote operator resulting in an immediate retrieval effort following an emergency landing. These remote aerial systems float, at least for a period of time, which facilitates their recovery following an emergency water landing. In addition, the infrequency in which overflights occur further reduces potential threat to the physical environment. Similarly, manned aircraft operations are expected to have negligible effects to water quality due to the low frequency in which operations occur throughout the year. In addition, aircraft pilots are highly skilled and trained, maintaining compliance with FAA regulations. In the unlikely event a manned aircraft requires an emergency landing in the ocean, immediate action would be taken to mitigate the situation and ensure the health and safety of individuals and the surrounding environment. As such, these effects are anticipated to be short-term and negligible on affected water quality.

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters is expected to result in negligible effects on water quality due to the lack of discharge involved in operations of these tools. Deployment of AUV/ROV/gliders/drifters is considered a discharge and most national marine sanctuaries have regulations restricting certain discharges. In those cases, a permit from the sanctuary superintendent will be required and the impact of that activity will be analyzed separately as part of the permitting process.

Deployment of Buoys

The normal deployment and use of equipment on the seafloor cause no discharge of harmful waste material into the water column and thus are expected to have negligible impact on water quality.

Deployment of Remote Sensing Equipment

Normal remote sensing operations cause no discharge of harmful waste material into the water column and thus are expected to have negligible impact on affected water quality.

Non-Motorized Crafts

Non-motorized crafts are expected to have negligible effects on water quality because they do not discharge any substance in the water.

SCUBA/Snorkel Operations

SCUBA/snorkel operations are expected to result in negligible effects on water quality due to the lack of discharge involved in SCUBA diving or snorkeling activities.

Vessel Maintenance

The routine maintenance of sanctuary owned vessels is episodic, low intensity and accomplished by trained NOAA personnel and contractors to avoid impacts to the physical environment. Where possible, bio-based lubricants and fluids (and, in some cases bio-based fuels are used) further reducing the threat to water quality resources in the unlikely event of a spill. Because these vessels are small and limited in total number at any location, heavy maintenance (e.g., welding, grinding, painting) is typically accomplished on land in self-contained contractor facilities which are highly regulated for industrial safety and environmental compliance including spill prevention by local, state and other federal entities. Therefore, the effects of vessel maintenance on water quality resources are expected to be negligible.

Air Quality

Activities with only less than significant adverse impacts

Aircraft Operations

Even though aircraft operations are infrequent within sanctuary boundaries, there are still some adverse effects on air quality associated with them. Unmanned remote aerial systems are generally battery operated and, often times, water and weather proofed to enable landings and retrievals in all weather conditions. As a result, only negligible effects are expected from the operation of unmanned remote aerial systems. Like vessels, some manned aircrafts use combustion engines to operate. Therefore, the engines emit pollutants similar to vessel emissions. Due to the small amount of pollutant emitted in the air and the infrequency in which manned aircrafts operate within sanctuary boundaries, indirect effects on air quality are expected to be less than significant adverse because these effects are localized and short-term.

Vessel Operations

The general operation of vessels has the potential to have adverse, but less than significant impacts on air quality from engine and generator emissions. The overall intensity of the vessel operations, however, is limited and episodic. In addition, larger sanctuary vessels constructed since the mid-2000's (such as the Shearwater and the Fulmar) have Tier 3 EPA compliant diesel engines; in other cases on smaller vessels, four stroke and low emission outboard motors are used whenever possible.

Activities with negligible impacts

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters are expected to result in negligible effects on air quality due to the lack of emissions involved in operations of these tools.

Deployment of Buoys

The normal deployment and use of equipment on the seafloor causes no discharge of harmful emissions into the atmosphere, and thus is expected to have negligible impact on affected air quality.

Deployment of Remote Sensing Equipment

Normal remote sensing operations cause no discharge of harmful emissions into the atmosphere, and thus these activities are expected to have negligible impact on air quality.

Non-Motorized Crafts

Non-motorized crafts are expected to have negligible effects on air quality because they do not emit any emission into the air.

Onshore Fieldwork

All onshore fieldwork is expected to have negligible impact to air quality as these activities do not involve air emissions.

SCUBA/Snorkel Operations

SCUBA/snorkel operations are expected to result in negligible effects on air quality due to the lack of emissions involved in SCUBA diving or snorkeling activities.

Vessel Maintenance

The routine maintenance of sanctuary owned vessels is episodic and low intensity and accomplished by trained NOAA personnel and contractors to avoid impacts to the physical environment. Because these vessels are small and limited in total number at any location, heavy maintenance (e.g., welding, grinding, painting) is typically accomplished on land in contractor's facilities which are highly regulated for industrial safety and environmental compliance by local,

state and other federal entities. Therefore, the effects of vessel maintenance on air quality resources are expected to be negligible.

Acoustics

Activities with only less than significant adverse impacts

Aircraft Operations

Unmanned and remote aerial systems conducting remote sensing survey activities often utilize repeat passes of low overflights and occur infrequently in a year (less than 5 flights each year). While noise emissions from these flights do occur, remote aerial monitoring projects are very limited in scope and time frame and are expected to result in activities that would cause less than significant adverse effects on acoustic resources, because these effects are short-term and localized. Manned aircraft are flown at an altitude where turbulence does not affect the water; however, sound can penetrate the surface and have less than significant adverse effects on the physical environment due to the high altitudes in which such aircrafts fly. While noise emissions will impact the acoustic environment, such effects are expected to be less than significant adverse because they are short-term, lasting only while the aircraft is overhead.

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters are expected to result in less than significant adverse effects on the acoustic environment due to minor engine noise associated with vehicle function and occasional use of operational altimeters. This equipment introduces limited, short-term and localized noise into the acoustic environment. Thus, these operations are expected to result in less than significant effects, because they are short-term and localized.

Deployment of Buoys

Some equipment attached to the seafloor may result in increased noise levels from its normal operations, such as the chain dragging on the seafloor due to wave action or currents. This disturbance is expected to be less than significant, if not negligible, to the acoustic environment, because it is low intensity and localized.

Deployment of Remote Sensing Equipment

The normal use of towed arrays, such as magnetometers, side scan sonar systems, and EK-60 fish finders, may result in increased noise levels from towing the sensing equipment. As this acoustic disturbance is relatively minor and short-term, the adverse impacts to the physical environment are expected to be less than significant, if not negligible.

Vessels are estimated be used, up to 24 days each year, to deploy passive acoustic equipment including recording hydrophones either attached to moorings which are anchored to the seafloor, or towed or tethered from a vessel using marine grade ropes or cables. Common equipment is approximately 2 ft long and 0.5 ft wide. Up to 30 staff and partners may be involved in these

acoustic equipment deployment missions. Passive acoustic equipment may be deployed using snorkel, SCUBA, or by vessel.

A hydrophone is a specialized microphone that is designed to listen and record underwater sound. They may either transmit live or recorded information related to the presence/absence of cetaceans, vessel traffic, and general soundscape of the area. The recording units consist of microphone components, battery and storage components encased in a waterproof housing. Hydrophones can be tethered, towed, or moored.

Sounds are often broadly categorized as impulsive or non-impulsive. Impulsive sounds have short durations, rapid rise-times, and higher peak sound pressures. Explosions, air guns, weapon firing, and impact pile driving are examples of highly impulsive sound sources. Multi beam and side scan sonars are often also characterized as impulsive due to their extremely short rise times, despite their more constrained frequency content. Vessels (propellers, machinery, and trustees used in dynamic positioning) are the most common sources of non-impulsive anthropogenic sound. Naval sonars are also typically characterized as non-impulsive, despite some features in common with research sonars such as discussed here.

For the purposes of understanding and addressing their impacts, sounds are characterized by their frequency, intensity, duration and duty cycle, among other features. Frequency can be understood as “pitch”, where the higher the frequency the higher the pitch, and is measured in Hertz (Hz). Intensity is a measure of “loudness”, or sound amplitude, and can be measured in decibels (dB). For side scan and multi beam sonar, duration can be measured in seconds from the on to offset of a single signal. Duty cycle is measured in number of pings per minute.

A specific sound source, such as side-scan and multi-beam sonars, depends on the “soundscape” (acoustic environment) of the west coast sites. The “soundscapes” of these sites are composed of anthropogenic (sounds produced by a variety of human activities), biological (sounds produced by animals) and geophysical (wind, waves and other physical forces that produce sound) components. These contributions vary significantly over time and space. Overall, the dominant contributions to the soundscape are living marine resource communications and both short and long-range vessel noise. Relatively rare use of highly directional, mid-high frequency, impulsive sources, such as the side-scan and multi-beam, represents a non-detectable change in the long-term (monthly, annual) acoustic conditions of an exposed location, and a near-non-detectable change over mid-duration (weekly) acoustic conditions. These adverse impacts to the soundscape are expected to be negligible due to the limited use of systems and the relatively small study areas.

Species-specific implications associated with the use of these active acoustic research sources are discussed further below in the “Biological Environment”.

Other Sampling Activities

Some other sampling operations, such as sediment sampling or water sampling, may result in increased noise levels from using the equipment under normal procedures. This equipment does not emit high intensity noise. As this acoustic disturbance is relatively minor and short-term, the adverse impacts to the acoustic environment are expected to be less than significant, if not negligible.

Vessel Operations

The general operation of vessels has the potential to have adverse, but less than significant impacts on acoustics generated by the movement of vessels through water, the operation of propulsion machinery and other equipment including depth sounders. The overall intensity of the vessel operations, however, is limited and episodic. Relative to the ambient acoustics and existing shipping traffic background noise, the addition of sanctuary vessel operations is expected to have limited direct adverse less than significant impacts. Impacts from scientific and mapping sonar operations are analyzed below in section Biological Environment.

Activities with negligible impacts

Non-Motorized Crafts

Non-motorized crafts are expected to have negligible effects on the acoustic environment because they are not capable of generating significant noise, lacking an engine or other motorized propulsion system. The noise generated by the user paddling the craft is negligible and likely to be quieter than nearby natural sounds such as waves or wind on the surface of the water.

Onshore Fieldwork

All onshore fieldwork is expected to have negligible impact to the acoustic environment as activities generally do not involve the emission of detectable noise either in the air or underwater.

SCUBA/Snorkel Operations

SCUBA/snorkel operations are expected to result in negligible effects on the acoustic environment due to the lack of significant noise emitted in SCUBA diving or snorkeling activities.

Vessel Maintenance

The routine maintenance of sanctuary owned vessels is episodic and low intensity and accomplished by trained NOAA personnel and contractors to avoid impacts to the physical environment. Because these vessels are small, heavy maintenance (e.g., welding, grinding, painting) is typically accomplished on land in contractor's facilities which are highly regulated for industrial safety and environmental compliance including by local, state and other federal entities. Therefore, the effects of vessel maintenance on acoustic resources are expected to be negligible.

4.1.2 Biological Environment

Habitat

Activities less than significant beneficial, less than significant adverse and negligible impacts

Onshore Fieldwork

Programs that involve monitoring biological resources from shore directly benefit affected resource directly and indirectly. Removal, disentanglement and monitoring efforts provide a direct benefit to biological resources as immediate attention and action is employed when necessary to ensure the safety and health of marine and nearshore habitat and species (birds, invertebrates, fish, sea turtles, cetaceans and other marine mammals). Indirect effects are expected from the education and outreach materials generated by these studies to educate the public about the resources. Public awareness and education is vital to helping public stakeholders understand the resources throughout the region. Improved public awareness and understanding of resources may inspire the public to cause fewer negative effects on resources, and to act to improve resource protection, both of which would benefit the resources in the long-term. These benefits remain less than significant effects due to the limited nature of the studies of the entire region. Because these studies need to be repeated over time, impacts are short-term for each particular effect. In the event of a vessel grounding or the presence of marine debris, necessitating the removal of large or bulky items, the prompt removal of such items benefits the entire ecosystem by eliminating the threat of further damage to the marine and nearshore environment. Similarly, large congregations of marine debris create entanglement and entrapment hazards and prompt removal eliminates threats to both habitat and species. By the immediate attention to known threats and the elimination of threats caused by foreign objects, such as marine debris, response efforts allow for species and habitat disentanglements.

Inherent in any effort to remove large or bulky foreign items from the nearshore or marine environment is the potential for impact to the surrounding environment. Grounded vessels may be dragged along shoreline areas to eliminate threat to the environment that the vessel may have caused. Similarly, large congregations of marine debris create entanglement and entrapment hazards, however, removal efforts may require the use of cranes or other equipment that could cause incidental damage to the surrounding area. In addition, while the physical presence of staff conducting monitoring and removal or mitigation efforts may displace or disturb nearshore and marine species, staff are highly trained and will employ ONMS best management practices to ensure disturbance is minimized as much as possible. As such, field work activities that require the removal and relocation of large foreign objects, such as marine debris or grounded vessels are expected to have a less than significant adverse impact on the surrounding biological environment.

Beach-walk and intertidal surveys through the movement of personnel engaged in collection and identification studies are expected to have negligible impacts to the surrounding ecosystem

(including habitat, fish, invertebrates, birds, and protected species). Short term and insignificant disturbance to the surrounding area may, but is unlikely to, occur during fieldwork activities through necessary, incidental, and unavoidable contact within the surrounding area. However, the effects of this contact are expected to be negligible as any contact with the environment is localized and short term (activities likely to occur a few days per year in any one area) and care would be taken to avoid unnecessary or potentially harmful contact.

Activities with both less than significant beneficial and less than significant adverse impacts

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters is considered a discharge and most national marine sanctuaries have regulations restricting certain discharges. In those cases, a permit from the sanctuary superintendent will be required. Deployment of AUV/ROV/gliders/drifters – that are used predominantly for scientific or educational purposes – is expected to increase the understanding and appreciation of the biological environment enhancing management strategies to protect biological habitat, invertebrates, fish, birds and protected species. The scientific and educational results also serve inform resource managers, and thereby, to improve public stewardship. These benefits, however, are expected to remain less than significant effects due to the limited nature of the studies of the entire region. Thus, these activities are expected to result in less than significant beneficial, indirect and long-term effects.

Deployment of AUV/ROV/gliders/drifters is expected to result in less than significant adverse effects on biological habitat and sessile invertebrates due to the small potential for disturbance of the water column or submerged lands in each sanctuary. While intentional or accidental improper operator techniques are possible, trained operators are utilizing assets that are very visible to the public and operators serve as models of best practices. In addition, the high mobility of these tools prevents overuse of any specific location. Thus, these operations are expected to result in less than significant adverse effects because they are short term and limited in scope.

Deployment of Buoys

Seafloor deployed equipment, such as instrumentation placed on data buoys that focus on biological data collection and monitoring, can improve the conservation and management of species and habitats, and allow sanctuary managers to better understand certain oceanographic conditions such as sea temperature, pH and carbon dioxide fluctuations that affect species and biological communities. This is expected to give managers better information to use when developing future habitat characterizations and research and management plans that address environmental changes. These benefits, usually derived from routine research and monitoring projects, are expected to be less than significant due to the limited nature of the studies of the entire region.

Further, mooring buoys used by visiting boaters are expected to prevent anchor damage to the seafloor, thereby yielding direct, short-term and long-term beneficial effects that are less than significant, because the effects to the biological environment are localized.

Because virtually all seafloor substrates in sanctuaries host some organisms, disturbing the seafloor with buoy deployments can adversely affect biological resources and habitats. Seafloor disturbance occurs in projects that involve buoy weights or moorings, often small buoys used for diving safety. However, every effort is made to place buoy anchors on bare bottom to limit any adverse disturbance. These buoys are removed at the termination of dive operations at each site visited. Temporary buoys and markers are also used to establish safety zones during response operations. The direct adverse effects on the physical environment are expected to be less than significant, because these effects are short-term and localized. Additionally, the buoys are light weight and designed for quick release to prevent damage to bottom habitats and organisms.

Further, deploying moored instruments on the seafloor is expected to have limited short-term, temporary effects including mortality only on the benthos directly impacted by the instrument or mooring.

The long-term effects from the permanent placement of buoys and moorings may adversely affect surface or subsurface organisms that may either be crushed or blocked from accessing overlying waters. However, the affected area on the bottom is very small. Therefore, the direct adverse effects for long-term buoys and moorings are expected to be less than significant, because they are localized.

Deployment of Remote Sensing Equipment

Remote sensing is expected to have several beneficial impacts on biological resources including data collection; increased understanding of individual species, biodiversity and habitats; the indirect benefits of developing education and outreach materials for public education; and the use of hydrographic mapping as a means to improve habitat characterization and protection of seabed living resources. Increased public education, awareness and understanding of resource protection may inspire users to cause fewer negative effects on resources, and to act in ways that benefit resources in the long-term. Given these efforts are localized and limited in scope, these beneficial effects are considered less than significant.

Deployment of remote sensing equipment, such as instrumentation on data buoys, is beneficial as it allows sanctuary managers to better understand certain oceanographic conditions such as sea temperature, pH and carbon dioxide fluctuations that affect species and biological communities. This gives managers better information to use when developing future research and management plans that address environmental changes, (i.e., ocean acidification). As another example, the development of hydrographic maps is beneficial as they lead to more precise habitat characterization, including the water column and other specific ecosystems, by the sanctuary and its partners. The impacts of these activities are expected to be beneficial and less than significant,

because the scope of work is limited and the connection to management of sanctuary resources is often indirect.

Possible adverse effects on habitat from remote sensing operations may occur if the equipment impacts or causes changes to habitat. Normal operations preclude this possibility, and any effects therefore are expected to be short-term and less than significant.

Other Sampling Activities

The use of other sampling techniques and instrumentation is expected to be beneficial to habitats as it allows sanctuary managers to better understand certain oceanographic conditions such as sea temperature, pH and carbon dioxide fluctuations that affect species and biological communities; can result in improved characterization of habitats and protection of seabed living resources; and improves the monitoring of habitat conditions and changes. This gives managers better information to use when developing future research and management plans. One example is coral disease mitigation and reversal studies that allow divers to directly remove diseased portions of coral colonies to test their recovery abilities. As the amount of coral removed is quite small the effects on the habitat are expected to be less than significant but beneficial to researchers and coral managers.

The use of other sampling technology and operations, particularly those involving collecting, capturing and tagging individual animals, may have some adverse impacts to marine species and habitats. For example, because virtually all seafloor substrates host some organisms, disturbing the seafloor with equipment and/or collecting samples can adversely affect these biological resources. Similar disturbances also occur in projects that involve injury assessment and restoration activities. ONMS staff are highly trained and will employ ONMS best management practices to minimize impacts. While there may be some adverse impacts the effects are expected to be less than significant because most monitoring and sampling devices deployed on the seafloor are relatively small in size and few in number, and are generally temporary or stay in place for a long-time, (i.e., undisturbed). Therefore, only a very small part of habitats are affected. While those organisms that are collected do not survive, the habitat itself is not likely to be significantly affected. Recommended minimization, avoidance and mitigation measures provided by NMFS will be employed to the maximum extent possible. Therefore, the overall impacts are expected to be short-term, direct, and less than significant because they are localized.

SCUBA/Snorkel Operations

The results of SCUBA/snorkel operations – that are predominantly for scientific or educational purposes – are expected to increase the understanding and appreciation of biological resources enhancing management strategies to protect biological habitat, invertebrates, fish, birds and protected species. The scientific and educational results can also serve to inform resource managers, and thereby, improve public stewardship. These benefits, however, are expected to remain less than significant effects due to the limited nature of the studies of the entire region.

Thus this activity is expected to result in less than significant beneficial, indirect, and long-term effects.

SCUBA/snorkel operations are expected to result in less than significant adverse effects on biological habitat and sessile invertebrates due to the minor and limited disturbance of the water column and bottom habitats (e.g., live bottom, coral) of each affected area. While intentional or accidental improper techniques and overuse of specific locations can result in damage to these resources, sanctuary dive sites vary according to the different projects throughout each sanctuary preventing overuse of any specific location. In addition, sanctuary divers and snorkelers are highly trained and will apply ONMS best management practices to minimize impacts. Thus, these operations are expected to result in less than significant adverse effects, because they are short-term and localized.

Vessel Operations

In general, conducting vessel operations allows sanctuary personnel to be on the water providing direct and indirect beneficial less than significant impacts to habitat, invertebrates, fish, birds and protected species through enforcing compliance and by providing education to users so that they may avoid impacts to biological resources. In addition, conducting vessel operations allows sanctuary personnel to respond to emergency incidents involving other users and wildlife.

The operation of vessels has the potential to have adverse but less than significant direct impacts to habitat resources from anchoring and from unintentional striking or groundings. Fixed moorings are used whenever possible to minimize impacts from anchoring. Vessel operations are episodic and low intensity. Vessel operators are highly trained and will apply the NOAA Small Boat Program and sanctuary standing orders and procedures to avoid direct impacts to habitat resources. In addition, the NOAA Small Boat program mandates that all sanctuary vessels longer than 40’ feet be operated by personnel with an appropriate tonnage USCG license or equivalent NOAA Corps experience for the vessel size. In general, operators of sanctuary vessels will employ ONMS best management practices to minimize impacts. And, because they are operating assets that are very visible to the public they serve as models of best practices to avoid harm to habitat.

Activities with less than significant beneficial and negligible impacts

Aircraft Operations

Monitoring efforts conducted via aircraft operations can lead to better characterization of habitat in remote areas and reduce the need for a physical presence in remote areas, thereby potentially reducing disturbances to the area’s physical and biological surroundings. Similarly, enforcement efforts can be enhanced by aircraft operations (both manned and unmanned) with additional and, in some cases, unanticipated, surveillance flights. As such, while infrequent in occurrence, the use of aircraft for law enforcement and habitat monitoring activities are expected to result in the

further protection of sanctuary resources, resulting in less than significant beneficial, indirect and long-term effects.

Aircraft operations, including both manned and unmanned remote aerial systems, are expected to have a negligible effect on affected habitat resources. The nature of planned aircraft operations is such that there is no direct interaction with habitat resources. In the unlikely event an aircraft is required to land due to an emergency, care would be taken to ensure minimal impact to the surrounding physical environment. All aircraft operators are highly trained and licensed to operate their respective aircraft within sanctuary boundaries per FAA regulations and NOAA standing orders.

Non-Motorized Crafts

In MBNMS, which promotes the Team Ocean program, trained teams aboard sanctuary non-motorized crafts stationed at heavily-visited sites during peak recreational boating seasons inform boaters about the sanctuary's zones and regulations and encourage proper use of resources and mooring, which can result in beneficial but not significant impacts to sanctuary habitats by preventing improper and damaging behavior by the public. In addition, for example, non-motorized crafts are sometimes used to assess resource injuries and development of restoration plans (when appropriate) which helps to prevent the injuries from expanding in size or increasing in severity, and create the site conditions necessary for the injured areas to recover to pre-incident conditions.

If non-motorized craft are launched from shore, there is the potential for trampling and temporary direct disturbance to shallow water features, but those are likely to be short-term, highly localized and of negligible intensity. When transiting on the water, non-motorized crafts are expected to have negligible impacts on biological habitats.

Activities with negligible impacts

Vessel Maintenance

The routine maintenance of sanctuary owned vessels is episodic, low intensity and accomplished by trained NOAA personnel and contractors to avoid impacts to the biological environment. Where possible, bio-based lubricants and fluids (and, in some cases bio-based fuels are used) further reducing the threat to habitat resources in the unlikely event of an unintentional spill. Because these vessels are small and limited in total number at any location, heavy maintenance (e.g., welding, grinding, painting) is typically accomplished on land in self-contained contractor facilities which are highly regulated for industrial safety and environmental compliance including spill prevention by local, state and other federal entities. Therefore, the effects of vessel maintenance on habitat resources are expected to be negligible.

Invertebrates

Activities with less than significant beneficial, less than significant adverse and negligible impacts

Onshore Fieldwork

Programs that involve monitoring biological resources from shore directly benefit affected resource directly and indirectly. Removal, disentanglement and monitoring efforts provide a direct benefit to biological resources as immediate attention and action is employed when necessary to ensure the safety and health of marine and nearshore habitat and species (birds, invertebrates, fish, sea turtles, cetaceans and other marine mammals). Indirect effects are expected from the education and outreach materials generated by these studies to educate the public about the resources. Public awareness and education is vital to helping public stakeholders understand the resources throughout the region. Improved public awareness and understanding of resources may inspire the public to cause fewer negative effects on resources, and to act to improve resource protection, both of which would benefit the resources in the long-term. These benefits remain less than significant effects due to the limited nature of the studies of the entire region. Because these studies need to be repeated over time, impacts are short-term for each particular effect. In the event of a vessel grounding or the presence of marine debris, necessitating the removal of large or bulky items, the prompt removal of such items benefits the entire ecosystem by eliminating the threat of further damage to the marine and nearshore environment. Similarly, large congregations of marine debris create entanglement and entrapment hazards and prompt removal eliminates threats to both habitat and species. By the immediate attention to known threats and the elimination of threats caused by foreign objects, such as marine debris, response efforts allow for species and habitat disentanglements.

Inherent in any effort to remove large or bulky foreign items from the nearshore or marine environment is the potential for impact to the surrounding environment. Grounded vessels may be dragged along shoreline areas to eliminate threat to the environment that the vessel may have caused. Similarly, large congregations of marine debris create entanglement and entrapment hazards, however, removal efforts may require the use of cranes or other equipment that could cause incidental damage to the surrounding area. In addition, while the physical presence of staff conducting monitoring and removal or mitigation efforts may displace or disturb nearshore and marine species, staff are highly trained and will employ ONMS best management practices to ensure disturbance is minimized as much as possible. As such, field work activities that require the removal and relocation of large foreign objects, such as marine debris or grounded vessels are expected to have a less than significant adverse impact on the surrounding biological environment.

