**U.S. INTEGRATED OCEAN OBSERVING SYSTEM (IOOS®) PROGRAM**

**PROGRAMMATIC ENVIRONMENTAL ASSESSMENT**

FINAL

JUNE 2016

**NOAA National Ocean Service**

**1305 East West Highway, SSMC 4, 13th floor**

**Silver Spring, MD 20910**

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| | |
|---|---|
| ACT | Alliance for Coastal Technologies |
| AOOS | Alaska Ocean Observing System |
| AUV | autonomous underwater vehicle |
| BOEM | Bureau of Ocean Energy Management |
| CariCOOS | Caribbean Coastal Ocean Observing System |
| CE | Categorical Exclusion |
| CeNCOOS | Central and Northern California Ocean Observing System |
| CEQ | Council on Environmental Quality |
| CFR | Code of Federal Regulations |
| CH | critical habitat |
| CODAR | Coastal Ocean Dynamics Applications Radar |
| DMAC | data management and communications |
| DPS | Distinct Population Segment |
| EA | Environmental Assessment |
| EEZ | Exclusive Economic Zone |
| EFH | Essential Fish Habitat |
| EIS | Environmental Impact Statement |
| EPA | U.S. Environmental Protection Agency |
| ESA | Endangered Species Act |
| FMC | Fishery Management Council |
| FR | Federal Register |
| FWS | U.S. Fish and Wildlife Service |
| FY | fiscal year |
| GCOOS | Gulf of Mexico Ocean Observing System |
| GLOS | Great Lakes Observing System |
| HAPC | Habitat Areas of Particular Concern |
| HF radar | High Frequency radio detection and ranging |
| Hz | Hertz |
| IACUC | Institutional Animal Care and Use Committee |
| ICOOS | Integrated Coastal and Ocean Observation System |
| IOOS | Integrated Ocean Observing System |
| IT | information technology |
| kHz | Kilohertz |
| km | Kilometer |
| LIDAR | light detection and ranging |

| | |
|---|---|
| m | meter |
| MARACOOS | Mid-Atlantic Regional Association for Coastal Ocean Observing Systems |
| MHz | megahertz |
| MMPA | Marine Mammal Protection Act |
| MMS | Minerals Management Service |
| MPA | marine protected area |
| ms | Millisecond |
| MSFCMA | Magnuson-Stevens Fishery Conservation and Management Act |
| NANOOS | Northwest Association of Networked Ocean Observing Systems |
| NAO | NOAA Administrative Order |
| NEPA | National Environmental Policy Act |
| NERACOOS | Northeastern Regional Association of Coastal Ocean Observing Systems |
| nm | nautical mile |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| O&M | operation and maintenance |
| PacIOOS | Pacific Islands Ocean Observing System |
| $pCO_2$ | partial pressure of carbon dioxide |
| PEA | Programmatic Environmental Assessment |
| R&D | research and development |
| RA | Regional Association |
| ROI | region of influence |
| SCCOOS | Southern California Coastal Ocean Observing System |
| SECOORA | Southeast Coastal Ocean Observing Regional Association |
| SHPO | State Historic Preservation Office |
| sonar | sound navigation and ranging |
| U.S.C. | U.S. Code |
| USACE | U.S. Army Corps of Engineer |
| USCG | U.S. Coast Guard |
| USVI | U.S. Virgin Islands |
| µs | microsecond |

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# EXECUTIVE SUMMARY

## INTRODUCTION

The National Oceanic and Atmospheric Administration (NOAA) established the U.S. Integrated Ocean Observing System® (IOOS) Program in accordance with Public Law 111-11, Subtitle C—Integrated Coastal and Ocean Observation System (ICOOS) Act of 2009 (33 U.S. Code [U.S.C.] §§ 3601–3610). IOOS represents a national consortium of federal and non-federal stakeholders with specific interest in marine environmental phenomena occurring in the open ocean, U.S. coastal waters, and the Great Lakes. The core mission of IOOS is the systematic provision of readily accessible marine environmental data and data products in an interoperable, reliable, timely, and user-specified manner to end-users/customers to serve seven critical and expanding societal needs:

1. Improve predictions of climate change and weather, and their effects on coastal communities and the nation;
2. Improve the safety and efficiency of maritime operations;
3. More effectively mitigate the effects of natural hazards;
4. Improve national and homeland security;
5. Reduce public health risks;
6. More effectively protect and restore healthy coastal ecosystems; and
7. Enable the sustained use of ocean and coastal resources.

The IOOS Program is composed of six subsystems that represent a collection of components organized to accomplish a specific function or set of functions. Of these six subsystems, three are designated as functional subsystems that provide the technical capability to readily access marine environmental data and produce data products: (1) observing systems, (2) data management and communication (DMAC), and (3) modeling and analysis. The remaining three subsystems are designated as cross-cutting subsystems that enable sustainment of, and improvement to, the IOOS Program by enhancing the utility of the functional subsystem capabilities. These subsystems are (1) governance and management, (2) research and development (R&D), and (3) training and education (NOAA 2010a).

To provide marine environmental data and data products, the IOOS Program relies on partnerships with non-federal components of IOOS, known as Regional Associations (RAs). These partnerships, in the form of cooperative agreements, allow for the collection and dissemination of data necessary to measure, track, explain, and predict events related directly and indirectly to weather and climate change, natural climate variability, and interactions between the oceanic and atmospheric environments, including the Great Lakes environment. The RA cooperative agreements are funded through a competitive process. In fiscal year (FY) 2010, 75 percent of the president's budget for IOOS was allocated to support these cooperative agreements. The data provided through these cooperative agreements provided 56 percent of the coastal observations used by NOAA to support marine forecasting outcomes, further validating the legitimacy of and the need for an integrated ocean observing system.

There are eleven RAs that have been established around the country and are currently addressing regional stakeholder needs for data and information products.

1. Pacific Islands Ocean Observing System (PacIOOS)
2. Alaska Ocean Observing System (AOOS)
3. Northwest Association of Networked Ocean Observing Systems (NANOOS)
4. Central and Northern California Ocean Observing System (CeNCOOS)
5. Southern California Coastal Ocean Observing System (SCCOOS)
6. Gulf of Mexico Ocean Observing System (GCOOS)
7. Southeast Coastal Ocean Observing Regional Association (SECOORA)
8. Caribbean Coastal Ocean Observing System (CariCOOS)
9. Mid-Atlantic Regional Association for Coastal Ocean Observing Systems (MARACOOS)
10. Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS)
11. Great Lakes Observing System (GLOS)

Regional efforts are intended to determine the appropriate resolution at which variables are measured, supplement the variables measured by federal agencies, provide data and information tailored to the requirements of stakeholders in the region, and implement programs to improve public awareness and education. The RAs are responsible for managing system development within the region and working with stakeholders to prioritize observations, products, and services that are most important, given available resources (NOAA 2011a).

NOAA prepared this Programmatic Environmental Assessment (PEA) to identify potential impacts on the environment; develop alternatives and tactical plans to mitigate identified impacts; and build a strategy to address dynamic situations at a tiered level when necessary. As the IOOS Program matures and authorizes an increasing number of activities by non-federal partners, it is imperative to analyze the Program's impact on the human and natural environment. This PEA also provides an efficient process for systematically analyzing the Program's compliance with applicable environmental laws and regulations.

## Key Changes from the Original Draft IOOS PEA

This "*Final IOOS PEA*" is a substantial revision to the previously-released November 2014 Draft IOOS PEA (the "*Original Draft IOOS PEA*"). Specifically, this Final IOOS PEA was modified to include a new action alternative representing a set of RA-recommended projects that could be undertaken within historical budget levels. This alternative, here identified as the "Proposed Action," was not previously analyzed in the Original Draft IOOS PEA. The Proposed Action is NOAA's preferred alternative.

This Final IOOS PEA retains the Proposed Action described in the Original Draft IOOS PEA, which has been retitled the "Full Capabilities Alternative." This alternative reflects the RA recommendations that are consistent with a higher budget level earlier proposed for the IOOS Program, but which is no longer considered supportable. While the IOOS Program is still committed to implementation of the Full Capabilities Alternative envisioned for the IOOS Program, it recognizes that realistic budget limitations will require additional time beyond the period evaluated in this PEA to complete the full installation. A complete description of the Full

Capabilities Alternative is in Section 2.2. Additionally, the analysis of the environmental consequences of this alternative was added to Section 4.3.

## PURPOSE

The purpose of the Proposed Action is to facilitate the collection, processing, distribution, and analysis of data related to environmental conditions of coastal, ocean, and Great Lakes systems to broaden the understanding of the natural phenomena and human influences on those phenomena affecting the ecosystems. This purpose would be facilitated by maintaining existing observing systems and expanding these systems in a national integrated system of ocean, coastal, and Great Lakes observing systems to address regional and national needs for ocean information and gather specific data on coastal, ocean, and Great Lakes variables. The *U.S. IOOS®: A Blueprint for Full Capability* (Blueprint) (IOOS 2010) recognizes that planning associated with the development and fielding/deployment of IOOS capabilities must incorporate the following three related objectives:

- Establish an integrated system by incorporating currently operating assets;
- Enhance the system by incorporating planned and programmed capabilities as they are resourced and become available; and
- Improve and expand the IOOS Program capabilities by incorporating new assets developed through research and pilot projects.

## NEED

The physical phenomena associated with ocean and Great Lakes systems, the interactions of those systems with near shore interfaces, and the influences that they have on world-wide atmospheric conditions are immensely complex. To evaluate these interactions and develop useful models to predict future trends and conditions requires equally complex data sets collected over long periods of time in ways that are reliable, consistent, and coordinated. The Blueprint, guided by the ICOOS Act, addresses the need for centralized coordination and stewardship of IOOS development and sustainment to enable distributed national and regional information concerning marine environmental data and IOOS Program implementation. Centralization of a program to coordinate data collection, verification, analysis, standardization, and distribution is essential to providing researchers and decision makers with reliable information on these complex and interrelated trends. As ocean systems are recognized as major contributors to climate phenomena, as well as for their impacts on international commerce, sustainable food, and raw materials for industry, demand for reliable information for management of these resources has never been more intense and is not likely to lessen in the future.

## SCOPE OF THE PEA

This PEA presents a programmatic analysis of potential impacts associated with the implementation of the IOOS Program technologies and activities, including installation, operation, and maintenance. The analysis was performed from a programmatic level, which evaluates the affected environment and potential environmental consequences from a broad perspective. The area analyzed encompasses the region of influence (ROI) for each RA in which the IOOS Program currently operates. This PEA also provides a programmatic analysis to support future, location specific analysis, as required. Location-specific analyses in subsequent NEPA documents would focus on the potential issues related to that location and consultation and permitting requirements.

## PROPOSED ACTION ALTERNATIVE (PREFERRED ALTERNATIVE)

Implementation of the IOOS Program requires implementation of all of the subsystems identified in Section 1.1.3 of this PEA. However, most of the subsystems described are administrative in nature and are being conducted using established procedures. These subsystems included the potential activities identified by each RA in the 10-year build-out plans that were submitted to the IOOS Program Office. The build-out plans represented all possible future activities until Fiscal Year 2020 (FY20). However, historically authorized funding of the program elements has not been sufficient to complete actions necessary to provide the Full Capability buildouts envisioned in the Blueprint and identified by the RAs. Recently, the RAs submitted budget requests covering Fiscal Year 2016 (FY16) through FY20 budget years. The RAs typically identified three levels or tiers of actions based on potential levels of appropriations and funding, with Tier 1 representing fully funded, Tier 2 representing less than fully funded, and Tier 3 representing level funding consistent with prior years. The activities identified in the Proposed Action represent the priority actions to be implemented consistent with the levels of funding historically available and the Tier 3 budget requests submitted by the RAs. The historical funding levels have been approximately 50 to 60 percent of the funding necessary to fully implement the Full Capability buildout identified in the Blueprint. Therefore, if funding is below the full Tier 3 request, the actions taken would be reduced and environmental impacts would be lower. However, progress in reaching full system capabilities and the benefits associated with the more robust data system would not be realized.

For all RAs, the impacts have been assessed based on a consistent set of conditions and assumptions for conduct of similar actions. For maintenance of buoys and sensor packages, it is assumed that the locations would be accessed using small surface vessels less than 65 feet in length, and that the vessels would observe applicable regulations regarding interactions with marine mammals and other protected species and in accordance with conditions established in consultation under the Endangered Species Act (ESA).

## FULL CAPABILITIES ALTERNATIVE

The Full Capabilities Alternative assumes that budget constraints are not a barrier to execution of the buildout plans developed by the RAs for the Blueprint. Under the Full Capabilities Alternative all proposed equipment acquisitions, deployments, maintenance and operations discussed by the RAs in the Blueprint would be completed. This alternative was previously identified as the “Proposed Action” in the Original Draft IOOS PEA.

## NO ACTION ALTERNATIVE

Under the No Action Alternative, IOOS would maintain the currently deployed assets, but would not fund any additional observational technology assets beyond those already deployed (approximately a total of 804 assets). Therefore, environmental baseline conditions would remain unchanged within each IOOS region, and there would be no impacts to environmental resources with implementation of the No Action Alternative. IOOS buoys, sensors, HF radar, and gliders have operated for more than 10 years.

IOOS was established with the passing of the ICOOS Act of 2009. The Act establishes federal-regional partnerships for understanding the unique characteristics of the nation's diverse regions, integrating existing information from federal and non-federal sources, and expanding the observation network to fill critical gaps, enhance analyses and understanding, and improve predictive and forecasting capabilities. If the No Action Alternative was selected, the IOOS Program Office would be unable to fulfill the requirements of the ICOOS Act.

## ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER ANALYSIS

In developing the Proposed Action, variations of the Preferred Alternative and Full Capabilities Alternative were identified. The alternatives identified involved operating at various levels below the Full Capability Alternative and decreasing funding for asset deployment and maintenance, training, product development, DMAC, and modeling and analysis. However, the IOOS Program Office determined that there would be no marked difference in impacts to the environment in the type or range of observational activities across the enterprise as a whole between other possible funding level adjustments. The quantity of observational activities would change at other funding levels, but the type and range of activities would not change significantly in terms of impact to the environment. A range of alternatives was also considered that focused on deploying specific technologies at projected funding levels at the expense of not deploying other technologies addressed in the Blueprint. While it appears that environmental impacts may be reduced by deploying only those technologies that would not result in direct impacts to the environment, the scope and consistency of data that would result from selective deployment would not meet the purpose of and need for the system, and the resultant gaps in data would likely significantly reduce the usefulness of the IOOS data sets. For these reasons, we determined these alternatives did not meet the purpose of and need for the Proposed Action or merit further study, thus the analyses of alternatives in this PEA are limited to the Proposed Action, the Full Capabilities Alternative, and the No Action Alternative.

## SUMMARY OF POTENTIAL IMPACTS

Table ES-1 provides a summary of the potential impacts from the implementation of technologies and activities associated with the Proposed Action, Full Capabilities Alternative, and No Action Alternative. All technologies and activities may not be proposed for all RAs.

While some activities are expected to result in short and long-term adverse impacts, all adverse impacts for the proposed action are expected to be negligible, or, for the full capabilities alternative, negligible to minor. Of the potential programmatic impacts to essential fish habitat resources, one technology may moorings were determined to have potential, site specific impacts. The EFH most likely to be affected are bottom habitats in nearshore and offshore waters where sensors and buoys will be placed (up to 10 miles from shore). The impacts include site specific and minimal shading of salt marsh and submerged aquatic vegetation, site specific damage to marsh and seagrasses from the installation, anchoring, and maintenance of these technologies, and site substrate scour adjacent to the anchoring system and line. These impacts are short- and long-term, but negligible in scale. For instance, for the proposed action, the RA's are proposing to install 26 buoys for a total 182, with a result of less than 52,000 square meters or less than 13 acres for all new buoys. The total sweep area would be less than 1000 acres, which is small in scale when considering the entire ROI for the programmatic action. As for impacts to marine mammals, ESA-listed species, or critical habitat, for both alternatives, RA's are required to implement all relevant PDC's to avoid adverse impacts, and the impacts are negligible for the proposed action, and negligible to minor for the full capabilities alternative.

Table ES-1. Summary of Potential Impacts on Resources from the Proposed Alternatives of the IOOS Program

| | **Proposed Action (Preferred Alternative)** | **Full Capabilities Alternative** | **No Action Alternative** |
|---|---|---|---|
| ***Physical Resources*** | | | |
| **Sensors/ Instrumentation** | Short- and long-term negligible adverse impacts on geological resources and water quality. | Short- and long-term, negligible to minor, adverse impacts on geological resources and water quality. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| **Vessels/Sampling** | Short-term, negligible, adverse impacts on geological resources or water quality. | Short-term, negligible, adverse impacts on geological resources or water quality. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| **Gliders/AUVs/ Drifters** | No impacts on geological resources. Long-term negligible adverse impacts on water quality. | No impacts on geological resources. Long-term, negligible to minor, adverse impacts on water quality. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| **Moorings/ Stations Buoys/ Fixed Arrays** | Short- and long-term, negligible, adverse impacts from installation and routine maintenance activities. No impacts from the operation of moorings and buoys. | Short- and long-term, minor, adverse impacts from installation and routine maintenance activities. No impacts from the operation of moorings and buoys. | Environmental baseline conditions would remain unchanged from current IOOS operations. |

| | Proposed Action (Preferred Alternative) | Full Capabilities Alternative | No Action Alternative |
|---|---|---|---|
| *Physical Resources (continued)* | | | |
| **HF Radar** | Short- and long-term, negligible, adverse impacts from installation and routine maintenance activities. If trenching is required to install power supplies for new or hardened sites, short-term, minor to moderate, adverse impacts on geological resources. No impacts from the operation of HF radar. | Short- and long-term, negligible to minor, adverse impacts from installation and routine maintenance activities. If trenching is required to install power supplies for new or hardened sites, short-term, minor to moderate, adverse impacts on geological resources. No impacts from the operation of HF radar. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| **SONAR** | No impacts on geological resources. Short- and long-term, negligible, adverse impacts on water quality from installation and maintenance activities. | No impacts on geological resources. Short- and long-term, negligible to minor, adverse impacts on water quality from installation and maintenance activities. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| **LIDAR** | Short- and long-term negligible adverse impacts on geological resources from installation and maintenance activities. No impacts on geological resources or water quality from the operation of LIDAR systems. | Short- and long-term, minor, adverse impacts on geological resources from installation and maintenance activities. No impacts on geological resources or water quality from the operation of LIDAR systems. | Environmental baseline conditions would remain unchanged from current IOOS operations. |

| | Proposed Action (Preferred Alternative) | Full Capabilities Alternative | No Action Alternative |
|---|---|---|---|
| *Biological Resources* | | | |
| **Sensors/ Instrumentation** | No impacts on terrestrial biological resources.<br>Short-term, negligible, adverse impacts on marine biological resources from the use of sensors or animal telemetry tags. | No impacts on terrestrial biological resources.<br>Short-term, negligible, adverse impacts on marine biological resources from the use of sensors or animal telemetry tags. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| **Vessels/Sampling** | No impacts on terrestrial biological resources.<br>Short-term, negligible adverse impacts on marine biological resources. | No impacts on terrestrial biological resources.<br>Short-term, negligible adverse impacts on marine biological resources. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| **Gliders/AUVs/ Drifters** | No impacts on terrestrial biological resources.<br>Short- and long-term, negligible, adverse impacts on marine biological resources.<br>Harassment of marine mammals would not be expected. | No impacts on terrestrial biological resources.<br>Short- and long-term, negligible, adverse impacts on marine biological resources.<br>Harassment of marine mammals would not be expected. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| **Moorings/ Stations Buoys/ Fixed Arrays** | Short- and long-term, negligible, adverse impacts on terrestrial biological resources.<br>No long-term adverse impacts on marine biological resources or critical habitat.<br>Short-term, negligible, adverse effects on EFH would be expected from the installation of moorings and anchors. | Short- and long-term, minor, adverse impacts on terrestrial biological resources.<br>No long-term adverse impacts on marine biological resources or critical habitat.<br>Short-term, minor, adverse effects on EFH would be expected from the installation of moorings and anchors. | Environmental baseline conditions would remain unchanged from current IOOS operations. |

| | Proposed Action (Preferred Alternative) | Full Capabilities Alternative | No Action Alternative |
|---|---|---|---|
| | ***Biological Resources (continued)*** | | |
| **HF Radar** | Short- and long-term, negligible, adverse impacts on terrestrial biological resources.<br>No impacts on marine biological resources.<br>If trenching is required to install power supplies for new or hardened sites, short-term, minor to moderate, adverse impacts on terrestrial biological resources.<br>No effects on EFH would be expected. | Short- and long-term, negligible to minor, adverse impacts on terrestrial biological resources.<br>No impacts on marine biological resources.<br>If trenching is required to install power supplies for new or hardened sites, short-term, minor to moderate, adverse impacts on terrestrial biological resources.<br>No effects on EFH would be expected. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| **SONAR** | No impacts on terrestrial biological resources.<br>Short- and long-term negligible adverse impacts on marine biological resources. | No impacts on terrestrial biological resources.<br>Short- and long-term, negligible to minor, adverse impacts on marine biological resources. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| **LIDAR** | Short- and long-term negligible adverse impacts on terrestrial biological resources.<br>No impacts on marine biological resources. | Short- and long-term, negligible to minor, adverse impacts on terrestrial biological resources.<br>No impacts on marine biological resources. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| | ***Cultural Resources*** | | |
| **Sensors/ Instrumentation** | Short- and long-term negligible adverse impacts. | Short- and long-term negligible to minor adverse impacts. | Environmental baseline conditions would remain unchanged from current IOOS operations. |

| | Proposed Action (Preferred Alternative) | Full Capabilities Alternative | No Action Alternative |
|---|---|---|---|
| ***Cultural Resources (continued)*** | | | |
| **Gliders/AUVs/ Drifters** | No impacts. | No impacts. | No impacts. |
| **Moorings/ Stations Buoys/ Fixed Arrays** | Short- and long-term negligible adverse impacts. | Short- and long-term negligible to minor adverse impacts. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| **HF Radar** | If trenching is required to install power supplies for new or hardened sites, potential long-term adverse impacts on archaeological resources could occur. | If trenching is required to install power supplies for new or hardened sites, potential long-term adverse impacts on archaeological resources could occur. | No impacts. |
| **SONAR** | No impacts | No impacts. | No impacts. |
| **LIDAR** | Short- and long-term negligible adverse impacts. | Short- and long-term negligible to minor adverse impacts. | Environmental baseline conditions would remain unchanged from current IOOS operations. |

## Mitigation And Monitoring For The Proposed Action

As site-specific regional projects are planned, appropriate monitoring measures would be proposed as part of the design, installation, implementation, and O&M activities within each region. Site-specific monitoring efforts would be more fully described in the appropriate region-specific tiered EA (e.g., tiered site-specific EA, supplemental environmental report, categorical exclusion, etc.). Appropriate potential monitoring and mitigation measures would be implemented at the site-specific stage through consultation with federal and state agencies, adherence to federal/state/local regulations, and development and implementation of environmental management plans and best management practices.

The IOOS Program had informational discussions with National Marine Fisheries Service (NMFS) Habitat Conservation Division and determined that moorings may have the potential for short-term, minor, localized, adverse effects on EFH and benthic habitats. However, IOOS concurred with and will implement the EFH conservation recommendations provided by NMFS on July 7, 2014 to avoid, minimize, or offset effects.

The effects of the Proposed Action (Preferred Alternative) are not highly uncertain and do not involve unique or unknown risks. The activities are based on proven observing platform technologies and operational characteristics, for which the effects on the environment and risk posture are well known. To fulfill its ESA and Marine Mammal Protection Act (MMPA) obligations, the U.S. IOOS program consulted with the National Marine Fisheries Service and identified project design criteria (PDC) to incorporate into the proposed action to avoid adverse effects to ESA-listed species and designated critical habitat and to avoid harassment of marine mammals. Proven measures would be implemented, such as, surveying the ROI prior to deployment of sensors or AUVs/gliders/drifters to ensure a threatened or endangered species is not within the area and complying with approved marine species tagging protocol.

Measures also would be implemented to prevent the introduction or spread of non-indigenous species, such as sanitizing boats and vessels before departure from ports and sterilizing gear/equipment/materials prior to placement in water bodies would be implemented. If a Regional Association cannot implement all relevant PDC, if PDC have not been identified for an activity, or if an activity is likely to adversely affect ESA-listed species or harass marine mammals, RA's must contact the IOOS Program Office. See Appendix G for a full list of PDCs.

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# 1. INTRODUCTION

## 1.1 General Description of IOOS

### 1.1.1 Background

The National Oceanic and Atmospheric Administration (NOAA) established the U.S. Integrated Ocean Observing System® (IOOS) Program in accordance with Public Law 111-11, Subtitle C—Integrated Coastal and Ocean Observation System (ICOOS) Act of 2009 (33 U.S. Code [U.S.C.] §§ 3601–3610). IOOS represents a national consortium of federal and non-federal stakeholders with specific interest in marine environmental phenomena occurring in the open ocean, U.S. coastal waters, and the Great Lakes. The core mission of IOOS is the systematic provision of readily accessible marine environmental data and data products in an interoperable, reliable, timely, and user-specified manner to end-users/customers to serve seven critical and expanding societal needs:

1. Improve predictions of climate change and weather, and their effects on coastal communities and the nation;
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NOAA prepared this Programmatic Environmental Assessment (PEA) to identify potential impacts to the environment; develop alternatives and tactical plans to mitigate identified impacts; and build a strategy to address dynamic situations at a tiered level when necessary. As the IOOS Program matures and authorizes an increasing number of activities by non-federal partners, it is imperative to analyze the Program's impact on the human and natural environment. This PEA also provides an efficient process for systematically analyzing the Program's compliance with applicable environmental laws and regulations.

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Program, it recognizes that realistic budget limitations will require additional time beyond the period evaluated in this PEA to complete the full installation. A complete description of the Full Capabilities Alternative is in Section 2.2. Additionally, the analysis of the environmental consequences of this alternative were added to Section 4.3.

### 1.1.2 Partnerships

To provide marine environmental data and data products, the IOOS Program relies on partnerships with non-federal components of IOOS, known as Regional Associations (RAs). These partnerships, in the form of cooperative agreements, allow for the collection and dissemination of data necessary to measure, track, explain, and predict events related directly and indirectly to weather and climate change, natural climate variability, and interactions between the oceanic and atmospheric environments, including the Great Lakes environment. The RA cooperative agreements are funded through a competitive process. In fiscal year (FY) 2010, 75 percent of the president's budget for IOOS was allocated to support these cooperative agreements. The data provided through these cooperative agreements provided 56 percent of the coastal observations used by NOAA to support marine forecasting outcomes, further validating the legitimacy of and the need for an integrated ocean observing system.

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IOOS functional associations include the Alliance for Coastal Technologies (ACT), which is a competitively-selected NOAA-funded partnership of research institutions, resource managers, private sector companies, and the Southeastern Universities Research Association. ACT provides the validation and verification of observing sensors, ensuring their accuracy (NOAA

2011a), and the Southeastern Universities Research Association acts as the IOOS modeling test bed, providing information technology and modeling support.

### 1.1.3 Program Overview

The IOOS Program is composed of six subsystems that represent a collection of components organized to accomplish a specific function or set of functions. Of these six subsystems, three are designated as functional subsystems that provide the technical capability to readily access marine environmental data and produce data products: (1) observing systems, (2) data management and communication (DMAC), and (3) modeling and analysis. The remaining three subsystems are designated as cross-cutting subsystems that enable sustainment of, and improvement to, IOOS Program by enhancing the utility of the functional subsystem capabilities. These subsystems are (1) governance and management, (2) research and development (R&D), and (3) training and education (NOAA 2010a). For the full IOOS Program to be functional, all of these subsystems are required to be operational. Many of the subsystems are dependent upon one another to provide, collect, and produce environmental data or to strengthen the multi-organizational support that provides the cooperative funding that multiplies the effect of NOAA funding. Each subsystem provides a key component of the IOOS Program.

Functional subsystems provide the technical capability to readily access marine environment data and data products. The functional subsystems and their definitions are included in Sections 1.1.3.1 through 1.1.3.4.

#### 1.1.3.1 Observing Subsystem

Observing subsystems consist of sensors that collect data, the platforms to host these sensors, and technology used to send the data to a data collection center, often with satellite telemetry. Observing subsystems come in various sizes, ranging from global scale systems collecting information on climate down to a local system focused on a single estuary. The observing subsystem is responsible for data quality assurance/quality control and metadata generation for measurements generated and transmitted. Observing subsystem data collectors transmit data from the sensor (i.e., hardware or human) to data providers such as ocean data assembly centers (DACs) and ocean data archive centers. Current capabilities of this subsystem include the following:

- *Global Observations*—NOAA's Climate Program Office, Climate Observations and Monitoring Program, marine weather analysis, climate research and prediction, and long-term monitoring for climate change detection and attribution.
- *National Observing Programs*—NOAA's National Data Buoy Center meteorological, oceanographic, and geophysical observations, including over 110 moored buoys that are deployed in the western Atlantic to the Pacific Ocean around Hawaii, and from the Bering Sea to the South Pacific.
- *NOAA's Center for Operational Oceanographic Products and Services*—National Water Level Program, National Currents Observation Program, and Physical Oceanographic Real Time System.

- *NOAA's Coastal-Marine Automated Network*—National Weather Service measures barometric pressure; wind direction, speed, and gusts; air and seawater temperature; water level; waves; relative humidity; precipitation; and visibility.
- *Wave Observation*—National Operational Wave Observation Plan provides a comprehensive surface wave-monitoring network.

**Technology Types**

Technologies deployed and observational activities under the IOOS Program can be categorized into the following groups: (1) passive Sensors and instrumentation; (2) vessels and sampling; (3) autonomous underwater vehicles (AUVs), gliders, and drifters; (4) moorings, marine stations, buoys, and fixed arrays; (5) high frequency (HF) radar; (6) sound navigation and ranging (sonar); and (7) light detection and ranging (LIDAR). Additionally, video and still cameras are often attached to sensor platforms. These technology and observational activity types are described in more detail in Appendices D and E. Brief descriptions are provided below.

1. ***Passive Sensors/Instrumentation.*** To measure changes and variability in the chemical, biological, and geological processes in the ocean, projects may propose the use of sensors, which can be deployed from a number of platforms, including AUVs, water column moorings, and on the seafloor (NOAA 2011d). Sensors can monitor parameters such as meteorological conditions, chlorophyll, turbidity, dissolved oxygen, temperature, salinity, partial pressure of carbon dioxide ($pCO_2$), pH, and wind. Table 1-1 provides details about representative types of non-acoustic sensors that may be used as part of IOOS. Table 1-2 provides details about representative types of active acoustic sensors that may be used as part of IOOS.

   NOAA has proposed an IOOS Marine Sensor Innovation Project, in coordination with the Animal Telemetry Observing Network. In the last 25 years, technological advances have made it possible to use animals as platforms to carry remote-sensing devices (i.e., animal telemetry). Large animals such as sharks and sea turtles can carry sophisticated tags that sample the environment and report to satellites. In cases where animals return to predictable haul out sites or where recapture rates are high (e.g., tuna caught around fish aggregation devices) the tags can be recovered and the entire archived data is downloaded. More recently, the decreasing size of acoustic transmitters allows their use to monitor the movements of smaller individuals over great distances using networks of underwater receivers. Animal telemetry complements gliders and other AUVs to provide unique data for resource management and ocean modeling and analysis (Moustahfid et al. 2011).

2. ***Vessels and Sampling.*** Marine vessels, including personal watercraft, may be used to implement, operate, and maintain aspects of the IOOS Program. Activities may range in size from small vessels to larger research vessels. Sampling may be performed from aboard a vessel or on-land along shorelines and can include activities such as conductivity, temperature, and depth surveys; beach monitoring; bathymetric surveys; monitoring of algae, zooplankton, and ocean conditions; invertebrate and fish sampling; and monitoring of fixed arrays.

**Table 1-1. Representative Types of Non-Acoustic Sensors Proposed for Use by IOOS**

| Sensor | Measurement | Platform(s) |
|---|---|---|
| **CTD** | Water conductivity, temperature, and depth | Mooring, benthic, AUV, glider |
| **Photosynthetically active radiation** | Light radiation | Mooring, glider, AUV |
| **Nitrate sensor** | Nitrates | Mooring |
| **Broadband seismometers** | Seismicity | EDP: benthic (borehole) |
| **Short-period seismometers** | Seismicity | Benthic |
| **Pressure** | Tidal and storm influence on seismicity and hydrothermal flow | Mooring, benthic, AUV, glider |
| **Temperature-resistivity-$H_2$** | Temperature-chlorinity and dissolved hydrogen | Mooring, benthic, AUV, glider |
| **Fluid-particulate DNA** | Fluid-particulate DNA | Benthic |
| **High-definition camera** | Imaging of biology and fluid flow at vents | Benthic, mooring |
| **Gravity meter** | Gravity field | Mooring |
| **Surface meteorology** | Air temperature, barometric pressure, relative humidity, wind velocity, short- and long-wave radiation, precipitation | Surface mooring |
| **Microbial incubators** | Environmental conditions within vent walls, co-registered microbe-temperature-fluid sampling | Benthic |
| **pH** | Acidity/alkalinity | Mooring, benthic, AUV, glider |
| **Chlorophyll a and colored dissolved organic matter fluorescence** | Chlorophyll a and dissolved organic matter | Mooring, benthic, AUV, glider |
| **Optical backscatter** | Turbidity and sediment concentration | Mooring, benthic, AUV, glider |
| **Oxygen** | Oxygen | Mooring, benthic, AUV, glider |
| **Partial pressure of $CO_2$** | Partial pressure of $CO_2$ | Mooring |

**Table 1-2. Representative Types of Active Acoustic Sensors Proposed for Use by IOOS**

| Acoustic Source | Frequency | Source Level (dBrms re 1μPa-m)[a] | Pulse Length | Purpose/Platform(s) |
|---|---|---|---|---|
| Acoustic Doppler Velocimeter | 1-6 MHz | ~220 | 600 μs | Current velocity/Mooring, benthic |
| Acoustic Doppler Current Profiler | 75-1,200 kHz | ~220 | 0.6-1.5 ms | Current velocity across the water column/Mooring profilers, gliders, AUVs, benthic sensors |
| Altimeters[b] | 170 kHz | 206 | 4 ms | Height above seafloor/glider |
| Tracking pingers | 10-30 kHz | 180-186 | ~7 ms | Location/AUVs, gliders |

Source: National Science Foundation (NSF) 2008.

Notes: kHz = kilohertz; MHz = megahertz; ms = milliseconds; μs = microseconds

[a] dBrms re 1μPa-m = decibels root-mean-square referenced to 1 microPascal at 1 meter.

[b] Altimeters would be used to assist AUVs and gliders with determining their altitude above the sea floor. They operate at 170 kHz with an output that is significantly less power than most boat depth sounders. The maximum root mean square voltage output from the altimeter printed circuit board is 260V. Therefore, the maximum sound pressure level would be 204.3dB. The beam pattern at -3DB is 18 degrees. The ping rate can be as fast as every four seconds to being turned off. Tracking pingers enable the tracking of AUVs and gliders once they are deployed. These pingers operate at 10–30 kHz and emit a very brief (7 ms) pulse at source levels of 180–186 dB re 1μPa at 1 m. The tracking pinger function is used only for emergency recovery. Additionally, most gliders are phasing out the use of tracking pingers altogether, so their use is becoming rare.

3. ***Gliders/AUVs/Drifters.*** A glider is a type of unmanned and untethered underwater vehicle that navigates autonomously, without any physical connection to a research vessel at the surface (NOAA 2011d), to monitor water currents, temperature, and conditions that reveal effects from storms, impacts on fisheries, and water quality (NOAA 2011e). Gliders use an onboard global positioning system to maintain their pre-programmed course and have two-way satellite communications with operators which allow them to report their locations and provide data when they surface.

   A powered AUV travels faster, but for a shorter duration than a glider. AUVs typically have onboard power, supplied by rechargeable batteries to operate a propeller or thrusters for propulsion (NOAA 2011d).

   Drifters are floating ocean buoys equipped with meteorological and/or oceanographic sensing instruments linked to transmitting equipment for sending the observed data to collecting centers. Drifters are typically released from a vessel and flow with surface currents.

4. ***Moorings, Stations, Buoys and Fixed Arrays.*** Ocean moorings and stations are observational platforms that are fixed in place with wires, buoys, weights, and floats. Mooring lines can be thousands of meters long, can allow for the attachment of sensors

and other instruments, and may enable inductive telemetry of data from sensors. Moorings may be completely submerged or supported by a surface buoy which can also be equipped with sensors, telemetry equipment, power generation and storage systems, or data systems (WHOI 2011). In general, moored buoy, open-ocean observatories are used to support air-sea, water-column, and seafloor sensors operating in remote, scientifically important locations and provide data and near-real time interaction to diverse communities of scientific and educational users.

5. ***HF Radar.*** HF radar systems measure the speed and direction of ocean surface currents in near real time. HF radar can measure currents over a large region of the coastal ocean, from a few kilometers offshore up to 200 kilometers (km), and can operate under any weather conditions. They are located near the water's edge, and need not be situated atop a high point of land. HF radar systems are the only sensors that can measure large areas at once with the detail required for the important applications described here. For comparison, satellites do not have this capability (NOAA 2011f).

6. ***SONAR.*** Sonar uses sound waves to find and identify objects in the water and determine water depth. Sonar systems transmit sound energy and analyze the return signal (echo) that bounces off the seafloor or other objects. Side scan sonar is a specialized system for detecting objects on the seafloor. In a side scan, the transmitted energy is formed into the shape of a fan that sweeps the seafloor from directly under the towfish to either side, typically to a distance of 100 meters. To obtain bathymetric data, vessel-mounted multi-beam sonar systems provide a fan-shaped coverage of the seafloor by measuring and recording the time elapsed between the emission of the signal from the transducer to the seafloor or object, and back again (NOAA 2006b). The Acoustic Doppler Velocimeter, and Acoustic Doppler Current Profiler would operate at frequencies greater than 75 kHz, with most operating at frequencies greater than 200 kHz. However, the altimeters would operate at 170 kHz and the tracking pingers would operate at frequencies between 10 and 30 kHz.

7. ***LIDAR*** (Light radar or light detection and ranging) has become an established method for collecting very dense and accurate elevation values. This active remote sensing technique is similar to radar but uses light pulses instead of radio waves. Collection of elevation data using LIDAR provides higher resolution, centimeter accuracy, and penetration in forested terrain (NOAA 2008a). LIDAR survey systems can be aircraft-mounted or terrestrial or tripod-mounted. Bathymetric LIDAR is used to acquire data in areas with complex and rugged shorelines. (NOAA 2012b).

#### 1.1.3.2 DMAC Subsystem

This subsystem comprises the information technology (IT) infrastructure that enables the interoperable transmission of marine environment data from a data provider (IOOS observing subsystem) to a data/services customer (IOOS modeling and analysis subsystem). Similarly, this subsystem makes available DMAC-compliant data products (products derived from data such as model outputs) to end users, including IOOS customers and data product repositories. It also maintains catalogs of data and registries of observation systems that facilitate customer discovery of desired observation data.

#### 1.1.3.3 Modeling and Analysis Subsystem

This subsystem includes the IOOS provided data, data products (products derived from IOOS data), and services used by IOOS users/customers (Federal and non-Federal organizations and agencies, industry, academia, the research community, nongovernmental organizations, tribal entities, professional organizations, and the general public). It also provides the mechanism by which intermediate and end users make their requirements for IOOS data and data products known (IOOS 2010).

#### 1.1.3.4 Cross-Cutting Subsystems

In general, IOOS cross-cutting subsystems enhance the utility of IOOS functional subsystem capabilities. The IOOS cross-cutting subsystems include entities, processes, and tools that provide products and services to ensure sustainment of, and improvements to, the overall system and its usage. The crosscutting subsystems and their definitions are as follows:

1. ***Governance and management subsystem.*** This subsystem comprises the collection of functions and activities that support the IOOS Program in terms of policy, plans, guidance, resources, processes, tools, and infrastructure.

2. ***Research and development subsystem.*** This subsystem comprises the functions and activities required to gather requirements for R&D and analyze and prioritize those requirements, and facilitate cooperation among partners with R&D capabilities to satisfy identified requirements. It also includes processes to manage R&D pilot projects, conduct technology assessments, field technology enhancements, and transition technology solutions from the laboratory to the field.

3. ***Training and education subsystem.*** This subsystem comprises the entities, processes, and tools required to develop and sustain a broad spectrum of educators and trainers who use IOOS information to achieve their education and training objectives and create the workforce needed to develop and sustain IOOS and produce IOOS information products, services, and tools.

## 1.2 PURPOSE AND NEED

### 1.2.1 Purpose

The purpose of the Proposed Action is to facilitate the collection, processing, distribution, and analysis of data related to environmental conditions of coastal, ocean, and Great Lakes systems to broaden understanding of the natural phenomena and human influences on those phenomena affecting the ecosystems. This purpose would be facilitated by maintaining existing observing systems and expanding these systems in a national integrated system of ocean, coastal, and Great Lakes observing systems to address regional and national needs for ocean information and gather specific data on coastal, ocean and Great Lakes variables. The *U.S. IOOS®: A Blueprint for Full Capability* (Blueprint) (IOOS 2010) recognizes that planning associated with the development and fielding/deployment of IOOS capabilities must incorporate the following three related objectives:

- Establish an integrated system by incorporating currently operating assets;
- Enhance the system by incorporating planned and programmed capabilities as they are resourced and become available; and
- Improve and expand the IOOS Program capabilities by incorporating new assets developed through research and pilot projects.

### 1.2.2 Need

The physical phenomena associated with ocean and Great Lakes systems, the interactions of those systems with near shore interfaces, and the influences that they have on world-wide atmospheric conditions are immensely complex. To evaluate these interactions and develop useful models to predict future trends and conditions requires equally complex data sets collected over long periods of time in ways that are reliable, consistent, and coordinated. The Blueprint, guided by the ICOOS Act, addresses the need for centralized coordination and stewardship of IOOS development and sustainment to enable distributed national and regional information concerning marine environmental data and IOOS Program implementation. Centralization of a program to coordinate data collection, verification, analysis, standardization, and distribution is essential to providing researchers and decision makers with reliable information on these complex and interrelated trends. As ocean systems are recognized as major contributors to climate phenomena, as well as for their impacts on international commerce, sustainable food, and raw materials for industry, demand for reliable information for management of these resources has never been more intense and is not likely to lessen in the future.

## 1.3 PROGRAMMATIC SCOPE

### 1.3.1 Concept of a Programmatic Environmental Assessment

A programmatic approach may be appropriate for addressing broad agency action(s) and when the action(s) being considered falls into one of the four major categories of actions to which the National Environmental Policy Act (NEPA) applies (40 Code of Federal Regulations [CFR] §1508.18(b)). These four categories include: (1) adopting official policy (e.g., national or regional rulemaking, adoption of an agency-wide policy or redesign of an existing program); (2) adopting formal plans (e.g., strategic planning linked to agency resource allocation or adoption of an agency plan for a group of related projects); (3) adopting agency programs (e.g., new agency mission or initiative or proposals to substantially redesign existing programs); and (4) approving multiple actions (e.g., several similar actions or projects in a region or nationwide, a suite of ongoing, proposed, or reasonably foreseeable actions that share common geography or timing).

The concept of “programmatic” NEPA analyses is also included in Council on Environmental Quality (CEQ) Regulations that address analyses of “broad actions” and the tiering process. CEQ interprets its regulations as allowing for the use of a programmatic approach in developing Environmental Assessments (EA) and Environmental Impact Statements (EIS). Programmatic NEPA reviews add value and efficiency to the decision-making process when they inform the scope of decisions and subsequent tiered NEPA reviews. A Programmatic EA or EIS can facilitate decisions on agency actions that precede site- or project-specific decisions and actions.

They also provide information and analysis that can be incorporated by reference in future, tiered, NEPA reviews or assessments.

The IOOS Program Office determined a programmatic approach was the most appropriate approach because the implementation of the IOOS Program occurs over multiple geographical areas (e.g., land-based and open ocean) and the limitations in available information and uncertainty regarding the timing and environmental impacts of subsequent implementing activities by non-federal RAs authorized via grants or cooperative agreements. The specific project and site details will not be known until the IOOS Program receives project proposals for review. The analysis in this Final PEA supports the planning-level decisions for funding future actions of the RAs and establishes the framework and parameters for subsequent analyses based on this programmatic review that examines the reasonably foreseeable impacts of expanding and maintaining the IOOS Program.

This Final PEA was prepared in accordance with NEPA (42 U.S.C. § 4321, et seq.) and CEQ Regulations for Implementing the Procedural Provisions of NEPA (40 CFR §§ 1500–1508), and NOAA Administrative Order (NAO) 216-6, "Environmental Review Procedures for Implementing the National Environmental Policy Act."

### 1.3.2 Tiering Subsequent Analyses

"Tiering"[1] refers to an approach whereby federal agencies prepare a site- or project-specific analysis based on a broader, more general, NEPA analysis document. The tiered NEPA analysis would summarize and incorporate discussions from the broader assessment (i.e., this Final PEA) and concentrate on the specific issues of the subsequent action. Agencies are encouraged to tier their EAs or EISs to eliminate repetitive discussions of the same issues and to focus on the actual issues ripe for decision at each level of environmental review (40 CFR § 1502.20).

Using this programmatic approach, the IOOS Program identified and prepared a qualitative analysis of the Program's general environmental impacts for the broad scope of actions planned for the expansion and implementation of the IOOS Program and will prepare sufficient in-depth "tiered" analyses for potential future actions, as appropriate. Subsequent analyses will likely be based on location-specific environmental factors where individual assets would be deployed or when the IOOS Program receives a project proposal from a potential applicant. The IOOS Program will fulfill its responsibilities under NEPA and other applicable Federal environmental laws and regulations for all actions authorized, funded, or carried out by the IOOS Program, the RAs, or other partners.

Figure 1-1 depicts the NEPA decision tree that would be used for projects implemented under the IOOS Program, which include documentation for any tiered analyses prepared subsequent to this PEA.

1 Federal agencies first consider the broad, general impacts of proposed program, plan, policy, or large scope project – or at the early stage of a phased proposal – and then conduct subsequent, narrower, decision focused reviews. (40 CFR §1502.20 and §1508.28)

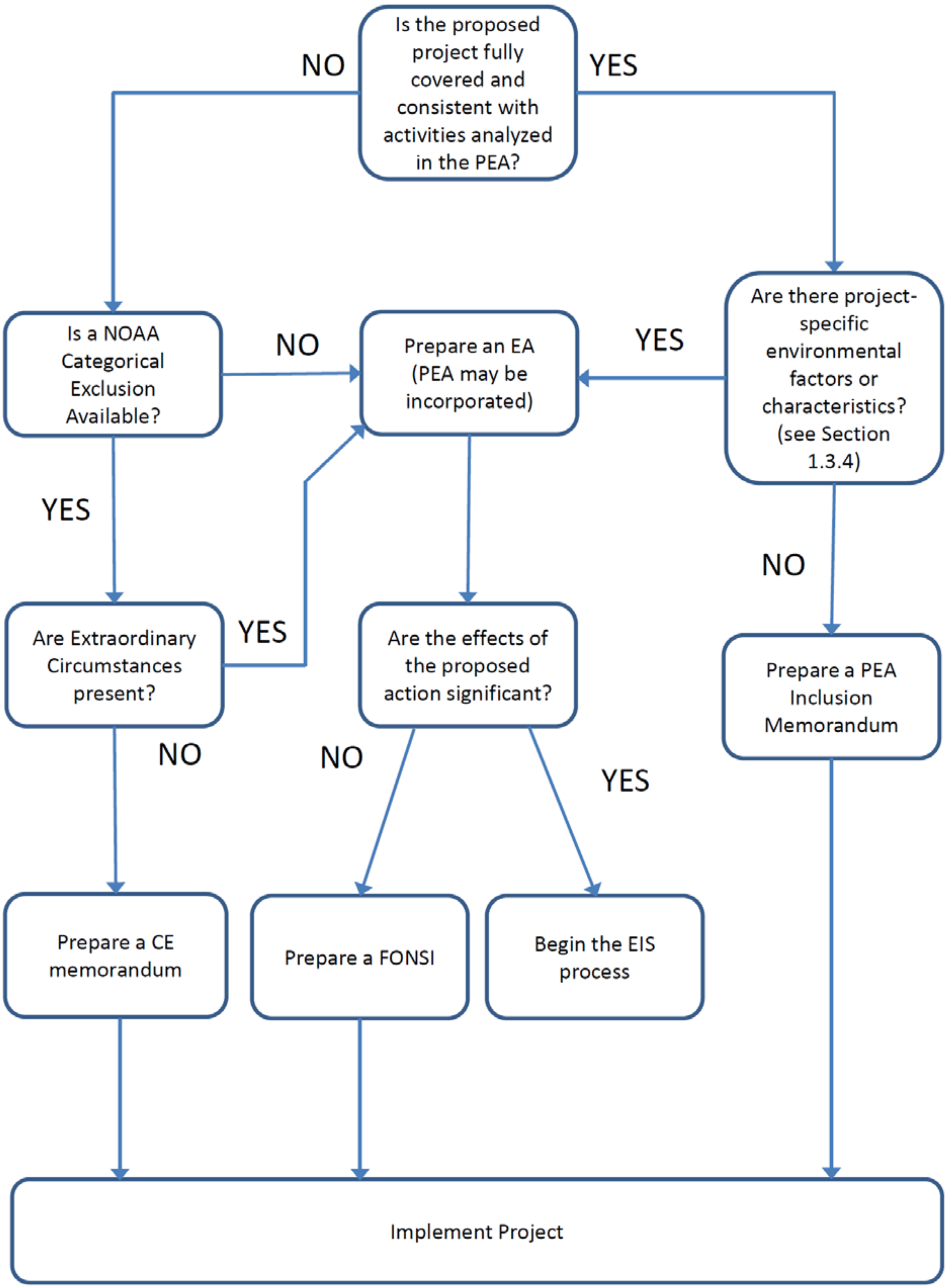


**Figure 1-1. IOOS Program NEPA Decision Tree**

### 1.3.3 U.S. IOOS Program NEPA Decision Process

If the proposed project is fully covered and consistent with the activities and associated impacts described in the PEA, the IOOS Program would use this Final PEA as the basis for compliance with NEPA. A PEA inclusion memorandum would be prepared, explaining that the proposed project does not require additional NEPA analysis. If a future project is described in this PEA but has the potential for adverse impacts that would be greater than those assessed in this PEA, a tiered EA may be required. If the project or a portion of the project is not adequately addressed in the PEA, further NEPA analysis would be required. If the project is not described in the PEA, but qualifies for a Categorical Exclusion (CE), a CE memorandum would be prepared (see Appendix A). If the project does not fall under a CE and the impacts are not expected to be significant, a new, tiered Environmental Assessment (EA) would be prepared (see Figure 1-1). If the project is expected to have significant impacts, an EIS would be prepared.

When making decisions to fund non-federal RA activities, the IOOS Program will review and approve a grant and cooperative agreement for environmental compliance in accordance with NEPA, Executive Order (EO) 12114 (when applicable), NOAA policies, and this Final PEA. The environmental compliance review of proposed projects carried out by the RAs or other partners under grants or cooperative agreements involves the determination of the appropriate analysis under NEPA and evaluation of the applicability and requirements of other environmental laws, regulations, and EOs. To prepare an analysis under NEPA, information about the proposed project must be provided by the applicant. The IOOS Program is responsible for obtaining this information which is typically provided by the applicants in the NOAA Environmental Compliance Questionnaire (OMB Approval No.: 0648-0538) (see Appendix A). For grants or cooperative agreements where specific requirements are needed to ensure environmental compliance, such as permits or consultations with regulating agencies, these requirements may be imposed through a Special Award Condition.

**Special Award Conditions and Conditional Approval of Specific Projects**

Conditional approval is a mechanism whereby an applicant is provided an opportunity to make necessary changes to a plan, a funding application, or to satisfy additional NEPA or other environmental compliance requirements before an action can occur. The award or expenditure under the award may be delayed via a Special Award Condition until the environmental compliance requirements are satisfied.

An example of a Special Award Condition project would be if a project could result in a take of Endangered Species Act (ESA)-listed species. If the applicant cannot modify their action to avoid take, and a federal permit is therefore required for implementation, the award may stipulate that expenditure of funds is not authorized prior to the applicant securing the permit. Conditional approval may be warranted if the time required to secure a permit exceeds the decision timeline for the award cycle and when delaying the award decision pending the permit decision would preclude funding a highly desirable project.

Special award conditions for prior approvals require that award recipients demonstrate compliance with applicable environmental laws (i.e., providing proof of permits, licenses, and authorizations) prior to implementing the project.

A standard condition of awards is that recipients comply with applicable federal, state, and local laws during project implementation. It may not be practical or possible for applicants of awards to have secured all applicable permits at the time the grant proposal is due for review. In those cases, the project is reviewed to determine whether it would violate such laws and the analysis of impacts assumes the grantee would operate in compliance. If monitoring of the activity suggests the grantee has not complied, or is not capable of complying, the award may be rescinded or future awards withheld.

### 1.3.4 Project-Specific Analysis

Some activities proposed under the IOOS Program may require preparation of a project-specific NEPA analysis. Once the location for a specific project has been determined, the decision tree shown in Figure 1-1 would be consulted to determine if project-specific NEPA analysis is required. The "*location-specific environmental factors or characteristics*" mentioned in Figure 1.1 include:

- Substantial changes in the scope or location of specific projects described in the IOOS Regional Association cooperative agreements.
- Additional efforts described by cooperative partners in 10-year build-out plans.
- Facility construction, such as to enclose data operations and equipment or to construct HF radar stations that would occur in a terrestrial environment.
- Marine Sensor Innovation Project activities, including the tagging of any marine species, including migratory birds, ESA-listed species, and marine mammals, with telemetry devices.
- Activities, such as mooring placements, proposed in sensitive or protected areas such as marine protected area (MPAs), critical habitat, essential fish habitat (EFH) and Habitat Areas of Particular Concern (HAPCs), and those with traditional cultural resources or designated for usual and accustomed tribal uses.
- Activities, such as mooring placements, proposed in fishery areas.
- Shore-based monitoring and surveying activities.

If one or more of these factors or characteristics is present in connection with the proposed project, then a project-specific NEPA analysis will be performed for that action, and documented in a CE memorandum or EA, as appropriate. It is not anticipated at this time that any IOOS projects would require the preparation of an EIS, however Figure 1.1 includes this possibility, for completeness.

If none of the factors or characteristics listed above are found to be present for a specific project, then IOOS will prepare a PEA Inclusion Memorandum, which will complete the NEPA process for that action.

### 1.3.5 Scope of PEA

This PEA presents a programmatic analysis of potential impacts associated with the implementation of IOOS Program technologies and activities, including installation, operation, and maintenance. The analysis was performed from a programmatic level, which evaluates the affected environment and potential environmental consequences from a broad perspective. The area analyzed encompasses the region of influence (ROI) for each RA in which the IOOS

Program currently operates. This PEA also provides a programmatic analysis to support future, location-specific analyses, as required. Location specific analyses would focus on the potential issues related to that location and consultation and permitting requirements.

This PEA includes a broad-level, general description of the affected environment; including physical resources (i.e., geological resources and water quality), biological resources (i.e., marine and terrestrial), and cultural resources.

This PEA is divided into the following sections: Section 1 includes a general description of the IOOS Program, its purpose and need, and programmatic scope; Section 2 describes the Proposed Action and alternatives; Section 3 describes the affected environment; Section 4 includes the analysis of environmental consequences and mitigation and monitoring measures; Section 5 includes a discussion of cumulative effects; Sections 6 and 7 include a list of references and document preparers, respectively; and Section 8 provides the list of agencies coordinated or consulted with during the preparation of this PEA.

## 1.4 ADDITIONAL REGULATORY CONSIDERATIONS

In accordance with CEQ regulations for implementing NEPA, federal agencies shall, to the fullest extent possible, integrate the requirements of NEPA with other planning and environmental review procedures required by law or by agency practice so that all such procedures run concurrently rather than consecutively. The IOOS Program Office consulted with and will continue to consult with regulatory agencies, as appropriate, during NEPA reviews and prior to implementation of the Proposed Action and RA activities to ensure that requirements are met. Section 3 (Affected Environment) of this PEA provides brief excerpts of the federal laws, regulations, or EOs associated with the Proposed Action and the evaluation of the affected environment and resources. Documentation of consultation and coordination with regulatory agencies is provided in Appendices H and I.

## 1.5 PUBLIC INVOLVEMENT

A public web site was established specifically for this PEA (http://www.ioos.noaa.gov/about/governance/environmental_compliance.html). In November 2014, NOAA provided the Original Draft IOOS PEA available for a 30-day public comment period and distributed the draft PEA via the IOOS website, regional partners' websites, and the IOOS Program Office Director's newsletter. The public and other participants submitted comments during the public comment period via: (1) written letters, (2) email, and (3) the program web site (received any time during the public comment period). In total, NOAA received a total of nine comments from three individuals during the comment period. NOAA considered all public comments and incorporated these comments as appropriate.

Following the public review period, it was determined that an additional alternative was necessary for the NEPA analysis. This Final IOOS PEA adds an action alternative representing a set of projects that could be undertaken with historical budget levels. This alternative, identified as the "Proposed Action," is NOAA's preferred alternative. This document retains the Proposed Action described in the Original Draft IOOS PEA, which has been retitled the "Full Capabilities Alternative" and is no longer the preferred alternative.

# 2. PROPOSED ACTION (PREFERRED ALTERNATIVE) AND ALTERNATIVES

NEPA requires federal agencies to consider alternatives to a proposed federal action. The evaluation of alternatives under NEPA assists the decision maker in ensuring that any unnecessary impacts are avoided through an assessment of alternative ways to achieve the underlying purpose of the Proposed Action that may result in less environmental harm. To warrant detailed evaluation under NEPA, an alternative must be reasonable and meet the stated purpose and need for the proposed action. For this Final PEA, the IOOS Program Office applied the following screening criteria to the alternatives to identify which ones should be brought forward for detailed analysis.

To be considered “reasonable” for purposes of this Final PEA, an alternative must meet the following criteria:

- The action is technically feasible;
- The action is consistent with the requirements and goals of the IOOS Program;
- The action must not violate any federal statute or regulation;
- The action must be consistent with reasonably foreseeable funding levels;
- The action must be consistent with long-term commitments and goals to maintain the integrity of regional and national information needs; and
- The action meets the requirements set forth in the ICOOS Act, the First U.S. Integrated Ocean Observing System Development Plan, and the *U.S. Integrated Ocean Observing System: A Blueprint for Full Capability*.

Based on these criteria, one alternative (the Full Capabilities Alternative) was identified as reasonable and, along with the No Action Alternative, was evaluated in detail in this Final PEA. The Proposed Action is based on historic funding levels and budget requests submitted by the RAs. The Proposed Action is the Preferred Alternative (Section 2.1). The Full Capabilities Alternative is based on the Blueprint determination of the levels of sensor and equipment deployment, data capture and analysis, system control, and information distribution required to realize the full capabilities of the IOOS Program envisioned in the Blueprint (Section 2.2). Finally, the No Action Alternative is analyzed to provide a comparison of potential impacts if the program is not funded (Section 2.3). Variations of the Proposed Action were considered but eliminated from further study because they did not meet the purpose and need of the Proposed Action (see Section 2.4).

For the Proposed Action and Full Capabilities Alternative, the specific actions proposed by each of the RAs are summarized in tables. The tables capture actions that require placement of new sensors or buoys, deployment of new equipment, or other actions that have the potential to interact physically with the environment and therefore to cause impacts. Also considered are the maintenance, repair, and operations of the existing systems that are necessary to maintain the current level of activities and information collection, and to maintain, repair, and operate the new systems after they are deployed. The continued operation of the DMAC and cross-cutting subsystems were considered, but because they do not involve direct interactions with the environment, were determined not to have the potential for environmental impacts. Therefore, the impact assessment focuses on the deployment and maintenance of equipment.

## 2.1 PROPOSED ACTION (PREFERRED ALTERNATIVE)

### 2.1.1 Regional Proposals and Build-out Plans

Implementation of the IOOS Program requires implementation of all of the subsystems identified in Section 1.1.3. However, most of the subsystems described are administrative in nature and are being conducted using established procedures in existing facilities (i.e., DMAC, modeling and analysis, and cross-cutting). These subsystems are included in the potential activities identified by each RA in the 10-year build-out plans that were submitted to the IOOS Program Office. The facility-based, administrative subsystems are currently operating and are not expected to result in additional environmental impacts. The build-out plans represent all possible future activities until FY20. However, historically authorized funding of the program elements has not been sufficient to complete actions necessary to provide the Full Capability buildouts envisioned in the Blueprint and identified by the RAs. Recently, the RAs submitted budget requests covering FY16 through FY20 budget years. The RAs typically identified three levels or tiers of actions based on potential levels of appropriations and funding. The activities identified in the Proposed Action represent the priority actions to be implemented consistent with the levels of funding historically available and the Tier 3 budget requests submitted by the RAs. The historical funding levels have been approximately 50 to 60 percent of the funding necessary to fully implement the Full Capability buildout identified in the Blueprint. Therefore, if funding is below the full Tier 3 request, the actions taken would be reduced and environmental impacts would be lower. However, progress in reaching full system capabilities and the benefits associated with the more robust data system would not be realized. Additionally, the associated benefits with the full system capabilities outweigh the increase of environmental impacts from the proposed action to the full system capabilities alternative. Table 2-1 summarizes these Tier 3 levels and additional details discussed by each RA are provided in subsequent subsections.

In the sections below, the actions proposed by each RA in its FY16 through FY20 budget request are summarized in Table 2-2 through Table 2-12. For all RAs, the impacts have been assessed based on a consistent set of conditions and assumptions for conduct of similar actions. For maintenance of buoys and sensor packages, it is assumed that the locations would be accessed using small surface vessels less than 65 feet in length, and that the vessels would observe applicable regulations regarding interactions with marine mammals and other protected species and in accordance with conditions established in consultation under the ESA. Specific conditions related to mitigation of impacts associated with specific actions are discussed in detail in Section 4.5.

**Table 2-1. Proposed Action Buildouts by Region**

| ACTIVITY | REGIONAL ASSOCIATION | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PacIOOS** | **AOOS** | **NANOOS** | **CeNCOOS** | **SCCOOS** | **GC** | **SECOORA** | **CariCOOS** | **MARACOOS** | **NERACOOS** | **GLOS** | **TOTAL** |
| | **NOTE: The ratios in each column represent No Action (Current Status) / Proposed Action.** | | | | | | | | | | | |
| Fixed shore station, water quality systems | 12/17 | 3/6 | 27/32 | 9/12 | 19/21 | 105/150 | 37/42 | 0/2 | 21/26 | 0/11 | 1/15 | **234/334** |
| Fixed platforms | 0/0 | 65/65 | 0/19 | 6/8 | 0/0 | 26/26 | 2/2 | 23/24 | 4/12 | 0/8 | 3 /4 | **106/168** |
| Fixed seafloor, bottom-mounted station | 0/0 | 18/18 | 5/5 | 0/2 | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | **23/50** |
| Moorings, buoys | 13/14 | 1/10 | 17/18 | 8/12 | 0/0 | 44/62 | 10/11 | 4/5 | 1/5 | 28/33 | 10/13 | **130/183** |
| Cabled coastal ocean observatory | 1/1 | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | 0/3 | **1/4** |
| Video camera | 0/0 | 95/95 | 0/0 | 10/10 | 0/0 | 0/0 | 0/0 | 0/2 | 0/0 | 0/0 | 0/0 | **105/107** |
| Drifters | 0/0 | 4/4 | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | 0/50 | 0/0 | 0/0 | **4/54** |
| Glider | 6/6 | 0/1 | 2/5 | 2/3 | 11/11 | 2/20 | 1/6 | 0/1 | 9/11 | 0/1 | 0/3 | **51/68** |
| Vessel transect | 0/0 | 0/7 | 0/7 | 0/6 | 9/9 | 0/0 | 0/22 | 0/1 | 0/35 | 0/15 | 0/3 | **9/105** |
| AUV | 0/0 | 0/0 | 0/0 | 0/1 | 0/0 | 3/33 | 0/0 | 0/1 | 0/8 | 0/1 | 0/8 | **0/52** |
| HF Radar | 4/4 | 3/5 | 11/21 | 29/40 | 34/39 | 8/16 | 14/16 | 2/11 | 33/43 | 9/13 | 0/0 | **147/208** |

Of the activities included in the Proposed Action, IOOS experience suggests that the placement of moorings and anchors will have the greatest potential for impacts to aquatic species. Therefore, for mooring and anchor placement, the following conditions would apply:

1. Survey stakeholders to determine a general location. Interviews are conducted with commercial and recreational sectors, and regulatory and compliance agencies. The local U.S. Coast Guard (USCG) authorities would be involved early in the process.
2. Review existing charts of the area to locate possible mooring locations. Typically, up to 5 sites may be targeted.
3. If necessary, dive at the location and determine biological cover (e.g., in the Caribbean) and issue a detailed site survey report. Sites that are primarily sand/rubble and are largely free of sessile fauna and flora are recommended. In other areas, survey reports can be done without the need for divers.
4. Voluntarily submit the sites to local NOAA officials for clearance with recommendation for final locations. Additional agencies are consulted as needed.
5. Submit paperwork if required by applicable regulations to the U.S. Army Corps of Engineer (USACE), the USCG, or appropriate state agencies for buoys in state waters.

Examples of oceanographic moorings (see Appendix D) include buoys and fixed arrays (seafloor and shore stations) and the associated hardware (e.g., anchors, trawl resistant cages) required to keep the moorings on station and protect onboard scientific instruments. Moorings are typically 1–3 meters in diameter. The anchors are designed so that drag is minimal. The vessels used for oceanographic mooring deployments and routine maintenance activities typically remain on-station or move very slowly and would not pose a collision threat to marine mammals or sea turtles. Most moorings are deployed for more than 10 years and are serviced in place. When moorings have to be removed for maintenance the buoy can either be detached from the anchor or the anchors are removed. After refurbishment, the moorings are reattached to the anchors or the mooring and anchors are redeployed. In areas where there is ice cover (e.g., the Great Lakes), the buoys and anchors are removed for the winter and redeployed when the ice has melted. When a mooring is permanently removed, all equipment (i.e., the buoy, array, and anchors) is removed.

If an RA proposes an action that is not consistent with those described in this PEA, then additional NEPA analysis would be necessary prior to project decision.

#### 2.1.1.1 PacIOOS

PacIOOS currently proposes observational activities around the Republic of Palau, the Federated States of Micronesia, the Republic of the Marshall Islands, Guam, the Commonwealth of the Northern Mariana Islands, American Samoa, and Hawaii (Taylor 2011) (Figure 2-1). No new activities are currently proposed for the U.S. Minor Outlying Islands (Howland, Baker, Johnston, Jarvis, Kingman, Palmyra, Midway, and Wake). A summary of proposed activities for FY16 and FY20 for PacIOOS is shown in Table 2-2.

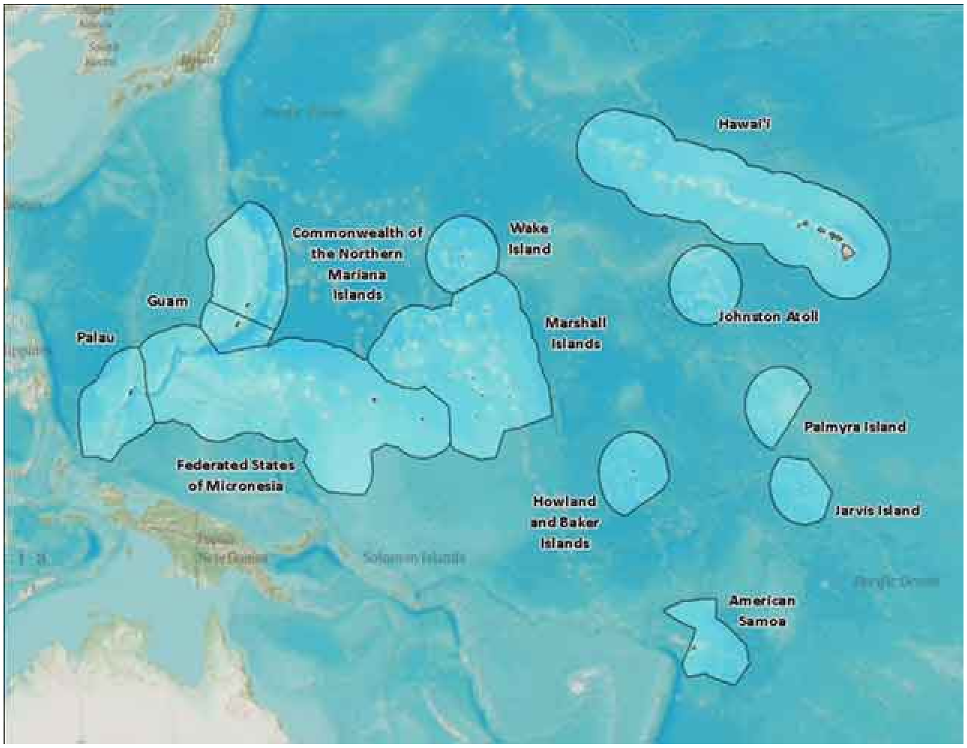


**Figure 2-1. ROI for PacIOOS**

**Table 2-2. Activities Proposed by PacIOOS for FY16–FY20**

| **Technology** | **Proposed Activities** |
|---|---|
| Sensors/ Instrumentation | • Maintain nearshore sensor packages<br>• Purchase and deploy 2 nitrate sensors—*Yap/Palau*<br>• Purchase and deploy 14 water quality sensor packages—*throughout the region*<br>• Purchase and deploy 2 current meters—*No location specified.*<br>• Purchase and deploy 35 new tags and receivers on sharks—*throughout the region* |
| Vessels/Sampling | • Maintain automated acoustic receivers array and VR3S modem fish tags and continue technology development—*span the Hawaiian archipelago from Midway Atoll to the Island of Hawaii* |
| Gliders/AUVs/ Drifters | • Purchase and deploy one Liquid Robotics Wave Glider with carbon dioxide sensors and Acoustic Doppler Current Profiler and subsurface sensors—*Hawaiian Islands*<br>• Conduct monthly 1-day AUV water quality surveys—*along south shore of Oahu, HI*<br>• Conduct additional event response-driven AUV surveys |

| Technology | Proposed Activities |
|---|---|
| Moorings/Stations Buoys/ Fixed Arrays | • Purchase and deploy five water quality buoys—*Kaneohe Bay and Island of Hawaii*<br>• Maintain existing buoys—*Throughout ROI*<br>• Expand wave buoy, current meter, and water level station capability to three other harbors—*offshore important harbors in Hawaii (Haleiwa, Hilo, Kahului)* |
| HF Radar | • Maintain four existing HF Doppler radio systems and add two new locations[a]—*existing locations on southern shore of Oahu, HI; new locations at Barber's Point in southwest coast of Oahu, HI, and Kaena Point in the northwest coast of Oahu, HI* |
| Sonar/LIDAR | • Expand to eight tripod scanning LIDAR locations—*Hawaiian Islands and Insular Pacific* |

Source: Ostrander 2015

Note: [a] Hardening the existing HF radar network would consist of enhancing sensor housings to withstand extreme weather events, addition of backup or uninterruptable power supplies, and provision of redundant communications channels. Installation of power supplies for new or hardened locations may require trenching for burial of power lines to existing electrical grids.

#### 2.1.1.2 AOOS

AOOS encompasses three Alaskan coastal and ocean observing sub-systems; the Gulf of Alaska, Bering Sea/Aleutian Islands, and Arctic Ocean (see Figure 2-2) (Dutton 2010). A summary of proposed activities for FY16–FY20 for AOOS is shown in Table 2-3.

**Figure 2-2. ROI for AOOS**

**Table 2-3. Activities Proposed by AOOS for FY16–FY20**

| Technology | Proposed Activities |
|---|---|
| Sensors/ Instrumentation | • Sustain weather observation systems<br>• Add Automatic Identification System stations in remote locations<br>• Maintain eight SnoTel (snowpack and climate sensors)—*Prince William Sound*<br>• Add water level meter—*Unalakleet*<br>• New monitoring packages for three previously installed nearshore moorings—*Prince William Sound* |
| Vessels/Sampling | • Conduct two cruises a year (May and August/September)—*along the Seward Line (northern Gulf of Alaska)*<br>• Conduct ocean acidification sampling two times per year—*along the Seward Line (northern Gulf of Alaska)*<br>• Small vessel conductivity, temperature, and depth surveys/deployments—*Kachemak Bay and lower Cook Inlet* |
| Gliders/AUVs/ Drifters | • New glider for opportunistic sampling during El Niño and La Niña events—*along the Seward Line (north Gulf of Alaska); Slocum Glider in the Chukchi Sea*<br>• *Add glider flights to monitor ocean conditions and marine mammals* |
| Moorings/Stations Buoys/ Fixed Arrays | • Purchase and install three wave buoys—*Chukchi Sea off coast of Red Dog Mine port site south of Kivalina; Bristol Bay; off Yakutat coast, Gulf of Alaska*<br>• Maintain autonomous moorings: surface and bottom sensor package that will measure $pCO_2$, pH, temperature, salinity, nitrate, oxygen, chlorophyll, and turbidity—*likely southeastern Alaska and lower Cook Inlet* |
| HF Radar | Map surface currents using existing systems |
| Sonar/LIDAR | Not Applicable |

Source: Riemer 2015

#### 2.1.1.3 NANOOS

NANOOS encompasses the waters from the U.S.-Canadian border in Washington to northern California and from the saltwater intrusion extent within bays and estuaries to the seaward extent of the U.S. Exclusive Economic Zone (EEZ) (see Figure 2-3) (Newton 2010). A summary of proposed activities for FY16–FY20 for NANOOS is shown in Table 2-4.