Beach-walk and intertidal surveys through the movement of personnel engaged in collection and identification studies are expected to have negligible impacts to the surrounding ecosystem (including habitat, fish, invertebrates, birds, and protected species). Short term and insignificant

disturbance to the surrounding area may, but is unlikely to, occur during fieldwork activities through necessary, incidental, and unavoidable contact within the surrounding area. However, the effects of this contact are expected to be negligible as any contact with the environment is localized and short term (activities likely to occur a few days per year in any one area) and care would be taken to avoid unnecessary or potentially harmful contact.

Activities with both less than significant beneficial and less than significant adverse impacts

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters – that are used predominantly for scientific or educational purposes – is expected to increase the understanding and appreciation of the biological environment enhancing management strategies to protect biological habitat, invertebrates, fish, birds and protected species. The scientific and educational results also serve inform resource managers, and thereby, to improve public stewardship. These benefits, however, are expected to remain less than significant effects due to the limited nature of the studies of the entire region. Thus, these activities are expected to result in less than significant beneficial, indirect and long-term effects.

Deployment of AUV/ROV/gliders/drifters is expected to result in less than significant adverse effects on mobile invertebrates, fish, protected species and birds due to the minor and limited, short-term impact caused by these tools. While intentional or accidental improper operator techniques are possible, trained operators are utilizing assets that are very visible to the public and operators serve as models of best practices. In addition, the high mobility of these tools prevents overuse of any specific location. Thus, these operations are expected to result in less than significant, short term, adverse effects.

Deployment of Buoys

The use of seafloor deployed equipment is expected to have several beneficial impacts on biological resources including data collection; increased understanding of individual species, biodiversity and habitats; monitoring; boating and transit safety; and the indirect benefits of developing education and outreach materials. Increased public education, awareness and understanding of resource protection may inspire users to cause fewer negative effects on resources, and to act in ways that benefit resources in the long-term. These benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

The physical placement of equipment on the seafloor, the direct contact with sessile benthic organisms by the gear itself, and the possible deterioration of buoy material that subsequently lands on the bottom may lead to the smothering and mortality of some invertebrates. However, the transitory nature of most of these devices, as well as the limited scope of each study with regards to the size of the region, is expected to keep these effects less than significant.

Deployment of Remote Sensing Equipment

Remote sensing is expected to have several beneficial impacts on biological resources including data collection; increased understanding of individual species, biodiversity and habitats; the indirect benefits of developing education and outreach materials for public education; and the use of hydrographic mapping as a means to improve habitat characterization and protection of seabed living resources. Increased public education, awareness and understanding of resource protection may inspire users to cause fewer negative effects on resources, and to act in ways that benefit resources in the long-term. These benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

The possible adverse effects of remote sensing operations on invertebrates have not been well studied or documented and are therefore not well known. However, it is possible that remote sensing equipment may indirectly adversely affect invertebrates through behavioral disturbances caused by the instruments themselves; or more directly through direct contact of sessile (i.e., immobile) benthic organisms by the gear itself. The transitory nature of these devices, as well as the limited scope of each study with regards to the size of the region, is expected to keep these effects less than significant.

Current understanding of the acoustic sensitivity and sound-production by invertebrate species remains limited. However, many species such as crabs, lobsters, urchins and corals are known to either produce sounds in intraspecific interactions and/or use acoustic cues in settlement phases. For these species, and these documented acoustic use contexts, the highest risk associated with human-induced impacts would be associated with more continuous and prevalent source types that could, in conditions of high or biologically vulnerable co-occurrence, lead to reduced ability to detect important cues (“masking”). The highly localized, relatively rare and impulsive nature of echo-sounder and multi-beam sonar use profiled here for west coast sites suggests that implications for the use of acoustics in settlement cueing and communication by species such as crabs, lobsters, urchins and other known acoustically-active species are likely to be negligible.

Other Sampling Activities

The use of other sampling activities is expected to have several beneficial impacts on biological resources including data collection for future study; increased understanding of individual species, biodiversity and habitats; improved conservation and management of resources; the indirect benefits of increased awareness and the development of education and outreach materials for public education that may inspire the public to cause fewer negative effects on resources, and to act in ways that benefit the sanctuary in the long-term. These benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

It is possible that other sampling activities may indirectly adversely affect invertebrates through behavioral disturbances caused by the instruments themselves; or more directly through contact of sessile benthic organisms (including some invertebrates) by the gear itself. The use of other sampling technology and operations, particularly those involving collecting, capturing and

tagging individual animals, may have some adverse impacts to marine invertebrates. ONMS staff are highly trained and will employ ONMS best management practices to minimize such effects and the frequency of such activities is limited. While those organisms that are collected do not, of course, survive, the overall population of these organisms themselves is not likely to be significantly affected. The transitory nature of these devices, as well as the limited scope of each study with regards to the size of the region, is expected to keep these effects less than significant.

SCUBA/Snorkel Operations

The results of SCUBA/snorkel operations – that are predominantly for scientific or educational purposes – are expected to increase the understanding and appreciation of biological resources enhancing management strategies to protect biological habitat, invertebrates, fish, birds and protected species. The scientific and educational results can also serve to inform resource managers, and thereby, improve public stewardship. These benefits, however, are expected to remain less than significant effects due to the limited nature of the studies of the entire region. Thus this activity is expected to result in less than significant beneficial, indirect, and long-term effects.

SCUBA/snorkel operations are expected to result in less than significant adverse effects on mobile invertebrates due to the minor and limited, short-term impact on animal behavior in each affected area. While intentional or accidental improper techniques and overuse of specific locations can result in increased disturbance of animals, sanctuary dive sites vary according to the different projects throughout each sanctuary generally preventing increased disturbance of animals in any one location. In addition, sanctuary divers and snorkelers are highly trained and employ ONMS best management practices to avoid improper actions that can cause undue harm to sanctuary living marine resources. Thus, these operations are expected to result in less than significant adverse effects, because they are short-term and localized.

Vessel Operations

In general, conducting vessel operations allows sanctuary personnel to be on the water providing direct and indirect beneficial less than significant impacts to habitat, invertebrates, fish, birds and protected species through enforcing compliance and by providing education to users so that they may avoid impacts to biological resources. In addition, conducting vessel operations allows sanctuary personnel to respond to emergency incidents involving other users and wildlife.

The operation of vessels has the potential to have adverse, but less than significant direct and indirect impacts to invertebrates from anchoring and from temporary displacement due to vessel movement. The effects of anchoring are short term and whenever possible are conducted in locations (i.e., sand) where concentrations of invertebrates are low.

Activities with only less than significant beneficial impacts

Aircraft Operations

Monitoring efforts conducted via aircraft operations can lead to better characterization of habitat and species in remote areas and reduce the need for a physical presence in remote areas, thereby potentially reducing disturbances to the area's physical and biological surroundings. Similarly, enforcement efforts can be enhanced by aircraft operations (both manned and unmanned) with additional and, in some cases, unanticipated, surveillance flights. As such, while infrequent in occurrence, the use of aircraft for law enforcement and habitat and species monitoring activities are expected to result in the further protection of sanctuary resources, resulting in less than significant beneficial, indirect and long-term effects.

Activities with negligible impacts

Non-Motorized Crafts

Due to their non-motorized nature, low speed, light weight, and high maneuverability, non-motorized crafts are likely to have only negligible impacts on invertebrates resulting from short-term, highly localized trampling and temporary direct disturbance of shallow water features.

Vessel Maintenance

The routine maintenance of sanctuary owned vessels is episodic, low intensity and accomplished by trained NOAA personnel and contractors to avoid impacts to the biological environment. Where possible, bio-based lubricants and fluids (and, in some cases bio-based fuels are used) further reducing the threat to habitat resources in the unlikely event of an unintentional spill. Because these vessels are small and limited in total number at any location, heavy maintenance (e.g., welding, grinding, painting) is typically accomplished on land in self-contained contractor facilities which are highly regulated for industrial safety and environmental compliance including spill prevention by local, state and other federal entities. Therefore, the effects of vessel maintenance on invertebrate resources are expected to be negligible.

Fish

Activities with less than significant beneficial, less than significant adverse and negligible impacts

Onshore Fieldwork

Programs that involve monitoring biological resources from shore directly benefit affected resource directly and indirectly. Removal, disentanglement and monitoring efforts provide a direct benefit to biological resources as immediate attention and action is employed when necessary to ensure the safety and health of marine and nearshore habitat and species (birds, invertebrates, fish, sea turtles, cetaceans and other marine mammals). Indirect effects are expected from the education and outreach materials generated by these studies to educate the public about the resources. Public awareness and education is vital to helping public stakeholders understand the resources throughout the region. Improved public awareness and understanding of resources may inspire the public to cause fewer negative effects on resources, and to act to

improve resource protection, both of which would benefit the resources in the long-term. These benefits remain less than significant effects due to the limited nature of the studies of the entire region. Because these studies need to be repeated over time, impacts are short-term for each particular effect. In the event of a vessel grounding or the presence of marine debris, necessitating the removal of large or bulky items, the prompt removal of such items benefits the entire ecosystem by eliminating the threat of further damage to the marine and nearshore environment. Similarly, large congregations of marine debris create entanglement and entrapment hazards and prompt removal eliminates threats to both habitat and species. By the immediate attention to known threats and the elimination of threats caused by foreign objects, such as marine debris, response efforts allow for species and habitat disentanglements.

Inherent in any effort to remove large or bulky foreign items from the nearshore or marine environment is the potential for impact to the surrounding environment. Grounded vessels may be dragged along shoreline areas to eliminate threat to the environment that the vessel may have caused. Similarly, large congregations of marine debris create entanglement and entrapment hazards, however, removal efforts may require the use of cranes or other equipment that could cause incidental damage to the surrounding area. In addition, while the physical presence of staff conducting monitoring and removal or mitigation efforts may displace or disturb nearshore and marine species, staff are highly trained and will employ ONMS best management practices to ensure disturbance is minimized as much as possible. As such, field work activities that require the removal and relocation of large foreign objects, such as marine debris or grounded vessels are expected to have a less than significant adverse impact on the surrounding biological environment.

Beach-walk and intertidal surveys through the movement of personnel engaged in collection and identification studies are expected to have negligible impacts to the surrounding ecosystem (including habitat, fish, invertebrates, birds, and protected species). Short term and insignificant disturbance to the surrounding area may, but is unlikely to, occur during fieldwork activities through necessary, incidental, and unavoidable contact within the surrounding area. However, the effects of this contact are expected to be negligible as any contact with the environment is localized and short term (activities likely to occur a few days per year in any one area) and care would be taken to avoid unnecessary or potentially harmful contact.

Activities with both less than significant beneficial and less than significant adverse impacts

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters – that are used predominantly for scientific or educational purposes – is expected to increase the understanding and appreciation of the biological environment enhancing management strategies to protect biological habitat, invertebrates, fish, birds and protected species. The scientific and educational results also serve inform resource managers, and thereby, to improve public stewardship. These benefits, however, are expected to remain less than significant effects due to the limited nature of the studies of the

entire region. Thus, these activities are expected to result in less than significant beneficial, indirect and long-term effects.

Deployment of AUV/ROV/gliders/drifters is expected to result in less than significant adverse effects on mobile invertebrates, fish, protected species and birds due to the minor and limited, short-term impact caused by these tools. While intentional or accidental improper operator techniques are possible, trained operators are utilizing assets that are very visible to the public and operators serve as models of best practices. In addition, the high mobility of these tools prevents overuse of any specific location. Thus, these operations are expected to result in less than significant, short term, adverse effects.

Deployment of Remote Sensing Equipment

Remote sensing is expected to have several beneficial impacts on biological resources including data collection; increased understanding of individual species, biodiversity and habitats; the indirect benefits of developing education and outreach materials for public education; and the use of hydrographic mapping as a means to improve habitat characterization and protection of seabed living resources. Increased public education, awareness and understanding of resource protection may inspire users to cause fewer negative effects on resources, and to act in ways that benefit resources in the long-term. These benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

Information on the movements of commercially and recreationally important fish species from remote sensing operations and tagging can be used to better manage species and protect their habitat. The impacts from these activities are expected to be indirectly beneficial in the long-term. They are expected to be less than significant because these are isolated studies that only provide incremental information on the movements of these fish species.

The possible adverse or beneficial effects of remote sensing operations on fish have not been well studied or documented and are therefore not well known. However, it is possible that remote sensing equipment may indirectly adversely affect fish through behavioral disturbances caused by the instruments themselves; or more directly through direct contact of fish by the gear itself. The transitory nature of these devices, as well as the limited scope of each study with regards to the size of the region, is expected to keep these effects less than significant.

Other Sampling Activities

The use of other sampling activities is expected to have several beneficial impacts on biological resources including data collection for future study; increased understanding of individual species, biodiversity and habitats; improved conservation and management of resources; the indirect benefits of increased awareness and the development of education and outreach materials for public education that may inspire the public to cause fewer negative effects on resources, and to act in ways that benefit the sanctuary in the long-term. These benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

Information gleaned from other sampling operations may be helpful in determining the movements of commercially and recreationally important fish species (e.g., the tagging of fish can be used to better manage species and protect their habitat). The impacts from these activities are expected to be indirectly beneficial in the long term. They are expected to be less than significant because these are isolated studies that only provide incremental information on the movements of these fish species.

Other sampling activities may indirectly adversely affect fish through behavioral disturbances caused by the instruments themselves; or more directly through contact of fish by the gear itself. ONMS staff are highly trained and will employ ONMS best management practices to minimize such effects and the frequency of such activities is limited. The transitory nature of these devices, as well as the limited scope of each study with regards to the size of the region, is expected to keep these effects less than significant.

Activities with less than significant beneficial and negligible impacts

Deployment of Buoys

The use of seafloor deployed equipment is expected to have several beneficial impacts on biological resources including data collection; increased understanding of individual species, biodiversity and habitats; monitoring; boating and transit safety; and the indirect benefits of developing education and outreach materials. Increased public education, awareness and understanding of resource protection may inspire users to cause fewer negative effects on resources, and to act in ways that benefit resources in the long-term. These indirect beneficial effects are expected to be less than significant, because they are long-term.

Seafloor deployed instrumentation is expected to exhibit no or negligible impacts to affected biological resources. Such impacts would only be expected where instrumentation unintentionally adversely comes in contact with an organism that is harmed by the operation.

Activities with only less than significant beneficial impacts

Aircraft Operations

Monitoring efforts conducted via aircraft operations can lead to better characterization of habitat and species in remote areas and reduce the need for a physical presence in remote areas, thereby potentially reducing disturbances to the area's physical and biological surroundings. Similarly, enforcement efforts can be enhanced by aircraft operations (both manned and unmanned) with additional and, in some cases, unanticipated, surveillance flights. As such, while infrequent in occurrence, the use of aircraft for law enforcement and habitat and species monitoring activities are expected to result in the further protection of sanctuary resources, resulting in less than significant beneficial, indirect and long-term effects.

SCUBA/Snorkel Operations

The results of SCUBA/snorkel operations – that are predominantly for scientific or educational purposes – are expected to increase the understanding and appreciation of biological resources enhancing management strategies to protect biological habitat, invertebrates, fish, birds and protected species. The scientific and educational results can also serve to inform resource managers, and thereby, improve public stewardship. However, benefits, such as increased protection of fish species, are expected to remain less than significant effects due to the limited nature of the studies of the entire region. Thus, this activity is expected to result in less than significant beneficial, indirect, and long-term effects.

Vessel Operations

In general, conducting vessel operations allows sanctuary personnel to be on the water providing direct and indirect beneficial less than significant impacts to habitat, invertebrates, fish, birds and protected species through enforcing compliance and by providing education to users so that they may avoid impacts to biological resources. In addition conducting vessel operations allows sanctuary personnel to respond to emergency incidents involving other users and wildlife.

Activities with negligible impacts

Non-Motorized Crafts

Due to their non-motorized nature, low speed, light weight, and high maneuverability, non-motorized crafts are likely to have only negligible impacts on fish resulting from short-term, highly localized trampling and temporary direct disturbance of shallow water features.

Birds

Activities with less than significant beneficial, less than significant adverse and negligible impacts

Onshore Fieldwork

Programs that involve monitoring biological resources from shore directly benefit affected resource directly and indirectly. Removal, disentanglement and monitoring efforts provide a direct benefit to biological resources as immediate attention and action is employed when necessary to ensure the safety and health of marine and nearshore habitat and species (birds, invertebrates, fish, sea turtles, cetaceans and other marine mammals). Indirect effects are expected from the education and outreach materials generated by these studies to educate the public about the resources. Public awareness and education is vital to helping public stakeholders understand the resources throughout the region. Improved public awareness and understanding of resources may inspire the public to cause fewer negative effects on resources, and to act to improve resource protection, both of which would benefit the resources in the long-term. These benefits remain less than significant effects due to the limited nature of the studies of the entire region. Because these studies need to be repeated over time, impacts are short-term for each

particular effect. In the event of a vessel grounding or the presence of marine debris, necessitating the removal of large or bulky items, the prompt removal of such items benefits the entire ecosystem by eliminating the threat of further damage to the marine and nearshore environment. Similarly, large congregations of marine debris create entanglement and entrapment hazards and prompt removal eliminates threats to both habitat and species. By the immediate attention to known threats and the elimination of threats caused by foreign objects, such as marine debris, response efforts allow for species and habitat disentanglements.

Inherent in any effort to remove large or bulky foreign items from the nearshore or marine environment is the potential for impact to the surrounding environment. Grounded vessels may be dragged along shoreline areas to eliminate threat to the environment that the vessel may have caused. Similarly, large congregations of marine debris create entanglement and entrapment hazards, however, removal efforts may require the use of cranes or other equipment that could cause incidental damage to the surrounding area. In addition, while the physical presence of staff conducting monitoring and removal or mitigation efforts may displace or disturb nearshore and marine species, staff are highly trained and will employ ONMS best management practices to ensure disturbance is minimized as much as possible. As such, field work activities that require the removal and relocation of large foreign objects, such as marine debris or grounded vessels are expected to have a less than significant adverse impact on the surrounding biological environment.

Beach-walk and intertidal surveys through the movement of personnel engaged in collection and identification studies are expected to have negligible impacts to the surrounding ecosystem (including habitat, fish, invertebrates, birds, and protected species). Short term and insignificant disturbance to the surrounding area may, but is unlikely to, occur during fieldwork activities through necessary, incidental, and unavoidable contact within the surrounding area. However, the effects of this contact are expected to be negligible as any contact with the environment is localized and short term (activities likely to occur a few days per year in any one area) and care would be taken to avoid unnecessary or potentially harmful contact.

Activities with both less than significant beneficial and less than significant adverse impacts

Aircraft Operations

Monitoring efforts conducted via aircraft operations can lead to better characterization of habitat and species in remote areas and reduce the need for a physical presence in remote areas, thereby potentially reducing disturbances to the area's physical and biological surroundings. Similarly, enforcement efforts can be enhanced by aircraft operations (both manned and unmanned) with additional and, in some cases, unanticipated, surveillance flights. As such, while infrequent in occurrence, the use of aircraft for law enforcement and habitat and species monitoring activities are expected to result in the further protection of sanctuary resources, resulting in less than significant effects.

While aircraft operations are infrequent, some adverse effects are anticipated on biological resources associated with bird strikes and behavioral disturbance from aircraft noise. Aircraft operating at low altitudes conducting remote sensing surveys may have indirect effects on biological resources via seabird disturbances (e.g., low overflights could result in seabird flushing). Aircraft operations, however, do not generally occur below 200 feet in elevation and generally operate at elevations of 500 feet or more, thereby minimizing potential interaction with birds and other biological resources. These projects are very limited in scope and time frame, and as such, are expected to result in activities that cause short-term, localized, and therefore, less than significant adverse effects on biological resources.

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters – that are used predominantly for scientific or educational purposes – is expected to increase the understanding and appreciation of the biological environment enhancing management strategies to protect biological habitat, invertebrates, fish, birds and protected species. The scientific and educational results also serve inform resource managers, and thereby, to improve public stewardship. These benefits, however, are expected to remain less than significant effects due to the limited nature of the studies of the entire region. Thus, these activities are expected to result in less than significant beneficial, indirect and long-term effects.

Deployment of AUV/ROV/gliders/drifters is expected to result in less than significant adverse effects on mobile invertebrates, fish, protected species and birds due to the minor and limited, short-term impact caused by these tools. While intentional or accidental improper operator techniques are possible, trained operators are utilizing assets that are very visible to the public and operators serve as models of best practices. In addition, the high mobility of these tools prevents overuse of any specific location. Thus, these operations are expected to result in less than significant, short term, adverse effects.

Deployment of Remote Sensing Equipment

Remote sensing is expected to have several beneficial impacts on biological resources including data collection; increased understanding of individual species, biodiversity and habitats; the indirect benefits of developing education and outreach materials for public education; and the use of hydrographic mapping as a means to improve habitat characterization and protection of seabed living resources. Increased public education, awareness and understanding of resource protection may inspire users to cause fewer negative effects on resources, and to act in ways that benefit resources in the long-term. These benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

The majority of remote sensing operations are usually distant and isolated from most organisms and ecosystems, so the impacts to the biological environment are usually negligible. However, there may be some specific less than significant adverse effects on certain species, together with

less than significant beneficial effects related to the generation of scientific data that aids sanctuary resource protection and management.

Other Sampling Activities

The use of other sampling activities is expected to have several beneficial impacts on biological resources including data collection for future study; increased understanding of individual species, biodiversity and habitats; improved conservation and management of resources; the indirect benefits of increased awareness and the development of education and outreach materials for public education that may inspire the public to cause fewer negative effects on resources, and to act in ways that benefit the sanctuary in the long-term. These benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

Sampling activities that focus on learning more about birds that reside in or visit a sanctuary, such as surveys, applying satellite tags for tracking, and studying tissue samples, can aid the management and protection of these animals. ONMS staff are highly trained and will employ ONMS best management practices to minimize impacts and the frequency of such activities is limited. The effects are expected to be long-term and less than significant, because the scope of work is limited and the time needed to implement sampling studies and interpret their results can be lengthy.

Vessel Operations

In general, conducting vessel operations allows sanctuary personnel to be on the water providing direct and indirect beneficial less than significant impacts to habitat, invertebrates, fish, birds and protected species through enforcing compliance and by providing education to users so that they may avoid impacts to biological resources. In addition, conducting vessel operations allows sanctuary personnel to respond to emergency incidents involving other users and wildlife.

The operation of vessels has the potential to have adverse, but less than significant short term direct and indirect impacts to birds due to temporary displacement or changes in behavior due to presence of vessel or from vessel movement. While highly unlikely, birds have the potential to be struck by a moving vessel.

Activities with less than significant beneficial and negligible impacts

Deployment of Buoys

The use of seafloor deployed equipment is expected to have several beneficial impacts on biological resources including data collection; increased understanding of individual species, biodiversity and habitats; monitoring; boating and transit safety; and the indirect benefits of developing education and outreach materials. Increased public education, awareness and understanding of resource protection may inspire users to cause fewer negative effects on resources, and to act in ways that benefit resources in the long-term. These benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

Seafloor deployed instrumentation is expected to exhibit no or negligible impacts to affected biological resources. Such impacts would only be expected where instrumentation unintentionally adversely comes in contact with an organism that is harmed by the operation.

Activities with only less than significant beneficial impacts

SCUBA/Snorkel Operations

The results of SCUBA/snorkel operations – that are predominantly for scientific or educational purposes – are expected to increase the understanding and appreciation of biological resources enhancing management strategies to protect biological habitat, invertebrates, fish, birds and protected species. The scientific and educational results can also serve to inform resource managers, and thereby, improve public stewardship. These benefits, however, are expected to remain less than significant effects due to the limited nature of the studies of the entire region. Thus this activity is expected to result in less than significant beneficial, indirect, and long-term effects.

Activities with negligible impacts

Non-Motorized Crafts

Due to their non-motorized nature, low speed, light weight, and high maneuverability, non-motorized crafts are likely to have only negligible adverse impacts on birds resulting from short-term, highly localized trampling and temporary direct disturbance of shallow water features.

Vessel Maintenance

The routine maintenance of sanctuary owned vessels is episodic, low intensity and accomplished by trained NOAA personnel and contractors to avoid impacts to the biological environment. Where possible, bio-based lubricants and fluids (and, in some cases bio-based fuels are used) further reducing the threat to habitat resources in the unlikely event of an unintentional spill. Because these vessels are small and limited in total number at any location, heavy maintenance (e.g., welding, grinding, painting) is typically accomplished on land in self-contained contractor facilities which are highly regulated for industrial safety and environmental compliance including spill prevention by local, state and other federal entities. Therefore, the effects of vessel maintenance on bird resources are expected to be negligible.

Protected Species

Activities less than significant beneficial, less than significant adverse and negligible impacts

Onshore Fieldwork

Programs that involve monitoring biological resources from shore directly benefit affected resource directly and indirectly. Removal, disentanglement and monitoring efforts provide a direct benefit to biological resources as immediate attention and action is employed when

necessary to ensure the safety and health of marine and nearshore habitat and species (birds, invertebrates, fish, sea turtles, cetaceans and other marine mammals). Indirect effects are expected from the education and outreach materials generated by these studies to educate the public about the resources. Public awareness and education is vital to helping public stakeholders understand the resources throughout the region. Improved public awareness and understanding of resources may inspire the public to cause fewer negative effects on resources, and to act to improve resource protection, both of which would benefit the resources in the long-term. These benefits remain less than significant effects due to the limited nature of the studies of the entire region. Because these studies need to be repeated over time, impacts are short-term for each particular effect. In the event of a vessel grounding or the presence of marine debris, necessitating the removal of large or bulky items, the prompt removal of such items benefits the entire ecosystem by eliminating the threat of further damage to the marine and nearshore environment. Similarly, large congregations of marine debris create entanglement and entrapment hazards and prompt removal eliminates threats to both habitat and species. By the immediate attention to known threats and the elimination of threats caused by foreign objects, such as marine debris, response efforts allow for species and habitat disentanglements.