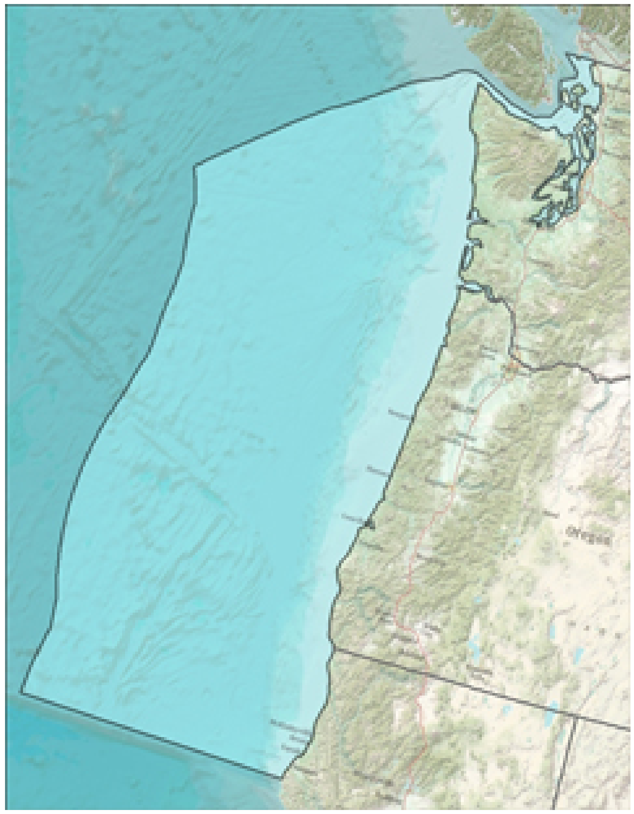

**Figure 2-3. ROI for NANOOS**

**Table 2-4. Activities Proposed by NANOOS for FY16–FY20**

| **Technology** | **Proposed Activities** |
|---|---|
| Sensors/<br>Instrumentation | • Equip 60–80 crab pots with temperature sensors and oxygen sensors—*within estuaries from the near shore (5 m depth) to the shelf break (200 m depth), over hundreds of kilometers along-shore.*<br>• Deploy $pCO_2$ analyzers in one estuary—*location not specified*<br>• Add a Vemco tracking receiver to the Cha'ba buoy—*off La Push, WA*<br>• Add sensors to select moorings |
| Vessels/Sampling | • Expand beach monitoring—*Columbia River littoral cell, Rockaway littoral cell* |
| Gliders/AUVs/<br>Drifters | • Add a second glider—*La Push, WA coast*<br>• Continue conducting operation of gliders—*Various locations* |
| Moorings/Stations<br>Buoys/<br>Fixed Arrays | • Contribute to maintenance and operation of existing buoys—*Various locations* |

| Technology | Proposed Activities |
|---|---|
| HF Radar | • Sustain 11 existing installations—*Northern California to Southern Washington*<br>• Harden existing HF radar installations[a], assign personnel, and expand data and product delivery—*Specific locations unknown*<br>• Add four new installations—*Central and Northern Washington* |
| Wave Radar | • Operation and maintenance (O&M) of existing marine radar wave observation site—*Newport, OR jetties* |
| Sonar/LIDAR | Not Applicable |

Source: Newton 2010

Note: [a] Hardening the existing HF radar network would consist of enhancing sensor housings to withstand extreme weather events, addition of backup or uninterruptable power supplies, and provision of redundant communications channels. Installation of power supplies for new or hardened locations may require trenching for burial of power lines to existing electrical grids.

#### 2.1.1.4 CeNCOOS

CeNCOOS encompasses over 960 km of coastline from the California-Oregon border south to Point Conception, California, and from the coastline out to the seaward extent of the EEZ (Ramp 2010) (Figure 2-4). A summary of proposed activities for FY16–FY20 for CeNCOOS is shown in Table 2-5.

**Figure 2-4. ROI for CeNCOOS**

**Table 2-5. Activities Proposed by CeNCOOS for FY16–FY20**

| Technology | Proposed Activities |
|---|---|
| Sensors/ Instrumentation | • Add harmful algal bloom and carbon variables to the shore stations; improve indices for upwelling response and chlorophyll-a from shore stations<br>• Add pH and $pCO_2$ sampling—*Moss Landing sea water intake sampling station* |
| Vessels/Sampling | • Institute the Bodega Ocean Observing Line (combination of vessel and AUV-based sensors) |
| Gliders/AUVs/ Drifters | • Add new glider line[a]—*Bodega Bay* |
| Moorings/Stations Buoys/ Fixed Arrays | • Maintain automated coastal shore stations—*Various locations*<br>• Continue operating coastal water quality stations and two buoy-mounted water quality stations—*in Marine Protected Areas (MPAs) in the Bodega Bay/Point Reyes sector*<br>• Maintain meteorological data collection station—*Moss Landing Marine Laboratory* |
| HF Radar | • Harden the HF radar surface current mapping network to reduce down time, improve accuracy, and produce products[b]—*location not specified*<br>• Maintain and operate HF radar surface current mapping stations—*Various locations*<br>• Add 11 new surface current mapping stations to fill gaps—*San Francisco Bay, Morro Bay* |
| Sonar/LIDAR | • Not Applicable |

Source: Anderson 2015.
Notes:
[a] A glider line is the path in which a glider travels. Typically the line is not traveled more than once and is typically not a straight line. No physical cables or other attachments would be installed.
[b] Hardening the existing HF radar network would consist of enhancing sensor housings to withstand extreme weather events, addition of backup or uninterruptable power supplies, and provision of redundant communications channels. Installation of power supplies for new or hardened locations may require trenching for burial of power lines to existing electrical grids.

### 2.1.1.5 SCCOOS

SCCOOS encompasses the Southern California Bight (Terrill et al. 2010) from Point Conception to San Diego, California and includes the Channel Islands (Figure 2-5). A summary of proposed activities for FY16–FY20 for SCCOOS is shown in Table 2-6.

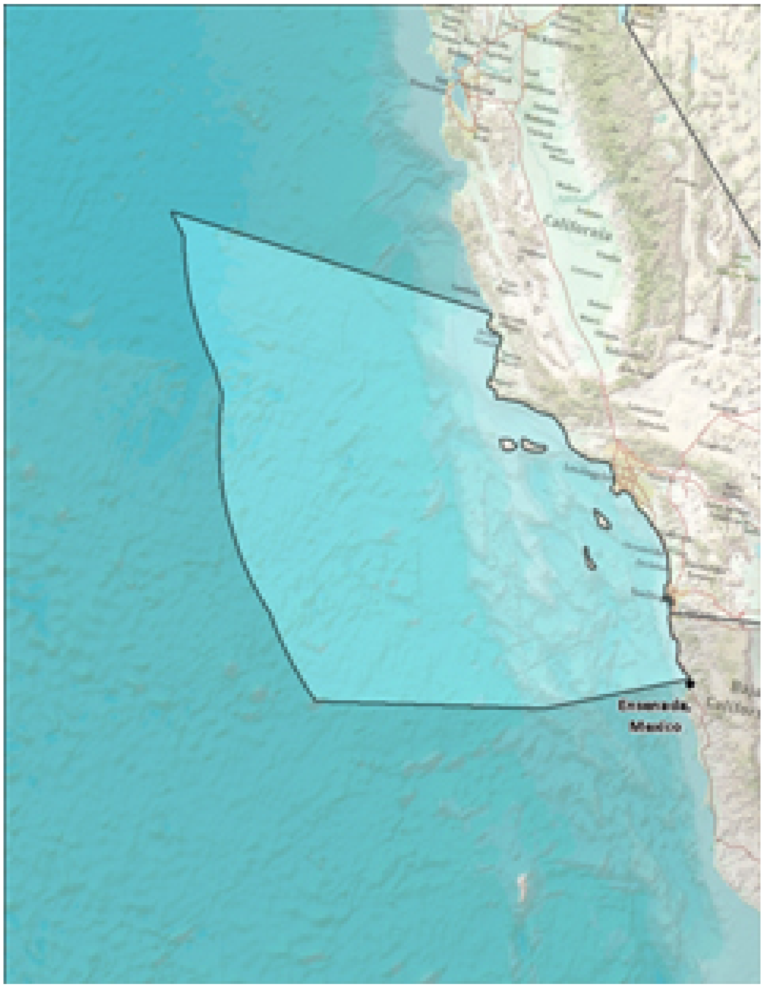

**Figure 2-5. ROI for SCCOOS**

**Table 2-6. Activities Proposed by SCCOOS for FY16–FY20**

| **Technology** | **Proposed Activities** |
|---|---|
| Sensors/ Instrumentation | • Add acoustic sensors to gliders<br>• Maintain sensor packages |
| Vessels/Sampling | • Storm events: monitor storm inundation at selected locations, including measuring run-up heights and inundation using pressure sensors, video cameras, and visual observations<br>• Pre- and post-storm events: survey sand levels on beaches |
| Gliders/AUVs/ Drifters | • Establish 5 glider lines[a]—*along the West Coast*<br>• Collaborate with CeNCOOS for new glider lines—*in Northern California*<br>• Deploy gliders to detect and map hazardous algal blooms—*Los Angeles area* |
| Moorings/Stations | • Maintain five pier-monitoring sites |

| Technology | Proposed Activities |
|---|---|
| Buoys/<br>Fixed Arrays | |
| HF Radar | • Add five sites to HF radar array[b]—*along the Southern California Bight* |
| Sonar/LIDAR | Not Applicable |

Source: Terrill et al. 2010

Notes: [a] A glider line is the path in which a glider travels. Typically the line is not traveled more than once and is typically not a straight line.

[b] The five new HF radar sites would operate in Marine Protected Areas and nearshore ecosystems in Santa Monica Bay and North San Diego

#### 2.1.1.6 GCOOS

GCOOS encompasses the Gulf of Mexico, the ninth largest body of water in the world, bordered by Mexico and five U.S. states: Texas, Louisiana, Mississippi, Alabama, and the west coast of Florida (Jochens 2011) (Figure 2-6). A summary of proposed activities for FY16–FY20 for GCOOS is shown in Table 2-7.

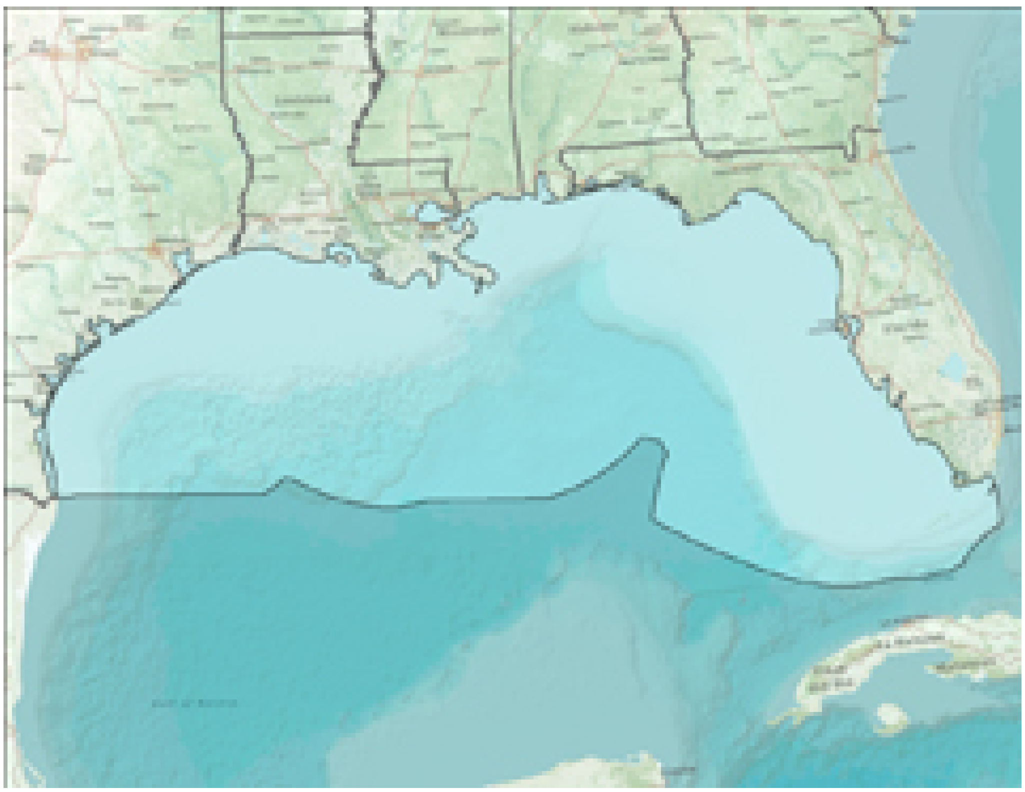

**Figure 2-6. ROI for GCOOS**

**Table 2-7. Activities Proposed by GCOOS for FY16–FY20**

| Technology | Proposed Activities |
|---|---|
| Sensors/ Instrumentation | • Hypoxia monitoring system for the Gulf: maintain real-time dissolved oxygen to an existing monitoring station—*Breton Sound, Louisiana*<br>• Develop enhancements to Physical Oceanographic Real-Time Systems—*location not specified* |
| Vessels/Sampling | • Partial support for the O&M existing harmful algal bloom observational systems: Beach Conditions Reporting System on 33 beaches—*Florida* |
| Gliders/AUVs/ Drifters | • Partial support for O&M for two glider systems already owned by partners—*location not specified* |
| Moorings/Stations Buoys/ Fixed Arrays | • Support for existing real-time observing system—*Big Bend Region of Florida at the Air-Force Tower, site N7*<br>• Moored buoy network: support for existing moorings and upgrades, plus supplements with moored measurements to existing oil and gas platforms—*Shelf moorings (outer shelf, inner shelf, mid shelf), continental slope and deepwater moorings, and moorings in bays and estuaries* |
| HF Radar | • Maintain and expand HF radar Observing System by 8 sites[a]—*Initially Gulf coast offshore, then near-coast.*<br>• O&M support for Coastal Ocean Dynamics Applications Radar (CODARs)—*Mississippi-Alabama-Florida panhandle* |
| Sonar/LIDAR | Not Applicable |

Source: Kirkpatrick 2015

Note: [a] Hardening the existing HF radar network would consist of enhancing sensor housings to withstand extreme weather events, addition of backup or uninterruptable power supplies, and provision of redundant communications channels. Installation of power supplies for new or hardened locations may require trenching for burial of power lines to existing electrical grids.

### 2.1.1.7 SECOORA

SECOORA encompasses four states along the Atlantic Coast in the southeastern United States—North Carolina, South Carolina, Georgia, and Florida—and includes part of the Gulf of Mexico along western Florida (Hernandez et al. 2011) (Figure 2-7). SECOORA includes three sub-regions: (1) along the wide West Florida Shelf, where the Loop Current extension into the Gulf and the ring shedding cycle can dramatically change current proximity to the shelf edge; (2) along southern and eastern Florida south of Cape Canaveral, where the shelf is extremely narrow and the Gulf Stream's path and meander envelope are tightly constrained by the Straits of Florida; and (3) the South Atlantic Bight between Cape Hatteras and Cape Canaveral, where the confluence of the Antilles Current and the Florida Current forms the core of the Gulf Stream. A summary of proposed activities for FY16–FY20 for SECOORA is shown in Table 2-8.

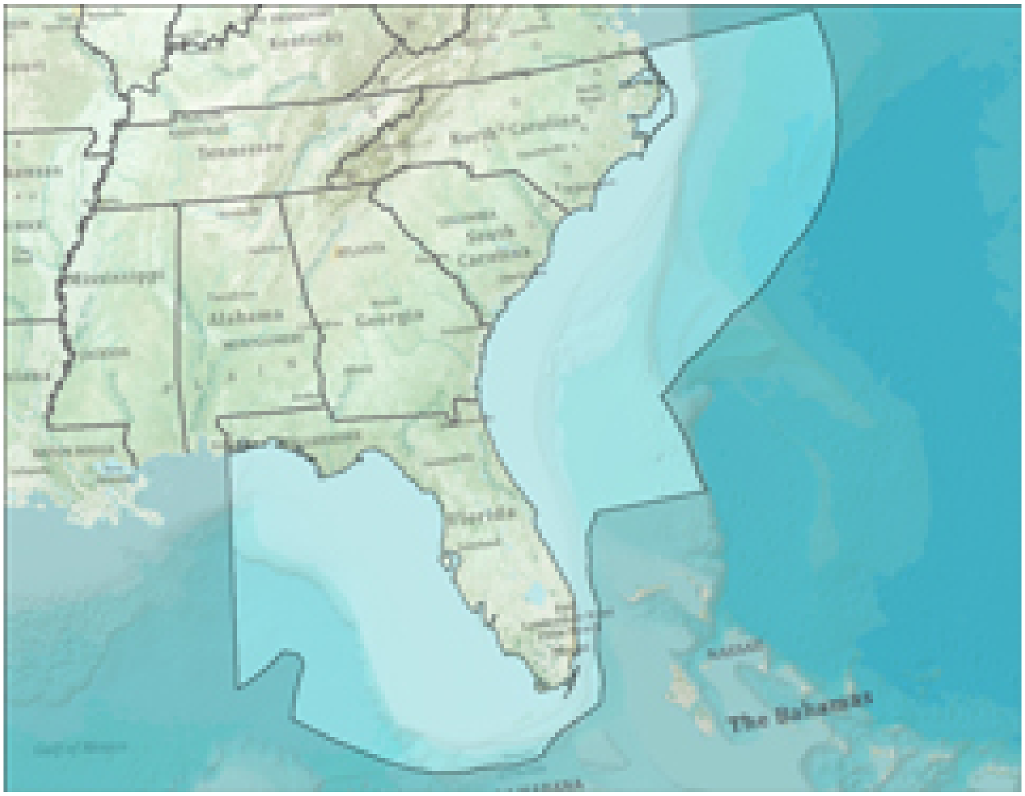


**Figure 2-7. ROI for SECOORA**

**Table 2-8. Activities Proposed by SECOORA for FY16–FY20**

| **Technology** | **Proposed Activities** |
|---|---|
| Sensors/ Instrumentation | • Operate and maintain a storm event monitoring system |
| Vessels/Sampling | Not Applicable |
| Gliders/AUVs/ Drifters | • Support operations of four existing gliders—*South Atlantic Bight*<br>• Expand flights of existing gliders—*Various locations*<br>• Procure five additional gliders and deploy—*Various locations*<br>• Deploy simple student-built drifters |
| Moorings/Stations Buoys/ Fixed Arrays | • O&M of existing offshore moored stations (13) and coastal stations (16)<br>• Procure and deploy two new water quality buoys—*Charleston* |
| HF Radar | • Add two new CODAR stations[a]—*Vero Beach and Kennedy Space Center* |
| Sonar/LIDAR | Not Applicable |

Source: Hernandez et al. 2011

Note: [a] Hardening the existing HF radar network would consist of enhancing sensor housings to withstand extreme weather events, addition of backup or uninterruptable power supplies, and provision of redundant communications channels. Installation of power supplies for new or hardened locations may require trenching for burial of power lines to existing electrical grids.

### 2.1.1.8 CariCOOS

CariCOOS encompasses the coastal areas of Puerto Rico and the U.S. Virgin Islands (USVI) (the U.S. Caribbean EEZ) (Morell 2011) (Figure 2-8). A summary of proposed activities for FY16–FY20 for CariCOOS is shown in Table 2-9.

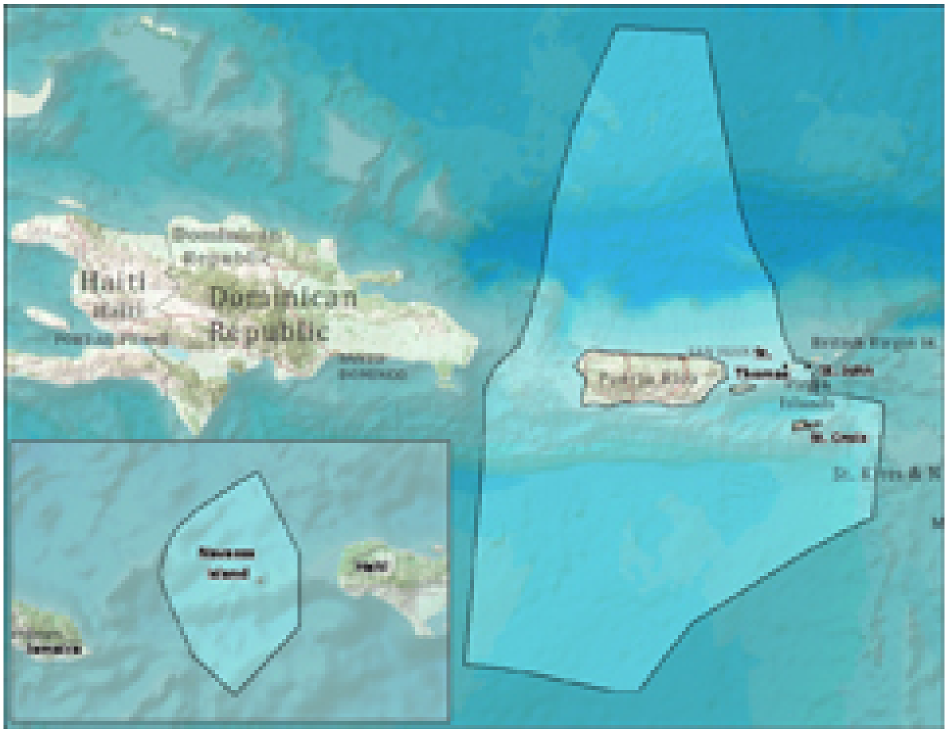


**Figure 2-8. ROI for CariCOOS**

**Table 2-9. Activities Proposed by CariCOOS for FY16–FY20**

| **Technology** | **Proposed Activities** |
|---|---|
| Sensors/ Instrumentation | • Deploy water quality sensors.<br>• Deploy turbidity sensor network. |
| Vessels/Sampling | • Use a personal watercraft as a bathymetry surveying system |
| Gliders/AUVs/ Drifters | • Maintain existing gliders. |
| Moorings/Stations Buoys/Fixed Arrays | • Install and operate one near-shore buoy.<br>• Install and operate two deep water buoys. |
| HF Radar | • Install 9 New 12MHz systems[a] |
| Sonar/LIDAR | Not Applicable |

Source: Morell 2011

Note: [a] Hardening the existing HF radar network would consist of enhancing sensor housings to withstand extreme weather events, addition of backup or uninterruptable power supplies, and provision of redundant communications channels. Installation of power supplies for new or hardened locations may require trenching for burial of power lines to existing electrical grids.

### 2.1.1.9 MARACOOS

MARACOOS encompasses the Mid-Atlantic Bight, which extends 1,000 km alongshore from Cape Cod, Massachusetts, to Cape Hatteras, North Carolina. The region includes 10 states, the northernmost coast of North Carolina, Virginia, Maryland, Delaware, Pennsylvania, New Jersey, New York, Connecticut, Rhode Island, and Massachusetts, as well as the District of Columbia (Glenn 2010) (Figure 2-9). A summary of proposed activities for FY16–FY20 for MARACOOS is shown in Table 2-10.

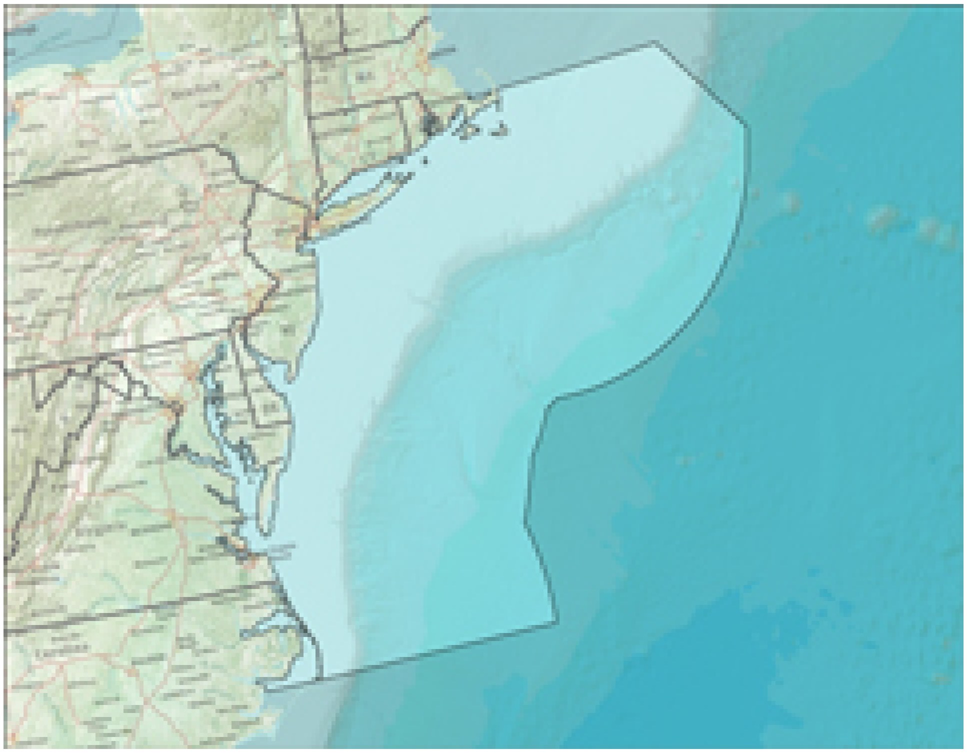

**Figure 2-9. ROI for MARACOOS**

**Table 2-10. Activities Proposed by MARACOOS for FY16–FY20**

| Technology | Proposed Activities |
|---|---|
| Sensors/ Instrumentation | • Maintain existing sensor packages |
| Vessels/Sampling | Not Applicable |
| Gliders/AUVs/ Drifters | • Simultaneously sample five cross-shelf triangles twice a year—*locations not specified*<br>• Procure and deploy 2 new gliders to complement existing MARACOOS glider fleet—*locations not specified* |
| Moorings/Stations Buoys/ Fixed Arrays | • Procure and deploy new moored ocean acidification buoy—*Location not specified* |

| Technology | Proposed Activities |
|---|---|
| HF Radar | • Enhance data quality and coordinate with surface drifters—*locations not specified* |
| Sonar/LIDAR | Not Applicable |
| Satellite | • Continue operating regional satellite network—*ground station at Rutgers University*<br>• Enhance existing capability with new satellite receiving station—*University of Delaware* |

Source: Glenn 2010

### 2.1.1.10 NERACOOS

NERACOOS extends from the Canadian Maritimes to Long Island Sound. It includes the coastal waters of Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut and encompasses the Gulf of Maine and Long Island Sound (Morrison 2011) (Figure 2-10). A summary of proposed activities for FY16–FY20 for NERACOOS is shown in Table 2-11.

**Figure 2-10. ROI for NERACOOS**

**Table 2-11. Activities Proposed by NERACOOS for FY16–FY20**

| Technology | Proposed Activities |
|---|---|
| Sensors/ | • Deploy and operate sensors: 5 different types of nutrient sensors (11 |

| Technology | Proposed Activities |
|---|---|
| Instrumentation | units total)—*University of Rhode Island dock; buoy integration* |
| Vessels/Sampling | • Harmful Algal Bloom Sampling: weekly shipboard sampling over an existing fixed array of five stations from May to October—*Outer Bay of Fundy* |
| Gliders/AUVs/ Drifters | • Maintain existing systems. |
| Moorings/Stations Buoys/ Fixed Arrays | • Add pH and CO2 sensors to buoys—*Gulf of Maine*<br>• Continue operating buoys currently deployed—*Various locations.* |
| HF Radar | • Continue operation—*northeastern Gulf of Maine* |
| Sonar/LIDAR | Not Applicable |

Source: Morrison 2011

#### 2.1.1.11 GLOS

GLOS encompasses the five Great Lakes—Lake Superior, Lake Michigan, Lake Huron, Lake Erie, and Lake Ontario—and the St. Lawrence River (Figure 2-11). Bordering this region are eight states including New York, Pennsylvania, Ohio, Indiana, Illinois, Wisconsin, Minnesota, Michigan, as well as two Canadian provinces (NOAA 2012c). A summary of proposed activities for FY16–FY20 for GLOS is shown in Table 2-12.

**Figure 2-11. ROI for GLOS**

**Table 2-12. Activities Proposed by GLOS for FY16–FY20**

| Technology | Proposed Activities |
|---|---|
| Sensors/ Instrumentation[1] | • Maintain the near shore network/enhance evaporation and biological sensors—*Various locations* |
| Vessels/Sampling | Not Applicable |
| Gliders/AUVs/ Drifters | • Provide limited support and coordinate deployment of mobile assets (AUV/glider) |
| Moorings/Stations Buoys/Fixed Arrays[3] | • Maintain and operate the Nearshore Network of *in situ* observing platforms (buoys and fixed structures) and sensors—*Lakes Superior, Huron, Ontario, Erie, and Michigan* |
| HF Radar | Not Applicable |
| Sonar/LIDAR | Not Applicable |

Source: Paige 2015.

## 2.2 FULL CAPABILITIES ALTERNATIVE

The Full Capabilities Alternative assumes that budget constraints are not a barrier to execution of the buildout plans developed by the RAs for the Blueprint. Under the Full Capabilities Alternative all proposed equipment acquisitions, deployments, maintenance and operations discussed by the RAs in the Blueprint would be completed. Table 2-13 summarizes the additional deployments that would be necessary to reach the Full Capabilities status by the end of FY20. The specifics of the Full Capabilities Alternative for each RA are identified in Table 2-14 through Table 2-24.

**Table 2-13. Full Capabilities Alternative Buildouts by Region**

| ACTIVITY | REGION | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PacIOOS | AOOS | NANOOS | CeNCOOS | SCCOOS | GCCOOS | SECOORA | CariCOOS | MARACOOS | NERACOOS | GLOS | **TOTAL** |
| | **NOTE: The ratios in each column represent No Action (Current Status) / Full Capabilities.** | | | | | | | | | | | |
| Fixed shore station, water quality systems | 12/103 | 3/15 | 27/90 | 9/20 | 19/39 | 105/200 | 37/124 | 0/4 | 21/30 | 0/30 | 1/30 | **234/685** |
| Fixed platforms | 0/36 | 65/65 | 0/36 | 6/9 | 0/40 | 3/3 | 2/36 | 23/25 | 4/20 | 0/15 | 3/15 | **106/300** |
| Fixed seafloor, bottom- mounted station | 0/220 | 18/18 | 5/5 | 0/3 | 0/0 | 0/0 | 0/10 | 0/2 | 0/0 | 0/0 | 0/0 | **23/258** |
| Moorings, buoys | 13/27 | 13/37 | 17/38 | 8/16 | 0/25 | 26/26 | 10/89 | 4/11 | 1/32 | 28/47 | 10/16 | **130/364** |
| Cabled coastal ocean observatory | 1/1 | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | 0/5 | **1/6** |
| Video camera | 0/0 | 95/95 | 0/0 | 10/10 | 0/0 | 0/0 | 0/0 | 0/2 | 0/0 | 0/0 | 0/0 | **105/107** |
| Drifters | 0/0 | 4/4 | 0/0 | 0/0 | 0/0 | 0/0 | 0/150 | 0/0 | 0/50 | 0/150 | 0/0 | **4/354** |
| Glider | 6/8 | 0/10 | 2/8 | 2/9 | 11/12 | 20/20 | 1/34 | 0/2 | 9/50 | 0/10 | 0/5 | **51/168** |
| Vessel transect | 0/0 | 0/7 | 0/7 | 0/6 | 9/9 | 0/0 | 0/22 | 0/1 | 0/35 | 0/15 | 0/7 | **9/109** |
| AUV | 0/2 | 0/0 | 0/0 | 0/2 | 0/2 | 3/33 | 0/4 | 0/1 | 0/15 | 0/2 | 0/15 | **3/76** |
| HF Radar | 4/28 | 3/22 | 11/31 | 29/50 | 34/42 | 8/36 | 14/39 | 2/29 | 33/52 | 9/25 | 0/0 | **147/354** |

#### 2.2.1.1 PacIOOS

**Table 2-14. Activities Proposed by PacIOOS for FY16–FY20**

| Technology | Proposed Activities |
| --- | --- |
| Sensors/ Instrumentation[a] | • Maintain array of 11 nearshore sensor packages (nine measure turbidity, temperature, salinity, and fluorescence; two monitor only salinity and temperature)—*across the PacIOOS ROI*<br>• Assemble instrument pool consisting of current meters, wave sensors, stream flow gages, and water quality sensors to conduct short-term process studies and evaluate baseline marine ecosystem properties—*across the PacIOOS ROI*<br>• Purchase and deploy 35 water quality sensor packages identified by ACT and PacIOOS (YSI 600 OMS with flourometer and Raven XT modem for real-time output)—*throughout the region*<br>• Purchase new tags and receivers; capture (using trolling, handlining, or baited hook shark line) and tag up to 100 individuals of non-protected species per year with acoustic and satellite transmitters and identification tags, specifically hammerhead shark, yellowfin tuna, sand bar shark, Galapagos shark, tiger shark, and other fishes, using Institutional Animal Care and Use Committee (IACUC)-approved protocols—*throughout the region* |
| Vessels/Sampling | • Maintain automated acoustic receivers array and VR3S modem fish tags and continue technology development—*span the Hawaiian archipelago from Midway Atoll to the Island of Hawaii* |
| Gliders/AUVs/ Drifters | • Purchase one Liquid Robotics Wave Glider with carbon dioxide sensors and Acoustic Doppler Current Profiler and subsurface sensors—*Hawaiian Islands*<br>• Conduct monthly 1-day AUV water quality surveys—*along south shore of Oahu, Hawaii*<br>• Conduct additional event response-driven AUV surveys |
| Moorings/Stations Buoys/Fixed Arrays[b] | • Annual operation and maintenance (O&M) of one real-time buoy (YSI EMM 68 buoy)—*Hilo Bay, Hawaii*<br>• Maintain water quality buoys—*locations not specified*<br>• Maintain three Datawell directional wave buoys—*surrounding Hawaii (Waimea Bay, Mokapu, and Lanai)*<br>• Maintain two Datawell buoys—*Guam, and Marshall Islands (Majuro)*<br>• Deploy and maintain three additional (already purchased) Datawell buoys—*offshore important harbors in Hawaii (Barber's Point, Kahului, Hilo)*<br>• Expand wave buoy, current meter, and water level station capability to three other harbors—*Oahu, Hawaii, and Maui (Haleiwa, Hilo, Kahului), Hawaii*<br>Maintain wave buoys, current meters, and water level stations |

| Technology | Proposed Activities |
|---|---|
| | deployed—*in Barber's Point Harbor and entrance channel*<br>• Maintain existing Kilo Nalu Observatory (cabled coastal ocean observatory)—*Waikiki, Hawaii*<br>• Maintain two deep water multi-purpose moorings with fixed sensors and profiling package; propose to integrate acoustic modems—*off the coast of Oahu, Hawaii* |
| HF Radar | • Maintain four existing high frequency Doppler radio systems and add two new locations—*existing locations on southern shore of Oahu, Hawaii; new locations at Barber's Point in southwest corner of Oahu, Hawaii, and Kaena Point in the northwest corner of Oahu, Hawaii* |
| Sonar/LIDAR | • Operate network of already deployed tripod scanning LIDAR at two focus sites (develop inundation-forecasting capability)—*on Oahu (Waikiki and Waimea), Hawaii*<br>• Plan to expand to eight tripod scanning LIDAR locations—*Hawaiian Islands and Insular Pacific* |

Source: Taylor 2011.

Notes: [a]ACT partner sites for field tests include sites in Maryland, Florida, Michigan, California, Alaska, and Hawaii. Demonstration of $pCO_2$ sensors may take place at additional sites beyond those indicated. Verification of *in situ* pH sensors will take place at locations that have yet to be determined (Tamburri 2010).

[b] Appendix D provides the descriptions and schematics for the types of moorings, stations, buoys and fixed arrays used in this region.

### 2.2.1.2 AOOS

**Table 2-15. Activities Proposed by AOOS for FY16–FY20**

| Technology | Proposed Activities |
|---|---|
| Sensors/ Instrumentation[a] | • Install and maintain a current meter—*Central Cook Inlet*<br>• Install water level sensors with bottom mount and shore-based bubbler system—*new village sites*<br>• Establish high-latitude observation node: bottom-mounted Acoustic Doppler Current Profiler and Seabird SBE-16 recorder measuring temperature, salinity, nutrients, $pCO_2$ and fluorescence on moorings—*central Chukchi Sea offshore of Wainwright*<br>• Add thermosalinographs to two research vessels—*vessel locations not specified*<br>• Test conductivity sensors—*Cordova tide station in Prince William Sound*<br>• Maintain eight SnoTel (snowpack and climate sensors)—*Prince William Sound*<br>• New monitoring packages for three previously installed nearshore moorings—*Prince William Sound* |

| Technology | Proposed Activities |
|---|---|
| Vessels/Sampling | • Conduct two cruises a year (May and August/September)—*along the Seward Line (north Gulf of Alaska)*<br>• Conduct ocean acidification sampling two times per year—*along the Seward Line (north Gulf of Alaska)*<br>• Small vessel conductivity, temperature, and depth surveys/deployments—*Kachemak Bay and lower Cook Inlet* |
| Gliders/AUVs/ Drifters | • New glider for opportunistic sampling during El Niño and La Niña events—*along the Seward Line (north Gulf of Alaska);* Slocum Glider in the Chukchi Sea |
| Moorings/Stations Buoys/ Fixed Arrays | • Purchase and install three WaveRider buoys—*Chukchi Sea off coast of Red Dog Mine port site south of Kivalina; Bristol Bay; off Yakutat coast, Gulf of Alaska*<br>• New telemetered mooring at GAK 1 station—*along the Seward Line (north Gulf of Alaska)*<br>• Purchase equipment (ice thickness and moored oxygen); replace pieces of equipment (hardware, anchors, floats); sustain biophysical moorings twice per year—*Bering Sea moorings*<br>• Establish high-latitude observation node: two moorings with spatial data collection by two Slocum gliders (operating in ice-free season) and small-vessel support—*central Chukchi Sea offshore of Wainwright*<br>• Deploy and maintain two new autonomous moorings: surface and bottom sensor package that will measure $pCO_2$, pH, temperature, salinity, nitrate, oxygen, chlorophyll, and turbidity—*likely southeastern Alaska and lower Cook Inlet*<br>• Purchase, test, and deploy a profiling mooring to provide high frequency depth-specific information on hydrographic properties for model assimilation, ground-truthing, and to augment a long-term dataset—*central Prince William Sound*<br>• Fund mooring turnovers for biological monitoring—*location not specified; will include support for acoustic monitoring equipment at entrances to Prince William Sound* |
| HF Radar | Seasonal HF radar deployment on the coast along the Chukchi Sea |
| Sonar/LIDAR | Not Applicable |

Source: Dutton 2010.

Note: [a] ACT partner sites for field tests include sites in Maryland, Florida, Michigan, California, Alaska, and Hawaii. Demonstration of $pCO_2$ sensors may take place at additional sites beyond those indicated. Verification of *in situ* pH sensors will take place at locations that have yet to be determined (Tamburri 2010).

### 2.2.1.3 NANOOS

**Table 2-16. Activities Proposed by NANOOS for FY16–FY20**

| Technology | Proposed Activities |
|---|---|
| Sensors/ Instrumentation | • Help support observation networks in Willapa Bay and South Slough/Coos Bay estuary clusters<br>• Equip 60-80 crab pots with temperature sensors and inexpensive oxygen sensors—*within estuaries from the near shore (5 m depth) to the shelf break (200 m depth), over hundreds of kilometers along-shore.* The crab pots are deployed by fishermen for their own use, and no NOAA funds are used for the deployment or retrieval of the crab pots.<br>• Deploy $pCO_2$ analyzers in one estuary—*location not specified (variety of regional sites with emphasis on sites stakeholders (e.g., shellfish growers) and educators (e.g., small- and community-college field sites) would maintain).*<br>• Integrate a miniaturized fish/mammal tracking receiver to the Seaglider—*La Push, Washington*<br>• Add a Vemco tracking receiver to the Cha-ba buoy—*off La Push, Washington*<br>• Add sensors to select moorings |
| Vessels/Sampling | • Conduct beach monitoring: monitoring components currently include geodetic control, topographic beach profiles, sediment size distributions, topographic 3D beach surface maps, nearshore bathymetry; Real-Time Kinematic Differential global positioning system surveying techniques: *Columbia River littoral cell, Rockaway littoral cell*<br>• Conduct beach monitoring: 119 permanently maintained existing sites and an additional 200-plus existing sites that are observed on ad hoc basis—*locations not specified*<br>• Conduct nearshore bathymetric surveys, measured using a personal watercraft-based coastal profiling system from approximately mean lower low water out to water depths greater than 10 m—*selected sites in Oregon and Washington*<br>• Zooplankton monitoring: new opportunistic sampling on cruises that are already planned (e.g., Washington buoy servicing cruises, University of Washington Puget Sound cruises)—*locations not specified* |
| Gliders/AUVs/ Drifters | • Continue conducting short-term operation of Seaglider AUV—*La Push, Washington coast*<br>• Continue conducting short-term operation of Slocum glider—*on the Washington shelf*<br>• Relocate glider observations mid-late 2012 from Newport line—*new location: off Crescent City, California* |

| Technology | Proposed Activities |
|---|---|
| | • Maintain Slocum glider with better sensor and technician support for all components<br>• Allow longer Slocum glider deployments<br>• Allow longer Seaglider deployments at La Push with better sensor and technician support for all components |
| Moorings/Stations Buoys/Fixed Arrays[a] | • Maintain operation of one buoy (NH-10 buoy)—*east-west Newport Hydrographic Line near Newport, Oregon*<br>• Allow longer deployments with better sensor and technician support.<br>• Maintain operations of surface Cha'ba mooring, sub-surface profiling mooring—*La Push, Washington coast*<br>• Maintain operation of NSF far-field plume mooring at 100 m and near-field plume mooring at 30 m—*just south of Columbia River on the Oregon shelf*<br>• Maintain station of 18 *in situ* endurance stations—*Columbia River estuary*<br>• Maintain Columbia River mooring operations with better sensor and technician support for all components<br>• Maintain operations for profiling moorings: six assets—*three in Hood Canal,* one *in Dabob Bay,* one *in Puget Sound main basin,* one *proposed in South Puget Sound*<br>• Support to currently deployed fixed mooring—*1 km from shore on Strawberry Hill Line (44.25N) at 15 m depth*<br>• Partially sustain the existing Yaquina Bay Land/Ocean Biogeochemical Observing Station—*Yaquina Bay, Oregon* |
| HF Radar | • Sustain 11 existing installations—*Northern California to Southern Washington*<br>• Harden existing HF radar installations, both hardware and personnel, and expand data and product delivery[b]<br>• Add three new HF radar sites—*Central and Northern Washington*<br>• Invest in a regional node to prepare and distribute mapped data from the U.S. West coast array<br>• Add a new observing capability through upgrade to a fully-coherent Doppler system to support better understanding of wave-current interaction processes in the inlet as well as water quality modeling efforts—*Yaquina Land/Ocean Biogeochemical Observatory (buoy), Yaquina Bay* |
| Wave Radar | • O&M of existing marine radar wave observation site—*Newport, Oregon jetties* |
| Sonar/LIDAR | • Add a LIDAR to each state to implement monitoring—*along coastal bluff* |

Source: Newton 2010

Notes: [a] Appendix D provides the descriptions and schematics for the types of moorings, stations, buoys and fixed arrays used in this region.
[b] Hardening the existing HF radar network would consist of enhancing sensor housings to withstand extreme weather events, addition of backup or uninterruptable power supplies, and provision of redundant communications channels. Installation of power supplies for new or hardened locations may require trenching for burial of power lines to existing electrical grids.

#### 2.2.1.4 CeNCOOS

**Table 2-17. Activities Proposed by CeNCOOS for FY16–FY20**

| **Technology** | **Proposed Activities** |
|---|---|
| Sensors/ Instrumentation[a] | • Add harmful algal bloom and carbon variables to the shore stations; improve indices for upwelling response and chlorophyll-a from shore stations<br>• Add pH and $pCO_2$ sampling—*Moss Landing sea water intake sampling station*<br>• Add new sensors to gliders for dissolved oxygen and ocean acidification—*location not specified* |
| Vessels/Sampling | • Conduct coordinated harmful algal bloom sampling—*along the central and northern California coast*<br>• Conduct surveys of ocean conditions: bi-weekly to monthly vessel-based plankton and larval fish sampling (see also glider sampling in same area)—*off the Russian River*<br>• Institute the Bodega Ocean Observing Line (combination of vessel and AUV-based sensors)<br>• Evaluate Liquid Robotics Wave Glider |
| Gliders/AUVs/ Drifters | • Maintain the across-shore Monterey Bay glider transect 24/7—*Monterey Bay*<br>• Add two new glider lines[c]—*Bodega Bay and Morro Bay*<br>• Conduct surveys of ocean conditions: bi-weekly to monthly continuous autonomous (glider) transects (see also vessel sampling in same area)—*off the Russian River*<br>• Institute the Bodega Ocean Observing Line (combination of vessel and AUV-based sensors); includes bird and marine mammal observations—*the Bodega Ocean Observing Node is centered at Bodega Marine Laboratory (38º19.110' N 123º04.294' W)* |
| Moorings/Stations Buoys/Fixed Arrays[b] | • Four ocean buoys with ocean acidification sensors (appear to be new buoys, but not explicitly stated)—*span Tomales Bay to Sand Hill Bluff*<br>• Add automated coastal shore stations—*Add new water quality monitoring station at the Monterey Commercial Wharf, as part of Monterey Bay Pier Data Assembly Center*<br>• Establish harmful algal bloom monitoring station—*Santa Cruz Wharf* |

| Technology | Proposed Activities |
|---|---|
| | • Maintain automated coastal shore stations—*north coast at Trinidad Head and Humboldt Bay; San Francisco Bay; one station in Pismo Beach, four in Morro Bay, one in San Luis Obispo Bay, one in Estero Bay; two stations at Bodega Head and Kibessilah Hill (near Fort Bragg)*<br>• Continue operating coastal water quality stations and two buoy-mounted water quality stations—*in Marine Protected Areas (MPAs) in the Bodega Bay/Point Reyes sector*<br>• Maintain meteorological data collection station—*Moss Landing Marine Laboratory* |
| HF Radar | • Harden the HF radar surface current mapping network to reduce down time, improve accuracy, and produce products[d] – *location not specified*<br>• Operate the north coast HF radar surface current mapping nodes—*Bodega Bay to the Oregon Border*<br>• Minor maintenance of the HF radar network—*northernmost node*<br>• Maintain and operate HF radar surface current mapping station—*San Francisco Bay and lower central coast*<br>• Add new surface current mapping stations to fill gaps—*San Francisco Bay, Morro Bay* |
| Sonar/LIDAR | • Conduct repeat seafloor mapping surveys using bathymetric sonar and mobile topographic LIDAR (as used for the original California Seafloor Mapping Project base maps)—*key areas such as MPAs and canyons to document where significant shoreline and seafloor change has taken place* |

Source: Ramp 2010.
Note:
[a] ACT partner sites for field tests include sites in Maryland, Florida, Michigan, California, Alaska, and Hawaii. Demonstration of $pCO_2$ sensors may take place at additional sites beyond those indicated. Verification of *in situ* pH sensors will take place at locations that have yet to be determined (Tamburri 2010).
[b] Appendix D provides the descriptions and schematics for the types of moorings, stations, buoys and fixed arrays used in this region.
[c] A glider line is the path in which a glider travels. Typically the line is not traveled more than once and is typically not a straight line.
[d] Hardening the existing HF radar network would consist of enhancing sensor housings to withstand extreme weather events, addition of backup or uninterruptable power supplies, and provision of redundant communications channels. Installation of power supplies for new or hardened locations may require trenching for burial of power lines to existing electrical grids.

### 2.2.1.5 SCCOOS

**Table 2-18. Activities Proposed by SCCOOS for FY16–FY20**

| Technology | Proposed Activities |
|---|---|
| Sensors/ Instrumentation [a] | • Add dissolved oxygen and nitrate sensors to gliders<br>• Design, install, and operate a system to measure CO2 levels—*Scripps pier*<br>• Include additional ocean acidification sensors on gliders and automated shore stations<br>• Automated shore station sampling at four pier sites (discussions are underway with the National Park Service to include additional ocean acidification sensors on SCCOOS platforms such as gliders and automated shore stations)—*San Diego, Orange County, Los Angeles, Santa Barbara* |
| Vessels/Sampling | • A time series section across the San Pedro Channel will be sustained using an underway conductivity-temperature-depth profiler; sampling will occur every other week—*from offshore of the Long Beach Breakwater to Two Harbors on Catalina Island*<br>• Extend quarterly sampling cruises to add nine stations near the coast to measure salinity, temperature, zooplankton, phytoplankton, and fish and invertebrate larvae<br>• Storm events: monitor storm inundation at selected locations, including measuring run-up heights and inundation using pressure sensors, video cameras, and visual observations<br>• Pre- and post-storm events: survey sand levels on beaches |
| Gliders/AUVs/ Drifters | • Bight-wide monitoring is accomplished on a series of lines, a round-trip section completed once every 2-3 weeks. Observed variables include temperature, salinity, velocity, and measures of phytoplankton, and zooplankton<br>• Establish glider lines[b]—*along the West Coast and Alaska*<br>• Collaborate with CeNCOOS for new glider lines—*in Northern California*<br>• Maintain hazardous algal bloom glider operations (30-day deployments)—*Santa Barbara Channel*<br>• Deploy gliders to detect and map hazardous algal blooms—*Los Angeles area* |
| Moorings/Stations Buoys/ Fixed Arrays | • Collect water properties at 10 existing shore stations<br>• Maintain five pier-monitoring sites that are part of the harmful algal bloom program, posting real-time temperature, salinity, water level, and chlorophyll fluorescence data to provide indications of fresh water input, upwelling, and algal blooms |
| HF Radar | • Continue the O&M of the HF radar array composed of 25 short and medium range systems and 6 long range systems—*along the* |

| Technology | Proposed Activities |
|---|---|
| | *Southern California Bight and interfaces with the CeNCOOS and NANOOS array to cover the entire West Coast* |
| Sonar/LIDAR | Not Applicable |

Source: Terrill et al. 2010.

Notes: [a] ACT partner sites for field tests include sites in Maryland, Florida, Michigan, California, Alaska, and Hawaii. Demonstration of $pCO_2$ sensors may take place at additional sites beyond those indicated. Verification of *in situ* pH sensors will take place at locations that have yet to be determined (Tamburri 2010).

[b] A glider line is the path in which a glider travels. Typically the line is not traveled more than once and is typically not a straight line.

### 2.2.1.6 GCOOS

**Table 2-19. Activities Proposed by GCOOS for FY16–FY20**

| Technology | Proposed Activities |
|---|---|
| Sensors/ Instrumentation [a] | • ACT: Verify *in situ* hydrocarbon sensors (moored and vertical profile testing of up to 10 instruments)—*Gulf of Mexico*<br>• Add telemetry to an existing offshore buoy—*Alabama*<br>• Hypoxia monitoring system for the Gulf: add and maintain real-time dissolved oxygen to an existing monitoring station—*Breton Sound, Louisiana*<br>• Develop a network of Autonomous Meteorological Data Monitoring Packages—*location not specified*<br>• Develop enhancements to Physical Oceanographic Real-Time Systems—*location not specified*<br>• Develop monitoring of the effects of Mississippi-Atchafalaya River discharge on the Gulf—*location not specified* |
| Vessels/Sampling | • Partial support for the O&M existing harmful algal bloom observational systems: Beach Conditions Reporting System on 33 beaches—*Florida* |
| Gliders/AUVs/ Drifters | • Partial support for O&M for two glider systems already owned by partners—*location not specified*<br>• Plan for gliders is in development; initial design is for gliders carrying a payload of Conductivity, Temperature, and Depth sensors, optical sensors for Colored Fraction of Dissolved Organic Matter, chlorophyll, turbidity and three channels of optical backscatter—*run in a saw tooth pattern around the Gulf of Mexico shelf*<br>• New gliders for deep water investigations/emergency situations |

| Technology | Proposed Activities |
|---|---|
| Moorings/ Stations Buoys/ Fixed Arrays | • Network of moored buoys: support for existing real-time observing system—*Big Bend Region of Florida at the Air-Force Tower, site N7*<br>• Moored buoy network: support for existing moorings and upgrades, plus supplements with moored measurements to existing oil and gas platforms—*Shelf moorings (outer shelf, inner shelf, mid shelf), continental slope and deepwater moorings, and moorings in bays and estuaries*<br>• Partial support for the O&M of existing harmful algal bloom observational systems: four Monitoring and Event Response for Harmful Algal Blooms AUV *in situ* sensor platforms—*Southwest Florida*<br>• Support to new provider of real-time data nodes: O&M support for seven real-time existing water quality monitoring stations—*Lake Okeechobee to the Gulf of Mexico, spanning 150 km*<br>• New moorings to fill gaps<br>• Partial support for the O&M of 26 Texas Coastal Ocean Observing System stations—*from South Padre Island to the Sabine River and Texas/Louisiana border*<br>• Partial support for the O&M of existing harmful algal bloom observational systems: local harmful algal bloom observatory for Public Health Protection—*Mote Marine Laboratory, Florida*<br>• Partial support for the O&M of existing harmful algal bloom observational systems: Imaging Flow Cytobot phytoplankton monitoring system—*Port Aransas, Texas*<br>• Hypoxia Monitoring System for the Gulf: maintain two of the real-time WAVCIS/BIO2 stations—*off Terrebonne Bay and Caminada Pass, Louisiana*<br>• Expand the existing sea level data observing network: upgrade systems, add approximately 30 new stations; add 5 to 10 sea level and meteorological data collection stations on oil platforms—*along the entire Gulf coast*<br>• Development of an advanced capability sentinel station—*deep-ocean* |
| HF Radar | • Maintain and expand HF radar Observing System for Surface Currents and Waves (combination of Coastal Ocean Dynamics Applications Radar (CODAR) Ocean Sensors Ltd. SeaSonde and Wellen Radars)—*Initially Gulf coast offshore, then near-coast. Three 5-MHz CODARs on Mississippi, Alabama coasts and Florida panhandle; three 5-MHz CODARs on West Florida Shelf; two 16-MHz WERA units in Florida Straits*<br>• O&M support for CODARs—*Mississippi-Alabama-Florida panhandle*<br>• Expand the current offshore HF radar network (8 sites) to 36 sites throughout the RA and on oil and gas platforms in the Gulf—*specific locations unknown* |

| Technology | Proposed Activities |
|---|---|
| Sonar/LIDAR | Not Applicable |

Source: Jochens 2011.

Notes: [a] ACT partner sites for field tests include sites in Maryland, Florida, Michigan, California, Alaska, and Hawaii. Demonstration of $pCO_2$ sensors may take place at additional sites beyond those indicated. Verification of *in situ* pH sensors will take place at locations that have yet to be determined (Tamburri 2010).

### 2.2.1.7 SECOORA

**Table 2-20. Activities Proposed by SECOORA for FY16–FY20**

| Technology | Proposed Activities |
|---|---|
| Sensors/ Instrumentation[a] | • Operate and maintain a storm event monitoring system (*integrated mobile observing system*) to support hurricane wind and water level measurements: shallow water storm surge and wave sensor network (*pressure sensors deployed in shallow water in forecast landfall area*); land-based real-time storm surge/wave/current sensors (*deployed in vulnerable locations*); and hurricane wind observing system (*deployed just outside landfall areas*)—includes deployment of portable wind towers and surge/wave sensors, onshore current measurement instruments, buoy structural components for north Florida buoy |
| Vessels/Sampling | Not Applicable |
| Gliders/AUVs/ Drifters | • Support operations of four existing gliders (the Slocum glider is equipped with conductivity-temperature-depth sensors and a full suite of bio-optical sensors to detect chlorophyll, colored dissolved organic matter, backscatter, and dissolved oxygen); in year 1, gliders transect limited to Georgia and North Carolina pilot areas, timed with spawning seasons of key fisheries and to overlap with modeling domains to support verification; in years 2-5, expand spatial and temporal coverage of gliders—*South Atlantic Bight*<br>• Deploy simple student-built drifters |
| Moorings/Stations Buoys/ Fixed Arrays | • Develop student-built Basic Operation Buoys; Advanced Basic Operation Buoys (provide U.S. Environmental Protection Agency (EPA) accepted data)<br>• O&M of existing offshore moored stations (13) and coastal stations (16)<br>• Enhance offshore array: redeploy decommissioned offshore moored station—*off northeast Florida coast*<br>• Enhance offshore array: deploy several offshore non-real time subsurface systems positioned to enable data comparison among mooring-derived, glider, and HF radar currents, and to support modeling verifications |

| Technology | Proposed Activities |
|---|---|
| HF Radar | • Maintain 14 HF radar sites (including both CODAR Ocean Sensors Ltd. SeaSonde deployments and Wellen Radars) |
| Sonar/LIDAR | Not Applicable |

Source: Hernandez et al. 2011.

Note: [a] ACT partner sites for field tests include sites in Maryland, Florida, Michigan, California, Alaska, and Hawaii. Demonstration of $pCO_2$ sensors may take place at additional sites beyond those indicated. Verification of *in situ* pH sensors will take place at locations that have yet to be determined (Tamburri 2010).

#### 2.2.1.8 CariCOOS

**Table 2-21. Activities Proposed by CariCOOS for FY16–FY20**

| Technology | Proposed Activities |
|---|---|
| Sensors/ Instrumentation | • Conduct Simulating Waves Nearshore model validations using CariCOOS buoy data at buoy sites, pressure sensors, and Nortek-Acoustic Wave and Current deployments elsewhere—*insular shelf near San Juan, southern insular shelf off Ponce, eastern shelf south of St. Thomas*<br>• Implement coordinated stepwise approach to accelerate turnover of fecal contamination detection by integrating instrumentation and culturing techniques with polymerase chain reaction base microbial source tracking in a pilot project—*Rincon area (northwest Puerto Rico)* |
| Vessels/Sampling | • Use a personal watercraft as a bathymetry surveying system—*location not specified* |
| Gliders/AUVs/Drifters | • Deploy Slocum gliders—*from Puerto Rico and the USVI: perform meridional sections of the northern Caribbean*<br>• Glider missions to the two oceanographic stations—*stations are the Caribbean Time Series Station and the Anegada time series station*<br>• 10 global positioning system-tracked Lagrangian drifters on standby—*location not specified; for deployment in the case of an oil spill or to verify current patterns* |
| Moorings/Stations Buoys/ Fixed Arrays | • Additional buoys for a total of five data buoys and two wave buoys—*Virgin Passage and the Mona Passage*<br>• New small nearshore buoys and/or fixed sensor arrays—*San Juan Bay and the Ports of Charlotte Amalie, Christiansted, St. Croix, and Ponce*<br>• Resume occupation of a long-term oceanographic station; may include Conductivity, Temperature, and Depth/Rosette casts to 1,000 m depth and collection of water samples—*Caribbean Time Series at 17°36'N 67°00'W* |
| HF Radar | • New 12 MHz systems—*coverage for eastern Mona Passage* |

| Technology | Proposed Activities |
|---|---|
| Sonar/LIDAR | • Install a hull-mounted side scan sonar on a personal watercraft—*location not specified* |

Source: Morell 2011

#### 2.2.1.9 MARACOOS

**Table 2-22. Activities Proposed by MARACOOS for FY16–FY20**

| Technology | Proposed Activities |
|---|---|
| Sensors/ Instrumentation[a] | • ACT: verification of *in situ* hydrocarbon sensors (moored and vertical profile testing of up to 10 instruments)—*Port of Baltimore, Maryland* |
| Vessels/Sampling | Not Applicable |
| Gliders/AUVs/ Drifters | • Simultaneously sample five cross-shelf triangles twice a year, one in June after the Cold Pool (a summertime strip of bottom trapped water stretching between Georges Bank and Cape Hatteras) has set up and the other in late August/September just before the Cold Pool's stormy decay (more than 175 flights planned)—*locations not specified*<br>• Region-wide sampling will require new gliders to complement existing MARACOOS glider fleet—*locations not specified*<br>• Demonstration of Liquid Robotics Wave Glider with Sonardyne Fetch Nodes |
| Moorings/Stations Buoys/ Fixed Arrays | • New York Harbor Observing System includes six shore-based salinity, temperature, turbidity, and water level sensors, two water level sensors, two moored platforms containing near-surface and near-bottom salinity, temperature, turbidity, and water level sensors, and two Acoustic Doppler Current Profilers |
| HF Radar | • Continued O&M and improvements/expansion of HF radar nested, high-resolution (25 MHz) networks (current network of 33 shore sites)—*locations not specified* |
| Sonar/LIDAR | Not Applicable |
| Satellite | • Continue operating regional satellite network—*ground station at Rutgers University*<br>• Enhance existing capability with new satellite receiving station (increase the number of satellites tracked and improve the resiliency of data collection and distribution in the Mid-Atlantic Bight)—*University of Delaware* |

Source: Glenn 2010

Note: [a] ACT partner sites for field tests include sites in Maryland, Florida, Michigan, California, Alaska, and Hawaii. Demonstration of $pCO_2$ sensors may take place at additional sites beyond those indicated. Verification of *in situ* pH sensors to take place at locations to be determined (Tamburri 2010).

### 2.2.1.10 NERACOOS

**Table 2-23. Activities Proposed by NERACOOS for FY16–FY20**

| Technology | Proposed Activities |
|---|---|
| Sensors/ Instrumentation | • Deploy and operate sensors: 5 different types of nutrient sensors (11 units total)—*University of Rhode Island dock; buoy integration* |
| Vessels/Sampling | • Harmful Algal Bloom Sampling: weekly shipboard sampling over an existing fixed array of five stations from May to October—*Outer Bay of Fundy*<br>• Develop a network of cost-effective ferry-based sampling to complement buoy observations; expand meteorological sampling and equip additional ferries based on funds—*Region-wide* |
| Gliders/AUVs/ Drifters | • Deploy student-built drifter systems—*Gulf of Maine and Southern New England Shelf*<br>• Evaluation of Liquid Robotics Wave Glider with Sonardyne Fetch Nodes |
| Moorings/Stations Buoys/ Fixed Arrays[a] | • Continue operating buoys currently deployed in the Gulf of Maine (up to six)—*two deep buoys in Northeast Channel and Jordan Basin; four coastal buoys widely spaced down Maine and Massachusetts coasts; one partner-funded buoy addresses water quality around Boston, Massachusetts*<br>• Continue operating buoys currently deployed in the Long Island Sound (up to three)—*two buoys in western Sound; one buoy in central Sound*<br>• Continue operating one buoy during ice-free months and a shore-based system at the mouth of the estuary —*Great Bay, New Hampshire*<br>• Continue operating one buoy—*Rhode Island coastal waters*<br>• Continue operating one buoy—*Gulf of Maine on Jeffrey's Ledge*<br>• Maintain and operate existing carbon dioxide monitoring stations – *two offshore and one near shore*<br>• Deploy, operate and validate six environmental sample processors for harmful algal bloom monitoring and three moorings available (initially one instrument during bloom season; key location deployments in subsequent years)—*Gulf of Maine*<br>• Maintain and operate existing carbon dioxide monitoring stations—*two offshore, one nearshore*<br>• Provide real-time transmission from three sites/year—*existing fixed water quality monitoring stations in Narragansett Bay, 13 estuarine locations*<br>• Institute sentinel monitoring of water column properties (two stations) and a laser optical plankton counter—*western Gulf of Maine, coastal near shore and deep offshore* |

| Technology | Proposed Activities |
|---|---|
| | • Northeast Bentho-Pelagic Observatory: continue a 3-year time series established at six sentinel sites; use a towed camera system (HabCam) to image the seafloor across 100 km scales, with millimeter resolution—*northeast Continental shelf from Hudson Canyon, Georges Bank, and the Stellwagen Bank National Marine Sanctuary to northern Gulf of Maine* |
| HF Radar | • Continue operation of CODAR Ocean Sensors Ltd. SeaSonde (up to three locations)—*northeastern Gulf of Maine* |
| Sonar/LIDAR | Not Applicable |

Source: Morrison 2011.
Note: [a] Appendix D provides the descriptions and schematics for the types of moorings, stations, buoys, and fixed arrays used in this region.

### 2.2.1.11 GLOS

**Table 2-24. Activities Proposed by GLOS for FY16–FY20**

| Technology | Proposed Activities |
|---|---|
| Sensors/ Instrumentation[a] | • ACT: verification of *in situ* hydrocarbon sensors (moored and vertical profile testing of up to 10 instruments)—*Kalamazoo River, Michigan*<br>• Enhance the near shore network/enhance evaporation and biological sensors: add observations in key tributaries—*e.g., St. Louis River/Duluth Harbor-Lake Superior; Lower Fox/Green Bay-Lake Michigan; Saginaw River/Bay-Lake Huron; Maumee River-Lake Erie; Genesee River-Lake Ontario* |
| Vessels/Sampling | Not Applicable |
| Gliders/AUVs/ Drifters | • Provide limited support and coordinate deployment of mobile assets (AUV/glider)[b]<br>• Deploy Slocum Glider in 2012 |
| Moorings/Stations Buoys/ Fixed Arraysc | • Maintain and operate the Nearshore Network of *in situ* observing platforms (buoys and fixed structures) and sensors—*Lakes Superior, Huron, Ontario, Erie, and Michigan* |
| HF Radar | Not Applicable |
| Sonar/LIDAR | Not Applicable |

Source: Read 2011.
Notes: [a] ACT partner sites for field tests include sites in Maryland, Florida, Michigan, California, Alaska, and Hawaii. Demonstration of $pCO_2$ sensors may take place at additional sites beyond those indicated. Verification of *in situ* pH sensors to take place at locations to be determined (Tamburri 2010).
[b] Approximate locations of Great Lakes *in situ* observing platform activities:
Lake Superior: St. Louis River/Estuary and Keweenaw Peninsula areas

| Technology | Proposed Activities |
|---|---|

Lake Michigan: Green Bay/Fox River area
Lake Huron: Saginaw Bay area
Lake Erie: Maumee Bay and Cleveland Areas
Lake Ontario: Rochester Embayment and Genesee River
Connecting waterways: Lake St. Clair Corridor, Upper St. Lawrence River

[c] Appendix D provides the descriptions and schematics for the types of moorings, stations, buoys, and fixed arrays used in this region.

## 2.3 NO ACTION ALTERNATIVE

Under the No Action Alternative, the IOOS Program would maintain the currently deployed network of observing systems (804 assets) and would not fund additional observational technology assets to expand the existing network of observing systems. The program would be implemented using the same protocols implemented from 2010-2015. Maintaining the currently deployed network of observing systems is necessary to fulfill the minimum requirements set forth in the ICOOS Act, the First U.S. Integrated Ocean Observing System Development Plan, and the *U.S. Integrated Ocean Observing System: A Blueprint for Full Capability*.

## 2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER ANALYSIS

In developing the Proposed Action, variations of the Full Capabilities Alternative were identified. The alternatives identified involved operating at various levels below the full capability identified for the Proposed Action and decreasing funding for asset deployment and maintenance, training, product development, DMAC, and modeling and analysis. The quantity of observational activities would change at other funding levels, but the type and range of activities would not change significantly in terms of impact on the environment. A range of alternatives that focused on deploying specific technologies at projected funding levels at the expense of not deploying other technologies addressed in the Blueprint. While it appears that environmental impacts may be reduced by deploying only those technologies that would not result in direct impacts on the environment, the scope and consistency of data that would result from selective deployment would not meet the purpose and need of the system, and the resultant gaps in data would likely significantly reduce the usefulness of the IOOS data sets. For these reasons, we determined these alternatives did not meet the purpose and need for the Proposed Action or merit further study. Thus, the analyses of alternatives in this PEA are limited to the Proposed Action, the Full Capabilities Alternative, and the No Action Alternative.

# 3. AFFECTED ENVIRONMENT

This section describes the affected environment and existing conditions for the resource categories applicable to the regions of influence (ROI) affected by the IOOS Program. The ROI for the Proposed Action is defined as the geographic regions in which projects are funded by IOOS Program during FY11 through FY15, specifically marine and coastal waters as well as beach, coastal, and estuarine habitats. Although efforts proposed by each RA within the temporal scope of the project would be implemented within the 200-nautical mile (nm) U.S. EEZ, NOAA's Policy is that the scope of its NEPA analyses includes consideration of the impacts of actions on the marine environment within and beyond the EEZ (NOAA Administrative Order 216-6). ACT validation and testing efforts would be conducted within the geographic areas described in section 2.1.3, *Regional Proposals and Build-out Plans*. Additionally, if an IOOS-funded technology is placed in foreign territorial waters or on foreign soil, then EO 12114, *Environmental Effects Abroad of Major Federal Actions,* would apply.

NOAA reviewed environmental and cultural resource categories for applicability to the project. Through the analysis, certain resource categories clearly not affected by the IOOS Program were eliminated from further evaluation. Only the resources potentially affected by the project are discussed further in this section and in section 4.0, *Environmental Consequences*. Below is a summary of those resources that were eliminated from further environmental analysis because the specific locations of the Proposed Action are unknown at this point. Tiered environmental analyses may include some of the resources, if necessary.

**Resources Not Affected by the Proposed Action or the Alternatives**

***Air Quality.*** The air quality varies greatly depending on the geographic location and the time of year. The proposed activities would include installation of sea-based and onshore monitoring stations, however, specific equipment installation locations, and O&M schedules are unknown at this time. Planned construction activities for onshore installations might involve the use of gasoline or diesel-powered digging equipment (see Appendix E). Offshore installation of monitoring buoys and sensors would require the use of ships. Ship and equipment exhaust emissions would be limited in duration to the installation of the equipment. All vehicles and equipment used in installations would adhere to Federal, State and local environmental laws and regulations. For these reasons, detailed discussion of air quality emissions was eliminated from further consideration in this PEA. However, a tiered environmental document may include analysis of air quality emissions, if necessary.

***Climate.*** The climate varies greatly depending on the specific RA and the time of year. The proposed activities would include installation of sea-based and onshore monitoring stations. However, specific equipment installation locations, and O&M schedules are unknown at this time. Planned construction activities for onshore installations could involve the use of gasoline or diesel-powered digging equipment (see Appendix E). Offshore installation of monitoring buoys and sensors would require the use of ships. Ship and equipment emissions of greenhouse gases would be singular events and would not have expected measureable impacts on the climate. Therefore, detailed discussion of climate was eliminated from further consideration in this PEA. However, a tiered environmental document may include analysis of climate and greenhouse gases, if necessary.

***Recreation Resources.*** The amount of recreational resources varies greatly depending on the geographic location of the RA. Specific equipment installation locations and O&M schedules are unknown at this time. Offshore observing platforms would have a limited footprint and would be sited in open water. Onshore observing systems, including pier and shoreline-mounted instrumentation and HF radar antennae, are installed in accordance with local zoning requirements and site-specific regulations. For example, HF radar antennae installed in beach areas in Hawaii are built into fence posts to limit their visual and aesthetic impact. For these reasons, detailed discussion of recreational resources was eliminated from further consideration in this PEA. However, a tiered environmental document may include analysis of recreational resources, if necessary.

***Land Use.*** The majority of the activities proposed under the IOOS Program are in or on the open water and are not land based. Additionally, offshore observing platform installations have no land use guidance or restrictions and onshore observing platforms require no change in land use or zoning for the installation of the observing systems. Therefore, a detailed discussion of land use was eliminated from further consideration in this PEA. However, a tiered environmental document may include analysis of land use, if necessary.

***Aesthetics and Visual Resources.*** Offshore observing platforms, such as sensors deposited on the seafloor, are not visible from the surface or the shore and therefore have no aesthetic or visual impact above water. It is highly unlikely that recreational divers would encounter observing platforms because of the criteria for sensor placement. Buoys have a minimal above-surface profile and in a vast majority of cases are out of view from shorelines. Onshore observing systems, including shore and pier-mounted sensors and HF radar installations, have a small footprint and antenna heights are limited to approximately 7m. For example, antenna could be installed on existing fence posts and flagpoles to limit the aesthetic impact on a historic site and recreational areas (see Appendix E). Due to the lack of specific information regarding equipment installation locations and schedules, detailed discussion of aesthetics and visual resources was eliminated from further consideration in this PEA. However, a tiered environmental document may include analysis of aesthetics and visual resources, if necessary.

***Human Health and Safety.*** Onshore and offshore observing platforms would pose no risk to human health and safety. Offshore sensors are passive arrays and onshore sensors, including sea level gauges and water quality testing equipment are also passive and would not pose a health risk. Additionally, HF radar and LIDAR sensors use radio and light wave frequencies which do not pose risks to human health or safety. The installation, operation, and maintenance of all observation platforms would be performed in compliance with all relevant Federal, State, local and tribal health and safety regulations. Therefore, a detailed discussion of human health and safety was eliminated from further consideration in this PEA. However, a tiered environmental document may include analysis of human health and safety, if necessary.

***Transportation.*** The proposed activities would include installation of sea-based and onshore monitoring stations, however, specific equipment installation locations, and O&M schedules are unknown at this time. Additionally, all proposed projects would be implemented in coordination with state and coastal authorities, USCG, and USACE. Equipment locations (i.e., stations, moorings, buoys, and fixed arrays) would be selected to avoid heavily used marine vessel transit corridors and hazards to navigation, in accordance with Federal laws and regulations. Due to the lack of specific information regarding equipment installation locations and schedules, detailed discussion of transportation systems and resources was eliminated from further consideration in this PEA. However, a tiered environmental document may include analysis of transportation systems and resources, if necessary.

## 3.1 PHYSICAL RESOURCES

### 3.1.1 Applicable Laws, Regulations, and Executive Orders

***Clean Water Act.*** The primary law governing U.S. water quality is the Clean Water Act (CWA) of 1972, 33 U.S.C. §§ 1251 et seq. This act provides for the restoration and maintenance of the chemical, physical, and biological integrity of the nation's waters. CWA Section 301(a) specifies that the discharge of any pollutant is unlawful unless it is in compliance with the CWA. The CWA (Section 402) established the federal limits (through the National Pollutant Discharge Elimination System) for the amount of pollutants discharged into surface waters from point (e.g., a vessel) and nonpoint (e.g., storm water runoff) sources. It emphasizes technology-based control strategies and requires dischargers to have permits to use public resources for waste discharge. The CWA also limits the amount of pollutants that may be discharged and requires wastewater to be treated with the best treatment technology economically achievable regardless of receiving water conditions. CWA Section 402 also regulates the incidental discharge of pollutants from the normal operation of commercial vessels through the Vessel Discharge Permit Program. In many states, CWA compliance has been delegated to the state agencies for implementation and compliance.

The operation of vessels used for sampling and SONAR activities and gliders/AUVs are subject to CWA regulations. In the unlikely event of pollutant discharge, the IOOS Program would comply with all applicable CWA regulations. In an effort to prevent the accidental discharge of pollutants, the IOOS Program ensures that the equipment in use is in proper working condition. The IOOS Program maintains compliance with these applicable CWA regulations by obtaining the required discharge permits.

***Coastal Zone Management Act.*** The Coastal Zone Management Act of 1972 (CZMA), 16 U.S.C. §§ 1451 et seq., authorized the National Coastal Zone Management Program which comprehensively addresses the nation's coastal issues through a voluntary partnership between the federal government and coastal and Great Lakes states and territories. This program is administered at the federal level by NOAA's Office for Coastal Management. If a state chooses to participate in the National Coastal Zone Management Program, it must develop and implement a federally-approved coastal zone management program. Section 307 of the CZMA requires that federal actions, inside or outside the coastal zone, which have reasonably foreseeable effects on any coastal use (land or water) or natural resource of the coastal zone be consistent with the enforceable policies of a state's federally-approved coastal management program. Federal actions include federal agency activities, federal license or permit activities, and federal financial assistance activities. Federal agency activities must be consistent to the maximum extent practicable with the enforceable policies of a state coastal management program, and license and permit and financial assistance activities must be fully consistent. The IOOS Program will require RAs and grantees to work with state coastal management programs to ensure any federal actions are consistent with the enforceable policies of the state's coastal management program.