Inherent in any effort to remove large or bulky foreign items from the nearshore or marine environment is the potential for impact to the surrounding environment. Grounded vessels may be dragged along shoreline areas to eliminate threat to the environment that the vessel may have caused. Similarly, large congregations of marine debris create entanglement and entrapment hazards, however, removal efforts may require the use of cranes or other equipment that could cause incidental damage to the surrounding area. In addition, while the physical presence of staff conducting monitoring and removal or mitigation efforts may displace or disturb nearshore and marine species, staff are highly trained and will employ ONMS best management practices to ensure disturbance is minimized as much as possible. As such, field work activities that require the removal and relocation of large foreign objects, such as marine debris or grounded vessels are expected to have a less than significant adverse impact on the surrounding biological environment.

Beach-walk and intertidal surveys through the movement of personnel engaged in collection and identification studies are expected to have negligible impacts to the surrounding ecosystem (including habitat, fish, invertebrates, birds, and protected species). Short term and insignificant disturbance to the surrounding area may, but is unlikely to, occur during fieldwork activities through necessary, incidental, and unavoidable contact within the surrounding area. However, the effects of this contact are expected to be negligible as any contact with the environment is localized and short term (activities likely to occur a few days per year in any one area) and care would be taken to avoid unnecessary or potentially harmful contact.

Activities both less than significant beneficial and less than significant adverse impacts

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters – that are used predominantly for scientific or educational purposes – is expected to increase the understanding and appreciation of the biological environment enhancing management strategies to protect biological habitat, invertebrates, fish, birds and protected species. The scientific and educational results also serve inform resource managers, and thereby, to improve public stewardship. These benefits, however, are expected to remain less than significant effects due to the limited nature of the studies of the entire region. Thus, these activities are expected to result in less than significant beneficial, indirect and long-term effects.

Deployment of AUV/ROV/gliders/drifters is expected to result in less than significant adverse effects on mobile invertebrates, fish, protected species and birds due to the minor and limited, short-term impact caused by these tools. While intentional or accidental improper operator techniques are possible, trained operators are utilizing assets that are very visible to the public and operators serve as models of best practices. In addition, the high mobility of these tools prevents overuse of any specific location.

Entanglement of protected resources – primarily marine mammals - in ROV cable is possible, but unlikely because the duration of operations is very limited and the operation is attended. Should an animal be observed in the vicinity, the ROV can be quickly retrieved. Thus, these operations are expected to result in less than significant, short-term adverse effects.

Deployment of Buoys

The use of seafloor deployed equipment is expected to have several beneficial impacts on biological resources including data collection; increased understanding of individual species, biodiversity and habitats; monitoring; boating and transit safety; and the indirect benefits of developing education and outreach materials. Increased public education, awareness and understanding of resource protection may inspire users to cause fewer negative effects on resources, and to act in ways that benefit resources in the long-term. These benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

The use of seafloor deployed equipment can be used for monitoring marine mammal behavior, thus reducing the possible deleterious impacts of human interactions with these animals. The impacts from these activities are expected to be beneficial and less than significant because the information gleaned from this equipment is a small part of the overall management scheme for the protection of marine mammal and other protected species and does not, in and of itself, contribute to a significant change in marine mammal management.

If the seafloor deployed equipment uses active sonar or other noise-generating technology as part of its normal operations there is a possibility that marine mammals may be adversely affected, perhaps causing behavioral changes such as altering their foraging, diving or vocalization patterns. Another possible adverse impact to marine mammals may be the slight chance of

entanglement with a mooring cable. These adverse impacts are expected to be short-term and localized, and therefore considered to be less than significant.

Deployment of Remote Sensing Equipment

Remote sensing operations include the use of active or side-scan sonar that may adversely impact species, particularly marine mammals (some endangered or threatened) through increased noise in the environment. See Chapter 2 Tables 2-6 for information on the type of equipment used and their specs. For example, hydrographic survey data collection uses active sonar in varying frequency ranges to map the seafloor. These systems are typically either hull-mounted multibeam or towed side-scan sonar systems. Active sonar devices emit pulses of sound waves that travel through the water, reflect off objects, and return to a receiver on the ship. This and other anthropogenic underwater noise may adversely affect marine mammals in several ways including causing some behavioral changes such as altering their foraging, diving or vocalization patterns. These adverse impacts are short-term and localized, and therefore are expected to be less than significant.

Marine Mammals

As noted in source descriptions above, the majority of the active acoustic work conducted within CINMS, OCNMS and CBNMS uses mid to higher frequencies (Chapter 2 Tables 2-6).

- **Impact to low-frequency cetaceans**: Although CINMS, OCNMS and CBNMS include key habitat used by several species of low-frequency active cetaceans (see Appendix B), the hearing sensitivities of these species are presumed not to optimize detection of these sources. Therefore, no impact from the use of the active acoustic equipment described above is expected for low-frequency cetaceans.

- **Impact to mid frequency pinnipeds**: Mid and higher frequency sensitive pinniped species (see Appendix B) aggregate in haulouts around the Channel Islands or outer coast of Washington during the summer. Therefore, while nearshore work may be conducted in the summer, staff will attempt to focus nearshore efforts in unmapped areas away from sensitive habitats. As a result, the use of active acoustic systems would have minimal impacts on mid and higher frequency pinnipeds, due to the minimal spatial and temporal overlap with mid and higher frequency sensitive pinniped species.

- **Impact to mid frequency cetaceans**: Mid-frequency cetaceans are thus the focus of impact consideration for this work (see Appendix B). Because the sources assessed here are downward facing, do not propagate over large distances (due to high attenuation of higher frequencies) and are strongly directional (constrained within narrow beams), low impacts are expected on mid-frequency cetaceans. Individual animals would need to be in very close range of the source, and located directly below it to be exposed to higher intensities capable of inducing physical injury to ears or causing behavioral responses. Such risk is minimized through the application of mitigations discussed below.

- **Impact to high frequency cetaceans**: The harbor porpoise is considered a high frequency cetacean and occurs in all of the west coast sanctuaries. Harbor porpoise hearing ranges between 275 Hz to 160 kHz, with most sensitive hearing between ~ 13kHz and ~125 kHz. Because acoustic sources range from 30 kHz[24] to 120 kHz and 200 kHz[25], harbor porpoises could be affected. However, because these sources are highly ephemeral in use, do not propagate over large distances (due to high attenuation of higher frequencies) and are strongly directional and downward facing (constrained within narrow beams), the effects are expected to be rare and less than significant.

Other Listed Species

There are a number of other ESA species around the Channel Islands including 2 species of abalone, 3 species of birds, Green Sturgeon, and Olive Ridley Turtles. Other than abalone, the same species occur in OCNMS and CBNMS, with the addition of Coho and Chinook salmon and Leatherback turtles. The mid to higher frequencies emitted by the sources assessed here have not been documented to disturb these species. Turtles are believed to be mostly low frequency sensitive. In their PEA, Office of Coast Survey found that their similar acoustic work "may affect, but not likely to adversely affect" any Endangered Species as part of ESA Section 7 Consultation with NMFS. Therefore, less than significant adverse impacts are expected to other listed species from acoustic operations.

Mitigation and Monitoring

Sanctuary staff incorporates operational mitigation measures into its survey activities to reduce or avoid impacts wherever practicable. Vessels operate a slow speed (4-8 knots) during survey effort. They use downward-facing, mid to high frequency sources outside of the highest hearing sensitivity ranges for most offshore-centric local low-frequency cetacean species. In addition, the sonars are operated at the lowest power setting and are turned off when any marine mammals have been sighted within 1nm of the vessel.

Sanctuary procedures requires that a designated lookout stand watch on the ship's bridge during transit and survey operations, scanning the water for humans, animals, vessels, and other objects. Personnel on board NOAA ships and contractor vessels are required to monitor and report locations of marine mammal sightings as part of their regular operational protocol. Currently, the lookout records any sightings of marine mammals on either a paper marine mammal log or by an automated marine mammal report logging system such as SpotterPro, a smartphone application for filing reports. Regardless of format or mode of delivery, the observation report records the species, number of animals, behavior, time, and location of the sighting. Each year, NOAA ships are required to include 24 hours of "safety stand down" training activities for on-board personnel.

[24] Vessels *R/V Shearwater* and *Sharkcat* for CINMS. The Kongsberg EM302 is a 30kHz multibeam system and has a swath width 5.5 times water depth up to a 8 km wide swath.
[25] MBNMS, CBNMS & GFNMS- *R/V Fulmar* and *R4107*. The *Fulmar* is a single beam system. Acoustic backscatter data are collected at three different frequencies (38 kHz, 120 kHz, and 200 kHz) using the vessel's SIMRAD EK60 echosounder.

NOAA is incorporating basic strategies for marine mammal detection and monitoring into standard ocean observatory roles for personnel.

Additionally, staff will limit activities around known rookeries and pupping grounds for endangered marine mammals and birds during breeding and pupping seasons when possible. These habitats usually have peak densities during mid-summer for many species around the Channel Islands and outer coast of Washington and during these times, staff will attempt to limit research activities near these sensitive areas. It should be noted that there is no scientific evidence supporting a disturbance of nesting or breeding seabirds in the presence of a ship surveying in nearshore waters.

Non-Motorized Crafts

In MBNMS, which promotes the Team Ocean program in the West Coast Region, trained teams aboard sanctuary non-motorized crafts stationed at heavily-visited sites during peak recreational boating seasons inform boaters about the sanctuary's zones and regulations and encourage proper use of resources and mooring, which is expected to result in beneficial but not significant impacts to ESA-listed species and marine mammals by helping to prevent improper and damaging behavior by the public.

Non-motorized crafts are likely to have adverse but not significant effects on protected species or marine mammals due to some temporary disturbance resulting in displacing some marine mammals or altering their behavior. One of the ways in which ONMS minimizes the risk of disturbance to protected species or marine mammals is by maintaining a safe distance between them and ONMS-operated crafts.

Other Sampling Activities

The use of other sampling activities is expected to have several beneficial impacts on biological resources including data collection for future study; increased understanding of individual species, biodiversity and habitats; improved conservation and management of resources; the indirect benefits of increased awareness and the development of education and outreach materials for public education that may inspire the public to cause fewer negative effects on resources, and to act in ways that benefit the sanctuary in the long-term. These benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

Various sampling operations aimed at better protection and management of marine mammals include applying tags to record and study whale behavior, and deploying instruments into the water column to measure internal waves as a means of understanding their effects on whale foraging. These long-term scientific studies aim to aid sanctuary managers and are expected to result in less than significant beneficial impacts.

Further, large whale disentanglements are often very public opportunities for direct interaction with these large, often endangered mammals. These operations directly benefit the animals by freeing them from harmful, entangling fishing gear, and provide a substantial indirect benefit

from public attention and educational opportunities. The effects of this type of activity are expected to be beneficial and less than significant, but may be short-term as the publicity from any single event may fade quickly unless education and outreach programs continue to inform the public of the dangers of entanglements.

Tagging whales with digital tags that adhere to the skin with suction cups is non-invasive but has the potential to alter their behavior on a short-term basis. Additionally, operating a research vessel in close proximity to whales can have short-term temporary effects on their behavior, and carries the very remote risk of the vessel striking the animal. ONMS staff are highly trained and will employ all recommended minimization and mitigation measures required by NMFS. The impacts from these activities are expected to be adverse and less than significant.

Vessel Operations

In general, conducting vessel operations allows sanctuary personnel to be on the water providing direct and indirect beneficial less than significant impacts to habitat, invertebrates, fish, birds and protected species through enforcing compliance and by providing education to users so that they may avoid impacts to biological resources. In addition, conducting vessel operations allows sanctuary personnel to respond to emergency incidents involving other users and wildlife.

The operation of vessels has the potential to have adverse, but less than significant short term direct and indirect impacts to ESA listed species and marine mammals due to temporary displacement or changes in behavior due to presence of vessel or from vessel movement. While unlikely, protected species have the potential to be struck by a moving vessel. Smaller vessels like the ones used by ONMS are typically faster, but have higher maneuverability and shallow draft compared to larger vessels (i.e., NOAA ships) therefore they are even less likely to collide with and injure protected species. The vessels which ONMS operates in the West Coast sanctuaries are each less than or equal to 65 feet in length and are highly maneuverable.

Regardless of boat size, operators of sanctuary vessels have will follow sanctuary, ESA and marine mammal regulations. And, because they are highly trained and will employ ONMS best management practices to minimize impacts and are operating assets that are very visible to the public they serve as models of best practices to avoid harm to protected species and sanctuary resources. Best management practices, including maintaining lookouts for protected species, interacting with other vessel operators (e.g., whale watch boats), receiving real time survey information on the locations and concentration of marine mammals in particular, reducing speeds, and maintaining safe distances will be exercised.

The combination of a limited number of days at sea, large operational area, and small number of vessels operated by ONMS further decreases the likelihood of significant impacts to protected species. Due to all of these factors it is very unlikely that sanctuary vessel operations would have significant impacts on protected species.

Deployment of Remote Sensing Equipment[26]

Remote sensing activities include the use of both active (sound producing) and passive (listening only) technologies for a variety of uses (e.g., monitoring humpback whales and their habitat, and inventorying resources and documenting maritime heritage sites) and can have several indirect beneficial impacts on biological resources in west coast sites. Such benefits include increased understanding of individual species, biodiversity and habitats; better education and outreach materials for public education, which can lead to indirect benefits to living marine resources through informed management actions; and the use of hydrographic mapping as a means to improve habitat characterization and protection of seabed living and maritime heritage resources. Increased public education, awareness and understanding of resource protection may inspire users to cause fewer negative effects on resources, and to act in ways that benefit resources in the long-term. These benefits are expected to be less than significant due to the limited nature of the studies of the entire region.

As discussed above, active acoustic sources (side-scan and multi-beam sonars) may be used in west coast sanctuaries. All but one ONMS vessel uses single beam sonar capabilities. As previously mentioned, ONMS contracts other vessels for specific projects as needed. For example, the Office of Coast Survey maps portions of our west coast sanctuaries on a NOAA ship, such as the Rainier. The multibeam echo sounder systems used on the NOAA ship *Rainier*, for example, can operate at frequencies of 100 kHz and launches from the ship use frequencies of 200-400 kHz, and typical source levels (SL) are 225-229 dB re 1 µPa @ 1m. Power, amplitude, pulse, width and ping rate vary depending on the depths of the ocean in the area being mapped. The *Rainier*'s ship mounted Kongsberg EM-710 system operates in waters 250 meters and deeper; in shallower water, the *Rainier's* survey launches operate Reson 7125 or 8125 systems. Additionally, multibeam systems of other research vessels of opportunity (*e.g.*, M/V *Nautilus*) are used to map the seafloor and employ similar equipment.

The *R/V Tatoosh* used in OCNMS is the only ONMS small boat equipped with a multibeam sonar. The hull-mounted Reson SeaBat 8101 Extended Range multibeam echosounder on the *R/V Tatoosh* collects seafloor data. The sounder has 150° maximum swath width (75° each side) and a 500m depth range capability. The Extended Range 8101 has a maximum transmit power of 220 dB µPa (micropascals) at 1m. The transmit pulse width is 21- 225 µS (micro-seconds) at 240kHz. The ping rate range is 1-40 pings/second, governed by the 'round-trip transit and receive time' of the selected range.

A typical OCNMS seafloor survey covers depths from 10-45 m; speed 6 kt; swath width maximum equal to 60°; transmit level 2 (2 of 8 levels with Full power equal to 220dB); narrow transmit pulse 63 µS (between 21-225 µS); with ping rates from 18-40 pings/second over the course of a 12 hours survey day. If the survey is focused on shoals <15m, work may transmit up to 1M pings/sec. over an area of 3-4 miles within a survey day. Generally, throughout a 12 hour

[26]While sonar scientific and mapping operations are technically included in vessel operations, the analysis presented here calls them out separately to facilitate the analysis of potential impacts of active acoustic equipment use on marine mammals and protected species.

survey, less than 600K pings/sec. are transmitted over an area that extends from shallow 10m nearshore to deeper 40m shelf where the ping rate is significantly less (18pps). The multibeam sonar is operated at the lowest power setting and is turned off when marine mammals have been sighted within 1nm of the vessel.

Evaluation of noise impacts to individual species necessitates characterization of source features and use profiles, and affiliation of those features with co-occurrence, context and sensitivity of exposed animals. In extreme cases, the aligning of these risk factors can result, in soft tissue injuries and even fatality if animals are exposed to very high intensity sounds in very proximate conditions. Higher intensity exposures within animal's frequency range of hearing also can cause injury in the form of permanent hearing damage, also referred to as permanent threshold shift (PTS). Exposure to moderate intensity sounds within relevant frequency ranges can cause temporary threshold shifts (TTS) in hearing, which are recoverable over a subsequent period of non-exposure. Sometimes over great distances from the source, exposure to sound can result in behavioral effects for affected species that can result in alteration of biologically important activities such as feeding, mating or migration. In more extreme cases, behavioral responses can lead indirectly to death, such as animals having strong aversion responses and rising from deep waters too quickly or traveling into shallow waters and beaching. Finally, also over a broad range of distances, exposure to non-invasive sounds or cumulative acoustic energy from a variety of sound sources leading to higher "background" noise levels, can result in masked communications and/or degraded ability for animals to hear acoustic environmental cues used to support biologically important activities (again, such as navigation, feeding, reproduction).

In order to predict whether a marine mammal's exposure to a sound source will result in either temporary or permanent changes in their hearing ability, NMFS has developed Technical Guidance[27] which provides acoustic thresholds for onset of permanent threshold shift (PTS) and temporary threshold shifts (TTS) in marine mammals for all sound sources (NMFS 2016). Specifically, it identifies the levels of received sound at which individual marine mammals are predicted to experience changes in their hearing sensitivity (either temporary or permanent) for acute, incidental exposure to underwater anthropogenic sound sources. The current NMFS threshold for the onset of PTS in cetaceans from exposure to in-water sounds is ≥ 180 dB re 1 µPa. The same threshold for pinnipeds is ≥ 190 dB re 1 µPa. Exposure to impulsive in-water sounds at ≥ 160 dB re 1 µPa is the threshold for the onset of TTS and behavioral disturbance for all marine mammals, whereas the same threshold for exposure to non-impulsive sound (continuous noise) is ≥ 120 dB re 1 µPa.

The sonar systems to be used in this action are considered impulsive sources. Thus, the 160 dB re 1 µPa threshold for predicting the onset of TTS and behavioral disturbance is applied, and significant exposure above that level at a frequency within the animal's hearing range is

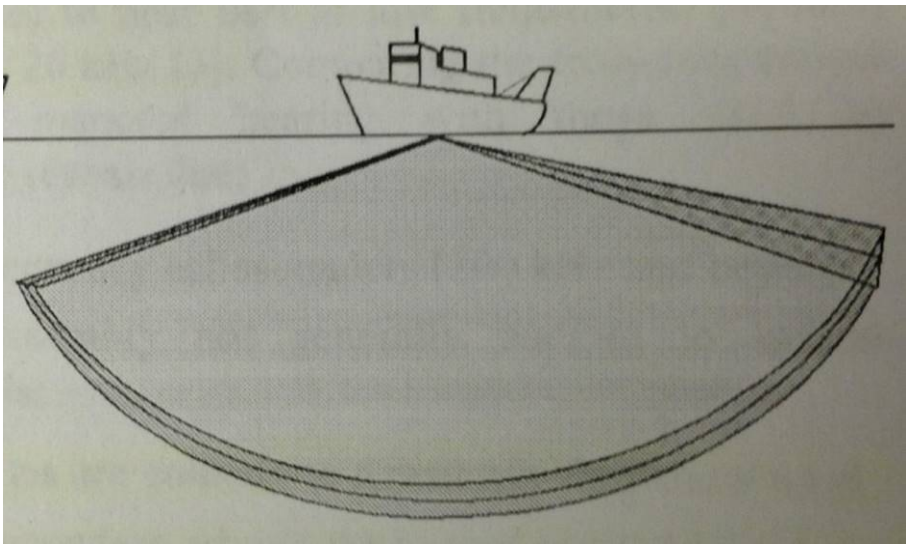
[27] http://www.nmfs.noaa.gov/pr/acoustics/Acoustic%20Guidance%20Files/opr-55_acoustic_guidance_tech_memo.pdf accessed on April 18, 2018.

considered an adverse impact. However, not all cetaceans and pinnipeds will experience TTS or behavioral responses at the 160 dB threshold. As indicated in Tables 8 and 10, hearing capabilities vary among marine mammal groups, and mapping sonars only overlap with the hearing range of regionally-occurring mid-frequency cetaceans (toothed whales/Sperm whale), pinnipeds (*e.g.*, Guadalupe fur seal), and high frequency cetaceans (e.g., harbor porpoise).

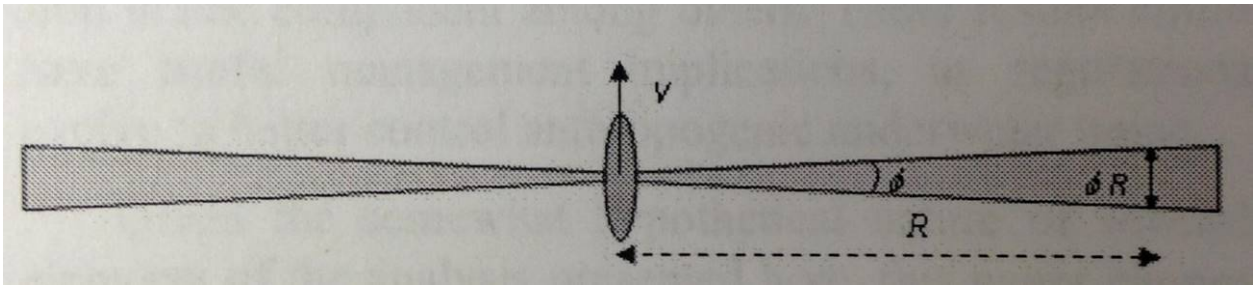
In order to assess the likelihood that an animal will be exposed to sound levels at or greater 160 dB re 1 µPa, we must determine the propagation, or spreading, in meters, of the sound from the source (in this case, the vessel). Figures 2a and 2b provides diagrams excerpted from Lurton & DeRuiter (2011) that show the general sound propagation (isopleth) of a multibeam sonar system from both horizontal (Fig 2a) and overhead (Fig. 2b) perspectives. The 160 dB received level isopleth forms a ring around the vessel at 200 meters, except within the fan-shaped ensonification volume (as pictured in Figure 1) where it extends out to approximately 750 meters. Any marine mammal within this isopleth would receive sound levels of 160 dB or higher.

Accurately predicting the 160 dB re 1 µPa isopleth from any sound source is difficult, but particularly so for multibeam sonar. First, propagation of sound produced underwater is highly dependent on environmental characteristics such as bathymetry, bottom type, water depth, temperature, and salinity. The sound received at a particular location will be different than near the source due to the interaction of many factors, including propagation loss; how the sound is reflected, refracted, or scattered; the potential for reverberation; and interference due to multi-path propagation. In addition, absorption greatly affects the distance over which higher-frequency sounds propagate. Detailed information on these naturally occurring factors in the marine environment is rarely available and consequently they are generally not considered in the equations.

Multibeam sonar are focused sonar arrays that use “selective angular directivity” and furthermore transmit “very short pulses at limited ping rates” (Lurton & DeRuiter 2011). These two characteristics of this type of sonar decrease the probability of the animals being subjected to TTS threshold intensity levels (see Figure 2).



a)



b)

Figure 2. Diagrams showing a typical multibeam ensonification volume from a) the horizontal and b) the overhead prospective (From Lurton & DeRuiter 2011).

Submerged animals more than 200m from the ship that are caught in the ensonification volume as the ship passes will be only briefly subjected to the elevated sound levels occurring inside the transmitter beam pattern. Furthermore, the narrow fan-shaped beam patterns of the *Rainier* and *Tatoosh* systems provide ample possibilities for the animals to quickly escape the sound. The only possible scenario for more extended exposure would be if the animal were to suddenly start moving in the exact direction and speed as the ship, which is unlikely.

Finally, transmit pulse forms and rates further distinguish multibeam sonar from other types of sonar and acoustic sources and further reduce their potential threat to marine mammals. Sound is not transmitted continuously from these systems but rather in extremely short pulses (i.e., pings).

Another consideration is the hearing range of the various species found in the survey areas.. As mentioned previously, mid-frequency cetaceans is the group that may be affected by the use of multibeam sonar systems. See Appendix B for a representative list of cetacean hearing ranges.

Finally, to further address the unlikely impacts to marine mammals, observers on the *Rainer's* and *Tatoosh* bridge or the marine mammal observation deck will carefully monitor for the

presence of marine protected species, and permitted personnel would follow the BMPs listed above, thereby minimizing disturbance. Shallow water mapping would be conducted during daylight hours as much as possible and only with cetacean observers present. If cetaceans are present within 200 meters of the ship, the vessel would stop until the animals depart the area. The multibeam systems will remain on throughout the cruises to avoid the possibility of startle responses by marine mammals that could be in the vicinity of the ship, particularly at night. Leaving them on also provides marine mammals advanced warning that the ship is in the vicinity, further reducing the possibility of a collision. If the systems are shut down for any reason, such as turning off the EM 710 during an extensive area of shallow water mapping, the multibeam soft start mode – a delay function, also referred to as "ramp up", whereby sonar transmissions are started at a low output level and gradually increase - would be used to minimize any startle responses.

For those cetaceans exposed to the 160 isobeth, the impacts are likely limited to temporary, minor behavioral disturbances. Based on the best information available, including the mobility of marine mammals in the water column, the propensity for marine mammals to avoid obtrusive sounds, and the proposed mitigation measures above, mild alert and startle responses, avoidance of the survey vessel, and brief or minor modification of vocal behaviors are the most probable responses to exposure. In addition, the relatively rare, impulsive and highly localized implications of these source types result in non existent (humpbacks) to negligible (toothed whales) implications for acoustic masking of communication signals or other important biological signals within mid-higher frequency hearing ranges. No measurable impacts are expected to occur on the ability of exposed cetaceans to forage, shelter, navigate, reproduce, and avoid predators and other threats such as vessels. Therefore, the impacts expected to result from exposure to noise from active acoustic research sources would have insignificant effects on cetaceans that may be in the area.

Exposed pinnipeds may experience behavioral responses as the result of exposure to the project's sonar noise. Based on the best information available, including the motility of free-ranging marine mammals in the water column, the propensity for marine mammals to avoid obtrusive sounds, and the proposed mitigation measures above, mild alert and startle responses, avoidance of the survey vessel, and alteration in diving patterns are the most probable pinniped response to exposure. In addition, the relatively rare, impulsive and highly localized implications of these source types result in negligible implications for acoustic masking of communication signals or other important biological signals within mid-higher frequency hearing ranges. No measurable impacts are expected to occur on the ability of exposed seals to forage, shelter, navigate, reproduce, and avoid predators and other threats such as vessels. Therefore, the impacts expected to result from exposure to the project's sonar noise would have insignificant effects on pinnipeds.

Activities with only less than significant beneficial impacts

Aircraft Operations

Monitoring efforts conducted via aircraft operations can lead to better characterization of habitat and species in remote areas and reduce the need for a physical presence in remote areas, thereby potentially reducing disturbances to the area's physical and biological surroundings. Similarly, enforcement efforts can be enhanced by aircraft operations (both manned and unmanned) with additional and, in some cases, unanticipated, surveillance flights. As such, while infrequent in occurrence, the use of aircraft for law enforcement and habitat and species monitoring activities are expected to result in the further protection of sanctuary resources, resulting in less than significant beneficial, indirect and long-term effects.

SCUBA/Snorkel Operations

The results of SCUBA/snorkel operations – that are predominantly for scientific or educational purposes – are expected to increase the understanding and appreciation of biological resources enhancing management strategies to protect biological habitat, invertebrates, fish, birds and protected species. The scientific and educational results can also serve to inform resource managers, and thereby, improve public stewardship. These benefits, however, are expected to remain less than significant effects due to the limited nature of the studies of the entire region. Thus this activity is expected to result in less than significant beneficial, indirect, and long-term effects.

Activities with negligible impacts

Vessel Maintenance

The routine maintenance of sanctuary owned vessels is episodic, low intensity and accomplished by trained NOAA personnel and contractors to avoid impacts to the biological environment. Where possible, bio-based lubricants and fluids (and, in some cases bio-based fuels are used) further reducing the threat to habitat resources in the unlikely event of an unintentional spill. Because these vessels are small and limited in total number at any location, heavy maintenance (e.g., welding, grinding, painting) is typically accomplished on land in self-contained contractor facilities which are highly regulated for industrial safety and environmental compliance including spill prevention by local, state and other federal entities. Therefore, the effects of vessel maintenance on protected species are expected to be negligible.

Essential Fish Habitat

ONMS has identified one category of field operations that may adversely affect Essential Fish Habitat in the West Coast Region: response to vessel grounding. Although the process of assessing damage from vessel grounding is unlikely to have any adverse impacts on EFH, salvage operations themselves could impact EFH through injury to bottom habitat or discharge to pelagic habitat. ONMS generally coordinates the emergency salvage, and oversees the operation to insure minimal disturbance to sanctuary resources. Salvage can take place from land, air, or sea, or a combination of these. A discussion of the effects of these operations on EFH can be found in Chapter 5. In general, ONMS expects only minimal adverse impacts, if any, to EFH from the activities presented in this document.

Summary of Effects on Biological Resources

It is expected that Alternative 1 will beneficially affect biological resources by enhancing conservation and management of living resources and data collection for future study. The adverse effects on biological resources are expected to be short-term and temporary from all field operations including those that physically alter a biological resource such as tagging a seabird and those that disturb a biological resource such as vessel transiting. Digital tagging of whales or attempts to tag constitutes a take under MMPA and ESA, and consultation with NMFS is required for that activity. Tagging is non-invasive but has the potential to alter behavior on a short-term, temporary basis. Adverse effects on EFH would be short-term and less than significant, and will result from deployment of ARU buoys on the seafloor. Collecting samples of species would have a less than significant adverse impact because the amount of biomass collected would not result in species or population-level effect.

In addition, ONMS has determined that active acoustic activities will result in very little risk of injury to marine mammals and other endangered species in the West Coast national marine sanctuaries, as well as very little risk of injury to additional sanctuary resources such as fish and marine invertebrates. Risk is minimized due to source characteristics (higher frequency highly directional sources), their use context (during time periods and within regions of the sanctuary with less overlap with protected and endangered species), and additional mitigations applied (observer-triggered shut downs, low power selections).

4.1.3 Socioeconomic Environment

Maritime Transportation

Activities with less than significant beneficial and negligible impacts

Deployment of Buoys

The data generated by seabed deployed equipment can increase knowledge of sanctuary resources, leading to better resource management, more public awareness and appreciation, increased safety, improved partnerships between sanctuary managers, users and constituents, and the promotion of public and commercial uses. Thus, the socioeconomic environment stands to benefit since many trade, tourism, recreation, research and commercial ventures depend on the vitality of the sanctuary. Given the long-term nature of scientific study and sanctuary management, these beneficial effects are expected to be less than significant.

Additionally, the use of buoys to aid navigation is beneficial to marine transport as they assist in preventing groundings in shallow areas. The impacts from these activities are expected to be beneficial and less than significant, because producing aids to navigation is not a primary focus of the work of sanctuary staff.

Occasionally, buoys, mooring lines and other equipment may temporarily interfere with the conduct of commercial or recreational activities (such as fishing or transit), but the effect is expected to be short-term and negligible as most of the operations are limited in scope and time.

Deployment of Remote Sensing Equipment

The data generated by remote sensing operations can increase knowledge of sanctuary resources, and better characterizations of habitats may lead to better resource management, more public education and outreach, and improved partnerships between sanctuary managers, users and constituents. Given the long-term nature of scientific study and sanctuary management these beneficial effects are expected to be less than significant.

Additionally, the use of remote sensing to develop bathymetric maps is beneficial to marine navigation as it assists in preventing groundings. The impacts from these activities are expected to be beneficial and less than significant, because producing aids to navigation is not a primary focus of the work of sanctuary staff.

Occasionally, scientific activities conducted by ONMS such as transect surveys may temporarily interfere with the conduct of commercial or recreational activities, but the effect is expected to be short-term and negligible.

Other Sampling Activities

The information gleaned from the use of other sampling operations is expected to advance scientific study and inquiry, create greater awareness and appreciation of sanctuary resources, and promote public and commercial uses. The socioeconomic environment stands to benefit since many trade, tourism, recreation, research and commercial ventures depend on the vitality of the sanctuary. Given the long-term nature of scientific study and sanctuary resource management these beneficial effects are expected to be less than significant.

Occasionally, other sampling operations conducted by sanctuary staff and partners may temporarily interfere with the conduct of commercial or recreational activities, but these effects will be short-term, localized and therefore considered to be less than significant if not negligible.

Activities with only less than significant beneficial impacts

Aircraft Operations

In general, aircraft operations, whether primarily used for species and habitat surveys or surveillance and monitoring for compliance within sanctuary boundaries, are expected to have a less than significant beneficial effect on the socioeconomic environment resulting in both long-term and short-term benefits. Surveillance flights aid in short-term enforcement efforts as well long-term compliance. Furthermore, research gained from such operations can lead to better characterization of habitats and species aiding in education and outreach efforts as well as informed management decisions and policy. Thus, less than significant beneficial, indirect and short and long-term effects are expected to result.

Activities with negligible impacts

Vessel Maintenance

Vessel maintenance activities are highly unlikely to have detectable effect on marine transport because these activities are low intensity, episodic and typically conducted pierside or on-land.

Research and Education

Activities with less than significant beneficial and negligible impacts

Deployment of Buoys

Research and educational materials developed from data gathered from buoys and other seabed deployed instrumentation foster a greater awareness and appreciation for sanctuary resources, which in turn promotes public use of the sanctuary (e.g., diving, kayaking, snorkeling, glass bottom boat excursions). Local businesses benefit from this dynamic. For example, small, weighted buoys temporarily deployed for dive operations provide safety for divers. Thus this activity is expected to result in less than significant beneficial, short-term and direct effects.

Occasionally, buoys, mooring lines and other equipment may temporarily interfere with the conduct of commercial or recreational activities (such as fishing or transit), but the effect is expected to be short-term and negligible as most of the operations are limited in scope and time.

Deployment of Remote Sensing Equipment

The data generated by remote sensing operations can increase knowledge of sanctuary resources, and better characterizations of habitats may lead to better resource management, more public education and outreach, and improved partnerships between sanctuary managers, users and constituents. Given the long-term nature of scientific study and sanctuary management these beneficial effects are expected to be less than significant.

Occasionally, scientific activities conducted by ONMS such as transect surveys may temporarily interfere with the conduct of commercial or recreational activities, but the effect is expected to be short-term and negligible.

Other Sampling Activities

Sanctuary research and education that derives from other sampling operations include such activities as reef assessment and monitoring programs; video and photographic documentation of whales; maritime heritage field activities; whale disentanglement training; and the development of public outreach materials, all designed to both better protect and manage sanctuary resources and offer related socioeconomic opportunities to users and constituents. These activities are expected to result in benefits that are short or long-term, direct or indirect, and less than significant.

Occasionally, other sampling operations conducted by sanctuary staff and partners may temporarily interfere with the conduct of commercial or recreational activities, but these effects will be short-term, localized and therefore considered to be less than significant if not negligible.

Activities with only less than significant beneficial impacts

Aircraft Operations

In general, aircraft operations, whether primarily used for species and habitat surveys or surveillance and monitoring for compliance within sanctuary boundaries, are expected to have a less than significant beneficial effect on the socioeconomic environment resulting in both long-term and short-term benefits. Surveillance flights aid in short-term enforcement efforts as well long-term compliance. Furthermore, research gained from such operations can lead to better characterization of habitats and species aiding in education and outreach efforts as well as informed management decisions and policy. Thus, less than significant beneficial, indirect and short and long-term effects are expected to result.

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters in sanctuaries are expected to have a less than significant, long-term beneficial effect on sanctuary research and education resources. This is because all projects are designed to learn more about each sanctuary so that managers can better protect all of its resources. By undertaking these projects, it is expected that resources will be better protected, restored, or preserved. Because of this, the socioeconomic environment in each sanctuary stands to benefit since many trade, tourism, recreation, research, and commercial ventures depend on the vitality of the sanctuaries.

Onshore Fieldwork

ONMS projects associated with onshore fieldwork activities are intended to enhance awareness and understanding of sanctuary natural and cultural resources. This heightened awareness can have a direct and indirect beneficial effect on socioeconomic resources. Research and monitoring efforts lead to a better understanding of interactions of species with each other and their surrounding environment, which in turn aids in better and more informed management of resources. For example, an understanding of seabird foraging habits can help fishermen employ measures and techniques to reduce the risk of interacting and harming seabirds. In addition, the presence of staff conducting onshore survey and monitoring efforts can afford an opportunity for public interaction and education. Public education is vital to helping public stakeholders understand the resources throughout the region. Improved public awareness and understanding of resources may inspire the public to cause fewer negative effects on resources, and to act to improve resource protection, both of which are expected to benefit the resources in the long-term. Thus, the effects are expected to be beneficial, indirect, short-term and long-term, localized, and thus, less than significant.

SCUBA/Snorkel Operations

SCUBA/snorkel operations are expected to have a less than significant long-term beneficial effect on sanctuary research and education resources. This is because all projects are designed to learn more about each sanctuary so that managers can better protect sanctuary resources. By undertaking these projects, it is expected that resources will be better protected, restored, or preserved. Because of this, the socioeconomic environment in each sanctuary stands to gain a benefit since many trade, tourism, recreation, research, and commercial ventures depend on the vitality of the sanctuaries.

Vessel Operations

Conducting vessel operations allows sanctuary personnel to be on the water providing what are expected to be direct and indirect less than significant beneficial impact to human uses through enforcing compliance with sanctuary and other regulations and by providing education and general awareness to other users so that they may avoid impacts to sanctuary resources. Vessels serve as platforms for research activities which are analyzed elsewhere in this document.

Activities with negligible impacts

Vessel Maintenance

Vessel maintenance activities are highly unlikely to have detectable effect on research and education because these activities are low intensity, episodic and typically conducted pierside or on-land.

Human Use (Fishing, Recreation, Tourism)

Activities with less than significant beneficial and negligible impacts

Aircraft Operations

In general, aircraft operations, whether primarily used for species and habitat surveys or surveillance and monitoring for compliance within sanctuary boundaries, are expected to have a less than significant beneficial effect on the socioeconomic environment resulting in both long-term and short-term benefits. Surveillance flights aid in short-term enforcement efforts as well long-term compliance. Furthermore, research gained from such operations can lead to better characterization of habitats and species aiding in education and outreach efforts as well as informed management decisions and policy. Thus, less than significant beneficial, indirect and short and long-term effects are expected to result.

Aircraft operations are not expected to impact maritime users as no manned aircraft operations occur on or near the ocean. While most unmanned aerial systems are operated from a vessel and the system remains within eyesight and under the control of the operator at all times, interactions with human use activities such as fishing (recreational or commercial) and tourism are expected to be negligible.

Deployment of Buoys

Information on the movements of commercially and recreationally important fish species from seabed deployed instrumentation can be used to better manage species and protect their habitat. This is expected to result in a less than significant benefit to fishermen and those associated with the fishing industry as sanctuary partners.

The only identified possible adverse impact to human uses from seabed deployed instrumentation is the slight possibility of contact with or entanglement in mooring lines by small vessels. This is expected to be a very localized, short-term and therefore considered to be a less than significant if not negligible effect.

Deployment of Remote Sensing Equipment

Sanctuary operations foster a greater awareness and appreciation for sanctuary resources, which in turn promotes public use of a sanctuary (e.g., diving, kayaking, snorkeling, glass bottom boat excursions). Local businesses are expected to benefit from this dynamic; however these effects are likely to be less than significant.

Further, information on the movements of commercially and recreationally important fish species from remote sensing operations and tagging can be used to better manage species and protect their habitat. This is expected to result in a less than significant benefit to fishermen and those associated with the fishing industry as sanctuary partners.

Occasionally, scientific activities conducted by ONMS such as transect surveys may temporarily interfere with the conduct of commercial or recreational activities, but the effect is expected to be short-term and negligible.

Other Sampling Activities

Other sampling activities can foster a greater awareness and appreciation for sanctuary resources, which in turn promotes public use of a sanctuary (e.g., through diving, kayaking, snorkeling, glass bottom boat excursions). Local businesses benefit from this dynamic; however these effects are likely to be less than significant. For example, applying digital tags to whales can benefit whale watching activities by providing additional information for the on-board naturalists to discuss with their passengers thus enhancing their experience and appreciation for whales, and promoting the whale-watching industry.

Further, information on the movements of commercially and recreationally important fish species from sampling techniques and tagging can be used to better manage species, protect their habitat and streamline fishing effort. This is expected to result in a less than significant but measurable benefit to fishermen and those associated with the fishing industry.

Occasionally, other sampling operations conducted by sanctuary staff and partners may temporarily interfere with the conduct of commercial or recreational activities, but these effects will be short-term, localized and therefore considered to be less than significant if not negligible.

Activities with only less than significant beneficial impacts

Non-Motorized Crafts

Trained teams aboard sanctuary non-motorized crafts stationed at heavily-visited sites during peak recreational boating seasons inform recreational boaters about the sanctuary's zones and regulations, encourage proper use of resources and mooring buoys, promote dive flag safety, and promote safe and responsible boating behavior, which are expected to result in better and safer visitor experience. The impacts from these activities are expected to be beneficial and less than significant.

Onshore Fieldwork

Beach cleanups and large scale removal efforts have both direct and indirect beneficial socioeconomic human use impacts; however these effects are likely to be less than significant. Beach cleanups both aid in the overall health of a nearshore area and afford the general public an opportunity to be involved, and assist, in conservation activities. In addition, participation in such activities can lead to a heightened level of consciousness in regards to conservation and preservation of cultural and natural resources.

Vessel Operations

Conducting vessel operations allows sanctuary personnel to be on the water providing direct and indirect less than significant beneficial impact to human uses through enforcing compliance with sanctuary and other regulations and by providing education and general awareness to other users so that they may avoid impacts to sanctuary resources. In addition, conducting vessel operations allows sanctuary personnel to respond to emergency incidents involving other users.

Activities with only less than significant adverse impacts

SCUBA/Snorkel Operations

SCUBA/snorkel operations are expected to have a less than significant, short-term, localized adverse effect on sanctuary users due to the potential for temporary displacement of fishing activity when divers or snorkelers are present conducting sanctuary operations.

Activities with negligible impacts

Vessel Maintenance

Vessel maintenance activities are highly unlikely to have detectable effect on other human uses because these activities are low intensity, episodic and typically conducted pierside or on-land.

Summary of Effects on Socioeconomic Resources

The expected effects on socioeconomic resources would be predominantly positive and beneficial. The information gained from scientific study and inquiry would create greater awareness and appreciation of sanctuary resources, and promote public and some commercial

uses. ONMS believes these advantages would outweigh the short-term adverse effects on socioeconomic activities; however these effects are likely to be less than significant.

4.1.4 Maritime Heritage and Cultural Environment

Maritime Heritage Resources

Activities with both less than significant beneficial and less than significant adverse impacts

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters in sanctuaries is expected to have a less than significant, long-term beneficial effect on maritime heritage resources, cultural resources and historic properties. All projects are designed to learn more about each sanctuary so that managers can better protect sanctuary resources. By undertaking these projects, the historical environment is expected to be better protected, restored, or preserved. Thus, these resources stand to gain a benefit from these activities. These impacts are expected to be less than significant because the extent of protection that better informed management can provide to heritage resources, cultural resources and historic properties is limited.

Deployment of AUV/ROV/gliders/drifters in sanctuaries is expected to have a less than significant adverse effect on maritime heritage resources, cultural resources and historic properties. While intentional or accidental improper operator techniques are possible, trained operators are utilizing assets that are very visible to the public and operators serve as models of best practices. Thus, these operations are expected to result in less than significant adverse effects.

Deployment of Buoys

The use of seabed deployed equipment is expected to have an overall positive and beneficial effect on maritime heritage resources in a sanctuary because it can help sanctuary mangers locate and document new archaeological sites, and better characterize and monitor these resources.

These information is expected to benefit maritime heritage resources by enabling better protection and management; raising public awareness; preventing anchoring on historic resources; and allowing researchers and all interested people to gain a better understanding and appreciation of a sanctuary's maritime archaeological history. Further, the measurement of oceanographic and water quality conditions through equipment located on deployed buoys at an archaeological site aids researchers in developing more efficient field work protocols. Thus, given the nature of archaeological research and documentation these impacts are expected to be long-term, localized and therefore, less than significant.

The National Historic Preservation Act mandates that a sanctuary inventory and document historic resources. Consequently, every effort is made to survey areas prior to sampling and to use

all available technologies to contribute to the inventory of historic resources. Precautionary measures are taken to avoid disturbance of known historic resources.

The possible adverse impacts to maritime heritage resources from seabed deployment of instrumentation are the highly improbable physical impact of the equipment on a heritage resource such as a shipwreck. Maritime archaeological operations are performed by highly-skilled and experienced researchers and divers with extensive knowledge of NHPA protocols so the possibility of any serious harm to historic artifacts is quite small. Therefore, the effects of these operations are expected to be long-term, localized, and therefore, less than significant.

There is also a slight risk in studying and identifying historic and culturally-significant sites as this may lead to looters and memento-seekers carrying off important historic resources, but again the possibility of this is quite small as the great majority of divers respect the historic and culturally significance of these artifacts. Moreover, great care is given to how and when information is made public for newly discovered sites; therefore, less than significant adverse impacts are expected.

Deployment of Remote Sensing Equipment

The National Historic Preservation Act mandates that a sanctuary inventory and document historic resources. Consequently, every effort is made to survey areas prior to sampling and to use all available technologies to contribute to the inventory of historic resources.

The use of remote sensing equipment is expected to have a beneficial effect on maritime heritage resources in a sanctuary because it can help sanctuary mangers locate and document new archaeological sites, and better characterize and monitor these resources. For example, multi-beam or side-scan sonar systems can be used to locate and protect maritime heritage resources, improve understanding of these resources, and allow researchers to better assess the significance of these resources to develop more refined management approaches. Further, the measurement of oceanographic and water quality conditions at an archaeological site aids researchers in developing more efficient field work protocols. However these beneficial effects are likely to be less than significant.

A possible adverse impacts to maritime heritage resources from remote sensing operations are the highly improbable physical impact of the equipment on a heritage resource such as a shipwreck. There is also a slight risk in studying and identifying historic and culturally-significant sites as this may lead to looters and memento-seekers carrying off important historic resources. However, precautionary measures are taken to avoid disturbance of known historic resources. Deployment of remote sensing equipment is expected to have adverse impacts on maritime heritage resources, cultural resources and historic properties which are less than significant.

Onshore Fieldwork

Onshore fieldwork that involves resource documentation and monitoring is expected to have a less than significant beneficial effect on the study and preservation of historic and maritime

heritage sanctuary resources as well as the study, preservation, and practice of cultural resources. Such activities promote improved understanding and protection of these resources that can lead to enhanced environmental stewardship and better management. These impacts are expected to be less than significant because these projects are of a short duration and limited in scope. Thus, extent of protection that better informed management can provide to heritage resources, cultural resources and historic properties is limited.

Onshore fieldwork activities are expected to have adverse impacts on maritime heritage resources, cultural resources and historic properties which are less than significant. These projects are designed to not interfere with historical artifacts that may be found in the region. During incident response efforts, however, there is a small likelihood of disturbing maritime heritage, historical and/or cultural resources. Staff (ONMS and specialized contract staff) conducting incident response efforts are highly skilled and trained with ONMS best management practices to minimize impacts. In addition, if these activities are conducted in areas near historic or cultural resources, appropriate experts (e.g., cultural or archeologic) are consulted prior to extraction.

Other Sampling Activities

The use of other sampling activities in a sanctuary has many positive and beneficial effects on maritime heritage resources because it may help sanctuary mangers locate and document new archaeological sites, lead to enhanced resource characterization, protection and management; raise public awareness; and allow researchers and all interested people to gain a better understanding and appreciation of a sanctuary's maritime archaeological history. Further, the measurement of oceanographic and water quality conditions at an archaeological site aids researchers in developing more efficient field work protocols.

This process of discovery, documentation, collection and sometimes extraction of artifacts for educational and research purposes is designed to learn more about these sanctuary resources so that managers and partners can work together to better protect and preserve our history. Given the nature of maritime archaeological operations the impacts from these activities are long-term, localized, and therefore, less than significant.

Some sampling activities could potentially occur in the vicinity of historic and cultural resources and may, thus, adversely affect these resources, but as these operations are evaluated in advance for proximity to historic resources on the seafloor, and are conducted by personnel with experience and knowledge of the protocols laid out in the National Historic Preservation Act, the possibility of any serious harm is remote and only less than significant adverse impacts are expected.

However, possible but highly unlikely adverse impacts to maritime heritage resources from other sampling operations do exist and include physical impact of the equipment on a shipwreck, anchoring by research vessels, and destruction of historic resources by damaging extraction techniques such as using grabs or corers on the seafloor in close proximity to an artifact. All of these scenarios would be unintentional as every effort would be made to scan the area for historic

properties prior to sampling. Some sampling activities are expected to have adverse impacts on maritime heritage resources, cultural resources and historic properties which are less than significant.

SCUBA/Snorkel Operations

SCUBA/snorkel operations are expected to have a less than significant, long-term beneficial effect on maritime heritage resources, cultural resources and historic properties. All projects are designed to learn more about each sanctuary so that managers can better protect all these resources. By undertaking these projects, historical resources are expected to be better protected, restored, or preserved; thus gaining benefit from these activities. While intentional or accidental improper diving or snorkeling techniques and overuse of specific locations can result in damage to these resources, sanctuary divers and snorkelers are highly trained and will employ ONMS best management practices to minimize adverse impacts. Thus, these operations are expected to result in less than significant adverse effects. These impacts are expected to be less than significant because the extent of protection that better informed management can provide to heritage resources, cultural resources and historic properties is limited.

Activities with less than significant beneficial and negligible impacts

Non-Motorized Crafts

Non-motorized crafts, as described in Chapter 2, are sometimes used to inform boaters about the sanctuary's zones and regulations and encourage proper use of resources and mooring buoys, which are expected to result in beneficial but not significant impacts to sanctuary habitats by preventing improper and damaging behavior by the public.