***Estuary Protection Act****.* The Estuary Protection Act, 16 U.S.C. §§ 1221 et seq., establishes a process to protect, conserve, and restore estuaries in a manner that adequately and reasonably maintains a balance between the conservation of natural resources interests and the need to develop estuaries for the growth and development of the nation. The Secretary of the Interior is authorized to cooperate with states and federal agencies in undertaking studies and inventories of U.S. coastal estuaries to determine whether such areas should be acquired by the Federal Government for protection. The statute further requires the Secretary of the Interior to assess impacts of commercial and industrial developments on estuaries, enter into cost-sharing agreements with states and subdivisions for permanent management of estuarine areas in their possession, and encourage state and local governments to consider the importance of estuaries in their planning activities related to federal natural resource grants. In planning for the use or development of water and land resources, Federal agencies are also required to consider impacts of commercial and industrial developments on estuaries. The information developed and distributed by IOOS Programs will facilitate the intent of this Act.

***Estuary Restoration Act of 2000.*** The Estuaries and Clean Waters Act of 2000, 33 U.S.C. §§ 2901 et seq., encourages the restoration of estuary habitat through more efficient project financing and enhanced coordination of Federal and non-Federal restoration programs. The Secretary of the Army is responsible for establishing an estuary habitat restoration program, carrying out estuary habitat restoration projects, and providing technical assistance through the award of contracts and cooperative agreements to non-Federal entities. The Under Secretary for Oceans and Atmosphere of the Department of Commerce is a member of the Estuary Habitat Restoration Council which is responsible for: (1) developing an estuary habitat restoration strategy designed to ensure a comprehensive approach to maximize benefits derived from estuary habitat restoration projects and foster coordination of Federal and non-Federal activities related to restoration of estuary habitat; (2) soliciting, reviewing, and evaluating project proposals and developing recommendations for consideration by the Secretary of the Army; and (3) maintaining a database and monitoring all estuary habitat restoration projects. The information developed and distributed by IOOS Programs will facilitate the intent of the Act.

***Rivers and Harbors Act.*** The Rivers and Harbors Act of 1899, 33 U.S.C. §§ 401 et seq., regulates the following: (1) construction activities associated with bridges, causeways, dams, or dikes; (2) obstruction, excavation, or filling of navigable waters (often associated with construction of wharves, piers, and similar structures); (3) establishment of harbor lines and conditions related to grants for extensions of piers; and (4) penalties related to the regulated actions and to the removal of existing structures. Section 10 of the Rivers and Harbors Act authorizes the USACE to regulate the dredging, filling, excavation, or other modifications to navigable waters of the United States. The IOOS Program will require RAs and grantees to demonstrate compliance with the Rivers and Harbors Act requirements as applicable.

***Executive Order 11988, Floodplain Management (May 24, 1977).*** EO 11988, *Floodplain Management*, directs all federal agencies to refrain from conducting, supporting, or allowing actions in floodplains unless it is the only practical alternative. In order to comply, the following must be analyzed: the potential for encroachment into floodplains by different alternatives; risks of the action; impacts on natural and beneficial floodplain values; support of incompatible floodplain development; and measures to minimize floodplain impacts and to preserve/restore any beneficial floodplain values affected by the project. The base floodplain is currently defined as “the area subject to flooding by the flood or tide having a 1 percent chance of being exceeded in any given year.” An encroachment is defined as “an action within the limits of the base floodplain.” However, on January 30, 2015, EO 13690 amended EO 11988, creating a new flood risk reduction standard for federally funded projects. The Federal Flood Risk Management Standard was established to reduce the risk and cost of future flood disasters by ensuring that Federal investments in and affecting floodplains are constructed to better withstand the impacts of flooding. The new standard seeks to increase resilience against flooding by expanding management from the current base flood level to a higher vertical elevation and corresponding horizontal floodplain. The flood elevation and corresponding floodplain is to be determined by an agency using one of three approaches: (1) a climate informed science approach that uses the best-available, actionable hydrologic and hydraulic data and methods that integrate current and future changes in flooding based on climate science; and (2) an approach using the freeboard value, reached by adding an additional 2 feet to the base flood elevation for non-critical actions and by adding an additional 3 feet to the base flood elevation for critical actions (i.e., any activity for which even a slight chance of flooding would be too great); and (3). On October 8, 2015, the Federal Emergency Management Agency published the Guidelines for Implementing EO 11988 and EO 13690. NOAA will take necessary action to adopt and implement the new flood risk management standard.

## 3.1.2 Physical Resources Common to All Regions

### 3.1.2.1 Physical Characteristics

Geologic hazards that could affect offshore activities are mainly associated with the scouring action of ocean currents and seafloor instability caused by geologic characteristics and processes. Tidal, tsunami, and storm driven waves can affect sediment transport, undermining foundational structures and possibly leading to failure. Energy from currents and waves can also pose a hazard to submarine cables and moorings. Unconsolidated surface sediments are susceptible to liquefaction and mass movement as a result of earthquakes and storm surges. These surfaces can pose a hazard to foundation structures, submarine cables, and moorings. Gaseous sediments, a result of decomposing matter or gas rising along fault planes, can be present on the ocean floor. Faults, mapped throughout U.S. waters, can lead to ground-shaking, fault displacements, and tectonic wrapping associated with earthquake activities. Additionally, variable bottom types and irregular topography can affect the mooring and anchoring of structures (Minerals Management Service (MMS) 2007).

The phenomenon known as El Niño-Southern Oscillation has long been recognized as a significant factor in the inter-annual variability of atmospheric-oceanic response (NOAA 2011g). El Niño-Southern Oscillation events radiate from the equatorial regions at irregular intervals, which most commonly range from 3 to 7 years (NOAA 2011g). The two distinct forms of El Niño-Southern Oscillation in the Pacific Ocean are known as El Niño and La Niña. Large-scale oceanographic events such as El Niño change the characteristics of water temperature and productivity across the Pacific, and these events have a significant effect on the habitat range and movements of pelagic species (FWS 2008, as cited in NOAA 2011g). During La Niña, sea surface temperatures in the eastern tropical Pacific are below average, and temperatures in the western tropical Pacific are above average (Friedlander et al. 2009, as cited in NOAA 2011g).

#### 3.1.2.2 Water Quality

In coastal environments, water quality is influenced by river drainage, erosion, and atmospheric deposition (e.g., precipitation and dust). Human activities can affect water quality through nonpoint source runoff, pollutant discharges, dumping, hazardous material spills, and air emissions (NOAA 2009). The CWA provides for the regulation of pollutant discharges into the waters of the United States and quality standards for surface waters (EPA 2011a).

### 3.1.3 PacIOOS

The PacIOOS includes the Republic of Palau, the Federated States of Micronesia, the Republic of the Marshall Islands, Guam, the Commonwealth of the Northern Mariana Islands, American Samoa, and Hawaii.

#### 3.1.3.1 Physical Characteristics

The Caroline Islands (Palau and the Federated States of Micronesia), Marshall Islands, and Mariana Islands (Territory of Guam and the Commonwealth of Northern Mariana Islands) are all part of Micronesia, located in the western Pacific Ocean. American Samoa and the Hawaiian Islands are part of Polynesia, located in the central Pacific Ocean (Western Pacific Regional FMC 2009a).

Geologic processes associated with plate tectonics, volcanism, and reef accretion are responsible for the formation of Pacific islands. The Caroline Islands (approximately 2,000 $km^2$) are composed of many low coral atolls, with a few high islands. The Marshall Islands (approximately 466 $km^2$), which geologically include Wake Island, are made up of 34 low-lying atolls separated into two chains: the southeastern Ratak Chain and the Ralik Chain. The Mariana Islands (approximately 1,026 $km^2$) are composed of 15 volcanic islands that are part of a submerged mountain chain that stretches from Guam to Japan, almost 2,414 km. American Samoa (approximately 200 $km^2$) is surrounded by an EEZ of approximately 390,000 $km^2$ and includes Tutuila (approximately 142 $km^2$), the Manua Islands (a group of three volcanic islands with a total land area of less than 52 $km^2$), and two coral atolls (Rose Atoll and Swains Island). The Hawaiian Islands extend for nearly 2,414 km and are comprised of 137 islands, islets, and coral atolls. The exposed islands are part of an undersea mountain range, which was formed by a by a hot spot within the Pacific Plate (Western Pacific Regional FMC 2009a).

The islands of Palau can be classified as volcanic, high-limestone, low platform, and reef or atoll. The coastlines of the Republic of Palau are comprised of coral and sand beaches and rock along large expanses of mangrove swamp. The barrier reef surrounding the main island group averages 2.5 km in width on the west side of the islands. Well-developed stands of mangrove forests are found along rivers and coastal mudflats. Sea grass beds also provide coastal habitat. Limestone forests found on lime outcrops, and coralline limestone islands are susceptible to any disturbance. Palau lies outside of the typhoon belt of the northern equatorial Pacific. However, winds pick up speed during typhoon events that veer close to the islands (SOPAC 2007a).

The coral reef ecosystem is the dominant shallow marine feature of the Federated States of Micronesia. Mangrove forests and sea grass beds are well developed especially along the fringes of the high islands and some atolls. The Federated States of Micronesia are affected by storms and typhoons that are generally more severe in the western islands (GFSM 2002).

The Republic of the Marshall Islands consists entirely of low-lying coral atolls and, remnants of the more commonly known and visited high volcanic islands, with terrain comprised of low coral limestone and sand islands. The islands border the typhoon belt, but such storms are rare (United Nations 2012).

All of the Mariana Islands have some nearshore coral reef development. Some islands have only a narrow fringing reef system, while others such as Saipan have extensive reef flats extending seaward for hundreds of meters. The seafloor of this region is characterized by the Mariana Trench, the Mariana Trough, ridges, numerous seamounts, hydrothermal vents, and volcanic activity (DoN 2009). Guam is located on the Mariana Ridge, a volcanic arc approximately 160 km west of the Mariana Trench (DoN 2010). Earthquake activity is common on Guam and across the entire Mariana Island chain (Lander et al. 2002). Typhoons, tropical storms, and associated storm surges are also a common occurrence (NOAA 2011h). The islands in the chain have a high risk for tsunami as evidenced by the frequency of tsunamis that have occurred in the region (Dunbar and Weaver 2008).

American Samoa is the only U.S. territory located south of the equator. The largest island, Tutuila, features Pago Pago Harbor, the deepest and one of the most sheltered bays in the South Pacific. All of the islands have fringing coral reefs, and a large and complex relict barrier reef surrounds Tutuila. Coastal wetlands are limited in American Samoa, which is the eastern-most natural limit for mangroves (Western Pacific Regional FMC 2012). Geologic hazards in American Samoa include earthquakes, tsunamis, and volcanic eruptions locations. Earthquakes originate from the Tonga Trench, where the Pacific and Australian tectonic plates collide. Most tsunamis that affect American Samoa are generated by earthquakes from fault movements along the Pacific Rim in the Aleutian Islands, South America, the Tonga Trench, and other locations (FEMA 2008).

The Hawaiian Archipelago is in the central subtropical region of the North Pacific Ocean, near the middle of the North Pacific gyre. Near the Hawaiian Islands, oceanic flows are generally from east to west, with vigorous eddies forming on the leeward side of the islands (Flament et al. 1998, as cited in NOAA 2011g). To the south of Hawaii, the North Equatorial current flows westward, completing the circuit of the North Pacific gyre. The islands of Hawaii are influenced by the transition zone between the nutrient-poor surface waters of the North Pacific Subtropical Gyre and the nutrient-rich surface waters of the North Pacific Subpolar Gyre (Kazmin and Rienecker 1996, Leonard et al. 2001, Polovina et al. 2001, and Friedlander et al. 2009, as cited in NOAA 2011g). Colder, nutrient-rich waters are brought to the region by seasonal shifts and interannual migrations of this front. These waters are important to the productivity and ecology of the region (Polovina and Haight 1999, Nakamura and Kazmin 2003, Polovina 2005, and Friedlander et al. 2009, as cited in NOAA 2011g). The Hawaiian Islands are typically not impacted by tropical storms, but do experience annual extratropical storms (storms that originate outside of tropical latitudes) creating high waves during winter. These waves shape the ecosystem by limiting the growth and abundance of coral communities, and lead to species and growth forms that are adapted to these dynamic wave energy environments (Grigg et al. 2008, as cited in NOAA 2011g).

Surface currents in the Pacific Ocean are driven by the trade winds and westerlies, such that surface flows are predominantly westward in low latitudes and eastward in high latitudes. When these flows encounter the continents they are diverted both north and south to form coastal currents, which further serve to establish rotating water masses ("gyres") that characterize the overall circulation patterns of the ocean (NOAA 2011g).

Geologic hazards in the Hawaiian Islands include earthquakes, tsunamis, and volcanic eruptions. The Hawaiian Islands and American Samoa are affected by tsunamis that are typically generated by earthquakes from fault movements around the Pacific Rim.

### 3.1.3.2 Water Quality

Coastal waters of Palau are impacted daily from land-based pollution, and gasoline and oil from outboard motors and vessels. Sedimentation is also an issue for the coastal areas, where sediment-covered reefs have no live coral (SOPAC 2007a).

In the Federated States of Micronesia, there are some water quality concerns in areas where there is ongoing coastal development and agriculture, particularly in relation to the health of surrounding coral reef ecosystems (NOAA 2010b).

Sedimentation from development projects, land-based run-off, and eroding shorelines threatens the quality of Marshall Islands marine waters, and lagoons of some urban islands are affected by high levels of human and animal waste as well as oil spills. Coastal construction, land-based run-off, pollution, and human and animal waste among others all contribute to declining coral health (Republic of the Marshall Islands 2008).

No overall condition assessments were available for Guam, the Northern Mariana Islands, or American Samoa (EPA 2008). However, in 2010, Guam assessed the water quality of 14 percent of its coastal shoreline (26 km of a total 188 km); and all of the assessed shorelines were impaired because of pollution (EPA 2010a). In 2010, the Northern Mariana Islands assessed the water quality for 378 km of its coastal shoreline (total shoreline km were not reported); 64 percent of the assessed shorelines were in good condition, and 36 percent were impaired because of pollution or impaired biota (EPA 2010b). In 2010, American Samoa assessed the water quality for 84 percent of its coastal shoreline (216 km of a total 256 km); of which 40 percent of the assessed shorelines were in good condition, and 60 percent were impaired because of pollution or impaired biota (EPA 2010c).

American Samoa faces coastal concerns of fishery habitat loss, coastal hazards such as hurricanes, flooding, and erosion, marine debris, and solid waste. Coral reefs surrounding the island of Tutuila are impacted by poor water quality (FEMA 2008). There are concerns about coastal erosion and pollution in Pago Pago Harbor on Tutuila (Western Pacific Regional FMC 2012).

The overall condition of Hawaiian coastal waters is rated good, based on good water quality and good to fair sediment quality. Approximately 78 percent of the coastal area was rated good for water quality condition, 18 percent of the area was rated fair, and 4 percent of the area was rated poor (EPA 2008). Nearshore localized concentrations of pollutants occur near populated areas due to stormwater discharges and permitted sanitary outfalls (NOAA 2011g).

## 3.1.4 AOOS

The AOOS includes three Alaskan coastal and ocean observing sub-systems; the Gulf of Alaska, Bering Sea/Aleutian Islands, and Arctic Ocean.

### 3.1.4.1 Physical Characteristics

Alaska is the largest state in the United States with a total area of 1,593,438 $km^2$, including 70,849 $km^2$ of coastal water over which the state has jurisdiction and approximately 690,000 $km^2$ of wetlands, with more than 8,000 $km^2$ of estuarine wetlands (low-wave energy environments), and approximately 190 $km^2$ of marine wetlands (high-energy wave environments). Alaska's productive marine waters include the North Pacific Ocean, Bering Sea, Chukchi Sea, and Arctic Ocean. More than 70 percent of the total area of the U.S. continental shelves is in Alaska (NOAA 2005a).

Alaska is bounded on the east by the North America land mass and bounded by water bodies on the north, west, and south. The northeast quadrant of the Pacific Ocean, which includes the Gulf of Alaska and the Bering Sea, is south of Alaska. Although separated from the main ocean body by the Aleutian Islands, the Bering Sea is considered to be a northern extension of the northeast Pacific Ocean by virtue of hydraulic communication through the numerous passes and channels between the islands (NOAA 2007).

Along the land boundary, the continental shelf (depth less than or equal to 200 m) is relatively narrow (less than 50 km) along the British Columbia and southeast Alaska coasts, and then broadens to 100 km or more along the southcentral Alaska coast. Along portions of the Kenai and Alaska peninsulas, the continental shelf attains a width of nearly 200 km. Although dotted by numerous seamounts rising to within 1,000 m of the surface, seabed depths over most of the northeast Pacific Ocean tend to be greater than 4,000 m. Maximum depths of more than 7,000 m occur in the Aleutian Trench, which parallels and marks the southern base of the Aleutian Island chain (NOAA 2007).

The Bering Sea is a semi-enclosed, high-latitude sea. Of its total area of 2.3 million $km^2$, 44 percent is continental shelf (depths less than 200 m), 13 percent is continental slope, and 43 percent is deep water basin (depths up to 3,800 m along the western margin of the sea). The Eastern Bering Sea is characterized by an exceptionally broad (more than 500 km) shelf region with a narrow continental slope adjoining an extensive Aleutian Basin. Its broad continental shelf on the east side of the Bering Sea is one of the most biologically productive areas in the world. A special feature of the Bering Sea is the pack ice that covers most of its eastern and northern continental shelf during winter and spring (NOAA 2007). The dominant circulation of the water begins with the passage of North Pacific water (the Alaskan Stream) into the Bering Sea through the major passes in the Aleutian Islands (Favorite et al. 1976, as cited in NOAA 2007). There is net water transport eastward along the north side of the Aleutian Islands, and a turn northward at the continental shelf break and at the eastern perimeter of Bristol Bay.

Eventually, Bering Sea water exits northward through the Bering Strait, or westward and south along the Russian coast, entering the western North Pacific via the Kamchatka Strait. Some resident water joins new North Pacific water entering Near Strait, which sustains a permanent gyre around the deep basin in the central Bering Sea (NOAA 2007).

The Aleutian Islands lie in an arc that forms a partial geographic barrier to the exchange of northern Pacific marine waters with Eastern Bering Sea waters. The Aleutian Islands continental shelf is narrow compared with the Eastern Bering Sea shelf, ranging in width on the north and south sides of the islands from about 4 km or less to 42 to 46 km; the shelf broadens in the eastern portion of the Aleutian Islands arc. The Aleutian Islands comprise approximately 150 islands and extend about 2,260 km in length (NOAA 2005a).

The Gulf of Alaska generally includes all waters within the EEZ along the southeastern, southcentral, and southwestern coasts of Alaska from Dixon Entrance to Unimak Pass, a distance along the Alaskan coastline of more than 2,500 km (NOAA 2007). Areas in the ROI that are located off of the Gulf of Alaska include Prince William Sound, Resurrection Bay, Cook Inlet, and Kachemak Bay (an arm of Cook Inlet). The Gulf of Alaska has approximately 160,000 $km^2$ of continental shelf, which is less than 25 percent of the Eastern Bering Sea shelf (NOAA 2005a). Numerous troughs and shallow banks characterize the topography of the western Gulf of Alaska (NOAA 2007). The dominant circulation in the Gulf of Alaska is characterized by the cyclonic flow of the Alaska gyre (Musgrave et al. 1992, as cited in NOAA 2005a). The circulation consists of the eastward-flowing Subarctic Current system at approximately 50º N and the Alaska Coastal Current (Alaska Stream) system along the northern Gulf of Alaska (NOAA 2005a). The Alaskan Stream, which flows southwesterly and roughly parallel to the shelf break at 50-100 centimeters per second, dominates offshore, near-surface circulation (NOAA 2007). Nearshore, the Alaska Coastal Current is the dominant feature (Reed and Schumacher 1986, as cited in NOAA 2007).

The Gulf of Alaska has a variety of seabed types such as gravely sand, silty mud, and muddy to sandy gravel, as well as areas of hardrock (Hampton et al. 1986, as cited in NOAA 2005a). The dominant shelf sediment consists of clay silt and the shoreline sediments are predominately sand. Most of the western Gulf of Alaska shelf consists of many banks and reefs with numerous coarse, clastic, or rocky bottoms, as well as patchy bottom sediments. In contrast, the shelf near Kodiak Island consists of flat relatively shallow banks cut by transverse troughs. The substrate in the area from Near Strait and close to Buldir Island, Amchitka, and Amukta Passes is mainly bedrock outcrops and coarsely fragmented sediment interspersed with sand bottoms (NOAA 2005a).

The Beaufort and Chukchi seas are the northernmost seas bordering Alaska. The Beaufort and Chukchi seas are parts of the Arctic Ocean, but both are linked, atmospherically and oceanographically, to the Pacific Ocean. Annual formation and decay of sea ice influence the oceanography and dynamics of the Beaufort and Chukchi seas (NOAA 2011i). The Beaufort Sea is a semi-enclosed basin with a narrow continental shelf extending 30 to 80 km from the coast (Chu et al. 1999, as cited in NOAA 2011i). The Alaskan coast of the Beaufort Sea is about 600 km in length, reaching from the Canadian border in the east, to the Chukchi Sea at Point Barrow in the west. The continental shelf of the Beaufort Sea is relatively shallow, with an average water depth of about 37 m (NOAA 2011i). Numerous narrow and low relief barrier islands within 1.6 to 32 km of the coast influence nearshore processes in the Beaufort Sea (Brown et al. 2010, as cited in NOAA 2011i).

The Chukchi Sea is predominantly a shallow sea with a mean depth of 40 to 50 m (NOAA 2011i). Gentle mounds and shallow troughs characterize the seafloor morphology of the Chukchi Sea (Chu et al. 1999, as cited in NOAA 2011i). The Chukchi Sea shelf is approximately 500 km wide and extends roughly 800 km northward from the Bering Strait to the continental shelf break (Weingartner 2008, as cited in NOAA 2011i). Beyond the shelf break, water depths increase quickly beyond 1,000 m (NOAA 2011i).

There are two major sea valleys in the Chukchi Sea: Herald Canyon, and Barrow Canyon. The shoreline west of Barrow is characterized by nearly continuous sea cliffs up to 12 m high and cut into perennially frozen ice-rich sediments. Near Icy Cape and Point Franklin offshore barrier islands along the coast enclose shallow lagoons. Elsewhere the cliffs are abutted by narrow beaches (NOAA 2007). The western edge of the Chukchi Sea shelf extends to Herald Canyon, and the eastern edge is defined by Barrow Canyon (Pickart and Stossmeiser 2008, as cited in NOAA 2011i), which separates the Beaufort and Chukchi seas (NOAA 2011i).

Much of the southeast and southcentral coast of Alaska is very convoluted, and consists of hundreds of bays, estuaries, coves, fjords, and other coastal features (EPA 2008). Alaskan waters also contain five major taxonomic groups of corals, which provide habitat for fish, among other species.

Physical hazards that could affect the marine and coastal environment in Alaska include storms and highwind events, storm surges, intense waves, coastal flooding, earthquakes, tsunamis, and volcanic activity.

#### 3.1.4.2 Water Quality

Routine monitoring of coastal resources is currently not comprehensive in Alaska. The overall condition of Southcentral Alaskan coastal waters, which include Prince William Sound and Cook Inlet, is rated good, based on good ratings for water quality, sediment quality, and fish tissue contaminants indices. Most of the coastal area (88 percent) is rated good for water quality condition, with the remainder of the area rated fair. Data from assessments of the southeastern region of Alaska and the Aleutian Islands region are scheduled for future publication by EPA (EPA 2008). The majority of the water flowing into the Beaufort and Chukchi seas is relatively free from the influence of human activity, and there are currently no impaired waters (as defined by the CWA Section 303(d)) identified within the Arctic Region by the State of Alaska (ADEC 2010, as cited in NOAA 2011i).

El Niño-Southern Oscillation events account for approximately one-third of the ice and sea surface temperature variability in the Bering Sea (Niebauer and Day 1989, as cited in NOAA 2007). During El Niño events, the Aleutian Low pressure system tends to be more intense and is positioned further to the south, thereby producing stronger winds, larger waves, and cooler water temperatures (Bromirski et al. 2005, as cited in NOAA 2011g).

## 3.1.5 NANOOS

The NANOOS includes the waters off the coasts of Washington, Oregon, and a portion of northern California and from the saltwater intrusion extent within bays and estuaries to the seaward extent of the U.S. EEZ.

### 3.1.5.1 Physical Characteristics

The continental shelf width in the northwest region off the coasts of Washington and northern Oregon ranges from approximately 70 km to less than 30 km (NOAA 2007). The 100-m water-depth contour occurs fairly close to shore, usually within 40 km. The continental shelf in this region is characterized by physiographic features that include a series of deep-water ridges, submarine canyons and channels, submarine fans, seastacks and small islands, a broad terrace, submarine banks (shoals), and seamount chains (MMS 2007a).

Two of the principal currents that occur along the western coast of the United States are the California Current and the Davidson Current. The main California Current begins off southern British Columbia and ends off southern Baja California and is usually located several km offshore (MMS 2007a). The current proceeds southwards along the U.S. west coast and is slow, meandering, broad, and indistinct (NOAA 2007). The Davidson Current is a narrower, weaker countercurrent that runs north along the west coast of the United States from northern California to Washington to at least latitude of 48°N during the winter.

Major coastal habitat types in the northwest include sandy beaches and dunes; rocky shores and intertidal zones; mudflats; rocky cliffs; lagoons and estuaries; freshwater and salt marshes; and tidal creeks (Airamé et al. 2003; PRBO Conservation Science 2005; FWS 2005, as cited in MMS 2007a).

Physical hazards that could affect the marine and coastal environment in the northwest are mainly associated with the scouring action of ocean currents and seafloor instability, either from seismic activity or sedimentary processes. Hazards include scouring action of ocean currents; slope failures, which can be triggered by earthquakes, storm surges, faulting, sediment loading, dissociation of hydrates, dewatering processes, or human activity; faulting and warping; tsunamis; subsurface fluid and gas expulsion; and irregular topography (MMS 2007a).

### 3.1.5.2 Water Quality

Water quality off the coasts of Washington and Oregon is very good, in part because of the limited number of sewage outfalls (and relatively low effluent volumes) found along the coast (MMS 2007a). Prevailing winds cause down welling close to the coast in winter and upwelling of cold, nutrient-laden oceanic water close to the coast in summer (NOAA 2007). The movement of northern waters southward by the California Current makes the coastal waters cooler than coastal areas of comparable latitude on the east coast of the United States, despite the occasional movement of somewhat warmer water northward during the winter by the Davidson Current (MMS 2007a).

### 3.1.6 CeNCOOS

CeNCOOS includes more than 960 km of coastline from the California-Oregon border south to Point Conception, California, and from the coastline out to the seaward extent of the EEZ.

#### 3.1.6.1 Physical Characteristics

The main physiographic feature of the northern California area is the Eel River Basin, which has a northern trend and extends 200 km south from near Cape Sebastian on the southern Oregon coast to Cape Mendocino on the northern California coast and about 70 km from the coastline seaward to the continental slope (MMS 2007a). The geology of the central California continental shelf and slope records a history of accretion and subduction that continues to change by the active transform motion between the Pacific and North American Plates (McCulloch 1989, as cited in MMS 2007a). In this area, the 100-m water-depth contour occurs fairly close to the shore; its maximum distance from the shoreline is about 40 km at the Farallon Islands, just south of Point Reyes, and west of San Francisco Bay. The physiography of the area varies from north to south and consists of two major end provinces and a middle transition zone (McCulloch et al. 1977, 1980; McCulloch 1989; and Normark and Gutmacher 1989; as cited in MMS 2007a). The two major end provinces and the middle transition zone are described as:

- The continental shelf in the northern physiographic province (Cape Mendocino to north of Point Sur) is well developed and varies in width from 10 to 40 km. The shelf meets the upper edge of the slope at a depth of about 180 m and merges with the ocean floor at a depth of about 3,500 m.
- The transition zone marks the area near Monterey Bay between the northern and southern provinces in the central California shelf. The shelf in this zone is not well developed, and the slope is long and gentle, merging with the seafloor without a distinct change in topography. The main physiographic feature in this region is the Outer Santa Cruz Basin, an elongate syncline trending northwest across the continental shelf to the toe of the continental slope.
- The southern province extends south from Point Sur to the vicinity of Point Conception. The shelf is not well developed in this area, and there is not a well-defined topographic break between the shelf and the slope. The shelf drops steeply (about 2,740 m) at the Santa Lucia Escarpment, just to the west of the Santa Lucia Bank.

The California region overall is seismically active and characterized by a variety of coastal features, including narrow beaches and high bluffs, rocky headlands, mountains, dune-backed shores, marine terraces, estuaries, bays and lagoons, and tidal inlets. Erosion rates are high along the California coast and are typically episodic, with major cliff retreat, land sliding, and sand removal taking place during large storms. However, as a result of tectonic uplift, the coastline continues to rise relative to sea level (MMS 2007a).

Two of the principal currents that occur along the western coast of the United States are the California Current and the Davidson Current. The California Current begins off southern British Columbia and ends off southern Baja California. It is a broad, shallow, slow-moving current that exhibits high spatial and temporal variability and is usually located several kilometers offshore

(MMS 2007a). The California Current represents the eastward portion of the North Pacific Gyre and transports cool water with low salinity toward the equator (Broenkow 2006 and Pickard and Emery 1990, as cited in MMS 2007a). The movement of northern waters southward makes the coastal waters cooler than coastal areas of comparable latitude on the east coast of the United States. Additionally, extensive upwelling of colder subsurface waters occurs, caused by prevailing northwesterly winds. The Davidson Current is a narrower, weaker countercurrent that occasionally moves somewhat warmer water northward during the winter. The Davidson Current runs north along the west coast of the United States from northern California to Washington to at least latitude 48°N during the winter (MMS 2007a).

Physical hazards that could affect the marine and coastal environment in the California region overall include coastal storms, scouring of coastline, earthquakes, tsunamis, sediment loading, and irregular topography.

#### 3.1.6.2 Water Quality

Off the northern California coast, factors affecting water quality include municipal sewage outfalls and riverine input. Marine and coastal water quality along the northern California coast is generally excellent with select contaminants (e.g., heavy metals, petroleum, and chlorinated hydrocarbons) producing only localized degradation. Coastal and marine water quality off the central California coast is very good, with minor exceptions. Portions of Monterey Bay have degraded water quality as a result of sewage effluent and riverine input from several local rivers (MMS 2002, as cited in MMS 2007a).

As the California Current flows southward along the Pacific Coast during the spring and summer, a combination of the northwesterly winds and the earth's rotation causes the surface waters to be deflected offshore. As the surface water moves offshore, it is replaced with cold, nutrient-rich waters from below, which introduces the nutrients (nitrates, phosphates, and silicates) to the water column (NOAA 2003, as cited in MMS 2007a).

### 3.1.7 SCCOOS

The SCCOOS includes the Southern California Bight from Point Conception, California to the U.S.-Mexico border and includes the Channel Islands.

#### 3.1.7.1 Physical Characteristics

The California Continental Borderland is a complex of basins and ridges/islands/banks and contains several submarine canyons. These features follow the northwest-southeast trends of the Transverse Range, with a secondary east-west trend in the northernmost part, and they are arranged in rough rows that converge to the south. The submerged part of the California borderland is approximately 900 km in length. The continental shelf is fairly narrow in this region and typically does not exceed 8 km in width. Its maximum width (about 250 km) occurs at the U.S.-Mexico border. The 100-m water-depth contour also occurs at distances of up to 8 km offshore. The borderland also contains several submarine canyons (MMS 2007a).

The southern portion of the California Current System consists of the southward flowing, surface intensified California Current, northward flowing Southern California Counter Current, and the northward flowing, subsurface California Undercurrent (Terrill et al. 2010).

Additional information about California coastal features and habitats, major currents, and physical hazards are provided in Section 3.2.6.1, *Physical Characteristics*. Additionally, Southern California can experience, rarely, remnants of hurricanes and tropical storms (MMS 2007a).

#### 3.1.7.2 Water Quality

Coastal and marine water quality off southern California is generally good, but, as with the central California coast, localized areas of water quality degradation exist due to high volume point sources (e.g., municipal wastewater outfalls in Los Angeles, Orange County, and San Diego), coupled with the combined effects of discharges from numerous small sources (MMS 2002, as cited in MMS 2007a). Nearly 1.5 billion gallons of treated sewage is discharged daily into the ocean along with additional inputs from river systems carrying treated sewage, stormwater, urban, and agricultural runoff. Additional untreated sewage crosses the border from Mexico. Some of these discharges contribute bacterial and viral contamination and may influence harmful algal bloom development (Terrill et al. 2010). Additionally, natural petroleum seeps are recognized as significant sources of hydrocarbons in the southern California area (MMS 2007a). The Southern California Bight is profoundly influenced by El Niño (Lynn and Bograd 2002, as cited in Terrill et al. 2010) with southern influences arriving by advection, coastally trapped waves, and atmospheric teleconnection.

### 3.1.8 GCOOS

The GCOOS includes the Gulf of Mexico, bordered by Mexico and five U.S. states: Texas, Louisiana, Mississippi, Alabama, and the west coast of Florida.

#### 3.1.8.1 Physical Characteristics

The Gulf of Mexico encompasses a surface area of 1.7 million $km^2$, with a mean water depth of 1,615 m. The continental shelf is the shallowest part in the Gulf, extending from the coastline to a depth of about 200 m. The shallower part of the shelf, with depths up to 100 m, extends out from the coast for less than 16 km around the Mississippi delta to 160 km off the southwestern Florida tip (MMS 2007b).

The geology of the Gulf of Mexico within U.S. waters can be subdivided into three regions: northern Gulf of Mexico, northeast Gulf of Mexico, and the south Florida continental shelf and slope.

- The northern Gulf of Mexico encompasses Texas, Louisiana, Mississippi, and Alabama; the major geologic feature in this area is the Mississippi Fan extending from the Mississippi Delta to the central abyssal plain.
- The northeast Gulf of Mexico extends from the Mississippi Delta to the Apalachee Bay in western Florida, and it is composed of soft sediments.

- The south Florida continental shelf and slope is the submerged portion of the Florida peninsula, extending from south from Apalachee Bay to the Straits of Florida, including the Florida Keys and Dry Tortugas (MMS 2007b).

Beyond the continental shelf lie the continental slope and the Gulf of Mexico Basin. The continental slope is a steep area containing diverse geomorphic features such as canyons, troughs, and salt structures. At the base of the continental slope is the Gulf of Mexico Basin, the deepest portion of the Gulf. The Basin is on the western part of the Gulf and includes the Sigsbee Abyssal Plain, the Sigsbee Deep, and the Mississippi Cone. The maximum depth ranges from 3,750 m to 4,330 m in the Basin (MMS 2007b).

The dominant circulation current in the Gulf is the Loop Current, which enters through the Yucatan Channel and exits through the Florida Straits. The Loop Current is mainly confined the southeastern region of the Gulf of Mexico, but it may extend into the northeastern or north-central Gulf. The main circulation currents in the western and central Gulf of Mexico are closed-ring Loop Current Eddies, which may change their orientation and location depending on the season. Noncoastal marine waters in the Gulf of Mexico are influenced by the configuration of the Gulf of Mexico Basin and runoff from land. The configuration of the Gulf of Mexico Basin controls oceanic waters entering the Gulf from the Caribbean Sea and freshwater from the Mississippi River system (MMS 2007b).

The Gulf of Mexico coastline is characterized by mainland shores, bays and lagoons, deltaic plains, chenier plains, barrier islands and peninsulas, and tidal inlets. The coast of Florida is characterized by mangrove swamps, sandy barriers and mainland beaches, irregular drowned karst topography, salt marshes, sea grass beds, coral reefs, and soft bottoms. Barrier islands are a main feature in the southwestern Florida shore; the northwestern coast is mostly drowned karst topography, and marsh and upland hammocks. The main features of the Alabama coast are sandy barrier islands that are separated from the mainland by lagoons, unfilled river valleys, salt marshes, sea grass beds, and soft and hard bottoms. The Mississippi Coast is composed of mainly chain barrier islands separated by tidal inlets, mainland bluffs covered by pine forest, salt marshes crossed by tidal creeks and bayous, sea grass beds, soft sediments, and hard bottoms. The Louisiana coast is characterized by delta lobes from the Mississippi Delta, eroding beaches, high sandy beaches with intervening marsh swales, short barrier islands, sea grass beds, and soft and hard bottoms. The Texas coast is characterized by beaches and barrier islands, bays, lagoons, salt marshes, sea grass beds, and soft and hard bottoms (Morton et al. 2004 and BOEM 2011). Additionally, deepwater corals and chemosynthetic communities can be found in deeper water beyond the continental shelf (BOEM 2011).

The climate in the Gulf of Mexico is subtropical, and the Gulf of Mexico is a microtidal, storm-dominated region. The shorelines surrounding the Gulf of Mexico are constantly changing due to waves and currents that cause sediment transport and erosion (Morton et al. 2004). Due to its proximity to tropical waters and its subtropical climate, the Gulf of Mexico is frequently affected by cyclones, which commonly occur from August to September (NOAA 2006c, as cited in MMS 2007b). These storms can cause severe damage to physical, economic, biological, and social systems in the Gulf of Mexico but usually tend to be localized (MMS 2007b).

### 3.1.8.2 Water Quality

The overall condition of the Gulf of Mexico coastal waters is fair to poor (EPA 2008a). Coastal water in the Gulf of Mexico is influenced by rivers draining into the area, atmospheric deposition, and sediment influx. The Mississippi River drains nearly half of the conterminous United States and is the major river discharging into the Gulf of Mexico. The main variables affecting coastal water quality in this region are water temperature, salinity, suspended solids, and nutrients. Hydrologic influences include tides, near shore circulation, freshwater discharge, and precipitation (MMS 2007b).

Oceanic water and freshwater containing land runoff mix in the Gulf, creating a water composition different from deep oceanic waters. Marine waters in the Gulf of Mexico contain a turbid surface layer, with high concentrations of nitrate, phosphates, and silicates. During the summer months, water discharging from the Mississippi spreads over most of the shelf resulting in a stratified water column and hypoxic bottom waters known as The Hypoxic Zone. The Hypoxic Zone forms each spring and summer following peak discharge periods and has been growing since 1985. The Hypoxic Zone persists until local wind-driven circulation mixes the water column (MMS 2007b).

## 3.1.9 SECOORA

The SECOORA includes four states along the Atlantic Coast in the southeastern United States (North Carolina, South Carolina, Georgia, and Florida) and includes part of the Gulf of Mexico along western Florida.

### 3.1.9.1 Physical Characteristics

SECOORA can be divided into three sub-regions: the South Atlantic Bight (between Cape Hatteras, North Carolina, and Cape Canaveral, Florida); southern and eastern Florida (south of Cape Canaveral, Florida); and the wide West Florida Shelf. The sub-region along the West Florida Shelf overlaps with the GCOOS area (Hernandez et al. 2011).

The South Atlantic Bight and the area south of Cape Canaveral sit on the same continental shelf, which ranges in width from 1 to 130 km and encompasses an area over 100,000 $km^2$ (MMS 2007b). The shelf is 25 km wide off the Dry Tortugas narrowing to approximately 5 km off Palm Beach; it broadens to reach about 120 km in width off of Georgia and South Carolina and narrows to about 30 km off Cape Hatteras (South Atlantic FMC 2011a). Two platforms are contained within this shelf, the Florida Platform, off the northern Florida coast, and the Carolina Platform, off the North Carolina coast. These platforms extend out forming thick sediment wedges which are truncated by the Gulf Stream. The shelf surface is covered mostly by a layer of thin sand less than 5 m thick. In areas where there is no sand coverage, harder cemented sand exposures form, consisting of smooth outcrops or rough bottoms with reliefs up to 15m (MMS 2007b). One of the main geologic features in this region is the Blake Plateau, an intermediate depth outer shelf with depths ranging from 350 to 1,000 m. This plateau is composed of older sediments due to the Gulf Stream, which lies above it and transports most sediment along its current. The western and northern portions of the plateau have deep elongated and flat bottomed erosional depressions caused by the scouring action of the Gulf Stream (MMS 2007b). In the southernmost end of Florida is the Florida Keys reef tract, one of the largest bank-barrier reef systems in the world. Ranging in depth from near the surface to 70 m, the reef extends 356 km from near Miami to the Tortugas region (NOAA 1996, as cited in NOAA 2010c). Beyond the continental shelf is the continental slope, a gentle, transitional drop from the shallow shelf edge of about 60 m onto the Blake Plateau and the Straits of Florida. Shelf-edge reefs occur near the top of the slope (MMS 2007b).

South of Cape Hatteras, the Florida Current is the major current. The Florida Current starts in south Florida and flows northward along the east coast until reaching Cape Hatteras. It is considered to be the beginning of the Gulf Stream (MMS 2007b). Near the Dry Tortugas, the Florida Current creates gyres that can persist for several months (South Atlantic FMC 2011a). The southeast Atlantic coast is characterized primarily by barrier islands, as well as mainland shores in the Carolinas and Florida, estuaries and lagoons, capes, tidal inlets, and delta plains (Morton and Miller 2005). Barrier islands typically occur in areas of low wave energy, gentle continental shelf slopes, and shifting sand deposits that can affect nearshore currents and wave patterns, particularly during storms (Morton et al. 2004). The second largest estuary in the continental United States, the Albemarle Pamlico Sound, lies behind the North Carolina Outer Banks.

The North Carolina coast is characterized by sandy capes, barrier islands, tidal inlets, shell bottom, submerged aquatic vegetation, wetlands, soft bottom, and hard bottom. The South Carolina coast is characterized in the north by narrow barriers and salt marshes or sandy beaches and dunes and in the south by both wide, stable and narrow, migrating barrier islands, as well as tidal inlets (Deaton et al. 2010 and Morton et al. 2004). The Georgia coast is characterized by short, wide barrier islands with sandy beaches, backed by salt marshes and separated by large tidal inlets (Morton et al. 2004). The Georgia Bight creates a high tidal range and affects the morphologies of the barriers and inlets along the coast of Georgia that resemble those of northern Florida and southern South Carolina (Morton and Miller 2005). The coasts of Florida are characterized by barrier islands at the outer edges of the coastal plains, tidal inlets between barrier islands, large coastal bays, lagoons, mangrove swamps, sandy barriers, and mainland beaches, irregular drowned karst topography, coral reefs, sea grasses, and marshes (Morton et al. 2004 and MMS 2007b).

In the southeast Atlantic, the largest waves and highest sustained wind speeds are associated with major hurricanes. Hurricanes in the southeast region typically follow a northward or westward path (Morton and Miller 2005). In this region, landfall depends on particular storm paths, and the areas at greatest risk are southeastern Florida, South Carolina, and North Carolina (Simpson and Lawrence 1971, as cited in Morton and Miller 2005). Georgia has the lowest risk because of the position of its embayed shoreline relative to the tracks of most Atlantic hurricanes (Morton and Miller 2005).

### 3.1.9.2 Water Quality

According to the National Coastal Condition Report, the overall condition of southeastern U.S. coastal waters is good to fair, and the overall water quality condition in Gulf Coast waters, which includes the western coast of Florida, is fair to poor (EPA 2008a). The area south of Cape Hatteras, North Carolina, to Cape Canaveral, Florida, is characterized by mainly turbid and productive waters, influenced by the Gulf Stream, with a small tidal range (MMS 2007b). Water quality of southeast Atlantic coast estuaries and the eastern Gulf of Mexico is affected by the increasing coastal population (NOAA 2009). Strong surface winds can induce upwelling and down welling regimes in the southeast region that affects the ecosystem in profound ways. Similarly, significant upwelling events are induced by the passage of tropical storms. These events, which also may cause the mixing of surface waters with cooler thermocline waters, can produce significant cooling episodes that affect ecosystem function. Wintertime cyclogenesis also occurs over the Gulf Stream creating severe weather such as extra-tropical cyclones that impact both the southeast and mid-Atlantic (Hernandez et al. 2011).

### 3.1.10 CariCOOS

The CariCOOS includes the coastal areas of Puerto Rico and the USVI.

#### 3.1.10.1 Physical Characteristics

The Commonwealth of Puerto Rico includes the island of Puerto Rico, the adjacent islands Vieques and Culebra, and various other isolated islands including Mona and Monito. The USVI consists of three of the largest islands in the Virgin Island chain: St. Croix, St. Thomas, and St. John (Caribbean FMC 2005).

Puerto Rico, St. John, and St. Thomas sit on the same continental shelf. The shelf extends horizontally along the east-west axis to the British Virgin Islands. It is about 12.9 km wide south of the USVI and 32.2 km wide north of the USVI. St. Croix sits on a different shelf south of St. Thomas and St. John. The St. Croix shelf is narrower and shallower, extending 4 km wide south of the island and less than 0.2 km wide northwest of the island. The St. Croix shelf connects through a deep submerged mountain rage to the southeast shelf of Puerto Rico (Caribbean FMC 2005). The areas surrounding Puerto Rico and USVI are relatively shallow, with nearshore waters ranging from 0 to 20 m in depth and outer shelf waters ranging from 20 to 30 m in depth (Caribbean FMC 2011).

Beyond the continental shelf, Puerto Rico is fringed by deep ocean waters. To the west of the island is the Mona Passage, about 120 km wide and more than 1,000 m deep, to the north is the Puerto Rico Trench, about 8,500 m deep, and to the south is the deep Venezuelan Basin of the Caribbean, descending down to 5,000 m. St. Croix is entirely surrounded by the Caribbean Sea, while the coasts of St. Thomas and St. John open to the Atlantic Ocean to the north (Caribbean FMC 2011).

Puerto Rico is a rectangular island about 56 km by 177 km, with a coastline measuring about 1,127 km, including Vieques and Culebra. The USVI covers an area of about 195 $m^2$, with a coastline measuring about 282 km. Coastal habitats in Puerto Rico and the USVI include mangroves, intertidal salt flats, tidal marshes, sandy beaches, and rocky shores (Caribbean FMC 2005).

The continental shelf around Puerto Rico and USVI is relatively shallow, and coastal currents are mainly tidally and wind driven. In Puerto Rico, coastal currents flow east to west off the northern and southern coasts and are influenced mainly by coastal-shelf topography. The north and east coasts are continuously exposed to winds and waves from the Atlantic Ocean. The USVI coastal currents exhibit more variation due to the shallow nature of the continental shelf in this area. To the south of Puerto Rico and the USVI, ocean waters are influenced by the Caribbean current. The Caribbean current also flows west and it is located about 100 km south of the islands, but can move south in the winter time. Circulation within the Caribbean Sea exhibits temporal and spatial variation in the form of eddies and meanders, and it is mainly dependent on bottom topography, wind forcing, current width and shear, and collision of different currents. Ocean waters to the north of Puerto Rico and the USVI are influenced by the westward North Equatorial current—the predominant hydrological driving force in the Caribbean region (Caribbean FMC 2011).

A large portion of the Caribbean lies within the hurricane belt, and Puerto Rico and the USVI are commonly subject to hurricanes and tropical storms. Hurricanes can substantially affect portions of shallow reefs and other coastal habitats. Past storms passing through Puerto Rico and USVI have caused significant reduction in coral populations, uprooting of mangroves and sea grass habitats, mechanical defoliation of coastal plants, and deposition of sediments and other materials. Hurricanes can also have beneficial effects for coastal communities such as removing accumulation of materials, reopening salt ponds to the sea, and increasing species diversity in coral reefs (Caribbean FMC 2011). Other significant physical hazards that could affect the marine and coastal environment in this region include earthquakes and tsunamis.

#### 3.1.10.2 Water Quality

The overall condition of the Puerto Rico coastal waters is poor (EPA 2008a). Non-coastal waters near Puerto Rico and the USVI are relatively stratified and, because no upwelling occurs in this area, severely nutrient limited, with nitrogen being the principal limiting nutrient (Caribbean FMC 2011).

In 2010, Puerto Rico assessed water quality for 94 percent of its coastal shoreline. Thirty-eight percent of assessed shorelines were impaired mainly due to organic enrichment, oxygen depletion, pathogens, and turbidity. Major sources for contaminants and pollutants of coastal contaminants include urban runoff, sewage and municipal discharges, and modifications of rivers that drain to the coast (EPA 2010d).

In 2010, the USVI assessed water quality for 523 km of coastal shoreline. Nine percent of the assessed shoreline was impaired mainly from turbidity, organic enrichment, oxygen depletion, pathogens, and nutrients. Major sources of contaminants included nonpoint source pollution, recreational uses, municipal and sewage discharges, and runoff (EPA 2010e).

### 3.1.11 MARACOOS

The MARACOOS includes the coastlines of 10 states; the northernmost coast of North Carolina, Virginia, Maryland, Delaware, Pennsylvania, New Jersey, New York, Connecticut, Rhode Island, and Massachusetts, as well as the District of Columbia.

### 3.1.11.1 Physical Characteristics

Most of MARACOOS sits on a relatively broad shelf, with a width greater than 120 km throughout most of the shoreline, reaching depths of about 100 m for most of the region (MMS 2007b). In the north, the shelf extends out about 193 km off Cape Cod, narrows gradually to 113 km off New Jersey, and at the south end extends about 32 km off Cape Hatteras. The continental shelf is relatively flat, and slopes toward the continental slope (Mid-Atlantic FMC 2011). A mantle of sand covers most of the shelf, ranging in thickness from 20 m throughout most of the mid-Atlantic region, and increasing to about 40 m on the northern portion of the region. Linear sand ridges are also characteristic of the continental shelf in this region (MMS 2007b).

Beyond the continental shelf is the continental slope, dissected by deep canyons and valleys. Sediments on the slope are mainly sandy silts on the upper slope and silts and clays on the lower slope (McGregor 1983, as cited in MMS 2007b). The Baltimore Canyon Trough is one of the most notable features within the MARACOOS. It is an elongate, northeast-trending basin characterized by extensional tectonic features. Its south-north range is from Virginia to several kilometers off the southern Rhode Island coast, and its west-east range is from within the continental shelf to beyond the continental slope. It is the deepest basin along the U.S. Atlantic margin; it thickens seaward, reaching a thickness of up to 18 km (MMS 2007b).

Continental shelf waters in the Mid-Atlantic Bight are subjected to tidal effects, while offshore waters on the continental slope circulate in an elongated gyre. Waters on both the continental shelf and slope can be affected by the equatorial Gulf Stream current, as its boundaries oscillate between onshore and offshore waters (USCG 1996). In general, coastal waters in the Mid-Atlantic Bight circulate on the continental shelf on a southwesterly pattern from Cape Cod to Cape Hatteras, where they become entrained in the Gulf Stream System (Mulford and Norcross 1971). On occasions the Labrador Current, usually north of Cape Cod, will extend down to Cape Hatteras (MMS 2007b).

The mid-Atlantic region encompasses several estuaries; the four major estuaries located within this region are Buzzards Bay, Narragansett Bay, Delaware Bay, and Chesapeake Bay. The coastal geology of the mid-Atlantic is characterized by a mix of estuaries, rocky coastlines, mainland beaches, barrier islands, and tidal inlets. The northern part of the region, from Massachusetts to New York, is characterized by deeply indented coastlines surrounded by rocky shores, headlands and pocket beaches, mainland beaches, linear barrier islands, tidal inlets, and extensive marshes. The central and southern mid-Atlantic region is similar to the northern section; however, rocky shores are not predominant features in the central and southern region. The central and southern region is characterized by continuous barrier islands, tidal inlets and large embayments, extensive wetlands and marshes in areas where lagoons have been partially filled, and barrier and mainland beaches. The shape and morphology of beaches and barrier islands throughout the mid-Atlantic region are a function of tidal rage, and wave energy and direction (MMS 2007b).

The Chesapeake Bay is the largest estuary in the United States, stretching about 322 km from Havre de Grace, Maryland, to Norfolk, Virginia, with a width varying from 5.5 to 56 km. Shipping channels in the Bay can be deeper than 30 m (Chesapeake Bay Program 2012a). The Chesapeake Bay assumed its present shape about 3,000 years ago on the submerged

Susquehanna River Valley. Remnants of this ancient submerged river valley still exist on the Bay in the form of troughs forming deep channels along the Bay's bottom (Chesapeake Bay Program 2012b).

### 3.1.11.2 Water Quality

The National Coastal Condition Report measured the overall condition of the northeast coast of the United States, which included coastal waters from Virginia to Maine. According to this report, the overall condition of coastal waters of the eastern U.S. coast was rated fair to poor (EPA 2008a). Coastal waters of the Mid-Atlantic Bight exhibit strong seasonal variations, with surface water temperatures ranging from 5-30 °C throughout the year (NOAA 2012d). Coastal waters are subject to large fresh water inputs from the Delaware Bay and the Chesapeake Bay which can influence salinity (USCG 1996). The mid-Atlantic region is highly populated, and coastal waters are severely influenced by large inputs of nutrients and sediments from agricultural operations and urban sources (MMS 2007b).

Circulation within the Chesapeake Bay is influenced by the influx of freshwater from all rivers and tributaries, mainly to the north of the Bay, and the influx of salty oceanic water from the south. This results in a slightly stratified system, with a saltier bottom layer flowing northward and a fresher water layer flowing southward in the Bay. Wind can also impact circulation in the Bay, either disrupting or reinforcing this two-layered flow of fresh and salt water. It can also mix the two layers and reverse the direction of flow. During the summer time, as a result of increased stratification, large areas of low or no oxygen bottom waters occur throughout the Bay (Chesapeake Bay Program 2012c).

Water quality in the Chesapeake Bay is in critical condition. Waters in the Chesapeake Bay are impaired by nitrogen, phosphorus, and sediment pollution which can lead to algal blooms and hypoxic zones. Excess nutrients and sediments are mainly from agriculture, sewage, stormwater, and air pollution. Decline of oysters, underwater grasses, and other natural filters has also contributed to decreased water clarity in the Bay. EPA has developed a Bay-wide "pollution diet" plan to determine the amount of nitrogen, phosphorus, and sediment pollution that each state in the Chesapeake Bay watershed contributes and to improve water quality in the Chesapeake Bay. The Chesapeake Bay Foundation is working to develop plans to restore filtering organisms in the Chesapeake Bay (Chesapeake Bay Foundation 2012).

## 3.1.12 NERACOOS

The NERACOOS includes the coastal waters of Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut and encompasses the Gulf of Maine and Long Island Sound.

### 3.1.12.1 Physical Characteristics

The NERACOOS sits on a broad continental shelf wider than 120 km (MMS 2007b). The most notable geologic features within this region are the Gulf of Maine, George's Bank, Stellwagen Bank, and the Great South Channel (USCG 1996). The Gulf of Maine is a semi-enclosed coastal basin, covering an area of 90,700 $km^2$ and with an average depth of 150 m. It is bordered to the north by Nova Scotia and to the west by Maine, New Hampshire, and Massachusetts. To the south, the Gulf is open at the surface, but at depths greater than 50 m it forms a boundary with George's Bank, and to the east it is open to the ocean (USCG 1996). The Gulf of Maine is topographically unique, containing 21 separate basins with depths exceeding 250 m, and a maximum depth of 350 m to the north at Georges Basin. It also has high points, which can reach peaks at 9 m below the surface consisting of moraines, outcroppings of bedrock, or remnants of sedimentary shelf. The substrate of the Gulf is varied and can consist of mud, sand, gravel, boulders, and bedrock. Bedrock is the predominant substrate along the western edge of the Gulf, and mud is the second most common substrate on the inner continental shelf (New England FMC 2003).

Georges Bank is a large shallow submarine bank south of the Gulf of Maine. It is 150 km wide and 280 km long, and rises more than 100 m above the Gulf of Maine floor with an average depth of less than 40 m at the crest (Backus and Bourne 1987, as cited in USCG 1996). The Bank is characterized by linear ridges; a smooth, gently dipping sea floor; highly energetic peaks with sand ridges; and extensive gravel pavement. Bottom sediments on the Bank range from clay to gravel (New England FMC 2003). The Bank is bordered to the north by the Northeastern Channel (70 m deep), which also connects the Bank to the Gulf of Maine, and to the south by the Great South Channel (140 m deep), which connects the Gulf of Maine and the Atlantic Ocean (USCG 1996).

Stellwagen Bank is a submarine bank measuring 37.2 km in length, lying just north of Cape Cod, to the southwest of the Gulf of Maine. It contains a series of shallow banks in its southern border, and except for the Northwest Channel, it is mostly isolated from deeper waters of the North Atlantic. Its sediments consist mostly of sand and gravel (USCG 1996).

The Great South Channel is a large funnel-shaped feature separating the main part of Georges Bank from Nantucket Shoals (New England FMC 2003). It is has an average depth of about 175 m, and sediment types include gravel pavement and mounds, scattered boulders, sand with storm generated ripples, scattered shells, and mussel beds (USCG 1996, New England FMC 2003). The Great South Channel is one of the most used cetacean habitats off the northeastern United States (NOAA 1993, as cited in USCG 1996).

Waters in the Gulf of Maine flow in a counterclockwise non-tidal current around the coastal margin. This flow is driven mainly by fresh, cold water entering from the northeast over the Scotian Shelf and the Northeast Channel, and freshwater river runoff, which is particularly important in the spring. Dense, warmer waters entering through the bottom of the Northeast Channel from the continental slope can also influence flow (New England FMC 2003).

Waters in Georges Bank circulate in a clockwise direction, strongest in the spring and summer (USCG 1996). Flow in Georges Bank is also influenced by semidiurnal tidal flows and intermittent storm-induced currents. Tidal currents have a strong influence on circulation within Georges Bank and maintain a well-mixed vertical water column within the bank (New England FMC 2003).

Coastal geology of the northeastern region consists mostly of coastal and estuarine features such as salt marshes, mud flats, rocky intertidal zones, sand beaches, and submerged aquatic vegetation. Rocky intertidal zones are periodically submerged, high-energy environments, found extensively on the northeastern region. Sandy beaches and salt marshes, and their corresponding intertidal zones are also found extensively on the northeastern region (New England FMC 2003).

### 3.1.12.2 Water Quality

The National Coastal Condition Report measured the overall condition of the northeast coast of the United States, which included coastal waters from Virginia to Maine. According to this report, the overall condition of coastal waters of the eastern U.S. coast was rated fair to poor (EPA 2008a). The EPA rated the overall condition of northeast estuaries as poor due to impairments to aquatic life (27 percent of areas) and impairments for human use (31 percent of areas), and threatened for aquatic life (49 percent of areas) (EPA 2004, as cited in MMS 2007b).

The interaction of currents and bodies of waters entering the Gulf of Maine results in an intense seasonal cycle of winter cooling and turnover, springtime freshwater runoff from rivers, and summer warming, which in turn influence oceanographic and biologic processes in the Gulf. Localized areas of upwelling interaction can also occur in numerous places throughout the Gulf as a result of tides, winds, currents, and wave interactions (New England FMC 2003). The well mixed water environment within the center of Georges Bank is a key contributor to the productivity, abundance, and diversity of marine populations on the Bank (USCG 1996).

## 3.1.13 GLOS

The GLOS includes the five Great Lakes (Lake Superior, Lake Michigan, Lake Huron, Lake Erie, and Lake Ontario) and the St. Lawrence River.

### 3.1.13.1 Physical Characteristics

The Great Lakes are glacier lakes which began forming during the Pleistocene Epoch, as the glaciers advanced and retreated many times, scouring the earth in the region (GLIN 2012). The bottom sediments of the Great Lakes are characterized by sand, silt, clay and boulders deposited by the receding glaciers in various mixtures and forms. These deposits include features such as moraines, flat till plains, till drumlins, and eskers formed of sands and gravels from meltwaters. To the north and northwest, the Great Lakes are bordered by the Canadian Shield, characterized by gentle rolling hills and small mountain remnants (EPA 2008b).

The shoreline geology in the Great Lakes region is characterized mainly by sand beaches, sand dunes, and wetlands consisting of marshes, bogs, and swamps. Wetlands can range in size from small wetlands in scattered bays to extensive shoreline wetlands such as those in the southwestern region of Lake Erie. Isle Royal, in the northwestern section of Lake Superior, has a unique landscape left behind by the geologic process of receding glaciers, consisting of reddish sedimentary rocks on the southern section and rocky bluffs on the northern section, left behind by geologic process of receding glaciers (GLIN 2012).

Lake Superior is the largest of the lakes by volume; it has an average depth of 147 m, and a maximum depth of 406 m. Lake Michigan is the second largest of the Great Lakes and is the only one entirely within the United States; it has an average depth of 85 m and a maximum depth of 282 m. Lake Huron is the third largest of the lakes by volume and includes Georgian Bay.

Lake Erie is the smallest of the lakes by volume; it has an average depth of 19 m and a maximum depth of 64 m. Lake Ontario encompasses a smaller area than Lake Erie but is much deeper; it has an average depth of 86 m and a maximum depth of 244 m (EPA 2011b). The St. Lawrence River connects the Great Lakes to the North Atlantic Ocean and has a watershed at the border of New York and Canada, which drains approximately 777,000 $km^2$ at its most downstream point in the United States (New York Department of Environmental Conservation 2012).

Water level in lakes can be affected by day to day factors such as weather, or by seasonal variations due to climate. Day-to-day changes caused by winds can create a “wind set-up,” blowing water from one side of the lake to the other. A *seiche* is another form of water oscillation occurring as a result of a rapid change in winds and barometric pressure. Annual or seasonal variations occur mainly due to changes in precipitation and runoff. Generally, the lowest water levels occurring in the Great Lakes occur during the winter, because most of the precipitation is locked in ice and snow on land. Water levels are the highest during the summer time after the spring thaw when runoff to lakes increases (EPA 2008b).

### 3.1.13.2 Water Quality

Water in the Great Lakes system is replenished through precipitation, surface runoff, groundwater inflow, or inflow from tributaries to the lakes. Surface runoff can be affected by erosion and clearing of forested lands, which can affect water quality of the lakes. Groundwater inflow can pick up materials of human origin that have been buried and carry this contamination into the lakes (EPA 2008b).

The National Coastal Condition Report assesses the overall condition of all five of the Great Lakes, the St. Lawrence River, and the St. Clair River Lake. According to this report, the overall condition of water within the entire Great Lake system is rated fair to poor (EPA 2008a). Based on mean water volume and mean rate of runoff each lake has a different retention time, which can affect how pollutants affect each lake. Lake Superior has the longest retention times, 191 years, based on its large volume and depth. Most of its basin is forested and the surrounding human population is relatively small, resulting in relatively low levels of pollutants entering Lake Superior from runoff or groundwater inflow. Lake Michigan has a retention time of 99 years. It receives the waste from the world’s largest concentration of pulp and paper mills, and its southern basin is among the most urbanized areas in the Great Lakes system, influenced by Milwaukee, Wisconsin, and the Chicago, Illinois, Metropolitan Area. Lake Huron has a retention time of 22 years. Its basin is intensely farmed and contains the Flint and Saginaw–Bay City, Michigan, metropolitan areas. Lake Erie has a retention time of 2.6 years and, due to the fertile soils surrounding the lake, this area is intensely farmed. It receives runoff from the agricultural areas of southwestern Ontario, and parts of Ohio, Indiana, and Michigan. Seventeen metropolitan areas are located within its basin. Lake Ontario has a retention time of 6 years and the cities of Hamilton and Toronto, Ontario, are located along its shores (EPA 2011b). In the St. Lawrence River watershed, acid rain, mercury deposition, and agricultural impacts are widespread issues (New York Department of Environmental Conservation 2012)

The Great Lakes are managed in part by the International Joint Commission, a commission led by U.S. and Canadian officials to cooperate and jointly manage the entire Great Lakes region (IJC 2012).

## 3.2 BIOLOGICAL RESOURCES

### 3.2.1 Applicable Laws, Regulations, and Executive Orders

***Endangered Species Act.*** The ESA of 1973, 16 U.S.C. 1531 et seq., establishes policy to protect and conserve threatened and endangered species and the habitats in which they are found and on which they depend. The ESA is administered by the U.S. Fish and Wildlife Service (FWS) and the NOAA National Marine Fisheries Service (NMFS). Section 7 of the ESA requires federal agencies to consult with FWS, NMFS, and the appropriate state agencies to determine if proposed actions may affect listed or candidate species or designated critical habitat.

Pursuant to the ESA, the federal government designated certain areas as critical habitat areas for species listed under the ESA. Critical habitats are defined as specific areas:

- within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation and those features may require special management considerations or protection; and
- outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation.

In addition to protection of threatened and endangered species under the ESA, individual states offer protection for state-listed threatened or endangered species. Consultation with the appropriate federal or state agency would be conducted prior to any activities that may impact state-listed threatened or endangered species.

***Magnuson-Stevens Fishery Conservation and Management Act.*** The Magnuson-Stevens Fishery Conservation and Management Act of 1976 (MSFCMA), 16 U.S.C. 1801 et seq., conserves and manages fishery resources, including anadromous species, found within the U.S. EEZ. The purpose of the MSFCMA is to support and encourage implementation and the conservation and management of highly migratory species, promote commercial and recreational fishing under sound conservation and management principles, provide for the preparation and implementation of fishery management plans, and establish eight regional fishery management councils to exercise sound judgment in the stewardship of fishery resources. Section 305(b) of the MSFCMA requires that federal agencies must consult with the NMFS on those activities authorized, funded, or undertaken that may adversely affect EFH that may have directly (e.g., physical disruption) or indirectly (e.g., loss of prey species) effects on EFH.

Federal agencies retain the discretion to determine what actions fall within the definition of "adverse effect." Additionally, during consultation or the development of an EA, NOAA Fisheries Staff can assist with the determination of the level (i.e., negligible, minor) of an adverse effect on EFH. Temporary or minimal impacts are not always considered to be adverse effects. "Temporary impacts" are those that are limited in duration and that allow the particular environment to recover without measurable impact. "Minimal impacts" are those that may result in relatively small changes in the affected environment and insignificant changes in ecological functions.

***Marine Mammal Protection Act.*** The Marine Mammal Protection Act (MMPA), 16 U.S.C. 1361 et seq., was enacted in 1972 to protect marine mammals, and ensure that population stocks and essential habitats of marine mammals are maintained at, or restored to, healthy population levels. Jurisdiction over marine mammals under the MMPA is shared between FWS and NMFS. FWS has jurisdiction over sea otters, polar bears, manatees, dugongs, and walruses, while NMFS has jurisdiction over all other marine mammals (i.e., all cetaceans and pinnipeds, except walrus). The MMPA established a moratorium on the taking (i.e., meaning to or attempt to hunt, harass, capture, or kill) or importing of marine mammals. The MMPA provides NOAA with authority to allow, upon request, the take of small numbers of marine mammals by U.S. citizens who engage in specified activities (such as scientific research, commercial and non-commercial fishery, or public display) if NMFS finds the take will have a negligible impact on the species or stock, and will not have an unmitigable adverse impact on the availability of the species or stock for subsistence use (where relevant). Consultation with the appropriate federal agency would be conducted prior to any activities that may impact protected marine mammals.

***Migratory Bird Treaty Act.*** The Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703 et seq., implements a series of treaties the United States has entered into with Canada, Mexico, Japan, and Russia for the conservation of migratory birds. Under this Act, it is federally prohibited, unless permitted by regulations, to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport or cause to be transported, carry or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention . . . for the protection of migratory birds . . . or any part, nest, or egg of any such bird" (16 U.S.C. 703). The Secretary of the Interior is authorized, subject to limitations, to allow exceptions to the regulations. If federal actions are likely to negatively impact migratory bird populations, the federal agency must consult with FWS.

***National Marine Sanctuaries Act.*** The National Marine Sanctuaries Act (NMSA), 16 U.S.C. 1431 et seq., authorizes the Secretary of Commerce to designate and protect as national marine sanctuaries areas of the marine environment with special national or international significance due to their "conservation, recreational, ecological, historical, scientific, cultural, archeological, educational, or esthetic qualities" (16 U.S.C. 1431). Management of national marine sanctuaries has been delegated to NOAA's Office of National Marine Sanctuaries. Pursuant to section 304(d) of the National Marine Sanctuaries Act, federal agency actions likely to destroy, cause the loss of, or injure any sanctuary resource are subject to consultation with the National Marine Sanctuaries Program. Consultation will require a statement describing the action and its potential effects on sanctuary resources, as well as reasonable and prudent alternatives to protect sanctuary resources, prior to undertaking any action. Sanctuary permits are required when an individual wishes to conduct an activity within a sanctuary that is otherwise prohibited. IOOS RAs that have designated national marine sanctuaries include: PacIOOS, NANOOS, CeNCOOS, SCCOOS, GCOOS, SECOORA, MARACOOS, NERACOOS, and GLOS.

***Executive Order 13089, Coral Reef Protection (June 11, 1998)***. EO 13089, *Coral Reef Protection*, requires federal agencies to protect coral reef ecosystems and, to the extent permitted by law, prohibits them from authorizing funding or carrying out any actions that will degrade these ecosystems.  Federal agencies whose actions may affect U.S. coral reef ecosystems must provide for implementation of measures needed to research, monitor, manage, and restore affected ecosystems, including, but not limited to, measures reducing impacts from pollution, sedimentation, and fishing.

***Executive Order 13112, Invasive Species (February 3, 1999).*** EO 13113, *Invasive Species,* defines an invasive species as a species that is nonnative to a particular ecosystem and whose introduction causes or is likely to cause, economic, or environmental harm or harm to human health.  Under EO 13113, federal agencies are required to:

- Identify any actions that may affect invasive species;
- Prevent invasive species introduction;
- Detect and respond to and control populations of invasive species in a cost-effective and environmentally sound manner;
- Monitor invasive species populations accurately and reliably;
- Provide for restoration of native species and habitat conditions in invaded ecosystems;
- Conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species;
- Promote public education on invasive species and the means to address them; and
- Abstain from authorizing, funding, or carrying out actions that are likely to cause or promote invasive species introduction or spread, unless the agency has determined that the benefits of such actions clearly outweigh the potential harm caused by invasive species and that all feasible and prudent measures to minimize risk of harm will be taken.

***Executive Order 13158, Marine Protected Areas (May 26, 2000).*** The purpose of EO 13158, *Marine Protected Areas* (MPAs), is to help protect the significant natural and cultural resources within the marine environment for the benefit of present and future generations by strengthening and expanding the nation's system of MPAs.  MPAs are defined as "any area of the marine environment that has been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein."  This EO directs federal agencies to work closely with state, local, and nongovernmental partners to create a comprehensive system of MPAs representing diverse U.S. marine ecosystems, and the nation's natural and cultural resources and to avoid causing harm to MPAs through federally conducted, approved, or funded activities.

## 3.2.2 Biological Resources Common to All Regions

### 3.2.2.1 Marine Protected Areas

The United States has developed a national system of Marine Protected Areas (MPA) to ensure conservation and sustainable use of the nation's marine resources and formally recognize areas of the marine environment that have been reserved by federal, state, territorial, tribal, or local laws to provide lasting protection natural and cultural resources (EO 13158).  The purpose of this system is to support the effective conservation, restoration, and sustainable use of significant cultural and natural resources.  MPAs can be classified as Eligible, Member, Nominated, and Not Eligible.  Only member sites have been accepted into the system and are listed in the official List of National System of MPAs, published in the Federal Register, and at http://marineprotectedareas.noaa.gov/aboutmpas/mpacenter/. However, MPAs listed as eligible, nominated, or not eligible still meet the definition of an MPA and receive different levels of protection depending on the individual MPA (NOAA 2010d). Currently, there are 297 Member MPAs listed in the List of National System of MPAs. Eligible MPAs can be nominated to the National System through a science based process (NOAA 2012e).

#### 3.2.2.2 Migratory Birds

The MBTA protects migratory birds, including bird parts, nests, or eggs. Marine birds spend the majority of their life at sea, coming ashore mainly to breed or to avoid severe environmental conditions. Examples are pelagic birds (e.g., petrels and shearwaters); diving birds (e.g., cormorants and pelicans); and gulls, terns, and skimmers. Pelagic species typically concentrate to feed in nutrient-rich upwelling areas (MMS 2007a). Types of seabirds and waterfowl common to U.S. marine waters include albatrosses, petrels, cormorants, loons, shearwaters, fulmars, gulls, kittiwakes, jaegers, terns, phalaropes, murres, puffins, and auks (NOAA 2005a and NOAA 2011i). Several species form large congregations of individuals or "rafts" in marine waters, which can number in the hundreds or thousands, and some species dive 20 m or more while feeding in the benthos.

Coastal bird species forage and/or nest in coastal habitats such as sandy beaches, wetlands, rocky shores, islands, estuaries, bays, lagoons, and coastal forests and uplands. Examples are shorebirds, such as sandpipers, plovers, and avocets; wading birds, such as herons and egrets; waterfowl; raptors; and numerous passerines, such as jays, blackbirds, finches, warblers, and sparrows. Species that are characteristic of sandy beaches include plovers, willets, whimbrels, marbled godwits, sanderlings, and sandpipers. Species using rocky shorelines or offshore rocks include oystercatchers, turnstones, spotted sandpipers, and surfbirds. U.S. coastal habitats provide nesting and foraging habitats for seasonal and year-round residents, and neo-tropical migrants (NGS 1999, as cited in MMS 2007a).

Migratory birds in North America migrate along specific paths between summer breeding grounds and wintering grounds extending from the Arctic to Central and South America. Major flyways through the ROI described in this PEA include the Atlantic, Central, Mississippi, Pacific, and Central Pacific flyways. Larger water bodies and shorelines present stopover habitats or staging areas upon which migratory birds rely for feeding during migration.

#### 3.2.2.3 Marine Mammals

Marine mammals are protected under the MMPA and are addressed in detail within each regional discussion, below. Orders of marine mammals found in U.S. waters include cetaceans, sirenians, and carnivores (i.e., pinnipeds and fissipeds). Cetaceans include mysticetes (i.e., baleen whales) and odontocetes (i.e., toothed whales and dolphins). Sirenians include dugongs and manatees. Pinnipeds include walruses, fur seals and sea lions, and true seals. Fissipeds include polar bears and otters.

## 3.2.3 PacIOOS

### 3.2.3.1 Fish

The PacIOOS contains a vast variety of fish species, such as skipjack tuna, yellowfin tuna, bigeye tuna, reef finfish, pelagic fish, mangrove crab, lobster, trochus, giant clam, beche-de-mer, and other invertebrates (United Nations 2002). Reef fish include barracuda, eel, emperor, goatfish, grouper, jacks, jobfish, mackerel, milkfish, mojarra, mullet, parrotfish, rabbitfish, ray, rudderfish, sardines, scad, sea bream, snapper, surgeonfish, trevally, unicornfish, and wrasse (United Nations 2002).

The Palau EEZ (629,000 $km^2$) borders Indonesia, the Philippines, and the Federated States of Micronesia to the south, west and east, and is surrounded by high seas areas to the north and southeast (Sisior 2006). Palau's Marine Protection Act of 1994 places restrictions on fishing gear, fishing seasons, and exports of certain threatened fish and shellfish (United Nations 2002).

The Federated States of Micronesia's EEZ covers over 1.6 million $km^2$ and falls under the jurisdiction of the Federated States of Micronesia National Government. The Micronesian Fisheries Authority oversees the conservation, management, and development of all commercial fisheries within this area.