Non-motorized craft are expected to have negligible effects on any maritime heritage resources, cultural resources or historic properties because they are lightweight, slow and maneuverable and therefore able to avoid contact with sensitive historic and cultural resources. Therefore, non-motorized crafts are generally unlikely to have an impact on such resources.

Activities with negligible impacts

Aircraft Operations

Aircraft operations, while infrequent, can aid in the identification or historic and cultural sites within sanctuary boundaries. However, due to the infrequency of flights (less than 5 flights per year), the fact that most sanctuary resources are underwater, and the need for specialized equipment to survey marine resources from aircrafts, effects on historic and cultural resources are expected to be negligible.

Vessel Maintenance

Vessel maintenance activities are highly unlikely to have detectable effect on historical or cultural resources uses because they are low intensity, episodic and typically conducted pier side or on-land away from such resources.

Vessel Operations

Vessel operations are highly unlikely to have a detectable effect on maritime heritage resources, cultural resources or historical properties. ONMS vessel operators are highly trained and will employ ONMS best management practices to minimize adverse impacts. They are aware of the locations of maritime heritage and cultural resources in the sanctuary; as a result, they would refrain from anchoring in a location where there is a potential for damaging these resources. An accidental grounding or sinking could have a negative impact on these resources if it was inadvertently occurring right on top of a maritime heritage or cultural resource site; however, this occurrence seems rather unlikely.

Cultural Resources

Activities with both less than significant beneficial and less than significant adverse impacts

Deployment of AUV/ROV/Gliders/Drifters

Deployment of AUV/ROV/gliders/drifters in sanctuaries is expected to have a less than significant, long-term beneficial effect on maritime heritage resources, cultural resources and historic properties. All projects are designed to learn more about each sanctuary so that managers can better protect sanctuary resources. By undertaking these projects, the historical environment is expected to be better protected, restored, or preserved. Thus, these resources stand to gain a benefit from these activities. These impacts are expected to be less than significant because the extent of protection that better informed management can provide to heritage resources, cultural resources and historic properties is limited.

Deployment of AUV/ROV/gliders/drifters in sanctuaries is expected to have a less than significant adverse effect on maritime heritage resources, cultural resources and historic properties. While intentional or accidental improper operator techniques are possible, trained operators are utilizing assets that are very visible to the public and operators serve as models of best practices. Thus, these operations are expected to result in less than significant adverse effects.

Onshore Fieldwork

Onshore fieldwork that involves resource documentation and monitoring is expected to have a less than significant beneficial effect on the study and preservation of historic and maritime heritage sanctuary resources as well as the study, preservation, and practice of cultural resources. Such activities promote improved understanding and protection of these resources that can lead to enhanced environmental stewardship and better management. All projects are of a short duration

and limited scope and do not interfere with cultural resources; instead they serve to characterize better what is in the region. These impacts are expected to be less than significant because the extent of protection that better informed management can provide to heritage resources, cultural resources and historic properties is limited.

Onshore fieldwork activities are expected to have adverse impacts on maritime heritage resources, cultural resources and historic properties which are less than significant. In addition, in many locations, cultural beliefs, traditions, and practices provide a foundational context in which sanctuary activities function. As a result, local and traditional knowledge is utilized to further protect both cultural and natural sanctuary resources. Because onshore fieldwork is conducted with the benefit of this knowledge, onshore fieldwork activities are expected to have impacts on cultural resources which are less than significant and beneficial.

These projects are designed to not interfere with historical artifacts that may be found in the region. During incident response efforts, however, there is a small likelihood of disturbing maritime heritage, historical and/or cultural resources. Staff (ONMS and specialized contract staff) conducting incident response efforts are highly skilled and trained with ONMS best management practices to minimize impacts. In addition, if these activities are conducted in areas near historic or cultural resources, appropriate experts (e.g., cultural or archeologic) are consulted prior to extraction.

SCUBA/Snorkel Operations

SCUBA/snorkel operations are expected to have a less than significant, long-term beneficial effect on maritime heritage resources, cultural resources and historic properties. All projects are designed to learn more about each sanctuary so that managers can better protect all these resources. By undertaking these projects, historical resources are expected to be better protected, restored, or preserved; thus gaining benefit from these activities. While intentional or accidental improper diving or snorkeling techniques and overuse of specific locations can result in damage to these resources, sanctuary divers and snorkelers are highly trained and will employ ONMS best management practices to avoid improper actions that can cause harm to historical resources. Thus, these operations are expected to result in less than significant adverse effects. These impacts are expected to be less than significant because the extent of protection that better informed management can provide to heritage resources, cultural resources and historic properties is limited.

Activities with less than significant beneficial and negligible impacts

Non-Motorized Crafts

Non-motorized crafts, as described in Chapter 2, are sometimes used to inform boaters about the sanctuary's zones and regulations and encourage proper use of resources and mooring buoys, which are expected to result in beneficial but not significant impacts to sanctuary habitats by preventing improper and damaging behavior by the public.

Non-motorized craft are expected to have negligible effects on any maritime heritage resources, cultural resources or historic properties because they are lightweight, slow and maneuverable and therefore able to avoid contact with sensitive historic and cultural resources. Therefore, non-motorized crafts are generally unlikely to have an impact on such resources.

Activities with negligible impacts

Aircraft Operations

Aircraft operations, while infrequent, can aid in the identification or historic and cultural sites within sanctuary boundaries. However, due to the infrequency of flights (less than 5 flights per year), the fact that most sanctuary resources are underwater, and the need for specialized equipment to survey marine resources from aircrafts, effects on historic and cultural resources are expected to be negligible.

Deployment of Remote Sensing Equipment

Remote sensing operations are expected to have no or negligible effect on maritime heritage and cultural resources as they usually will not come in contact with these resources at all.

Vessel Maintenance

Vessel maintenance activities are highly unlikely to have detectable effect on historical or cultural resources uses because they are low intensity, episodic and typically conducted pier side or on-land away from such resources.

Vessel Operations

Vessel operations are highly unlikely to have a detectable effect on maritime heritage resources, cultural resources or historical properties. ONMS vessel operators are highly trained and will employ ONMS best management practices to minimize adverse impacts. They are aware of the locations of maritime heritage and cultural resources in the sanctuary; as a result, they would refrain from anchoring in a location where there is a potential for damaging these resources. An accidental grounding or sinking could have a negative impact on these resources if it was inadvertently occurring right on top of a maritime heritage or cultural resource site; however, this occurrence seems rather unlikely.

Summary of Effects on Historic and Cultural Resources

The anticipated effects on historic and cultural resources would be predominantly less than significant and beneficial. These field operations locate and document new archaeological sites; lead to enhanced resource characterization, protection and management; raise public awareness; and allow researchers and all interested people to gain a better understanding and appreciation of a sanctuary's maritime archaeological history, all of which are beneficial effects to historic and cultural resources. Precautionary measures are taken to avoid disturbance of known historic resources.

4.2 Alternative 2: Conduct Field Operations without Voluntary and Precautionary Procedures for Vessel Operations

The environmental consequences of Alternative 2 would be very similar to those of Alternative 1 because the majority of field operations would be identical between the two alternatives. Vessel operations in the sanctuaries alone would be slightly different in Alternative 2. Current ONMS vessel operations best management practices would be discontinued.

4.2.1 Biological Environment

Sanctuary vessel best management practices, as described in Chapter 2, focus on reducing potential impacts to marine mammals, and other federally-listed species from vessel strikes in sanctuaries along the west coast. Therefore, discontinuing these best management practices would be expected to have an effect on birds, and protected species.

Birds

In the waters of West Coast sanctuaries, operating without following the best management practices could result in vessel strikes or behavioral disturbance of seabirds, as the vessels would generally operate at higher speeds and with fewer observers on the deck to look for wildlife. A collision or disturbance would likely only affect an individual bird and not an entire bird colony, since it would occur on the water and not on land, reducing the overall impact to bird communities as a whole. Therefore, this would be expected to have a direct, less than significant adverse impact on seabirds.

Protected Species

In the waters of West Coast sanctuaries, operating without following the best management practices could result in vessel strikes or behavioral disturbance of marine mammals and turtles, as the vessels would generally operate at higher speeds and would not have voluntary standing orders directing vessel crew to take extra precautions when protected species are known to be present. Due to the fact that the sanctuaries have few vessels and are not on the water every day, the overall likelihood of a vessel strike with marine mammals or turtles would still be low. Therefore, this could have a direct, but less than significant adverse impact on protected species.

4.2.2 Acoustic Environment

In the waters of West Coast sanctuaries, operating without following the best management practices could result in disturbance to marine mammals and generation of unnecessary noise in general. Voluntary procedures to use the lowest power setting and avoid using scientific equipment when marine mammals have been sighted would not be followed, which would result in a higher level of anthropogenic noise being introduced underwater. Due to the fact that the sanctuaries have few vessels and are not on the water every day, the increase in underwater noise compared to ambient conditions is not expected to be significant. Therefore, this could have a direct, but less than significant adverse impact on protected species.

4.3 Cumulative Impacts

The cumulative effect of the proposed action is expected to be the incremental environmental effect that the proposed action has when added to other past, present, and foreseeable future actions in the affected environment. ONMS reviewed the projects identified in the individual impacts assessment above as causing any beneficial or adverse effects on resources in order to identify potential cumulative issues.

Categories of field operations identified with some potential to contribute to cumulative effects include those that could result in seafloor disturbance and/or noise pollution, those that include vessel operations, and those aimed at resource protection. These effects are described below.

4.3.1 Cumulative Effects on Physical Environment

Field operations that could result in disturbance to the physical environment include:

- Deployment of Buoys
- Vessel Operations
- SCUBA and Snorkel Operations
- Other Sampling Activities
- Aircraft Operations
- Deployment of AUVs/ROVs
- Deployment of Remote Sensing Equipment

The following sanctuary-directed scientific activities could contribute adversely to the cumulative effects of **seafloor disturbance**: deploying moored buoys, obtaining benthic samples, anchoring research vessels, and exploring shipwrecks and archaeological artifacts. These activities are likely to all result in minor, short-term disturbance of the seafloor. In addition to these sanctuary-directed activities, there are a host of other external activities that when combined with the sanctuary-directed activities may have cumulative effects on the seafloor. The principal external activities that disturb the seafloor are commercial fishing (e.g., trawling), harbor dredging, potential new alternative energy arrays or underwater cables. Compared to the large-scale and potentially long-term effects of these activities, the sanctuary-directed activities mentioned above are minor, short-term, and affect a very small area, and thus, are not expected to contribute significantly to overall cumulative effects on the seafloor.

The following sanctuary-directed scientific activities could contribute adversely to the cumulative effects of **water quality**: operating research vessels and transiting of a research vessel. In addition to these sanctuary-directed activities, there are a host of other external activities that

when combined with the sanctuary-directed activities may have cumulative effects on water quality.

The following sanctuary-directed scientific activities could contribute adversely to the cumulative effects of **noise pollution**: operating research vessels to conduct surveys and transects; the transiting of a research vessel; operating aircraft for surveys; remote sensing operations and deploying AUVs/ROVs and towed arrays to survey habitats and biological activity. In addition to these sanctuary-directed activities, there are a host of other external activities that when combined with the sanctuary-directed activities may have cumulative effects on noise pollution. The principal external activities that contribute to noise pollution are commercial shipping (e.g., tankers, freighters, container ships, tug and barge, cruise ships), commercial fishing, and vessels operations of the U.S. Navy and U.S. Coast Guard. Compared to the large-scale, chronic effects of commercial shipping, the sanctuary-directed sources of noise are expected to be minor, short-term, and have a small footprint and thus, are not expected to contribute significantly to overall cumulative effects of noise pollution.

In addition, the proposed action is not expected to contribute to any significant adverse impacts on **air quality** or climate change. Compared against existing vessel and shipping traffic, the addition of sanctuary vessel operations is expected to have less than significant impact on air quality.

4.3.2 Cumulative Effects on Biological Environment

Field operations that could result in disturbance to the biological environment include:

- Deployment of Buoys
- Vessel Operations
- SCUBA and Snorkel Operations
- Other Sampling Activities
- Aircraft Operations
- Deployment of AUVs/ROVs
- Deployment of Remote Sensing Equipment

The following sanctuary-directed scientific activities could contribute adversely to the cumulative effects on **living marine resource disturbance** such as striking whales: operating research vessels and SCUBA dives to conduct surveys and transects; transiting of a research vessel; deploying AUVs/ROVs and towed arrays to survey habitats and biological activity and locate archaeological artifacts; and conducting diving operations. In addition to these sanctuary-directed activities, there are a host of other external activities that when combined with the sanctuary-

directed activities may have cumulative effects on living marine resources. The principal external activities that contribute to cumulative effects on living marine resources are commercial shipping (e.g., tankers, freighters, container ships, tug and barge, cruise ships); vessel operations related to commercial and recreational fishing, whale watching, and recreational boating; and vessel operations of the U.S. Navy and U.S. Coast Guard. Compared to the considerable level of external (i.e., non-sanctuary related) vessel operations and the fact that sanctuary-directed vessel operations are conducted by highly trained personnel, and prohibit wastewater discharge, the sanctuary-directed vessel operations are minor and highly regulated and thus are not expected to contribute significantly to overall cumulative effects on biological resources. Other external activities that aim to contribute to marine resource protection are other NOAA research, cooperative fishery research sponsored by NOAA, and research conducted by academic, non-profit and government institutions. Given that these marine resource protection activities are intended to improve the health of species and ecosystems through improved understanding and knowledge, and that these activities are conducted in a precautionary manner by highly trained professionals, it is highly unlikely that the cumulative effect of these activities would be adverse.

4.3.3 Cumulative Effects on Socioeconomic Environment

None of the field operations analyzed in this environmental assessment are expected to result in significant disturbance to the socioeconomic environment. All of the effects to the socioeconomic environment would be less than significant. The principal external activities that contribute to cumulative effects on the socioeconomic environment are regional fishery management frameworks, global or regional shifts in shipping patterns, and shifts in tourism trends. Compared to the large-scale and potentially long-term effects of these activities, the sanctuary-directed activities mentioned above are minor, short-term, and affect a very small area, and thus, are not expected to contribute significantly to overall cumulative effects on the socioeconomic. Therefore, the potential for adverse cumulative impacts in combination with other uses of the affected area is expected to be very low.

4.3.4 Cumulative Effects on Maritime Heritage and Cultural Environment

None of the field operations analyzed in this environmental assessment are expected to result in significant disturbance to the maritime heritage and cultural environment. All of the effects to the maritime heritage and cultural environment would be less than significant. The principal external activities that contribute to cumulative effects on the maritime heritage and cultural environment are similar to the ones mentioned above regarding disturbance of the seabed (i.e., commercial fishing, harbor dredging, potential new alternative energy arrays or underwater cables). Compared to the large-scale and potentially long-term effects of these activities, the sanctuary-directed activities mentioned above are minor, short-term, affect a very small area, and are generally designed to avoid known resources. Thus, they are not expected to contribute significantly to overall cumulative effects on the maritime heritage and cultural environment. Therefore, the potential for adverse cumulative impacts in combination with other uses of the affected area is expected to be very low.

4.4 Conclusions

Alternative 1 (Status Quo: field operations with additional required mitigations resulting from consultations and permits) has overall beneficial effects to the environment as managers gain more information and take actions to better protect resources; the public becomes more educated about sanctuary resources; and damaged resources are restored. While there are some adverse effects associated with this alternative, these effects are not expected to be significant and are short-term, with the exception of the deployment and placement of buoys and moorings which may have less than significant, long-term, adverse impacts. Through the consultation and permitting process, NOAA would gain a better understanding of any additional beneficial effects or operational costs associated with the required mitigation. However, it is expected that any additional required mitigation would further reduce potential adverse effects on protected resources such as marine mammals and threatened and endangered species.

In comparison, Alternative 2 would still yield similar beneficial effects to the environment, but would have more potential risk for adverse effects to protected resources and habitat.

Table 11 below provides a summary of the environmental impacts expected to result from the 2 alternatives.

Table 11. Summary of Anticipated Effects of Status Quo Alternative to Conduct Field Operations in the West Coast Region

Legend	**Effects Across Resource Categories**			
Ø Not applicable				
~ Negligible				
+ Less than significant, beneficial				
- Less than significant, adverse				
Categories of Field Operations	**Physical**	**Biological**	**Socioeconomic**	**Historic and Cultural**
Vessel Operations Projects	~/-	+/-	+	~
Vessel Maintenance	~/-	~	~	~
Aircraft Operations	Ø	Ø	Ø	Ø
Non-Motorized Craft	Ø	Ø	Ø	Ø
SCUBA or Snorkel Operations	~	+/-	~	+/-
Onshore Fieldwork	Ø	Ø	Ø	Ø
Deployment of AUVs/ROVs	~/-	+/-	+	+/-
Deployment of Remote Sensing Equipment	~/+/-	~/+/-	~/+/-	~/+/-

Deployment of Equipment on the Seafloor	~/+/-	~/+/-	~/+/-	~/+/-
Other Sampling Activities	~/+/-	~/+/-	~/+/-	~/+/-

Table 12. Summary of Effects by Resource Element and Alternative for all West Coast Sanctuaries

	Alternative 1	**Alternative 3**
RESOURCE ELEMENTS		
Geology	Activities have both less than significant adverse and less than significant beneficial impacts (onshore fieldwork, deployment of buoys, deployment of remote sensing equipment, other sampling activities). One activity has only less than significant adverse impacts (vessel operations). Justification: Adverse impacts caused by onshore marine debris removal activities, seafloor disturbance from deployment activities, anchoring, unintentional groundings, and other sampling activities are expected to be short-term, of low intensity, and localized. Temporary buoys are less than 10lbs and are designed for quick release to prevent damage to habitat, marker buoys are removed at the end of each diving day, and drifter buoys are permanent but only 30-40cm in diameter and few in number. Anchor damage would be minimized by BMPs, requiring users to avoid sensitive areas, & would be small scale. The benefits of removing marine debris and grounded vessels is short-term and localized. Increased understanding of sanctuary resources may aid in the development of education and outreach materials and indirectly increase protection and management of resources, but these benefits are limited in scope.	Similar to Alt 1
Water Quality	Activities have less than significant adverse impacts (onshore fieldwork, vessel operations). Justification: Impacts caused by emissions from vessel operations and onshore fieldwork are expected to be short-term and of low intensity. The risk of fuel, lubricant, sewage and garbage spills is low because state and federal regulations prohibit most discharges. ONMS vessel operators are trained to follow the NOAA Small Boat Program mandates and BMPs to avoid impacts; removal efforts are conducted by experienced ONMS staff when necessary.	Similar to Alt 1
Air Quality	Activities have less than significant adverse impacts (aircraft operations, vessel operations). Justification: The adverse impacts caused by vessel and aircraft emissions are expected to be short-term and of low intensity. Large vessels have EPA Tier 3-compliant diesel engines and small vessels have four stroke and low emission motors. Thus, they contribute only a small about of emissions relative to other activities.	Similar to Alt 1

Acoustic Environment	Activities have less than significant adverse impacts (aircraft operations, deployment of AUV/ROV/gliders/drifters, deployment of buoys, deployment of remote sensing equipment, other sampling activities, vessel operations). Justification: Noise disturbance from activities is expected to be short-term and of low intensity. We do not know how loud the sound scape is currently, but we believe the contribution of these activities is small relative to the whole.	Similar to Alt 1
Biological Environment		
Biological Habitat	Activities have both less than significant adverse and less than significant beneficial impacts (deployment of AUV/ROV/gliders/drifters, deployment of buoys, deployment of remote sensing equipment, other sampling activities, onshore fieldwork, SCUBA/snorkel operations, vessel operations). Some activities have only less than significant beneficial impacts (non-motorized crafts, aircraft operations). Justification: Adverse impacts from removal of debris during fieldwork, anchoring, other sampling activities, unintentionally grounding vessels, deployment of equipment, and diving are expected to be short-term, localized and limited in scope. Training and BMPs teach users to avoid harm to habitat and inform users how to avoid improper operation of equipment. Temporary buoys are less than 10lbs and are designed for quick release to prevent damage to habitat, marker buoys are removed at the end of each diving day, and drifter buoys are permanent but only 30-40cm in diameter and few in number. Non-motorized craft can help inform the public of regulations and proper use of resources, and provide an assessment of injury to resources. Vessels and aircraft increase enforcement. Characterization of habitat leads to the formation of management plans to address environmental changes. SCUBA/snorkel operations, onshore activities, and deployment of equipment can aid in the development of education and outreach materials and help increase public understanding and appreciation of sanctuary resources. However, benefits are localized and limited in scope.	Same as Alternative 1, but there will be an additional indirect, less than significant adverse impact due to the discontinuation of current vessel procedures. With no BMPs, the impact on habitat will be the same as Alternative 1 or worse. However, harm will be limited in scope.
Invertebrates	Activities have both less than significant adverse and less than significant beneficial impacts (onshore fieldwork, deployment of AUV/ROV/gliders/drifters, deployment of buoys, deployment of remote sensing equipment, other sampling activities, SCUBA/snorkel operations, vessel operations). One activity has only less than significant beneficial impacts (aircraft operations). Justification: Indirect adverse impacts (e.g., temporary behavior modification or displacement), are expected to be short-term and localized. Injury or mortality due to direct contact with gear are expected to be minimal due to the limited scope and transitory nature of activities. Users are trained according to BMPs to avoid harm to resources, avoid over collection and overuse of any specific location. Vessel and aircraft operations increase enforcement. Characterizing species movements will improve species management and habitat protection. SCUBA/snorkel operations, onshore activities, and deployment of equipment can aid in the development of education and outreach materials and help increase public	Same as Alternative 1, but there will be an additional indirect, less than significant adverse impact due to the discontinuation of current vessel procedures. With no BMPs, the impact on fish will be the same as Alternative 1 or worse. However, harm will be limited in scope.

	understanding and appreciation of sanctuary resources. Benefits will be limited in scope.	
Fish	Activities have both less than significant adverse and less than significant beneficial impacts (onshore fieldwork, deployment of AUV/ROV/gliders/drifters, deployment of buoys, deployment of remote sensing equipment, other sampling activities). Some activities have only less than significant beneficial impacts (aircraft operations, SCUBA/snorkel operations, vessel operations). Justification: Adverse impacts, like temporary behavior modification or temporary displacement, direct contact with gear and tagging, are expected to be short-term and localized. Characterizing species movements will improve species management and habitat protection. Vessel and aircraft operations increase enforcement. SCUBA/snorkel operations, onshore activities, and deployment of equipment can aid in the development of education and outreach materials and help increase public understanding and appreciation of sanctuary resources. Benefits are limited in scope.	Same as Alternative 1, but there will be an additional indirect, less than significant adverse impact due to the discontinuation of current vessel procedures. With no BMPs, the impact on fish will be the same as Alternative 1 or worse. However, harm will be limited in scope.
Birds	Activities have both less than significant adverse impacts and less than significant beneficial impacts (onshore fieldwork, aircraft operations, deployment of AUV/ROV/gliders/drifters, deployment of remote sensing equipment, other sampling activities, vessel operations). Some activities have only less than significant beneficial impacts (deployment of buoys, SCUBA/snorkel operations). Justification: Adverse impacts, like temporary behavior modification or displacement from the presence of vessels and aircraft or onshore fieldwork, are expected to be short-term and localized. Direct collisions with aircraft are expected to unlikely because aircraft operate above 200 feet in elevation. Injury from sampling is expected to be temporary. Vessel and aircraft operations increase enforcement. Research will aid in management and protection of species. SCUBA/snorkel operations, onshore activities, and deployment of equipment can aid in the development of education and outreach materials and help increase public understanding and appreciation of sanctuary resources. Benefits will be limited in scope.	Same as Alternative 1, but there will be an additional direct, less than significant adverse impact due to increased collisions and disturbance due to the discontinuation of current vessel procedures. Collision or disturbance by vessels would likely only affect an individual bird or bird colony. Thus, the impact is not significant.

Protected Species	Activities have both less than significant adverse and less than significant beneficial impacts (onshore fieldwork, deployment of AUV/ROV/gliders/drifters, deployment of buoys, deployment of remote sensing equipment, non-motorized crafts, other sampling activities, vessel operations). Some activities have only less than significant beneficial impacts (aircraft operations, SCUBA/snorkel operations). Justification: Adverse impacts (e.g., behavior modification from AUV/ROV/gliders/drifters, equipment deployed on the seafloor, and onshore activities), are expected to be short-term and localized. ROV entanglement is unlikely due to the presence of observers on deck to avoid contact with species and the small duration of operations. Mid frequency pinnipeds and cetaceans may be affected; however, sources assessed are downward facing, do not propagate over large distances (due to high attenuation of higher frequencies) and are strongly directional (constrained within narrow beams), low impacts are expected on mid-frequency cetaceans. Thus, individual animals would need to be in very close range of the source, and located directly below it to be exposed to higher intensities capable of inducing physical injury to ears or causing behavioral responses. Vessel impacts are minimized through the use of small, maneuverable vessels that have shallow draft. Larger vessels move slower and implement BMPs which require an observer to be on deck, conduct activities during daylight hours, use multibeam systems that use focused sonar arrays and emit short pulses at limited ping rates, turn off sonars when marine mammals have been sighted within 1nm of the vessel, and avoid sensitive habitats. Non-motorized craft will inform the public of regulations and proper use of resources, and provide an assessment of injury to resources. Equipment will monitor marine mammal behavior and may lead to management plans to reduce human impacts. Disentanglements provide direct benefits to species and indirect benefits from increased public attention and education. Vessel and aircraft operations increase enforcement. SCUBA/snorkel operations, onshore activities, and deployment of equipment can aid in the development of education and outreach materials and help increase public understanding and appreciation of sanctuary resources. However, benefits will be short-term and limited in scope.	Same as Alternative 1, but there will be an additional direct, less than significant adverse impact due to increased collisions and disturbance due to the discontinuation of current vessel procedures. Harm is expected to be limited in scope.
Socioeconomic Environment		
Maritime Transportation	Activities have less than significant beneficial and negligible impacts (deployment of buoys, deployment of remote sensing equipment, other sampling activities). Justification: Limited scope; assist in navigation and prevent groundings, but will only incrementally add to body of bathymetry knowledge and network of navigation buoys already in place. Activities may temporarily interfere with transit, but the effect is expected to be short-term and negligible as most activities are limited in scope and time.	

Research and Education	Some activities have less than significant beneficial and negligible impacts (deployment of buoys, deployment of remote sensing equipment, other sampling activities). Some activities have only less than significant beneficial impacts (aircraft operations, deployment of AUV/ROV/gliders/drifters, onshore fieldwork, SCUBA/snorkel operations, vessel operations). Justification: Activities may temporarily interfere with human uses, but the effect is expected to be short-term and negligible as most activities are limited in scope and time. Increased awareness & appreciation of sanctuary resources. Characterization of resources will aid management, research and monitoring of sanctuary resources. Beneficial impacts are short-term and limited in scope. Activities will only incrementally add to opportunities for research in the sanctuaries.	Similar to Alt 1
Human Uses	Some activities have less than significant beneficial and negligible impacts (aircraft operations, deployment of buoys, deployment of remote sensing equipment, other sampling activities). Some activities have only less than significant beneficial impacts (non-motorized crafts, onshore fieldwork, vessel operations). One activity has less than significant adverse impacts (SCUBA/snorkel operations). Justification: Temporary interference of commercial or recreational activities is expected to be short-term and localized. Benefits include increasing enforcement, increasing education and awareness of sanctuary resources and regulations, promoting safety, and avoiding harm to sanctuary resources. Characterizing movements of species will benefit commercial and recreational businesses, improve species management and habitat protection, and increase appreciation for sanctuary resources. Benefits are limited in scope.	Similar to Alt 1
Maritime Heritage and Cultural Environment		
Maritime Heritage Resources	Activities have both less than significant adverse and less than significant beneficial impacts (deployment of AUV/ ROV/gliders/drifters, deployment of buoys, deployment of remote sensing equipment, onshore fieldwork, other sampling activities, SCUBA/snorkel operations). One activity has less than significant beneficial impacts (non-motorized crafts). Justification: Adverse effects, including disturbance of and damage to known historic and cultural resources, will be mitigated through the application of precautionary measures. These include not divulging information on the location of newly discovered sites. ONMS staff performing research will be trained to employ NHPA protocols that describe how to avoid harm to historic artifacts. Resource characterization and monitoring will aid in protection and management of artifacts, raise public awareness, and increase understanding and appreciation of sanctuary resources. Non-motorized craft help inform the public of regulations and proper use of resources. However, benefits are short-term and limited in scope.	Similar to Alt 1

	Activities have both less than significant adverse and less than significant beneficial impacts (deployment of AUV/ROV/gliders/drifters, onshore fieldwork, SCUBA/snorkel operations,). One activity has only less than significant beneficial impacts (non-motorized crafts).	Similar to Alt 1
Cultural and Historic Resources	Justification: There is a small likelihood of disturbance to resources because staff are trained prior to underwater survey work to minimize their impact. Activities are localized and limited in scope. Benefits include the use of traditional knowledge to ensure culturally sensitive management of resources and informing the public of regulations, resource characterization and monitoring will aid in protection and management of artifacts, raising public awareness, and increasing understanding and appreciation of sanctuary resources. Benefits are short-term and limited in scope.	

*Will be further fleshed out after we receive information from NMFS consultations.
ND=Not Described

5.0

CONSULTATIONS

5.1 Magnuson-Stevens Act

In 1976, Congress passed the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801, et seq.). The MSA fosters long-term biological and economic sustainability of the nation's marine fisheries out to 200 nautical miles from shore. Key objectives of the MSA are to prevent overfishing, rebuild overfished stocks, increase long-term economic and social benefits, and ensure a safe and sustainable supply of seafood. Two of the main purposes of the MSA (16 U.S.C. §§ 1801, et seq.) are to promote domestic commercial and recreational fishing under sound conservation and management principles, and to provide for the preparation and implementation, in accordance with national standards, of FMPs which will achieve and maintain, on a continuing basis, the optimum yield from each fishery. The 10 National standards of the MSA require that FMPs contain certain conservation and management measures, including measures necessary to prevent overfishing, to rebuild overfished stocks, to insure conservation, to facilitate long-term protection of Essential Fish Habitat (EFH), and to realize the full potential of the Nation's fishery resources. Furthermore, the MSA also declares that the National Fishery Conservation and Management Program utilizes, and is based upon, the best scientific information available; involves, and is responsive to the needs of interested and affected States and citizens; considers efficiency; and draws upon federal, state, and academic capabilities in carrying out research, administration, management, and enforcement.

The EFH provisions of the MSA require NMFS to provide recommendations to federal and state agencies for conserving and enhancing EFH, for any actions that may adversely impact EFH. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity". Federal agencies must consult with NMFS and assess the effects of their actions on EFH. There is no separate permit or authorization process; EFH consultation is typically addressed during the NEPA process and incorporated into other permits. ONMS will use this draft PEA to consult with the Southeast Region EFH Coordinator to assess the impacts of ONMS field operations on EFH. The EFH assessment submitted to NMFS is below. NMFS concurred with the general concurrence.

5.1.1 Essential Fish Habitat Assessment

Introduction

The consultation requirements of §305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA; 15 U.S.C. 1855(b)) provide that:

- Federal agencies must consult with the Secretary on all actions, or proposed actions, authorized, funded, or undertaken by the agency, that may adversely affect essential fish habitat (EFH);
- the Secretary shall provide recommendations (which may include measures to avoid, minimize, mitigate, or otherwise offset adverse effects on EFH) to conserve EFH to federal or state agencies for activities that would adversely affect EFH;
- the federal action agency must provide a detailed response in writing to the National Marine Fisheries Service (NOAA Fisheries) and to any Council commenting under §305(b)(3) of the MSA within 30 days after receiving an EFH Conservation Recommendation.

Program Description

The Programmatic Environmental Assessment of Field Operations in the West Coast National Marine Sanctuaries developed by NOAA's Office of National Marine Sanctuaries (ONMS) describes current and ongoing activities for research and management in five sites: Olympic Coast National Marine Sanctuary, Cordell Bank National Marine Sanctuary, Greater Farallones National Marine Sanctuary, Monterey Bay National Marine Sanctuary and Channel Islands National Marine Sanctuary.

Section 2 of this document, the *Description of Proposed Action and Alternatives*, describes the activities ONMS undertakes as part of its field operations in these sites.

Essential Fish Habitat in the Region

The five national marine sanctuaries in the region overlap with EFH for groundfish, salmon, coastal pelagic species, and highly migratory species. A complete description of the EFH designations and the criteria used to determine them is available in the Pacific Fishery Management Council's Amendment 2 (2011) to the *Fishery Management Plan for U.S. West Coast Fisheries for Highly Migratory Species*; Amendment 19 (2005) to the *Pacific Coast Groundfish Fishery Management Plan*; Amendment 18 (2014) to the *Pacific Coast Salmon Fishery Management Plan*; and Amendment 13 (2011) to the *Coastal Pelagic Species Fishery Management Plan*.

Groundfish

The overall extent of groundfish EFH for all Fishery Management Unit species is identified as all waters and substrate within the following areas:

- Depths less than or equal to 3,500 m (1,914 fathoms (fm)) to mean higher high water level (MHHW) or the upriver extent of saltwater intrusion, defined as upstream and landward to where ocean-derived salts measure less than 0.5 ppt during the period of average annual low flow.
- Seamounts in depths greater than 3,500 m as mapped in the EFH assessment GIS.
- Areas designated as Habitat Areas of Particular Concern (HAPCs) not already identified by the above criteria.

Salmon

In the estuarine and marine areas, salmon EFH extends from the extreme high tide line in nearshore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (200 nautical miles or 370.4 km) offshore of Washington, Oregon, and California north of Point Conception.

Coastal Pelagic Species

The coastal pelagic species (CPS) fishery includes four finfish (Pacific sardine, Pacific [chub] mackerel, northern anchovy, and jack mackerel) the invertebrate, market squid, and all *euphausiid* (krill) species that occur in the West Coast EEZ. The east-west geographic boundary of EFH for CPS is defined to be all marine and estuarine waters from the shoreline along the coasts of California, Oregon, and Washington offshore to the limits of the EEZ and above the thermocline where sea surface temperatures range between 10°C to 26°C. The southern boundary is the United States-Mexico maritime boundary. The northern boundary is more dynamic, and is defined as the position of the 10°C isotherm, which varies seasonally and annually. The EFH designation for all species of krill extends the length of the West Coast from the shoreline to the 1,000 fm isobath and to a depth of 400 meters (1,312 feet).

Highly Migratory Species

Common Thresher Shark

- Neonate/early juveniles: Epipelagic, neritic and oceanic waters off beaches, in shallow bays, in near surface waters from the U.S.-Mexico EEZ border north to off Santa Cruz (37° N latitude) over bottom depths of 6 to 400 fm, particularly in water less than 100 fm deep and to a lesser extent further offshore between 200-300 fm.

- Late juveniles/subadults: Epipelagic, neritic and oceanic waters off beaches and open coast bays and offshore, in near-surface waters from the U.S.-Mexico EEZ border north to off Pigeon Point, California (37° 10' N latitude) from the 6 fm to 1400 fm isobaths.

- Adults: Epipelagic, neritic and oceanic waters off beaches and open coast bays, in near surface waters from the U.S.-Mexico EEZ border north seasonally to Cape Flattery, WA from the 40 fm isobath westward to about 127° 30' W longitude. north of the Mendocino Escarpment and from the 40 to 1900 fm isobath south of the Mendocino Escarpment.

Shortfin Mako Shark

- Neonate/early juveniles: Oceanic and epipelagic waters of the U.S. West Coast from the 100 fm isobath out to the 2000 fm isobath (and possibly beyond) from the Mexico border to Point Pinos, CA, especially the Southern Calif. Bight, from the 1000 fm isobath out to 2000 fm isobath from Monterey Bay north to Cape Mendocino; and from the 1000 fm isobath out to the EEZ boundary north of Cape Mendocino to latitude 46° 30' N latitude.

- Late juveniles/subadults: Oceanic and epipelagic waters from the U.S.-Mexico EEZ border north to 46° 30' N latitude from the 100 fm isobath out to the EEZ boundary north to San Francisco (38° N latitude), and from 1000 fm out to the EEZ boundary north to San Francisco (38° N latitude) and from 1000 fm out to the EEZ boundary north of San Francisco.

- Adults: Epipelagic oceanic waters from the U.S.-Mexico EEZ border north to 46° 30' N latitude extending from the 400 fm isobath out to the EEZ boundary south of Point Conception, from 1000 fm isobath out to the EEZ boundary and beyond north of Point Conception, and from the 1000 fm isobath out to the EEZ boundary and beyond, North of Point Conception, CA.

Blue Shark

- Neonate/early juveniles: Epipelagic, oceanic waters from the U.S.-Mexico border north to the U.S.-Canada border from the 1000 fm isobath seaward to the outer boundary of the EEZ and beyond; extending inshore to the 100 fm isobath south of 34° N latitude.

- Late juveniles/subadults: Epipelagic, oceanic waters from the U.S.-Mexico border north to 37° N latitude (off Santa Cruz, CA) from the 100 fm isobath seaward to the outer boundary of the EEZ and beyond; and north to the U.S.-Canada border from the 1000 fm isobath seaward to the EEZ outer boundary.

- Adults: Epipelagic, oceanic waters from the U.S.-Mexico border north to the U.S.-Canada border from the 1000 fm isobath seaward to the outer boundary of the EEZ and beyond; extending inshore to the 200 fm isobath south of 37° N latitude off Santa Cruz, CA.

Albacore Tuna

- Juvenile: Oceanic, epipelagic waters generally beyond the 100 fm isobath from the U.S.-Mexico EEZ border north to U.S.-Canada border, and westward to the outer edge of the EEZ boundary. Habitat concentrations off southern and central California and the area of the Columbia River Plume area. Reported to feed opportunistically, predominantly on fish (e.g., Pacific saury) and squids. Associated with sea surface temperatures (SSTs) between 10°C and 20°C in waters of the North Pacific Transition Zone in dissolved oxygen saturation levels greater than 60%.

- Adult: Oceanic, epipelagic waters generally beyond the 100 fm isobath from the U.S.-Mexico EEZ border north to U.S.-Canada border, and westward to the outer edge of the EEZ boundary. Associated with SSTs between 14°C and 25°C in waters of the North Pacific Transition Zone in dissolved oxygen saturation levels greater than 60%.

Bigeye Tuna

- Juvenile: Oceanic, epipelagic and mesopelagic waters beyond the 200 fm isobaths out to the EEZ boundary from the U.S.-Mexico EEZ border north to Point Conception, CA, some years extending northward to Monterey Bay (37° N latitude). Associated with SSTs between 13°C and 29°C with optimum between 17°C and 22°C. Habitat concentrated in the Southern California Bight primarily south of 34° N latitude from the 100 fm isobath out to the 1000 fm isobath.

- Adult: Oceanic, epipelagic and mesopelagic waters beyond the 200 fm isobath out to the EEZ boundary from the U.S.-Mexico EEZ border north to Point Conception, CA, some years extending northward to Monterey Bay (37° N latitude). Associated with SSTs between 13°C and 29°C with optimum between 17°C and 22°C. Habitat concentrated in the Southern California Bight primarily south of 34° N latitude from the 100 fm isobath out to the 1000 fm isobaths.

Northern Bluefin Tuna

- Juvenile: Oceanic, epipelagic waters beyond the 100 fm isobath from the U.S.-Mexico EEZ border north to U.S.-Canada border, and westward to the outer edge of the EEZ boundary. Associated with SST between 14°C and 23°C. Northerly migratory extension appears dependent on position of the North Pacific Subarctic Boundary.

- Adult: No regular habitat within the U.S. EEZ.

Skipjack Tuna

- Juvenile: No habitat within the U.S. West Coast EEZ.

- Adult: Oceanic, epipelagic waters beyond the 400 fm isobath out to the EEZ boundary from the U.S.- Mexico EEZ border northward to Point Conception, CA, and northward

beyond the 1000 fm isobath north to about 40° N latitude. Associated with SSTs between 18°C and 20°C and dissolved oxygen level > 3.5 ppm.

Yellowfin Tuna

- Juvenile: Oceanic, epipelagic waters from the U.S.- Mexico EEZ border north to Point Conception, CA, some years extending northward to Monterey Bay (37° N latitude). South of Pt Conception from the 100 fm isobath out to the EEZ boundary; north of Point Conception from 300 fm isobath out to the EEZ boundary. Associated with SSTs between 18° to 31°C.

Striped Marlin

- Adult: Oceanic, epipelagic waters of the Southern California Bight, above the thermocline, from the 200 fm isobath from the U.S.-Mexico EEZ border to about 34° 09' N latitude (Pt. Hueneme, CA), east of the Santa Rosa-Cortes Ridge (a line from South Point, Santa Rosa Island, southeast to the EEZ boundary at approx. 31° 36' N latitude and 118° 45' W longitude). Preferred water temperature bounded by 20 to 25°C.

Swordfish

- Juvenile:
    - Males under 102 cm EFL and females under 144 cm EFL: Oceanic, epipelagic and mesopelagic waters from the U.S.-Mexico EEZ border north to 41° N latitude. In the Southern California Bight primarily south of the Santa Barbara Channel Islands from the 400 fm isobath out to the EEZ boundary. North of Point Conception from the 1000 fathom isobaths westward to the EEZ outer boundary and northward to 41° N latitude.
    - Males over 102 cm EFL and females over 144 cm EFL: Oceanic, epipelagic and mesopelagic waters out to the EEZ boundary inshore to the 400 fm isobath in southern and central California from the U.S.-Mexico EEZ border north to 37° N latitude; beyond the 1000 fm isobaths northward to 46° 40' N latitude.

Dorado or Dolphinfish

- Juveniles and subadults: Epipelagic (-30 m deep) and predominantly oceanic waters offshore the 6 fm isobath along coastal California from the U.S.- Mexico border generally as far north as Point Conception, CA (34° 34' N latitude) and within the U.S. West Coast EEZ primarily east of the Santa Rosa-Cortes Ridge. (Line extends from Point Conception south-southeast to a point on the EEZ boundary at 31° 36' N latitude and 118° 45' W longitude). Prefers sea surface temperatures 20°C and higher during warm water incursions.

- Adults: Epipelagic (-30 m deep) and predominantly oceanic waters offshore the 6 fm isobath along coastal California from the U.S.-Mexico border generally as far north as Point Conception, CA (34° 34' N latitude) and within the U.S. West Coast EEZ primarily east of the Santa Rosa-Cortes Ridge. (Line extends from Point Conception south-southeast to a point on the EEZ boundary at 31° 36' N latitude and 118° 45' W longitude). Prefers sea surface temperatures 20°C and higher during warm water incursions

Assessment of Effects on Essential Fish Habitat

NOAA's Office of National Marine Sanctuaries has identified one category of field operations that may adversely affect Essential Fish Habitat in the West Coast Region: response to vessel groundings in Greater Farallones, Monterey Bay, and Channel Islands national marine sanctuaries. Although the process of assessing damage from vessel grounding is unlikely to have any adverse impacts on EFH, salvage operations themselves could impact EFH, through injury to bottom habitat or discharge to pelagic habitat. It should be noted that an absence of response to vessel casualties is likely to result in stronger impacts on EFH and sanctuary resources than the effects of a response.

Vessel groundings or sinkings involving a large commercial vessel like a container ship or a cruise ship will typically be responded to by the USCG under the Oil Pollution Act (OPA) and potentially to address hazards to navigation, due to their size and the amount of pollutants they have the potential to spill in the marine environment. In those cases, NOAA only engages for both scientific and technical expertise through the NOAA Scientific Support Coordinators and as a federal resource trustee, but is not the agency responsible for the action. In all groundings or sinkings, regardless of size, once the major threat of oil pollution under OPA no longer exists, the response shifts to a NMSA-focused response by ONMS to limit damages to sanctuary resources. The strategies employed to address the environmental threats of a sunken or grounded vessel to sanctuary resources would also help address concerns of impacts to EFH. To that end, the priority it is work with the responsible party and their insurance company if one exists to refloat or remove the vessel and any associated debris as soon as possible to limit the amount of physical impact to the site. Crushing and smothering injuries are common with groundings or sinkings until removal, as are issues associated with marine debris. If funds are not available from the insurer, ONMS may have funds through the Damage Assessment and Restoration Revolving Fund (non-appropriated funds from previous settlements) to salvage the vessel. The salvage priorities are to remove any contaminants or entanglement hazards including refrigerants, hydraulic fluids, nets, lines etc. In areas of limited accessibility, it is common to require the wreck to be cut up and lifted out via helicopter, as the wrecks are generally too compromised to refloat. If funds are not available for a complete salvage effort, portions of the hull may be left.

Habitat impacts to coastal and marine fisheries would be greatest when portions of the wreck are left at the grounding site. Impacts incurred to EFH during salvage, such as bottom disturbance, will generally be limited in scope to the salvage site and will be temporally limited to the amount of time it takes to do the salvage, after which recovery would take place. Priorities for removal

are always contaminants and the most problematic hazards mentioned above regardless of whether the vessel has sunk or is aground, limiting the amount of impact to EFH over time. The occurrence of a grounding or sinking cannot be planned; however, when responding to a marine casualty the primary focus of ONMS is to protect sanctuary resources. As a result, great consideration is given to minimize impacts to the habitats, much of which are also designated as EFH. For casualties that have the potential to result in more than minimal impacts to EFH, it is highly likely that the USCG would be the primary agency handling the case and appropriate emergency consultation would be addressed by USCG under OPA. All activities are described in detail in Section 2 of the environmental assessment accompanying this EFH assessment.

Proposed Mitigation Measures

ONMS staff and contractors follow a set of best management practices (BMP) to minimize any potential damage to bottom habitat or the water column to the greatest extent possible. Across all five sites in the region, managers limit activities in accordance with the following BMPs: instruments are deployed and lowered onto sandy substrate whenever possible; deployment of instruments occurs slowly and under constant supervision to minimize risk and mitigate impacts if a collision or entanglement occurs; and while vehicles or personnel are deployed, spotters monitor the activities at all times. Lastly, ONMS typically does not allow night operations.

Conclusion

ONMS expects the adverse effects on EFH from the field operations described above to be minimal. This conclusion is based on the relatively small number of days at sea, divers and equipment deployments conducted annually, as well as the best management practices and training protocols in place for ONMS staff and contractors as described in Chapter 2.

Revision, Tracking, and Review

If any changes are made to the ONMS West Coast field operations such that there may be different adverse effects on EFH, ONMS will notify NOAA Fisheries and the agencies will discuss whether any programmatic Conservation Recommendations provided by NOAA Fisheries should be revised. ONMS will provide NOAA Fisheries with an annual report of all field operations undertaken under the PEA. Every five years, NOAA Fisheries will review the programmatic EFH Conservation Recommendations and determine whether they should be updated to account for new information or new technology.

5.2 Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) of 1972 (16 U.S.C. 1361 et seq.), as amended, prohibits, with certain exceptions, the “take” of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S. The MMPA defines “take” as: “to harass, hunt, capture, or kill, or attempt to harass, hunt, capture or kill any marine mammal.” 16 U.S.C. § 1362. Harassment means any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine

mammal stock in the wild (Level A harassment); or that has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering, but does not have the potential to injure a marine mammal or marine mammal stock in the wild (Level B harassment). 16 U.S.C. § 136228. 16 U.S.C. § 136229.

Section 101(a)(5)(A-D) of the MMPA provides a mechanism for allowing, upon request, the "incidental," but not intentional, taking, of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing or directed research on marine mammals) within a specified geographic region. The NMFS Office of Protected Resources (OPR) processes applications for incidental takes of small numbers of marine mammals. Authorization for incidental takes may be granted if NMFS finds that the taking would be of small numbers, have no more than a "negligible impact" on those marine mammal species or stocks, and not have an "unmitigable adverse impact" on the availability of the species or stock for "subsistence" uses. NMFS' issuance of an incidental take authorization also requires NMFS to make determinations under NEPA and Section 7 of the ESA[30].

The purpose of issuing incidental take authorizations (ITAs) is to provide an exemption to the take prohibition in the MMPA, and to ensure that the action complies with the MMPA and NMFS's implementing regulations. ITAs may be issued as either: 1) regulations and associated Letters of Authorization (LOAs); or 2) Incidental Harassment Authorizations (IHAs). An IHA can only be valid for 1 year and LOAs can be valid for up to 5 consecutive years. An IHA may be issued when the action has the potential to result in harassment only (Level B Harassment, i.e., injury or disturbance). If the action has the potential to result in serious injury or mortality, or to result in harassment only and is planned for multiple years, then an IHA may not be issued, but an LOA and regulations may be issued if NMFS makes the required findings.
In addition, NMFS can in some circumstances authorize directed take of marine mammals through the following types of permits:

- Scientific Research Permit
- General Authorization for Scientific Research
- Public Display Permit
- Commercial or Educational Photography Permit

Pursuant to Section 101(a)(5)(A) of the MMPA, NMFS, upon application from ONMS, may plan to propose regulations to govern the unintentional taking of marine mammals, by harassment, incidental to the proposed field operations for ONMS in the Atlantic Ocean, Pacific Ocean, and Gulf of Mexico. The issuance of MMPA incidental take regulations and associated LOAs to the

[28] "Harassment" is defined by Level A Harassment, which has the potential to injure a marine mammal or marine mammal stock in the wild; and Level B Harassment which has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering
[29] Source: http://www.nmfs.noaa.gov/pr/dontfeedorharass.htm
[30] http://www.westcoast.fisheries.noaa.gov/protected_species/marine_mammals/mmpa_esa.html

ONMS is a federal action, thereby requiring NMFS to analyze the effects of the action on the human environment pursuant to NEPA, which is covered in this PEA.

ONMS intends to submit a request for technical assistance to NMFS as to whether we have provided enough information to support our likely to not adversely affect marine mammals determination. If, based on technical assistance, NMFS recommends that ONMS seek a LOA, then NMS will submit an application for a for the incidental taking of small numbers of marine mammals that could occur during their vessel operations and active acoustic equipment use. This PEA will provide informational support for a LOA application, if needed, and the rulemaking process and provide NEPA compliance for the authorization, if granted.

5.3 Endangered Species Act

The Endangered Species Act (ESA) of 1973 as amended (16 U.S.C. § 1531, et seq.), provides for the conservation of species that are endangered or threatened throughout all or a significant portion of their range, and the conservation of the ecosystems on which they depend. The ESA directs all federal agencies to work to conserve endangered and threatened species and to use their authorities to further the purposes of the Act. NMFS works with U.S. Fish and Wildlife Service (USFWS) to manage ESA-listed species. Generally, NMFS manages marine species, while USFWS manages land and freshwater species.

A species is considered endangered if it is in danger of extinction throughout all or a significant portion of its range. A species is considered threatened if it is likely to become an endangered species within the foreseeable future. When listing a species as threatened or endangered, NMFS or FWS also designate critical habitat for the species to the maximum extent prudent and determinable. 16 USC § 1533(a)(3).

Section 7(a)(2) of the ESA states that each federal agency shall, in consultation with the Secretary, insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. In fulfilling these requirements, each agency must use the best scientific and commercial data available. The consultation process is further developed in regulations promulgated at 50 CFR §402.