The Western Pacific Regional FMC has established Fishery Ecosystem Plans for the Pacific Remote Island Areas (including Wake Island), Mariana Islands, American Samoa, Hawaii, and Pacific pelagic fisheries. The Western Pacific Regional FMC manages and has established EFH for bottom fish and seamount ground fish, crustaceans, precious corals, and coral reef ecosystem fisheries throughout the Western Pacific Region, which the Western Pacific Regional FMC defines as Guam, the Commonwealth of the Northern Mariana Islands, American Samoa, and Hawaii (Western Pacific Regional FMC 2009b).

The Western Pacific Regional FMC has designated the following areas as HAPCs: The water column down to 1,000 meters that lies above seamounts and banks with summits shallower than 2,000 meters, all escarpments/slopes between 40 and 280 meters throughout the Western Pacific Region (bottomfish HAPC); the three known areas of juvenile opakapaka (Hawaiian pink snapper) habitat (two off Oahu and one off Molokai in the Hawaiian Island archipelago); all banks within the Northwestern Hawaiian Islands, Mariana Archipelago, and American Samoa with summits less than 30 meters (spiny and slipper lobster complex); all no-take MPAs, all Pacific remote islands, and numerous existing MPAs, research sites, and coral reef habitats throughout the western Pacific (coral reef taxa); the Makapuu, Wespac, and Brooks Banks beds in Hawaii (precious corals); and the Auau Channel in Hawaii (black corals) (Western Pacific Regional FMC 2009b).

### 3.2.3.2 Marine Mammals

Of the more than 20 species of odontocetes present in this region, sperm whales (*Physeter macrocephalus*) are the most common. Mysticetes such as the minke whale (*Balaenoptera acutorostrata*) and Bryde's whale (*Balaenoptera edeni*) are also present (SOPAC 2007b and Western Pacific Regional FMC 2009a). The only sirenian that occurs in the Pacific region is the dugong (*Dugong dugon*), which is present within the ROI in the waters of Palau (SOPAC

2007b). The dugong is listed as endangered under the ESA. The Hawaiian monk seal (*Monachus schauinslandi*), a pinniped listed as endangered under the ESA, occurs in the region, in the Northwestern and mainland Hawaiian Islands (Western Pacific Regional FMC 2009a). Seven marine mammal species that occur throughout the Pacific region are listed as endangered under the ESA (see Section 3.2.3.3, *Threatened and Endangered Species*).

#### 3.2.3.3 Threatened and Endangered Species

Several marine or coastal species listed as threatened or endangered species under the ESA are found throughout the PacIOOS. These include the following species managed by NMFS and/or FWS (Table 3-1).

**Table 3-1. Threatened or Endangered Species in the PacIOOS**

| Common Name | Scientific Name | Status |
|---|---|---|
| | ***Reptiles*** | |
| Saltwater crocodile | *Crocodylus porosus* | Endangered |
| Green turtle | *Chelonia mydas* | Threatened |
| Hawksbill turtle | *Eretmochelys imbricata* | Endangered |
| Loggerhead turtle | *Caretta caretta* | Endangered (North and South Pacific Ocean DPSs) |
| Olive Ridley turtle | *Lepidochelys olivacea* | Threatened |
| Leatherback turtle | *Dermochelys coriacea* | Endangered |
| | ***Birds*** | |
| Short-tailed albatross | *Phoebastria albatrus* | Endangered |
| Hawaiian dark-rumped petrel | *Pterodroma phaeopygia sandwichensis* | Endangered |
| Newell's Townsend's Shearwater | *Puffinus auricularis newelli* | Threatened |
| | ***Mammals*** | |
| Hawaiian monk seal | *Monachus schauinslandi* | Endangered, CH |
| Dugong | *Dugong dugon* | Endangered |
| Sei whale | *Balaenoptera borealis* | Endangered |
| Blue whale | *Balaenoptera musculus* | Endangered |
| Fin whale | *Balaenoptera physalus* | Endangered |
| Humpback whale | *Megaptera novaeangliae* | Endangered [a] |
| Sperm whale | *Physeter macrocephalus* | Endangered |

Sources: FWS 2012a, NOAA 2012f

Notes: CH = designated critical habitat; DPS = Distinct Population Segments

[a] NOAA Fisheries proposes to revise the ESA listing for the humpback whale to identify 14 DPS, list 2 as threatened and 2 as endangered, and identify 10 others as not warranted for listing.

**Designated Critical Habitat**

*Hawaiian monk seal.* In June 2015, NMFS issued a Final Rule on the designation of critical habitat for the Hawaiian monk seal that includes sixteen occupied areas within the range of the species: ten areas in the Northwestern Hawaiian Islands (NWHI) and six in the main Hawaiian Islands (MHI). These areas contain one or a combination of habitat types: Preferred pupping and nursing areas, significant haul-out areas, and/or marine foraging areas, that will support conservation for the species. Specific areas in the NWHI include all beach areas, sand spits and islets, including all beach crest vegetation to its deepest extent inland, lagoon waters, inner reef waters, and including marine habitat through the water's edge, including the seafloor and all subsurface waters and marine habitat within 10 meters (m) of the seafloor, out to the 200-m depth contour line around the following 10 areas: Kure Atoll, Midway Islands, Pearl and Hermes Reef, Lisianski Island, Laysan Island, Maro Reef, Gardner Pinnacles, French Frigate Shoals, Necker Island, and Nihoa Island. Specific areas in the MHI include marine habitat from the 200-m depth contour line, including the seafloor and all subsurface waters and marine habitat within 10 m of the seafloor, through the water's edge 5 m into the terrestrial environment from the shoreline between identified boundary points on the islands of: Kaula, Niihau, Kauai, Oahu, Maui Nui (including Kahoolawe, Lanai, Maui, and Molokai), and Hawaii (NOAA 2015 and 80 FR 50925).

## 3.2.4 AOOS

### 3.2.4.1 Fish

The North Pacific FMC is responsible for the conservation and management of fish stocks within the federal 200-NM limit off the coast of Alaska (North Pacific FMC 2012a). The North Pacific FMC manages five fisheries, including Bering Sea and Aleutian Islands ground fish (e.g., pollock, cod, flatfish, sablefish, and rockfish), Gulf of Alaska ground fish, king and Tanner crab, salmon, and scallop, and has designated EFH for each. Additionally, the North Pacific FMC uses an ecosystem-based management policy to manage fishery resources in the Arctic Management Area. Specifically, all federal waters of the U.S. Arctic are closed to commercial fishing for any species of finfish, mollusks, crustaceans, and all other forms of marine animal and plant life. Harvest of marine mammals and birds, subsistence or recreational fishing, and fisheries managed by the State of Alaska are not regulated by the Arctic Fisheries Management Plan (North Pacific FMC 2012b).

The Fishery Management Plan for Salmon Fisheries in the EEZ Off Alaska was amended in 2012 to specifically exclude the three historical net commercial salmon fishing areas and the sport salmon fishery from the West Area EEZ. The Fisheries Management Plan would prohibit commercial salmon fisheries in the modified West Area and would continue to delegate management authority to the State of Alaska for the directed commercial salmon troll fishery and the sport salmon fishery in the East Area EEZ (North Pacific FMC 2012c). Within identified EFH, the North Pacific FMC has designated HAPC, which include the Alaska Seamount Habitat Protection Areas, Bowers Ridge Habitat Conservation Zone, and Gulf of Alaska Coral Habitat Protection Areas, Gulf of Alaska Slope Habitat Conservation Areas, and Skate Nursery Areas. Within the Alaska Seamount Habitat Protection Areas, which encompass approximately 5,300 $nm^2$, no federally permitted vessel may fish with bottom contact gear (nonpelagic trawl, dredge, dinglebar, pot, or hook-and-line gear). Within the Bowers Ridge Habitat Conservation Zone, which encompasses approximately 5,300 $nm^2$, no federally permitted vessel may fish with mobile bottom contact gear (nonpelagic trawl, dredge, or dinglebar gear). Within the Gulf of Alaska Coral Habitat Protection Areas, which encompasses approximately 2,100 $nm^2$, no federally permitted vessel may fish with bottom contact gear (nonpelagic trawl, dredge, dinglebar, pot, or hook-and-line gear) (North Pacific FMC 2010). Within the Gulf of Alaska Slope Habitat Conservation Areas, which encompasses approximately 3,000 $nm^2$, no federally permitted fishing vessel may fish with bottom contact gear. However, there are Skate Nursery Areas (designated as HAPC) in the Gulf of Alaska, which encompasses approximately 82 $nm^2$. In these HAPCs, a priority must be given to monitoring for skate eggs.

#### 3.2.4.2 Marine Mammals

There are more than 10 species of odontocetes present in this region, including Baird's beaked whale (*Berardius bairdii*), beluga whale (*Delphinapterus leucas*), killer whale (*Orcinus orca*), sperm whale, Cuvier's beaked whale (*Ziphius cavirostris*), Stejneger's beaked whale (*Mesoplodon stejnegeri*), Dall's porpoise (*Phocoenoides dalli*), and harbor porpoise (*Phocoena phocoena*). Mysticetes such as the blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), minke whale, humpback whale, gray whale (*Eschrichtius robustus*), bowhead whale (*Balaena mysticetus*), and North Pacific right whale (*Eubalaena japonica*) are also present. Sirenians no longer occur in Alaskan waters; the Steller sea cow (*Hydrodamalis gigas*) used to occur in Alaskan waters but was hunted to extinction. Pinnipeds include the ringed seal (*Phoca hispida*), ribbon seal (*Histriophoca fasciata*), Pacific walrus (*Odobenus rosmarus divergens*), harbor seal (*Phoca vitulina*), spotted seal (*Phoca largha*), bearded seal (*Erignathus barbatus*), northern fur seal (*Callorhinus ursinus*), Steller sea lion (*Eumetopias jubatus*), and California sea lion (*Zalophus californianus*). Marine fissipeds include the polar bear (*Ursus maritimus*) and northern sea otter (*Enhydra lutris kenyoni*) (NOAA 2005a and NOAA 2011i, j). Twelve marine mammal species that occur throughout the AOOS are listed as endangered under the ESA (see Section 3.2.4.3, *Threatened and Endangered Species*).

#### 3.2.4.3 Threatened and Endangered Species

Several marine or coastal species listed as threatened or endangered species under the ESA are found throughout the Alaska region. These include the following species managed by NMFS and/or FWS (Table 3-2).

**<u>Designated Critical Habitat</u>**

*Spectacled eider*. The spectacled eider is a large sea duck that breeds on the coasts of Alaska and northeastern Siberia. Critical habitat includes areas on the Yukon–Kuskokwim Delta, in Norton Sound, Ledyard Bay, and the Bering Sea between St. Lawrence and St. Matthew Islands (FWS 2012b and 66 FR 9146).

*Steller's eider*. The Steller's eider is a small sea duck that breeds along the Arctic coasts of Alaska and eastern Siberia. Units of designated critical habitat are the Yukon–Kuskokwim Delta, Kuskokwim Shoals, Seal Islands, Nelson Lagoon, and Izembek Lagoon, on the Bering Sea coast of Alaska (FWS 2012b and 66 FR 8850).

**Table 3-2. Threatened or Endangered Species in the AOOS**

| **Common Name** | **Scientific Name** | **Status** |
|---|---|---|
| ***Reptiles*** | | |
| Green turtle | *Chelonia mydas* | Threatened |
| Loggerhead turtle | *Caretta caretta* | Endangered (North Pacific Ocean DPS) |
| Olive Ridley turtle | *Lepidochelys olivacea* | Threatened |
| Leatherback turtle | *Dermochelys coriacea* | Endangered |
| ***Fish*** | | |
| Pacific euchalon/smelt | *Thaleichthys pacificus* | Threatened |
| ***Birds*** | | |
| Eskimo curlew | *Numenius borealis* | Endangered |
| Short-tailed albatross | *Phoebastria albatrus* | Endangered |
| Spectacled eider | *Somateria fischeri* | Threatened, CH |
| Steller's eider | *Polysticta stelleri* | Threatened (Alaska breeding population), CH |
| ***Mammals*** | | |
| Steller sea lion | *Eumetopias jubatus* | Endangered (Western DPS), CH |
| Polar bear | *Ursus maritimus* | Threatened, CH |
| Northern sea otter | *Enhydra lutris kenyoni* | Threatened (Southwest Alaska DPS), CH |
| Bowhead whale | *Balaena mysticetus* | Endangered |
| North Pacific right whale | *Eubalaena japonica* | Endangered, CH |
| Sei whale | *Balaenoptera borealis* | Endangered |
| Blue whale | *Balaenoptera musculus* | Endangered |
| Fin whale | *Balaenoptera physalus* | Endangered |
| Humpback whale | *Megaptera novaeangliae* | Endangered |
| Killer whale | *Orcinus orca* | Endangered (Southern Resident DPS) |
| Beluga whale | *Delphinapterus leucas* | Endangered (Cook Inlet DPS), CH |
| Sperm whale | *Physeter macrocephalus* | Endangered |

Source: FWS 2012a, NOAA 2012f.

Note: CH = designated critical habitat.

*Steller sea lion.* Critical habitat has been designated for both the Eastern and Western DPSs and includes marine waters, terrestrial rookeries (breeding sites), and haulouts (resting sites) in the Bering Sea and Gulf of Alaska, around the Aleutian Islands (NOAA 2011k).

*Polar bear*. Units of designated critical habitat are Sea-Ice Habitat, Terrestrial Denning Habitat, and Barrier Island Habitat. Sea-Ice Habitat includes the mean high tide line to the 300-m depth contour, with the following limits: EEZ to the north, International Date Line to the west, and the range of the Chukchi-Bering Seas population to the south. Barrier island habitat includes the barrier islands themselves and associated spits, and the water, ice, and any other terrestrial habitat within 1.6 km of the islands (FWS 2012b and 75 FR 76120).

*Northern sea otter*. Units of designated critical habitat for the Alaska DPS include approximately 18,000 km of coastline and are subdivided as the (1) Western Aleutian Unit; (2) Eastern Aleutian Unit; (3) South Alaska Peninsula Unit; (4) Bristol Bay Unit; and (5) Kodiak, Kamishak, Alaska Peninsula Unit islands (FWS 2012b and 74 FR 51988).

*North Pacific right whale.* Critical habitat has been established in the Bering Sea Critical Habitat Area and Gulf of Alaska Critical Habitat Area (NOAA 2011k).

*Beluga whale.* Critical habitat includes two specific marine areas in Cook Inlet, Alaska. These areas are bounded on the upland by Mean High Water datum, except for the lower reaches of four tributary rivers (NOAA 2011k and 76 FR 20180).

## 3.2.5 NANOOS

### 3.2.5.1 Fish

The Pacific FMC is responsible for the conservation and management of fish stocks and fishery resources within the federal 200-nautical miles (nm) limit off the coasts of Washington, Oregon, and California. The Pacific FMC manages fisheries for approximately 119 species of salmon, groundfish, coastal pelagic fish (sardines, anchovies, and mackerel), and highly migratory fish (tunas, sharks, and swordfish) and has established EFH for each. The Pacific FMC also collaborates with other organizations, including the International Pacific Halibut Commission, which manages fish stocks that migrate through the Council’s jurisdiction (Pacific FMC 2012). Within identified EFH, the Pacific FMC has designated HAPC for groundfish, which include estuaries, canopy kelp, seagrass, rocky reefs, and “areas of interest” including all waters and sea bottom in state waters shoreward from the three nautical mile boundary of the territorial sea shoreward to MHHW off of Washington and Daisy Bank/Nelson Island, Thompson Seamount, President Jackson Seamount off of Oregon, (a variety of submarine features, such as banks, seamounts, and canyons, along with Washington State waters) for ground fish. Additionally, the Pacific FMC has established closed areas to protect ground fish habitat, including bottom trawl closed areas, bottom contact closed areas, and a bottom trawl footprint closure (Pacific FMC 2011). Additionally, the Pacific FMC has designated HAPC for salmon which includes Complex channels and floodplain habitats, Thermal refugia, Spawning habitat, Estuaries, and Marine and estuarine submerged aquatic vegetation (Pacific FMC 2014).

### 3.2.5.2 Marine Mammals

At least 32 species of marine mammals occur in this region, including mysticetes such as the North Pacific right whale, blue whale, and Humpback whale. Odontocetes present in the region include the pygmy sperm whale (*Kogia breviceps*), sperm whale, and several species of dolphin.

Sirenians do not occur in northwest waters. Pinnipeds such as the harbor seal, Steller sea lion, California sea lion, and northern fur seal occur, as well as a fissiped, the southern sea otter (*Enhydra lutris nereis*) (MMS 2007a). While some species are year-round residents, others occur as seasonal residents or as migrants. Several species, such as some of the *Mesoplodon* beaked whales, are cryptic and rarely observed (Carretta et al. 2007, as cited in MMS 2007a). Nine marine mammal species that occur throughout the northwest region are listed as threatened or endangered under the ESA (see Section 3.2.5.3, *Threatened and Endangered Species*).

### 3.2.5.3 Threatened and Endangered Species

Several marine or coastal species listed as threatened or endangered species under the ESA are found throughout the NANOOS. These include the following species managed by NMFS and/or FWS (Table 3-3).

**Table 3-3. Threatened or Endangered Species in the NANOOS**

| Common Name | Scientific Name | Status |
|---|---|---|
| ***Reptiles*** | | |
| Green turtle | *Chelonia mydas* | Threatened |
| Loggerhead turtle | *Caretta caretta* | Endangered (North Pacific Ocean DPS) |
| Olive Ridley turtle | *Lepidochelys olivacea* | Threatened |
| Leatherback turtle | *Dermochelys coriacea* | Endangered, CH |
| ***Fish*** | | |
| Green sturgeon | *Acipenser medirostris* | Threatened (Southern DPS), CH |
| Chum salmon | *Oncorhynchus keta* | Threatened (Columbia River and Hood Canal summer-run ESUs), CH |
| Coho salmon | *Oncorhynchus kisutch* | Threatened (Lower Columbia River, Oregon Coast, and Southern Oregon/Northern California Coasts ESUs), CH |
| Sockeye salmon | *Oncorhynchus nerka* | Threatened (Ozette Lake ESU), CH |
| Chinook salmon | *Oncorhynchus tshawytscha* | Threatened (Lower Columbia River and Puget Sound ESUs), CH |
| Steelhead trout | *Oncorhynchus mykiss* | Threatened (Puget Sound ESU), CH |
| Pacific euchalon/smelt | *Thaleichthys pacificus* | Threatened (Southern DPS), CH |
| Bocaccio | *Sebastes paucispinis* | Endangered (Puget Sound/Georgia Basin DPS) |
| Canary rockfish | *Sebastes pinniger* | Threatened (Puget Sound/Georgia Basin DPS) |
| Yelloweye rockfish | *Sebastes ruberrimus* | Threatened (Puget Sound/Georgia Basin DPS) |
| ***Birds*** | | |

| Common Name | Scientific Name | Status |
|---|---|---|
| Short-tailed albatross | *Phoebastria albatrus* | Endangered |
| Western snowy plover | *Charadrius alexandrinus nivosus* | Threatened (Pacific coastal population), CH |
| Marbled murrelet | *Brachyramphus marmoratus* | Threatened, CH |
| ***Mammals*** | | |
| Steller sea lion | *Eumetopias jubatus* | Threatened (Eastern DPS), CH |
| Southern sea otter | *Enhydra lutris nereis* | Threatened |
| North Pacific right whale | *Eubalaena japonica* | Endangered |
| Sei whale | *Balaenoptera borealis* | Endangered |
| Blue whale | *Balaenoptera musculus* | Endangered |
| Fin whale | *Balaenoptera physalus* | Endangered |
| Humpback whale | *Megaptera novaeangliae* | Endangered |
| Killer whale | *Orcinus orca* | Endangered (Southern Resident DPS), CH |
| Sperm whale | *Physeter macrocephalus* | Endangered |

Source: FWS 2012a, NOAA 2012f.

Note: ESU = evolutionary significant unit, CH = designated critical habitat.

**<u>Designated Critical Habitat</u>**

*Coho salmon.* Critical habitat has been designated for the Oregon Coast and Southern Oregon/Northern California Coasts ESUs. For the Oregon Coast ESU, critical habitat includes specified areas in Benton, Clatsop, Columbia, Coos, Curry, Douglas, Lane, Oregon, Lincoln, Polk, Tillamook, Washington, and Yamhill Counties, Oregon (NOAA 2011k and 73 FR 7816). For the Southern Oregon/Northern California Coasts ESU, critical habitat includes all river reaches accessible to listed coho salmon between Cape Blanco, Oregon, and Punta Gorda, California. Critical habitat consists of the water, substrate, and adjacent riparian zone of estuarine and riverine reaches (including off-channel habitats) in specified hydrologic units and counties (NOAA 2011k and 64 FR 24049).

*Sockeye salmon.* Critical habitat has been designated for the Ozette Lake ESU and includes specified areas in Clallam County, Washington. Critical habitat includes tributaries to Ozette Lake, including the Ozette River, which flows to the Pacific Ocean. In estuarine and nearshore marine areas critical habitat includes areas contiguous with the shoreline from the line of extreme high water out to a depth no greater than 30 meters relative to mean lower low water (NOAA 2011k and 70 FR 52630).

*Chinook salmon.* Critical habitat has been designated for the Lower Columbia River and Puget Sound ESUs. For the Lower Columbia River ESU, this includes specified areas in Clackamas, Clatsop, Columbia, Hood River, and Multnomah Counties, Oregon, and Clark, Cowlitz, Klickitat, Lewis, Pacific, Skamania, and Wahkiakum Counties, Washington. For the Puget Sound ESU, critical habitat includes specified areas in Clallam, Jefferson, King, Mason, Pierce, Skagit, Snohomish, Thurston, and Whatcom Counties, Washington. In estuarine and nearshore marine areas critical habitat includes areas contiguous with the shoreline from the line of extreme high water out to a depth no greater than 30 meters relative to mean lower low water (NOAA 2011k and 70 FR 52630).

*Steelhead trout.* Critical habitat has not yet been determined for the Puget Sound ESU (NOAA 2011k).

*Pacific euchalon/smelt.* Critical habitat has been designated for the Southern DPS and includes specified areas in the Umpqua River, Tenmile Creek, Sandy River, Columbia River, Oregon, and Grays River, Skamokawa Creek, Elochoman River, Cowlitz River, Toutle River, Kalama River, Lewis River, Quinault River, and Elwha River, Washington. In estuarine areas, critical habitat includes tidally influenced areas as defined by the elevation of mean higher high water (NOAA 2011k and 76 FR 65324).

*Western snowy plover.* Critical habitat units include areas in the following counties: Grays Harbor and Pacific counties, Washington; Coos, Curry, Douglas, Lane, and Tillamook counties, Oregon. The primary constituent elements of critical habitat for the pacific coast population of western snowy plover are the habitat components that provide sparsely vegetated areas above daily high tides (such as sandy beaches, dune systems immediately inland of an active beach face, salt flats, seasonally exposed gravel bars, dredge spoil sites, artificial salt ponds and adjoining levees) that are relatively undisturbed by the presence of humans, pets, vehicles or human-attracted predators; sparsely vegetated sandy beach, mud flats, gravel bars or artificial salt; and surf or tide-cast organic debris such as seaweed or driftwood (FWS 2012b and 70 FR 57026). In March 2011, FWS proposed revisions to the designated critical habitat, which would include the addition of or modification to three units in Washington and eight units in Oregon (FWS 2012b and 76 FR 16054).

*Marbled murrelet.* Critical habitat includes Curry and Josephine Counties, Oregon (specified federal lands designated as Late Successional Reserves) (FWS 2012b and 76 FR 61599).

*Steller sea lion.* Critical habitat designated for the Eastern DPS includes aquatic zones extending 914.4 m seaward and air zones extending 914.4 m upward from mapped points at Long Brown and Seal Rocks and Pyramid Rock, Oregon (NOAA 2011k).

*Killer whale.* Critical habitat designated for the Southern Resident DPS includes three specific marine areas of Puget Sound, Washington, within the following counties: Clallam, Jefferson, King, Kitsap, Island, Mason, Pierce, San Juan, Skagit, Snohomish, Thurston, and Whatcom. Critical habitat includes all waters relative to a contiguous shoreline delimited by the line at a depth of 6.1 m relative to extreme high water in specified areas (NOAA 2011k and 71 FR 69054).

## 3.2.6 CeNCOOS

### 3.2.6.1 Fish

The Pacific FMC is responsible for the conservation and management of fish stocks and fishery resources within the federal 200-nm limit off the coasts of Washington, Oregon, and California. The Pacific FMC manages fisheries for approximately 119 species of salmon, groundfish, coastal pelagic fish (sardines, anchovies, and mackerel), and highly migratory fish (tunas, sharks, and swordfish) and has established EFH for each. The Pacific FMC also collaborates with other organizations, including the International Pacific Halibut Commission that manage fish stocks that migrate through the Council's jurisdiction (Pacific FMC 2012).

Within identified EFH, the Pacific FMC has designated HAPC, which include estuaries, canopy kelp, seagrass, rocky reefs, and "areas of interest" for groundfish, including all seamounts, such as Gumdrop Seamount, Pioneer Seamount, Guide Seamount, Taney Seamount, Davidson Seamount; Mendocino Ridge, Cordell Bank, and Monterey Canyon. Additionally, the Pacific FMC has established closed areas to protect groundfish habitat, including bottom trawl closed areas, bottom contact closed areas, and a bottom trawl footprint closure (Pacific FMC 2011). Additionally, the Pacific FMC has designated HAPC for salmon which includes Complex channels and floodplain habitats, Thermal refugia, Spawning habitat, Estuaries, and Marine and estuarine submerged aquatic vegetation (Pacific FMC 2014).

### 3.2.6.2 Marine Mammals

At least 32 species of marine mammals occur in this region, including mysticetes such as the North Pacific right whale, blue whale, sei whale, fin whale, and humpback whale. Odontocetes present in the region include the pygmy sperm whale, sperm whale, and several species of dolphin. Sirenians do not occur in central and northern California waters. Pinnipeds such as the harbor seal, California sea lion, northern elephant seal (*Mirounga angustirostris*), and Guadalupe fur seal (*Arctocephalus townsendi*) occur, as well as a fissiped, the southern sea otter (MMS 2007a). While some species are year-round residents, others occur as seasonal residents or as migrants. Several species, such as some of the *Mesoplodon* beaked whales, are rarely observed (Carretta et al. 2007, as cited in MMS 2007a). Among the nonendangered cetaceans, the short-beaked common dolphin is the most abundant. Other relatively abundant species are the northern right-whale dolphin (*Lissodelphis borealis*), long-beaked common dolphin (*Delphinus capensis*), Pacific white-sided dolphin (*Lagenorhynchus obliquidens*), and Dall's porpoise. The harbor porpoise is relatively common and widely distributed along the entire Pacific Coast. Ten marine mammal species that occur throughout the central and northern California region are listed as threatened or endangered under the ESA (see Section 3.2.6.3, *Threatened and Endangered Species*).

### 3.2.6.3 Threatened and Endangered Species

Several marine or coastal species listed as threatened or endangered species under the ESA are found throughout CeNCOOS. These include the following species managed by NMFS and/or FWS (Table 3-4).

**Table 3-4. Threatened or Endangered Species in the CeNCOOS**

| Common Name | Scientific Name | Status |
|---|---|---|
| | ***Mollusks*** | |
| Black abalone | *Haliotis cracherodii* | Endangered, CH |
| White abalone | *Haliotis sorenseni* | Endangered |
| | ***Reptiles*** | |
| Green turtle | *Chelonia mydas* | Threatened |
| Loggerhead turtle | *Caretta caretta* | Endangered (North Pacific Ocean DPS) |
| Olive Ridley turtle | *Lepidochelys olivacea* | Threatened |
| Leatherback turtle | *Dermochelys coriacea* | Endangered, CH |
| Green sturgeon | *Acipenser medirostris* | Threatened (Southern DPS), CH |
| | ***Fish*** | |
| Coho salmon | *Oncorhynchus kisutch* | Endangered (Central California coast ESU), CH<br>Threatened (Central Oregon/Northern California coasts ESU), CH |
| Chinook salmon | *Oncorhynchus tshawytscha* | Threatened (California Coastal ESU), CH |
| Steelhead trout | *Oncorhynchus mykiss* | Threatened (Central California coast, Northern California, and South-Central California coast ESUs), CH |
| Pacific euchalon/smelt | *Thaleichthys pacificus* | Threatened (Southern DPS), CH |
| | ***Birds*** | |
| Short-tailed albatross | *Phoebastria albatrus* | Endangered |
| Light-footed clapper rail | *Rallus longirostris levipes* | Endangered |
| California clapper rail | *Rallus longirostris obsoletus* | Endangered |
| Western snowy plover | *Charadrius alexandrinus nivosus* | Threatened (Pacific coastal population), CH |
| California least tern | *Sterna antillarum browni* | Endangered |
| Marbled murrelet | *Brachyramphus marmoratus* | Threatened, CH |
| | ***Mammals*** | |
| Guadalupe fur seal | *Arctocephalus townsendi* | Threatened |

| Common Name | Scientific Name | Status |
|---|---|---|
| Steller sea lion | *Eumetopias jubatus* | Threatened (Eastern DPS), CH |
| Southern sea otter | *Enhydra lutris nereis* | Threatened |
| North Pacific right whale | *Eubalaena japonica* | Endangered |
| Sei whale | *Balaenoptera borealis* | Endangered |
| Blue whale | *Balaenoptera musculus* | Endangered |
| Fin whale | *Balaenoptera physalus* | Endangered |
| Humpback whale | *Megaptera novaeangliae* | Endangered |
| Killer whale | *Orcinus orca* | Endangered (Southern Resident DPS) |
| Sperm whale | *Physeter macrocephalus* | Endangered |

Source: FWS 2012a, NOAA 2012f.

Note: CH = designated critical habitat.

**<u>Designated Critical Habitat</u>**

*Leatherback turtle.* Critical habitat includes coastal marine waters from the extreme low water line west to the 200 m isobath between Point Sur and Point Arena, California; nearshore areas from Point Arena to Point Arguello, California west to the 3,000 m isobath (NOAA 2011k and 77 FR 4170).

*Black abalone.* Critical habitat includes rocky intertidal and subtidal habitats within central and northern California marine coastal areas, including the following: Del Mar Landing Ecological Reserve in Sonoma County to Point Bonita in Marin County; South of San Francisco Bay in San Francisco County to Natural Bridges State Beach in Santa Cruz County; Pacific Grove in Monterey County to Cayucos in San Luis Obispo County; and Montaña de Oro State Park in San Luis Obispo County to just south of Government Point in Santa Barbara County. Critical habitat has also been designated in intertidal and subtidal areas around the following central and northern California offshore islands: the Farallon Islands, San Francisco County, and Año Nuevo Island, San Mateo County (NOAA 2011k and 76 FR 66806).

*Green sturgeon.* Critical habitat includes all U.S. coastal marine waters out to the 60 fathom depth bathymetry line from Monterey Bay, California, north and east to include waters in the Strait of Juan de Fuca, Washington; and all tidally influenced areas of San Francisco Bay, San Pablo Bay, Suisun Bay, Humboldt Bay, California up to the elevation of mean higher high water (NOAA 2011k and 74 FR 52300).

*Coho salmon.* Critical habitat has been designated for the Central California Coast and Southern Oregon/Northern California Coasts ESUs. For the Central California Coast ESU, critical habitat includes all river reaches accessible to listed coho salmon from Punta Gorda in northern California south to the San Lorenzo River in central California, including Arroyo Corte Madera Del Presidio and Corte Madera Creek, tributaries to San Francisco Bay. Critical habitat consists of the water, substrate, and adjacent riparian zone of estuarine and riverine reaches (including off-channel habitats) in specified hydrologic units and counties. For the Southern Oregon/Northern California Coasts ESU, critical habitat has been designated to include all river reaches accessible to listed coho salmon between Cape Blanco, Oregon, and Punta Gorda, California. Critical habitat consists of the water, substrate, and adjacent riparian zone of estuarine and riverine reaches (including off-channel habitats) in specified hydrologic units and counties (NOAA 2011k and 64 FR 24049).

*Chinook salmon.* Critical habitat has been designated for the California Coastal ESU and includes specified areas in San Humboldt, Trinity, Mendocino, Sonoma, Lake, Napa, Glenn, Colusa, and Tehama Counties. Critical habitat in estuaries is defined by the perimeter of the water body as displayed on standard 1:24,000 scale topographic maps or the elevation of extreme high water, whichever is greater (NOAA 2011k and 70 FR 52488).

*Steelhead trout.* Critical habitat has been designated for the Central California Coast, Northern California, and South-Central California Coast ESUs. For the Central California Coast ESU, this includes specified areas in Lake, Mendocino, Sonoma, Napa, Marin, San Francisco, San Mateo, Santa Clara, Santa Cruz, Alameda, Contra Costa, and San Joaquin Counties. For the Northern California ESU, critical habitat includes specified areas in Humboldt, Trinity, Mendocino, Sonoma, Lake, Glenn, Colusa, and Tehama Counties. For the South-Central California Coast ESU, critical habitat includes specified areas in Monterey, San Benito, Santa Clara, Santa Cruz, San Luis Obispo Counties. Critical habitat in estuaries is defined by the perimeter of the water body as displayed on standard 1:24,000 scale topographic maps or the elevation of extreme high water, whichever is greater (NOAA 2011k and 70 FR 52488).

*Pacific euchalon/smelt.* Critical habitat has been designated for the Southern DPS and includes specified areas in the Mad River, Redwood Creek, and Klamath River, California. In estuarine areas, critical habitat includes tidally influenced areas as defined by the elevation of mean higher high water (NOAA 2011k and 76 FR 65324).

*Western snowy plover.* There are 60 critical habitat units designated in California, Oregon and Washington. The primary constituent elements of critical habitat for the Pacific coast population of western snowy plover are the habitat components that provide sparsely vegetated areas above daily high tides (such as sandy beaches, dune systems immediately inland of an active beach face, salt flats, seasonally exposed gravel bars, dredge spoil sites, artificial salt ponds and adjoining levees) that are relatively undisturbed by the presence of humans, pets, vehicles or human-attracted predators; sparsely vegetated sandy beach, mud flats, gravel bars or artificial salt; and surf or tide-cast organic debris such as seaweed or driftwood (FWS 2012b and 70 FR 57026).

*Marbled murrelet.* Critical habitat includes Siskiyou, Del Norte, and Humboldt Counties, California (specified federal lands designated as Late Successional Reserves) (FWS 2012b and 76 FR 61599).

*Steller sea lion*. Critical habitat designated for both the Eastern DPS includes aquatic zones extending 914 m seaward and air zones extending 914 m upward from mapped points at Sugarloaf Island and Cape Mendocino, the Southeast Farallon Islands, and Ano Nuevo Island, California (NOAA 2011k).

## 3.2.7 SCCOOS

### 3.2.7.1 Fish

The Pacific FMC is responsible for the conservation and management of fish stocks and fishery resources within the federal 200-nm limit off the coasts of Washington, Oregon, and California. The Pacific FMC manages fisheries for approximately 119 species of salmon, groundfish, coastal pelagic fish (sardines, anchovies, and mackerel), and highly migratory fish (tunas, sharks, and swordfish) and has established EFH for each. The Pacific FMC also collaborates with other organizations, including the International Pacific Halibut Commission that manages fish stocks that migrate through the Council's jurisdiction (Pacific FMC 2012). Within identified EFH, the Pacific FMC has designated HAPC, which include estuaries, canopy kelp, seagrass, rocky reefs, and "areas of interest" for groundfish, including all seamounts, such as San Juan Seamount, specific areas in the Federal waters of the Channel Island National Marine Sanctuary, and specific areas of the Cowcod Conservation Areas off of California. Additionally, the Pacific FMC has established closed areas to protect groundfish habitat, including bottom trawl closed areas, bottom contact closed areas, and a bottom trawl footprint closure (Pacific FMC 2011). Additionally, the Pacific FMC has designated HAPC for salmon which includes complex channels and floodplain habitats, thermal refugia, spawning habitat, estuaries, and marine and estuarine submerged aquatic vegetation (Pacific FMC 2014).

### 3.2.7.2 Marine Mammals

At least 36 species of marine mammals occur in this region, including mysticetes such as the North Pacific right whale, blue whale, fin whale, humpback whale, and Bryde's whale. Odontocetes present in the region include the pygmy sperm whale, sperm whale, and several species of dolphin. Sirenians do not occur in southern California waters. Pinnipeds such as the California sea lion and Guadalupe fur seal occur, as well as a fissiped, the southern sea otter (MMS 2007a). While some species are year-round residents, others occur as seasonal residents or as migrants. Several species, such as some of the *Mesoplodon* beaked whales, are rarely observed (Carretta et al. 2007, as cited in MMS 2007a). Among the nonendangered cetaceans, the short-beaked common dolphin is the most abundant. Other relatively abundant species are the northern right-whale dolphin, Pacific white-sided dolphin, and Dall's porpoise. The harbor porpoise is relatively common and widely distributed along the entire Pacific Coast. Ten marine mammal species that occur throughout the southern California region are listed as threatened or endangered under the ESA (see section 3.2.7.3, *Threatened and Endangered Species*).

### 3.2.7.3 Threatened and Endangered Species

Several marine or coastal species listed as threatened or endangered species under the ESA are found throughout southern California. These include the following species managed by NMFS and/or FWS (Table 3-5).

**Designated Critical Habitat**

*Black abalone.* Critical habitat includes rocky intertidal and subtidal habitats within southern California marine coastal areas, including the following: Montaña de Oro State Park in San Luis Obispo County to just south of Government Point in Santa Barbara County; and Palos Verdes

Peninsula extending from the Palos Verdes/Torrance border to Los Angeles Harbor in southwestern Los Angeles County. Critical habitat has also been designated in intertidal and subtidal areas around the following southern California offshore islands: San Miguel Island, Santa Rosa Island, Santa Cruz Island, and Santa Barbara Island, Santa Barbara County; Anacapa Island, Ventura County; and Santa Catalina Island, Los Angeles County) (NOAA 2011k and 76 FR 66806).

*Steelhead trout.* Critical habitat has been designated for the Southern California ESU and includes specified areas in San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, and San Diego Counties. Critical habitat in estuaries is defined by the perimeter of the water body as displayed on standard 1:24,000 scale topographic maps or the elevation of extreme high water, whichever is greater (NOAA 2011k and 70FR52488).

**Table 3-5. Threatened or Endangered Species in the SCCOOS**

| Common Name | Scientific Name | Status |
|---|---|---|
| | ***Mollusks*** | |
| Black abalone | *Haliotis cracherodii* | Endangered, CH |
| White abalone | *Haliotis sorenseni* | Endangered |
| | ***Reptiles*** | |
| Green turtle | *Chelonia mydas* | Threatened |
| Hawksbill turtle | *Eretmochelys imbricata* | Endangered |
| Loggerhead turtle | *Caretta caretta* | Endangered (North Pacific Ocean DPS) |
| Olive Ridley turtle | *Lepidochelys olivacea* | Threatened |
| Leatherback turtle | *Dermochelys coriacea* | Endangered |
| | ***Fish*** | |
| Steelhead trout | *Oncorhynchus mykiss* | Endangered (Southern California ESU), CH |
| | ***Birds*** | |
| Light-footed clapper rail | *Rallus longirostris levipes* | Endangered |
| Western snowy plover | *Charadrius alexandrinus nivosus* | Threatened (Pacific coastal population) |
| California least tern | *Sterna antillarum browni* | Endangered |
| | ***Mammals*** | |
| Guadalupe fur seal | *Arctocephalus townsendi* | Threatened |
| Steller sea lion | *Eumetopias jubatus* | Threatened (Eastern DPS) |
| Southern sea otter | *Enhydra lutris nereis* | Threatened |
| North Pacific right | *Eubalaena japonica* | Endangered |

| Common Name | Scientific Name | Status |
|---|---|---|
| whale | | |
| Sei whale | *Balaenoptera borealis* | Endangered |
| Blue whale | *Balaenoptera musculus* | Endangered |
| Fin whale | *Balaenoptera physalus* | Endangered |
| Humpback whale | *Megaptera novaeangliae* | Endangered |
| Killer whale | *Orcinus orca* | Endangered (Southern Resident DPS) |
| Sperm whale | *Physeter macrocephalus* | Endangered |

Source: FWS 2012a, NOAA 2012f.

Note: CH = designated critical habitat.

## 3.2.8 GCOOS

### 3.2.8.1 Fish

The Gulf of Mexico FMC is responsible for the conservation and management of fish stocks and fishery resources within the federal 200-nm limit off the coasts of Texas, Louisiana, Mississippi, Alabama, and western Florida to Key West (Gulf Coast FMC 2012). The Gulf of Mexico FMC manages seven fisheries including coastal migratory pelagic, red drum, reef fish, shrimp, spiny lobster, stone crab, and coral and coral reefs. The coastal migratory pelagics fisheries management unit and the spiny lobster fisheries management units are managed through a joint plan of the Gulf of Mexico and South Atlantic FMCs (Gulf Coast FMC 2010). EFH has been designated for all seven managed fisheries to protect the essential habitats for each life history stage of 26 representative species.

Within identified EFH, the Gulf of Mexico FMC has designated HAPC, which include the Florida Middle Grounds, Madison-Swanson Marine Reserve, Tortugas North and South Ecological Reserves, Pulley Ridge, East and West Flower Garden Banks, Stetson Bank, Sonnier Bank, MacNeil, 29 Fathom Bank, Rankin Bright Bank, Geyer Bank, McGrail Bank, Bouma Bank, Rezak Sidner Bank, Alderice Bank, Jakkula Bank, and individual reefs and banks of the Northwestern Gulf of Mexico. These areas predominantly contain living coral reefs or hard bottom areas with known coral colonies. The Madison-Swanson Marine Reserve is a known spawning aggregation site primarily for gag and scamp, though other reef fish species also spawn there (Gulf Coast FMC 2005).

### 3.2.8.2 Marine Mammals

Twenty-nine marine mammal species occur in the Gulf of Mexico. Odontocetes such as the bottlenose dolphin (*Tursiops truncatus*), typically found in coastal waters, are the most common species in the region. Mysticetes are mostly oceanic and their occurrence in the Gulf of Mexico is rare or extralimital; Bryde’s whale is the only mysticete regularly found in the Gulf of Mexico. They are mostly found in the continental shelf or deeper waters with a few stranding exceptions on the coast of Texas (e.g., blue whale). The only sirenian occurring in U.S. waters is the West Indian manatee (*Trichechus manatus*), which primarily occur in coastal and brackish areas of

Florida, but can range from Texas to Virginia in U.S. coastal waters. Pinnipeds do not normally occur in Gulf of Mexico waters (MMS 2007b). The Caribbean monk seal (*Monachus tropicalis*) used to occur in this region but is now extinct; additionally, vagrant seals have been spotted off the Florida coast. Six marine mammal species that occur in the Gulf of Mexico are listed as threatened or endangered under the ESA (see section 3.2.8.3, *Threatened and Endangered Species*).

#### 3.2.8.3 Threatened and Endangered Species

Several marine or coastal species listed as threatened or endangered species under the ESA are found throughout the Gulf of Mexico. These include the following species managed by NMFS and/or FWS (Table 3-6).

**Table 3-6. Threatened or Endangered Species in the Gulf of Mexico ROI**

| Common Name | Scientific Name | Status |
|---|---|---|
| ***Corals*** | | |
| Staghorn coral | *Acropora cervicornis* | Threatened, CH |
| Elkhorn coral | *Acropora palmata* | Threatened, CH |
| ***Reptiles*** | | |
| American crocodile | *Crocodylus acutus* | Threatened |
| Green turtle | *Chelonia mydas* | Endangered (Florida Coast Breeding Populations) |
| Hawksbill turtle | *Eretmochelys imbricata* | Endangered |
| Loggerhead turtle | *Caretta caretta* | Threatened |
| Kemp’s ridley turtle | *Lepidochelys kempii* | Endangered |
| Leatherback turtle | *Dermochelys coriacea* | Endangered |
| ***Fish*** | | |
| Smalltooth sawfish | *Pristis pectinata* | Endangered, CH |
| Largetooth sawfish | *Pristis perotteti* | Endangered |
| Shortnose sturgeon | *Acipenser brevrostrum* | Endangered |
| Gulf sturgeon | *Acipenser oxyrinchus desotoi* | Threatened, CH |
| ***Birds*** | | |
| Wood stork | *Mycteria americana* | Endangered |
| Whooping crane | *Grus americana* | Endangered |
| Mississippi sandhill crane | *Grus canadensis pulla* | Endangered |
| Piping plover | *Charadrius melodus* | Threatened |
| Roseate tern | *Sterna dougallii dougallii* | Threatened |

| Common Name | Scientific Name | Status |
|---|---|---|
| | ***Mammals*** | |
| West Indian manatee | *Trichechus manatus* | Endangered [a] |
| Sei whale | *Balaenoptera borealis* | Endangered |
| Blue Whale | *Balaenoptera musculus* | Endangered |
| Fin whale | *Balaenoptera physalus* | Endangered |
| Humpback whale | *Megaptera novaeangliae* | Endangered |
| Sperm whale | *Physeter catodon* | Endangered |

Source: FWS 2012a, NOAA 2012f.

Note: CH = designated critical habitat.

[a] The West Indian manatee was proposed for downlisting from endangered to threatened on January 8, 2016.

**Designated Critical Habitat**

*Staghorn and Elkhorn coral.* The south and southeastern coasts of Florida, including the Florida Keys and a portion to the southwest of Florida, are designated elkhorn coral and staghorn coral critical habitat (FWS 2012b).

*Smalltooth sawfish.* Portions of the southern and southwestern tip of Florida are designated smalltooth sawfish critical habitat (FWS 2012b).

*Gulf sturgeon.* The northwestern coast of Florida is part of the area designated as Gulf sturgeon critical habitat (FWS 2012b).

## 3.2.9 SECOORA

### 3.2.9.1 Fish

The South Atlantic FMC is responsible for the conservation and management of fish stocks within the federal 200-nm limit off the coasts of North Carolina, South Carolina, Georgia, and east Florida to Key West (South Atlantic FMC 2012a). The South Atlantic FMC manages eight fisheries, including coastal migratory pelagics, coral and live bottom habitat, dolphin and wahoo, golden crab, shrimp, snapper grouper, spiny lobster, and *Sargassum* (South Atlantic FMC 2012b), and has identified EFH for each (South Atlantic FMC 2012c). Snapper grouper is currently the only fishery that is considered to be overfished and is highly regulated both recreationally and commercially (South Atlantic FMC 2012b).

Within identified EFH, the South Atlantic FMC has designated HAPC, which includes the following:

**Coral, Coral Reef, and Live Bottom EFH-HAPCs**

- 10-Fathom Ledge
- Big Rock

- The Point
- Hurl Rocks
- Charleston Bump
- Gray's Reef National Marine Sanctuary
- *Phragmatopoma* (worm reef) reefs off the central east coast of Florida
- *Oculina* Banks off the east coast of Florida from Ft. Pierce to Cape Canaveral
- Nearshore (0-4 m, 0-12 ft) hard bottom off the east coast of Florida from Cape Canaveral to Broward County
- Offshore (5-30 m, 15-90 ft) hard bottom off the east coast of Florida from Palm Beach County to Fowey Rocks
- Biscayne Bay, Florida
- Biscayne National Park, Florida
- Florida Keys National Marine Sanctuary
- Cape Lookout
- Cape Fear
- Stetson Reefs, Savannah and East Florida Lithoherms, and Miami Terrace
- Pourtales Terrace
- Blake Ridge Diapir (South Atlantic FMC 2011b)

**Coastal Migratory Pelagics EFH-HAPCs**

- Sandy shoals of Cape Lookout, Cape Fear, and Cape Hatteras from shore to the ends of the respective shoals, but shoreward of the Gulf Stream
- The Point
- Ten-Fathom Ledge
- Big Rock
- Charleston Bump
- Hurl Rocks
- The Point off Jupiter Inlet
- *Phragmatopoma* (worm reef) reefs off the central east coast of Florida
- Nearshore hard bottom south of Cape Canaveral
- The Hump off Islamorada, Florida
- The Marathon Hump off Marathon, Florida
- The "Wall" off of the Florida Keys
- Pelagic *Sargassum*
- Atlantic coast estuaries with high numbers of Spanish mackerel and cobia based on abundance data from the ELMR program including Bogue Sound, New River, and Broad River

**Snapper-Grouper EFH-HAPCs**

- Medium to high profile offshore hard bottoms where spawning normally occurs
- Localities of known or likely periodic spawning aggregations
- Nearshore hardbottom areas
- The Point
- Ten Fathom Ledge

- Big Rock
- Charleston Bump
- Mangrove habitat
- Seagrass habitat
- Oyster/shell habitat
- All coastal inlets
- All state-designated nursery habitats of particular importance to snapper-grouper*
- Pelagic and benthic *Sargassum*
- Hoyt Hills for wreckfish
- The *Oculina* Bank Habitat Area of Particular Concern
- All hermatypic coral habitats and reefs
- Manganese outcroppings on the Blake Plateau
- SAFMC designated Artificial Reef Special Management Zones
- Snowy Grouper Wreck MPA
- Northern South Carolina MPA
- Edisto MPA
- Charleston Deep Artificial Reef MPA
- Georgia MPA
- North Florida MPA
- St. Lucie Hump MPA
- East Hump MPA
- Irregular bottom comprised of troughs and terraces intermingled with sand, mud, or shell hash bottom for Golden tilefish
- Mud-clay bottoms in depths of 150-300 meters for Golden tilefish
- Irregular bottom habitats along the shelf edge in 45-65 m depth, shelf break
- Upper slope along the 100fm contour (150-225 m) for Blueline tilefish
- Hardbottom habitats characterized as rock overhangs, rock outcrops, manganese phosphorite rock slab formations, or rocky reefs in the South Atlantic Bight; and the Georgetown Hole (Charleston Lumps) off Georgetown, South Carolina for Blueline tilefish (South Atlantic FMC 2011b)

Table 3-7 references the state regulations that designate areas that serve as nursery habitat and warrant special protection under state law. These areas are "state-designated nursery habitat" under the EFH or EFH-HAPC designations for penaeid shrimp, snapper grouper species, and coastal migratory pelagic species.

**Table 3-7. State-Designated Nursery Habitat and Applicable Regulations**

| Designation | Regulation | Comments |
|---|---|---|
| ***North Carolina*** | | |
| Inland Primary Nursery Areas | 15A NCAC 10C.0503 | |
| Primary Nursery Areas | 15A NCAC 03R.0103 | |
| Permanent Secondary Nursery Areas | 15A NCAC 03R.0104 | |

| Designation | Regulation | Comments |
|---|---|---|
| Secondary Nursery Areas | 15A NCAC 03R.0105 | |
| Strategic Habitat Areas and Critical Habitat Areas | Coastal Habitat Protection Plan, Chapter 8 | None as of November 30, 2010 |
| Crab Spawning Sanctuaries | 15A NCAC 03R.0110 | |
| Oyster Sanctuaries | 15A NCAC 03R.0117 | |
| Outstanding Resource Waters | 15A NCAC 02B.0225 | |
| ***South Carolina*** | | |
| Outstanding Resource Waters | DHEC R. 61-69 | Only coastal counties included as state designated nursery grounds |
| Outstanding National Resource Waters | DHEC R. 61-68 | None coastal as of November 30, 2010 |
| ***Georgia*** | | |
| Outstanding National Resource Waters | GA. COMP. R. & Regs. 391-3-6-.03 | None as of November 30, 2010 |
| ***Florida*** | | |
| Outstanding Florida Waters | 62-302.700, F.A.C. | Only State Aquatic Preserves included as state-designated nursery grounds |

**Penaeid Shrimp EFH-HAPCs**

- All coastal inlets
    - Coastal inlets include the throat of the inlet as well as shoal complexes associated with the inlets. Shoals formed by waters moving landward through the inlet are referred to as flood tidal shoals, and shoals formed by waters moving waterward through the inlet are referred to as ebb tidal shoals.
- All state-designated nursery habitats of particular importance to shrimp
- State-identified overwintering areas

**Spiny Lobster EFH-HAPCs**

- Florida Bay
- Biscayne Bay
- Card Sound
- Coral/Hard Bottom Habitat from Jupiter Inlet, Florida through the Dry Tortugas, Florida: In practice, the northern limit for inshore benthic habitats designated EFH for spiny lobster is Sebastian Inlet, the northern extent of the offshore benthic habitats designated as EFH for spiny lobster is the area offshore of the St. Johns River.

**Dolphin-Wahoo EFH-HAPCs**

- The Point
- Ten-Fathom Ledge
- Big Rock
- Charleston Bump
- Georgetown Hole
- The Point off Jupiter Inlet
- The Hump off Islamorada, Florida
- The Marathon Hump off Marathon, Florida
- The “Wall” off of the Florida Keys
- Pelagic *Sargassum*

### 3.2.9.2 Marine Mammals

In the southeast Atlantic region, odontocetes are the most common mammal and occur in coastal habitats (e.g., dolphins and porpoise) as well as shelf and slope/deep habitats (e.g., dolphins and whales). Sperm whales are known to concentrate in off-shore areas east of Cape Hatteras during the winter time. Risso’s dolphin (*Grampus griseus*) and striped and spotted dolphins (*Stenella* spp.) are known to occur offshore. Bottlenose dolphins and harbor porpoise are the most common odontocete found in coastal waters inhabiting estuaries, harbors, and river mouths. Mysticetes are occasionally present and can occur in coastal, shelf, and slope/deep habitats. Areas of coastal Florida and Georgia have been identified as major breeding and nursing grounds for North Atlantic right whales (*Eubalaena glacialis*); occasional sightings have been reported from coastal waters in North Carolina. Some occasional sightings of humpback whales have been observed from Cape Hatteras to south Florida. Many of the large whales and populations of smaller toothed whales migrate seasonally along the U.S. Atlantic coast. The only sirenian that occurs in U.S. waters is the federally endangered West Indian manatee, which is primarily located in eastern Florida and southern Georgia and uses open coastal (shallow nearshore) areas and estuaries as well as freshwater tributaries. Manatees use coastal and riverine habitats for feeding, resting, mating, and calving. North Carolina is the northernmost area occupied seasonally on a regular basis by manatees. Pinnipeds (seals, sea lions, and walruses) do not normally occur in southeastern Atlantic waters (MMS 2007b). Seven marine mammal species that occur throughout the southeast Atlantic region are listed as endangered under the ESA (see Section 3.2.9.3, *Threatened and Endangered Species*).

### 3.2.9.3 Threatened and Endangered Species

Several marine or coastal species listed as threatened or endangered species under the ESA are found throughout the southeast Atlantic. These include the following species managed by NMFS and/or FWS (Table 3-8).

**Designated Critical Habitat**

*Johnson’s seagrass*. Coastal areas from central eastern Florida in Brevard County to south eastern Florida in Miami-Dade County are designated Johnson’s Seagrass critical habitat (NOAA 2011k).

*Staghorn and Elkhorn coral.* The south and southeastern coasts of Florida, including the Florida Keys and a portion to the southwest of Florida, are designated elkhorn coral and staghorn coral critical habitat (NOAA 2011k).

*Smalltooth sawfish.* Portions of the southern and southwestern tip of Florida are designated smalltooth sawfish critical habitat (NOAA 2011k).

*Gulf sturgeon.* The northwestern coast of Florida is part of the area designated as Gulf sturgeon critical habitat (NOAA 2011k).

*North Atlantic right whale.* The northern east coast of Florida and the southern Georgia coast are designated as North Atlantic right whale critical habitats (NOAA 2011k).

**Table 3-8. Threatened or Endangered Species in the SCCOOS**

| Common Name | Scientific Name | Status |
|---|---|---|
| | ***Grasses and Corals*** | |
| Johnson's seagrass | *Halophila johnsonii* | Threatened, CH |
| Staghorn coral | *Acropora cervicornis* | Threatened, CH |
| Elkhorn coral | *Acropora palmata* | Threatened, CH |
| | ***Reptiles*** | |
| American crocodile | *Crocodylus acutus* | Threatened |
| Green turtle | *Chelonia mydas* | Endangered (Florida Coast Breeding Populations) |
| Hawksbill turtle | *Eretmochelys imbricata* | Endangered |
| Loggerhead turtle | *Caretta caretta* | Threatened |
| Kemp’s ridley turtle | *Lepidochelys kempii* | Endangered |
| Leatherback turtle | *Dermochelys coriacea* | Endangered |
| | ***Fish*** | |
| Smalltooth sawfish | *Pristis pectinata* | Endangered, CH |
| Largetooth sawfish | *Pristis perotteti* | Endangered |
| Shortnose sturgeon | *Acipenser brevrostrum* | Endangered |
| Gulf sturgeon | *Acipenser oxyrinchus desotoi* | Threatened, CH |
| Atlantic sturgeon | *Acipenser oxyrinchus oxyrinchus* | Endangered |
| | ***Birds*** | |
| Wood stork | *Mycteria americana* | Endangered |
| Piping plover | *Charadrius melodus* | Threatened |
| Roseate tern | *Sterna dougallii dougallii* | Threatened |
| | ***Mammals*** | |
| West Indian manatee | *Trichechus manatus* | Endangered |

| Common Name | Scientific Name | Status |
|---|---|---|
| North Atlantic right whale | *Eubalaena glacialis* | Endangered, CH |
| Sei whale | *Balaenoptera borealis* | Endangered |
| Blue Whale | *Balaenoptera musculus* | Endangered |
| Fin whale | *Balaenoptera physalus* | Endangered |
| Humpback whale | *Megaptera novaeangliae* | Endangered |
| Sperm whale | *Physeter catodon* | Endangered |

Source: FWS 2012a, NOAA 2012f.

Note: CH = designated critical habitat.

## 3.2.10 CariCOOS

### 3.2.10.1 Fish

The Caribbean FMC is responsible for the conservation and management of fish stocks and fishery resources within the federal 200-nm limit off the coasts of the entire Commonwealth of Puerto Rico and the USVI (Caribbean FMC 2012). The Caribbean FMC manages four fisheries, including coral, shallow water reef, spiny lobster, and queen conch, and has designated EFH for each. For the spiny lobster, queen conch, and shallow reef fisheries, EFH consists of all waters from mean high water to the outer boundary of the EEZ. For the coral fishery, EFH consists of all waters from mean low water to the outer boundary of the EEZ. These EFH areas encompass areas were species protected under the different fishery management plans at different life stages can be found.

Within identified EFH, the Caribbean FMC has designated HAPC within the coral and shallow reef fisheries and life stages of all managed species will be protected under these HAPCs. The Caribbean FMC has designated multiple HAPCs for reef fish spawning:

**Caribbean Reef Fish Spawning**

Puerto Rico:

- Tourmaline Bank
- Abrir La Sierra Bank
- Bajo de Sico
- Vieques El Sico

St. Croix:

- Mutton snapper spawning aggregation area
- East of St. Croix (Lang Bank)

St. John:

- Hind Bank Marine Conservation District
- Grammanik Bank

**Caribbean Reef Species**

HAPCs that are areas of ecological importance to Caribbean reef species:

Puerto Rico:

- Hacienda la Esperanza, Manatí
- Bajuras and Tiburones, Isabela
- Cabezas de San Juan, Fajardo
- JOBANNERR, Jobos Bay
- Bioluminescent Bays, Vieques
- Boquerón State Forest
- Pantano Cibuco, Vega Baja
- Piñones State Forest
- Río Espiritu Santo, Río Grande
- Seagrass beds of Culebra Island (nine sites designated as Resource Category 1 and two additional sites)
- Northwest Vieques seagrass west of Mosquito Pier, Vieques

St. Thomas:

- Southeastern St. Thomas, including Cas Cay, the Mangrove Lagoon and St. James Marine Reserves and Wildlife Sanctuaries
- Saba Island/Perseverance Bay, including Flat Key and Black Point Reef

St. Croix:

- Salt River Bay National Historic Park and Ecological Preserve and Marine Reserve and Wildlife Sanctuary
- Altona Lagoon
- Great Pond
- South Shore Industrial Area
- Sandy Point National Wildlife Refuge

**Caribbean Coral Species**

HAPC that are areas of ecological importance to Caribbean coral species:

Puerto Rico:

- Luis Peña Channel, Culebra
- Mona/Monito
- La Parguera, Lajas
- Caja de Muertos, Ponce
- Tourmaline Reef
- Guánica State Forest
- Punta Petrona, Santa Isabel

- Ceiba State Forest
- La Cordillera, Fajardo
- Guayama Reefs
- Steps and Tres Palmas, Rincón
- Los Corchos Reef, Culebra
- Desecheo Reefs, Desecheo

<u>St. Croix:</u>

- St. Croix Coral Reef Area of Particular Concern, including the East End Marine Park
- Buck Island Reef National Monument
- South Shore Industrial Area Patch Reef and Deep Reef System
- Frederiksted Reef System
- Cane Bay
- Green Cay Wildlife Refuge

### 3.2.10.2 Marine Mammals

Eighteen marine mammal species have been reported in water surrounding Puerto Rico and both the United States and British Virgin Islands (Mignucci-Giannoni 1998, Caribbean FMC 2005). Of the 13 identified odontocete species, the oceanic dolphin family is the most commonly sighted. Most dolphins occur offshore over the continental slope and in proximity to ocean ridges (Winn et al. 1979, as cited in Mignucci-Giannoni 1998). Dolphins have been reported for most of the year except during May and from August to October. Most other odontocetes are commonly found offshore or near the continental shelf ledge and are more common during the winter and spring. Atlantic spotted dolphins (*Stenella frontalis*), bottlenose dolphins, and spinner dolphins (*Stenella longirostris*) are commonly found near shore and are observed throughout the year. Of the five identified mysticete species, the humpback whale is the most commonly sighted. Mysticetes are equally distributed in the near shore, offshore, and near the shelf ledge regions, and are more commonly found during winter and early spring. Several of these species migrate north during the spring (Mignucci-Giannoni 1998).

The one sirenian known to occur in Puerto Rico, the West Indian Manatee, is found throughout near-shore and brackish areas of the island, especially around the southern and eastern end, as well as around Vieques Island. It appears that manatees are absent from the USVI except for rare sightings. Pinnipeds have not been reported in Puerto Rico and the USVI. The Caribbean monk seal was known to occur in this region, however it was declared extinct in 1996 (Caribbean FMC 2005). In March 2008, NMFS completed a five-year status review of the species, and based on the best available information, concluded that the species is extinct. A final rule to delist the species from the ESA was published in the Federal Register (73 FR 63901) on October 28, 2008. Six marine mammal species that occur in the Caribbean region are listed as threatened or endangered under the ESA (see section 3.2.10.3, *Threatened and Endangered* Species).

### 3.2.10.3 Threatened and Endangered Species

Several marine or coastal species listed as threatened or endangered species under the ESA are found throughout the CariCOOS. These include the following species managed by NMFS and/or FWS (Table 3-9).

**Table 3-9. Threatened or Endangered Species in the CariCOOS**

| Common Name | Scientific Name | Status |
|---|---|---|
| | ***Corals*** | |
| Staghorn coral | Acropora cervicornis | Threatened, CH |
| Elkhorn coral | Acropora palmata | Threatened, CH |
| | ***Reptiles*** | |
| Green turtle | Chelonia mydas | Threatened, CH |
| Hawksbill turtle | Eretmochelys imbricata | Endangered, CH |
| Loggerhead turtle | Caretta caretta | Threatened |
| Leatherback turtle | Dermochelys coriacea | Endangered, CH |
| | ***Birds*** | |
| Piping plover | Charadrius melodus | Threatened |
| Roseate tern | Sterna dougallii dougallii | Endangered |
| | ***Mammals*** | |
| West Indian Manatee | Trichechus manatus | Endangered |
| Sei whale | Balaenoptera borealis | Endangered |
| Blue Whale | Balaenoptera musculus | Endangered |
| Fin whale | Balaenoptera physalus | Endangered |
| Humpback whale | Megaptera novaeangliae | Endangered |
| Sperm whale | Physeter catodon | Endangered |

Source: FWS 2012a, NOAA 2012f.

Note: CH = designated critical habitat.

**Designated Critical Habitat**

*Staghorn and Elkhorn coral*. Waters surrounding most of Puerto Rico and the USVI have been designated as critical habitat areas for elkhorn and staghorn coral (NOAA 2011k).

*Green turtle*. All of the waters surrounding Culebra Island, Puerto Rico, have been designated as critical habitat areas for the green sea turtle (NOAA 2011k).

*Hawksbill turtle*. All of the waters surrounding Mona Island, Puerto Rico, have been designated as critical habitat areas for the hawksbill turtle (NOAA 2011k).

*Leatherback turtle.* Areas in the southwest of St. Croix, USVI, have been designated as critical habitat areas for the leatherback sea turtle (NOAA 2011k). In 2011, NOAA accepted a petition recommending designation of additional critical habitat for the leatherback turtle on the beaches and in near-shore waters of Puerto Rico (76 FR 25660).

## 3.2.11 MARACOOS

### 3.2.11.1 Fish

The Mid-Atlantic FMC is responsible for the conservation and management of fish stocks and fishery resources within the federal 200-nm limit off the coasts of North Carolina, Virginia, Maryland, Delaware, Pennsylvania, New Jersey, and New York (Mid-Atlantic FMC 2012a). Fisheries of North Carolina are also managed by the South Atlantic FMC (See section 3.3.9.1, *Fish*). The states of Connecticut, Rhode Island, and Massachusetts are managed by the New England FMC (See section 3.2.12.1, *Fish*). The Mid-Atlantic FMC manages six fisheries, including Atlantic mackerel, squid (long-finned and short-finned) and butterfish; bluefish; dogfish; surfclam and ocean quahog; summer flounder, scup and black sea bass; tilefish; and monkfish. The Mid-Atlantic FMC has established EFH for Atlantic mackerel, black sea bass, bluefish, butterfish, tilefish, surf clam, ocean quahog, scup, spiny dogfish, summer flounder, short fin squid, long fin squid, as well as highly migratory species and billfish (NOAA 2012g). Within identified EFH, the Mid-Atlantic FMC has designated the summer flounder HAPC which includes all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH (Mid-Atlantic FMC 1998). The Mid-Atlantic FMC has also designated golden tilefish HAPC which includes portions of Norfolk, Veatch, Lydonia, and Oceanographer canyons within the depth range within the same depth contour identified as EFH; known to have clay outcrop/pueblo habitats (Mid-Atlantic FMC 2008).

### 3.2.11.2 Marine Mammals

Several species of marine mammals inhabit the coastal and offshore waters in the mid-Atlantic region. Common odontocetes include sperm whales, which can be found throughout the mid-Atlantic region during the spring and towards the continental shelf during the fall, and dolphins, which can be found on the continental shelf or on the slope, depending on the species. Some dolphins, as the bottlenose dolphin, inhabit coastal and estuarine waters of the mid-Atlantic region south of Long Island, New York. Most other odontocetes are common mostly on the continental slope and deeper waters beyond the slope. Mysticetes, such as North Atlantic right whale, fin whale, and humpback whale, can be found in coastal waters, over the continental shelf, or on the continental slope and beyond. North Atlantic right whales can be seen offshore from New Jersey to North Carolina during the winter. Pinnipeds that occur in the mid-Atlantic region include harp seals (*Pagophilus groenlandicus*), which have been observed on the coast north of New Jersey, and harbor seals, which are seasonal inhabitants from southern New England to New Jersey (MMS 2007b). Six marine mammal species that occur in the mid-Atlantic region are listed as threatened or endangered under the ESA (see section 3.2.11.3, *Threatened and Endangered* Species).

### 3.2.11.3 Threatened and Endangered Species

Several marine or coastal species listed as threatened or endangered species under the ESA are found throughout the MARACOOS. These include the following species managed by NMFS and/or FWS (Table 3-10).

**Table 3-10. Threatened or Endangered Species in the MARACOOS**

| Common Name | Scientific Name | Status |
|---|---|---|
| | ***Reptiles*** | |
| Green turtle | *Chelonia mydas* | Threatened |
| Hawksbill turtle | *Eretmochelys imbricata* | Endangered |
| Loggerhead turtle | *Caretta caretta* | Threatened |
| Kemp's ridley turtle | *Lepidochelys kempii* | Endangered |
| Leatherback turtle | *Dermochelys coriacea* | Endangered |
| | ***Fish*** | |
| Shortnose sturgeon | *Acipenser brevrostrum* | Endangered |
| Atlantic sturgeon | *Acipenser oxyrinchus oxyrinchus* | Endangered |
| | ***Birds*** | |
| Piping plover | *Charadrius melodus* | Threatened (except Great Lakes watershed, where Endangered) |
| Roseate tern | *Sterna dougallii dougallii* | Threatened |
| | ***Mammals*** | |
| North Atlantic right whale | *Eubalaena glacialis* | Endangered, CH |
| Sei whale | *Balaenoptera borealis* | Endangered |
| Blue Whale | *Balaenoptera musculus* | Endangered |
| Fin whale | *Balaenoptera physalus* | Endangered |
| Humpback whale | *Megaptera novaeangliae* | Endangered |
| Sperm whale | *Physeter catodon* | Endangered |

Source: FWS 2012a, NOAA 2012f.

Note: CH = designated critical habitat.

**Designated Critical Habitat**

*North Atlantic right whale.* The Cape Cod Bay and sections of the Great South Channel have been designated as critical habitat areas for the North Atlantic right whale (NOAA 2011k).

### 3.2.12 NERACOOS

#### 3.2.12.1 Fish

The New England FMC is responsible for the conservation and management of fish stocks and fishery resources within the federal 200-nm limit of the coasts of Connecticut, Rhode Island, Massachusetts, New Hampshire, and Maine (New England FMC 2012a). The New England FMC manages nine fisheries, including Atlantic salmon; skates; deep-sea red crab; dogfish; small mesh multispecies (whiting); Atlantic herring; monkfish; sea scallop; and northeast multispecies (groundfish) (New England FMC 2012b-i). Management of the spiny dogfish is led by the Mid-Atlantic FMC (New England FMC 2012j). The New England FMC has designated EFH for 27 of the managed species (New England FMC 2012k). The New England FMC has designated HAPC for Atlantic salmon in 11 rivers in Maine, including: Dennys, Machias, East Machias, Pleasant, Narraguagus, Ducktrap, Sheepscot, Kennebec, Penobscot, St. Croix, Tunk Stream. The New England FMC has also designated a Northern Edge Juvenile Cod HAPC.

#### 3.2.12.2 Marine Mammals

Odontocetes, including dolphins and toothed whales, are the most common order of marine mammals observed in the northeastern region. Sperm whales occur in Georges Bank, the Northeast Channel, and the continental shelf south of New England during the summer time; sperm whale appearance peaks on the New England continental shelf in the fall. Risso’s dolphin, striped dolphins, Atlantic and pantropical spotted dolphins, false and pygmy killer whales (*Pseudorca crassidans* and *Feresa attenuata*), short-finned and long-finned pilot whales (*Globicephala* spp.), and various species of beaked whales (*Mesoplodon* spp.) occur offshore in the shelf edge, canyons, other pronounced seafloor features, and areas of ocean current convergence.

Other species such as the bottlenose dolphin and harbor porpoise commonly occur inshore of the slope break and in nearshore and coastal habitats. Pinnipeds are known to occur in the northeastern region. Occurrences of harp seal have been increasing on the northeastern coast from Maine to New Jersey. The gray seal (*Halichoerus grypus*) is also known to occur in the southern northeastern region. The harbor seal is a known year-round resident in Maine. Areas in the Scotian Shelf, George’s Bank, and Bay of Fundy are known to be important feeding, nursery, and mating grounds during the summer time for the North Atlantic right whale. Atlantic waters off New England are also major feeding grounds for the fin whale (MMS 2007b). Humpback whales are known to congregate on feeding grounds in the Gulf of Maine, the Great South Channel, Georges Bank, and Stellwagen Bank during the summer (NatureServe 2006 and Waring et al. 2007, as cited in MMS 2007b). No sirenians occur in the northeastern region (MMS 2007b). Six marine mammal species that occur in the northeast region are listed as threatened or endangered under the ESA (see Section 3.2.12.3, *Threatened and Endangered* Species).

### 3.2.12.3 Threatened and Endangered Species

Several marine or coastal species listed as threatened or endangered species under the ESA are found throughout the NERACOOS. These include the following species managed by NMFS and/or FWS (Table 3-11).

**Table 3-11. Threatened or Endangered Species in the NERACOOS**

| Common Name | Scientific Name | Status |
|---|---|---|
| | ***Reptiles*** | |
| Green turtle | *Chelonia mydas* | Threatened |
| Hawksbill turtle | *Eretmochelys imbricata* | Endangered |
| Loggerhead turtle | *Caretta caretta* | Threatened |
| Kemp's ridley turtle | *Lepidochelys kempii* | Endangered |
| Leatherback turtle | *Dermochelys coriacea* | Endangered |
| | ***Fish*** | |
| Shortnose sturgeon | *Acipenser brevrostrum* | Endangered |
| Atlantic Sturgeon | *Acipenser oxyrinchus oxyrinchus* | Threatened |
| Atlantic Salmon | *Salmo salar* | Endangered, CH |
| | ***Birds*** | |
| Piping plover | *Charadrius melodus* | Threatened (except Great Lakes watershed, where Endangered) |
| Roseate tern | *Sterna dougallii dougallii* | Threatened |
| | ***Mammals*** | |
| North Atlantic right whale | *Eubalaena glacialis* | Endangered, CH |
| Sei whale | *Balaenoptera borealis* | Endangered |
| Blue Whale | *Balaenoptera musculus* | Endangered |
| Fin whale | *Balaenoptera physalus* | Endangered |
| Humpback whale | *Megaptera novaeangliae* | Endangered |
| Sperm whale | *Physeter catodon* | Endangered |

Sources: FWS 2012a, NOAA 2012f.

Note: CH = designated critical habitat

**<u>Designated Critical Habitat</u>**

*Atlantic salmon.* All perennial, rivers, streams, estuaries, and lakes connected to the marine environment, except those areas specifically excluded, and marine coastal zones have been designated as critical habitat areas for the Atlantic salmon (NOAA 2011k).

*North Atlantic right whale.* Sections of the Great South Channel have been designated as critical habitat areas for the North Atlantic right whale (NOAA 2011k).

## 3.2.13 GLOS

### 3.2.13.1 Fish

The Great Lakes represent one of the most important freshwater resources in the United States and Canada. Fisheries in this region are managed by the transboundary cooperative agency, the Great Lakes Fishery Commission through the *Joint Strategic Plan for Management of Great Lakes Fisheries* (GLFC 2007). This plan was developed by the eight U.S. states bordering the Great Lakes, the Canadian province of Ontario, two intertribal agencies, and several federal agencies. Implementation of the plan is accomplished through Lake Committees for each lake. Some of the initiatives covered under this plan include rehabilitation of native species; disease prevention and management; exotic species research and control; stocking levels; and determination of total allowable catch and allocation agreements. Lake Commissions from each lake meet regularly to determine how best to regulate and protect commercial fisheries from the Great Lakes (GLFC 2004). There is no Regional FMC in the Great Lakes region, and thus EFH and HAPCs are not designated for any of its fisheries.

Average annual catches for commercial fisheries in the Great Lakes are around 50,000 metric tons. This number is lower than annual catches for commercial fisheries in the 1950's, the peak of commercial fisheries landings. The decline in fisheries has largely been due to over-fishing, pollution, toxic contaminants, habitat destruction, and introduction of exotic species, especially the parasitic sea lamprey and zebra mussels. Some native species such as the lake trout, sturgeon, and lake herring were able to survive in reduced numbers, but have been largely replaced by introduced species as smelt, alewife, splake, and Pacific salmon. Lake trout, once the top predator in the region, is now only commercially fished in Lake Superior due to low numbers in other lakes. The lake trout population in Lake Superior is still dependent on annual stocking to maintain high population numbers. The blue pike of Lake Erie and the Atlantic salmon of Lake Ontario, once top predators in those lakes, are currently believed to be extinct and have been replaced by walleye, hatchery-reared coho, and Chinook salmon. Currently, commercial fisheries in the Great Lakes are mainly based on whitefish, smelt, bloater chubs and perch, and alewife (EPA 2008c).

### 3.2.13.2 Marine Mammals

There are no marine mammals present in the Great Lakes.

### 3.2.13.3 Threatened and Endangered Species

Several aquatic or coastal species listed as threatened or endangered species under the ESA are found throughout the Great Lakes region. These include the following species managed by NMFS and/or FWS (Table 3-11).

**Table 3-12. Threatened or Endangered Species in the Great Lakes ROI**

| Common Name | Scientific Name | Status |
|---|---|---|
| ***Mollusks*** | | |
| Purple cat's paw | *Epioblasma obliquata obliquata* | Endangered |
| Riffleshell | *Epioblasma torulosa rangiana* | Endangered |
| Pink mucket | *Lampsilis abrupta* | Endangered |
| Ring pink | *Obovaria retusa* | Endangered |
| White wartyback | *Plethobasus cicatricosus* | Endangered |
| Orangefoot pimpleback | *Plethobasus cooperianus* | Endangered |
| Clubshell | *Pleurobema clava* | Endangered |
| Rough pigtoe | *Pleurobema plenum* | Endangered |
| ***Birds*** | | |
| Piping plover | *Charadrius melodus* | Endangered |
| Roseate tern | *Sterna dougallii dougallii* | Threatened |

Sources: FWS 2012a, NOAA 2012f

## 3.3 CULTURAL RESOURCES

### 3.3.1 Applicable Laws, Regulations, and Executive Orders

***National Historic Preservation Act (NHPA).*** The NHPA of 1966 (16 U.S.C. §§ 470 et seq.), as amended, requires federal agencies to consider the preservation of historic districts, buildings, structures, or objects that might be impacted by a proposed action. The intent of the NHPA is to integrate consideration of historic preservation issues into the early stages of project planning by a federal agency. Under the NHPA, State Historic Preservation Officers (SHPOs) are responsible for managing historic properties within their state. Section 106 of the NHPA requires federal agencies to take into account the effects of their proposed actions on historic properties and provide the Advisory Council on Historic Preservation with the opportunity to comment on proposed actions. The Advisory Council on Historic Preservation oversees and ensures the consideration of historic properties in the federal planning process. The Section 106 process attempts to accommodate historic preservation concerns with the needs of federal actions through early stage consultations (36 CFR 800.1). In addition, the Section 106 process uses consultation among federal agencies and other parties with an interest in the potential effects of a federal action on historic properties to assist with the identification of historic properties potentially affected by the proposed action; assess effects; and find ways to avoid, minimize, or mitigate any adverse effects on historic properties (36 CFR 800.2).

The installation of sensors on or near historic properties would be subject to NHPA regulations. The IOOS Program would consult with the necessary SHPO to maintain compliance with the NHPA to avoid direct or visual impacts to a historic property.

***Archaeological and Historic Preservation Act.*** The Archaeological and Historic Preservation Act provides for the preservation of historical and archeological data (including relics and specimens) which might otherwise be irreparably lost or destroyed as the result of federal or federally funded actions. If actions performed by a federal agency are found to cause irreparable loss or destruction of significant scientific, pre-historical, historical, or archeological data by an appropriate historical or archaeological authority, the agency shall notify the Secretary of the Interior and provide appropriate information concerning the activity. Such agency may request the Secretary to undertake the recovery, protection, and preservation of such data or it may, with funds appropriated for such project, undertake preservation activities themselves.

***Abandoned Shipwreck Act.*** Under the Abandoned Shipwreck Act of 1987 (43 U.S.C. §§ 2101 et seq.), the U.S. Government asserted title to three categories of abandoned shipwrecks: abandoned shipwrecks embedded in a State's submerged lands; abandoned shipwrecks embedded in coralline formations protect by a State on its submerged lands; and abandoned shipwrecks located on a State's submerged lands and included in or determined eligible for inclusion in the National Register of Historic Places. Upon asserting title, the U.S. transferred its title to those shipwrecks to the State in or on whose submerged lands the shipwreck is located with the exception of shipwrecks owned by Indian tribes. The installation of anchors or stations on or in abandoned shipwrecks are subject to regulations established in the Abandoned Shipwreck Act and by the applicable State. The IOOS Program would consult with the necessary state agencies to maintain compliance with the Abandoned Shipwrecks Act to avoid direct impacts to an abandoned shipwreck.

***Executive Order 13175 (November 6, 2000): Consultation and Coordination with Indian Tribal Governments.*** EO 13175, *Consultation and Coordination with Indian Tribal Governments* establishes regular and meaningful consultation and collaboration with tribal officials in the development of federal policies or actions that have tribal implications. Under this EO, federal agencies must respect Indian tribal self-government and sovereignty, honor tribal treaty and other rights, and strive to meet the responsibilities that arise from the unique legal relationship between the federal government and Indian tribal governments. For actions that affect Tribal lands or traditional fishing practices, consultation with the appropriate Tribal government would be conducted as required.

### 3.3.2 Cultural Resources Common to All Regions

The NHPA of 1966 is the primary federal statute that addresses the management of cultural resources. Each state has a SHPO that administers state cultural resource programs and ensures the conservation and protection of cultural resources within the state. Cultural resources can refer to any prehistoric or historic sites, buildings, districts, structures, traditional use areas, or objects considered important to a culture or community. Cultural resources can include traditional resources related to fishing and other marine or nearshore resources, such as traditional or tribal fishing rights (NSF 2008). MPAs can also have cultural designations (NOAA 2010d).

Specific federal obligations to Native American tribes vary by region, depending on tribal status (e.g., federally recognized treaty fishing rights; federally recognized tribes; tribes seeking federal recognition; state-recognized tribes). The procedures outlined in the NOAA Procedures for Government-to-Government Consultation with Federally Recognized Indian Tribes and Alaska Natives (NOAA Tribal Consultation Handbook) provide guidance to NOAA to support a more consistent, effective and proactive approach to conducting tribal consultations. The Handbook is intended to improve NOAA's management of its relations and cooperative activities with Indian Tribes, and to provide for meaningful and timely input from Tribes into the Federal decision-making process on policy matters having substantial direct effects on them. Policies that have tribal implications refer to regulations, legislative comments or actions that have substantial direct effects on one or more Indian Tribes, on the relationship between the Federal government and Indian Tribes, or on the distribution of power and responsibilities between the Federal government and Indian Tribes.

### 3.3.3 PacIOOS

Many tropical islands in the Pacific Ocean are confronted by rapidly growing human populations, but have few economic resources that their residents can use. In addition to supporting island economies, fishing also continues to contribute to the cultural integrity and social cohesion of Pacific island communities (Western Pacific Regional FMC 2009b).

The Federated States of Micronesia have traditionally used subsistence farming and fishing practices to meet the needs of the population, although there has more recently been a shift towards a commercial economy (GFSM 2002). Subsistence fishery landings in Palau (estimated as nearly 1.5 times the amount of commercial fishery landings in 1999) occur throughout the coastal areas and outer islands of the country (United Nations 2002). Coastal fisheries in the Marshall Islands are composed principally of small operations, primarily in the outer islands, which are conducted within the context of a subsistence economy (MIMRA 2003). Fishing in Guam and the Commonwealth of the Northern Mariana Islands continues to be important not only in terms of contributing to the subsistence needs of the Chamorro people but also in terms of preserving their history and identity (Western Pacific Regional FMC 2009b). Fishing assists in perpetuating traditional knowledge of marine resources and maritime heritage of the Chamorro culture (Western Pacific Regional FMC 2009b). In American Samoa, fishery types include a shoreline subsistence fishery, an artisanal fishery for offshore pelagic fishes, an artisanal fishery for offshore bottomfish, and a recreational tournament fishery (Craig et al. 1993, as cited in Western Pacific Regional FMC 2009a). In Hawaii, participation in recreational and subsistence fishing represents a substantial proportion of the local population (estimated at more than 8 percent of Hawaii's population) (State of Hawaii 2005, as cited in Western Pacific Regional FMC 2009c).

The SHPOs in the PacIOOS are the Guam Historic Resources Division (http://historicguam.org/about.htm), American Samoa Historic Preservation Office (http://ashpo.org/), and the State Historic Preservation Division of the Hawaii Department of Land and Natural Resources (http://hawaii.gov/dlnr/hpd/).

### 3.3.4 AOOS

Federal and Alaska law define subsistence as the customary and traditional uses of wild resources for food, clothing, fuel, transportation, construction, art, crafts, sharing, and customary trade. Subsistence uses are central to the customs and traditions of many cultural groups in Alaska, including Aleut, Athabaskan, Alutiiq, Euromamerican, Haida, Inupiat, Tlingit, Tsimshian, and Yup'ik. Subsistence fishing and hunting are important sources of employment and nutrition in almost all rural coastal communities. Of 129 coastal towns, not including boroughs, 108 participate in the subsistence lifestyle for traditional lifestyle, nourishment, sociocultural, and/or economic purposes. Ninety-five percent of rural households consume subsistence-caught fish, according to the State of Alaska. Fish varieties include salmon, halibut, herring, and whitefish. Seals, sea lions, walruses, beluga, and bowhead whales, and sea otters comprise the marine mammal harvest. The subsistence food harvest in rural areas represents about 2 percent of the fish and game harvested annually in Alaska (NOAA 2005b). Stakeholders in AOOS include coastal subsistence communities from Dillingham to Nuiqsut (Dutton 2010).

Most marine waters under federal jurisdiction for subsistence are located in southwest Alaska and along the Alaska Peninsula. The federal subsistence priority means that subsistence uses by rural residents are accorded priority over non-subsistence uses (commercial or sport). Alaska holds exclusive authority to manage subsistence on lands and waters on state and private property in Alaska, including some marine waters in the state (NOAA 2005b). Alaska state law directs the Board of Game and Board of Fisheries to provide a reasonable opportunity for subsistence uses first, before providing for other uses of any harvestable surplus of a fish or game population. This is often referred to as the "subsistence preference" or sometimes the "subsistence priority" (ADFG 2012).

The SHPO for the AOOS is the Alaska SHPO (http://dnr.alaska.gov/parks/oha/shpo/shpo.htm).

### 3.3.5 NANOOS

There are more than 30 federally-recognized tribes with recognized treaty/tribal fishing rights in the northwest region (Sims 2011). The Olympic Coast National Marine Sanctuary on the coast of Washington is entirely encompassed by the traditional harvest areas of the Hoh, Makah, and Quileute tribes, and the Quinault Indian Nation. As sovereign nations, the tribes have treaty fishing rights and co-management responsibilities with the State of Washington for fishery resources and fishing activities within the sanctuary (NOAA 2011l). Tribal interest and management authority extends beyond reservation boundaries to include the usual and accustomed fishing areas, as defined for each tribe in *United States v. State of Washington*, 384 F. Supp. 312 (WD Wash. 1974) (NOAA 2006d). The Hoh, Makah, and Quileute tribes, the Quinault Indian Nation, the state of Washington, and the NOAA Office of National Marine Sanctuaries created the Olympic Coast Intergovernmental Policy Council in 2007, which provides a regional forum for resource managers to exchange information, coordinate policies, and develop recommendations for resource management within the sanctuary (NOAA 2011l). The Northwest Indian Fisheries Commission provides natural resources management support for 20 treaty Indian tribes in western Washington (Northwest Indian Fisheries Commission 2012).

The SHPO agencies in the NANOOS are the Washington Department of Archaeology and Historic Preservation (http://www.dahp.wa.gov/) and Oregon Parks and Recreation Department, Heritage Programs, SHPO (http://www.oregon.gov/OPRD/HCD/SHPO/).

### 3.3.6 CeNCOOS

The SHPO for the CeNCOOS is the California State Parks, Office of Historic Preservation (http://ohp.parks.ca.gov/?page_id=21755).

### 3.3.7 SCCOOS

The SHPO for the SCCOOS is the California State Parks, Office of Historic Preservation (http://ohp.parks.ca.gov/?page_id=21755).

### 3.3.8 GCOOS

The SHPOs for the GCOOS are the Florida Division of Historical Resources (http://www.flheritage.com/), the Alabama Historical Commission (http://preserveala.org/), the Louisiana Office of Cultural Development (http://www.crt.state.la.us/), the Mississippi Department of Archives and History (http://mdah.state.ms.us/), and the Texas Historical Commission (http://www.thc.state.tx.us/).

### 3.3.9 SECOORA

The SHPOs for the SECOORA are the Florida Division of Historical Resources (http://www.flheritage.com/), the Georgia Department of Natural Resources, Historic Preservation Division (http://georgiashpo.org/), the South Carolina Department of Archives and History, SHPO (http://shpo.sc.gov), and the North Carolina Department of Cultural Resources, SHPO (http://www.hpo.ncdcr.gov/).

### 3.3.10 CariCOOS

In Puerto Rico and the USVI, fisheries in commercial sectors can be characterized as “artisanal” because their commercial fishing vessels are mostly under 14 m long, have small crews, participate in multiple fisheries, and yield smaller revenues. Their seafood processors are often small-scale producers. However, commercial fishermen still need permits to fish (Caribbean Council Fisheries Management 2004).

The historic preservation agency in Puerto Rico is the Institute of Puerto Rican Culture (http://www.icp.gobierno.pr/). In the USVI, the agency in charge of cultural resources is the Department of Planning and Natural Resources (http://www.dpnr.gov.vi/).

### 3.3.11 MARACOOS

The SHPOs for the MARACOOS are the Massachusetts Historical Commission (http://www.sec.state.ma.us/mhc/), the Rhode Island Historical Preservation and Heritage Commission (http://www.rihphc.state.ri.us/), Connecticut’s Historic Preservation and Museum

Division of the Connecticut Commission on Culture and Tourism (http://www.cttrust.org/index.cgi/11860), New York State Office of Parks, Recreation, and Historic Preservation (http://nysparks.com/shpo/), New Jersey Historic Preservation Office (http://www.nj.gov/dep/hpo/), Delaware Division of Historical and Cultural Affairs (http://history.delaware.gov/preservation/), Maryland Historical Trust (http://mht.maryland.gov/), Virginia Department of Historic Resources (http://www.dhr.virginia.gov/).

### 3.3.12 NERACOOS

The Maine Department for Inland Fisheries and Wildlife recognizes Maine Native American traditional fishing rights and issues a set number of trapping and fishing licenses for individuals belonging to the Passamaquoddy Tribe, the Penobscot Nation, the Houlton Band of Maliseet Indians, the Aroostook Band of Micmacs, or the Aroostook Micmac Council (Maine IF&W 2012). The SHPOs for the NERACOOS are the New Hampshire Division of Historical Resources (http://www.nh.gov/nhdhr/) and the Maine Historic Preservation Commission (http://www.maine.gov/mhpc/).

### 3.3.13 GLOS

Two tribal organizations, the Great Lakes Indian Fish and Wildlife Commission and the Chinnewa Ottawa Resources Authority, manage traditional fishing rights and resources in the Great Lakes. The Great Lakes Indian and Wildlife Commission is an agency of 11 Ojibwe nations in Minnesota, Wisconsin, and Michigan managing traditional fishing rights in Lake Superior for individuals belonging to these nations (GLIFWC 2012). The Chippewa Ottawa Resource Authority manages fishing rights from five different tribal organizations under all 1836 Treaties (Chippewa Ottawa Resource Authority 2012).

The SHPOs for the GLOS are, New York State Office of Parks, Recreation, and Historic Preservation (http://nysparks.com/shpo/),the Pennsylvania Bureau for Historic Preservation(http://www.portal.state.pa.us/portal/server.pt/community/historic_preservation/3741), the Ohio Historic Preservation Office (http://www.ohiohistory.org/resource/histpres/), the Indiana Division of Historic Preservation and Archaeology (http://www.in.gov/dnr/historic/), the Illinois historic Preservation Agency (http://www.illinoishistory.gov/), the Wisconsin Historical Society (http://www.wisconsinhistory.org/), the Minnesota SHPO (http://www.mnhs.org/shpo/), and the Michigan SHPO (http://www.michigan.gov/shpo).

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# 4. ENVIRONMENTAL CONSEQUENCES

This section describes the possible impacts to existing environmental conditions within the IOOS Program. Based upon a preliminary analysis of the potential impacts of the proposed activities associated with the installation and subsequent O&M of proposed IOOS assets, some resource areas typically analyzed in an EA are not addressed in this PEA because impacts to these resource areas are considered unlikely (see Table 3-1). Accordingly, the discussion of the affected environment and associated environmental impact analyses focuses on marine and terrestrial physical resources, including geology and water quality; marine and terrestrial biological resources; and traditional cultural resources.

## 4.1 IMPACT ASSESSMENT METHODOLOGY

For the purposes of this PEA, the evaluation criteria for potential impacts to physical, biological, and traditional cultural resources from the implementation of the Proposed Action are described in Table 4-1. The evaluation criteria include the type, intensity, and duration of potential impacts. Additionally, impacts are described in terms of whether they are a direct or indirect result of the Proposed Action. *Direct impacts* would be an immediate result of project-related activities (e.g., direct mortality of species or removal of vegetation and habitat) and may be either temporary (reversible) or permanent (irreversible). Most direct effects are confined to the project footprint, but some (e.g., noise) may extend beyond the project boundary. Indirect impacts would be spatially removed from project-related activities, or occur later in time, but are reasonably certain to occur. Indirect effects tend to be diffuse, resource-specific, and less amenable to quantification or mapping than direct effects.

**Table 4-1. Evaluation Criteria for Analyzing Potential Environmental Impacts**

| | |
|---|---|
| ***Type*** | |
| Beneficial | The impact would result in some level of environmental improvement. |
| Adverse | The impact would result in some level of environmental degradation. |
| ***Intensity*** | |
| Negligible | No impact to resources or the impact would be at or below levels of detection. |
| Minor | A detectable change to resources; however, the impact would be small, localized, and of little consequence. |
| Moderate | A readily apparent change to the human environment which would not be major. |
| Major | A substantial change to the character of the resource over a large area. |
| ***Duration*** | |
| Short-term | Occurs only during the period of IOOS installation or O&M activities. |
| Long-term | Continues after the period of IOOS installation or O&M activities. |

As discussed in Section 1.1.3.1, a number of ocean observing technologies are proposed for deployment within the ROI under the IOOS Program. Given that site-specific details regarding the placement of the proposed sensors, gliders/AUVs, drifters, moorings, and HF radar are not known at this time, the following impact analysis provides a programmatic assessment based on the installation of these technologies and their associated O&M once they are deployed.

## 4.2 PROPOSED ACTION (PREFERRED ALTERNATIVE)

### 4.2.1 Physical Resources

#### 4.2.1.1 Geological Resources

**Passive Sensors/Instrumentation and Moorings, Stations, Buoys, and Fixed Arrays**

On average, anchors are 1 to 2 meters in diameter and each buoy usually requires one anchor, however 3-4 buoys can use two anchors. Therefore, the impacted area at a buoy installation of 3 buoys would be less than 4 meters. For example, the typical sweep radius of the standard buoy (i.e., the University of Maine Buoy) used in the Gulf of Maine and the Caribbean is less than 25 meters, therefore a long-term, minor, adverse impacts would be expected.

As noted in Table 2.1, the RAs are proposing to install 26 buoys to increase the number of buoys to a total of 182. The total chain sweep area is less than 2,000 square meters per buoy, which would be a total of less than 52,000 square meters or less than 13 acres for all new buoys. If chain sweep from all installed buys is considered, then the total sweep area would be less than 400,000 square meters or less than 100 acres. The RAs cover hundreds of thousands of acres, therefore either 13 acres of disturbance from new buoys or 100 acres for all buoys would be expected to result in negligible impacts. Given the large overall area of IOOS operations, specific details of buoys is available in Appendix D. Location of the buoys would be consistent with the recommendations provided by NMFS during informal consultation (see Appendix H).

Under the Proposed Action, potential impacts to marine geological resources from installation and O&M of the proposed IOOS assets would be associated with the placement of mooring anchors and associated sensors or fixed platforms on the seafloor. The placement of these anchors, sensors, and platforms could result in short-term, negligible adverse, impacts on marine geological sediments in the immediate vicinity of the proposed IOOS assets. Additional negligible impacts on marine geological sediments would be expected if a buoy or instrumentation broke loose from its anchor and disturbed sediments. Therefore, negligible impacts on marine geological resources from implementation of the Proposed Action across the ROI would be expected.

**Vessels/Sampling**

Marine vessels, including personal watercraft, may be used to implement, operate, and maintain aspects of the IOOS Program. Vessels may be owned and operated by a variety of entities from NOAA vessels to privately owned vessels depending on the type of action and agreement between the RA and the entity completing the action. Negligible adverse impacts on marine geological resources would be expected if a vessel accidentally runs aground during sampling activities. If a vessel is required to use an anchor during sampling activities, short-term, negligible, adverse impacts on marine geological resources would be expected.

**Gliders/AUVs/Drifters**

The deployment of gliders, AUVs, and drifters within the ROI would have no impact on geological resources, as the proposed AUVs and gliders would move within the water column similar to a dolphin or whale, and drifters float on the sea surface, moving with ocean currents. In the unlikely event of a glider, AUV, or drifter malfunction, negligible adverse impacts on sediments or geological resources would be expected.

**HF Radar**

Under the Proposed Action, the site-specific locations of the proposed shore-based HF radar stations are unknown at this time. However, previous installation of HF radar stations indicates that there would be negligible impacts to terrestrial geological resources during the installation and operation of the HF radar stations. To assess the potential impacts on terrestrial geological resources (e.g., sand dunes, nearshore areas), additional appropriate site-specific environmental documentation (e.g., NOAA Environmental Compliance Questionnaire [see Appendix A], tiered site-specific EA) would be completed prior to the installation of any proposed new HF radar stations. RAs would also consult with the necessary state coastal zone management programs and determine if there would be any reasonably foreseeable effects to coastal uses or resources of the state and, if so, whether the HF radar stations would be consistent with the enforceable policies of the state's coastal management program.

**SONAR**

Under the Proposed Action, no short- or long-term impacts on geological resources would be expected from the installation and O&M of proposed SONAR. SONAR operates at a low power and uses short pulse lengths (see Table 2-2). SONAR sources can be associated with moorings, gliders, and AUVs.

**LIDAR**

Under the Proposed Action, short- and long-term, negligible, adverse impacts on marine geological resources would be expected from the installation and O&M of proposed LIDAR systems. Aircraft-mounted LIDAR would have no impact on geological resources. LIDAR systems that are mounted to a terrestrial or tripod system would have long-term, negligible, adverse impacts at the site of installation. Specific LIDAR system installation sites are unknown at this time. Additional tiered environmental analysis would be completed once the sites for LIDAR systems have been selected.

#### 4.2.1.2 Water Quality

Potential water quality impacts from the implementation of the Proposed Action would be limited by the permitting requirements of the CWA, which would be followed for onshore and offshore infrastructure deployments during the appropriate site-specific evaluations.

**Sensors/Instrumentation and Moorings, Stations, Buoys, and Fixed Arrays**

Under the Proposed Action, small-scale increases in turbidity could occur from the installation of sensors, instruments, and moorings and the O&M of the mooring anchors, fixed platforms, and associated sensors on the seafloor. Increases in turbidity from anchor placement or installation of seafloor mounted sensors would be a short-term, localized, minor, adverse impact during the installation activities. Sediments would disperse or settle back to the seafloor following disturbance. Coarse sediments (i.e., sand) would resettle within seconds in the immediate area, whereas fine sediments (i.e., silt or clay) would tend to drift and remain in suspension for minutes to hours, depending on particle sizes and bottom currents (MMS 1999). Repair activities and/or future removal of the instruments could have impacts on marine water quality similar to those of installation at the affected locations. Implementation of the Proposed Action would not alter currents or circulation regimes within the ROI. Therefore, the short-term increase in suspended sediment concentrations and turbidity levels from the implementation of the Proposed Action would be expected to result in negligible adverse impacts to marine water quality.

Additional turbidity would be caused by buoy anchor chain sweep. As noted in Table 2.1, the RAs are proposing to install 26 buoys to increase the number of buoys to a total of 182. The total chain sweep area is less than 2,000 square meters per buoy, which would be a total of less than 52,000 square meters or less than 13 acres for all new buoys. If chain sweep from all installed buys is considered, then the total sweep area would be less than 400,000 square meters or less than 100 acres. The RAs cover hundreds of thousands of acres, therefore the increase in turbidity from either 13 acres of disturbance from new buoys or 100 acres for all buoys is expected to be localized, long-term, direct, adverse, negligible impacts. Specific details of buoys is available in Appendix D. Location of the buoys would be consistent with the recommendations provided by NMFS during informal consultation (see Appendix H).

Proposed installation and O&M activities under the Proposed Action would not introduce any materials or substances into the marine environment that would adversely affect marine water quality. Research and other vessels would be used for mooring, glider, and AUV deployments, and vessel-based sampling/surveying. A potential source of hazardous materials contamination could be the unanticipated spill or discharge of fuel, lubricants, or sensor components (e.g., batteries) from a project vessel or associated IOOS equipment and sensors. However, such spills are unlikely to occur because the installation, operation, and maintenance activities would be compliant with existing federal, state, and research vessel owner/operator hazardous materials and waste management requirements (UNOLS 2009). If a spill did occur, vessels would adhere to Section 311 of the CWA regarding the containment, cleanup, and reporting of spills to ensure that the impacts would be minimized. Therefore, short- and long-term, negligible, adverse impacts on marine water quality would be expected from the implementation of the Proposed Action.

**Vessels/Sampling**

Marine vessels, including personal watercraft, may be used to implement, operate, and maintain aspects of the IOOS Program. Short-term, negligible, adverse impacts on water quality would be expected from accidental vessel discharge, spills, or ballast/bilge water discharge during sampling activities. However, vessels would be operated according to applicable laws and regulations that restrict onboard hazardous material use and the discharge of bilge water.

**Gliders/AUVs/Drifters**

Long-term, negligible, adverse impacts on water quality would be expected from the use of gliders, AUVs, and drifters under the Proposed Action. The proposed AUVs and gliders would move within the water column at low speeds and drifters float on the sea surface, moving with ocean currents and would not increase turbidity. AUVs use lithium ion batteries that are sealed within the AUV and have little to no potential for leakage.

**HF Radar**

Under the Proposed Action, the site-specific locations of the proposed shore-based HF radar stations are unknown at this time; however negligible adverse impacts on water quality would be expected during the installation and O&M of the HF radar stations.

HF radar stations would be installed on level sites without surface water features or direct drainage to the ocean. A project-specific Stormwater Pollution Prevention Plan incorporating Best Management Practices for erosion and sedimentation control would be prepared and implemented, as appropriate, to prevent the discharge of sediment, pollutants, or runoff from any proposed HF radar sites. Once proposed site-specific HF radar locations have been identified, additional appropriate site-specific environmental documentation (e.g., NOAA Environmental Compliance Questionnaire [see Appendix A], tiered site-specific EA) would be completed prior to the installation of any proposed new HF radar stations to assess the potential site-specific impacts to terrestrial water quality. RAs would also consult with the necessary state coastal zone management programs and determine if there would be any reasonably foreseeable effects to coastal uses or resources of the state and, if so, whether the HF radar stations would be consistent with the enforceable policies of the state's coastal management program.

**SONAR**

Short-term, negligible, adverse impacts on water quality would be expected from the installation and O&M activities of SONAR systems. The proposed SONAR systems receive their power from the associated vessels, moorings, AUVs, or gliders which are expected to have negligible impacts on marine water quality.

**LIDAR**

No adverse impacts on water quality would be expected from the installation and maintenance of terrestrial or tripod-mounted LIDAR systems. LIDAR uses ultraviolet, visible, or near-infrared light for imaging and mapping; therefore no impacts on water quality would be expected from the operation of LIDAR systems.

### 4.2.2 Biological Resources

#### 4.2.2.1 Terrestrial Biological Resources

**Sensors/Instrumentation; Vessels/Sampling; Gliders/AUVs/Drifters; Moorings, Stations, Buoys, and Fixed Arrays; and SONAR**

Oceanographic sensors; vessels used for sampling; gliders, AUVs, and drifters; moorings, stations, buoys, and fixed arrays; and SONAR systems are marine based systems and do not contain a terrestrial component; therefore, no impacts to terrestrial biological resources would be expected from the deployment of these systems.

Under the Proposed Action, the RAs would monitor storm events, conduct beach/sediment sampling, and other shoreline monitoring activities at selected land-based locations. Monitoring activities would include but would not be limited to using pressure sensors, video cameras and visual observers; taking soil samples along beaches or other coastal areas; and survey of sand levels on beaches. Monitoring locations and a description of the proposed sensors, their deployment schemes (e.g., affixed to pier pylons or other stable structures) are unknown at this time. Once site-specific project locations are known, a tiered NEPA analysis would be completed to determine the impacts of proposed monitoring and surveying activities. Agency experience with past monitoring actions indicates that there could be short-term, negligible, adverse impacts on terrestrial biological resources from proposed IOOS shore-based monitoring activities from the intermittent disruption of habitat during installation. Prior to monitoring and survey activities, project personnel would work with state coastal zone management agencies, State and National Parks, tribal entities, and other land managers, if required, to obtain any required permits or permissions. In addition, siting of all proposed shore-based facilities will be done in coordination and consultation with relevant federal and state agencies (e.g., FWS) to avoid and minimize potential impacts to terrestrial biological resources including, but not limited to, migratory birds, ESA-listed species, and associated critical habitat.

**HF Radar**

Under the Proposed Action, shore-based HF radar stations would be installed; however specific locations are unknown at this time. Short-term, negligible, adverse impacts on terrestrial biological resources would be expected during the installation of HR radar stations. If trenching is required to install power supplies for new or hardened sites, short-term, minor to moderate, adverse impacts on terrestrial biological resources would be expected. Long-term, negligible, adverse impacts on terrestrial biological resources would be expected from the continued operation and maintenance of these systems. Once site-specific HF radar locations have been identified, additional appropriate site-specific environmental documentation (e.g., NOAA Environmental Compliance Questionnaire [see Appendix A], tiered site-specific EA) would be completed prior to installation to assess the potential site-specific impacts on terrestrial biological resources (e.g., migratory birds and ESA-listed species). RAs would also consult with the necessary state coastal zone management programs and determine if there would be any reasonably foreseeable effects to coastal uses or resources of the state and, if so, whether the HF radar stations would be consistent with the enforceable policies of the state's coastal management program.

**LIDAR**

Short-term, negligible, adverse impacts on terrestrial biological resources would be expected from the installation of terrestrial or tripod-mounted LIDAR systems. The O&M of LIDAR systems would have long-term, negligible, adverse impacts on terrestrial biological resources from the use of the ultraviolet, visible, or near-infrared light for imaging and mapping. Once site-specific locations for terrestrial or tripod-mounted LIDAR systems have been identified, additional appropriate site-specific environmental documentation (e.g., NOAA Environmental Compliance Questionnaire [see Appendix A], tiered site-specific EA) would be completed prior to installation to assess the potential site-specific impacts on terrestrial biological resources (e.g., migratory birds and ESA-listed species).

### 4.2.2.2 Marine Biological Resources

**Sensors/Instrumentation**

To measure changes and variability in the chemical, biological, and geological processes in the ocean, RAs propose the use of a complex suite of oceanographic sensors. These sensors would be deployed from a number of platforms including surface buoys, profiling moorings, fixed seafloor moorings, piers, AUVs, gliders, and/or drifters. No impacts would be expected from the operation of the oceanographic sensors on marine biological resources as they passively collect data from the water column (e.g., salinity and water temperature).

Generally, tagging procedures do not cause stress to the fish or shark, beyond the capture and physical tagging of the individual. However, tags do have the potential to cause negative physiological, behavioral, or immunological effects to the animal, such as: tags not well-attached in the musculature may cause tissue irritation or secondary infection; the size and/or weight of the tag may increase the energy required by the individual to swim, feed, and/or evade predators; and external tags have the potential to biofoul which could cause tissue irritation in the individual on which the tag is mounted (Thorsteinson 2002). As required in all previous similar tagging operations by the University of Hawaii at Mānoa, research team protocols would be strictly followed to minimize potential negative impacts on individual fish and sharks. Descriptions of the research team protocol are provided in the Institutional Animal Care and Use Committee (IACUC) tagging methods approved for PacIOOS is found in Appendix B. Although there is the potential for short-term, negligible, adverse impacts on individuals that are tagged, long-term, permanent impacts on populations of tagged fish and shark species would not be expected to occur.

**Vessels/Sampling**

Marine vessels, including personal watercraft, may be used to implement, operate, and maintain aspects of the IOOS Program. The vessels used would be similar to vessels already in use in the ROI, therefore no additional adverse impacts would be expected. The equipment would be used for a short time period and then removed from the water once complete. Short-term, negligible adverse impacts on marine biological resources would be expected from potential vessel strikes during sampling activities. However, strikes are unlikely because the PDC's require trained observers on vessels and adherence to NMFS's Vessel Strike Avoidance Measures. [See Appendix G.] Additionally, if any ocean observing infrastructure would be sited in or traverse through (e.g., glider, AUV) an MPA, NOAA National Marine Sanctuary, or a national park, consultation with, and permits from the appropriate agency must be completed prior to infrastructure deployment.

**Moorings, Stations, Buoys, and Fixed Arrays**

Placement of moorings and anchors would be implemented, to the maximum extent possible, according to the recommendations from NOAA Fisheries, Office of Habitat Conservation (July 2014) (see Section 4.5 for a complete list of the recommendations). Placement of moorings and anchors could have the potential to impact benthic communities if non-mobile species are crushed and benthic area is no longer productive; however these impacts would be avoided to the maximum extent possible. Additional long-term impacts are caused by chain sweep that would degrade the area swept and potentially prevent recolonization of the area by local benthic species. However, as described in Section 4.2.1.1, the area potentially impacted by chain sweep is negligible compared to the area of interest for the IOOS RAs. Once site-specific locations for moorings and anchors have been identified, additional appropriate site-specific environmental documentation (e.g., NOAA Environmental Compliance Questionnaire [see Appendix A], tiered site-specific EA) would be completed, if necessary, prior to installation to assess the potential site-specific impacts on marine biological resources.

Entanglement of marine species with mooring lines (i.e., lines connecting the topside buoy to the anchor) in the water column is considered highly unlikely due to the ability of marine species to detect and avoid the mooring lines and because the mooring cables are sufficiently rigid to eliminate the slack that causes entanglement. Based on observations of underwater cables (ONR 2001; DoN 2004; Dollar and Brock 2006), the cables, anchors, and scientific sensors would be covered with marine growth or buried by sand. The presence of cables and other man-made structures may enhance the physical complexity of the marine habitats and provide settling or sheltering locations for marine organisms, which would result in a long-term, minor, beneficial impact. No long-term adverse impacts on marine biological resources or critical habitat would be expected from the installation of the proposed mooring anchors and scientific sensors on the seafloor (NMFS 2008b).

*Essential Fish Habitat.* Under the provisions of MSFCMA, federal agencies must consult with NMFS prior to authorizing, funding, or undertaking any actions that may adversely affect EFH. Correspondence with NOAA Fisheries, Office of Habitat Conservation (see Appendix H) was initiated in July 2014. NOAA Fisheries, Office of Habitat Conservation provided a variety of recommendations to reduce effects on EFH that would be associated with the installation and maintenance of moorings and buoys; such as locating the moorings/buoys away from EFH and not grouping multiple anchors in one area. Recommendations and mitigation measures provided by NOAA Fisheries, Office of Habitat Conservation are provided in Section 4.5. Federal agencies retain the discretion to determine what actions fall within the definition of "adverse effect." Additionally, during consultation or the development of an EA, NOAA Fisheries Staff could assist with the determination of the level (i.e., negligible, minor) of an adverse effect on EFH. Temporary or minimal impacts are not always considered to be adverse effects. "Temporary impacts" are those that are limited in duration and that allow the particular environment to recover without measurable impact. "Minimal impacts" are those that may result in relatively small changes in the affected environment and insignificant changes in ecological functions.

All designated EFH must be considered when determining the potential effects of a Proposed Action on EFH. Effects on EFH could include temporary mechanical disturbance of the substrate, and long-term coverage of relatively small areas of substrate by proposed mooring anchors and scientific sensors. Although site-specific locations of proposed moorings are unknown at this time, short-term, negligible, adverse effects on EFH would be expected from the installation of moorings and associated anchors in each RA. Over time, the natural movement of sediments by ocean currents and burrowing organisms would reestablish natural bottom topography. The short-term minor increase in turbidity and sedimentation is not expected to adversely affect the ability of EFH to support healthy fish populations and affected areas are expected to recover quickly. The site-specific placement of moorings would avoid sensitive habitats (e.g., corals, rocky outcrops, or HAPCs). Through IOOS' best management practices (see Appendix G) and adhering to the EFH Conservation Recommendations provided by the Office of Habitat Conservation in July 2014 (see Section 4.5 and Appendix H), regular O&M activities for the IOOS assets would have effects on EFH similar to those of installation at the affected locations. Due to the small footprint of the mooring's anchor and the preference for anchoring away from submerged aquatic vegetation and hard bottoms, long-term negligible adverse impacts from mooring activity on the quality or quantity of EFH would not be expected. Therefore, the installation and O&M of the proposed IOOS assets within the ROI might have negligible minimal adverse effects on EFH in the respective regions.

**<u>Gliders/AUVs/Drifters</u>**

The use of gliders, AUVs, and drifters within the ROI is not expected to affect marine species. The proposed gliders and AUVs would move within the water column. Gliders are sealed, contain no motors or fuels; and move at very slow speeds (0.5 knots), drastically minimizing the potential for collisions with marine mammals. AUVs and gliders are powered by batteries that are sealed with little potential for leakage. AUVs also move at low speeds (approximately 3-5 knots) with little potential for collisions with marine species. Similar use of AUVs and gliders was assessed for the installation and O&M of the NSF's Ocean Observatories Initiative (OOI) in the Pacific and Atlantic Oceans, and the NMFS Office of Protected Resources issued Letters of Concurrence under the ESA and MMPA for no adverse impacts to ESA-listed species, designated and proposed critical habitat, or marine mammals (NMFS 2008a, b). Additionally, given the low duty cycles, the brief period when an individual animal could potentially be within the very narrow beam of the source, and the relatively low source levels of the proposed acoustic sources, negligible adverse impacts on fish and marine mammals would be expected. Additionally, this technology would not be expected to result in harassment of marine mammals. Therefore, the use of gliders and AUVs associated with the proposed IOOS Program would have negligible adverse impacts on marine biological resources. Additionally, if any ocean observing infrastructure would be sited in or traverse through (e.g., glider, AUV) an MPA, NOAA National Marine Sanctuary, or a national park, consultation with, and permits from the appropriate agency must be completed prior to infrastructure deployment.

**<u>HF Radar and LIDAR</u>**

HF radar would be located at shore stations and HF radar does not penetrate the water surface. Therefore, there would be no impacts to marine biological resources with the use of HF radar within the IOOS ROI. Additionally, no effects on EFH would be expected from the installation of additional HF Radar stations. Once site-specific locations for LIDAR systems have been identified, additional appropriate site-specific environmental documentation (e.g., NOAA Environmental Compliance Questionnaire [see Appendix A], tiered site-specific EA) would be completed prior to installation to assess the potential site-specific impacts on terrestrial biological resources (e.g., migratory birds and ESA-listed species).

**SONAR**

Short- and long-term, negligible, adverse impacts on marine biological resources would be expected from the installation and O&M of the proposed SONAR systems. Informal consultation with NMFS (November 14, 2014) concluded that there may be an impact on marine species and designated critical habitat, but it is not likely to adversely affect ESA listed species or designated critical habitat. Most of the active acoustic/SONAR sources proposed for use within the ROI would operate at frequencies much higher than those that would be audible by fish (500 Hz to approximately 3 kHz), marine mammals (mysticetes approximately 7 Hz to 22 kHz; odontocetes approximately 150 Hz to 180 kHz; and pinnipeds 75 Hz to 75 kHz), and sea turtles (60 Hz to 1 kHz) (Ridgway et al. 1969; Richardson et al. 1995; Southall et al. 2007). Acoustic instruments that do operate within the hearing range of protected species include the Acoustic Doppler Velocimeter and Acoustic Doppler Current Profiler, which would operate at frequencies greater than 75 kHz, with most operating at frequencies greater than 200 kHz. In addition, Doppler Current Profilers operate at approximately 38 kHz, which is well below levels that are known to interfere with marine mammal and fish behavior.

The IOOS RAs have been operating gliders since 2008 and have operated gliders for more than 20,000 days with no report of interference with marine mammals. A glider day is defined as 1 glider in the water, operating for 24 hours. The IOOS Program proposes to deploy additional gliders with active acoustics, such as altimeters to measure the depth of the water. The altimeters would operate at 170 kHz and the tracking pingers would operate at frequencies between 10 and 30 kHz. The altimeter is used to navigate the glider and pings a few times per dive with each ping being very short; approximately 2-5 milliseconds. The pinging function for tracking is only used for emergency recovery and is not in regular use. The hearing frequencies for fish and marine mammals overlap with these frequencies. These acoustic sources could be audible to individuals of these species within the narrow extent of a transmitted sound beam. Therefore, long-term, negligible, adverse impacts on fish and marine mammals from the continued use of gliders equipped with altimeters would be expected.

### 4.2.3 Cultural Resources

The IOOS Program activities cover a variety of locations and environmental conditions. Given that site-specific project locations are unknown at this time, a programmatic discussion of cultural resources was developed. Letters notifying each potentially affected SHPO have been sent to alert them of the nature of the IOOS activities (see Appendix I). Since specific locations are not known, consultation under Section 106 of the NHPA is not possible at this time. Prior to the installation or operation of IOOS Program assets, a tiered NEPA analysis would be completed to address specific project areas. Prior to NOAA funding/approval of infrastructure being deployed onshore or in state, territorial, or federal waters, NOAA would consult with the appropriate SHPO to ensure that their ocean observing activities do not adversely affect any traditional cultural resources. A site-specific evaluation of potential impacts to cultural resources would be completed prior to any infrastructure installation as a part of the tiered analysis.

Prior to NOAA funding/approval of deployment of any oceanographic fixed moorings, gliders, AUVs or shore-based systems (e.g., HF radar) within tribal boundaries or usual and accustomed fishing areas, NOAA would initiate a consultation with affected tribes or tribal nations under Section 106 of the NHPA and consistent with EO 13175. IOOS and the RAs would obtain information from affected tribes or tribal nations on proposed ocean observing activities and tribal fishing regulations in order to avoid disruption of tribal fishing patterns. Additionally, input from affected tribes and tribal nations would be considered in the final siting of ocean observing infrastructure and all data from the ocean observing activities would be made available to tribal fisheries managers. Therefore, implementation of the Proposed Action would result in negligible adverse effects to traditional cultural resources, including fishing rights within any IOOS RA. Consultation with SHPOs and Federally recognized tribes would be completed to avoid impacts to buried, archaeological resources in areas where trenching is required to install power supplies for new or hardened HF radar sites. If a cultural resource is identified during trenching activities, the SHPO and appropriate stakeholders would be notified and consulted with to determine the necessary course of action. However, if an archaeological resource is disturbed, potential long-term adverse impacts on cultural resources would be expected from the localized disturbance.

## 4.3 FULL CAPABILITIES ALTERNATIVE

### 4.3.1 Physical Resources

#### 4.3.1.1 Geological Resources

**Passive Sensors/Instrumentation and Moorings, Stations, Buoys, and Fixed Arrays**

Compared to the Proposed Action, the Full Capabilities Alternative would result in approximately twice as much geological sediments being swept by the buoy mooring chains and the placement of anchors, giving approximately 200 acres of long-term adverse impacts to geological resources. However, since the area would still be small relative to the total area in ROI, and the anchors would be placed to minimize impact on geologic resources, long-term, adverse minor impacts would be expected. Approximately double the quantity of passive sensors would be deployed under the Full Capabilities Alternative. However, the use of passive sensors under the Full Capabilities Alternative would also have negligible adverse impacts on geological resources, due to the very limited nature of interaction between the sensors and geological resources.

**Vessels/Sampling**

Compared to the Proposed Action, the Full Capabilities Alternative would result in the operation of approximately twice as many marine vessels, including personal watercraft to implement, operate, and maintain aspects of the IOOS Program. Negligible adverse impacts on marine geological resources would be expected if a vessel accidentally runs aground during sampling activities. If a vessel is required to use an anchor during sampling activities, short-term, negligible, adverse impacts on marine geological resources would be expected.

**Gliders/AUVs/Drifters**

Compared to the Proposed Action, the Full Capabilities Alternative would result in the deployment of approximately twice as many gliders, AUVs, and drifters within the ROI. No impact on geological resources would be expected, as the proposed AUVs and gliders would move within the water column, and drifters float on the sea surface, moving with ocean currents. In the unlikely event of a glider, AUV, or drifter malfunction negligible adverse impacts on sediments or geological resources would be expected.

**HF Radar**

Compared to the Proposed Action, the Full Capabilities Alternative would result in the installation of approximately twice as many HF radar stations. However, the site-specific locations of the shore-based HF radar stations are unknown at this time. Previous installation of HF radar stations indicates that there would be negligible impacts to terrestrial geological resources during the installation and operation of the HF radar stations. If trenching is required to install power supplies for new or hardened sites, short-term, minor, adverse impacts on geological resources would be expected. To assess the potential impacts on terrestrial geological resources (e.g., sand dunes, nearshore areas), additional appropriate site-specific environmental documentation (e.g., NOAA Environmental Compliance Questionnaire [see Appendix A], tiered site-specific EA) would be completed prior to the installation of any proposed new HF radar stations. RAs would also consult with the necessary state coastal zone management programs and determine if there would be any reasonably foreseeable effects to coastal uses or resources of the state and, if so, whether the HF radar stations would be consistent with the enforceable policies of the state's coastal management program.

**SONAR**

As described for the Proposed Action, no short- or long-term impacts on geological resources would be expected from the installation and O&M of proposed SONAR as a component of the Full Capabilities Alternative. SONAR operates at a low power and uses short pulse lengths (see Table 2-2). SONAR sources would be associated with moorings, gliders, and AUVs.

**LIDAR**

Compared to the Proposed Action, the Full Capabilities Alternative would result in the installation of approximately twice as many LIDAR systems. As described for the Proposed Action, short- and long-term, negligible, adverse impacts on marine geological resources would be expected from the installation and O&M of proposed LIDAR systems as a component of the Full Capabilities Alternative. Aircraft-mounted LIDAR would have no impact on geological resources. LIDAR systems that are mounted to a terrestrial or tripod system would have long-term, negligible, adverse impacts at the site of installation. Specific LIDAR system installation sites are unknown at this time. Additional tiered environmental analysis would be completed once the sites for LIDAR systems have been selected.

#### 4.3.1.2 Water Quality

Potential water quality impacts from the implementation of the Full Capabilities Alternative would be limited by the permitting requirements of the CWA, which would be followed for onshore and offshore infrastructure deployments during the appropriate site-specific evaluations.

**Sensors/Instrumentation and Moorings, Stations, Buoys, and Fixed Arrays**

Compared to the Proposed Action, the Full Capabilities Alternative would result in approximately twice as much sediments being swept by the buoy mooring chains and the placement of anchors, resulting in additional long-term increases in localized turbidity in these areas. However, since the area would still be small relative to the total area in ROI, long-term, direct, adverse minor impacts would be expected. Approximately double the quantity of passive sensors would be deployed under the Full Capabilities Alternative. However, the use of passive sensors under the Full Capabilities Alternative would also have no adverse impacts on water quality, due to the lack of interaction between the sensors and water column.

Compared to the Proposed Action, the Full Capabilities Alternative would result in the installation of approximately twice as many sensors, instruments, moorings, anchors, and fixed platforms. Short-term, negligible to minor increases in turbidity would be expected from the installation of these assets. Sediments would disperse or settle back to the seafloor following disturbance. Coarse sediments (i.e., sand) would resettle within seconds in the immediate area, whereas fine sediments (i.e., silt or clay) would tend to drift and remain in suspension for minutes to hours, depending on particle sizes and bottom currents (MMS 1999).

Repair activities and/or future removal of the instruments could have impacts on marine water quality similar to those of installation at the affected locations. Implementation of the Full Capabilities Alternative would not alter currents or circulation regimes within the ROI. Therefore, the increase in suspended sediment concentrations and turbidity levels from the implementation of the Full Capabilities Alternative would be expected to result in negligible to minor, adverse impacts on marine water quality.

Proposed installation and O&M activities under the Full Capabilities Alternative would not introduce any materials or substances into the marine environment that would adversely affect marine water quality. Research and other vessels would be used for mooring, glider, and AUV deployments, and vessel-based sampling/surveying. A potential source of hazardous materials contamination could be the unanticipated spill or discharge of fuel, lubricants, or sensor components (e.g., batteries) from a project vessel or associated IOOS equipment and sensors. However, such spills are unlikely to occur because the installation, operation, and maintenance activities would be compliant with existing federal, state, and research vessel owner/operator hazardous materials and waste management requirements (UNOLS 2009). If a spill did occur, vessels would adhere to Section 311 of the CWA regarding the containment, cleanup, and reporting of spills to ensure that the impacts would be minimized. Therefore, short- and long-term, negligible, adverse impacts on marine water quality would be expected from the implementation and O&M of the Full Capabilities Alternative.

**Vessels/Sampling**

Marine vessels, including personal watercraft, may be used to implement, operate, and maintain aspects of the IOOS Program. Compared to the Proposed Action, the Full Capabilities Alternative would result in the deployment of approximately twice as many marine vessels to be used for sampling activities. Short-term, negligible, adverse impacts on water quality would be expected from accidental vessel discharge, spills, or ballast/bilge water discharge during sampling activities. However, vessels would be operated according to applicable laws and regulations that restrict onboard hazardous material use and the discharge of bilge water.

**Gliders/AUVs/Drifters**

Compared to the Proposed Action, the Full Capabilities Alternative would result in the deployment of approximately twice as many gliders, AUVs, and drifters as a component of the IOOS Program. The proposed AUVs and gliders would move within the water column at low speeds and drifters float on the sea surface, moving with ocean currents and would not increase turbidity. AUVs use lithium ion batteries that are sealed within the AUV and have little to no potential for leakage. Therefore, long-term, negligible to minor, adverse impacts on water quality would be expected from the use of gliders, AUVs, and drifters under the Full Capabilities Alternative.

**HF Radar**

Compared to the Proposed Action, the Full Capabilities Alternative would result in the installation of approximately twice as many shore-based HF radar stations. However, the site-specific locations of these stations are unknown at this time. Short- and long-term, negligible to minor, adverse impacts on water quality would be expected during the installation and O&M of the HF radar stations.

HF radar stations would be installed on level sites without surface water features or direct drainage to the ocean. A project-specific Stormwater Pollution Prevention Plan incorporating Best Management Practices for erosion and sedimentation control would be prepared and implemented, as appropriate, to prevent the discharge of sediment, pollutants, or runoff from any proposed HF radar sites. Once proposed site-specific HF radar locations have been identified, additional appropriate site-specific environmental documentation (e.g., NOAA Environmental Compliance Questionnaire [see Appendix A], tiered site-specific EA) would be completed prior to the installation of any proposed new HF radar stations to assess the potential site-specific impacts to terrestrial water quality. RAs would also consult with the necessary state coastal zone management programs and determine if there would be any reasonably foreseeable effects to coastal uses or resources of the state and, if so, whether the HF radar stations would be consistent with the enforceable policies of the state's coastal management program.

**SONAR**

Compared to the Proposed Action, the Full Capabilities Alternative would result in the installation of approximately twice as many SONAR systems. Short- and long-term, negligible, adverse impacts on water quality would be expected from the installation and O&M activities of SONAR systems. The proposed SONAR systems receive their power from the associated vessels, moorings, AUVs, or gliders which are expected to have negligible impacts on marine water quality.

**LIDAR**

Compared to the Proposed Action, the Full Capabilities Alternative would result in the installation of approximately twice as many LIDAR systems. No impacts on water quality would be expected from the installation and O&M activities of terrestrial or tripod-mounted LIDAR systems. LIDAR uses ultraviolet, visible, or near-infrared light for imaging and mapping; therefore no impacts on water quality would be expected from the operation of LIDAR systems.

## 4.3.2 Biological Resources

### 4.3.2.1 Terrestrial Biological Resources

**Sensors/Instrumentation; Vessels/Sampling; Gliders/AUVs/Drifters; Moorings, Stations, Buoys, and Fixed Arrays; and SONAR**

Oceanographic sensors; SONAR; moorings; gliders, AUVs, and drifters; and vessels used for sampling are marine based systems, and do not contain a terrestrial component; therefore, no impacts on terrestrial biological resources would be expected from the deployment of these systems.

Compared to the Proposed Action, the Full Capabilities Alternative would deploy approximately twice as many activities; including storm monitoring, beach/sediment sampling, and other shoreline monitoring at selected land-based locations. Monitoring activities would include but would not be limited to using pressure sensors, video cameras and visual observers; taking soil samples along beaches or other coastal areas; and survey of sand levels on beaches. Monitoring locations and a description of the proposed sensors, however their deployment schemes (e.g., affixed to pier pylons or other stable structures) are unknown at this time. Once site-specific project locations are known, a tiered NEPA analysis would be completed to determine the impacts of proposed monitoring and surveying activities. Agency experience with past monitoring actions indicates that there would be short-term, negligible to minor, adverse impacts on terrestrial biological resources from proposed IOOS shore-based monitoring activities from the intermittent disruption of habitat during installation. Prior to monitoring and survey activities, project personnel would work with state coastal zone management agencies, State and National Parks, tribal entities, and other land managers, if required, to obtain any required permits or permissions. In addition, siting of all proposed shore-based facilities would be completed in coordination and consultation with relevant federal and state agencies (e.g., FWS) to avoid and minimize potential impacts to terrestrial biological resources including, but not limited to, migratory birds, ESA-listed species, and associated critical habitat.

**HF Radar**

Compared to the Proposed Action, the Full Capabilities Alternative would install approximately twice as many shore-based HF radar stations; however specific locations are unknown at this time. Short-term, negligible to minor, adverse impacts on terrestrial biological resources would be expected during the installation of HR radar stations. Long-term, negligible to minor, adverse impacts on terrestrial biological resources would be expected from the continued operation and maintenance of these systems. If trenching is required to install power supplies for new or hardened sites, short-term, minor to moderate, adverse impacts on terrestrial biological resources would be expected. Once site-specific HF radar locations have been identified, additional appropriate site-specific environmental documentation (e.g., NOAA Environmental Compliance Questionnaire [see Appendix A], tiered site-specific EA) would be completed prior to installation to assess the potential site-specific impacts on terrestrial biological resources (e.g., migratory birds and ESA-listed species). RAs would also consult with the necessary state coastal zone management programs and determine if there would be any reasonably foreseeable effects to coastal uses or resources of the state and, if so, whether the HF radar stations would be consistent with the enforceable policies of the state's coastal management program.

**LIDAR**

Compared to the Proposed Action, the Full Capabilities Alternative would install approximately twice as many LIDAR systems; however specific locations are unknown at this time. Short-term, negligible to minor, adverse impacts on terrestrial biological resources would be expected from the installation of terrestrial or tripod-mounted LIDAR systems. The O&M of LIDAR systems would be expected to have long-term, negligible to minor, adverse impacts on terrestrial biological resources from the use of the ultraviolet, visible, or near-infrared light for imaging and mapping. Once site-specific locations for terrestrial or tripod-mounted LIDAR systems have been identified, additional appropriate site-specific environmental documentation (e.g., NOAA Environmental Compliance Questionnaire [see Appendix A], tiered site-specific EA) would be completed prior to installation to assess the potential site-specific impacts on terrestrial biological resources (e.g., migratory birds and ESA-listed species).

#### 4.3.2.2 Marine Biological Resources

**Sensors/Instrumentation**

Compared to the Proposed Action, the Full Capabilities Alternative would deploy approximately twice as many oceanographic sensors from platforms, buoys, moorings, piers, AUVs, gliders, and/or drifters. The impacts associated with the installation of the sensors is discussed in the sections regarding which type of equipment the sensor would be deployed from.

The installation of the sensor itself is expected to have no impacts on marine biological resources, however, the sensor could be attached to a variety of different platforms. The installation of these platforms (i.e., buoys, moorings, and anchors) would be expected to have short-term, negligible to minor, adverse impacts, as discussed in the following sections. No impacts would be expected on marine biological resources from the operation of the oceanographic sensors as they passively collect data from the water column (e.g., salinity and water temperature).

Additionally, approximately twice as many animal telemetry tags would be deployed under the Full Capabilities Alternative as compared to the Proposed Action. Generally, tagging procedures do not cause stress to the fish or shark, beyond the capture and physical tagging of the individual. Descriptions of the research team protocol are provided in the IACUC tagging methods approved for PacIOOS is found in Appendix B. Although there is the potential for short-term, negligible, adverse impacts to individuals that are tagged, long-term, permanent overall impacts to populations of tagged fish and shark species would not be expected.

**Vessels/Sampling**

Compared to the Proposed Action, the Full Capabilities Alternative would deploy approximately twice as many marine vessels. Marine vessels, including personal watercraft, may be used to implement, operate, and maintain aspects of the IOOS Program. The vessels used would be similar to vessels already in use in the ROI, therefore short-term, negligible, adverse impacts on marine biological resources would be expected from potential vessel strikes during sampling activities. The equipment would be used for a short time period and then removed from the water once complete. Additionally, if any ocean observing infrastructure would be sited in or traverse through (e.g., glider, AUV) an MPA, NOAA National Marine Sanctuary, or a national park, consultation with, and permits from the appropriate agency must be completed prior to infrastructure deployment or transit (i.e., transit through PMNM requires notice).

**Moorings, Stations, Buoys, and Fixed Arrays**

Compared to the Proposed Action, the Full Capabilities Alternative would result in approximately twice as much sediments being swept by buoy mooring chains. However, the anchors would be placed to minimize impact to benthic communities, long-term, adverse minor impacts would be expected. Once site-specific locations for moorings and anchors have been identified, additional appropriate site-specific environmental documentation (e.g., NOAA Environmental Compliance Questionnaire [see Appendix A], tiered site-specific EA) would be completed, if necessary, prior to installation to assess the potential site-specific impacts on marine biological resources.

Entanglement of marine species with mooring lines (i.e., lines connecting the topside buoy to the anchor) in the water column is considered highly unlikely due to the ability of marine species to detect and avoid the mooring lines and because the mooring cables are sufficiently rigid to eliminate the slack that causes entanglement. Based on observations of underwater cables (ONR 2001; DoN 2004; Dollar and Brock 2006), the cables, anchors, and scientific sensors would be covered with marine growth or buried by sand. The presence of cables and other man-made structures may enhance the physical complexity of the marine habitats and provide settling or sheltering locations for marine organisms, which would result in a long-term, minor, beneficial impact. No long-term adverse impacts on marine biological resources or critical habitat would be expected from the installation of the proposed mooring anchors and scientific sensors on the seafloor (NMFS 2008b).

*Essential Fish Habitat.* Under the provisions of the MSFCMA, federal agencies must consult with NMFS prior to authorizing, funding, or undertaking any actions that may adversely affect EFH. Correspondence with NOAA Fisheries, Office of Habitat Conservation (see Appendix H) was initiated in July 2014. NOAA Fisheries, Office of Habitat Conservation recommended a variety of recommendations to reduce effects on EFH that would be associated with the installation and maintenance of moorings and buoys; such as locating moorings/buoys away from EFH and not grouping multiple anchors in one area. Recommendations and mitigation measures provided by NOAA Fisheries, Office of Habitat Conservation can be found in Section 4.5.

All designated EFH must be considered when determining the potential effects of a Proposed Action on EFH. Effects on EFH could include temporary mechanical disturbance of the substrate, and long-term coverage of relatively small areas of substrate by proposed mooring anchors and scientific sensors. Although site-specific locations of proposed moorings are unknown at this time, short-term, minor, adverse effects on EFH would be expected from the installation of moorings and associated anchors in each RA. Over time, the natural movement of sediments by ocean currents and burrowing organisms would reestablish natural bottom topography. The short-term minor increase in turbidity and sedimentation is not expected to adversely affect the ability of EFH to support healthy fish populations and affected areas are expected to recover quickly. The site-specific placement of moorings would avoid sensitive habitats (e.g., corals, rocky outcrops, or HAPCs). Through IOOS' best management practices (see Appendix G) and adhering to the EFH Conservation Recommendations provided by the Office of Habitat Conservation in July 2014 (see Section 4.5 and Appendix H), regular O&M activities for IOOS assets would have effects on EFH similar to those of installation at the affected locations. Due to the small footprint of the mooring's anchor and the preference for anchoring away from submerged aquatic vegetation and hard bottoms, long-term minor adverse effects from mooring activity on the quality or quantity of EFH would be expected. Therefore, the installation and O&M of the proposed IOOS assets within the ROI would be expected to have negligible adverse effects on EFH in the respective regions.

**Gliders/AUVs/Drifters**

At full build out, the IOOS Program expects between 7-10 gliders deployed continuously along each of the east, west, and gulf coasts, for total of about 30 at any given time. This operating area is millions of square miles with the gliders operating between 10-500 meters from one another. Given the low duty cycles, the brief period when an individual animal could potentially be within the very narrow beam of the source, and the relatively low source levels of the proposed acoustic sources, short-term negligible adverse impacts on fish and marine mammals would be expected. Additionally, this technology would not be expected to result in harassment of marine mammals.

**HF Radar and LIDAR**

Compared to the Proposed Action, the Full Capabilities Alternative would deploy approximately twice as many HF Radar and LIDAR systems in the ROI. However, HF radar and LIDAR systems would be located at shore stations and HF radar does not penetrate the water surface. Therefore, there would be no expected impacts to marine biological resources with the use of HF radar within the IOOS ROI. Additionally, no effects on EFH would be expected from the installation of additional HF Radar and LIDAR systems.

**SONAR**

Compared to the Proposed Action, the Full Capabilities Alternative would deploy approximately twice as many SONAR systems in the ROI. Short- and long-term, negligible to minor, adverse impacts on marine biological resources would be expected from the installation and O&M of the proposed SONAR systems. Informal consultation with NMFS (November 14, 2014) concluded that there may be an impact on marine species and designated critical habitat, but it is not likely to adversely affect these resources pursuant to the ESA. Most of the active acoustic/SONAR sources proposed for use within the ROI would operate at frequencies much higher than those that would be audible by fish (500 Hz to approximately 3 kHz), marine mammals (mysticetes approximately 7 Hz to 22 kHz; odontocetes approximately 150 Hz to 180 kHz; and pinnipeds 75 Hz to 75 kHz), and sea turtles (60 Hz to 1 kHz) (Ridgway et al. 1969; Richardson et al. 1995; Southall et al. 2007). The Acoustic Doppler Velocimeter and Acoustic Doppler Current Profiler would operate at frequencies greater than 75 kHz, with most operating at frequencies greater than 200 kHz.

Under this alternative, the IOOS Program proposes to deploy additional gliders with active acoustics, such as altimeters to measure the depth of the water. The IOOS RAs have been operating gliders since 2008 and have operated gliders for more than 20,000 days with no report of interference with marine mammals. The altimeters would operate at 170 kHz and the tracking pingers would operate at frequencies between 10 and 30 kHz. These acoustic sources could be audible to individuals of these species within the narrow extent of a transmitted sound beam. Therefore, long-term, negligible, adverse impacts on fish and marine mammals from the continued use gliders equipped with altimeters would be expected.

### 4.3.3 Cultural Resources

The IOOS Program activities cover a variety of locations and environmental conditions. Compared to the Proposed Action, the Full Capabilities Alternative would deploy approximately twice as much equipment as a part of the IOOS Program. Therefore, there is greater potential for impacts on cultural resources (e.g., shipwrecks). However, prior to NOAA funding/approval of infrastructure being deployed onshore or in state, territorial, or federal waters, NOAA would consult with the appropriate SHPO to ensure that their ocean observing activities do not adversely affect any traditional cultural resources or shipwrecks. A site-specific evaluation of potential impacts on cultural resources would be completed prior to any infrastructure installation as a part of the tiered analysis.

Additionally, prior to NOAA funding/approval of deployment of any oceanographic fixed moorings, gliders, AUVs or shore-based systems (e.g., HF radar) within tribal boundaries or usual and accustomed fishing areas, NOAA would initiate a consultation with affected tribes or tribal nations under Section 106 of the NHPA and consistent with EO 13175. The IOOS Program and the RAs would obtain information from affected tribes or tribal nations on proposed ocean observing activities and tribal fishing regulations in order to avoid disruption of tribal fishing patterns. Input from affected tribes and tribal nations would be considered in the final siting of ocean observing infrastructure and all data from the ocean observing activities would be made available to tribal fisheries managers. Therefore, implementation of the Proposed Action would be expected to result in negligible adverse effects to traditional cultural resources, including fishing rights within any IOOS RA. Consultation with SHPOs and Federally recognized tribes would be completed to avoid impacts to buried, archaeological resources in areas where trenching is required to install power supplies for new or hardened HF radar sites. If a cultural resource is identified during trenching activities, the SHPO and appropriate stakeholders would be notified and consulted with to determine the necessary course of action. However, if an archaeological resource is disturbed, potential long-term adverse impacts on cultural resources would be expected from the localized disturbance.

## 4.4 NO ACTION ALTERNATIVE

Under the No Action Alternative, IOOS would maintain the currently deployed assets but would not fund any additional observational technology assets beyond those already deployed (a total of approximately 804 assets). Therefore, environmental baseline conditions would remain unchanged within each IOOS region, and there would be no additional impacts to environmental resources with implementation of the No Action Alternative. IOOS buoys, sensors, HF radar, and gliders have operated for more than 10 years. There have been no reports of adverse impacts on environment resources from the use of this equipment. Routine maintenance is required for the buoys and sensors. For the buoys this is either done in place by cleaning and swapping out equipment or the removal of the buoys for refurbishment. At the time of the maintenance a short-term negligible impact on the local habitat would be expected with the removal and redeployment of the moorings. Sensors must be cleaned and recalibrated on an annual basis. This is usually done at location or by swapping out instruments with no impact to the habitat or environment. HF radars require routine maintenance to ensure that the cables are intact, lines that secure the antennas are taught, and antenna patterns are calibrated. This calibration is usually done by tracking a small boat. A negligible impact on the terrestrial environment would be expected from foot traffic at the site.

The IOOS Program was established with the passing of the ICOOS Act of 2009. The Act establishes federal-regional partnerships for understanding the unique characteristics of the nation's diverse regions, integrating existing information from federal and non-federal sources, and expanding the observation network to fill critical gaps, enhance analyses and understanding, and improve predictive and forecasting capabilities. If the No Action Alternative was selected, the IOOS Program Office would be unable to fulfill the full system capabilities envisioned in the ICOOS Act and would not meet the purpose of the proposed action to continuing, improving, and expanding the IOOS Program capabilities.

## 4.5 MITIGATION AND MONITORING

As site-specific regional projects are planned, appropriate monitoring measures would be proposed as part of the design, installation, implementation, and O&M activities within each region. Site-specific monitoring efforts would be more fully described in the appropriate region-specific tiered NEPA document (e.g., tiered site-specific EA, supplemental environmental report, NOAA Environmental Compliance Questionnaire [see Appendix A], etc.). Appropriate potential monitoring and mitigation measures would be implemented at the site-specific stage through consultation with federal and state agencies, adherence to federal/state/local regulations, and development and implementation of environmental management plans and best management practices. All vessels operating within the ROI in support of IOOS projects would be required to follow vessel owner/operator best management practices in the deployment of assets and during survey and sampling activities. Prior to deployment of assets which would have the potential for marine geological, cultural or biological impacts (e.g., dropping mooring anchors), personnel from the individual RA or the vessel crew would survey the bottom to assure that assets are not sited in an area such that adverse impacts could occur (e.g., adverse impacts to submerged aquatic vegetation, EFH, shipwrecks). Additionally, appropriate personnel from each RA would consult and file permits, as appropriate, with federal, state and tribal agencies prior to deploying assets (e.g., moorings, HF radar) in support of IOOS.

Programmatic-level monitoring and mitigation is discussed below.

**EFH**

Through consultation with the NOAA Fisheries Office of Habitat Conservation (July 7, 2014), the following conservation recommendations were provided to minimize effects to EFH, pursuant to Section 305(b)(4)(A) of the MSFCMA.

1. To the maximum extent possible, locate overwater buoy structures in deep water to avoid shade impacts to SAV from the on water structure.
2. Site buoys and water quality sensor platforms outside of sensitive EFH, specifically HAPCs, corals, salt marshes, eelgrasses and other SAV habitats, and rocky bottoms.
3. When practicable, and the benthic resources present dictate, sinkers should be deliberatively lowered rather than jettisoned off the side of a boat to ensure proper placement on the bottom. Diver assisted placement is recommended when available and practicable. When sinkers must be raised, ensure that they are returned to their original location and orientation to avoid damaging a new or larger area. Minimize chain lengths to minimize the scour radius around sinkers.
4. Whenever possible, and especially when sinkers are placed near HAPCs, corals, salt marshes, eelgrasses and other SAV habitats, and rocky bottoms, floats should be used on the lower end of sinker chains to decrease scour around sinkers, specifically with NANOOS buoy array, Washington Coast Moorings, Yachts-TIDAS 900 Buoy, single point mooring, and Datawell Mark III Wave Rider Buoy.
5. Consider the cumulative impact from the deployment of multiple anchors and buoys in close proximity. The number of buoys that will be placed as described in Table 4-3 in the IOOS January 2014 PEA are minimal per square mile of area described and should be positioned to minimize the impacts of the site specific anchor and buoys technologies.
6. To the maximum extent possible (within the confines of USCG Navigation rules), if there is light given off by any parts of the moorings and buoy sensors used by the U.S. IOOS Program, limit the use of this light or orient the artificial light so disturbance is avoided. Unnatural light can create unnatural nighttime conditions that can increase the susceptibility of some fish to predation and interfere with predator/prey interactions.

**Animal Telemetry Network**

Federal and state permits required for marine species tagging, as well as IACUC approvals, would be obtained prior to any IOOS-related marine species tagging efforts. PacIOOS and GCOOS researchers would consult with FWS and NMFS, as well as NOAA's Office of National Marine Sanctuaries and the National Park Service if tagging is to occur within their jurisdictions, and any relevant state agencies, regarding required permits for tagging any marine species, including ESA-listed species, such as the Kemp's ridley sea turtle. Additionally, to ensure that all tagging methods are conducted in accordance with the U.S. Department of Agriculture Animal Welfare Act of 1966 and 1985 amendments, as well as the Public Health Service Policy on Humane Care and Use of Laboratory Animals, each researcher proposing to conduct animal tagging would submit their tagging methods for approval by their individual IACUC.

**Moorings**

Prior to deploying moorings, appropriate permits from the USACE must be obtained. If the mooring has an attached surface buoy, RA personnel would also apply for required USCG Private Aids to Navigation permits. If a mooring is placed within a national marine sanctuary or monument, a permit from NOAA Office of National Marine Sanctuaries would be required. Finally, if a mooring is within state boundaries (out to 3 nm) permits from appropriate state agencies would be required. These permits vary by state and would be identified in the region-specific tiered EA.

RA personnel would be required to monitor buoys and have an automated alert to notify personnel if a buoy has drifted from its charted location. This may happen if a mooring line breaks, causing the mooring to drift off-station. RA personnel would contact the USCG who would then subsequently notify mariners of the potential hazard to navigation. For more information on the specifications and installation procedures for buoys and undersea moorings, please see Appendix D.

**AUVs/Gliders/Drifters**

Prior to deploying AUVs, gliders, or drifters, each RA would consult with its regional USCG office to determine if any permits are required. Additionally, if any of these assets move through tribal boundaries or usual and accustomed fishing areas, NOAA would initiate consultation with affected tribes or tribal nations under Section 106 of the NHPA and consistent with EO 13175.

**Fisheries**

The proposed installation and O&M activities of IOOS assets within the ROI could have the potential to impact commercial fisheries that use equipment that contacts the bottom by potentially becoming entangled with moorings, associated anchors, scientific sensors on the seafloor, or AUVs and gliders, causing damage to or loss of their fishing gear, or damage to IOOS assets. It is expected that the site-specific placement of moorings and other IOOS assets within the ROI would be done in coordination with regional and local fishing communities to avoid and minimize potential fisheries interactions. The IOOS Program would discourage the closing of fishing areas from the deployment of moorings, gliders, AUVs, or other technologies under any of the alternatives.

Once the site-specific location and deployment scheme for proposed sensors is determined (i.e., instrument deployment on existing moorings versus the deployment of a new mooring platform to house the instruments), the RAs would work with appropriate federal agencies (e.g., USACE and USCG) to acquire the appropriate permits prior to oceanographic sensor deployment. If sensors are deployed on a surface buoy, the buoy would be permitted through the USCG as a Private Aid to Navigation and would be clearly charted on NOAA navigation charts, published in a Notice to Mariners, and through direct contact with marine user communities. If the sensors are deployed on subsurface moorings, RAs would work with USACE to appropriately permit the subsurface mooring. The RA would also follow-up with the USCG to determine if the subsurface mooring would need to be published in the Notice to Mariners and listed as a hazard to navigation. The details listed in the Notice to Mariners would then be used to update the appropriate NOAA charts. Additionally, if any of the sensors are deployed on surface or subsurface moorings within state waters (out to 3 nm) the regional entity would obtain the necessary environmental permits from the appropriate state agencies prior to mooring deployment. In addition, RAs would notify the USCG prior to glider or AUV deployments to keep them informed of the planned route and duration of the deployment.

**Marine Mammals/Endangered Species**

To fulfill its ESA and Marine Mammal Protection Act (MMPA) obligations, the U.S. IOOS program consulted with the National Marine Fisheries Service and identified project design criteria (PDC) to incorporate into the proposed action to avoid adverse effects to ESA-listed species and designated critical habitat and to avoid harassment of marine mammals. If RAs cannot implement all relevant PDC for a particular project, if PDC have not been identified for an activity, or if an activity is likely to adversely affect ESA-listed species or harass marine mammals, RA's must contact the IOOS Program Office to determine if further ESA section 7 consultation (formal or informal) may be required.