The ESA requires action agencies to consult or confer with the Services when there is discretionary federal involvement or control over the action. When a federal agency's action "may affect" a protected species, that agency is required to consult formally with NMFS or FWS, depending upon the endangered species, threatened species, or designated critical habitat that may be affected by the action (50 CFR §402.14 (a)). Federal agencies are exempt from this general requirement if they have concluded that an action "may affect, but is not likely to adversely affect" endangered species, threatened species, or designated critical habitat and NMFS or the USFWS concurs with that conclusion (50 CFR §402.14 (b)). This is commonly referred to as

"informal consultation". This finding can be made only if ALL of the reasonably expected effects of the proposed action will be beneficial, insignificant, or discountable. An action agency shall confer with the Services if the action is likely to jeopardize the continued existence of a proposed species or result in the destruction or adverse modification of proposed critical habitat.

Most consultations are conducted informally with the federal agency or a designated non-federal representative. When the biological assessment or other information indicates that the action has no likelihood of adverse effect (including evaluation of effects that may be beneficial, insignificant, or discountable), the Services provide a letter of concurrence, which completes informal consultation. The agency is not required to prepare a biological assessment for actions that are not major construction activities, but, if a listed species or critical habitat is likely to be affected, the agency must provide the Services with an account of the basis for evaluating the likely effects of the action.

Action agencies initiate formal consultation through a written request to the Services. To comply with the section 7 regulations, the initiation package is submitted with the request for formal consultation and must include the materials listed in 50 CFR §402.14(c). If a biological assessment is required, formal consultation cannot be initiated until the biological assessment is completed. The contents of biological assessments prepared pursuant to the Act are largely at the discretion of the action agency although the regulations provide recommended contents (50 CFR §402.12(f)). Formal consultations determine whether a proposed agency action(s) is likely to jeopardize the continued existence of a listed species (jeopardy) or destroy or adversely modify critical habitat (adverse modification), and they are documented by a biological opinion (BiOp). They also determine and authorize the amount or extent of anticipated incidental take in an incidental take statement, identify reasonable and prudent alternatives, if any, when an action is likely to result in jeopardy or adverse modification, and identify ways the action agencies can help conserve listed species or critical habitat when they undertake an action.

In addition, ESA Section 10(a)(1)(A) authorizes the NMFS and FWS to issue permits for scientific purposes or to enhance the propagation or survival of listed species. The permitted activity must not operate to the disadvantage of the species and must be consistent with the purposes and policy set forth in section 2 of the Act. Section 10(a)(1)(A) permits are also required:

- when a reasonable and prudent alternative calls for scientific research that will result in take of the species (this includes scientific research carried out by the Services);
- when the agency, applicant or contractor plans to carry out additional research not required by an incidental take statement that would involve direct take (if this is part of the action and direct take is contemplated, a permit is not needed); and
- for species surveys associated with biological assessments (usually developed during informal consultation) that result in take, including harassment.

ONMS began informal consultation with NMFS Office of Protected Species Division, at the onset of developing this draft PEA. These discussions have been oriented toward assuring the DPEA covers all listed species and potential effects from ONMS field operations and provides the appropriate analysis in support of formal section 7 consultation, which will begin with the publication of the draft PEA.

5.4 National Historic Preservation Act

Section 106 of the National Historic Preservation Act of 1966 (NHPA) (54 U.S.C. § 300101 et. seq.) requires federal agencies to take into account the effects of their undertakings on historic properties in accordance with regulations issued by the Advisory Council on Historic Preservation (ACHP) at 36 C.F.R. Part 800. The regulations require that federal agencies consult with states, tribes, and other interested parties (consulting parties) when making their effect determinations.

The regulations establish four basic steps in the NHPA 106 process: determine if the undertaking is the type of activity that could affect historic properties, identify historic properties in the area of potential effects, assess potential adverse effects, and resolve adverse effects.

The first step in the process is for the responsible federal agency to determine whether the undertaking is a type of activity that could affect historic properties. Undertakings consist of any project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a federal agency, including those carried out by or on behalf of a federal agency; those carried out with federal financial assistance; those requiring a federal permit, license or approval; and those subject to State or local regulation administered pursuant to a delegation or approval by a federal agency. Historic properties are properties that are included in the National Register of Historic Places or that meet the criteria for the National Register. If so, the agency must identify the appropriate State Historic Preservation Officer/Tribal Historic Preservation Officer (SHPO/THPO) to consult with during the process. http://www.achp.gov/shpo.html. It should also plan to involve the public, and identify other potential consulting parties. Consulting parties may include Indian tribes and Native Hawaiian organizations, local governments, permit or license applicants, and interested members of the public. If it determines that it has no undertaking, or that its undertaking is a type of activity that has no potential to affect historic properties, the agency has no further Section 106 obligations.

If the agency's undertaking could affect historic properties, the agency must identify historic properties in the area of potential effects. If the agency finds that no historic properties are present or affected, it provides documentation to the appropriate State Historic Preservation Officer/Tribal Historic Preservation Officer (SHPO/THPO) and, barring any objection in 30 days, proceeds with its undertaking.

If the agency finds that historic properties are present, it proceeds to assess possible adverse effects, in consultation with the SHPO/THPO. If the parties agree that there will be no adverse effect, the agency proceeds with the undertaking and any agreed-upon conditions. If a) they find that there is an adverse effect, or if the parties cannot agree and ACHP determines within 15 days that there is an adverse effect, the agency begins consultation to seek ways to avoid, minimize, or mitigate the adverse effects.

The agency consults to resolve adverse effects with the SHPO/THPO and others, who may include Indian tribes and Native Hawaiian organizations, local governments, permit or license applicants, and members of the public. ACHP may participate in consultation when there are substantial impacts to important historic properties, when a case presents important questions of policy or interpretation, when there is a potential for procedural problems, or when there are issues of concern to Indian tribes or Native Hawaiian organizations.
Consultation usually results in a Memorandum of Agreement (MOA), which outlines agreed-upon measures that the agency will take to avoid, minimize, or mitigate the adverse effects. In some cases, the consulting parties may agree that no such measures are possible, but that the adverse effects must be accepted in the public interest. The ACHP provides helpful checklists on its website for drafting and reviewing agreements.

If consultation proves unproductive, the agency or the SHPO/THPO, or ACHP itself, may terminate consultation. If a SHPO terminates consultation, the agency and ACHP may conclude an MOA without SHPO involvement. However, if a THPO terminates consultation and the undertaking is on or affecting historic properties on tribal lands, ACHP must provide its comments. The agency head must take into account ACHP's written comments in deciding how to proceed.

ONMS will provide a copy of this DPEA to the SHPOs and THPOs in areas affected by the research activities examined in this DPEA. ONMS will consider all comments from SHPO, THPO, and other consulting parties, and take steps to comply with NHPA.

5.5 Executive Order 12989, Environmental Justice

EO 12898 directs federal agencies to take the appropriate and necessary steps to identify and address disproportionately high and adverse effects of federal projects on the health or environment of minority and low-income populations to the greatest extent practicable and permitted by law. No such effects are identified in this draft PEA.

5.6 Executive Order 13158, Marine Protected Areas

The purpose of this order is to strengthen and expand the Nation's system of MPAs to enhance the conservation of our Nation's natural and cultural marine heritage and the ecologically and economically sustainable use of the marine environment for future generations. The order encourages federal agencies to use science-based criteria and protocols to identify and prioritize

natural and cultural resources in the marine environment that should be protected to secure valuable ecological services and to monitor and evaluate the effectiveness of MPAs. Each federal agency whose actions affect the natural or cultural resources that are protected by an MPA shall identify such actions. To the extent permitted by law and to the maximum extent practicable, each federal agency, in taking such actions, shall avoid harm to the natural and cultural resources that are protected by an MPA. ONMS has considered its potential effects on MPAs, such as the sites included in the National Marine Sanctuary System, in this draft PEA and found that the impacts are minor.

5.7 Coastal Zone Management Act

The Coastal Zone Management Act (CZMA, 16 U.S.C. § 1451) was enacted in 1972 to encourage coastal states, Great Lake states, and U.S. Territories and Commonwealths (collectively referred to as "coastal states" or "states") to preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone. The CZMA is a voluntary program for states; currently, thirty-four coastal states have a federally approved coastal management program except Alaska, which voluntarily withdrew from the program in 2011. Section 307 of the CZMA is known as the "federal consistency" provision.

The federal consistency provision requires federal actions (inside or outside a state's coastal zone) that affect any land or water use or natural resource of a state's coastal zone, to be consistent with the enforceable policies of the state coastal management program (CMP). The term "effect on any coastal use or resource" means any reasonably foreseeable effect on any coastal use or resource resulting from the activity, including direct and indirect (cumulative and secondary) effects. The federal consistency regulations at 15 C.F.R. part 930 set forth detailed timeframes and procedures that must be followed carefully.

The two types of federal actions addressed in the federal consistency regulations that NOAA programs most frequently encounter are federal agency activities (15 C.F.R. part 930, subpart C), and federal license or permit activities (subpart D). In addition, subpart E of the regulations addresses outer continental shelf plans and subpart F applies to federal financial assistance provided to state and local governments. A federal action that will have reasonably foreseeable coastal effects, but which does not fall under 15 C.F.R. subpart D, subpart E, or subpart F should be treated as a federal agency activity under subpart C.

Federal agency activities (subpart C) are activities and development projects performed by a federal agency, or a contractor for the benefit of a federal agency. For federal agency development projects occurring inside a state's coastal zone, the federal agency must submit a Consistency Determination to the state. For all other federal agency activities, inside or outside the coastal zone, the federal agency must submit a Consistency Determination to the state if the federal agency determines the activity may have reasonably foreseeable effects on the state's coastal uses or resources. Federal agencies need only prepare one Consistency Determination for

the proposed action and not for individual authorizations or reviews associated with the proposed action, such as NEPA documents, Endangered Species Act consultations, federal permits the agency may need, etc. Federal agency activities must be consistent to the maximum practicable with the enforceable policies of the state's Coastal Zone Management Plan (CMP). If there are no reasonably foreseeable effects, the federal agency may be required to provide a Negative Determination to the state. See 15 C.F.R. § 930.35.

ONMS will provide a copy of this draft PEA and a consistency determination to the state coastal management agency in every state with a federally-approved coastal management program whose coastal uses or resources are affected by these field operations. Each state has sixty days in which to agree or disagree with the determination regarding consistency with that state's approved coastal management program. If a state fails to respond within sixty days, the state's agreement may be presumed.

6.0

REFERENCES

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National Marine Fisheries Service. 2018. Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Dept. of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-55, 178 p.

PMNM. Feb 14, 2014. Revised Request for Endangered Species Act Section 7 Initiation of Informal Consultation.

APPENDIX A

LIST OF NOAA VESSELS AND AIRCRAFT OPERATING IN THE WEST COAST REGION

Name	Sanctuary	Homeport	Length	Range	Cruising Speed
R/V Tatoosh	Olympic Coast	Port Angeles, WA	38 ft	300 nm	22 kts
R/V Fulmar	Cordell Bank and Monterey Bay	Monterey, CA	65 ft	450 nm	20 kts
R4107	Monterey Bay	Monterey, CA	41 ft	250 nm	19 kts
R/V Shearwater	Channel Islands	Santa Barbara, CA	62 ft	400 nm	19 kts
R/V Shark Cat	Channel Islands	Monterey, CA	28 ft	120 nm	25 kts
Unmanned Aerial System "Puma"	All West Coast Sanctuaries	Santa Barbara, CA	The Puma is a 13-pound, battery-powered aircraft with a nine-foot wingspan, equipped with real-time video and still photo capability. The aircraft can be hand-launched from any location on land or at sea from a boat and is controlled remotely by an operator. Durable and rugged for deployment to remote marine areas and repeat usage, the aircraft can fly for up to two hours on a charge and cover a range of about 50 square miles. The Office of National Marine Sanctuaries has been testing the "Puma" for several years to determine how this remotely controlled aircraft can aid in large-scale marine protected area management.		

APPENDIX B

HEARING RANGES OF MARINE MAMMALS IN ALL WEST COAST SANCTUARIES

Common Name	Scientific Name	Local Population ESA Listing	Functional Hearing Group*	Functional Hearing Range	Present in OCNMS	Present in CBNMS	Present in GFNMS	Present in MBNMS	Present in CINMS
North Pacific Right Whale	*Eubalaena japonica*	Endangered	LFC	7 Hz to 35 kHz	✓	✓	✓	✓	
Humpback Whale	*Megaptera novaeangliae*	Endangered	LFC	7 Hz to 35 kHz	✓	✓	✓	✓	✓
Minke Whale	*Balaenoptera acutorostrata*	None	LFC	7 Hz to 35 kHz	✓	✓	✓	✓	✓
Blue Whale	*Balaenoptera musculus*	Endangered	LFC	7 Hz to 35 kHz	✓	✓	✓	✓	✓
Gray Whale	*Eschrichtius robustus*	Delisted	LFC	7 Hz to 35 kHz	✓	✓	✓	✓	✓
Fin Whale	*Balaenoptera physalus*	Endangered	LFC	7 Hz to 35 kHz	✓	✓	✓	✓	
Sei Whale	*Balaenoptera borealis*	Endangered	LFC	7 Hz to 35 kHz	✓	✓	✓	✓	✓
Sperm Whale	*Physeter macrocephalus*	Endangered	MFC	150 Hz to 160 kHz	✓	✓	✓	✓	✓
Dwarf Sperm Whale	*Kogia sima*	None	HFC	275 Hz to 160 kHz			✓	✓	
Pygmy Sperm Whale	*Kogia breviceps*	None	HFC	275 Hz to 160 kHz			✓	✓	

Dall's Porpoise	*Phocoenoides dalli*	None	HFC	275 Hz to 160 kHz		✓	✓	✓	
Harbor Porpoise	*Phocoena phocoena*	None	HFC	275 Hz to 160 kHz	✓	✓	✓	✓	✓
Killer Whale	*Orcinus orca*	None	MFC	150 Hz to 160 kHz	✓	✓	✓	✓	✓
False Killer Whale	*Pseudorca crassidens*	None	MFC	150 Hz to 160 kHz				✓	
Baird's Beaked Whale	*Berardius bairdii*	None	MFC	150 Hz to 160 kHz			✓	✓	
Blainsville Beaked Whale	*Mesoplodon densirostris*	None	MFC	150 Hz to 160 kHz			✓		
Cuvier's Beaked Whale	*Ziphius cavirostris*	None	MFC	150 Hz to 160 kHz			✓	✓	
Hubb's Beaked Whale	*Mesoplodon carlhubbsi*	None	MFC	150 Hz to 160 kHz			✓	✓	
Stejneger's Beaked Whale	*Misoplodon stejnegeri*	None	MFC	150 Hz to 160 kHz			✓		
Risso's Dolphin	*Grampus griseus*	None	MFC	150 Hz to 160 kHz		✓	✓	✓	✓
Northern Right Whale Dolphin	*Lissodelphis borealis*	None	MFC	150 Hz to 160 kHz		✓	✓	✓	✓
Short-Finned Pilot Whale	*Globicephala macrorhynchus*	None	MFC	150 Hz to 160 kHz			✓	✓	
Long-Beaked Common Dolphin	*Delphinus capensis*	None	MFC	150 Hz to 160 kHz	✓	✓	✓	✓	✓
Pacific White-Sided	*Lagenorhynchus*	None	MFC	150 Hz to	✓	✓	✓	✓	✓

Dolphin	*obliquidens*			160 kHz					
Short-Beaked Common Dolphin	*Delphinus delphis*	None	MFC	150 Hz to 160 kHz	✓	✓	✓	✓	✓
Pantropical Spotted Dolphin	*Stenella attenuata*	None	MFC	150 Hz to 160 kHz			✓		
Striped Dolphin	*Stenella coeruleoalba*	None	MFC	150 Hz to 160 kHz			✓	✓	
Rough-Toothed Dolphin	*Steno bredanensis*	None	MFC	150 Hz to 160 kHz			✓	✓	
Bottlenose Dolphin	*Tursiops truncates*	None	MFC	150 Hz to 160 kHz	✓	✓	✓	✓	✓
Harbor Seal	*Phoca vitulina*	None	MFP	50 Hz to865 kHz	✓	✓	✓	✓	✓
Northern Elephant Seal	*Mirounga angustirostris*	None	MFP	50 Hz to 86 kHz	✓	✓	✓	✓	✓
Northern Fur Seal	*Callorhinus ursinus*	None	MFO	60 Hz to 39 kHz			✓	✓	✓
Guadalupe Fur Seal	*Arctocephalus townsendi*	Threatened	MFO	60 Hz to 39 kHz	✓	✓	✓	✓	✓
Northern Sea Otter	*Enhydra lutris kenyoni*	Threatened	MF	60 Hz to 39 kHz			✓		
Southern Sea Otter	*Enhydra lutris nereis*	Threatened	MF	60 Hz to 39 kHz	✓	✓	✓	✓	✓
Stellar Sea Lion	*Eumetopias jubatus*	Threatened	MFO	60 Hz to 39 kHz	✓	✓	✓	✓	✓
California Sea Lion	*Zalophus californianus*	Endangered	MFO	60 Hz to 39 kHz	✓	✓	✓	✓	✓

APPENDIX C

CONSULTATION LETTERS FOR THE WEST COAST REGION

As described in Chapter 5, ONMS will use this draft PEA to meet consultation requirements under a variety of environmental statutes. The final PEA will include copies of all consultation documentation in this Appendix.

APPENDIX D

Species Lists by National Marine Sanctuary

OLYMPIC COAST NATIONAL MARINE SANCTUARY		
Inverted Common Name	**Scientific Name**	**ESA Listing Status (E=endangered, T=threatened, F=foreign, XN=nonessential experimental population, SAT=threatened due to similarity of appearance)**
Fish: 8 species		
Marine/Adromous Species		
Bocaccio (rockfish)	*Sebastes paucispinus*	E
Eulachon, Pacific/smelt	*Thaleichthys pacificus*	T
Rockfish, canary	*Sebastes pinniger*	T
Rockfish, yelloweye	*Sebastes ruberrimus*	T
Salmon, Chinook (king)	*Oncorhynchus tshawytscha*	Snake River and Sacramento River Winter-Run DPSs; T in California Coastal, Central Valley spring-run, Lower Columbia River, Puget Sound, Snake River fall-run, Snake River spring/summer-run, and Upper Willamette River ESUs; E in Sacramento River winter-run and Upper Columbia River spring-run ESUs, XN in Upper Columbia River spring-run in the Okanogan River subbasin, WA ESU
Salmon, Sockeye	*Oncorhynchus (=Salmo) nerka*	Snake River DPS; T in Ozette Lake ESU; E in Snake River ESU
Shark, Scalloped Hammerhead	*Sphyrna lewini*	E in Eastern Pacific DPS; E in Eastern Atlantic DPS; T in Central & Southwest Atlantic and Indo-West Pacific DPSs
Sturgeon, Green	*Acipenser medirostris*	T
Marine Mammals: 35 species		
Dolphins		
Bottlenose dolphin	*Tursiops truncates*	MMPA

Long-beaked common dolphin	*Delphinus capensis*	MMPA
Northern right whale dolphin	*Lissodelphis borealis*	MMPA
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	MMPA
Risso's (Grampus) dolphin	*Grampus griseus*	MMPA
Short-beaked common dolphin/Common dolphin	*Delphinus delphis*	MMPA
Spotted dolphin	*Stenella plagiodon*	MMPA
Striped dolphin	*Stenella coeruleoalba*	MMPA
Porpoises		
Dall's porpoise	*Phocoenoides dalli*	MMPA
Harbor porpoise	*Phocoena phocoena*	MMPA
Whales		
Baird's beaked whale	*Berardius bairdii*	MMPA
Blue Whale	*Balaenoptera musculus*	E, MMPA
Cuvier's beaked whale	*Ziphius cavirostris*	MMPA
Dwarf sperm whale	*Kogia simus*	MMPA
False killer whale	*Pseudorca crassidens*	E, MMPA
Fin Whale	*Balaenoptera physalus*	E, MMPA
Gray whale	*Eschrichtius robustus*	E(F), MMPA
Hubb's beaked whale	*Mesoplodon carlhubbsi*	MMPA
Humpback Whale	*Megaptera novaeangliae*	E, MMPA
Killer whale	*Orcinus orca*	E, MMPA
Minke whale	*Balaenoptera acutorostrata*	MMPA
North Pacific right whale	*Eubalaena japonica*	E, MMPA
Pygmy sperm whale	*Kogia breviceps*	MMPA
Sei Whale	*Balaenoptera borealis*	E, MMPA
Short-finned pilot whale	*Globicephala macrorhynchus*	MMPA
Sperm Whale	*Physeter macrocephalus*	E, MMPA
Stejneger's beaked whale	*Mesoplodon stejnegeri*	MMPA
Otariid Pinnipeds (Sea Lions/Fur Seals)		
California sea lion	*Zalophus californianus*	MMPA
Guadalupe fur seal	*Arctocephalus townsendi*	T, MMPA
Northern fur seal	*Callorhinus ursinus*	MMPA
Steller sea lion	*Eumetopias jubatus*	E, MMPA
Phocid Pinnipeds		

(Seals)_		
Harbor seal	*Phoca vitulina*	MMPA
Northern elephant seal	*Mirounga angustirostris*	MMPA
Otters		
Northern sea otter	*Enhydra lutris kenyoni*	T, MMPA
Southern sea otter	*Enhydra lutris nereis*	T, MMPA
Reptiles: 4 species		
Turtles		
Green Sea Turtle	*Chelonia mydas*	T entire range; Central North Pacific, East Pacific, North Atlantic, South Atlantic DPSs T; E in Central South Pacific, Central West Pacific DPSs
Leatherback	*Dermochelys coriacea*	E
Loggerhead	*Caretta caretta*	E North Pacific Ocean DPS; T Northwest Atlantic DPS
Pacific (Olive) Ridley	*Lepidochelys olivacea*	T
Seabirds/Shorebirds: 4 species		
Albatross, short-tailed	*Phoebastria (=Diomedea) albatrus*	E, MBTA
Knot, red	*Calidris canutus rufa*	T, MBTA
Murrelet, marbled	*Brachyramphus marmoratus*	T; MBTA; WA state listed as T
Plover, western snowy	*Charadrius alexandrinus nivosus*	T; MBTA; WA state listed as E

CORDELL BANK NATIONAL MARINE SANCTUARY		
Inverted Common Name	**Scientific Name**	**ESA Listing Status (E=endangered, T=threatened, F=foreign, XN=nonessential experimental population, SAT=threatened due to similarity of appearance)**
Marine & Freshwater Invertebrates:		
Abalone		
Black abalone	*Haliotis cracherodii*	E
Fish: 12 species		
Marine/Adromous Species		
Bocaccio (rockfish)	*Sebastes paucispinus*	E
Eulachon, Pacific/smelt	*Thaleichthys pacificus*	T
Rockfish, canary	*Sebastes pinniger*	T

Rockfish, yelloweye	*Sebastes ruberrimus*	T
Salmon, Chinook (king)	*Oncorhynchus tshawytscha*	T in California Coastal, Central Valley spring-run, Lower Columbia River, Puget Sound, Snake River fall-run, Snake River spring/summer-run, and Upper Willamette River ESUs; E in Sacramento River winter-run and Upper Columbia River spring-run ESUs, XN in Upper Columbia River spring-run in the Okanogan River subbasin, WA ESU
Salmon, Chum	*Oncorhynchus keta*	T in Columbia River and Hood Canal summer-run ESUs
Salmon, Coho	*Oncorhynchus (=Salmo) kisutch*	E in Central California Coast ESU; T in Lower Columbia River, Oregon Coast, and Southern Oregon ESUs
Salmon, Sockeye	*Oncorhynchus (=Salmo) nerka*	T in Ozette Lake ESU; E in Snake River ESU
Shark, Scalloped Hammerhead	*Sphyrna lewini*	E in Eastern Pacific DPS; E in Eastern Atlantic DPS; T in Central & Southwest Atlantic and Indo-West Pacific DPSs
Steelhead/Rainbow Trout	*Oncorhynchus (=Salmo) mykiss*	E in Southern California DPS; T in California Central Valley, Central California Coast, Lower Columbia River, Middle Columbia River, Northern California, Puget Sound, Snake River Basin, South-Central California Coast, Upper Columbia River, and Upper Willamette River DPSs
Sturgeon, Green	*Acipenser medirostris*	T
Brackish Water Species		
Goby, tidewater	*Eucyclogobius newberryi*	E
Marine Mammals: 38 species		
Dolphins		
Bottlenose dolphin	*Tursiops truncates*	MMPA
Long-beaked common dolphin	*Delphinus capensis*	MMPA
Northern right whale dolphin	*Lissodelphis borealis*	MMPA
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	MMPA
Risso's (Grampus) dolphin	*Grampus griseus*	MMPA
Rough-toothed dolphin	*Steno bredanensis*	MMPA