The PDC contains special measures for installation of equipment when in the range of ESA-listed corals or Johnson's sea grass, sea turtles, or smalltooth sawfish, such as requirements for a soft start to encourage species to leave the area, or to shut down or postpone in-water work when marine mammals or ESA-listed species are observed within certain exclusion zones. RA's will avoid in-land installations at pinniped rookeries or known haul-out/pupping beaches. RA's will adhere to NMFS' Vessel Strike Avoidance Measures and strike reporting measures, adhere to North Atlantic right whale vessel speed restrictions in Seasonal and Dynamic Management Areas, reduce vessel speeds when within the ranges of marine mammals or sea turtles, and otherwise maintain enumerated distances from marine mammals or sea turtles. RA's will avoid anchoring on corals or in ESA-listed abalone habitat and Johnson's seagrass critical habitat. When using sonar, RA's will ramp up prior to use, and shutdown or power down when cetacean, pinniped, or sea turtles are sighted within enumerated exclusion zones. When using Lidar, RA's will maintain aircraft altitudes of 1000 ft. A full list of the PDC's that are incorporated into the proposed action are found in Appendix G.

**Monitoring**

Within one year after finalization of the Programmatic Environmental Assessment, the U.S. IOOS® Program will finalize a standardized monitoring plan to characterize the baseline biological and anthropogenic noise in each Region, by providing passive acoustic (PA) coverage of the Region. The objective is to include PA on most systems (gliders, moorings, vessels, etc.) to estimate cetacean and fish exposure, monitor stressors (e.g., chronic and acute human activities), and detect possible effects (Southall et al. 2013). The goal (within 5 years) is to operate at least one PA system in each Region to insure that IOOS® activities are not adversely affecting threatened and endangered species and their designated critical habitat. Additionally, RA's will summarize observers' data annually, and submit summary and data sheets with annual reports.

## 4.6 SUMMARY OF POTENTIAL EFFECTS

Table 4-2 provides a summary of the potential impacts from the implementation of technologies and activities associated with the Proposed Action, Full Capabilities Alternative, and No Action Alternative. Table 4-3 provides a summary of the geographic extent of IOOS sensors. All technologies and activities may not be proposed for all RAs.

**Table 4-2. Summary of Potential Impacts on Resources from the Proposed Alternatives of the IOOS Program**

| | Proposed Action (Preferred Alternative) | Full Capabilities Alternative | No Action Alternative |
|---|---|---|---|
| ***Physical Resources*** | | | |
| **Sensors/ Instrumentation** | Short- and long-term negligible adverse impacts on geological resources and water quality. | Short- and long-term, negligible to minor, adverse impacts on geological resources and water quality. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| **Vessels/Sampling** | Short-term, negligible, adverse impacts on geological resources or water quality. | Short-term, negligible, adverse impacts on geological resources or water quality. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| **Gliders/AUVs/ Drifters** | No impacts on geological resources. Long-term negligible adverse impacts on water quality. | No impacts on geological resources. Long-term, negligible to minor, adverse impacts on water quality. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| **Moorings/ Stations Buoys/ Fixed Arrays** | Short- and long-term, negligible, adverse impacts from installation and routine maintenance activities. No impacts from the operation of moorings and buoys. | Short- and long-term, minor, adverse impacts from installation and routine maintenance activities. No impacts from the operation of moorings and buoys. | Environmental baseline conditions would remain unchanged from current IOOS operations. |

| | Proposed Action (Preferred Alternative) | Full Capabilities Alternative | No Action Alternative |
|---|---|---|---|
| ***Physical Resources (continued)*** | | | |
| **HF Radar** | Short- and long-term, negligible, adverse impacts from installation and routine maintenance activities. If trenching is required to install power supplies for new or hardened sites, short-term, minor to moderate, adverse impacts on geological resources. No impacts from the operation of HF radar. | Short- and long-term, negligible to minor, adverse impacts from installation and routine maintenance activities. If trenching is required to install power supplies for new or hardened sites, short-term, minor to moderate, adverse impacts on geological resources. No impacts from the operation of HF radar. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| **SONAR** | No impacts on geological resources. Short- and long-term, negligible, adverse impacts on water quality from installation and maintenance activities. | No impacts on geological resources. Short- and long-term, negligible to minor, adverse impacts on water quality from installation and maintenance activities. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| **LIDAR** | Short- and long-term negligible adverse impacts on geological resources from installation and maintenance activities. No impacts on geological resources or water quality from the operation of LIDAR systems. | Short- and long-term, minor, adverse impacts on geological resources from installation and maintenance activities. No impacts on geological resources or water quality from the operation of LIDAR systems. | Environmental baseline conditions would remain unchanged from current IOOS operations. |

| | Proposed Action (Preferred Alternative) | Full Capabilities Alternative | No Action Alternative |
|---|---|---|---|
| | ***Biological Resources*** | | |
| **Sensors/ Instrumentation** | No impacts on terrestrial biological resources.<br>Short-term, negligible, adverse impacts on marine biological resources from the use of sensors or animal telemetry tags. | No impacts on terrestrial biological resources.<br>Short-term, negligible, adverse impacts on marine biological resources from the use of sensors or animal telemetry tags. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| **Vessels/Sampling** | No impacts on terrestrial biological resources.<br>Short-term, negligible adverse impacts on marine biological resources. | No impacts on terrestrial biological resources.<br>Short-term, negligible adverse impacts on marine biological resources. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| **Gliders/AUVs/ Drifters** | No impacts on terrestrial biological resources.<br>Short- and long-term, negligible, adverse impacts on marine biological resources.<br>Harassment of marine mammals would not be expected. | No impacts on terrestrial biological resources.<br>Short- and long-term, negligible, adverse impacts on marine biological resources.<br>Harassment of marine mammals would not be expected. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| **Moorings/ Stations Buoys/ Fixed Arrays** | Short- and long-term, negligible, adverse impacts on terrestrial biological resources.<br>No long-term adverse impacts on marine biological resources or critical habitat.<br>Short-term, negligible, adverse effects on EFH would be expected from the installation of moorings and anchors. | Short- and long-term, minor, adverse impacts on terrestrial biological resources.<br>No long-term adverse impacts on marine biological resources or critical habitat.<br>Short-term, minor, adverse effects on EFH would be expected from the installation of moorings and anchors. | Environmental baseline conditions would remain unchanged from current IOOS operations. |

| | Proposed Action (Preferred Alternative) | Full Capabilities Alternative | No Action Alternative |
|---|---|---|---|
| | ***Biological Resources (continued)*** | | |
| **HF Radar** | Short- and long-term, negligible, adverse impacts on terrestrial biological resources. No impacts on marine biological resources. If trenching is required to install power supplies for new or hardened sites, short-term, minor to moderate, adverse impacts on terrestrial biological resources. No effects on EFH would be expected. | Short- and long-term, negligible to minor, adverse impacts on terrestrial biological resources. No impacts on marine biological resources. If trenching is required to install power supplies for new or hardened sites, short-term, minor to moderate, adverse impacts on terrestrial biological resources. No effects on EFH would be expected. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| **SONAR** | No impacts on terrestrial biological resources. Short- and long-term negligible adverse impacts on marine biological resources. | No impacts on terrestrial biological resources. Short- and long-term, negligible to minor, adverse impacts on marine biological resources. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| **LIDAR** | Short- and long-term negligible adverse impacts on terrestrial biological resources. No impacts on marine biological resources. | Short- and long-term, negligible to minor, adverse impacts on terrestrial biological resources. No impacts on marine biological resources. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| | ***Cultural Resources*** | | |
| **Sensors/ Instrumentation** | Short- and long-term negligible adverse impacts. | Short- and long-term negligible to minor adverse impacts. | Environmental baseline conditions would remain unchanged from current IOOS operations. |

| | Proposed Action (Preferred Alternative) | Full Capabilities Alternative | No Action Alternative |
|---|---|---|---|
| ***Cultural Resources (continued)*** | | | |
| **Gliders/AUVs/ Drifters** | No impacts. | No impacts. | No impacts. |
| **Moorings/ Stations Buoys/ Fixed Arrays** | Short- and long-term negligible adverse impacts. | Short- and long-term negligible to minor adverse impacts. | Environmental baseline conditions would remain unchanged from current IOOS operations. |
| **HF Radar** | If trenching is required to install power supplies for new or hardened sites, potential long-term adverse impacts on archaeological resources could occur. | If trenching is required to install power supplies for new or hardened sites, potential long-term adverse impacts on archaeological resources could occur. | No impacts. |
| **SONAR** | No impacts | No impacts. | No impacts. |
| **LIDAR** | Short- and long-term negligible adverse impacts. | Short- and long-term negligible to minor adverse impacts. | Environmental baseline conditions would remain unchanged from current IOOS operations. |

**Table 4-3. Geographic Extent of IOOS Sensors**

| Regions | AOOS | CariCOOS | CeNCOOS | GCOOS | GLOS | MARACOOS | NANOOS | NERACOOS | PacIOOS | SCCOOS | SECOORA |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Square Miles – Totals | 33,904 | 875 | 2,570 | 17,141 | 94,000 | 11,332 | 4,436 | 6,130 | 30,000 | 857 | 20,346 |
| Distance from coast line (miles) | 10 | 10 | 20 | 20 | 1 | 10 | 15 | 15 | 1 | 20 | 10 |
| Total Area | 339,040 | 8,750 | 51,400 | 342,820 | 94,000 | 113,320 | 66,540 | 91,950 | 30,000 | 17,140 | 203,460 |
| Total New Sensors | 48 | 11 | 19 | 131 | 39 | 40 | 84 | 49 | 105 | 45 | 166 |
| Square Miles per Sensor | 7,063 | 795 | 2,705 | 2,616 | 2,410 | 2,833 | 792 | 1,876 | 285 | 380 | 1,225 |
| | | | | | | | | | | | |
| Alabama | | | | 607 | | | | | | | |
| Alaska | 33,904 | | | | | | | | | | |
| California | | | 2,570 | | | | | | | 857 | |
| Connecticut | | | | | | | | 618 | | | |
| Delaware | | | | | | 2,625 | | | | | |
| Florida (Atlantic) | | | | | | | | | | | 3,341 |
| Florida (Gulf) | | | | 5,095 | | | | | | | 5,095 |
| Georgia | | | | | | | | | | | 2,344 |
| Louisiana | | | | 7,721 | | | | | | | |
| Maine | | | | | | | | 3,478 | | | |
| Maryland | | | | | | 3,190 | | | | | |
| Massachusetts | | | | | | 500 | | 1,519 | | | |
| Mississippi | | | | 359 | | | | | | | |
| New Hampshire | | | | | | | | 131 | | | |

| **Regions** | **AOOS** | **CariCOOS** | **CeNCOOS** | **GCOOS** | **GLOS** | **MARACOOS** | **NANOOS** | **NERACOOS** | **PacIOOS** | **SCCOOS** | **SECOORA** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| New Jersey | | | | | | 1,792 | | | | | |
| New York | | | | | | 2,625 | | | | | |
| North Carolina | | | | | | 600 | | | | | 3,375 |
| Oregon | | | | | | | 1,410 | | | | |
| Puerto Rico | | 700 | | | | | | | | | |
| Rhode Island | | | | | | | | 384 | | | |
| South Carolina | | | | | | | | | | | 2,876 |
| Texas | | | | 3,359 | | | | | | | |
| US Virgin Islands | | 175 | | | | | | | | | |
| Virginia | | | | | | | | | | | 3,315 |
| Washington | | | | | | | 3,026 | | | | |
| Buoys - Now | 1 | 4 | 8 | 44 | 18 | 1 | 17 | 28 | 13 | 0 | 10 |
| Buoys - full build out | 37 | 11 | 16 | 80 | 28 | 32 | 38 | 47 | 27 | 25 | 89 |
| Total New Buoys | 36 | 7 | 8 | 36 | 10 | 31 | 21 | 19 | 14 | 25 | 79 |
| Water Quality Sensors - now | 3 | 0 | 9 | 105 | 1 | 21 | 27 | 0 | 12 | 19 | 37 |
| Water Quality Sensors - full build out | 15 | 4 | 20 | 200 | 30 | 30 | 90 | 30 | 103 | 39 | 124 |
| Total New Water Quality Sensors | 12 | 4 | 11 | 95 | 29 | 9 | 63 | 30 | 91 | 20 | 87 |

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# 5. CUMULATIVE EFFECTS

CEQ regulations stipulate that the cumulative effects analysis should consider the potential environmental impacts resulting from "the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions" (40 CFR 1508.7). The first step in assessing cumulative effects involves identifying and defining the scope of other actions and their interrelationship with the proposed action or alternatives (CEQ 1997). The scope must consider other projects that coincide with the location and timetable of the proposed action and other actions. Cumulative effects analyses evaluate the interactions of multiple actions.

## 5.1 PAST, PRESENT, AND REASONABLY FORESEEABLE FUTURE ACTION

### 5.1.1 National Ocean Policy Implementation Plan

The *Draft National Ocean Policy Implementation Plan* (National Ocean Council 2012) describes actions the federal government will take to improve the health of the ocean, coasts, and Great Lakes. These actions include steps that will be taken to further implement IOOS observational and data management components. Actions under this plan may include inventory of IOOS assets and capabilities, and data management integration. NOAA will develop the IOOS Program consistent with the *National Ocean Policy Implementation Plan*, and the *National Ocean Policy Implementation Plan* is not expected to result in adverse environmental impacts relative to the implementation of the IOOS Program.

### 5.1.2 Ocean Observatories Initiative

The OOI is a long-term program funded by the NSF to provide sustained ocean measurements to study climate variability, ocean circulation and ecosystem dynamics, air-sea exchange, seafloor processes, and plate-scale geodynamics (OOI 2012a). The OOI consists of a network of observatories across the globe collecting ocean and seafloor data through the deployment of different assets and technologies. Four of the OOI stations are within the IOOS ROI (OOI 2012b):

- Station Papa: located in the North Pacific, this station consists of a hybrid profiler mooring, flanking moorings, and gliders.
- Regional Scale Nodes: located off the Oregon and Washington coastlines, this is a cabled coastal ocean observatory consisting of cabled nodes, seafloor instrumentation, and profiler moorings.
- Endurance Array: located off the Oregon and Washington coastlines, this station consists of two mooring lines, three fixed platform sites on each line, surface buoys, benthic packages, gliders, and AUVs.
- Pioneer Array: located in the northern mid-Atlantic region this station consists of profiler moorings, surface moorings, surface buoys, gliders, and AUVs.

The OOI would complement the broader effort to establish the IOOS Program. As these efforts mature, the OOI integrated observatory would be the NSF's contribution to IOOS and a key and enabling U.S. contribution to the international Global Ocean Observing System and the Global Earth Observation System of Systems (NSF 2011). When completed, the OOI would contribute to the overall number of deployed technological assets, but impacts associated with those assets would be similar to those associated with the IOOS Program, therefore negligible to minor cumulative impacts would be expected.

### 5.1.3 Physical Oceanographic Real-Time Systems (PORTS®)

PORTS® is a program of NOAA's National Ocean Service that integrates real-time environmental observations, forecasts and other geospatial information to improve the safety and efficiency of maritime commerce. PORTS systems vary by location and can be comprised of separate instruments, including water-level gauges and meteorological instruments. There are 21 PORTS systems operational in the United States as of February 2012, located in the following locations (NOAA 2012h): Cherry Point, Washington; Chesapeake Bay (north); Chesapeake Bay (south); Delaware Bay and River; Gulfport, Mississippi; Houston/Galveston, Texas; Lake Charles, Louisiana; Los Angeles/Long Beach, California; Lower Columbia River; Lower Mississippi River; Mobile Bay; Narragansett Bay; New Haven, Connecticut; New York/New Jersey Harbor; Pascagoula, Mississippi; Port of Anchorage, Alaska; Sabine Neches; San Francisco Bay, California; Soo Locks, Michigan; Tacoma, Washington; and Tampa Bay, Florida.

PORTS would contribute to the overall number of deployed technological assets, but impacts associated with those assets would be similar to those associated with the IOOS Program, therefore negligible to minor cumulative impacts would be expected.

### 5.1.4 Offshore Energy Development

Offshore oil and gas drilling on the U.S. outer continental shelf is managed by the Bureau of Ocean Energy Management (BOEM). Offshore oil drilling currently occurs in parts of the northern and southern Alaska coast and parts of central and western Gulf of Mexico (BOEM 2011). Offshore oil and gas drilling has the potential to lead to accidental oil spills that could have severe adverse effects on biological and cultural resources in a particular region, such as the Deepwater Horizon oil spill and the Exxon Valdez oil spill, the two biggest oil spills in U.S. waters. Additional adverse impacts on the noise environment from offshore exploration activities would also be expected.

The Exxon Valdez oil spill occurred in March 1989, when the tanker *Exxon Valdez* ran aground on Bligh Reef in Prince William Sound, spilling approximately 11 million gallons of North Slope crude oil. This oil spill cased injury to both natural resources and services (human uses) in the area. Some 756 km of shoreline were oiled by the spill, and several months later, oil from the spill was found as far as 966 km from the site of the grounding (Exxon 1994).

The Deepwater Horizon oil spill occurred in April 2010, when the mobile drilling unit *Deepwater Horizon* exploded and sank, releasing an estimated 5 million barrels over an 87-day period. The magnitude of the oil spill was unprecedented, affecting coastal and oceanic ecosystems, as well as resources of ecological, recreational, and commercial importance; at one point during the oil spill up to 37 percent of open water in the Gulf of Mexico was closed for fishing (Deepwater Horizon Natural Resources Trustees 2011). In July 2015, BP agreed to pay $18.7 billion in fines.

BOEM is responsible for offshore renewable energy development in Federal waters and anticipates future development on the outer continental shelf from three general sources: offshore wind energy, ocean wave energy, and current wave energy. The majority of systems used for these types of activities are still in the prototype-testing phases and regulations are being implemented and evaluated as the technologies develop (BOEM 2012a).

Cape Wind Associates, LLC has proposed a 130, 3.6 megawatt wind turbine generators with the capacity to produce about 468 megawatts, 7.6 km off shore of Cape Cod, Massachusetts, on Horseshoe Shoal in Nantucket Sound (Cape Wind 2014). Offshore energy is not limited to these states; states in both the Pacific coast and the Atlantic coast have expressed interest in developing off shore energy projects and are currently working with the BOEM to develop these plans (BOEM 2012b). Currently, Cape Wind has obtained all of the required Federal and state permits and a 25-year commercial lease from BOEM. Construction will begin shortly after financing has been secured (Cape Wind 2014).

Drilling related to offshore energy development can also affect the local geology and disturb the sea floor. Off shore development of wind and alternative energy may disrupt the biological community in a particular area. Beneficial impacts could include emissions reductions and increased energy security. However, since most technologies are still in the testing phase these impacts are not fully known. Severity and extent of impacts due to off shore energy development is dependent on the type of activity and magnitude of event.

### 5.1.5 National and Homeland Security Activities

The U.S. Navy, USCG, and U.S. Customs and Border Protection conduct operations and training exercises within the EEZ to ensure that their security missions are fulfilled. These activities include deployment of surface and subsurface vessels from small craft to large ships. Activities may include high speed pursuits, live fire actions, underway refueling, and vessel anchoring. These activities have the potential to impact water quality through spills or releases of fuels and lubricants; introduction of munition related contaminants such as, metals and polycyclic aromatic hydrocarbons; impacts to marine mammals, sea turtles, and other protected species through animal strikes or avoidance responses; and impacts to habitat areas and seafloor areas from anchoring and anchor chain sweep. Additional adverse impacts on marine species and recreation from the increased noise of live fire actions would also be expected. Cumulatively, long-term, direct and indirect, minor to moderate, adverse impacts would be expected from the Proposed Action and National and Homeland Security activities. However, all Federal agencies are subject to compliance with all federal requirements to minimize impacts and for the protection of these marine and terrestrial resources.

### 5.1.6 Commercial Activities

Commercial activities such as fisheries, aquaculture, and marine transport can impact the physical and biological environment. Commercial fishing may cause physical disruption of the sea floor and impact fisheries stocks. Aquaculture facilities may impact seafloor and coastal habitats, water quality, and the biological community. Marine transport activities may cause physical disruption of the sea floor, impact water quality, result in contamination and pollution, and present the potential for oil and fuel spills (NOAA 2011n). Marine transport activities present a strike hazard for marine mammals. The number of vessels and size of vessels used for marine transportation has been increasing, resulting in an increased potential for detrimental impacts. The combination of increased number and size of marine vessels may lead to deepening and widening of marine channels, increased number of marine mammal strikes, and possible collisions with buoys and moorings. Dredging of marine channels and bottom habitats is commonly performed for marine navigation purposes. Dredging can negatively impact bottom surface habitat, sediment placement, water turbidity, and flow regimes in localized areas.

Impacts from commercial activities would be short- or long-term, widespread or localized depending on the activity or event causing the impact (NOAA 2011n).

### 5.1.7 Runoff and Waste Disposal

Runoff from residential, industrial, and agricultural sources could have an adverse impact on water quality. Depending on the type of activity, these impacts can be localized or more widespread. Some forest and agricultural activities can lead to erosion, and runoff of fertilizers, pesticides or other chemicals, nutrient increases, and alteration of water flow. Waste disposal and ocean dumping can also decrease water quality, but these impacts may be localized to the dumping site (NOAA 2011n). Impacts from IOOS activities would be expected to have negligible adverse impacts on water quality, which may occur in the unlikely event of a spill or discharge from a vessel. Therefore, cumulatively, the impacts from runoff and waste disposal and IOOS activities would be expected to be short-term, negligible to minor, and adverse.

### 5.1.8 Climate Change

Climate change may have varied adverse impacts on the biological, physical, and cultural resources in coastal and oceanic regions. Impacts from climate change may include rising sea level, changes in water temperature, increased ocean acidification, increases in extreme weather events, changes in climatic patterns, change in ocean currents, and changes in freshwater flow (NOAA 2011n). IOOS activities would include the use of vessels and fuels for sampling activities would increase the amount of carbon dioxide released to the atmosphere. However, the purpose of and need for the Proposed Action is to gather data regarding ocean currents, flows, and temperatures to evaluate the interactions of climate and ocean and the Great Lakes systems. The negligible impact that would occur from the proposed action would be outweighed by the benefit to the analysis of climate change.

## 5.2 SUMMARY OF CUMULATIVE IMPACTS

The Proposed Action, implementation and expansion of the IOOS Program, would have short-term, negligible to minor, adverse impacts on physical, biological, and cultural resources within the ROI. Site-specific placement of moorings and other IOOS assets within the ROI would be done in coordination with regional and local fishing communities to avoid and minimize potential fisheries interactions. Deployment of assets under the IOOS Program as well as other federally funded programs such as the OOI and PORTS could have impacts similar to those of the Proposed Action. Cumulatively, the number of deployed assets would be greater among all programs than for any single program alone. The IOOS Program offsets the technological asset deployment by supporting the national coordination of ocean observations and data, which helps inform resource management. This coordination of resources and information would mitigate adverse impacts associated with activities such as offshore energy development, climate change, waste disposal and runoff, and commercial activities by ensuring that the most comprehensive information would be available to the decision makers for these activities. Overall, expansion of the IOOS capabilities is expected to result in beneficial cumulative impacts because of the expanded availability of data related to the ocean and near shore environment.

The effects of the Proposed Action on physical, biological, and cultural resources, when combined with the effects of the other actions summarized above, are expected to be negligible. The cumulative impacts analysis at the site-specific level should take the number and types of past, present, and reasonably foreseeable future actions in the ROI into consideration. The programmatic processes described in Section 1.3 of this PEA would ensure that any additional actions under the IOOS Program would not result in major impacts on the physical, biological, and cultural environments.

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# APPENDIX A

## NOAA Environmental Compliance Questionnaire

The purpose of this questionnaire is to assist National Ocean Service (NOS) and U.S. IOOS® in conducting an environmental review of proposed projects carried out by an external entity under grants or cooperative agreements to determine the appropriate analysis per NEPA and the applicability and requirements of the Marine Mammal Protection Act (MMPA), Endangered Species Act (ESA), Magnuson-Stevens Act (MSFCMA), and National Marine Sanctuaries Act (NMSA). This information will not be used in place of coordination or consultation discussions.

**National Marine Sanctuaries Act (NMSA)**

Office of National Marine Sanctuaries conducts consultations with federal agencies taking actions which are likely to destroy, cause the loss of or injure sanctuary resources and provides permits to individuals or agencies wishing to conduct activities that would otherwise be prohibited within sanctuary waters.

1. After examining protected area boundaries within the National Marine Sanctuaries layer of the National Ocean Service Multipurpose Marine Cadastre, please indicate whether your activity occurs in or near National Marine Sanctuary waters. If no, please skip to Question 6 under the Endangered Species Act section. If yes, which sanctuary? (Check all that apply).

    - Gray's Reef
    - Florida Keys
    - Flower Garden Banks Stellwagen Bank Monitor
    - Thunder Bay
    - Channel Islands
    - Cordell Bank
    - Monterey Bay
    - Greater Farallones
    - Olympic Coast
    - Hawaiian Islands Humpback Whale
    - Fagatele Bay
    - Papahānaumokuākea Marine National Monument

2. If your activities do occur within Sanctuaries waters, you may require a permit. While each sanctuary has its own unique set of regulations (see below), there are some regulatory prohibitions that are typical for many sanctuaries (i.e. discharging material, disturbing or

altering the seabed, disturbing cultural resources, and exploring for, developing, or producing oil and gas). Click below to assess whether your actions require a permit.

If yes, please go to the National Marine Sanctuary Permits website for a permit application, instructions on how to apply, and sanctuary permit contact information. Your activity may also require sanctuary consultation, which will be integrated with the permitting procedures, if applicable. If no, please proceed to Question 6.

- Gray's Reef
- Florida Keys
- Flower Garden Banks
- Stellwagen Bank
- Monitor
- Thunder Bay
- Channel Islands
- Cordell Bank
- Monterey Bay
- Greater Farallones
- Olympic Coast
- Hawaiian Islands Humpback Whale
- Fagatele Bay
- Papahānaumokuākea Marine National Monument

3. Please visit the Sanctuary Consultations website to determine whether your activity also requires consultation with the NOAA Office of National Marine Sanctuaries?

   Is your activity *likely to injure* any sanctuary resources or *may it affect* the resources of Stellwagen Bank? If no, please proceed to Question 4. If yes, for which Sanctuary do you require consultation? (Check all that apply)

   - Gray's Reef
   - Florida Keys
   - Flower Garden Banks
   - Stellwagen Bank
   - Monitor
   - Thunder Bay

- Channel Islands
- Cordell Bank Monterey Bay
- Greater Farallones
- Olympic Coast
- Hawaiian Islands Humpback Whale
- Fagatele Bay

4. Are your proposed activities conducted for the purpose of research or education? If no, please skip to Question 5. If yes, please provide project details below.

   Approximately how many samples will be taken?

   What are your sampling methods?

   During what season (or life cycle, if applicable) does your activity occur?

   Will you be introducing non-native organisms or experimental populations?

   Approximately how much area of habitat/substrate will be disturbed (sq. ft.)?

   How many participants are involved?

   What mitigative precautions do you plan to implement?

5. Are you requesting a permit for any of these special circumstances? If yes, specify which activity in which sanctuary.

   - Aircraft overflight
   - Channel Islands
   - Monterey Bay
   - Gulf of the Farallones
   - Olympic Coast
   - Baitfishing (FL Keys)
   - Pyrotechnics or fireworks (Monterey Bay)
   - Artificial reefs (all sanctuaries)
   - Cultural heritage resource use (FL Keys)

**Endangered Species Act (ESA)**

Federal agencies are required to consult with the NOAA Fisheries Office of Protected Resources and/or the USFWS (depending on the species) when an action they authorize, fund, or carry out "may affect" an endangered or threatened species or critical habitat. If a federal agency plans to capture or conduct studies directly on listed species, they must obtain a permit.

6. Are marine species listed under the ESA or their critical habitat present in the action area for your proposed activity? Please note that the action area refers to all areas affected directly or indirectly by the proposed activities and not merely the immediate surrounding area. Find regulations and FAQs on our website. Please visit the NOAA Fisheries Office of Protected Resources Critical Habitat page for habitat maps. If no, please skip to the MSFCMA section. If yes, contact the Office of Protected Resources to initiate consultation.

7. If your activities co-occur with species or their habitat, consult with the NOAA Fisheries Office of Protected Resources to determine whether your activity is *likely to adversely affect* protected resources.

After reviewing your documentation, if NOAA Fisheries determines that your activities are *not likely to adversely affect* protected resources, informal consultation will be considered complete.

After reviewing your documentation, if NOAA Fisheries does not determine that your actions are *not likely to adversely affect* protected resources, formal consultation is required and can be initiated at this time.

8. If NOAA Fisheries determines that your activity requires consultation because it may disturb, disrupt, change, or cause the loss of ESA-listed species or areas designated as critical habitat, please provide the additional information below for an accurate assessment of the impacts of your actions on species and habitat.

   Which species are affected?

   Are you transiting through the area?

   Are you placing gear in the water?

   Are you constructing infrastructure impacting the seafloor?

   Are you installing buoys or ocean observing systems?

Are you conducting habitat restoration activities?

How large of an area will be impacted (kms)?

How many discrete locations?

Other

9. Are your proposed activities conducted for the purpose of education, enhancement, or directed research on ESA-listed species or their critical habitat? If no, please proceed to Question 10. If yes, please provide project details below.

   Approximately how many samples will be taken?

   What are your sampling methods?

   During what season (or life cycle, if applicable) does your activity occur?

   Will you be introducing non-native organisms or experimental populations?

   Approximately what area of habitat/substrate will be disturbed (sq. ft.)?

   How many participants are involved?

   What mitigative precautions do you plan to implement?

**Magnuson-Stevens Act Essential Fish Habitat (MSFCMA EFH)**

NOAA Fisheries Office of Habitat Conservation regularly conducts consultations under the Magnuson Stevens Act for activities that have the potential to cause direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of Essential Fish Habitat (EFH).

10. Please take a moment to familiarize yourself with the NOAA Fisheries Essential Fish Habitat mapper and data inventory. The mapper does not contain spatial information for all EFH habitats. Therefore, after viewing the mapper, it is important to also contact the appropriate NOAA Fisheries Regional EFH Coordinator for more information on EFH identifications, descriptions, and locations in your region. After reviewing these resources, please indicate whether your action could reduce the quantity or quality of EFH. If no, skip to the MMPA section. If yes, please provide details below.

11. Does your activity propose to impact benthic (seafloor, estuary, or river bed) habitat through direct marine construction or indirect physical disturbance, or propose to impact the water column through chemical or biological disturbance? Examples are listed below. Please check all that apply to your activity.

Anchoring

Pile-driving

Buoy mooring and anchoring

Impounding Explosive demolition Dredging

Water diversions

Enhanced sedimentations

Sample collections

Using nets along the bottom

Resource damage assessments

Habitat restoration

Rig construction and drilling

Pier or dock construction or repair

Seawall construction or repair

Installation of a permanent structure on the bottom

Excavation

Mining

Hazardous material use

Discharging ballast or treated waste water

Power plant effluent discharge

Upstream nutrient or pesticide use

Introduction of non-native species

Altering water temperature or flow

Conducting work at a time that disrupts the ability of the water column to provide nursery grounds and feeding habitat

12. If you checked at least one of the activities listed in Question 11, consultation may be required.

To facilitate consultation with NOAA Fisheries, please speak with your NOAA Fisheries Regional EFH Coordinator, explore the regulations, and provide details that are as specific as possible about your planned activity, including a description of the activity, including the following required details.

Location(s) of activity

Approximate area affected

Duration of activity

Degree of alteration

Amount of seafloor, estuary or river affected

Amount discharged (volume and concentration), if any

Toxicity of the treated waters or chemicals, if any

Upstream pesticides or nutrients are already in the water column, if any

Potential adverse effects of the action on EFH and the managed species

Proposed mitigation, if applicable

**Marine Mammal Protection Act (MMPA)**

These questions are designed to help the action agency or Principal Investigator understand whether the action may potentially result in the incidental and unintentional behavioral harassment, injury, or mortality of marine mammals. Intentional interaction (e.g., directed scientific research) with marine mammals will require permitting under section 104 of the MMPA (e.g., scientific research permit).

Take of marine mammals is prohibited unless an exception applies, such as when NMFS has issued a permit for incidental or directed take. Activities that incidentally may affect marine mammals include pile-driving, seismic surveys, icebreaking, rocket launches, drilling, explosive detonations, sonar, and other marine or shoreline activities.

Additional basic information that may be required for assessment of potential action impacts includes:

(1) what, specifically, does the action involve; (2) where does the action occur; (3) what time of year does the action occur; and (4) how frequently and for what duration does the action occur. The action proponent should describe any current mitigation measures that may reduce the impact of the action on marine mammals, regardless of whether they are designed for that purpose or not. For example, certain research protocols are not designed for mitigation purposes but have that effect (e.g., limited trawl times).

13. Are your proposed activities likely to cause injury to or modify the behavior of any marine mammals that live in or near your action area? If no, please skip to Question 14. If yes, you may require a permit from NOAA Fisheries Office of Protected Resources. Find MMPA permitting FAQs and regulations on our website. Please consider mitigation and avoidance measures in consultation with our permitting office.

If yes, list all species that may be affected and provide project details in the following Questions.

14. Does the action involve the use of active acoustic sound sources (e.g., sonar, echosounder, seismic, explosives, drilling)? If no, please skip to Question 15. If yes, please name the sound source and provide details below.

    Sound level

    Sound frequency

    Sound duration

    Sound directionality

    Sound duty cycle

15. Does the action have any component of in-water marine construction? If no, please skip to Question 16. If yes, name the activity and check all that apply.

    Explosive demolition

    Pile-driving

    Rig construction and drilling

Pier or dock construction or repair

Seawall construction or repair

Installation of a permanent structure on the bottom

16. Does your activity include aircraft operations (e.g. fixed-wing, helicopter, rocket launch)? If yes, name the craft type and provide details below.

Aircraft type

Flight purpose

Altitude

Flight duration

Sound level, output, and duration if flown below 1,000 ft

17. Does the proposed action involve deployment of gear into or on the water that has the potential to entangle a marine mammal (e.g., nets, longlines, research equipment)? If yes, name the gear type and provide details below.

What is the location or region where the action will take place?

What is the length and depth of the gear?

How long is the gear deployed?

How many discrete tows will be made?

How often is the gear tended and what is your observer coverage?

Please describe any other precautionary bycatch avoidance measures employed.

18. Does the action have the potential to result in the disturbance of pinnipeds on land or ice, either through physical presence or airborne sound? If yes, please check all that apply and provide details below.

When does your activity occur?

What is the duration of human presence?

Does the activity occur in or near rookeries or haul-outs?

Does activity occur during mating or pupping seasons?

Does activity occur in or near rookeries?

What mitigative precautions do you plan to implement?

## National Environmental Policy Act (NEPA)

NEPA requires Federal agencies to consider the environmental effects of any activity which may be fully or partially funded, regulated, conducted, or approved by a Federal agency. During the decision-making process, NOAA must analyze and document the potential direct, indirect, and cumulative effects that their proposed action would have on the human environment. NEPA applies to NOAA actions that occur within the United States and its waters as well as those actions in which NOAA is involved that occur outside the United States, or those that may affect resources not subject to the management authority of the United States (NOAA Administrative Order [NAO] 216-6 § 7.01).

19. Do any of the following descriptions apply to the proposed action?
    a. A project or programmatic action that may significantly affect the quality of the human environment.
    b. An action required by law to be subject to an EIS.
    c. A research project, activity, or program that:
        i. Is conducted in the natural environment on a scale at which substantial air masses are manipulated, substantial amounts of mineral resources are disturbed, substantial volumes of water are moved, or substantial amounts of wildlife habitats are disturbed
        ii. Would have a significant impact on the quality of the human environment either directly or indirectly
        iii. Is intended to form a major basis for development of future projects that would be considered major actions significantly affecting the environment; or
        iv. Involve the use of highly toxic agents, pathogens, or non-native species in open systems.
    d. A Federal plan, study, or report prepared by NOAA that could determine the nature of future major actions to be undertaken by NOAA or other Federal agencies that would significantly affect the quality of the human environment.

e. The development of a new Fisheries Management Plan (FMP) for a previously unregulated species (**Note: this applies only to fishery management actions**).
f. An FMP amendment and regulatory action when the regional Fishery Management Council or NOAA Fisheries determines that significant beneficial or adverse impacts are reasonably expected to occur (**Note: this applies only to fishery management actions**).

If any of the preceding descriptions apply to the proposed action, NOAA will be required to prepare an EIS. See Chapter 5 of the NOAA NEPA Handbook for details on the EIS process.

If none of the conditions in the preceding list apply to your action, proceed to Question 21.

20. Do any of the following conditions apply to the proposed action?
    a. Actions that involve a geographic area with unique characteristics such as historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
    b. Actions that are the subject of controversy based on potential environmental consequences.
    c. Actions that have uncertain environmental impacts or unique or unknown risks.
    d. Actions that establish a precedent or decision in principle about future proposals.
    e. Actions that may result in cumulatively significant impacts.
    f. Actions that may have any adverse effects upon endangered or threatened species or their habitats (Note that this would not normally include issuance of Low Effect Incidental Take Permits under Section 10 of the Endangered Species Act).

If any of the preceding conditions apply to the proposed action, NOAA will be required to prepare an EA or an EIS, depending on the level of impacts expected from the proposed action. See Chapters 4 and 5 of the NOAA NEPA Handbook for details on the EA and EIS process, respectively.

If none of the conditions in the preceding list apply to your action, then a CE may apply. See Chapter 3 of the NOAA NEPA Handbook for details on the CE process. NAO 216-6 Section 6.03 includes a full list of action categories that may qualify for a CE.

If your proposed action does not fall within any of the categories listed in Section 6.03, then a CE may not be used. NOAA will be required to prepare an EA or an EIS, depending on the level of impacts expected from the proposed action. See Chapters 4 and 5 of the NOAA NEPA Handbook for details on the EA and EIS process, respectively. Please contact your Line (or Staff) Office NEPA Coordinator or NEPA Point of Contact with any questions.

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# APPENDIX B

## University of Hawaii at Mānoa Approved Institutional Animal Care and Use Committee Protocol for Tagging Sharks and Finfish

University of Hawaii at Mānoa approved Institutional Animal Care and Use Committee (IACUC) protocol for tagging sharks and finfish includes protocols for target species capture and restraint, transmitter implantation, tag attachment, and resuscitation and release. Principal investigators at the University of Hawaii at Mānoa plan to tag up to 100 individuals of non-protected species per year with acoustic and satellite transmitters and identification tags, to include hammerhead shark, yellowfin tuna, sand bar shark, Galapagos shark, tiger shark, and other fishes.

*Capture and Restraint*. The University of Hawaii at Mānoa research team will capture target species by trolling (towing an artificial lure), handlining (using a single baited hook) and using a baited, 10 hook shark line (for large sharks). The research team will bring captured sharks and large fishes alongside the vessel, place a braided, soft nylon rope around the caudal peduncle (point of attachment of the tail to the body) and secure rope and hook leader to the vessel. In this position, animals can be manipulated into an inverted position (ventral side upward) which induces tonic immobility (catalepsy). Team members will place smaller specimens in a padded V-shaped cradle, invert them to induce catalepsy, cover their eyes with a smooth wet cloth (to prevent abrasion and to keep them calm) and place a hose with running seawater in the mouth to provide oxygen to the gills. When in catalepsy, sharks and fishes remain completely limp and docile and show no outward indication of distress. This technique has been widely used to manipulate a wide variety of sharks and fishes both in captivity and in the wild for the purposes of measurement, medication and minor surgery (Gruber & Zlotkin 1982, Henningsen 1994, Holland et al. 1999). The research team has repeatedly and successfully used this technique in the preceding phases of this research (e.g., Holland et al. 1999, Protocol No. 97-066-4).

*Transmitter Implantation*. The research team will implant coded acoustic transmitters (V16, 9 mm diameter, 90 mm long, Vemco, Halifax, Nova Scotia) into the body cavities of each animal through a 3 centimeter incision in the abdominal wall (e.g., Holland et al. 1999, Meyer & Honebrink 2005). The incision will be closed using interrupted nylon sutures. The transmitters will be coated in a combination of bee and paraffin wax to smooth the contours of the transmitter and reduce the chance of the transmitter being rejected by the animal (e.g., Holland et al. 1999, Meyer & Honebrink 2005). Previous studies have shown that sharks and fishes retain these transmitters for at least 3.5 years and 1.5 years respectively (Lowe et al. in press, Meyer & Honebrink 2005).

*Attachment of Satellite Tags*. Two types of satellite transmitters, (1) Fin mounted fixed transmitters (SPOT tags, 41 mm x 30 mm x 17 mm, weight 32 g, Wildlife Computers, Seattle) and (2) Pop-up archiving tags (PAT tags, length 180 mm, positively buoyant in water, Wildlife Computers, Seattle), will be externally attached to sharks. SPOT tags transmit the shark's location to the Argos satellite array whenever the dorsal fin breaks the surface of the water. PAT tags collect and store temperature, depth and light intensity data as the shark swims, and then detach from the animal on a preprogrammed date and time. The released PAT tags float to the surface where they transmit archived data to the Argos satellite array. SPOT tags will be attached by using a template to make four small (3 mm diameter) holes near the tip of the shark's dorsal fin, pushing short, threaded rods extending from the transmitter through these holes, and then securing the device on the opposite side of the fin with washers and bolts. PAT tags will be attached using small titanium-steel darts that are inserted under the shark's skin at the base of the dorsal fin and locked in place through the dorsal ceratotrichia.

*Attachment of External Identification Tags*. Following transmitter implantation, the research team will tag all transmitter-equipped sharks and fishes with externally-visible identification 'dart' tags (Hallprint, Australia). The barbs of these nylon ID dart tags are inserted at the base of the dorsal fin using a large gauge tagging needle, and held in place by the bony (fishes) or cartilaginous (sharks) 'spines' that hold the dorsal fin erect (e.g., Holland et al. 1999, Meyer & Honebrink 2005). This is the most common ID tagging method used in field studies of sharks and fishes.

*Resuscitation and Release*. Following surgery and tagging, the research team will remove the hook and tail rope, and revive sharks and fishes by towing them slowly through the water before release. Sharks and fishes recover rapidly from tonic immobility and the entire handling process can be completed in less than 10 minutes.

References:

Gruber S.H. and E. Zlotkin. (1982). Bioassy of surfactants as shark repellents. Nav. Res. Rev. 2:18-27.

Henningsen, A.D. (1994). Tonic immobility in 12 elasmobranchs: Use as an aid in captive husbandry. Zoo Biology 13:325-32.

Holland, K.N., B.M. Wetherbee, C.G. Lowe and C.G. Meyer. (1999). Movements of tiger sharks (Galeocerdo cuvier) in coastal Hawaiian waters. Mar. Biol. 134: 665-673.

Lowe CG, Wetherbee BM and CG Meyer. In Press. Using acoustic telemetry monitoring techniques to quantify movement patterns and site fidelity of sharks and giant trevally around French Frigate Shoals and Midway Atoll. Atoll Research Bulletin.

Meyer, CG & R Honebrink (2005). Retention of surgically implanted transmitters by Bluefin trevally (Caranx melampygus). Implications for long-term movement studies. Transactions of the American Fisheries Society 134 (3): 602-606.

# APPENDIX C

## Regional Assets by Type and Region for Each Alternative

U.S. IOOS Regional Assets by Type and Region under No Action and Full Build-out Alternatives

| Region | AOOS | | | CaRA | | | CeNCOOS | | | GCOOS | | | GLOS | | | MARACOOS | | | NANOOS | | | NERACOOS | | | PacIOOS | | | SCCOOS | | | SECOORA | | | TOTALS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area (square | 339,040 | | | 8,750 | | | 51,400 | | | 342,820 | | | 94,000 | | | 113,320 | | | 66,550 | | | 91,950 | | | 30,000 | | | 17,140 | | | 203,460 | | | | | |
| Alternatives | No Action | Full Build-out | Δ | No Action | Full Build-out | Δ | No Action | Full Build-out | Δ | No Action | Full Build-out | Δ | No Action | Full Build-out | Δ | No Action | Full Build-out | Δ | No Action | Full Build-out | Δ | No Action | Full Build-out | Δ | No Action | Full Build-out | Δ | No Action | Full Build-out | Δ | No Action | Full Build-out | Δ | Total No Action | Total Full Build-out | Δ |
| Fixed Shore Station/Water Quality Systems | 3 | 15 | 12 | 0 | 4 | 4 | 9 | 20 | 11 | 105 | 200 | 95 | 1 | 30 | 29 | 21 | 30 | 9 | 27 | 90 | 63 | 0 | 30 | 30 | 12 | 103 | 91 | 19 | 39 | 20 | 37 | 124 | 87 | 234 | 685 | 451 |
| Met Data Collection Station on Fixed Platforms | 65 | 65 | 0 | 23 | 25 | 2 | 6 | 9 | 3 | 8 | 8 | 0 | 3 | 15 | 12 | 4 | 20 | 16 | 0 | 36 | 36 | 0 | 15 | 15 | 0 | 36 | 36 | 0 | 40 | 40 | 2 | 36 | 34 | 111 | 305 | 194 |
| Fixed Seafloor or Bottom-Mounted Station | 18 | 18 | 0 | 0 | 2 | 2 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 220 | 220 | 0 | 0 | 0 | 0 | 10 | 10 | 23 | 258 | 235 |
| Single-Purpose and Multi-Purpose Moorings/Buoys | 1 | 37 | 36 | 4 | 11 | 7 | 8 | 16 | 8 | 44 | 80 | 36 | 16 | 16 | 0 | 1 | 32 | 31 | 17 | 38 | 21 | 28 | 47 | 19 | 13 | 27 | 14 | 0 | 25 | 25 | 10 | 89 | 79 | 142 | 418 | 276 |
| Cabled Coastal Ocean Observatory | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 | 5 |
| Video camera | 95 | 95 | 0 | 0 | 0 | 0 | 10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 105 | 105 | 0 |
| Buoy - Drifter | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 50 | 0 | 0 | 0 | 0 | 150 | 150 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 150 | 150 | 4 | 354 | 350 |
| Glider | 0 | 10 | 10 | 0 | 2 | 2 | 2 | 9 | 7 | 2 | 27 | 25 | 0 | 5 | 5 | 9 | 50 | 41 | 2 | 8 | 6 | 0 | 10 | 10 | 6 | 8 | 2 | 11 | 12 | 1 | 1 | 34 | 33 | 33 | 175 | 142 |
| Vessel Transect | 0 | 7 | 7 | 0 | 1 | 1 | 0 | 6 | 6 | 0 | 0 | 0 | 0 | 7 | 7 | 0 | 35 | 35 | 0 | 7 | 7 | 0 | 15 | 15 | 0 | 0 | 0 | 9 | 9 | 0 | 0 | 22 | 22 | 9 | 109 | 100 |
| AUV | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 15 | 15 | 0 | 15 | 15 | 0 | 0 | 0 | 0 | 2 | 2 | 0 | 2 | 2 | 0 | 2 | 2 | 0 | 4 | 4 | 0 | 43 | 43 |
| HF Radar | 3 | 22 | 19 | 2 | 29 | 27 | 29 | 50 | 21 | 3 | 33 | 30 | 0 | 0 | 0 | 33 | 52 | 19 | 11 | 31 | 20 | 9 | 25 | 16 | 4 | 28 | 24 | 34 | 42 | 8 | 14 | 39 | 25 | 142 | 351 | 209 |
| TOTAL | 189 | 273 | 84 | 29 | 75 | 46 | 64 | 125 | 61 | 162 | 348 | 186 | 20 | 93 | 73 | 68 | 284 | 216 | 62 | 215 | 153 | 37 | 294 | 257 | 36 | 425 | 389 | 73 | 169 | 96 | 64 | 508 | 444 | 804 | 2809 | 2005 |

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# APPENDIX D

## Buoys, Moorings, Arrays and Sondes

U.S. IOOS® Regions will employ a variety of coastal, Great Lakes and estuary buoys, buoy arrays, and water quality stations.  While a majority of the instruments will be deployed in state waters, some of the coastal buoys extend into Federal waters out to about 40 nautical miles.  Below are representative buoys, moorings, buoy arrays and stations that will be deployed.

**<u>Coastal Buoys and Moorings</u>**

The University of Maine, School of Marine Science, Physical Oceanography Group, has been developing and operating real-time ocean observing systems since 1997.  The University of Maine buoy is used by two U.S. IOOS® regions – Northeast Regional Association Coastal Ocean Observing System (NERACOOS) and Caribbean Coastal Ocean Observing System (CariCOOS).  This buoy is 2 meters in diameter.  The buoy is solar powered, and a large part of its payload requirements are related to the power system.  The system consists of two rechargeable 12 V dc power supplies with a 160 Ah capacity and trickle-charged by 4 ea. - 40 Watt solar panels.  The onboard batteries supply power to all the buoy electronics: these include the communication and positioning systems, a micro-processor, controller, digital and analog sensors, and navigational aids.  The power system is designed and packaged to fit inside a watertight well.

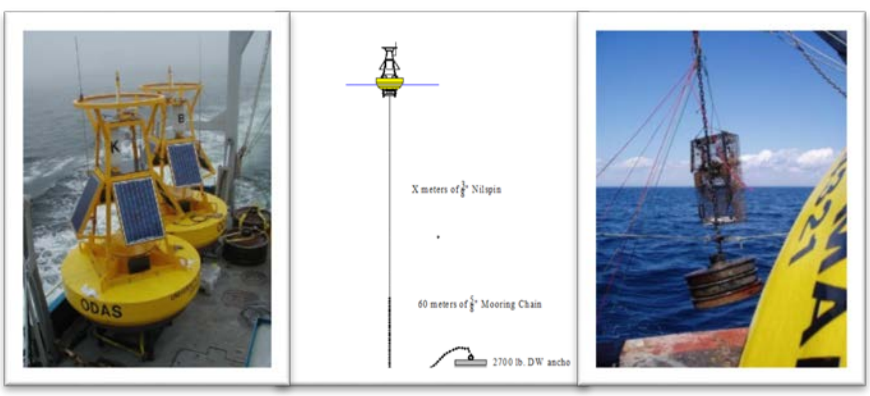


**Figure D-1:  University of Maine buoys, anchor, and schematic of mooring**

Based on ten years of experience deploying various types of moorings in the Gulf of Maine, operators concluded that a modified slack chain mooring is suitable for the near coastal gulf.  The use of minimal equipment and components reduces the man-hours needed for preparation, standardizes the design for the sites, and improves the mooring's survival of periodic entanglements with fishing gear and the rigorous environment.  This design also allows the reuse of mooring components because the entire mooring, including anchor and chain, is recovered for each turn-around operation.  The anchors for the Gulf of Maine and Caribbean buoy arrays are made from used locomotive wheels.  Three wheels are stacked and pinned on a spindle.  The top of the spindle includes a steel lifting hoop to which the anchor chain is attached. The anchor weighs approximately 2,800 lbs. air weight (about 2,380 lbs. under water).  The anchor is approximately 1 meter in diameter and 0.6 meters high.  The anchors are recovered when the buoys are recovered, and usually redeployed multiple times. After a few years the spindles are replaced. Some buoys are moored with elastic tethers and acoustic releases; their anchors remain on the bottom.

**Commercial Buoys and Moorings:** A number of U.S. IOOS® Regions use commercial buoys. A common buoy is the Guardian Series from Mooring Systems, Inc. The Guardian buoy is 2 meters in diameter and incorporates durable self-fendering hulls made of Surlyn foam. Surlyn foam is closed cell, extremely tough, and requires little maintenance. A galvanized steel frame and footed base provides a reliable construction that places the buoy system in compression while moored. A lightweight aluminum tower supports a host of instrumentation, solar panels, and navigation lights. The central well has a watertight compartment available for mounting batteries or electronics, and a removable topside end-cap allowing access while moored.

**Figure D-2: Guardian Series buoy from Mooring Systems, Inc.**

U.S. IOOS® Regions may employ either the commercial anchor/bottom mount available from Mooring Systems, Inc., or a custom anchor fashioned from locomotive wheels or other cast iron anchor. Mooring Systems, Inc., manufactures a trawl resistant bottom mount designed for protecting oceanographic instrumentation from trawler gear. The instrument platforms are suited for use with up-looking Doppler profilers, and provide sufficient space for extra battery housings, and other instrumentation. The bottom mount dimensions are 1.7 meters by 1.2 meters with a height of 0.5 meters.

**Figure D-3: Mooring Systems, Inc., Miniaturized Trawl Resistant Bottom Mount (MTRBM)**

U.S. IOOS® Regions also fashion custom anchors to suit bottom types found in their regions. Figure D-4 shows a representative example of a cast iron anchor. These anchors weigh between 1,300 lbs. air weight and 4,000 lbs. air weight. The anchor is approximately 0.8 meters in diameter and 0.3 meters high. Experience shows that these anchors do not drag. The moorings have a chain on the bottom that adds additional weight and absorbs the load.

**Figure D-4: University of Connecticut cast iron anchor**

CRIMP/$CO_2$ Buoys: U.S. IOOS® Regions collaborate with NOAA's Pacific Marine Environmental Marine Laboratory and NOAA's Ocean Acidification Program to deploy Coral Reef Instrumented Monitoring Platform (CRIMP) and $CO_2$ buoys. The buoy has a height of approximately 0.9 meters above the waterline and depth of approximately 1.16 meters below the waterline. The buoy is equipped with a flashing amber beacon with a flash sequence of on for 1 second and off for 3 seconds.

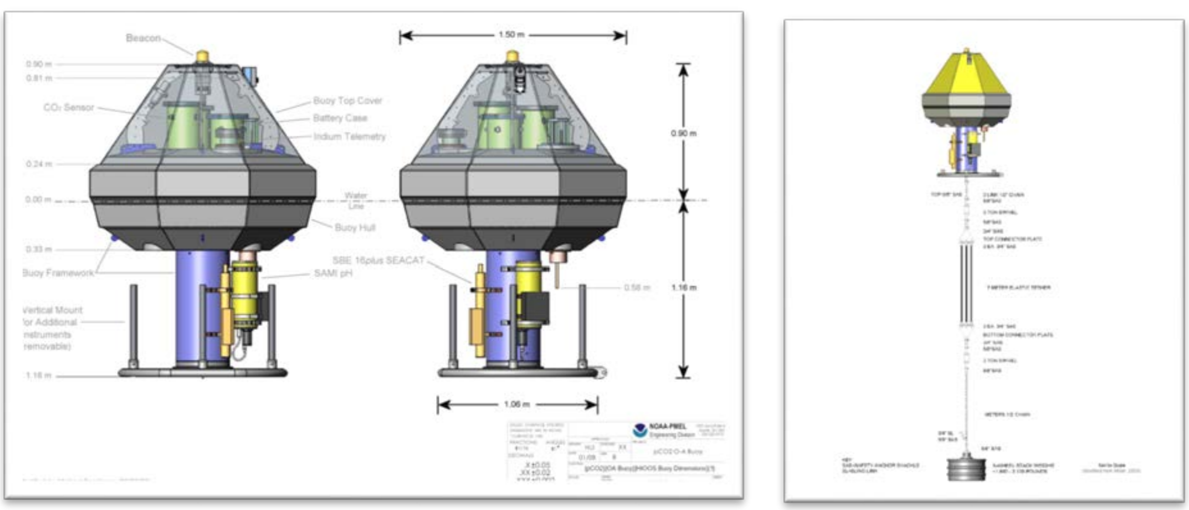


**Figure D-5: Schematic of CRIMP/$CO_2$ buoy and mooring designed by NOAA/PMEL**

<u>**Coastal Profiling Buoys and Buoy Arrays**</u>

U.S. IOOS® Regions will deploy profiling buoys and buoy arrays. The examples in figures D-6, D-7, D-8 and D-9 are representative of the types of systems that will be deployed. The Ocean Origo multipurpose moored profiling system is built by Ocean Origo, PLC. Ocean Origo develops, manufactures and sells equipment for oceanographic monitoring and surveillance in open ocean and coastal waters, fjords and lakes. The buoy is 2 meters in diameter. The profiling system is the SeaTramp™, which has a 1.7 km profiling range and moves along a guiding wire. The casing is a non-corrosive twin titanium pressure casing for long life, safe and smooth deck handling, extended serviceability and improved stability.

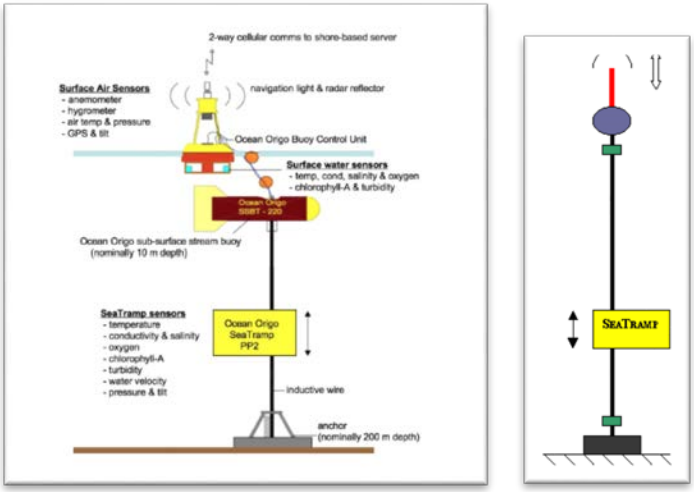


**Figure D-6: Schematic of Ocean Origo multipurpose moored profiling system**

U.S. IOOS® Regions will deploy a small number of arrays.  For example the Northwest Association of Networked Ocean Observing Systems (NANOOS) array deployed off La Push, WA, includes the Cha'ba surface buoy, the NEMO subsurface buoy, and the Seaglider.

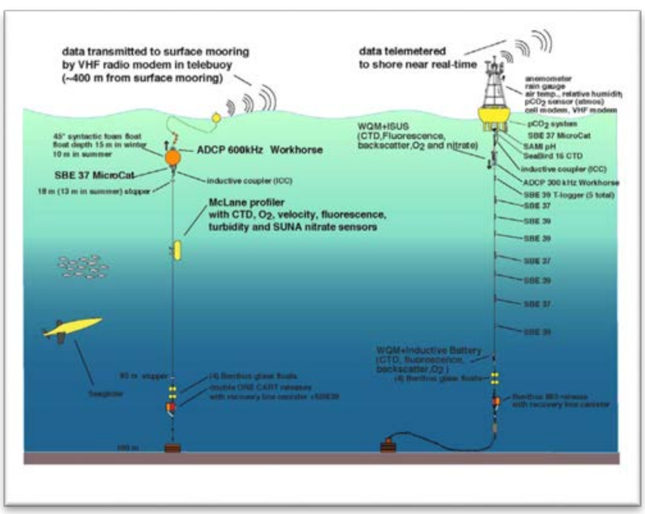


**Figure: D-7: Schematic of buoy array in the NANOOS Region**

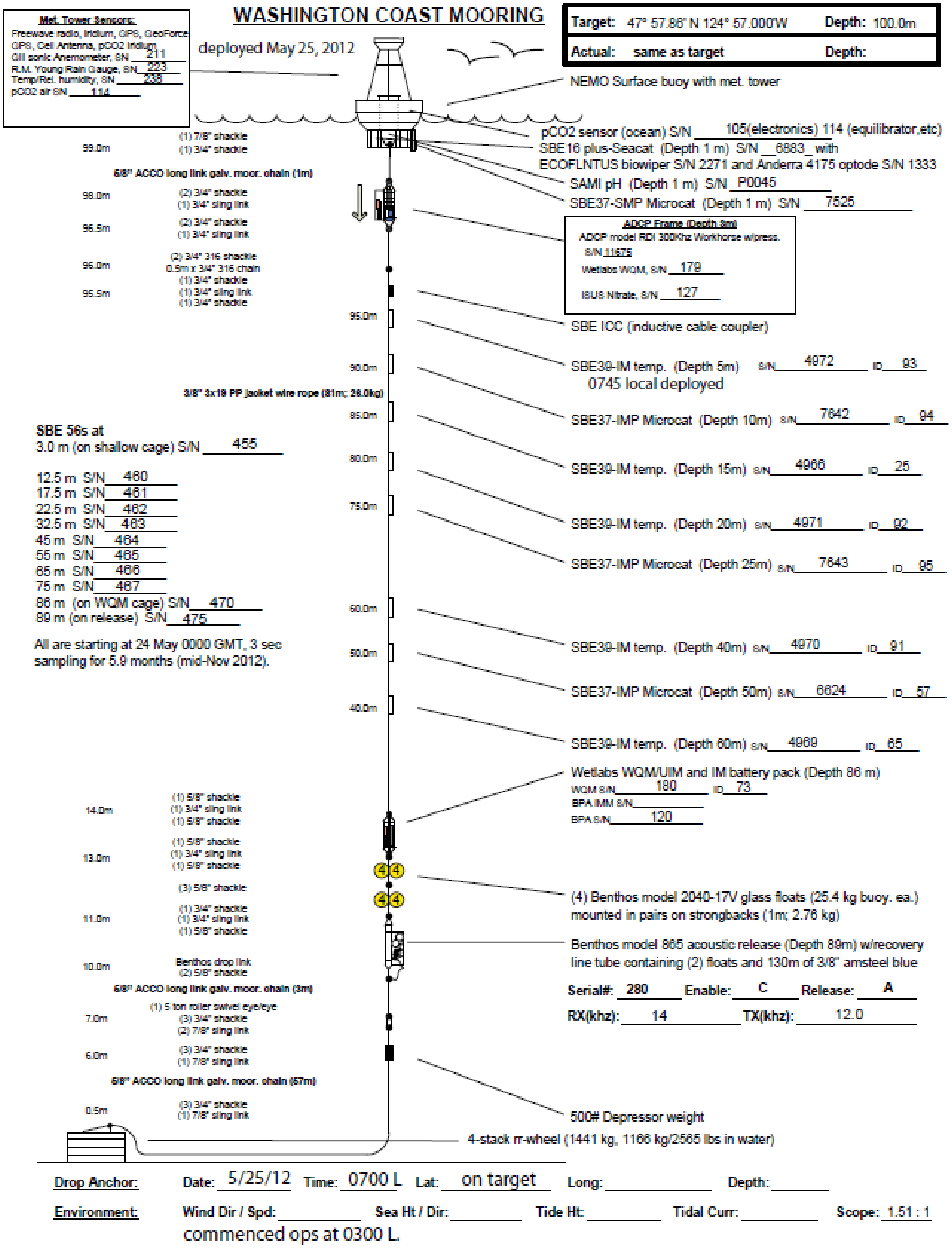


**Figure D-8: Schematic of mooring deployed off La Push, WA**

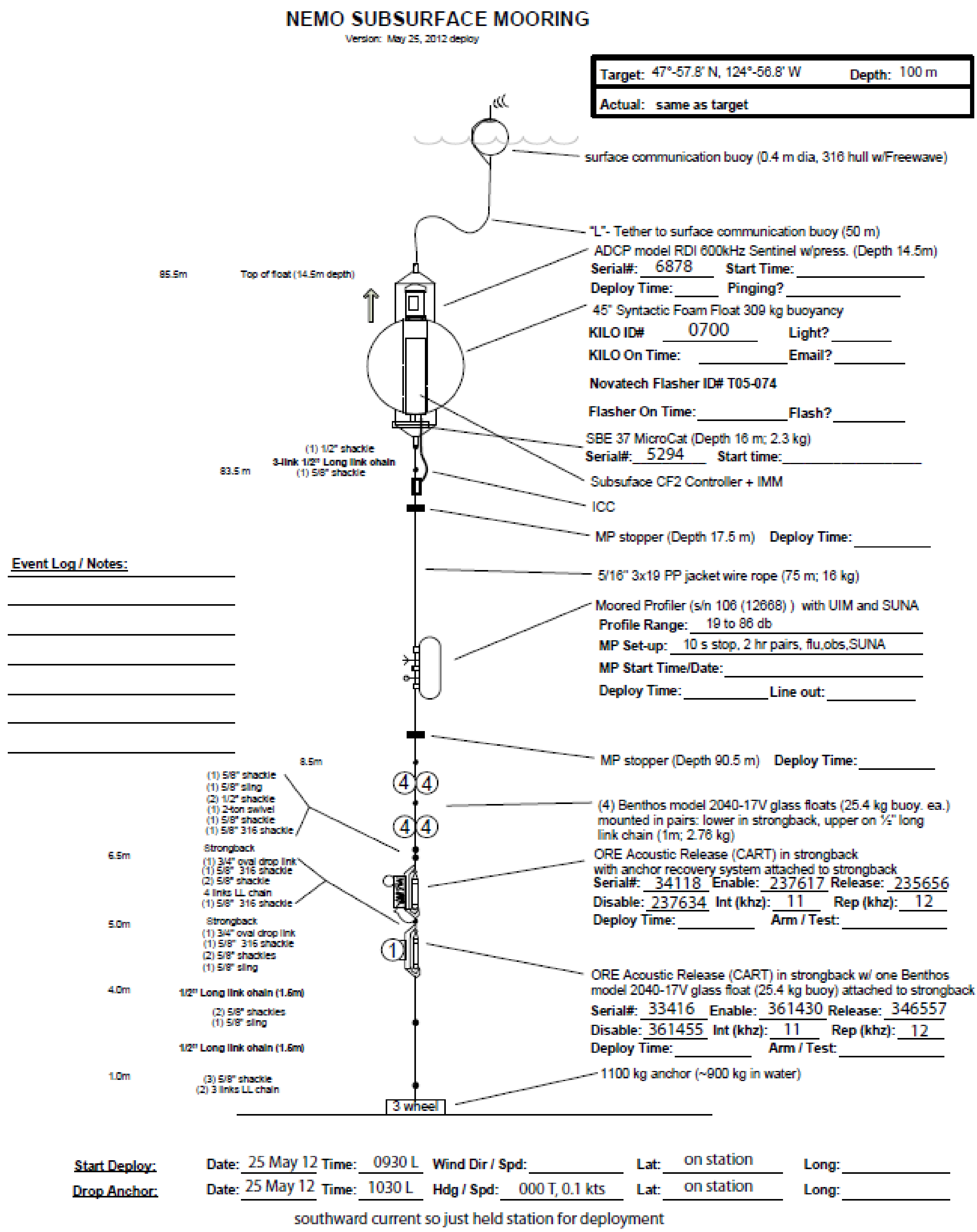


**Figure D-9: Schematic of NEMO subsurface mooring deployed off La Push, WA**

## Great Lakes Buoys and Moorings

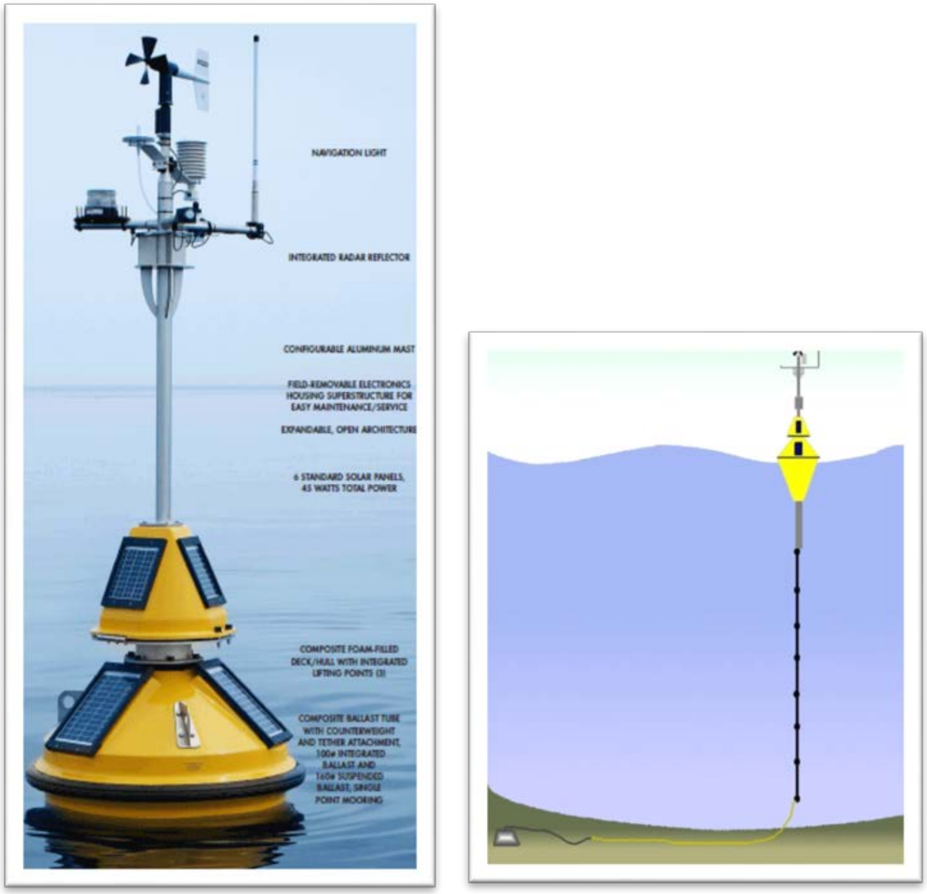


**Figure D-10: S2 Yachts – TIDAS 900 Buoy and schematic of a single point mooring**

TIDAS 900 Buoy: The Total Integrated Data Acquisition System (TIDAS) 900 Buoy is a marine research station developed for coastal freshwater and saltwater data monitoring. This buoy was developed and is sold by S2 Yachts. The 900 Buoy is a low cost-low maintenance, easy launch-easy retrieval monitoring system, designed as a “plug and play” platform, giving significant flexibility in measured parameters and making it possible to add other data sensors as desired. The TIDAS 900 Buoy is 1.12 meters in diameter, with a height of 3 meters above the waterline and depth of 1.97 meters below the waterline. The buoy weighs 350 lbs.

University of Wisconsin-Milwaukee Fondriest Buoy: The Fondriest - NexSens CB-500 coastal data buoy is designed for deployment in coastal waters, harbors, estuaries, and other freshwater or marine environments. The floating platform supports both topside and subsurface environmental monitoring sensors with options for spread spectrum radio, cellular, and satellite data transmission to shore. Temperature strings, multi-parameter sondes, Doppler current meters, weather stations, and other monitoring instruments can be deployed quickly. The buoy is constructed of an inner core of cross-linked polyethylene foam with a tough polymer skin. The mooring uses a two-point system and two anchors. Each anchor is each approximately 0.9 meters in diameter and 0.9 meters high.

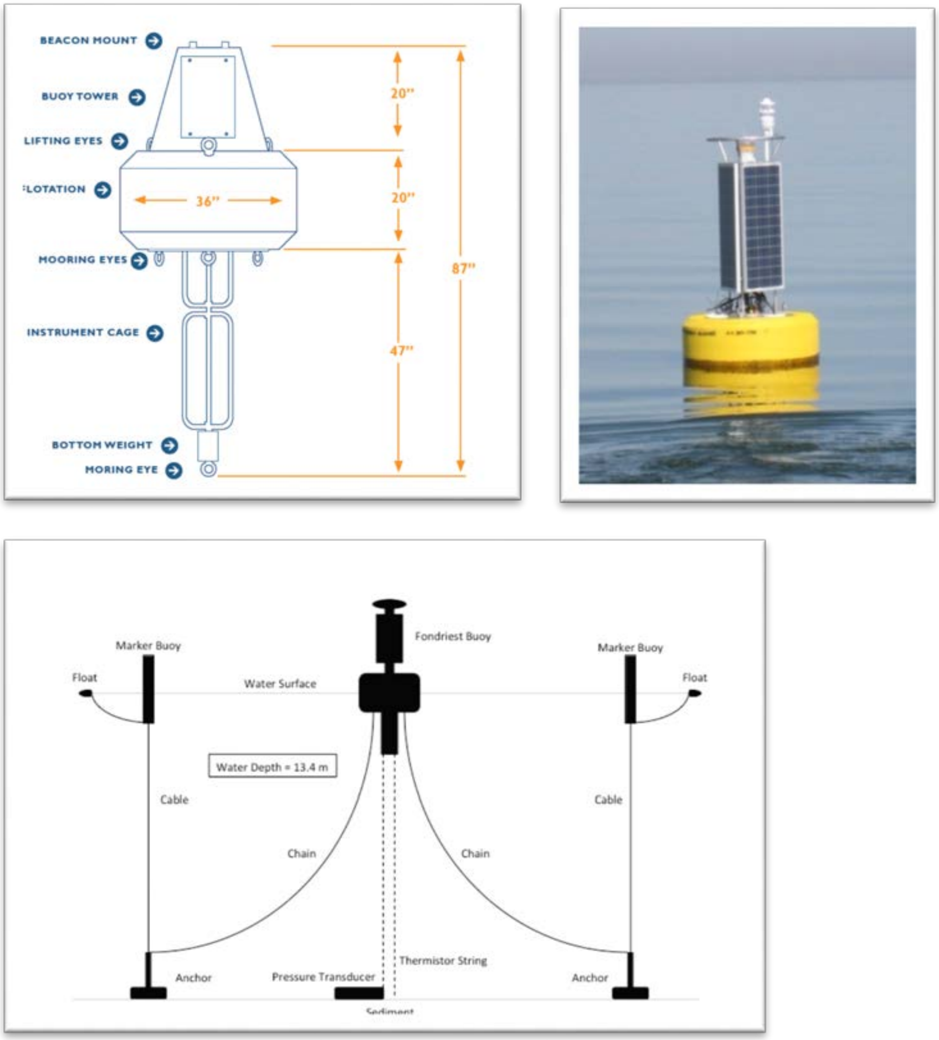


**Figure D-11: Schematics of Fondriest buoy and 2-point mooring**

## <u>Bay and Estuary Buoys</u>

Bay and estuary buoys are similar to coastal buoys but are often smaller, with a diameter closer to 1 meter vice 2 meters. They are placed only after habitat is considered, ensuring they do not interfere with eel or sea grasses. Often the buoys are placed in estuaries to monitor nutrient loads to protect those critical habitats. Figure D-12 shows an example of a buoy deployed in Puget Sound.

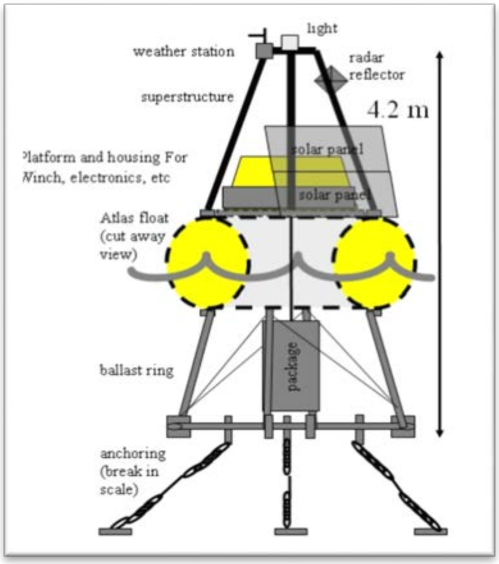


**Figure D-12: Schematic of buoy deployed in Puget Sound**

In addition to the University of Maine buoys noted above in the Coastal Buoys and Moorings subsection, the other buoy used by U.S. IOOS® Regions for wave measurements is the Datawell buoy.  The Datawell buoy is 0.9 meters in diameter and has a spherical hull.

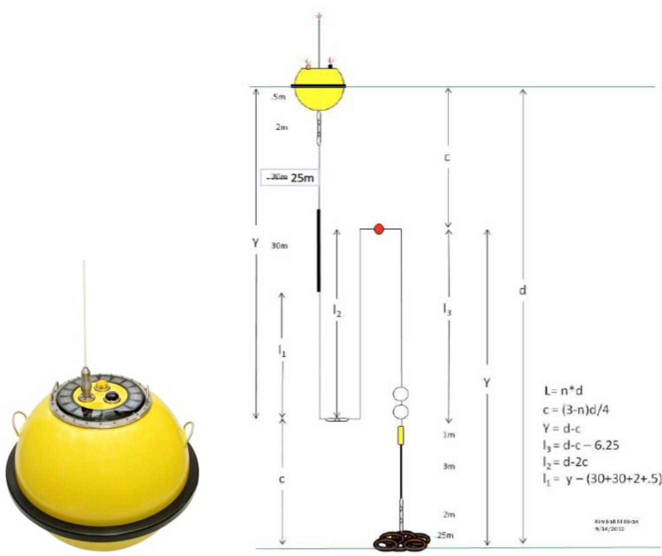


**Figure D-13: Datawell Mark III Wave Rider Buoy and schematic of mooring**

# Water Quality Stations

Water quality stations are either pier mounted, mounted on a structure within an estuary, or mounted on a buoy offshore. Common sondes used in these stations include the YSI 6000 and the Seabird Electronics (SBE) 16. The sondes are either pier mounted or structures are built to hold the sonde. Below is the schematic of the SBE 16 sonde and an example of a structure and pier mount. The water quality system is deployed on substrate or attached to the pilings in the water.

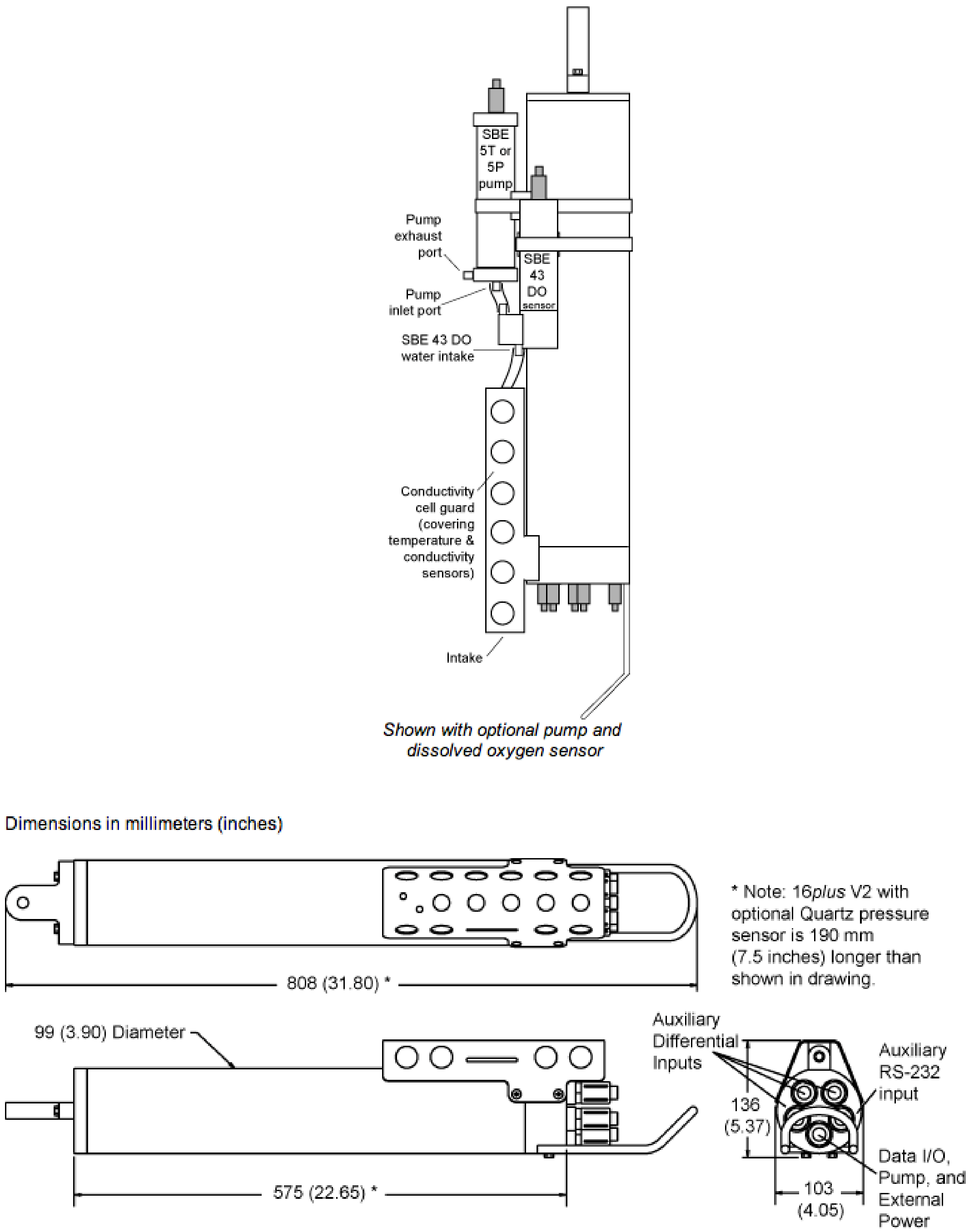


**Figure D-14: Schematic of SBE 16plus V2 water quality system**

**Figure D-15: National Estuarine Research Reserve (NERRS) water quality station**

*Image from San Luis Obispo Science and Ecosystem Alliance at the California Polytechnic Center for Coastal Marine Sciences (http://www.slosea.org/initiatives/wq/wqgallery.php). The station is located on a pier in Morrow Bay, CA (CeNCOOS Region).*

**Figure D-16: Water quality station in the Central and Northern California Ocean Observing System Region**

**Figure D-17: Florida Department of Natural Resources water quality station**

In the Central and Northern California Ocean Observing System (CeNCOOS) Region, the Bodega Marine Laboratory (BML) operates an oceanographic buoy on the 30 meter isobath, immediately offshore of the lab. Deployed in December 2009, the buoy provides data on currents at all depths, seawater temperature, salinity, chlorophyll fluorescence, light transmissivity, dissolved oxygen, $pCO_2$ and pH.

**Figure D-18: Water quality buoy and station deployed in CeNCOOS region**

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# APPENDIX E

## Description of High Frequency Radar Types, Placement, and Installation

### HF Radar

HF radar systems measure the speed and direction of ocean surface currents in near real time. Currents in the ocean are equivalent to winds in the atmosphere because they move things from one location to another. Currents carry nutrients as well as pollutants, so it is important to know the currents for ecological and economic reasons. Because currents carry any floating object, USCG search and rescue operators use HF radar data to make critical decisions when rescuing disabled vessels and people stranded in the water. HF radar can measure currents over a large region of the coastal ocean, from a few kilometers offshore up to 200 km, and can operate under any weather conditions. They are located near the water's edge, and need not be situated atop a high point of land. Traditionally, crews placed current measuring devices directly into the water to retrieve current speeds. While these direct measurement systems are still widely used as a standard reference, HF radars are the only sensors that can measure large areas at once with the detail required for the important applications described here. Not even satellites have this capability (NOAA 2011f). HF radar systems support a range of applications, including search and rescue, spill response, harmful algal bloom monitoring, pollution tracking, larval transport, and coastal water quality assessments. Data can also provide value in ecosystem assessment and fisheries management. U.S. IOOS® partners currently operate approximately 130 HF radars in 10 of the 11 U.S. IOOS® Regions. All but one of the HF radar sites in U.S. and Caribbean coastal zones are operated by U.S. IOOS® Regional Associations.


**Figure E-1: Snapshot map of U.S. IOOS® -operated radar locations (Does not illustrate maximum capability)**

There are two types of radars used by U.S. IOOS® Regional Associations; the CODAR SeaSonde – Direction Finding and the WERA and LERA – Phased Array

**CODAR SeaSonde**

Newer CODAR SeaSondes use a single-pole combined transmit and receive antenna while some older models and the lower frequency models (5 MHz) use separate transmit and receive antennas.  Of the ~130 radars in operation within U.S. IOOS® Regional Associations, more than 90% are of this design.  Each CODAR radar site will have, therefore, one or, at most, two antenna poles.  Total height, including supporting base, ranges from 6 to 8 meters for the combined or the separate antenna systems depending on transmit frequency.

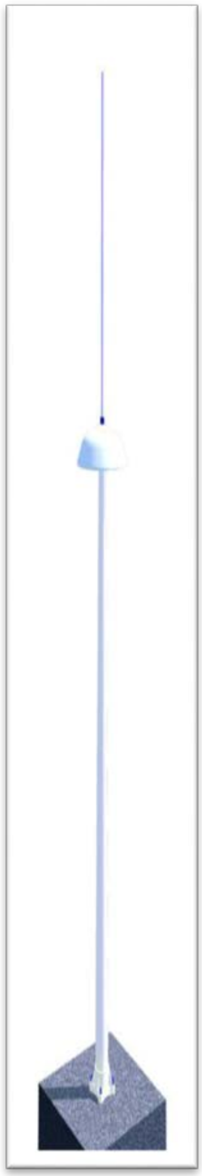


**Figure E-2: A CODAR SeaSonde Antenna**

*Installation*

Antennas can be secured by a base such as shown in Figure C-2, or tethered to the ground using wire or polyester rope.  Data transmission from the antennas to a base station is made via one transmit cable and 3 receive cables.  The typical cable run is between 30-100m.  Cables are typically laid on the ground.  In some locations, cables are run through a plastic conduit, and in some cases property owners require cables be buried.  For underground cable runs, installers dig a ditch using a ditch witch, at a depth of about 6 inches.

***Computer Requirements***

**Figure E-3: A CODAR Computer system.**

The computer is located in an existing nearby building where possible, or in a specialized CODAR enclosure.

The SeaSonde Enclosure 36 is a small, rugged closed-loop temperature-controlled enclosure for containing the SeaSonde remote unit electronics. The small enclosure is just large enough to fit the SeaSonde transmit and receive chassis, the mini-style computer with small monitor (or laptop style computer), a UPS device and other small pieces of electronics.  This enclosure is appropriate for both indoor and outdoor use.

**Figure E-4: SeaSonde Enclosure 36**

## WERA and LERA Phased Array Systems

WERA and LERA phased array systems differ from the CODAR SeaSonde systems in the number of antennas employed: there are typically four transmit antenna elements but between 8-16 receive antenna elements. These receive elements are typically arranged in a line along the shore with receive and transmit arrays being separated by tens of meters. The four elements of the transmit array are usually arranged in a rectangular pattern with each element being two to six meters in height depending on transmit frequency. The length of the receive antenna arrays depend on the transmit frequency and the number of elements but are on the order of 100 meters in length. Currently there are four radar systems in the Miami area, four along the Georgia/South Carolina coast, two on the west coast of Florida and four arrays on the island of Oahu in Hawaii.

### *Installation and Special Cases*

Cables are typically laid on the ground. In some sites cables are run through a plastic conduit, and in some cases property owners require cables be buried. For example, during a recent installation in Florida, the county required the cables to be buried as the HF radar is located on a public beach. In this case the ditch for the cable run was 1.5 feet deep and 10 inches wide. The county provided the equipment to dig the trench.

### *Aesthetics*

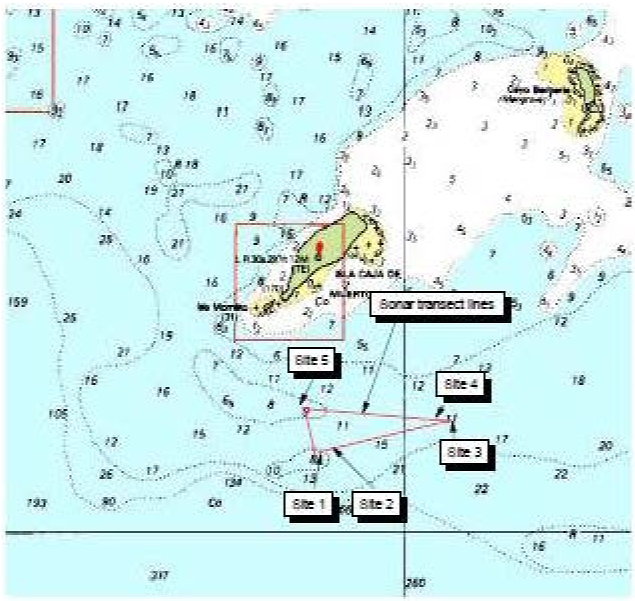
Often antennas must comply with local ordinances and aesthetic code. Installations have employed some creative approaches to meet local requirements. Examples include:

- The Lighthouse Historical Society provided approval for the installation of an HF radar antenna on the Block Island Light House.
- Operators disguised an antenna as a flag pole for an installation on a public beach in Florida.
- Antennas were installed within fence posts in Hawaii to disguise them on a local beach.

# APPENDIX F

## CarICOOS Data Buoy 1 Site Evaluation

J. Corredor and J. Morell
Caja de Muertos location
November 13, 2008




The CarICOOS Ocean Observing program calls for the emplacement of two coastal ocean data buoys on the shelf edge of the Puerto Rico/ Virgin Islands region. Five prospective sites for emplacement of CarICOOS Data Buoy 1 on the south coast of Puerto Rico were evaluated by SCUBA assisted phototransect. The five sites surveyed are located to the Southeast of the island of Caja de Muertos on the outer insular shelf edge of PR.

Locations and depths are noted in table below. Site descriptions follow. Photographs cover areas of approximately 2 x 3 m.

| SITE | Depth (m) | Latitude (degrees) | Latitude min | Longitude degrees | Longitude min | Comment |
|---|---|---|---|---|---|---|
| site 1 | 16 | 17 | 50.88 | 66 | 31.15 | Coral |
| site 2 | 19 | 17 | 50.94 | 66 | 31.06 | Sand & rubble |
| site 3 | 21 | 17 | 51.49 | 66 | 29.35 | Hard bottom community |
| site 4 | 27 | 17 | 51.49 | 66 | 29.400 | Sand & rubble |
| site 5 | 18 | 17 | 51.58 | 66 | 31.36 | Sand, rodoliths, macroalgae |

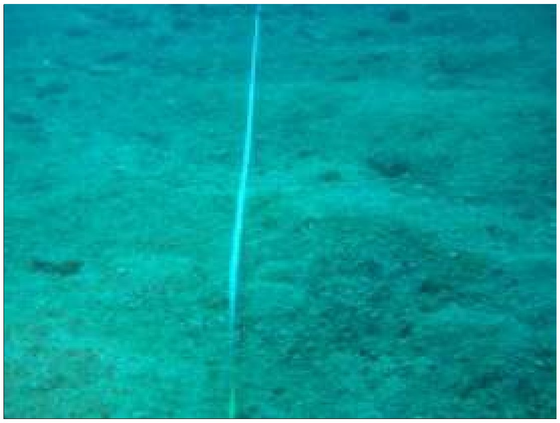
## Site 1. Corona

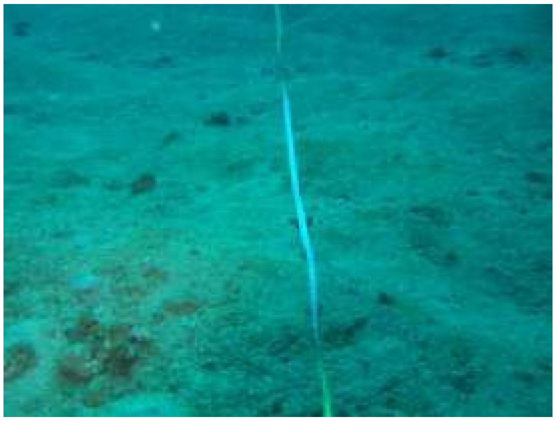
This site appears in charts as a bean shaped elevation rising in depth from 11 fathoms to a minimum reported 8.5 f. Minimum depth observed was 16 m. Extension is roughly 1 x 0.3 nautical miles. The hard bottom elevation is surrounded by sand and rubble. Rocky bottom communities consist mainly of hard and soft corals sponges and macroalgae.

Significant coral cover was observed in a narrow fringe along the northeastern border of the elevation. Hard coral species observed include *Montastrea cavernosa*, *M. annularis complex, Dendrogyra cylindrus, Meandrina meandrites*. Acroporids were not observed

## Site 2

Shallow depression (15 x 20m) with sand and rubble bottom (no macroorganisms observed) ca. 100m NE of Site 1 Corona. Bottom is for the most part barren of benthic macroinvertebrates. Depth observed was 19 m. Surrounding areas are sparsely populated with soft corals and sponges.



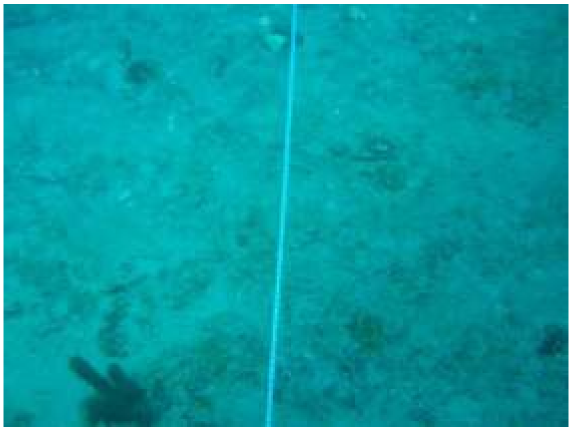


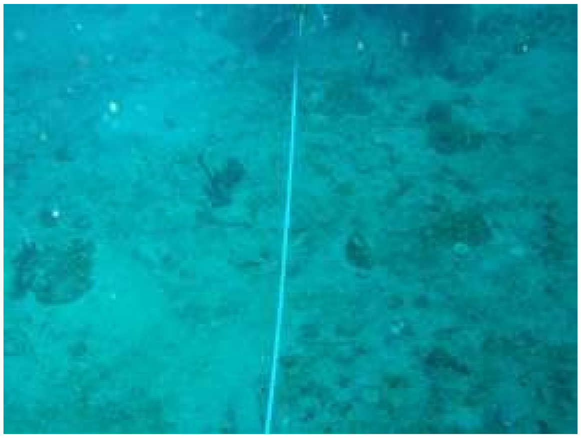
## Site 3 Seamount

This site is only marked on charts by a depth datum of 11 fathom surrounded by markings exceeding this depth. Minimum depth observed was 21 m The site is an oval elevation of approximately 0.2 x 0.3 nautical miles tending east-west. Hard bottom prevalent through the elevation is crossed by occasional sand channels. Sparse hard bottom macroinvertebrate communities are observed. Large (0.5 – 1 m) *Xetospongia* colonies are dispersed at distances of 5-10 m. Soft corals at distances of 1-5 m. Sparse hard coral cover includes *M. cavernosa* and *S. siderea*. With colonies not exceeding 0.5 m diameter.

## Site 4

Sand & rubble bottom adjacent to Seamount. Depth 27 m. Isolated sponges and macroalgae.





## Site 5. Caja de Muerto Sand Bank

This site is the closest to Caja the Muertos at 2.0 nautical miles from the lighthouse bearing 195 magnetic. Depth observed was 18m. Bottom is dominated by sand & rubble.

Macroorganisms, very sparsely present, include macroalgae (*Udotea sp.*, *Caulerpa sp.*, *Halimeda*) and calcareous algae rodoliths. Submerged dunes with wavelengths on the order of 1 – 2 m attest to significant sediment reworking.

Sonar bottom returns in transects between sites (see chart) were featureless save for the rocky bottom elevations described leading to the conclusion that sand and rubble bottom prevails throughout this outer shelf region.

## Alternative Analysis

Sites 1 and 3 are not suitable due to the presence of sessile benthic flora and fauna. Moreover, depth at site 3 exceeds the 20 meter cutoff required by bottom mounted ADCP for surface wave detection in tropical waters.

Site 2 and 4 are marginally suitable since the proposed deployment does not pose a direct threat to benthic communities. However, areas adjacent to the sites host benthic macroorganisms. These sites are relatively close the insular shelf break placing the buoys close to shipping channels. Deep to shallow water wave transition may be expected to occur too near these sites therefore posing a particular challenge for wave model validation (hard to filter data for sww calibration).

Site 5 was visually identified from the ship as a large sandy bank. Echo-sounding returns reaffirmed the site size and homogeneity. The site's distance from the shelf break and navigation channel provides for buoys safety and adequate shallow water wave signature. The virtual absence of benthic macroorganism assures minimal environmental impact.

# APPENDIX G

## Project Design Criteria

As modified, the proposed action may affect, but is not likely to adversely affect, the following listed species and designated critical habitat as designated under the Endangered Species Act (ESA) (denoted by an asterisk):

**Table 1. ESA Species**

| Common name (Distinct population segment, evolutionarily significant unit, or subspecies) | Scientific name | Status |
|---|---|---|
| *Cetaceans* | | |
| Blue whale | Balaenoptera musculus | Endangered |
| Bowhead whale | Balaena mysticetes | Endangered |
| Fin whale | Balaenoptera physalus | Endangered |
| Gray whale (Western North Pacific) | Eschrichtius robustus | Endangered |
| Humpback whale | Megaptera novaeangliae | Endangered |
| Killer whale (Southern Resident*) | Orcinus orca | Endangered |
| North Atlantic right whale* | Eubalaena glacialis | Endangered |
| North Pacific right whale* | Eubalaena japonica | Endangered |
| Sei whale | Balaenoptera borealis | Endangered |
| Sperm whale | Physeter macrocephalus | Endangered |
| Beluga whale (Cook Inlet)* | Delphinapterus leucas | Endangered |
| False killer whale (Main Hawaiian Islands insular) | Pseudorca crassidens | Endangered |
| *Pinnipeds* | | |
| Guadalupe fur seal | Arctocephalus townsendi | Threatened |
| Hawaiian monk seal* | Monachus schauinslandi | Endangered |
| Steller sea lion (Western*) | Eumetopias jubatus | Endangered |
| Ringed seal (Arctic) | Phoca hispida hispida | Threatened |
| *Sea turtles* | | |
| Green sea turtle (Florida & Mexico's Pacific Coast colonies) | Chelonia mydas | Endangered |
| Green sea turtle (all other areas*) | | Threatened |
| Hawksbill sea turtle* | Eretmochelys imbricate | Endangered |
| Kemp's ridley sea turtle | Lepidochelys kempii | Endangered |
| Leatherback sea turtle* | Dermochelys coriacea | Endangered |

| **Common name (Distinct population segment, evolutionarily significant unit, or subspecies)** | **Scientific name** | **Status** |
|---|---|---|
| Loggerhead sea turtle (North Pacific Ocean) | | Endangered |
| Loggerhead sea turtle (Northwest Atlantic Ocean) | | Threatened |
| Olive ridley sea turtle (Mexico's Pacific Coast breeding colonies) | Lepidochelys olivacea | Endangered |
| Olive ridley sea turtle (all other areas) | | Threatened |
| Sturgeons | | |
| Shortnose sturgeon | Acipenser brevirostrum | Endangered |
| Green sturgeon (Southern*) | Acipenser medirostris | Threatened |
| Gulf sturgeon | Acipenser oxyrinchus desotoi | Threatened |
| Atlantic sturgeon (Gulf of Maine) | Acipenser oxyrhynchus | Threatened |
| Atlantic sturgeon (New York Bight) | | Endangered |
| Atlantic sturgeon (Chesapeake Bay) | | Endangered |
| Atlantic sturgeon (Carolina) | | Endangered |
| Atlantic sturgeon (South Atlantic) | | Endangered |
| *Salmonids* | | |
| Atlantic salmon (Gulf of Maine*) | Salmo salar | Endangered |
| Chinook salmon (CA Coastal*) | Oncorhynchus tschawytscha | Threatened |
| Chinook salmon (Central Valley Spring-run*) | | Threatened |
| Chinook salmon (Lower Columbia River*) | | Threatened |
| Chinook salmon (Upper Columbia River Spring-run*) | | Endangered |
| Chinook salmon (Puget Sound*) | | Threatened |
| Chinook salmon (Sacramento River Winter-run*) | | Endangered |
| Chinook salmon (Snake River Fall-run*) | | Threatened |
| Chinook salmon (Snake River Spring/Summer-run*) | | Threatened |
| Chinook salmon (Upper Willamette River*) | | Threatened |
| Chum salmon (Columbia River*) | Oncorhynchus keta | Threatened |
| Chum salmon (Hood Canal Summer-run*) | | Threatened |
| Coho salmon (Central CA Coast*) | Oncorhynchus kisutch | Endangered |
| Coho salmon (Lower Columbia River) | | Threatened |
| Coho salmon (Southern Oregon & Northern California Coast*) | | Threatened |
| Coho salmon (Oregon Coast*) | | |

| Common name (Distinct population segment, evolutionarily significant unit, or subspecies) | Scientific name | Status |
|---|---|---|
| Sockeye salmon (Ozette Lake*) | Oncorhynchus nerka | Threatened |
| Sockeye salmon (Snake River*) | | Endangered |
| Steelhead (Central California Coast*) | Oncorhynchus mykiss | Threatened |
| Steelhead (California Central Valley*) | | Threatened |
| Steelhead (Lower Columbia River*) | | Threatened |
| Steelhead (Middle Columbia River*) | | Threatened |
| Steelhead (Northern California*) | | Threatened |
| Steelhead (Puget Sound) | | Threatened |
| Steelhead (Snake River Basin*) | | Threatened |
| Steelhead (South-Central California Coast*) | | Threatened |
| Steelhead (Southern California*) | | Threatened |
| Steelhead (Upper Columbia River*) | | Threatened |
| Steelhead (Upper Willamette River*) | | Threatened |
| *Other fishes* | | |
| Pacific eulachon | Thaleichthys pacificus | Threatened |
| Bocaccio (Georgia Basin) | Sebastes paucispinis | Endangered |
| Yelloweye rockfish (Georgia Basin) | Sebastes pinniger | Threatened |
| Canary rockfish (Georgia Basin) | Sebastes ruberrimus | Threatened |
| Smalltooth sawfish* | Pristis pectinate | Endangered |
| Scalloped hammerhead, Eastern Atlantic DPS | Sphyrna lewini | Endangered |
| Scalloped hammerhead, Eastern Pacific DPS | Sphyrna lewini | Endangered |
| *Marine plants* | | |
| Johnson's seagrass* | Halophilia johnsonii | Threatened |
| *Marine invertebrates* | | |
| White abalone | Haliotis sorenseni | Endangered |
| Black abalone* | Haliotis cracherodii | Endangered |
| Elkhorn coral* | Acropora palmate | Threatened |
| Staghorn coral* | Acropora cervicornis | Threatened |
| (Coral, no common name) | Acropora globiceps | Threatened |
| (Coral, no common name) | Acropora jacquelineae | Threatened |
| (Coral, no common name) | Acropora lokani | Threatened |
| (Coral, no common name) | Acropora pharaonis | Threatened |
| (Coral, no common name) | Acropora retusa | Threatened |

| Common name (Distinct population segment, evolutionarily significant unit, or subspecies) | Scientific name | Status |
|---|---|---|
| (Coral, no common name) | Acropora rudis | Threatened |
| (Coral, no common name) | Acropora speciose | Threatened |
| Pillar coral | Dendrogyra cylindrus | Threatened |
| (Coral, no common name) | Euphyllia paradivisa | Threatened |
| (Coral, no common name) | Isopora crateriformis | Threatened |
| (Coral, no common name) | Montipora australiensis | Threatened |
| Rough cactus coral | Mycetophyllia ferox | Threatened |
| Boulder star coral | Orbicella franksi | Threatened |
| Lobed star coral | Orbicella annularis | Threatened |
| Mountainous star coral | Orbicella faveolata | Threatened |
| (Coral, no common name) | Pavona diffluens | Threatened |
| (Coral, no common name) | Seriatopora aculeate | Threatened |

To fulfill its ESA and Marine Mammal Protection Act (MMPA) obligations, the U.S. Integrated Ocean Observing System (U.S. IOOS®) Program consulted with the National Marine Fisheries Service (NMFS) ESA Interagency Cooperation Division and the Permits and Conservation Division. U.S. IOOS® and NMFS identified the following project design criteria (PDC) to avoid adverse effects to ESA-listed species and designated critical habitat and to avoid harassment of marine mammals. If a Regional Association implements all relevant PDC, no further action is needed to comply with the ESA and MMPA. Further action is needed if a Regional Association cannot implement all relevant PDC, if PDC have not been identified for an activity (i.e., the activity is not listed below), or if an activity is likely to adversely affect ESA-listed species or harass marine mammals. Please contact the U.S. IOOS® Program Office if further action is needed.

## Installation

- Installations must occur during daylight hours
- All installation material must be removed upon completion of the installation; all instruments/installations must be removed when no longer in use to avoid the creation of marine debris and the potential for entanglement
- Pilings cannot exceed 18 inches in diameter
- Avoid use of impact/vibratory hammers
- Avoid installations in designated critical habitat (http://www.nmfs.noaa.gov/pr/species/criticalhabitat.htm)
- Avoid disturbing benthic ESA-listed species (e.g., abalone, coral, and seagrass)

- Avoid anchoring at sites where benthic ESA-listed may be present (http://www.nmfs.noaa.gov/pr/species/esa/)
- Perform visual survey (e.g., video, scuba, etc.) at site installation to insure no benthic ESA-listed species are present
- For installations within the range of ESA-listed corals or Johnson's seagrass, use turbidity curtains for the smallest practicable area; monitor daily to insure that ESA-listed species are not impacted by their presence; and remove upon project completion
- Adhere to NMFS' Sea Turtle and Smalltooth Sawfish Construction Condition (Enclosure 1)
- Adhere to Best Management Practices for General In-Water Work Including Boat and Diver Operations (Enclosure 2)
- Avoid land installations (HF radar) at pinniped rookeries and known haul-out/pupping beaches
- Halt or post-pone in-water work when marine mammals or ESA-listed species are observed within the exclusion zone:
    - Cetaceans: 100 yards
    - Pinnipeds: 50 yards
    - Sea turtles: 50 yards
    - Sawfish: 50 yards
    - Sturgeon: 50 yards
- Do not resume in-water work until individual(s) vacate area of own volition
- Installations must not occur when visibility prevents observation of the exclusion zone
- Clearance of Exclusion Zone. Visual monitoring of the exclusion zone must begin no less than 60 minutes prior to the beginning of soft start and continue until installations cease or sighting conditions do not allow observation of the sea surface (e.g., fog, rain, darkness). If a cetacean, pinniped, sea turtle, sawfish, or sturgeon is observed, the observer must note and monitor the position, relative bearing and estimated distance to the animal until the animal dives or moves out of visual range of the observer. The observer must continue to observe for additional animals that may surface in the area, as often there are numerous animals that may surface at varying time intervals.
- Implementation of Soft Start. Implement a "soft start" at the beginning of each installation in order to provide additional protection to cetaceans, pinnipeds, sea turtles, sawfish, and sturgeon near the project area by allowing them to vacate the area prior to the commencement of installation activities.
- Shut Down for Cetaceans, Pinnipeds, and Sea Turtles, Sawfish, and Sturgeon. Any time a cetacean, pinniped, sea turtle, sawfish, and/or sturgeon is observed within the exclusion zone, the observer must call for a shutdown of the installation. The installation activity must cease as soon as it is safe to do so. Any disagreement or discussion should occur only after shut-down, unless such discussion relates to the safety of the timing of the

activity's cessation. Subsequent restart of the installation may only occur following clearance of the exclusion zone of any cetacean, pinniped, sea turtle, sawfish, and/or sturgeon for 60 minutes.

- All installation activities must be conducted at least 150m (500ft) from any observed ice seal lair. During transit to the installation site, vehicles should drive on a snow road whenever possible to minimize the building ice roads. Vehicles must avoid pressure ridges, ice ridges, and ice deformation areas where seal structures are likely to be present. If it is not possible to avoid these features, NMFS may require use of trained dogs to determine no seal lairs are present prior to onset of activities within 150m (500ft) of any of these features.
- Avoid use of submarine cables

## Collision/prop scarring/anchoring

- Employ trained observers on all vessels (100% observer coverage)
- Species identification keys (for marine mammals, sea turtles, and ESA-listed fishes, corals, abalone, and seagrass) must be available on all vessels
- Adhere to NMFS's Vessel Strike Avoidance Measures and Injured or Dead Protected Species Reporting measures (Appendix C)
- Adhere to North Atlantic right whale vessel speed restrictions (≤10 knots) in Seasonal and Dynamic Management Areas (http://www.nmfs.noaa.gov/pr/shipstrike/)
- Report into the Mandatory Ship Reporting System when entering North Atlantic right whale critical habitat (http://www.nmfs.noaa.gov/pr/pdfs/shipstrike/msr_placard.pdf)
- Reduce speed to 10 knots within the ranges of marine mammals and sea turtles; reduce speed to 5 knots or less when sea turtles are in the immediate area
- Maintain distances of
    - Cetaceans: 100 yards
    - Pinnipeds: 50 yards
    - Sea turtles: 50 yards
    - Sawfish: 50 yards
    - Sturgeon: 50 yards
- Immediately report any collision with and/or injury to any marine mammal, sea turtle, sawfish, or sturgeon to NMFS's Regional Office and Office of Protected Resources Division ((301) 427-8443 or e-mail: jennifer.schultz@noaa.gov). Also, for marine mammals and sea turtles, contact the local marine mammal or sea turtle stranding/rescue organization (Enclosure 4).
- Avoid grounding, raise prop, and reduce speed when in the range and critical habitat of benthic ESA-listed species
- Use designated anchorage areas when available

- Use mapping data to anchor in mud or sand, to avoid anchoring on corals
- Avoid anchoring in ESA-listed abalone habitat
- Avoid anchoring in Johnson's seagrass critical habitat
- Minimize anchor drag
- Inform all crew and field scientists about civil and criminal penalties for harming, harassing, or killing species protected under the ESA and MMPA

## Sonar/acoustic sensors

- Do not operate sonar systems within the range of the Cook Inlet beluga whale, Southern Resident killer whale, and Main Hawaiian Islands insular false killer whale. Within the range of all other marine mammals, operate sonar systems at frequencies at or above 200 kHz
- Operate acoustic Doppler current profiler at frequencies at or above 75 kHz and maintain an exclusion zone of 350 meters; monitor exclusion zone for at least 60 minutes prior to ramp up of the survey equipment
- Operate altimeters at frequencies at or above 170 kHz and maintain an exclusion zone of 110 meters; monitor exclusion zone for at least 60 minutes prior to ramp up of the survey equipment
- For tracking pingers, maintain an exclusion zone of 20 meters; monitor exclusion zone for at least 60 minutes prior to ramp up of the survey equipment
- Exclusion zone must be clear of all cetaceans, pinnipeds, and sea turtles to ensure that harassment does not occur
- If a cetacean, pinniped, or sea turtle is sighted at or within the exclusion zone, an immediate shutdown of the acoustic equipment is required. The vessel operator must comply immediately with such a call by the observer. Any disagreement or discussion should occur only after shut-down. Subsequent restart of the acoustic survey equipment must use the ramp-up provisions described below and may only occur following clearance of the exclusion zone of all cetaceans, pinnipeds, and sea turtles for 60 minutes.
- "Ramp-up" of the acoustic survey equipment must occur at the start or re-start of survey activities. A ramp-up would begin by powering the smallest acoustic equipment at its lowest power output. Gradually increase the power output and add other acoustic sources such that the source level increase does not exceeding 6 dB per 5-min period.
- If the acoustic sound source shuts down for reasons other than encroachment into the exclusion zone by a cetacean, pinniped, or sea turtle, including, but not limited to, mechanical or electronic failure, resulting in the cessation of the sound source for a period greater than 20 minutes, restart the survey equipment using the full ramp-up procedures and clearance of the exclusion zone of all cetaceans, pinnipeds, and sea turtles for 60 minutes. If the pause is less than 20 minutes the equipment may be re-started as soon as practicable at its operational level as long as visual surveys were continued diligently throughout the silent period and the exclusion zone remained clear of

cetaceans, pinnipeds, and sea turtles. If visual surveys were not continued diligently during the pause of 20- minutes or less, restart the acoustic equipment using the full ramp-up procedures and clearance of the exclusion zone of all cetaceans, pinnipeds, and sea turtles for 60 minutes.

- NMFS is in the process of developing a comprehensive acoustic policy that will provide guidance on managing sources of anthropogenic sound based on each species' sensitivity to different frequency ranges and intensities of sound; however, current thresholds for determining impacts to marine mammals typically center around root-mean-square received levels of 180 dB re 1μPa for potential injury, 160 dB re 1 μPa for behavioral disturbance/harassment from a non-continuous noise source, and 120 dB re 1 μPa for behavioral disturbance/harassment from a continuous noise source. Level A Harassment has the potential to injure a marine mammal or marine mammal stock in the wild; Level B Harassment 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 which does not have the potential to injure a marine mammal or marine mammal stock in the wild. If harassment (Level A or B) is likely to occur as a result of activities, please contact the U.S. IOOS® Program Office.

## Shark tagging

- Avoid interactions with monk seals and sea turtles; report any interactions to the Pacific Islands Regional Office, the Office of Protected Resources Division ((301) 427-8443 or e-mail: jennifer.schultz@noaa.gov), and the local marine mammal or sea turtle stranding/rescue organization (Enclosure 4)
- Boat operators must be vigilant in shallow waters and channels (where monk seals and sea turtles might be swimming or sleeping and surfacing while dazed)

## LIDAR

- Maintain aircraft altitudes of 1000 ft
- Maintain distances from pinnipeds of 50 yards

## Discharges/aquatic nuisance species

- Meet all EPA Vessel General Permit and Coast Guard requirements
- Avoid discharge of ballast water in designated critical habitat
- Use anti-fouling coatings
- Clean hull regularly to remove aquatic nuisance species
- Avoid cleaning of hull in designated critical habitat
- Avoid cleaners with nonylphenols
- Rinse anchor with high-powered hose after retrieval

## Monitoring

- Within one year after finalization of the Programmatic Environmental Assessment, the U.S. IOOS® Program will finalize a standardized monitoring plan to characterize the baseline biological and anthropogenic noise in each Region, by providing passive acoustic (PA) coverage of the Region. The objective is to include PA on most systems (gliders, moorings, vessels, etc.) to estimate cetacean and fish exposure, monitor stressors (e.g., chronic and acute human activities), and detect possible effects (Southall et al. 2013). The goal (within 5 years) is to operate at least one PA system in each Region to insure that IOOS® activities are not adversely affecting threatened and endangered species and their designated critical habitat.
- Summarize observers' data annually; submit summary and data sheets with annual report.

# Enclosure 1 to Appendix G

## Sea Turtle and Smalltooth Sawfish Construction Conditions

To avoid adverse effects to sea turtles and smalltooth sawfish, please comply with the following construction conditions:

a. Instruct all personnel associated with the project of the potential presence of these species and the need to avoid collisions with sea turtles and smalltooth sawfish. All construction personnel are responsible for observing water-related activities for the presence of these species.

b. Advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles or smalltooth sawfish, which are protected under the ESA.

c. Siltation barriers shall be made of material in which a sea turtle or smalltooth sawfish cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment. Barriers may not block sea turtle or smalltooth sawfish entry to or exit from designated critical habitat without prior agreement from NMFS.

d. All vessels associated with the construction project shall operate at “no wake/idle” speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes (e.g., marked channels) whenever possible.

e. If a sea turtle or smalltooth sawfish is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 50 feet of a sea turtle or smalltooth sawfish. Operation of any mechanical construction equipment shall cease immediately if a sea turtle or smalltooth sawfish is seen within a 50-ft radius of the equipment. Activities may not resume until the protected species has departed the project area of its own volition.

f. Any collision with and/or injury to a sea turtle or smalltooth sawfish shall be reported immediately to the National Marine Fisheries Service’s Regional Office and the local authorized sea turtle stranding/rescue organization.

# Enclosure 2 to APPENDIX G

# Best Management Practices for General In-Water Work

## Boat and Diver Operations

Constant vigilance shall be kept for the presence of ESA-listed marine species during all aspects of the proposed action, particularly in-water activities such as boat operations, diving, and deployment of anchors and mooring lines.

1. The project manager shall designate an appropriate number of competent observers to survey the marine areas adjacent to the proposed action for ESA-listed marine species.

2. Surveys shall be made prior to the start of work each day, and prior to resumption of work following any break of more than one half hour. Periodic additional surveys throughout the work day are strongly recommended.

3. All in-water work shall be postponed or halted when ESA-listed marine species are within 50 yards of the proposed work, and shall only begin/resume after the animals have voluntarily departed the area. If ESA-listed marine species are noticed within 50 yards after work has already begun, that work may continue only if, in the best judgment of the project supervisor, that there is no way for the activity to adversely affect the animal(s). For example; divers performing surveys or underwater work would likely be permissible, whereas operation of heavy equipment is likely not.

4. When piloting vessels, vessel operators shall alter course to remain at least 100 yards from whales, and at least 50 yards from other marine mammals and sea turtles.

5. Reduce vessel speed to 10 knots or less when piloting vessels at or within the ranges described above from marine mammals and sea turtles. Operators shall be particularly vigilant to watch for turtles at or near the surface in areas of known or suspected turtle activity, and if practicable, reduce vessel speed to 5 knots or less.

6. If despite efforts to maintain the distances and speeds described above, a marine mammal or turtle approaches the vessel, put the engine in neutral until the animal is at least 50 feet away, and then slowly move away to the prescribed distance.

7. Marine mammals and sea turtles should not be encircled or trapped between multiple vessels or between vessels and the shore.

8. Do not attempt to feed, touch, ride, or otherwise intentionally interact with any ESA-listed marine species.

9. No contamination of the marine environment should result from project-related activities.

10. A contingency plan to control toxic materials is required.

11. Appropriate materials to contain and clean potential spills will be stored at the work site, and be readily available.

12. All project-related materials and equipment placed in the water will be free of pollutants. The project manager and heavy equipment operators will perform daily pre-work equipment inspections for cleanliness and leaks. All heavy equipment operations will be postponed or halted should a leak be detected, and will not proceed until the leak is repaired and equipment cleaned.

13. Fueling of land-based vehicles and equipment should take place at least 50 feet away from the water, preferably over an impervious surface. Fueling of vessels should be done at approved fueling facilities.

14. Turbidity and siltation from project-related work should be minimized and contained through the appropriate use of effective silt containment devices and the curtailment of work during adverse tidal and weather conditions.

15. A plan will be developed to prevent debris and other wastes from entering or remaining in the marine environment during the project.

# Enclosure 3 to APPENDIX G

# Vessel Strike Avoidance Measures and Injured or Dead Protected Species Reporting

## Background

**Vessel Strike Avoidance Measures and Injured or Dead Protected Species Reporting**

NOAA Fisheries Service has determined that collisions with vessels can injure or kill protected species (e.g., endangered and threatened species, and marine mammals). The following standard measures are recommended to reduce the risk associated with vessel strikes or disturbance of these protected species. NOAA Fisheries Service should be contacted to identify any additional conservation and recovery issues of concern for protected species in your operating area.

**Protected Species Identification Training**

Vessel crews should use an Atlantic and Gulf of Mexico reference guide that helps identify the species of marine mammals and sea turtles that might be encountered in U.S. waters of the Atlantic Ocean, including the Caribbean and Gulf of Mexico. Additional training should be provided regarding information and resources available regarding federal laws and regulations for protected species, ship strike information, critical habitat, migratory routes and seasonal abundance, and recent sightings of protected species.

**Vessel Strike Avoidance**

The following measures must be taken in order to avoid causing injury or death to marine mammals and sea turtles:

1. Vessel operators and crews will maintain a vigilant watch for marine mammals and sea turtles to avoid striking sighted protected species.

2. When whales are sighted, maintain a distance of 100 yards or greater between the whale and the vessel.

3. When sea turtles or small cetaceans are sighted, attempt to maintain a distance of 50 yards or greater between the animal and the vessel whenever possible.

4. When small cetaceans are sighted while a vessel is underway (e.g., bow-riding), attempt to remain parallel to the animal's course. Avoid excessive speed or abrupt changes in direction until the cetacean has left the area.

5. Reduce vessel speed to 10 knots or less when mother/calf pairs, groups, or large assemblages of cetaceans are observed near an underway vessel, when safety permits. A single cetacean at the surface may indicate the presence of submerged animals in the vicinity; therefore, prudent precautionary measures should always be exercised. The

vessel will attempt to route around the animals, maintaining a minimum distance of 100 yards whenever possible.

6. Whales may surface in unpredictable locations or approach slowly moving vessels. When an animal is sighted in the vessel's path or in close proximity to a moving vessel, reduce speed and shift the engine to neutral. Do not engage the engines until the animals are clear of the area.

## Additional Requirements for the North Atlantic Right Whale

1. If a sighted whale is believed to be a North Atlantic right whale, federal regulation requires a minimum distance of 500 yards be maintained from the animal (50 CFR 224.103 (c)).

2. Vessels entering North Atlantic right whale critical habitat are required to report into the Mandatory Ship Reporting System.

3. Mariners should check with various communication media for general information regarding avoiding ship strikes and specific information regarding North Atlantic right whale sighting locations. These include NOAA weather radio, U.S. Coast Guard NAVTEX broadcasts, and Notices to Mariners.

### **Injured or Dead Protected Species Reporting**

Vessel crews will report sightings of any injured or dead protected species immediately, regardless of whether the injury or death is caused by your vessel.

- Report marine mammals regional Stranding Hotline
- Report sea turtles to the regional Stranding Network

If your vessel is responsible for the injury or death, the responsible parties will remain available to assist the respective salvage and stranding network as needed. In addition, if the injury or death was caused by a collision with your vessel, you must notify the NMFS Regional Office immediately of the strike by telephone or by fax. The report should include the following information:

a. the time, date, and location (latitude/longitude) of the incident;
b. the name and type of the vessel involved;
c. the vessel's speed during the incident;
d. a description of the incident;
e. water depth;
f. environmental conditions (e.g., wind speed and direction, sea state, cloud cover, and visibility);
g. the species identification or description of the animal, if possible; and
h. the fate of the animal.

## Enclosure 4 to APPENDIX G

## Marine Mammal and Sea Turtle Stranding Contacts

### Marine Mammals (http://www.nmfs.noaa.gov/pr/health/coordinators.htm)

**Large Whale Entanglement Hotline:** 1-877-SOS-WHALE (1-877-767-9425)

**Alaska** (AK)
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Phone: (907) 586-7248
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Barb Mahoney (Barbara.Mahoney@noaa.gov), Assistant Stranding Coordinator
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Anchorage, AK 99513
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**Northeast/Greater Atlantic** (ME, NH, MA, RI, CT, NY, NJ, PA, DE, MD, VA)
Mendy Garron (Mendy.Garron@noaa.gov), Stranding Coordinator
National Marine Fisheries Service
55 Great Republic Drive
Gloucester, MA 01930
Phone: (978) 281-9300
Fax: (978) 281-9394

**Stranding and Entanglement Hotline:** (866) 755-NOAA (866-755-6622)

Jamison Smith (Jamison.Smith@noaa.gov), East Coast Disentanglement Coordinator
Phone: (978) 281-9336
Fax: (978) 281-9394

**Southeast** (NC, SC, GA, FL, AL, MS, LA, TX, PR, VI)
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Miami, FL 33149
Phone: (305) 361-4586
Fax: (305) 361-1462

Erin Fougeres (Erin.Fougeres@noaa.gov), Stranding Program Administrator
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Fax: (727) 824-5309

**West Coast**
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Phone: (206) 526-4747

Justin Viezbicke (Justin.Viezbicke@noaa.gov), Stranding Coordinator (CA)
National Marine Fisheries Service
501 West Ocean Boulevard, Suite 4200
Long Beach, CA 90802
Phone: (562) 980-3230
Fax: (562) 980-4027

Justin Greenman (Justin.Greenman@noaa.gov), Assistant Stranding Coordinator (CA)
Phone: (562) 980-3264

**Pacific Islands** (HI, Guam, American Samoa, Commonwealth of the Northern Mariana Islands)
David Schofield (David.Schofield@noaa.gov), Stranding Coordinator
1601 Kapiolani Boulevard, Rm 1110
Honolulu, HI 96814
Phone: (808) 944-2269
Fax: (808) 973-2941

## Sea Turtles (http://www.nmfs.noaa.gov/strandings.htm)

**Northeast/Greater Atlantic** (ME, NH, MA, RI, CT, NY, NJ, PA, DE, MD, VA)
http://www.greateratlantic.fisheries.noaa.gov/prot_res/stranding/
Kate Sampson, Sea Turtle Stranding & Disentanglement Coordinator
978-282-8470

**Southeast** (NC, SC, GA, FL, AL, MS, LA, TX, PR, VI)
*http://www.sefsc.noaa.gov/species/turtles/stranding_coordinators.htm*

**West Coast**
http://www.westcoast.fisheries.noaa.gov/protected_species/sea_turtles/marine_turtles.html
To report a dead, injured or stranded sea turtle, please call: *1-800-853-1964*

**Pacific Islands** (HI, Guam, American Samoa, Commonwealth of the Northern Mariana Islands)
*http://www.pifsc.noaa.gov/marine_turtle/*
Report stranded, entangled, or injured marine turtles by calling the Turtle Research Program at(808) 725-5730, or see the Marine Turtle Stranding Contact Information page for more numbers. http://www.pifsc.noaa.gov/marine_turtle/strandings.php

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# Appendix H

## Consultation Regarding Biological Resources

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

Zdenka S. Willis
Director, U.S. Integrated Ocean Observing System (IOOS)
NOAA National Ocean Service
1100 Wayne Avenue
Silver Spring, MD 20910

July 7, 2014

Dear Ms. Willis:

Thank you for sharing the Deliberative and Pre-Decisional Draft of your Programmatic Environmental Assessment (PEA) for the NOAA U.S. Integrated Ocean Observing System (IOOS) and requesting programmatic Essential Fish Habitat (EFH) consultation pursuant to section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). We have reviewed the Pre-Decisional Draft of your PEA and consulted with the National Marine Fisheries Service (NMFS) regional offices in developing our comments and EFH Conservation Recommendations.

Pursuant to section 305(b)(4)(A) of the MSFCMA, the attachment to this letter contains NMFS programmatic EFH Conservation Recommendations for the proposed actions. Pursuant to section 305(b)(4)(B) of the MSFCMA, IOOS is required to respond to these EFH Conservation Recommendations within 30 days of their receipt. This response shall include a description of measures proposed by IOOS to avoid, mitigate, or offset the impact of the proposed mooring actions on EFH. If IOOS' response is inconsistent with the EFH Conservation recommendations, IOOS shall explain its reasons for not following the recommendations.

If you have any questions concerning this programmatic EFH consultation, please do not hesitate to contact me or Janine Harris of my staff at 301.427.8635.

Signed

Buck Sutter
Director, NOAA Fisheries Office of Habitat Conservation

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**Programmatic Essential Fish Habitat Consultation with NOAA's National Ocean Service on current and proposed activities of the Integrated Ocean Observing System IOOS Program**
**July 2014**

Pursuant to section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), the National Marine Fisheries Service (NMFS) and the National Ocean Service have initiated programmatic Essential Fish Habitat (EFH) consultation regarding the current and proposed activities conducted by the Integrated Ocean Observing System (IOOS) Program.

Summary of Proposed Action:

The National Ocean Service (NOS) Integrated Ocean Observing System (IOOS) Program establishes a national integrated system of ocean, coastal, and Great Lakes observing systems to address regional and national needs for ocean information and gathers specific data on key coastal, ocean, and Great Lakes variables. These programmatic actions are necessary to meet the IOOS mission to meet seven critical and expanding societal needs identified in the Integrated Coastal and Ocean Observation System Act of 2009 and *U.S. IOOS: A Blueprint for Full Capability*. IOOS proposes continuing implementation of and expanding the IOOS Program in order to reach full capacity, which would include high levels of asset deployment, training, product development, data management and communications (DMAC), and modeling analysis. The specific actions the IOOS program performs and is looking to expand are described in the Programmatic Environmental Assessment for NOAA U.S. Integrated Ocean Observing System (IOOS) Draft Deliberative and Pre-Decisional document provided to the NMFS Office of Habitat Conservation.

Of the potential programmatic impacts to resources outlined in Table 4-2 of the Programmatic Environmental Assessment (PEA), one technology may have potential site specific impacts to EFH and benthic habitats: moorings (including buoys, shore-based fixed stations (e.g. pier-based stations, water level) and seafloor mixed arrays). The other technologies described in the Programmatic Environmental Assessment would not adversely affect essential fish habitat, individually or cumulatively. Many technologies would not interact with essential fish habitat, such as animal telemetry, HF radar and sonar work. The use of gliders, AUVs and drifters, and IOOS actions using these technologies would not likely alter the water column habitat for managed fish species or otherwise adversely affect the quality or quantity of essential fish habitat due to the small footprint of potential interaction with fish habitat.

Effects on EFH

Pursuant to section 303(a)(7) of the MSFCMA, EFH has been described in Fishery Management Plans (FMPs) prepared by the Regional Fishery Management Councils. On a nationwide basis, EFH includes a variety of aquatic habitats that, depending on the particular managed species and life stage may extend as far offshore as the outer limit of the Exclusive Economic Zone (200 miles offshore) or as far inland as the freshwater streams and wetlands inhabited by anadromous fish. Activities adversely affecting EFH may include activities in EFH as well as activities that are outside EFH but have some indirect adverse effect on EFH. The moorings technology that the U.S. IOOS program uses and is looking to expand the use of has possible site-specific effects on EFH. The EFH most likely to be affected are bottom habitats in nearshore and offshore waters where sensors and buoys will be placed (up to 10 miles from shore). On a national, programmatic basis, affected EFH may include nearshore marine areas, bays, estuaries, tidal and non-tidal rivers and streams, as well as fresh, brackish, and saline wetlands. EFH is described in more detail in each of the FMPs.

The variety of IOOS moorings used and proposed for use are described in detail in Appendix D of the IOOS January 2014 draft deliberate and pre-decisional PEA. This appendix shows an array of sensor deployment designs, from offshore buoys to nearshore and onshore water quality stations. At the sites of the buoys and water quality stations, there is the potential for impacts to EFH that include:

- Site specific minimal shading of salt marsh and submerged aquatic vegetation (SAV) that can affect the temperature of the aquatic environment.
- Site specific damage to marsh and seagrasses from the installation, anchoring, and maintenance of these technologies (including the loss of habitat in the small foot print of some anchors like the Mooring Systems, Inc. Miniaturized Trawl Resistant Bottom Mount (.8 meter diameter base) shown in Figure D-3 and the installation of National Estuarine Research Reserve (NERRS) water quality stations as shown in Figure D-15).
- Site specific substrate scour adjacent to the anchoring system and line (such as with the chain associated with the NANOOS buoy array, Washington Coast Moorings, Yachts-TIDAS 900 Buoy, single point mooring and Datawell Mark III Wave Rider Buoy as shown in Figure D-7, D-8, D-10 and D-13, respectively).

Programmatic EFH Conservation Recommendations for IOOS

The following programmatic EFH Conservation Recommendations are provided pursuant to section 305 (b)(4)(A) of the MSFCMA.

1. To the maximum extent possible, locate overwater buoy structures in deep water to avoid shade impacts to SAV from the on water structure.

2. Site buoys and water quality sensor platforms outside of sensitive EFH habitat, specifically habitat areas of particular concern (HAPCs), corals, salt marsh, eelgrass and other SAV habitats, and rocky bottoms.

3. When practicable, and the benthic resources present dictate, sinkers should be deliberatively lowered rather than jettisoned off the side of a boat to ensure proper placement on the bottom. Diver assisted placement is recommended when available and practicable. When sinkers must be raised, ensure that they are returned to their original location and orientation to avoid damaging a new or larger area. Minimize chain lengths to minimize the scour radius around sinkers.

4. Whenever possible, and especially when sinkers are placed near HAPCs, coral, salt marsh, eelgrass and other SAV habitats, and rocky bottoms, floats should be used on the lower end of sinker chains to decrease scour around sinkers, specifically with NANOOS buoy array, Washington Coast Moorings, Yachts-TIDAS 900 Buoy, single point mooring and Datawell Mark III Wave Rider Buoy.

5. Consider the cumulative impact from the deployment of multiple anchors and buoys in close proximity. The number of buoys that will be placed as described in Table 4-3 in the

IOOS January 2014 draft deliberate and pre-decisional PEA are minimal per square mile of area described and should be positioned to minimize the impacts of the site specific anchor and buoys technologies.

6. To the maximum extent possible (within the confines of U.S. Coastal Guard navigation rules), if there is light given off by any parts of the moorings and buoys sensors used by the U.S. IOOS program, limit the use of this light or orient the artificial light so disturbance is avoided. Unnatural lighting can create unnatural nighttime conditions that can increase the susceptibility of some fish to predation and interfere with predator/prey interactions.

Conclusion

Based on our review of the information provided by NOS in the Deliberative and Pre-Decisional Draft of your Programmatic Environmental Assessment (PEA) for the NOAA U.S. Integrated Ocean Observing System and the programs effects on EFH, NMFS has provided the EFH Conservation Recommendations above.

As required by Section 305(b)(4)(B), NOS must respond in writing within 30 days of receiving these EFH Conservation Recommendations. NOS must include in this response a description of measures NOS proposes implementing to avoid, minimize, or mitigate adverse impacts on EFH. If NOS's response is inconsistent with NMFS EFH Conservation Recommendations, NOS must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the proposed actions and the measures needed to avoid, minimize, mitigate, or offset such effects. NMFS understands that 30 days may be insufficient time for complete review of all comments received on the Deliberative and Pre-Decisional Draft of your PEA, and thus NOS may be unable to respond fully within the 30-day timeframe specified in the MSFCMA. In this case, we recommend that NOS send NMFS a preliminary response within 30 days, and send a complete response when review of the comments and any necessary revisions are completed.

Revision and Review:

If the actions the program will be conducting change based on further comments on the Draft Programmatic Environmental Assessment, or if any changes are made to the IOOS activities and plan for expansion such that there may be different adverse effects on EFH, NOS must notify NMFS to discuss whether the programmatic EFH Conservation recommendations should be revised. Every five years or sooner, as appropriate, NMFS will review these programmatic EFH Conservation Recommendations and determine whether they should be updated to account for new information.

Project-Specific EFH Conservation Recommendations

There may be cases where effects on EFH from a specific activity in the IOOS program requires project-specific recommendations to conserve EFH. In these cases, NOS has the responsibility to contact regional EFH staff to determine if additional Conservation Recommendations apply. These contacts can be found at: http://www.habitat.noaa.gov/protection/efh/regionalcontacts.html

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

NOV 14 2014

Ms. Zdenka Willis, Director
U.S. Integrated Ocean Observing System
NOAA National Ocean Service
1100 Wayne Avenue, Suite 1225
Silver Spring, Maryland 20910

Re: Endangered Species Act Section 7 Programmatic Consultation on the U.S. Integrated Ocean Observing System Office's funding of Regional Associations' activities and the implementation of the Programmatic Environmental Assessment (PCTS #FPR-2014-9093)

Dear Ms. Willis:

Thank you for your letter dated September 30, 2014, in which the U.S. Integrated Ocean Observing System Office (IOOS) requested the National Marine Fisheries Service's (NMFS) concurrence with the determination that the proposed funding of Regional Associations' activities (i.e., installation and operation of ocean observing systems) may affect, but is not likely to adversely affect (NLAA), any species or designated critical habitat under NMFS' jurisdiction, pursuant to the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. § 1536(a)(2)). This letter reflects modifications recommended during consultation and made to your original proposed action, which was described in your letter dated June 25, 2014.

After careful review of the letters, the IOOS Programmatic Environmental Assessment, supporting documentation, and other relevant information, we concur with your determination (see Attachment 1). Our concurrence with the NLAA determination applies to IOOS's proposed action, which is described in the attached *Description of the Action* section of Attachment 1. The proposed action requires the Regional Associations to implement project design criteria, which were designed to avoid adverse effects to all ESA-listed species and designated critical habitat. If a Regional Association is unable to implement all relevant project design criteria, then further ESA section 7 consultation (formal or informal) may be required. Consultation is also required if:

- There is any incidental take of ESA-listed species,
- New information reveals effects of the action that may affect ESA-listed species or critical habitat in a manner or to an extent not previously considered,
- The action is modified in a manner causing effects to ESA-listed species or critical habitat not previously considered, or



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- A new species is listed or critical habitat designated that may be affected by the action.

This concludes NMFS' informal ESA section 7 consultation on IOOS's funding of Regional Associations activities and implementation of the Programmatic Environmental Assessment. If you have any questions about this correspondence please contact Cathy Tortorici, Chief, Endangered Species Act Interagency Cooperation Division, at (301) 427-8495 or by e-mail (cathy.tortorici@noaa.gov).

Also, please note that all marine mammals are protected under the Marine Mammal Protection Act of 1972 (MMPA), including several species that are not listed under the ESA. If Regional Association activities may take marine mammals through harassment, injury, or mortality, then a MMPA incidental take permit is required. For questions about MMPA permits, please contact Jolie Harrison, Chief, Permits and Conservation Division, at (301) 427-8401 or jolie.harrison@noaa.gov.

Sincerely,

Donna S. Wieting

Donna S. Wieting, Director
Office of Protected Resources

Attachment 1: National Marine Fisheries Service Endangered Species Act Section 7 Concurrence Letter Evaluation

**Attachment 1**
**National Marine Fisheries Service**
**Endangered Species Act Section 7**
**Concurrence Letter Evaluation**

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## 1 INTRODUCTION

Section 7(a)(2) of the ESA requires every Federal agency, in consultation with and with the assistance of NMFS, to insure that any action it authorizes, funds, or carries out in the United States or on the high seas, is not likely to jeopardize the continued existence of any ESA-listed species or result in the destruction or adverse modification of critical habitat (50 CFR 402.01). Federal agencies shall review their actions at the earliest possible time to determine whether any action may affect ESA-listed species or critical habitat; if such a determination is made, consultation is required (50 CFR 402(a)). Formal consultation is not required if the agency determines, and NMFS concurs, that the proposed action is not likely to adversely affect (NLAA) any ESA-listed species or critical habitat (50 CFR 402.14(b)). As described in the Endangered Species Consultation Handbook (USFWS and NMFS 1998), NLAA is the appropriate conclusion when effects on ESA-listed species (or designated critical habitat) are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are extremely unlikely to occur. Based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.

Section 9 of the ESA and Federal regulations pursuant to Section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined as an act which actually kills or injures fish or wildlife; such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavior patterns, including, breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). NMFS does not have a regulatory definition of harass under the ESA. The U.S. Fish and Wildlife Service (USFWS) defines harass as intentional or negligent actions that create the likelihood of injury to ESA-listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. The MMPA defines harassment as "any act of pursuit, torment, or annoyance which: has the potential to injure a marine mammal or marine mammal stock in the wild; or 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 which does not have the potential to injure a marine mammal or marine mammal stock in the wild (16 U.S.C. §1362(18)(A)(ii)." For this consultation, we interpret "harass" using the USFWS and MMPA definitions.

NMFS has developed techniques to streamline consultations on broad agency programs. These techniques and the requirements for ensuring ESA Section 7 compliance are discussed in

*Alternative Approaches for Streamlining Section 7 Consultation on Hazardous Fuels Treatment Projects* (68 FR 1628; http://www.fws.gov/endangered/pdfs/MemosLetters/streamlining.pdf). Programmatic consultations evaluate the expected effects of agency actions, in which the number, location, and timing of individual activities are not definitively known. In a programmatic consultation, the Federal agency must require project design criteria (PDC), which for informal consultations are designed to insure that all activities (individually and in aggregate) avoid adversely affecting ESA-listed species or critical habitat. During programmatic consultations, the effects analysis is completed up front in the programmatic consultation document (i.e., this concurrence letter). The following elements should be included in a programmatic consultation to ensure its consistency with Section 7 of the ESA and its implementing regulations:

- PDC to avoid adverse effects on ESA-listed species and critical habitat
- Description and evaluation of the manner in which activities to be implemented under the programmatic consultation may affect ESA-listed species and critical habitat
- Determination that when PDC are implemented, the individual and aggregate effects of all activities will not adversely affect ESA-listed species or their critical habitat
- Review of individual activities. If an individual activity can be implemented with adherence to the relevant PDC, then no further consultation is needed. If an activity cannot be implemented in accordance with the PDC, the Regional Association must contact the U.S. Integrated Ocean Observing System Office (IOOS). Then, IOOS must make a determination as to whether that activity:
    - Has no effect on ESA-listed species and critical habitat (in which case no additional consultation is needed)
    - May affect but is NLAA ESA-listed species and critical habitat (in which case NMFS concurrence is required)
    - Is likely to adversely affect ESA-listed species and critical habitat (in which case formal consultation with NMFS is required)
- Procedures for monitoring activities and validating effects predictions
- Comprehensive review of the program, generally conducted annually

**2 PROPOSED ACTION**

NOAA established IOOS in accordance with Public Law 111-11, Subtitle C – Integrated Coastal and Ocean Observation System Act of 2009 (33 USC 3601-3610). IOOS represents a national consortium of Federal and non-federal stakeholders with specific interest in marine environmental phenomena occurring in the open ocean, U.S. coastal waters, and the Great Lakes. The core mission of the IOOS is to provide readily accessible marine environmental data to serve seven critical and expanding societal needs:

1. Improve predictions of climate change and weather and their effects on coastal communities and the nation
2. Improve the safety and efficiency of maritime operations

3. More effectively mitigate the effects of natural hazards
4. Improve national and homeland security
5. Reduce public health risks
6. More effectively protect and restore healthy coastal ecosystems
7. Enable the sustained use of ocean and coastal resources.

IOOS proposes to implement and expand the national integrated system of ocean, coastal, and Great Lakes observing systems to address regional and national informational needs. This system includes six subsystems: observing; data management and communications; modeling and analysis; governance and management; research and development; and training and education. Only the observing subsystem, including research and development activities associated with observing subsystem enhancement, takes place in the field and may affect ESA-listed species and critical habitat. Therefore, we will not consider the other subsystems in our analyses. In addition, we will not consider Great Lakes activities, which do not overlap with the ranges of ESA-listed species under NMFS' jurisdiction.

IOOS proposes to issue cooperative agreements and fund competitive awards to 11 non-federal Regional Associations (Figure 1), which include:

- Pacific Islands Ocean Observing System (PacIOOS)
- Alaska Ocean Observing System (AOOS)
- Northwest Association of Networked Ocean Observing Systems (NANOOS)
- Central and Northern California Ocean Observing System (CeNCOOS)
- Southern California Coastal Ocean Observing System (SCCOOS)
- Gulf of Mexico Ocean Observing System (GCOOS)
- Southeast Coastal Ocean Observing Regional Association (SECOORA)
- Caribbean Coastal Ocean Observing System (CariCOOS)
- Mid-Atlantic Regional Association for Coastal Ocean Observing Systems (MARACOOS)
- Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS)
- Great Lakes Observing System (GLOS, which will not be considered further)

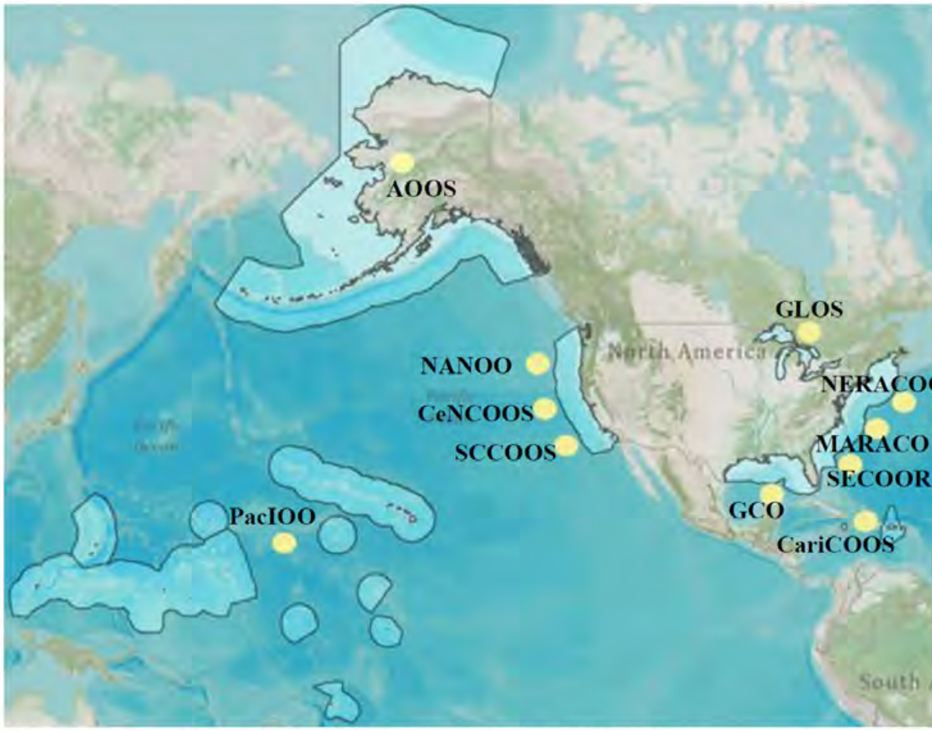


**Figure 1. Geographic location and boundaries of Regional Associations**

In 2011, IOOS established 5-year cooperative agreements with these Regional Associations. Each year, after IOOS receives its appropriation, a determination is made about which observing activities should remain priorities if available funding is less than expected (i.e, the descoping process). IOOS sends the Regional Association their annual release of funds at that time. However, a special award condition on the cooperative agreement requires the Regional Association to revise their work plan and milestones within 60 days of receiving the money. It is as this point that the Regional Associations sign off on their agreement to implement the relevant PDC and to contact IOOS if they are unable to do so.

The Regional Associations are responsible for managing system development within the region and working with stakeholders to prioritize the observations, products, and services that are most important, given available resources (NOAA 2011a). Each Association has proposed projected needs and potential activities for 2016 – 2020. Current and proposed observational activities fall into the following technological categories:

- Sensors/instrumentation
- Vessels and sampling

- Animal telemetry network
- Gliders, autonomous underwater vehicles (AUV), and drifters
- Moorings, marine stations, buoys, shore-based fixed stations, and seafloor fixed arrays
- High frequency (HF) radar
- Sound navigation and ranging (sonar)
- Light detection and ranging (lidar)

### 2.1 SENSORS/INSTRUMENTATION

IOOS proposes to fund the use of sensors and instrumentation to measure changes in chemical, biological, and geological oceanographic processes. These sensors are installed on a variety of platforms (Table 1). For example, a conductivity, temperature, and depth (CTD) sensor may be installed on a mooring, a glider, an AUV, or attached to the seafloor (i.e., benthic). Once installed, the operation of these sensors is still, silent, and self-contained (i.e., no intake or discharge). Data are transmitted through satellite telemetry to data assembly centers or via manual ship collection of the instruments. Intervals for transmission vary depending on the platform; some are continuous, while others periodic (e.g., gliders transmit when they come to the surface).

**Table 1. Oceanographic sensors (NOAA 2014).**

| Sensor | Measurement | Platform(s) |
|---|---|---|
| CTD | Water conductivity, temperature, and depth | Mooring, glider, AUV, benthic |
| Photosynthetically active radiation | Light radiation | Mooring, glider, AUV |
| Nitrate sensor | Nitrates | Mooring |
| Broadband seismometers | Seismicity | EDP (Extendable draft platform): benthic (borehole) |
| Short-period seismometers | Seismicity | Benthic |
| Pressure | Tidal and storm influence on seismicity and hydrothermal flow | Mooring, AUV, glider, benthic |
| Temperature-resistivity-$H_2$ | Temperature-chlorinity and dissolved hydrogen | Mooring, benthic, AUV, glider |
| Fluid-particulate DNA | Fluid-particulate DNA | Benthic |
| High-definition camera | Imaging of biology and fluid flow at vents | Benthic, mooring |
| Gravity meter | Gravity field | Mooring |
| Surface meteorology | Air temperature, barometric pressure, relative humidity, wind velocity, short- & long-wave radiation, precipitation | Surface mooring |
| Microbial incubators | Environmental conditions within vent walls, co-registered microbe-temperature-fluid sampling | Benthic |
| pH | Acidity/alkalinity | Mooring, benthic, AUV, glider |
| Chlorophyll a and colored dissolved organic matter fluorescence | Chlorophyll a and dissolved organic matter | Mooring, glider, AUV, benthic |
| Optical backscatter | Turbidity and sediment concentration | Mooring, glider, AUV, benthic |
| Oxygen | Oxygen | Glider, AUV, benthic, mooring |
| Partial pressure of $CO_2$ | Partial pressure of $CO_2$ | Mooring |

Unlike the above listed sensors, acoustic sensors emit noise (Table 2). Acoustic sensors are also similarly installed and maintained on a variety of platforms. Acoustic Doppler Current Profilers (ADCP) and velocimeters are hydroacoustic current meters, which measure water velocities over a depth range using the Doppler effect of sound waves scattered back from particles in the water column. Altimeters would be used to determine the altitude of AUVs and gliders. They operate at 170 kHz with an output that has significantly less power than most boat depth sounders. The maximum root mean square voltage output from the altimeter printed circuit board is 260 V. Therefore, the maximum sound pressure level would be 204.3 dB. The beam pattern at -3 dB is 18 degrees. Tracking pingers enable the tracking of AUVs and gliders. These pingers operate at 10 – 30 kHz and emit a very brief (7 ms) pulse at source levels of 180 – 186 dB re 1μPa at 1 m. The tracking pinger function is used only for emergency recovery, and most gliders are phasing out the use of tracking pingers altogether.

**Table 2. Acoustic sensors (NSF 2009, NOAA 2014).**

| Acoustic Source | Frequency (kHz) | Source Level (dBrms re 1μPa-m) | Pulse Length (ms) | Purpose/Platform(s) |
|---|---|---|---|---|
| Acoustic Doppler velocimeter | 1,000-6,000 | ~220 | 600,000 | Current velocity/Mooring, benthic |
| ADCP | 75-1,200 | ~220 | 0.6-1.5 | Current velocity across the water column/Mooring profilers, gliders, AUVs, benthic sensors |
| Altimeters | 170 | 206 | 4 | Height above seafloor/glider |
| Tracking pingers | 10-30 | 180-186 | ~7 | Location/AUVs, gliders |

### 2.2 VESSELS AND SAMPLING

IOOS proposes to fund the use of marine vessels, including personal watercraft, to implement, operate, and maintain IOOS technology. Vessels range in size as dictated by site-specific surveys, vessel schedules, and equipment to be installed (e.g., sensor types, models, etc.) (NOAA 2011b). Sampling performed from aboard a vessel (or along shorelines) includes: CTD surveys; beach monitoring; bathymetric surveys; monitoring of algae, zooplankton, and ocean conditions; invertebrate and fish sampling; and monitoring of fixed arrays. IOOS requires that all vessels operate under U.S. Coast Guard operating procedures. All vessels must comply with the U.S. Environmental Protection Agency's Vessel General Permit or Small Vessel General Permit.