Short-beaked common dolphin/Common dolphin	*Delphinus delphis*	MMPA
Spotted dolphin	*Stenella plagiodon*	MMPA
Striped dolphin	*Stenella coeruleoalba*	MMPA
Porpoises		
Dall's porpoise	*Phocoenoides dalli*	MMPA
Harbor porpoise	*Phocoena phocoena*	MMPA
Whales		
Baird's beaked whale	*Berardius bairdii*	MMPA
Blainsville beaked whale	*Mesoplodon densirostris*	MMPA
Blue Whale	*Balaenoptera musculus*	E, MMPA
Cuvier's beaked whale	*Ziphius cavirostris*	MMPA
Dwarf sperm whale	*Kogia simus*	MMPA
False killer whale	*Pseudorca crassidens*	E, MMPA
Fin Whale	*Balaenoptera physalus*	E, MMPA
Ginkgo-toothed whale	*Mesoplodon ginkgodens*	MMPA
Gray whale	*Eschrichtius robustus*	E(F), MMPA
Hubb's beaked whale	*Mesoplodon carlhubbsi*	MMPA
Humpback Whale	*Megaptera novaeangliae*	E, MMPA
Killer whale	*Orcinus orca*	E, MMPA
Minke whale	*Balaenoptera acutorostrata*	MMPA
North Pacific right whale	*Eubalaena japonica*	E, MMPA
Pygmy sperm whale	*Kogia breviceps*	MMPA
Sei Whale	*Balaenoptera borealis*	E, MMPA
Short-finned pilot whale	*Globicephala macrorhynchus*	MMPA
Sperm Whale	*Physeter macrocephalus*	E, MMPA
Stejneger's beaked whale	*Mesoplodon stejnegeri*	MMPA
Otariid Pinnipeds (Sea Lions/Fur Seals)		
California sea lion	*Zalophus californianus*	MMPA
Guadalupe fur seal	*Arctocephalus townsendi*	T, MMPA
Northern fur seal	*Callorhinus ursinus*	MMPA
Steller sea lion	*Eumetopias jubatus*	E, MMPA
Phocid Pinnipeds (Seals)		
Harbor seal	*Phoca vitulina*	MMPA
Northern elephant seal	*Mirounga angustirostris*	MMPA
Otters		
Northern sea otter	*Enhydra lutris kenyoni*	T, MMPA

Southern sea otter	*Enhydra lutris nereis*	T, MMPA
Reptiles: 5 species		
Turtles		
Green Sea Turtle	*Chelonia mydas*	T entire range; Central North Pacific, East Pacific, North Atlantic, South Atlantic DPSs T; E in Central South Pacific, Central West Pacific DPSs
Hawksbill	*Eretmochelys imbricata*	E
Leatherback	*Dermochelys coriacea*	E
Loggerhead	*Caretta caretta*	E North Pacific Ocean DPS; T Northwest Atlantic DPS
Pacific (Olive) Ridley	*Lepidochelys olivacea*	T
Seabirds/Shorebirds: 4 species		
Albatross, short-tailed	*Phoebastria (=Diomedea) albatrus*	E, MBTA
Knot, red	*Calidris canutus rufa*	T, MBTA
Murrelet, marbled	*Brachyramphus marmoratus*	T; MBTA; WA state listed as T
Plover, western snowy	*Charadrius alexandrinus nivosus*	T; MBTA; WA state listed as E

GREATER FARALLONES		
Inverted Common Name	**Scientific Name**	**ESA Listing Status (E=endangered, T=threatened, F=foreign, XN=nonessential experimental population, SAT=threatened due to similarity of appearance)**
Marine & Freshwater Invertebrates:		
Abalone		
Black abalone	*Haliotis cracherodii*	E
Fish: 12 species		
Marine/Adromous Species		
Bocaccio (rockfish)	*Sebastes paucispinus*	E
Eulachon, Pacific/smelt	*Thaleichthys pacificus*	T
Rockfish, canary	*Sebastes pinniger*	T
Rockfish, yelloweye	*Sebastes ruberrimus*	T

Salmon, Chinook (king)	*Oncorhynchus tshawytscha*	T in California Coastal, Central Valley spring-run, Lower Columbia River, Puget Sound, Snake River fall-run, Snake River spring/summer-run, and Upper Willamette River ESUs; E in Sacramento River winter-run and Upper Columbia River spring-run ESUs, XN in Upper Columbia River spring-run in the Okanogan River subbasin, WA ESU
Salmon, Chum	*Oncorhynchus keta*	T in Columbia River and Hood Canal summer-run ESUs
Salmon, Coho	*Oncorhynchus (=Salmo) kisutch*	E in Central California Coast ESU; T in Lower Columbia River, Oregon Coast, and Southern Oregon ESUs
Salmon, Sockeye	*Oncorhynchus (=Salmo) nerka*	T in Ozette Lake ESU; E in Snake River ESU
Shark, Scalloped Hammerhead	*Sphyrna lewini*	E in Eastern Pacific DPS; E in Eastern Atlantic DPS; T in Central & Southwest Atlantic and Indo-West Pacific DPSs
Steelhead/Rainbow Trout	*Oncorhynchus (=Salmo) mykiss*	E in Southern California DPS; T in California Central Valley, Central California Coast, Lower Columbia River, Middle Columbia River, Northern California, Puget Sound, Snake River Basin, South-Central California Coast, Upper Columbia River, & Upper Willamette River DPSs
Sturgeon, Green	*Acipenser medirostris*	T
Goby, tidewater	*Eucyclogobius newberryi*	E
Marine Mammals: 39 species		
Dolphins		
Bottlenose dolphin	*Tursiops truncates*	MMPA
Long-beaked common dolphin	*Delphinus capensis*	MMPA
Northern right whale dolphin	*Lissodelphis borealis*	MMPA
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	MMPA
(Pantropical) spotted dolphin	*Stenella attenuata*	MMPA
Risso's (Grampus) dolphin	*Grampus griseus*	MMPA
Rough-toothed dolphin	*Steno bredanensis*	MMPA

Short-beaked common dolphin/Common dolphin	*Delphinus delphis*	MMPA
Spotted dolphin	*Stenella plagiodon*	MMPA
Striped dolphin	*Stenella coeruleoalba*	MMPA
Porpoises		
Dall's porpoise	*Phocoenoides dalli*	MMPA
Harbor porpoise	*Phocoena phocoena*	MMPA
Whales		
Baird's beaked whale	*Berardius bairdii*	MMPA
Blainsville beaked whale	*Mesoplodon densirostris*	MMPA
Blue Whale	*Balaenoptera musculus*	E, MMPA
Cuvier's beaked whale	*Ziphius cavirostris*	MMPA
Dwarf sperm whale	*Kogia simus*	MMPA
False killer whale	*Pseudorca crassidens*	E, MMPA
Fin Whale	*Balaenoptera physalus*	E, MMPA
Ginkgo-toothed whale	*Mesoplodon ginkgodens*	MMPA
Gray whale	*Eschrichtius robustus*	E(F), MMPA
Hubb's beaked whale	*Mesoplodon carlhubbsi*	MMPA
Humpback Whale	*Megaptera novaeangliae*	E, MMPA
Killer whale	*Orcinus orca*	E, MMPA
Minke whale	*Balaenoptera acutorostrata*	MMPA
North Pacific right whale	*Eubalaena japonica*	E, MMPA
Pygmy sperm whale	*Kogia breviceps*	MMPA
Sei Whale	*Balaenoptera borealis*	E, MMPA
Short-finned pilot whale	*Globicephala macrorhynchus*	MMPA
Sperm Whale	*Physeter macrocephalus*	E, MMPA
Stejneger's beaked whale	*Mesoplodon stejnegeri*	MMPA
Otariid Pinnipeds (Sea Lions/Fur Seals)		
California sea lion	*Zalophus californianus*	MMPA
Guadalupe fur seal	*Arctocephalus townsendi*	T, MMPA
Northern fur seal	*Callorhinus ursinus*	MMPA
Steller sea lion	*Eumetopias jubatus*	E, MMPA
Phocid Pinnipeds (Seals)		
Harbor seal	*Phoca vitulina*	MMPA
Northern elephant seal	*Mirounga angustirostris*	MMPA
Otters		

Northern sea otter	*Enhydra lutris kenyoni*	T, MMPA
Southern sea otter	*Enhydra lutris nereis*	T, MMPA
Reptiles: 5 species		
Turtles		
Green Sea Turtle	*Chelonia mydas*	T entire range; Central N. Pacific, East Pacific, N. Atlantic, S. Atlantic DPSs T; E in Central South Pacific, Central West Pacific DPSs
Hawksbill	*Eretmochelys imbricata*	E
Leatherback	*Dermochelys coriacea*	E
Loggerhead	*Caretta caretta*	E North Pacific Ocean DPS; T Northwest Atlantic DPS
Pacific (Olive) Ridley	*Lepidochelys olivacea*	T
Seabirds/Shorebirds: 4 species		
Albatross, short-tailed	*Phoebastria (=Diomedea) albatrus*	E, MBTA
Knot, red	*Calidris canutus rufa*	T, MBTA
Murrelet, marbled	*Brachyramphus marmoratus*	T; MBTA; WA state listed as T
Plover, western snowy	*Charadrius alexandrinus nivosus*	T; MBTA; WA state listed as E

MONTEREY BAY NATIONAL MARINE SANCTUARY		
Inverted Common Name	**Scientific Name**	**ESA Listing Status (E=endangered, T=threatened, F=foreign, XN=nonessential experimental population, SAT=threatened due to similarity of appearance)**
Marine & Freshwater Invertebrates: 2 species		
Abalone		
Black abalone	*Haliotis cracherodii*	E
White abalone	*Haliotis sorenseni*	E
Fish: 12 species		
Marine/Adromous Species		
Bocaccio (rockfish)	*Sebastes paucispinus*	E
Eulachon, Pacific/smelt	*Thaleichthys pacificus*	T

Rockfish, canary	*Sebastes pinniger*	T
Rockfish, yelloweye	*Sebastes ruberrimus*	T
Salmon, Chinook (king)	*Oncorhynchus tshawytscha*	T in California Coastal, Central Valley spring-run, Lower Columbia River, Puget Sound, Snake River fall-run, Snake River spring/summer-run, and Upper Willamette River ESUs; E in Sacramento River winter-run and Upper Columbia River spring-run ESUs, XN in Upper Columbia River spring-run in the Okanogan River sub-basin, WA ESU
Salmon, Chum	*Oncorhynchus keta*	T in Columbia River and Hood Canal summer-run ESUs
Salmon, Coho	*Oncorhynchus (=Salmo) kisutch*	E in Central California Coast ESU; T in Lower Columbia River, Oregon Coast, and Southern Oregon ESUs
Shark, Scalloped Hammerhead	*Sphyrna lewini*	E in Eastern Pacific DPS; E in Eastern Atlantic DPS; T in Central & Southwest Atlantic and Indo-West Pacific DPSs
Steelhead/Rainbow Trout	*Oncorhynchus (=Salmo) mykiss*	E in Southern California DPS; T in California Central Valley, Central California Coast, Lower Columbia River, Middle Columbia River, Northern California, Puget Sound, Snake River Basin, South-Central California Coast, Upper Columbia River, and Upper Willamette River DPSs
Sturgeon, Green	*Acipenser medirostris*	T
Sturgeon, White	*Acipenser transmontanus*	E
Brackish Water Species		
Goby, tidewater	*Eucyclogobius newberryi*	E
Marine Mammals: 40 species		
Dolphins		
Bottlenose dolphin	*Tursiops truncates*	MMPA
Long-beaked common dolphin	*Delphinus capensis*	MMPA
Northern right whale dolphin	*Lissodelphis borealis*	MMPA
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	MMPA
(Pantropical) spotted dolphin	*Stenella attenuata*	MMPA
Risso's (Grampus) dolphin	*Grampus griseus*	MMPA

Rough-toothed dolphin	*Steno bredanensis*	MMPA
Short-beaked common dolphin/Common dolphin	*Delphinus delphis*	MMPA
Spotted dolphin	*Stenella plagiodon*	MMPA
Striped dolphin	*Stenella coeruleoalba*	MMPA
Porpoises		
Dall's porpoise	*Phocoenoides dalli*	MMPA
Harbor porpoise	*Phocoena phocoena*	MMPA
Whales		
Baird's beaked whale	*Berardius bairdii*	MMPA
Blainsville beaked whale	*Mesoplodon densirostris*	MMPA
Blue Whale	*Balaenoptera musculus*	E, MMPA
Cuvier's beaked whale	*Ziphius cavirostris*	MMPA
Dwarf sperm whale	*Kogia simus*	MMPA
False killer whale	*Pseudorca crassidens*	E, MMPA
Fin Whale	*Balaenoptera physalus*	E, MMPA
Ginkgo-toothed whale	*Mesoplodon ginkgodens*	MMPA
Gray whale	*Eschrichtius robustus*	E(F), MMPA
Hubb's beaked whale	*Mesoplodon carlhubbsi*	MMPA
Humpback Whale	*Megaptera novaeangliae*	E, MMPA
Killer whale	*Orcinus orca*	E, MMPA
Minke whale	*Balaenoptera acutorostrata*	MMPA
North Pacific right whale	*Eubalaena japonica*	E, MMPA
Perrin's beaked whale	*Mesoplodon perrini*	MMPA
Pygmy sperm whale	*Kogia breviceps*	MMPA
Sei Whale	*Balaenoptera borealis*	E, MMPA
Short-finned pilot whale	*Globicephala macrorhynchus*	MMPA
Sperm Whale	*Physeter macrocephalus*	E, MMPA
Stejneger's beaked whale	*Mesoplodon stejnegeri*	MMPA
Otariid Pinnipeds (Sea Lions/Fur Seals)		
California sea lion	*Zalophus californianus*	MMPA
Guadalupe fur seal	*Arctocephalus townsendi*	T, MMPA
Northern fur seal	*Callorhinus ursinus*	MMPA
Steller sea lion	*Eumetopias jubatus*	E, MMPA

Phocid Pinnipeds (Seals)		
Harbor seal	*Phoca vitulina*	MMPA
Northern elephant seal	*Mirounga angustirostris*	MMPA
Otters		
Northern sea otter	*Enhydra lutris kenyoni*	T, MMPA
Southern sea otter	*Enhydra lutris nereis*	T, MMPA
Reptiles: 5 species		
Turtles		
Green Sea Turtle	*Chelonia mydas*	T entire range; Central North Pacific, East Pacific, North Atlantic, South Atlantic DPSs T; E in Central South Pacific, Central West Pacific DPSs
Hawksbill	*Eretmochelys imbricata*	E
Leatherback	*Dermochelys coriacea*	E
Loggerhead	*Caretta caretta*	E North Pacific Ocean DPS; T Northwest Atlantic DPS
Pacific (Olive) Ridley	*Lepidochelys olivacea*	T
Seabirds/Shorebirds: 7 species		
Albatross, short-tailed	*Phoebastria (=Diomedea) albatrus*	E, MBTA
Knot, red	*Calidris canutus rufa*	T, MBTA
Murrelet, marbled	*Brachyramphus marmoratus*	T; MBTA; WA state listed as T
Plover, western snowy	*Charadrius alexandrinus nivosus*	T; MBTA; WA state listed as E
Rail, California clapper	*Rallus longirostris obsoletus*	E
Tern, California least	*Sterna antillarum browni*	E, MBTA
Tern, least	*Sterna antillarum*	E in U.S.A. (AR, CO, IA, IL, IN, KS, KY, LA_Miss. R. and tribs. N of Baton Rouge, MS_Miss. R., MO, MT, ND, NE, NM, OK, SD, TN, TX_except within 50 miles of coast); T in Western Hemisphere and adjacent oceans, incl. U.S.A. (FL, PR, VI), where not listed as endangered; MBTA
Land Species: 2 species		
Mouse, Salt-marsh	*Reithrodontomys raviventris*	E

harvest		
Reptiles		
San Francisco garter snake	*Thamnophis sirtalis tetrataenia*	E

CHANNEL ISLANDS NATIONAL MARINE SANCTUARY		
Inverted Common Name	**Scientific Name**	**ESA Listing Status (E=endangered, T=threatened, F=foreign, XN=nonessential experimental population, SAT=threatened due to similarity of appearance)**
Marine & Freshwater Invertebrates: 2 species		
Abalone		
Black abalone	*Haliotis cracherodii*	E
White abalone	*Haliotis sorenseni*	E
Fish: 9 species		
Marine/Adromous Species		
Bocaccio (rockfish)	*Sebastes paucispinus*	E
Rockfish, canary	*Sebastes pinniger*	T
Rockfish, yelloweye	*Sebastes ruberrimus*	T
Salmon, Chinook (king)	*Oncorhynchus tshawytscha*	T in California Coastal, Central Valley spring-run, Lower Columbia River, Puget Sound, Snake River fall-run, Snake River spring/summer-run, and Upper Willamette River ESUs; E in Sacramento River winter-run and Upper Columbia River spring-run ESUs, XN in Upper Columbia River spring-run in the Okanogan River subbasin, WA ESU
Salmon, Chum	*Oncorhynchus keta*	T in Columbia River and Hood Canal summer-run ESUs
Salmon, Coho	*Oncorhynchus (=Salmo) kisutch*	E in Central California Coast ESU; T in Lower Columbia River, Oregon Coast, and Southern Oregon ESUs
Shark, Scalloped Hammerhead	*Sphyrna lewini*	E in Eastern Pacific DPS; E in Eastern Atlantic DPS; T in Central & Southwest Atlantic and Indo-West Pacific DPSs
Sturgeon, Green	*Acipenser medirostris*	T

Steelhead/Rainbow Trout	*Oncorhynchus (=Salmo) mykiss*	E in Southern California DPS; T in California Central Valley, Central California Coast, Lower Columbia River, Middle Columbia River, Northern California, Puget Sound, Snake River Basin, South-Central California Coast, Upper Columbia River, and Upper Willamette River DPSs
Marine Mammals: 43 species		
Dolphins		
Bottlenose dolp+18:65hin	*Tursiops truncates*	MMPA
Long-beaked common dolphin	*Delphinus capensis*	MMPA
Northern right whale dolphin	*Lissodelphis borealis*	MMPA
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	MMPA
(Pantropical) spotted dolphin	*Stenella attenuata*	MMPA
Risso's (Grampus) dolphin	*Grampus griseus*	MMPA
Rough-toothed dolphin	*Steno bredanensis*	MMPA
Short-beaked common dolphin/Common dolphin	*Delphinus delphis*	MMPA
Spinner dolphin (long-snouted)	*Stenella longirostris*	MMPA
Spotted dolphin	*Stenella plagiodon*	MMPA
Striped dolphin	*Stenella coeruleoalba*	MMPA
Porpoises		
Dall's porpoise	*Phocoenoides dalli*	MMPA
Harbor porpoise	*Phocoena phocoena*	Morro Bay stock; MMPA
Whales		
Baird's beaked whale	*Berardius bairdii*	MMPA
Blainsville beaked whale	*Mesoplodon densirostris*	MMPA
Blue Whale	*Balaenoptera musculus*	E, MMPA
Bryde's whale	*Balaenoptera edeni*	MMPA
Cuvier's beaked whale	*Ziphius cavirostris*	MMPA
Dwarf sperm whale	*Kogia simus*	MMPA
False killer whale	*Pseudorca crassidens*	E, MMPA

Fin Whale	*Balaenoptera physalus*	E, MMPA
Ginkgo-toothed whale	*Mesoplodon ginkgodens*	MMPA
Gray whale	*Eschrichtius robustus*	E(F), MMPA
Hubb's beaked whale	*Mesoplodon carlhubbsi*	MMPA
Humpback Whale	*Megaptera novaeangliae*	E, MMPA
Killer whale	*Orcinus orca*	E.N. Pacific offshore stock and E.N. Pacific transient stock; E, MMPA
Minke whale	*Balaenoptera acutorostrata*	MMPA
North Pacific right whale	*Eubalaena japonica*	E, MMPA
Perrin's beaked whale	*Mesoplodon perrini*	MMPA
Pygmy sperm whale	*Kogia breviceps*	MMPA
Sei Whale	*Balaenoptera borealis*	E, MMPA
Short-finned pilot whale	*Globicephala macrorhynchus*	MMPA
Sperm Whale	*Physeter macrocephalus*	E, MMPA
Stejneger's beaked whale	*Mesoplodon stejnegeri*	MMPA
Otariid Pinnipeds (Sea Lions/Fur Seals)		
California sea lion	*Zalophus californianus*	MMPA
Guadalupe fur seal	*Arctocephalus townsendi*	T, MMPA
Northern fur seal	*Callorhinus ursinus*	MMPA
Steller sea lion	*Eumetopias jubatus*	E, MMPA
Phocid Pinnipeds (Seals)		
Harbor seal	*Phoca vitulina*	MMPA
Northern elephant seal	*Mirounga angustirostris*	MMPA
Ribbon seal	*Histriophoca fasciata*	MMPA
Otters		
Northern sea otter	*Enhydra lutris kenyoni*	T, MMPA
Southern sea otter	*Enhydra lutris nereis*	T, MMPA
Reptiles: 4 species		
Turtles		

Green Sea Turtle	*Chelonia mydas*	T entire range; Central North Pacific, East Pacific, North Atlantic, South Atlantic DPSs T; E in Central South Pacific, Central West Pacific DPSs
Leatherback	*Dermochelys coriacea*	E
Loggerhead	*Caretta caretta*	E North Pacific Ocean DPS; T Northwest Atlantic DPS
Pacific (Olive) Ridley	*Lepidochelys olivacea*	T
Seabirds/Shorebirds: 6 species		
Albatross, short-tailed	*Phoebastria (=Diomedea) albatrus*	E, MBTA
Knot, red	*Calidris canutus rufa*	T, MBTA
Murrelet, marbled	*Brachyramphus marmoratus*	T; MBTA; WA state listed as T
Plover, western snowy	*Charadrius alexandrinus nivosus*	T; MBTA; WA state listed as E
Tern, California least	*Sterna antillarum browni*	E, MBTA
Tern, least	*Sterna antillarum*	E in U.S.A. (AR, CO, IA, IL, IN, KS, KY, LA_Miss. R. and tribs. N of Baton Rouge, MS_Miss. R., MO, MT, ND, NE, NM, OK, SD, TN, TX_except within 50 miles of coast); T in Western Hemisphere and adjacent oceans, incl. U.S.A. (FL, PR, VI), where not listed as endangered; MBTA

APPENDIX E

Best Management Practices (BMPs) for Vessel Operations

All ONMS vessels must comply with the operational protocols and procedures in the NOAA Small Boats Policy (NAO 209-125). In addition, the following BMP's, which ONMS intends to include in the PEAs, are used as applicable by vessels during ONMS related operations:

Lookouts/Staying at the helm

- While underway, vessel operators should always stay alert for marine mammals, sea turtles, and other collision hazards.
- While transiting in areas where marine mammals and sea turtles are likely to occur, vessel operators should post a minimum of one dedicated lookout and operators should remain vigilant at the helm controls (keeping hands on the wheel and throttle at all times) and be ready to take action immediately to avoid an animal in their path.
- When operating in areas where marine mammals and sea turtles are present, a dedicated lookout is required in addition to the operator. A second lookout may be posted in circumstances where visibility is restricted.
- When marine mammals are riding the bow wake, or porpoising nearby, operators should exercise caution and take actions that avoid possible contact or collisions.
- When operating within visual range of whales, vessel operators should follow NOAA National Marine Fisheries Service (NMFS) Whale Watching guidelines unless otherwise covered by a NMFS permit, and only then with extreme caution.

Vessel Speed

- All vessels must reduce to prudent speed when marine mammals and sea turtles are visible within 1 nautical mile (nm) of the vessel and should not exceed 10 knots.

Maintaining Distance

- Once large whales[31] are sighted, vessel operators should stay at least 100 yards away, 200 yards away from killer whales and 50 yards away from sea turtles.

[31] For the purposes of this document, large whales include: blue, bowhead, bryde's, fin, grey, humpback, minke, right, sei, and sperm whales. Information based on Marine Wildlife Laws & Guidelines for Boaters, Paddlers and Viewers

- If large whales surface within 100 yards, vessel operators should stop immediately and use prudent seamanship to decide to either move away slowly or wait for the animal to move away on its own.
- In the case of northern right whales, a distance of at least 500 yards should be maintained per NMFS regulations.

Towing Divers

- Divers will be towed at approximately 3 kts/hour.

Operation of vessels during daylight hours

- Due to the increased risk of collision at night, vessel operations, whenever possible, should be planned for daylight hours (*i.e.*, between ½ hour before sunrise and ½ hour after sunset when possible).
- Restricted visibility can hinder an operator's ability to see and respond to a marine mammals and sea turtles. Prudent seamanship should be applied, including posting an additional lookout when there is the potential for marine animals in the vicinity.

Operation of vessels during night hours

- Standing Order for Nighttime Operations – If night time operations are essential and integral to the mission, the principal investigator must discuss mitigations for avoiding whales and other objects within the vessel operation corridor and incorporate them into the cruise plan. Mitigation measures could include: speed restrictions, additional lookouts, use of navigation lights, and use of sound signals, etc.

Standing Order for Operations around Marine Mammals

- This order requires several precautionary measures such as: incorporating whale sighting information in cruise planning, slowing to 10 kts in a Seasonal or Dynamic Management Area, following the Whale Watching Guidelines, maintaining a constant lookout for whales, and following specific procedures if a whale is struck.

Anchoring and deployment of instruments

- In the Southeast and Gulf of Mexico region, anchoring will be limited to sandy-bottom substrates to avoid damage to seagrasses and coral habitat.
- In the Southeast and Gulf of Mexico region, sargassum interaction is limited, as much as is reasonable feasible, to prevent impact on sea turtle hatchling habitat.
- In general, instruments are deployed and lowered onto sandy substrate whenever possible; deployment of instruments occurs slowly and under constant supervision to minimize risk and mitigate impacts if a collision or entanglement occurs; and

while vehicles or personnel are deployed, spotters monitor the activities at all times.

Safety

- Safety Briefings: All ONMS vessel captains include safety information during pre-cruise briefings for staff and volunteers.
- All divers working on ONMS vessels are diver-certified.

AMERICA'S UNDERWATER TREASURES