### 2.3 ANIMAL TELEMETRY NETWORK

IOOS proposes to fund telemetry monitoring of sharks and other predatory fishes in Hawaii. University of Hawaii researchers propose to attach acoustic, satellite transmitter, and identification tags to up to 100 hammerhead sharks, yellowfin tunas, sandbar sharks, Galapagos sharks, tiger sharks, and other fishes in the Hawaiian Archipelago. None of these species is listed or proposed for listing under the ESA. The researchers propose to capture target species by trolling (towing an artificial lure), handlining (using a single baited hook), and using a baited, 10 hook shark line (for large sharks). The long lines are set for 3 – 4 hours. The researchers propose to implant coded acoustic transmitters (V16, 9 mm diameter, 90 mm long, Vemco, Halifax, Nova Scotia) into each individual. The acoustic transmitters transmit (51 – 84 kHz) continuously until power is lost or until the transmitters are deactivated. Hydrophones are maintained by other Federal agency partners (i.e, not IOOS). The researchers would attach two types of satellite transmitters: fin mounted fixed transmitters (SPOT tags, 41 mm x 30 mm x 17 mm, weight 32 g, Wildlife Computers, Seattle); and pop-up archiving tags (PAT tags, length 180 mm, positively buoyant in water, Wildlife Computers, Seattle).

### 2.4 GLIDERS, AUVS, AND DRIFTERS

IOOS proposes to authorize and fund the use of gliders, AUVs, and drifters. A glider is an unmanned and untethered underwater vehicle that navigates autonomously, without any physical connection to a research vessel at the surface (NOAA 2011b). It monitors water currents, temperature, and conditions that reveal effects from storms, impacts on fisheries, and water quality (NOAA 2011c). Gliders, such as the Teledyne Webb Slocum glider, are 1.5 m in length, have a hull diameter of 22 cm, and operate at very slow speeds (approximately 0.5 knots) (Teledyne Webb Research 2010). Gliders have no external moving parts or motors, with the exception of gliders that have an external bladder and measurement sensors that are located in a plastic tail section (NOAA 2011b). They move on a pre-programmed course throughout the water column by using hydraulic buoyancy change to alter the vehicle density in relation to the surrounding water, allowing the vehicle to move vertically and horizontally. They use an onboard global positioning system to maintain their pre-programmed course and have two-way satellite communications, which allow them to report their locations and provide data to their operators when they surface. Gliders have a travel range of 600 – 6,000 km and can reach depths of 1 km (Teledyne Webb Research 2010). Due to the fact that gliders do not require battery powered propulsion, they can be deployed up to 8 months, making them ideal for regional scale sampling. Other similar gliders include: SeaGliders produced by the University of Washington and iRobot and Spray produced by Scripps Institute of Oceanography.

The Wave Glider® (Liquid Robotics, Inc.) is slightly different. It consists of a submerged glider and surface float joined by a 7-meter tether. The dimensions are as follows: 208 cm x 60 cm (float), 40 cm x 191 cm (glider), and 107 cm wide (wings). The Wave Glider® weighs 90 kg. The propulsion system operates by the mechanical conversion of wave energy into forward propulsion. It can travel between 0.4-2.0 knots and has an endurance of up to 1 year, due to its 655 watt-hour Lithium-ion solar-rechargeable battery. Individual batteries are isolated from each other, and there is an automatic charge/discharge cut-off (temperature/voltage). Standard mounted instruments include: an acoustic modem, automatic identification system, meteorological sensors, and passive acoustic recorder. It also includes a shore-activated marker light. A passive pressure-actuated release separates the float from the tether and glider if an entangled animal submerges the system.

AUVs typically have on-board power, supplied by rechargeable batteries to operate a propeller or thrusters for propulsion (NOAA 2011b). Though AUVs can operate for up to 70 hours, they are typically deployed for 1 day or less before the onboard batteries must be recharged (Kongsberg Maritime 2012). The base of vertical profiler moorings can be equipped with AUV docking stations, which allow an AUV to dock and recharge its batteries underwater, thereby extending its at-sea mission. AUVs can achieve speeds of 3 – 5 knots. They range in size. Some are deployable by two people, others require a vessel's A-frame or crane for deployment. AUVs may be equipped with CTD sensors, ADCPs, pressure sensors, fluorimeters, video cameras, still cameras, and acoustic imaging (NOAA 2011b). The Kongsberg Maritime Remote

Environmental Monitoring Unit (REMUS) is representative of the class of AUVs proposed for use. REMUS has a depth rating from 100 to 6000 m (Kongsberg Maritime 2012). The REMUS is relatively small and lightweight, measuring 19 centimeters (7.5 inches) in diameter and weighing about 37 kilograms (92 pounds). REMUS navigates with an acoustical system that uses 20 – 30 kHz transponders deployed using Global Positioning System satellites. REMUS has three motors, each with its own controller, that operate the propeller and two pairs of fins used for steering and diving.

Drifters are floating ocean buoys equipped with meteorological and/or oceanographic sensing instruments linked to transmitting equipment for sending the observed data to collecting centers. Drifters consist of a surface float (32 cm diameter), tether (16 cm), and drogue (7 m). Drifters are typically released from a vessel and flow with surface currents.

### 2.5 MOORINGS, MARINE STATIONS, BUOYS, SHORE-BASED FIXED STATIONS, AND SEAFLOOR FIXED ARRAYS

IOOS proposes to fund the use of moorings, marine stations, buoys, shore-based fixed stations, and seafloor fixed arrays to provide sustained atmospheric, physical, biogeochemical, ecological, and seafloor observations (NOAA 2011b). Ocean moorings and marine stations are observational platforms that are fixed in place with wires, buoys, weights, and floats. Mooring lines can be thousands of meters long, can allow for the attachment of sensors and other instruments, and may enable inductive telemetry of data from sensors. They may be completely submerged or supported by a surface buoy which can also be equipped with sensors, telemetry equipment, power generation and storage systems, or data systems (WHOI 2011). Ocean observatories may be associated with a buoy that provides a power source and wireless communications system or with a submarine cable that provides power and communications capabilities via terrestrial power grid connectivity (Chave et al. 2004). In general, moored buoy, open-ocean observatories are used to support air-sea, water-column, and seafloor sensors operating in remote, scientifically important locations and provide data and near-real time interaction to diverse communities of scientific and educational users. Multiple ocean observing technologies such as buoys or sensors may be moored or anchored in fixed arrays in order to provide wider coverage for data collection than a single instrument.

#### 2.5.1 Coastal buoys and moorings

The University of Maine buoy is used by NERACOOS and CariCOOS and is representative of other coastal buoys. It is 2 m in diameter. The buoy is solar powered, and a large part of its payload requirements are related to the power system. The system consists of two rechargeable 12 V direct current power supplies with a 160 Ampere-hour capacity and trickle-charged by 4-40 Watt solar panels. The onboard batteries supply power to all the buoy electronics: these include the communication and positioning systems, a micro-processor, controller, digital and analog sensors, and navigational aids. The power system is designed and packaged to fit inside a watertight well.

The buoy uses a modified slack chain mooring, which minimizes equipment and components, reduces the man-hours needed for preparation, standardizes the design for the sites, and improves the mooring's survival of periodic entanglements with fishing gear and the rigorous environment. This design also allows the reuse of mooring components because the entire mooring, including anchor and chain, is recovered for each turn-around operation. The anchors for the Gulf of Maine and Caribbean buoy arrays are made from used locomotive wheels. Three wheels are stacked and pinned on a spindle. The top of the spindle includes a steel lifting hoop to which the anchor chain is attached. The anchor weighs approximately 2,800 lbs. air weight (about 2,380 lbs. under water). The anchor is approximately 1 meter in diameter and 0.6 m high. The anchors are recovered when the buoys are recovered, and usually redeployed multiple times. After a few years the spindles are replaced.

Commercial buoys are also used. A representative commercial buoy is the Guardian Series from Mooring Systems, Inc. It is 2 m in diameter and incorporates durable self-fendering hulls made of Surlyn foam. Surlyn foam is closed cell, extremely tough, and requires little maintenance. A galvanized steel frame and footed base provides a reliable construction that places the buoy system in compression while moored. A lightweight aluminum tower supports a host of instrumentation, solar panels, and navigation lights. The central well has a watertight compartment available for mounting batteries or electronics, and a removable topside end-cap allowing access while moored. These buoys are moored using a commercial anchor, a bottom mount available from Mooring Systems, Inc., or a custom anchor fashioned from locomotive wheels or other cast iron anchor. Custom anchors generally weigh between 1,300 lbs. air weight and 4,000 lbs. air weight. The anchor is approximately 0.8 m x 0.3 m. Experience indicates that these anchors do not drag. The moorings have a chain on the bottom that adds additional weight and absorbs the load. Mooring Systems, Inc., manufactures a trawl resistant bottom mount designed for protecting oceanographic instrumentation from trawler gear. The instrument platforms are suited for use with up-looking Doppler profilers, and provide sufficient space for extra battery housings, and other instrumentation. The bottom mount dimensions are 1.7 meters by 1.2 meters with a height of 0.5 meters.

Coral Reef Instrumented Monitoring Platform and carbon dioxide buoys have a height of approximately 0.9 meters above the waterline and depth of approximately 1.16 meters below the waterline. The buoy is equipped with a flashing amber beacon with a flash sequence of on for 1 second and off for 3 seconds.

#### 2.5.2 Coastal profiling buoys and buoy arrays

IOOS proposes to fund the use of several profiling buoys and buoy arrays. The Ocean Origo multipurpose moored profiling system is 2 meters in diameter. It has a 1.7 km profiling range and moves along a guiding wire. The casing is a non-corrosive twin titanium pressure casing for long life, safe and smooth deck handling, extended serviceability and improved stability.

### 2.5.3 Bay and estuary buoys

Bay and estuary buoys are similar to coastal buoys but are often smaller, with 1 – 2 m diameter. They are placed only after habitat is considered, ensuring they do not interfere with eel or sea grasses. Often the buoys are placed in estuaries to monitor nutrient loads.

### 2.5.4 Water quality stations

Water quality stations are either pier mounted, mounted on a structure within an estuary, or mounted on a buoy offshore. The YSI 6000 and the Seabird Electronics 16 are representative examples that are either pier mounted or mounted to purpose-built structures. The water quality system is deployed on substrate or attached to the pilings in the water.

## 2.6 HF RADAR

IOOS proposes to fund the use of HF radar. HF radar systems measure the speed and direction of ocean surface currents in near real time. HF radar can measure currents over a large region of the coastal ocean, from a few kilometers offshore up to 200 km, and can operate under any weather conditions. They are located near the water's edge and need not be situated atop a high point of land.

Regional Associations currently operate approximately 130 HF radars in 10 of the 11 IOOS Regions. Two types of radar are used: Coastal Ocean Dynamics Applications Radar (CODAR) SeaSonde, which is direction finding, and Wellen Radar (WERA) or Least Expensive Radio (LERA), which are phased arrays.

Most radars (90 percent) use CODAR SeaSondes, which employs a single-pole, combined transmit and receive antenna. The total height, including supporting base is 6 – 8 m for the combined or the separate antenna systems depending on transmit frequency. The antenna systems are secured to a base or tethered to the ground using wire or polyester rope. Data transmission from the antennas to a base station is made via one transmit cable and three receive cables. The typical cable run is 30 – 100 m. Cables are typically laid on the ground. In some locations, cables are run through a plastic conduit, and in some cases property owners require cables be buried. For underground cable runs, installers dig a ditch using a ditch witch, at a depth of about 6 inches.

WERA and LERA phased array systems differ from the CODAR SeaSonde systems in the number of antennas employed: there are typically 4 transmit antenna elements but 8 – 16 receive antenna elements. These receive elements are typically arranged in a line along the shore with the receive and transmit arrays being separated by tens of meters. The four elements of the transmit array are usually arranged in a rectangular pattern with each element being 2 – 6 m in height depending on transmit frequency. The length of the receive antenna arrays depend on the transmit frequency and the number of elements but are approximately 100 m in length. Currently there are four radar systems in the Miami area, four along the Georgia/South Carolina coast, two on the west coast of Florida and four arrays on the island of Oahu in Hawaii. Cables are typically laid on the ground. In some sites cables are run through a plastic conduit, and in some cases property owners require cables be buried. For example, during a recent installation in Florida, the county required the cables to be buried as the HF Radar is located on a public beach. In this case, the ditch for the cable run was 1.5 ft deep and 10 inches wide. The county provided the equipment to dig the trench.

### 2.7 SONAR

IOOS proposes to fund the use of sonar. Sonar uses sound waves to find and identify objects in the water and determine water depth. Side scan sonar is a specialized system for detecting objects on the seafloor. Most side scan systems cannot provide depth information. Like other sonars, a side scan transmits sound energy and analyzes the return signal (echo) that has bounced off the seafloor or other objects. In a side scan, the transmitted energy is formed into the shape of a fan that sweeps the seafloor from directly under the towfish to either side, typically to a distance of 100 meters. The strength of the return echo is continuously recorded, creating a "picture" of the ocean bottom. Side scan sonar is typically used in conjunction with a single beam or multibeam sonar system to meet full bottom coverage specifications for hydrographic surveys (NOAA 2012). To obtain bathymetric data, vessel-mounted multibeam sonar systems provide a fan-shaped coverage of the seafloor by measuring and recording the time elapsed between the emission of the signal from the transducer to the seafloor or object, and back again. Multibeam sonars produce a "swath" of soundings. Search patterns usually resemble overlapping parallel lines to ensure full coverage of an area (NOAA 2006).

### 2.8 LIDAR

IOOS proposes to fund the use of lidar. Lidar has become an established method for collecting very dense and accurate elevation values. This active remote sensing technique is similar to radar but uses light pulses instead of radio waves. Lidar produces a rapid collection of points (more than 70,000 per second) over a large collection area. Collection of elevation data using lidar has several advantages over most other techniques. Chief among them are higher resolution, centimeter accuracy, and penetration in forested terrain (NOAA 2008). Lidar survey systems can be aircraft-mounted or terrestrial tripod-mounted; however, the Regional Associations only use tripod scanning lidar, which is terrestrial and stationary.

### 2.9 CURRENT STATUS AND FULL CAPACITY OF PROGRAM

In fiscal year 2011, IOOS entered into 5-year, cooperative agreements with 11 Regional Associations. In addition to activities proposed through fiscal year 2015, each Regional Association projected needs and potential activities through fiscal year 2020 (i.e., build-out plans). Table 3 describes the current state of IOOS and its potential full capacity (proposed), overall and by Regional Association. The build-out plans represent all possible future activities until fiscal year 2020; however, due to funding and logistical limitations, it is unlikely that the IOOS will reach full capacity by that time. Therefore, we consider the total proposed activities (Table 3) to be the maximum extent of effort anticipated, whereas the current activities are the minimum extent of effort (i.e., no new activities) anticipated.

**Table 3. Current status/proposed build-out by Regional Association and activity (NOAA 2014, Appendix C).**

| Region | AOOS | CaRa | CeN COOS | MARA COOS | NA NOOS | NERA COOS | Pac IOOS | SC COOS | SEC OORA | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|
| Fixed shore station, water quality systems | 3/15 | 0/4 | 9/20 | 21/30 | 27/90 | 0/30 | 12/103 | 19/39 | 37/124 | 128/455 |
| Fixed platforms | 65/65 | 23/25 | 6/9 | 4/20 | 0/36 | 0/15 | 0/36 | 0/40 | 2/36 | 100/282 |
| Fixed seafloor, bottom-mounted station | 18/18 | 0/2 | 0/3 | 0/0 | 5/5 | 0/0 | 0/220 | 0/0 | 0/10 | 23/258 |
| Moorings, buoys | 1/37 | 4/11 | 8/16 | 1/32 | 17/38 | 28/47 | 13/27 | 0/25 | 10/89 | 82/322 |
| Cabled coastal ocean observatory | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | 1/1 | 0/0 | 0/0 | 1/1 |
| Video camera | 95/95 | 0/0 | 10/10 | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | 0/0 | 105/105 |
| Drifters | 4/4 | 0/0 | 0/0 | 0/50 | 0/0 | 0/150 | 0/0 | 0/0 | 0/150 | 4/354 |
| Glider | 0/10 | 0/2 | 2/9 | 9/50 | 2/8 | 0/10 | 6/8 | 11/12 | 1/34 | 31/143 |
| Vessel transect | 0/7 | 0/1 | 0/6 | 0/35 | 0/7 | 0/15 | 0/0 | 9/9 | 0/22 | 9/102 |
| AUV | 0/0 | 0/1 | 0/2 | 0/15 | 0/0 | 0/2 | 0/2 | 0/2 | 0/4 | 0/28 |
| HF Radar | 3/22 | 2/29 | 29/50 | 33/52 | 11/31 | 9/25 | 4/28 | 34/42 | 14/39 | 139/318 |
| TOTAL | 189/273 | 29/75 | 64/125 | 68/284 | 62/215 | 37/294 | 36/425 | 73/169 | 64/508 | 622/2368 |

### 2.10 ADDITIONAL CONSULTATION REQUIRED

IOOS has identified the following activities that will require additional consultation under Section 7 of the ESA:

- Substantial changes in the scope or location of specific projects described in the Regional Association 5-year, cooperative agreements
- Additional efforts described by cooperative partners in 10-year build-out plans
- Facility construction, such as to enclose data operations and equipment or for HF radar stations that would occur in a terrestrial environment

- Marine Sensor Innovation Project activities, including the tagging of any marine species, including migratory birds, ESA-listed species, and marine mammals, with telemetry devices
- Activities, such as mooring placements, proposed in sensitive or protected areas such as marine protected areas, critical habitat, essential fish habitat, Habitat Areas of Particular Concern, and those with traditional cultural resources or designated for usual and accustomed tribal fishing
- Activities, such as mooring placements, proposed in fishery areas
- Shore-based monitoring and surveying activities

In addition, IOOS will request formal Section 7 consultation on any proposed activity that is likely to adversely affect ESA-listed species or designated critical habitat. For new activities (i.e., not listed above) that are NLAA, IOOS will request NMFS' concurrence with their determinations. IOOS will also request consultation (formal or informal) on any activities that may affect newly listed species or newly designated critical habitat.

### 2.11 Project Design Criteria

IOOS worked with NMFS to identify the following PDC, which are designed to avoid adverse effects to ESA-listed species and critical habitat and to avoid harassment of marine mammals. Because we concur with the NLAA determination, if a Regional Association implements all relevant PDC, no further action is needed to comply with the ESA and MMPA. A Regional Association must contact IOOS if it cannot implement all relevant PDC, if PDC have not been identified for an activity (i.e., the activity is not listed below), or if an activity is likely to adversely affect ESA-listed species or critical habitat or take (including by harassment) non-ESA listed marine mammals. If contacted, IOOS must make a determination as to whether that activity:

- Has no effect on ESA-listed species and critical habitat (in which case no ESA consultation is needed);
- May affect but is NLAA (in which case NMFS' concurrence is required); or
- Is likely to adversely affect ESA-listed species and critical habitat (in which case formal consultation with NMFS is required).

#### 2.11.1 Installations

- Installations must occur during daylight hours
- All installation material must be removed upon completion of the installation; all instruments/installations must be removed when no longer in use to avoid the creation of marine debris and the potential for entanglement
- Pilings cannot exceed 18 inches in diameter
- Avoid use of impact/vibratory hammers
- Avoid use of submarine cables

- Avoid installations in designated critical habitat (http://www.nmfs.noaa.gov/pr/species/criticalhabitat.htm)
- Avoid disturbing benthic ESA-listed species (e.g., abalone, coral, and seagrass)
- Avoid anchoring at sites where benthic ESA-listed may be present (http://www.nmfs.noaa.gov/pr/species/esa/)
- Perform visual survey (e.g., video, scuba, etc.) at site installation to insure no benthic ESA-listed species are present
- For installations within the range of ESA-listed corals or Johnson's seagrass, use turbidity curtains for the smallest practicable area; monitor daily to insure that ESA-listed species are not impacted by their presence; and remove upon project completion
- Adhere to NMFS' *Sea Turtle and Smalltooth Sawfish Construction Condition* (Appendix A)
- Adhere to *Best Management Practices (BMPs) for General In-Water Work Including Boat and Diver Operations* (Appendix B)
- Avoid land installations (HF radar) at pinniped rookeries and known haul-out/pupping beaches
- Halt or postpone in-water work when marine mammals or ESA-listed species are observed within the exclusion zone:
    - Cetaceans: 100 yards
    - Pinnipeds: 50 yards
    - Sea turtles: 50 yards
    - Sawfish: 50 yards
    - Sturgeon: 50 yards
- Do not resume in-water work until individual(s) vacate area of own volition
- Installations must not occur when visibility prevents observation of the exclusion zone
- Clearance of Exclusion Zone. Visual monitoring of the exclusion zone must begin no less than 60 minutes prior to the beginning of soft start and continue until installations cease or sighting conditions do not allow observation of the sea surface (e.g., fog, rain, darkness). If a cetacean, pinniped, sea turtle, sawfish, or sturgeon is observed, the observer must note and monitor the position, relative bearing, and estimated distance to the animal until the animal dives or moves out of visual range of the observer. The observer must continue to observe for additional animals that may surface in the area, as often there are numerous animals that may surface at varying time intervals.
- Implementation of Soft Start. Implement a "soft start" at the beginning of each installation in order to provide additional protection to cetaceans, pinnipeds, sea turtles, sawfish, and sturgeon near the project area by allowing them to vacate the area prior to the commencement of installation activities.
- Shut Down for Cetaceans, Pinnipeds, and Sea Turtles, Sawfish, and Sturgeon. Any time a cetacean, pinniped, sea turtle, sawfish, or sturgeon is observed within the exclusion zone, the observer must call for a shut down of the installation. The installation activity must

cease as soon as it is safe to do so. Any disagreement or discussion should occur only after shutdown, unless such discussion relates to the safety of the timing of the cessation of the activity. Subsequent restart of the installation may only occur following clearance of the exclusion zone of any cetacean, pinniped, sea turtle, sawfish, or sturgeon for 60 minutes.

- All installation activities must be conducted at least 150 m (500 ft) from any observed ice seal lair. During transit to the installation site, vehicles should drive on a snow road whenever possible, to minimize the building of ice roads. Vehicles must avoid pressure ridges, ice ridges, and ice deformation areas where seal structures are likely to be present. If it is not possible to avoid these features, NMFS may require the use of trained dogs to determine that no seal lairs are present before to the onset of activities within 150 m (500 ft) of any of these features.

#### 2.11.2 Collision/prop scarring/anchoring

- Employ trained observers on all vessels (100% observer coverage)
- Species identification keys (for marine mammals, sea turtles, and ESA-listed fishes, corals, abalone, and seagrass) must be available on all vessels
- Adhere to NMFS' *Vessel Strike Avoidance Measures and Injured or Dead Protected Species Reporting* measures (Appendix C)
- Adhere to North Atlantic right whale vessel speed restrictions (≤10 knots) in Seasonal and Dynamic Management Areas (http://www.nmfs.noaa.gov/pr/shipstrike/)
- Report into the Mandatory Ship Reporting System when entering North Atlantic right whale critical habitat (http://www.nmfs.noaa.gov/pr/pdfs/shipstrike/msr_placard.pdf)
- Reduce speed to 10 knots within the ranges of marine mammals and sea turtles; reduce speed to 5 knots or less when sea turtles are in the immediate area
- Maintain distances of:
    - Cetaceans: 100 yards
    - Pinnipeds: 50 yards
    - Sea turtles: 50 yards
    - Sawfish: 50 yards
    - Sturgeon: 50 yards
- Immediately report any collision with and/or injury to any marine mammal, sea turtle, sawfish, or sturgeon to the relevant NMFS Regional Office. Also, for marine mammals and sea turtles, contact the local marine mammal or sea turtle stranding/rescue organization (Appendix D).
- Avoid grounding, raise prop, and reduce speed when in the range and critical habitat of benthic ESA-listed species
- Use designated anchorage areas when available
- Use mapping data to anchor in mud or sand, to avoid anchoring on corals
- Avoid anchoring in ESA-listed abalone habitat

- Avoid anchoring in Johnson's seagrass critical habitat
- Minimize anchor drag
- Inform all crew and field scientists about civil and criminal penalties for harming, harassing, or killing species protected under the ESA and MMPA

**2.11.3 Sonar/acoustic sensors**

- Do not operate sonar systems within the geographic ranges of the Cook Inlet beluga whale, Southern Resident killer whale, and Main Hawaiian Islands insular false killer whale. Within the range of all other marine mammals, operate sonar systems at frequencies at or above 200 kHz
- Operate ADCP at frequencies at or above 75 kHz and maintain an exclusion zone of 350 meters; monitor exclusion zone for at least 60 minutes prior to ramp up of the survey equipment
- Operate altimeters at frequencies at or above 170 kHz and maintain an exclusion zone of 110 meters; monitor exclusion zone for at least 60 minutes prior to ramp up of the survey equipment
- For tracking pingers, maintain an exclusion zone of 20 meters; monitor exclusion zone for at least 60 minutes prior to ramp up of the survey equipment
- Exclusion zone must be clear of all cetaceans, pinnipeds, and sea turtles to ensure that harassment does not occur
- If a cetacean, pinniped, or sea turtle is sighted at or within the exclusion zone, an immediate shut down of the acoustic equipment is required. The vessel operator must comply immediately with such a call by the observer. Any disagreement or discussion should occur only after shut down. Subsequent restart of the acoustic survey equipment must use the ramp-up provisions described below and may only occur following clearance of the exclusion zone of all cetaceans, pinnipeds, and sea turtles for 60 minutes.
- "Ramp-up" of the acoustic survey equipment must occur at the start or re-start of survey activities. A ramp-up would begin by powering the smallest acoustic equipment at its lowest power output. Gradually increase the power output and add other acoustic sources such that the source level increase does not exceed 6 dB per 5-minute period.
- If the acoustic sound source shuts down for reasons other than encroachment into the exclusion zone by a cetacean, pinniped, or sea turtle, including, but not limited to, mechanical or electronic failure, resulting in the cessation of the sound source for a period greater than 20 minutes, restart the survey equipment using the full ramp-up procedures and clearance of the exclusion zone of all cetaceans, pinnipeds, and sea turtles for 60 minutes. If the pause is less than 20 minutes the equipment may be re-started as soon as practicable at its operational level as long as visual surveys were continued diligently throughout the silent period and the exclusion zone remained clear of cetaceans, pinnipeds, and sea turtles. If visual surveys were not continued diligently during the pause of 20 minutes or less, restart the acoustic equipment using the full ramp-

up procedures and clearance of the exclusion zone of all cetaceans, pinnipeds, and sea turtles for 60 minutes.

- NMFS is in the process of developing updated guidance for behavioral harassment; current thresholds for determining impacts to marine mammals typically center around root-mean-square received levels of 180 dB re 1μPa for potential injury, 160 dB re 1 μPa for behavioral disturbance/harassment from a non-continuous noise source, and 120 dB re 1 μPa for behavioral disturbance/harassment from a continuous noise source. Level A Harassment has the potential to injure a marine mammal or marine mammal stock in the wild; Level B Harassment 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 which does not have the potential to injure a marine mammal or marine mammal stock in the wild. If harassment (Level A or B) is likely to occur as a result of activities, please contact the IOOS Program Office.

#### 2.11.4 Shark tagging

- Avoid interactions with monk seals and sea turtles; report any interactions to the Pacific Islands Regional Office and the local marine mammal or sea turtle stranding/rescue organization (Appendix D)
- Boat operators must be vigilant in shallow waters and channels (where monk seals and sea turtles might be swimming or sleeping and surfacing while dazed)

#### 2.11.5 Lidar

- Maintain aircraft altitudes of 1000 ft
- Maintain distances from pinnipeds of 50 yards

#### 2.11.6 Discharges/aquatic nuisance species

- Meet all Coast Guard and Environmental Protection Agency requirements
- Avoid discharge of ballast water in designated critical habitat
- Use anti-fouling coatings
- Clean hull regularly to remove aquatic nuisance species
- Avoid cleaning of hull in designated critical habitat
- Avoid cleaners with nonylphenols
- Rinse anchor with high-powered hose after retrieval

### 2.12 MONITORING

- Within one year after finalization of the PEA, IOOS will finalize a standardized monitoring plan to characterize the baseline biological and anthropogenic noise in each Region, by providing passive acoustic (PA) coverage of the Region. The objective is to include PA coverage on most systems (gliders, moorings, vessels, etc.) to estimate cetacean and fish exposure, monitor stressors (e.g., chronic and acute human activities), and detect possible effects (Southall et al. 2013). The goal (within 5 years) is to operate at least one PA system within each Regional Association to verify that IOOS activities are not adversely affecting threatened and endangered species and their designated critical habitat. The standardized monitoring plan must include annual reports, which should be sent to IOOS, who will summarize and submit to the NMFS Office of Protected Resources annually.

- Summarize observers' data annually; submit summary and data sheets with annual report to IOOS. IOSS will summarize all reports and submit to the NMFS Office of Protected Resources annually.

**3 ACTION AREA**

Figure 1 identifies the action area, which includes: open ocean, U.S. coastal waters, and the Great Lakes.

**4 NMFS ESA-LISTED SPECIES IN THE ACTION AREA**

Table 4 identifies the ESA-listed species and designated critical habitat that occur within the action area.

**Table 4. ESA-listed species and designated critical habitat (denoted by an asterisk) within the action area.**

| Common name (Distinct population segment, evolutionarily significant unit, or subspecies) | Scientific name | Status |
|---|---|---|
| **Cetaceans** | | |
| Blue whale | *Balaenoptera musculus* | Endangered |
| Bowhead whale | *Balaena mysticetes* | Endangered |
| Fin whale | *Balaenoptera physalus* | Endangered |
| Gray whale (Western North Pacific) | *Eschrichtius robustus* | Endangered |
| Humpback whale | *Megaptera novaeangliae* | Endangered |
| Killer whale (Southern Resident*) | *Orcinus orca* | Endangered |
| North Atlantic right whale* | *Eubalaena glacialis* | Endangered |
| North Pacific right whale* | *Eubalaena japonica* | Endangered |
| Sei whale | *Balaenoptera borealis* | Endangered |
| Sperm whale | *Physeter macrocephalus* | Endangered |
| Beluga whale (Cook Inlet)* | *Delphinapterus leucas* | Endangered |
| False killer whale (Main Hawaiian Islands insular) | *Pseudorca crassidens* | Endangered |
| **Pinnipeds** | | |
| Guadalupe fur seal | *Arctocephalus townsendi* | Threatened |
| Hawaiian monk seal* | *Monachus schauinslandi* | Endangered |
| Steller sea lion (Western*) | *Eumetopias jubatus* | Endangered |
| Ringed seal (Arctic) | *Phoca hispida hispida* | Threatened |
| **Sea turtles** | | |

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|---|---|---|
| Green sea turtle (Florida & Mexico's Pacific Coast colonies) | *Chelonia mydas* | Endangered |
| Green sea turtle (all other areas*) | | Threatened |
| Hawksbill sea turtle* | *Eretmochelys imbricate* | Endangered |
| Kemp's ridley sea turtle | *Lepidochelys kempii* | Endangered |
| Leatherback sea turtle* | *Dermochelys coriacea* | Endangered |
| Loggerhead sea turtle (North Pacific Ocean) | | Endangered |
| Loggerhead sea turtle (Northwest Atlantic Ocean) | | Threatened |
| Olive ridley sea turtle (Mexico's Pacific Coast breeding colonies) | *Lepidochelys olivacea* | Endangered |
| Olive ridley sea turtle (all other areas) | | Threatened |
| **Sturgeon** | | |
| Shortnose sturgeon | *Acipenser brevirostrum* | Endangered |
| Green sturgeon (Southern*) | *Acipenser medirostris* | Threatened |
| Gulf sturgeon | *Acipenser oxyrinchus desotoi* | Threatened |
| Atlantic sturgeon (Gulf of Maine) | *Acipenser oxyrhynchus* | Threatened |
| Atlantic sturgeon (New York Bight) | | Endangered |
| Atlantic sturgeon (Chesapeake Bay) | | Endangered |
| Atlantic sturgeon (Carolina) | | Endangered |
| Atlantic sturgeon (South Atlantic) | | Endangered |
| **Salmonids** | | |
| Atlantic salmon (Gulf of Maine*) | *Salmo salar* | Endangered |
| Chinook salmon (CA Coastal*) | *Oncorhynchus tschawytscha* | Threatened |
| Chinook salmon (Central Valley Spring-run*) | | Threatened |
| Chinook salmon (Lower Columbia River*) | | Threatened |
| Chinook salmon (Upper Columbia River Spring-run*) | | Endangered |
| Chinook salmon (Puget Sound*) | | Threatened |
| Chinook salmon (Sacramento River Winter-run*) | | Endangered |
| Chinook salmon (Snake River Fall-run*) | | Threatened |
| Chinook salmon (Snake River Spring/Summer-run*) | | Threatened |
| Chinook salmon (Upper Willamette River*) | | Threatened |
| Chum salmon (Columbia River*) | *Oncorhynchus keta* | Threatened |
| Chum salmon (Hood Canal Summer-run*) | | Threatened |
| Coho salmon (Central CA Coast*) | *Oncorhynchus kisutch* | Endangered |
| Coho salmon (Lower Columbia River) | | Threatened |
| Coho salmon (Southern Oregon & Northern California Coast*) | | Threatened |
| Coho salmon (Oregon Coast*) | | |
| Sockeye salmon (Ozette Lake*) | *Oncorhynchus nerka* | Threatened |
| Sockeye salmon (Snake River*) | | Endangered |
| Steelhead (Central California Coast*) | *Oncorhynchus mykiss* | Threatened |
| Steelhead (California Central Valley*) | | Threatened |
| Steelhead (Lower Columbia River*) | | Threatened |
| Steelhead (Middle Columbia River*) | | Threatened |

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|---|---|---|
| Steelhead (Northern California*) | | Threatened |
| Steelhead (Puget Sound) | | Threatened |
| Steelhead (Snake River Basin*) | | Threatened |
| Steelhead (South-Central California Coast*) | | Threatened |
| Steelhead (Southern California*) | | Threatened |
| Steelhead (Upper Columbia River*) | | Threatened |
| Steelhead (Upper Willamette River*) | | Threatened |
| **Other fishes** | | |
| Pacific eulachon | *Thaleichthys pacificus* | Threatened |
| Bocaccio (Georgia Basin) | *Sebastes paucispinis* | Endangered |
| Yelloweye rockfish (Georgia Basin) | *Sebastes pinniger* | Threatened |
| Canary rockfish (Georgia Basin) | *Sebastes ruberrimus* | Threatened |
| Smalltooth sawfish* | *Pristis pectinata* | Endangered |
| Scalloped hammerhead, Eastern Atlantic DPS | *Sphyrna lewini* | Endangered |
| Scalloped hammerhead, Eastern Pacific DPS | *Sphyrna lewini* | Endangered |
| **Marine plants** | | |
| Johnson's seagrass* | *Halophilia johnsonii* | Threatened |
| **Marine invertebrates** | | |
| White abalone | *Haliotis sorenseni* | Endangered |
| Black abalone* | *Haliotis cracherodii* | Endangered |
| Elkhorn coral* | *Acropora palmata* | Threatened |
| Staghorn coral* | *Acropora cervicornis* | Threatened |
| (Coral, no common name) | *Acropora globiceps* | Threatened |
| (Coral, no common name) | *Acropora jacquelineae* | Threatened |
| (Coral, no common name) | *Acropora lokani* | Threatened |
| (Coral, no common name) | *Acropora pharaonis* | Threatened |
| (Coral, no common name) | *Acropora retusa* | Threatened |
| (Coral, no common name) | *Acropora rudis* | Threatened |
| (Coral, no common name) | *Acropora speciosa* | Threatened |
| Pillar coral | *Dendrogyra cylindrus* | Threatened |
| (Coral, no common name) | *Euphyllia paradivisa* | Threatened |
| (Coral, no common name) | *Isopora crateriformis* | Threatened |
| (Coral, no common name) | *Montipora australiensis* | Threatened |
| Rough cactus coral | *Mycetophyllia ferox* | Threatened |
| Boulder star coral | *Orbicella franksi* | Threatened |
| Lobed star coral | *Orbicella annularis* | Threatened |
| Mountainous star coral | *Orbicella faveolata* | Threatened |
| (Coral, no common name) | *Pavona diffluens* | Threatened |
| (Coral, no common name) | *Seriatopora aculeate* | Threatened |

## 5 EFFECTS OF THE ACTION

IOOS proposes to fund Regional Association activities, which may affect ESA-listed species and critical habitat (Table 4). Here, we consider the effects of these activities and evaluate whether these activities are likely to adversely affect species or critical habitat. For each set of activities, we identify the potential stressors. Next, we ask whether ESA-listed species or critical habitat are likely to be exposed to the stressors; if exposure is extremely unlikely to occur, we conclude that the effects are discountable. If exposure is likely, we ask how species and critical habitat are likely to respond to the stressors. We conclude that the effects are insignificant if the impact of the response is small (i.e., not measurable or detectable) and does not reach the scale where take occurs. Finally, we consider all activities, individually and in aggregate, and ask whether the action is likely to adversely affect ESA-listed species or critical habitat. If all effects are discountable or insignificant, we conclude NLAA.

### 5.1 SENSORS/INSTRUMENTATION

IOOS proposes to fund sensors and instrumentation to measure changes in chemical, biological, and physical ocean processes. Sensors and instrumentation are generally deployed from vessels or attached to moorings, gliders, AUVs, or other platforms. We will evaluate the effects of these platforms later in the document; here, we evaluate the operation of sensors and instrumentation. The sensors and instrumentation take measurements of the surrounding water or water drawn into the instrument. Sensors and instrumentation may discharge the water sample but do not discharge waste. Non-acoustic sensors do not emit noise, chemicals, or other potential disturbances; we do not identify any stressors associated with non-acoustic sensors and instrumentation. Therefore, we conclude that non-acoustic sensors and instrumentation will have no effect on ESA-listed species or critical habitat.

Acoustic sensors and instrumentation include: acoustic Doppler velocimeter, ADCP, altimeters, and tracking pingers. The potential stressor produced by these instruments is noise. Table 2 describes the acoustic characteristics of these instruments. The hearing ranges of ESA-listed species are as follows:

- Baleen whales use a wide range of vocalizations for navigation and communication (including mating calls). They are able to hear sounds within a frequency range of 7 Hz – 30 kHz (Ketten 1997, McDonald et al. 2005, Parks et al. 2007) and have very sensitive hearing at lower end of that range.
- Beluga whales (Cook Inlet DPS) are able to hear at frequencies of 40 Hz – 100 kHz, although their hearing is most acute from 10 – 75 kHz (Richardson et al. 1995).
- False killer whales (Main Hawaiian Islands Insular DPS) vocalize at frequencies of 1.5 – 130 kHz (Kamminga and Van Velden 1987, Thomas and Turl 1990) and hear best at frequencies below 65 kHz (Thomas et al. 1988).

- Killer whales (Southern Resident DPS) hear at frequencies of 0.5 – 120 kHz. Their hearing is most sensitive at frequencies of 18 – 42 kHz, which overlap with their echolocation clicks (Szymanski et al. 1999).
- Sperm whales have a hearing range of 2.5 – 60 kHz. Their hearing is most sensitive at < 20 kHz, however, and they respond weakly to higher frequencies (Carder and Ridgway 1990). In a study by Watkins and Schevill (1975), sperm whales reacted to nearby 6 – 13 kHz pingers by temporarily suspending sound production; they did not otherwise alter their behavior.
- Pinnipeds generally hear at frequencies of 75 Hz – 75 kHz (Southall 2007).
- Sea turtles hear at low frequencies (100 – 1000 Hz) (Bartol et al. 1999, Bartol and Ketten 2000, Ketten and Bartol 2006).
- Fish likely hear at low frequencies of <0.5 – 1 kHz (Wahlberg and Westerberg 2005).
- Mollusks likely detect low frequency sound (Mooney et al. 2010).

The frequency ranges of the acoustic sensors do not overlap with the hearing ranges of sea turtles, fish, or mollusks; corals and sea grass do not detect sound. Therefore, we conclude that acoustic sensors and instrumentation will have no effect on ESA-listed sea turtles, fish, invertebrates, or plants. The frequency ranges of the altimeters do not overlap with any ESA-listed species. Therefore, we conclude that altimeters will have no effect on any ESA-listed species.

The frequency range of tracking pingers overlaps with the hearing ranges of marine mammals. Therefore, tracking pingers may affect ESA-listed marine mammals. To evaluate the exposure of these species to the stressor, we consulted with Shane Guan, a NMFS acoustic specialist. He calculated the potential take zones, based on how energy spreads through water and frequency-specific absorption; he did not use weighting, which reduces the affected distances when the frequency falls outside of the animal's sensitive hearing range (S. Guan, NMFS OPR, pers. comm. to J. Schultz, NMFS, July 25, 2014). Based on his calculations, marine mammals would need to be within 10 – 20 m of the tracking pinger to be exposed to 160 dB, the level at which behavior changes (i.e., harassment or incidental take) may occur. The PDC require Regional Associations to maintain an exclusion zone of 20 m. Therefore, it is extremely unlikely that marine mammals would be exposed to the noise of tracking pingers (i.e., discountable). We conclude that tracking pingers are NLAA all ESA-listed marine mammals.

The frequency range of the ADCP does not overlap with the hearing ranges of pinnipeds, baleen whales, or sperm whales (i.e., no effect). It overlaps with the hearing ranges of Cook Inlet beluga whales, Southern Resident killer whales, and false killer whales (Main Hawaiian Islands Insular DPS); however, these species are most sensitive to lower frequencies (<75 kHz). Taking a conservative approach, the ADCP may affect ESA-listed beluga, killer, and false killer whales. Using the same parameters described for tracking pingers, Shane Guan calculated that a whale would need to be within 350 m of an ADCP operating at 75 kHz to be exposed to the received level of 160 dB. The PDC require Regional Associations to maintain an exclusion zone of 350 m with continuous monitoring. Most ADCPs operate at much higher frequencies (>400 kHz) and would not affect any ESA-listed species. Therefore, it is extremely unlikely that whales would be exposed to the noise of ADCPs (i.e., discountable). We conclude that ADCPs are NLAA Cook Inlet beluga whales, Southern Resident killer whales, and Hawaiian Insular false killer whales, and have no effect on other ESA-listed marine mammals. We conclude that sensors and instrumentation, operated individually or in aggregate (all instruments in all regions) are NLAA any ESA-listed species.

Sensors and instrumentation would have no effect on the critical habitat of all species, with the exception of the Cook Inlet beluga whale, which includes the essential feature of low in-water noise. Because the frequencies of the sensors exceed the hearing range of the Cook Inlet beluga whale or are extremely unlikely to be within the hearing range of these whales, sensors and instrumentation would have discountable effects on the critical habitat Cook Inlet beluga whale. We conclude that sensors and instrumentation are NLAA Cook Inlet beluga whale critical habitat.

### 5.2 VESSELS AND SAMPLING

IOOS proposes to authorize the use of marine vessels and sampling equipment, including personal watercraft, to implement, operate, and maintain ocean observing technology. Potential stressors caused by vessels include:

- Collision (ship strikes, grounding, anchoring, and prop scarring)
- Discharges (e.g., fuel, sewage, chemicals, and waste)
- Auditory and visual disturbance
- Entanglement is a potential stressor of sampling

#### 5.2.1 Collision

Vessel collisions include: ship strikes, groundings, prop scarring, and impact as a result of anchoring. The following ESA-listed species are susceptible to vessel collisions: marine mammals, sea turtles, sharks, sawfish, sturgeon, abalone, corals, and sea grass. Critical habitat may also be affected by collision if essential substrate is disturbed.

Vessel collisions are often associated with high speeds and lack of vigilance; collision is likely to result in mortality, injury, and/or loss of fitness to individuals (Laist et al. 2001, Hazel et al. 2007). For example, vessel collisions led to 171 documented whale deaths in the Northwest Atlantic from 1970 to 2009 (Van Der Hoop et al. 2013, van der Hoop et al. 2014). Vessel speed restrictions (≤ l0 knots) reduced total ship strike mortality risk by 80 – 90 percent in North Atlantic right whales (Conn and Silber 2013).

To avoid collisions with all ESA-listed mobile species, IOOS requires 100 percent observer coverage during Regional Association cruises. IOOS requires ship speed reductions to 10 knots or less, when within the ranges of marine mammals and sea turtles. IOOS requires ship speed reductions to 5 knots or less, when sea turtles are present. Vessels must maintain safe distances from marine mammals, sea turtles, sawfish, and sturgeon. These precautions will result in increased vigilance and decreased speed, making it extremely unlikely that any mobile species would be exposed to vessel collisions. Therefore, we conclude that the effects of vessel collision are discountable and NLAA any ESA-listed mobile species.

To avoid collision with all critical habitat and ESA-listed benthic species, speed must be reduced, the prop must be raised, and anchoring must be avoided when within critical habitat or the range of benthic species (i.e., abalone, corals, and seagrass). These precautions will result in increased vigilance and decreased speed, making it extremely unlikely that any ESA-listed benthic species or critical habitat will be exposed to vessel collisions. Therefore, we conclude that the effects of vessel collision are discountable and NLAA ESA-listed benthic species or critical habitat.

#### 5.2.2 Discharges

Vessel discharges into the surrounding environment may include: ballast water, sewage, oily water, deck wash wastewater, and the release of hull fouling organisms. The potential stressors caused by these discharges include: contaminants and aquatic nuisance species. U.S. Coast Guard regulations and U.S. Environmental Protection Agency Vessel General Permit and Small Vessel General Permit limit the type and amount of contaminants that may be discharged from a vessel. Their requirements limit the risk of aquatic nuisance species introduction. All vessels operating within waters of the United States are required to comply with the regulations and permits.

The introduction of aquatic nuisance species has been cited as a major threat to biodiversity, second only to habitat loss (Wilcove et al. 1998); it has been implicated in the endangerment of 48 percent of the species listed under ESA (Czech and Krausman 1997). In addition to meeting the U.S. Coast Guard and Environmental Protection Agency requirements, IOOS requires additional measures to minimize the risk of introducing aquatic nuisance species, including:

- Avoid discharge of ballast water in designated critical habitat
- Use anti-fouling coatings
- Clean hull regularly to remove aquatic nuisance species
- Avoid cleaning of hull in designated critical habitat
- Avoid cleaners with nonylphenols
- Rinse anchor with high-powered hose after retrieval

These precautions make it extremely unlikely that a ESA-listed species or critical habitat will be exposed to aquatic invasive species, as a result of Regional Association activities (i.e., discountable).

Species and critical habitat may be exposed to vessel discharges, including contaminants. The contaminant level in these discharges must be minimized in accordance with the U.S. Coast Guard regulations and Environmental Protection Agency permits. We expect Regional Associations to use at least one vessel and as many as ten, such that species and critical habitat would be exposed the minimized discharges of 10 – 100 vessels total (and only ten vessels in one region). The effects of these vessel discharges are likely to be extremely small and undetectable from baseline discharge levels (i.e., insignificant). Even the aggregate effects of these discharges, which may accumulate within a region but not across regions, is not likely to have measureable effects on species. Therefore, we conclude that vessel discharges are NLAA ESA-listed species or critical habitat.

**5.2.3 Noise and Visual Disturbance**

The noise and presence of vessels may affect mobile ESA-listed species and Cook Inlet beluga whale critical habitat. Low-frequency noise from large ships (20–200 Hz) overlaps with the hearing ranges of ESA-listed marine mammals, sea turtles, and fish. For marine mammals, shipping noise may mask intra-specific communication. For example, in response to increased background noise, beluga whales increase their call repetition and amplitude, shift to higher frequencies, and change the structure of call content (Lesage et al. 1999, Scheifele et al. 2005); killer whales respond with increased call durations and amplitude (Foote et al. 2004, Holt 2008, Holt et al. 2009).

The mere presence of vessels may affect mobile ESA-listed species because the sight of a large, mobile object may elicit anti-predatory response, such as avoidance. This stressor, which we call visual disturbance, is inherent to the normal use of vessels. Many individuals do not respond to the visual disturbance (Nowacek et al. 2004). Other individuals exhibit temporary changes in behavior, such as avoidance, without any apparent long-term consequences (Bauer et al. 1993).

IOOS requires reduced speed, which minimizes vessel noise. A slower vessel is also less likely to startle individuals or cause disruptions through visual disturbance. IOOS requires Regional Association vessels to maintain specified distances from marine mammals, sea turtles, and fish; this too will minimize vessel noise and visual disturbance. ESA-listed species are often exposed to the presence of vessels because millions of recreational vessels (National Marine Manufacturers Association 2011) and hundreds of thousands of non-recreational vessels (http://cfpub.epa.gov/npdes/vessels/vgpermit.cfm) occur along U.S. coasts. An additional 1 – 100 Regional Association vessels would not appreciably increase the likelihood of exposure to noise and visual disturbance, above baseline levels. Any effects on ESA-listed species would be undetectable, and we do not expect vessel use to result any take (i.e., insignificant). Therefore, we conclude that the noise and visual disturbance from vessels are NLAA ESA-listed species or the critical habitat of any species, including the Cook Inlet beluga whale.

#### 5.2.4 Entanglement

Survey, sampling, and the deployment of instruments from Regional Association vessels may involve the use of cables, line, or other materials that have the potential to entangle ESA-listed species. During deployment and throughout the survey, observers (100 percent coverage) would maintain vigilance and halt activities if an ESA-listed individual approached. IOOS requires the vessel to maintain specified distances from ESA-listed marine mammals, sea turtles, and fish. IOOS also requires the retrieval of all deployments. Therefore, it is extremely unlikely that sampling activities would entangle any ESA-listed species (i.e., discountable). We conclude that sampling is NLAA any ESA-listed species.

In summary, vessels and sampling may affect but are NLAA any ESA-listed species or critical habitat.

### 5.3 GLIDERS/AUVS/DRIFTERS

IOOS proposes to fund the use of gliders, AUVs, and drifters to monitor water conditions. These unmanned vehicles are much smaller and slower than manned vessels. We have concluded that vessel operations are NLAA all ESA-listed species and critical habitat. Therefore, gliders, AUVs, and drifters (which are expected to have even less impact) are NLAA all ESA-listed species and critical habitat. We review the potential stressors (collision, auditory/visual disturbance, and entanglement) to confirm this determination.

#### 5.3.1 Collision

Drifters remain at the sea surface. Gliders and drifters are designed to avoid contact with the seafloor and to return to the sea surface for retrieval and in the event of equipment failure. Therefore, it is extremely unlikely (i.e., discountable) that an unmanned vehicle would collide with benthic ESA-listed species (i.e., abalone, corals, or seagrass). We conclude that gliders, AUVs, and drifters are NLAA ESA-listed abalone, corals, or seagrass. Similarly, gliders, AUVs, and drifters are NLAA all designated critical habitat.

Drifters move at the speed of currents; gliders operate at 0.4 – 2 knots, and AUVs reach speeds of 3 – 5 knots. The vehicles are extremely unlikely to encounter any ESA-listed mobile species; however, if approached, a marine mammal, sea turtle, or fish would likely move 1 – 2 m to avoid interaction. The effects of such minor movements of a mobile marine animal is immeasurable and not likely to result in take (i.e., insignificant). Therefore, we collision is extremely unlikely (i.e., discountable), and the behavior required to avoid collision is NLAA any species.

### 5.3.2 Auditory/visual disturbance

Gliders, AUVs, and drifters run on low power, have few or no moving parts, and, as a result, generate very little noise. This noise is not likely to cause detectable behavior changes or result in the take of any mobile marine species (i.e., insignificant). Some AUVs emit noise at 20 – 30 kHz, which falls within the hearing range of marine mammals. However, due to the low sound source levels, it is extremely unlikely that marine mammals would encounter the noise from the vehicles, and the exposure (if any) would be temporary (not lasting more than minutes). Therefore, noise disturbance is discountable. The small size, slow speed, and independent movement (i.e., not in pursuit) of these unmanned vehicles are extremely unlikely to elicit anti-predatory responses in mobile ESA-listed species (i.e., discountable). Therefore, gliders, AUVs, and drifters are NLAA ESA-listed marine mammals, sea turtles, and fish.

### 5.3.3 Entanglement

Some gliders use a 7 m tether. Tension is maintained at a constant level, as a result of the buoyant float and the submerged glider. If an animal becomes entangled in the tether, a passive pressure-actuated release separates the float from the tether and the glider. It is extremely unlikely that an ESA-listed species would encounter the glider (i.e., discountable).
In summary, gliders, AUVs, and drifters may affect but are NLAA any ESA-listed species or critical habitat.

## 5.4 ANIMAL TELEMETRY NETWORK

IOOS proposes to fund research involving an animal telemetry network. At present, only one telemetry network is funded or proposed for funding: the University of Hawaii predatory fish network. The researchers tag sharks and fish (none of which are listed under the ESA) with acoustic, satellite, and identification tags. The researchers would not tag ESA-listed species and would not deploy hydrophones (which have previously been deployed by other Federal agencies). Therefore, the animal telemetry network would have no effect on ESA-listed species or critical habitat outside of Hawaii and no effect on cetaceans, sea turtles, and corals that occur in Hawaii.

The researchers would set hooks for predatory fish. This presents a potential stressor (i.e., hooking) for the Hawaiian monk seal, which has been known to steal bait from hooks. In the past decades, the researchers have captured and tagged 394 predatory fish in the Northwestern Hawaiian Islands, where the majority of Hawaiian monk seals reside (http://www.hawaii.edu/himb/ReefPredator/NWHI%20Predator.html). During this time, no Hawaiian monk seals have been hooked. The fishing techniques have been approved by the Hawaiian Monk Seal Research Program and have not resulted in any problems for the species (C. Littnan, NMFS Pacific Islands Fisheries Science Center, pers. comm. to J. Schultz, NMFS, August 20, 2014). Therefore, Hawaiian monk seal hooking as a result of large predator fishing is extremely unlikely (i.e., discountable). We conclude that the animal telemetry network is NLAA the Hawaiian monk seal.

Hawaiian monk seal critical habitat includes beach areas, lagoon waters, and ocean waters in the Northwestern Hawaiian Islands. Fishing for predatory fishes is likely to have an undetectable impact on these areas (i.e., insignificant). Though the animal telemetry network would occur within these areas, it is NLAA Hawaiian monk seal critical habitat.

### 5.5 MOORINGS, MARINE STATIONS, BUOYS, SHORE-BASED FIXED STATIONS, AND SEAFLOOR FIXED ARRAYS

IOOS proposes to fund the installation and operation of moorings, marine stations, buoys, shore-based fixed stations, and seafloor fixed arrays to support sustained atmospheric, physical, biogeochemical, ecological, and seafloor observations. These installations and operations may affect ESA-listed species and critical habitat. Potential stressors include: collision, noise, and turbidity (due to installations), entanglement, and electromagnetic field (EMF).

#### 5.5.1 Collision

During the installation or deployment of moorings, marine stations, buoys, shore-based fixed stations, and seafloor fixed arrays, there is the potential for collision with or the impact of all ESA-listed species, including: mobile species (i.e., marine mammals, sea turtles, and fish) and benthic species (i.e., invertebrates and seagrass). To avoid all collisions or impacts, IOOS would require Regional Associations to:

- Avoid all critical habitat
- Perform all installations in daylight hours and during clear visibility
- Perform visual surveys to avoid benthic ESA-listed species
- Maintain continual vigilance to avoid mobile ESA-listed species
- Maintain minimum distances from ESA-listed individuals
- Halt work if a mobile ESA-listed species approaches; do not resume work until the individual has left on its own volition
- Follow clearance, soft-start, and shut down procedures

Given the first precaution (i.e., no installations in critical habitat), installations would have no effect on critical habitat because they would not co-occur with critical habitat. Given the other precautions, it is extremely unlikely that any installation would result in a collision with or impact to any ESA-listed mobile or benthic species (i.e., discountable).

#### 5.5.2 Noise

During the installation or deployment of moorings, marine stations, buoys, shore-based fixed stations, and seafloor fixed arrays, there is the potential for noise to affect mobile ESA-listed species and Cook Inlet beluga whale critical habitat (i.e., low in-water noise levels are a primary constituent element). Noise would have no effect on benthic species and other critical habitat.

The IOOS requirements to avoid collision would also minimize the noise impacts on mobile ESA-listed species and critical habitat. Because installations would not be allowed in critical habitat, there would be no effect on Cook Inlet beluga whale critical habitat. The other requirements would minimize the level and exposure to noise. Any exposed individuals may respond to low noise levels by avoiding the immediate vicinity; however, such avoidance would be infrequent, of short duration, and not likely to result in take of any ESA-listed species (i.e., insignificant). Therefore, noise as a result of installation is likely to have insignificant effects on ESA-listed mobile species.

#### 5.5.3 Turbidity

Installations may result in increased turbidity within the immediate vicinity. Because installations would not be allowed in critical habitat, turbidity would have no effect on critical habitat. Turbidity has the potential to adversely affect fish, corals, and seagrass. Fish would likely avoid the installation areas; however, such avoidance would be infrequent, of short duration, and not likely to result in take of any ESA-listed species (i.e., insignificant). Therefore, turbidity as a result of installation is likely to have insignificant effects on ESA-listed fish.

In addition to the requirements listed above, IOOS would require curtains to contain the turbidity. Installations would not occur in areas where ESA-listed corals and seagrass occur. The turbidity curtains would minimize the turbidity that would reach ESA-listed coral or sea grass. We conclude that turbidity, as a result of installations, is extremely unlikely to affect ESA-listed corals and seagrass (i.e., discountable).

#### 5.5.4 Entanglement

Some moorings, marine stations, buoys, and seafloor fixed arrays use submarine cables. Submarine cables have resulted in 14 instances of large whale entanglements from the late 1800s to 1955 (Heezen 1958). All entanglements involved sperm whales, and the submarine cable was generally wrapped around the jaw, flukes, and fins. The whales may have become entangled while swimming along with their jaw plowing through the sediment in search of food or possibly mistaking tangled masses of slack cable for items of food (Heezen 1958). Since then, there have been many improvements in cable design and installation to prevent self-coiling. No entanglements have been noted since 1959 (Norman and Lopez 2002; Wood and Carter 2008) note no cable-whale interactions of any type. We conclude that ESA-listed whale entanglement in mooring chains or cables is extremely unlikely to occur (i.e., discountable). For the actions considered under this consultation, IOOS would not allow the use of submarine cables; any proposed use of submarine cables would require additional consultation. Entanglement in other moorings is extremely unlikely (i.e., discountable).

#### 5.5.5 EMF

Submarine cables may emit an EMF. Some ESA-listed species (including marine mammals, fish, and sea turtles) exhibit electrosensitivity and/or magnetosensitivity, such that an EMF has the potential to affect their foraging, predator avoidance, and navigation. While little is known regarding the potential effects of EMF on marine species, behavioral responses are known for some species (Normandeau et al. 2011). To avoid the potential impacts of EMF, IOOS would not allow the use of submarine cables. Therefore, EMF would not affect any ESA-listed species.

In summary, the installation and operation of moorings, marine stations, buoys, shored-based fixed stations, and seafloor fixed arrays would have no effect on critical habitat. The installation and operation of moorings, marine stations, buoys, shored-based fixed stations, and seafloor fixed arrays may affect, but are NLAA, any ESA-listed species.

### 5.6 HF RADAR

IOOS proposes to fund the use of HF radar to measure ocean currents. HF radar works over large regions of the coastal ocean. It is installed on land, near the water's edge. Once installed, HF radar would have no effect on any ESA-listed species. Installations would not affect aquatic species, including ESA-listed cetaceans, fish, invertebrates, plants, and their critical habitat. HF radar installation may affect amphibious species, including ESA-listed pinnipeds and sea turtles. While on land, ESA-listed sea turtles fall under the jurisdiction of USFWS. Therefore, we do not consider them further. HF Radar may affect Hawaiian monk seals, Steller sea lions (Western DPS), Guadalupe fur seals, ringed seals (Arctic DPS), or bearded seals (Beringia DPS).

Potential stressors caused by HF radar installations include: noise and visual disturbance. Such disturbances have the potential to disrupt pinniped land behaviors, including: resting, molting, parturition, and nursing. To prevent such stressors, IOOS would not allow installations at pinniped rookeries and known haul-out or pupping beaches. In addition, all installation activities must be conducted at least 150 m (500 ft) from any observed ice seal lair. Given these restrictions, it is extremely unlikely that HF radar will be installed where ESA-listed pinnipeds occur on land (i.e., discountable). We conclude that HF radar is NLAA any ESA-listed pinniped.

In addition to the above restrictions, IOOS would not allow any installations in designated critical habitat, including: Steller seal lion critical habitat (which includes all rookeries) and Hawaiian monk seal critical habitat, which includes beaches in the Northwestern Hawaiian Islands (where the majority of the species resides). Therefore, HF radar would have no effect on the critical habitat of pinnipeds or any other species.

### 5.7 SONAR

IOOS proposes to fund the use of sonar to map and characterize the seafloor. The Regional Associations would use a variety of sonar systems (single beam, multibeam, and side-scan). All systems produce the potential stressor of noise. Side-scan sonar frequencies generally range from 100 – 500 kHz. Single and multibeam sonar systems operate at frequencies of 12 kHz or greater. These frequencies exceed the hearing ranges of ESA-listed sea turtles, fish, and mollusks (corals and sea grass do not detect sound). Therefore, we conclude that sonar would have no effect on ESA-listed sea turtles, fish, invertebrates, or plants.

As previously described, the hearing ranges of marine mammals are as follows:

- Baleen whales: 7 Hz – 30 kHz
- Sperm whales: 2.5 – 60 kHz.
- Beluga whales: 40 Hz – 100 kHz
- Killer whales: 0.5 – 120 kHz
- False killer whales: 1.5 – 130 kHz
- Pinnipeds: 75 Hz – 75 kHz

Deng et al. (2014) indicate that the spectral properties of pulses transmitted by three commercially available 200 kHz echo sounders (sonar systems) generate sound below 200 kHz (i.e., 90 to 130 kHz) and within the hearing range of some marine mammals, including: killer whales, false killer whales, beluga whales. They report that these sounds were likely detectable by the animals over distances up to several hundred meters (Deng et al. 2014). While well below potentially harmful levels, these sounds could potentially affect the behavior of marine mammals within fairly close proximity to the sources (Deng et al. 2014).

To minimize the effects of sonar, IOOS would prohibit the use of sonar systems within the range of the Cook Inlet beluga whale, Southern Resident killer whale, and Main Hawaiian Islands Insular false killer whale. Because IOOS would not allow the use of sonar systems within their ranges, sonar would have no effect on the Cook Inlet beluga whale, Southern Resident killer whale, and Main Hawaiian Islands Insular false killer whale. The critical habitat of the Cook Inlet beluga whale includes the essential feature of low in-water noise. Because IOOS would not allow the use of sonar within the range of the Cook Inlet beluga whale, sonar would have no effect on the critical habitat of the species.

Within the range of all other marine mammals, IOOS would require the Regional Associations to operate sonar systems at frequencies at or above 200 kHz. Sonar systems operated at above 200 kHz would not affect baleen whales, sperm whales, and pinnipeds because they cannot hear sounds at such high frequencies. We conclude that sonar would have no effect on any ESA-listed species or critical habitat.

### 5.8 Lidar

IOOS proposes to fund the use of lidar to collect elevation values. Though lidar may be aircraft-mounted or terrestrial, the Regional Associations only use terrestrial lidar. Terrestrial lidar would have no effect on fully aquatic species, including ESA-listed cetaceans, fish, invertebrates, plants, and their critical habitat. Terrestrial lidar may affect amphibious species, including ESA-listed pinnipeds and sea turtles. While on land, ESA-listed sea turtles fall under the jurisdiction of USFWS. Therefore, we do not consider them further. Terrestrial lidar is only used in Hawaii. It would have no effect on Steller sea lions (Western DPS), Guadalupe fur seals, ringed seals (Arctic DPS), or bearded seals (Beringia DPS).

Terrestrial lidar may affect the Hawaiian monk seal. Potential stressors caused by terrestrial lidar include: visual disturbance. HiOOS proposes to map the elevation of the run-up line along the beaches during a range of wave and water level conditions. This would require HiOOS to set up the tripod along beaches where monk seals may haul out for resting, molting, parturition, or nursing. Generally, these beach areas are roped off to avoid disturbing monk seals. HiOOS would not cross these barriers to set up their tripod. In addition, IOOS requires Regional Associations to avoid approaching seals closer than 50 yards. At such distances, seals are not likely to change their behavior (e.g., resting, molting, or nursing) in response to such distance visual disturbances (i.e., discountable). Any effects are likely to be undetectable, minimal in impact, and unlikely to result in take (i.e., insignificant). Therefore, lidar is NLAA the Hawaiian monk seal.

Lidar is proposed for use in the main Hawaiian Islands and would have no effect on Hawaiian monk seal critical habitat, which is currently limited to locations in the Northwestern Hawaiian Islands. Lidar would have no effect on the critical habitat of any other species.

### 5.9 AGGREGATE EFFECTS

As described in the preceding sections, IOOS proposes to fund numerous activities, each of which are NLAA ESA-listed species and critical habitat. Here, we consider the aggregate effects of all activities on ESA-listed species and critical habitat. As described in Table 3, IOOS proposes to fund 622 current activities but may fund as many as 2,368 proposed activities. An individual may be exposed to:

- Multiple activities of a single type within a region
- Multiple types of activities within a region
- Multiple activities of multiples types in more than one region

In the first scenario (multiple activities of a single type within a region), we first ask whether an activity may affect species or critical habitat. Activities that have no effect on species or critical habitat individually are expected to have no effect in aggregate. Second, we ask whether the repetition of activities with discountable effects on species or critical habitat would appreciably increase their likelihood of exposure. Finally, we ask whether the insignificant effects of individual activities may rise to significance in aggregate (i.e., additive effects). Using these criteria, only two activities warrant further consideration: vessel usage and installation noise.

The use of multiple vessels within a region may increase the likelihood of collision, increase the amount of discharges, and create a significantly louder and more disruptive environment. To evaluate these possibilities, we consider the current and proposed number of vessel activities within each region (Table 3). Most Regional Associations do not currently conduct vessel transects; one Regional Association (SCCOOS) currently conducts nine vessel transects. The

Regional Associations propose 0 to 15 vessel transects in future years. Nine current and 15 proposed vessel transects would not significantly increase the likelihood of collision, the amount of vessel discharges, or the level of auditory or visual disturbances. Therefore, the additive effects of multiple vessels within a region are NLAA any species or critical habitat.

Similarly, the noise caused by the installation of moorings, marine stations, buoys, shore-based fixed stations, and seafloor fixed arrays may have additive effects on mobile ESA-listed species. The Regional Associations propose to install 0 – 91 fixed shore or water quality systems, 0 – 40 fixed platforms, 0 – 220 fixed seafloor or bottom-mounted stations, and 7 – 79 moorings (Table 3). In total, 7 – 430 installations may occur, nationwide, in the next 5 years; however, these installations are dependent on funding. IOOS does not anticipate a large increase in funding, such that new installations would be the exception rather than the norm. It is extremely unlikely that all installations within a region would occur in the same location and at the same time. All installations must proceed according to IOOS requirements, which include minimum distances, ramp-up, and shut down procedures. No installations may occur in critical habitat. There are likely to be additive effects of the noise generated by installation activities; however, those additive effects are not likely to cause detectable or measurable changes in the behavior of ESA-listed species. We do not expect the aggregate effects of installation noise to result in the take of any ESA-listed species. Therefore, the additive effects of installations within a region are likely to be insignificant and are NLAA any species.

The second scenario (within a single region, multiple different activities) may affect ESA-listed species or critical habitat. Using the same criteria as above, noise from vessels and installations may result in additive effects. However, as described above, few Regional Associations perform vessel transects, and there are few transects in any region. Therefore, the noise from these vessels is not likely to be detected above baseline levels (i.e., insignificant). The additive noise from vessels in addition to installations is not likely to be significantly greater than the noise from installations alone. Therefore, the noise effects from vessels and installations are NLAA any species.

Finally, we consider the implementation of all activities across all regions. Vessels and installations meet our criteria for activities that warrant further consideration; however, the stressors we are most concerned with (collision, discharges, noise, and visual disturbance) are not likely to travel across regional boundaries. Benthic species would not be exposed to stressors from other regions. For mobile species, an individual that is exposed to one of these stressors in one region is not likely to be exposed to the same stressor in another region. No aggregate effects would rise to the level of take of any species. Therefore, we conclude that the additive effects of all activities across all regions is NLAA all ESA-listed species and critical habitat under NMFS' jurisdiction (Table 5).

**Table 5. Summary of NMFS' concurrence of IOOS's NLAA determinations (NE = no effect).**

| | Stressors | Baleen, sperm whales | Small whales | Pinnipeds | Sea turtles | Fish | Invertebrates | Sea grass | Critical habitat |
|---|---|---|---|---|---|---|---|---|---|
| **Sensors and instruments** | Noise | NLAA | NLAA | NLAA | NE | NE | NE | NE | NE; NLAA, beluga whale |
| **Vessels and sampling** | Collision, discharge, noise, and visual disturbance | NLAA | NLAA | NLAA | NLAA | NLAA | NLAA | NLAA | NLAA |
| **Gliders, AUVs, and drifters** | Collision, noise, and visual disturbance | NLAA | NLAA | NLAA | NLAA | NLAA | NLAA | NLAA | NLAA |
| **Animal telemetry network** | Hooking | NE | NE | NE; NLAA, monk seal | NE | NE | NE | NE | NE; NLAA, monk seal |
| **Moorings, stations, buoys, and arrays** | Collision, entanglement, noise, and EMF | NLAA | NLAA | NLAA | NLAA | NLAA | NLAA | NLAA | NE |
| **HF radar** | Terrestrial noise and visual disturbance | NE | NE | NLAA | NE | NE | NE | NE | NE |
| **Sonar** | Noise | NE | NE | NE | NE | NE | NE | NE | NE |
| **Lidar** | Terrestrial noise and visual disturbance | NE | NE | NE; NLAA monk seal | NE | NE | NE | NE | NE |
| **Aggregate effects** | | **NLAA** | **NLAA** | **NLAA** | **NLAA** | **NLAA** | **NLAA** | **NLAA** | **NLAA** |

### 5.10 MONITORING AND REPORTING

IOOS requires all Regional Associations to have 100 percent observer coverage during vessel activities and installations. Observers must record data on all sightings and interactions with ESA-listed species, including: date, time, geographic coordinates, activity, species, number of individuals, distance to individuals, mitigation measures, behavior prior to the activity, behavior post activity, and body condition. Annually, the Regional Associations must submit their compiled observer data to IOOS. IOOS must submit the compiled data of all Regional Associations to NMFS annually. These data will be reviewed annually to evaluate the effects of the proposed action on ESA-listed species and critical habitat. Take is not authorized for any activity; if review of the data reveals take or any unanticipated effects, further consultation is required.

In addition, IOOS will work with the Regional Associations to establish at least one PA monitoring system within each region. The purpose of the PA system is to establish an acoustic baseline of each region so that the effects of future IOOS funded activities can be measured against this baseline. Thus, IOOS will be able to demonstrate that its action is not having adverse effects on species or critical habitat.

In summary, IOOS proposes to:

- Implement its action to minimize impact to ESA-listed species and critical habitat;
- Continually monitor impacts resulting from its action;
- Continually evaluate its impacts on ESA-listed resources; and
- Change the action if necessary to avoid adverse effects to ESA-listed species or critical habitat.

To minimize impact, IOOS requires PDC, which are designed to avoid all adverse effects to species and critical habitat. To continuously monitor impacts of its action, IOOS would require observer monitoring on all vessels and during all installations; IOOS also requires passive acoustic monitoring in all regions. At the end of each year, IOOS would review all annual reports from the previous year. If unanticipated effects or the take of any species occurred, IOOS would change its action (i.e., alter the PDC) and consult with NMFS. During the annual descoping period, IOOS would review all proposed activities for the next year. The Regional Associations would alert IOOS if they are unable to implement any PDC or if they propose to implement any new activities that have not yet been considered. IOOS would then review and, if needed, seek consultation with NMFS on the activity, prior to its implementation. In this manner, IOOS has designed its program to minimize, monitor, evaluate, and, if necessary, further reduce, the impacts of its action on all ESA-listed species and critical habitat.

**6 CONCLUSION**

Based on our analysis that the effects of the proposed action (individually and in aggregate) will be insignificant or discountable, we concur with the determination that IOOS's funding of the Regional Associations' activities and implementation of the PEA are not likely to adversely affect any ESA-listed species or adversely modify any designated critical habitat under NMFS jurisdiction.

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**APPENDIX A: Sea Turtle and Smalltooth Sawfish Construction Conditions**
To avoid adverse effects to sea turtles and smalltooth sawfish, please comply with the following construction conditions:

a. Instruct all personnel associated with the project of the potential presence of these species and the need to avoid collisions with sea turtles and smalltooth sawfish. All construction personnel are responsible for observing water-related activities for the presence of these species.

b. Advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles or smalltooth sawfish, which are protected under the ESA.

c. Siltation barriers shall be made of material in which a sea turtle or smalltooth sawfish cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment. Barriers may not block sea turtle or smalltooth sawfish entry to or exit from designated critical habitat without prior agreement from NMFS.

d. All vessels associated with the construction project shall operate at "no wake/idle" speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes (e.g., marked channels) whenever possible.

e. If a sea turtle or smalltooth sawfish is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 50 feet of a sea turtle or smalltooth sawfish. Operation of any mechanical construction equipment shall cease immediately if a sea turtle or smalltooth sawfish is seen within a 50-ft radius of the equipment. Activities may not resume until the protected species has departed the project area of its own volition.

f. Any collision with and/or injury to a sea turtle or smalltooth sawfish shall be reported immediately to the National Marine Fisheries Service's Regional Office and the local authorized sea turtle stranding/rescue organization.

**APPENDIX B: BEST MANAGEMENT PRACTICES (BMPS) FOR GENERAL IN-WATER WORK INCLUDING BOAT AND DIVER OPERATIONS**

Constant vigilance shall be kept for the presence of ESA-listed marine species during all aspects of the proposed action, particularly in-water activities such as boat operations, diving, and deployment of anchors and mooring lines.

1. The project manager shall designate an appropriate number of competent observers to survey the marine areas adjacent to the proposed action for ESA-listed marine species.
2. Surveys shall be made prior to the start of work each day, and prior to resumption of work following any break of more than one half hour. Periodic additional surveys throughout the work day are strongly recommended.
3. All in-water work shall be postponed or halted when ESA-listed marine species are within 50 yards of the proposed work, and shall only begin/resume after the animals have voluntarily departed the area. If ESA-listed marine species are noticed within 50 yards after work has already begun, that work may continue only if, in the best judgment of the project supervisor, that there is no way for the activity to adversely affect the animal(s). For example, divers performing surveys or underwater work would likely be permissible, whereas operation of heavy equipment is likely not.
4. When piloting vessels, vessel operators shall alter course to remain at least 100 yards from whales, and at least 50 yards from other marine mammals and sea turtles.
5. Reduce vessel speed to 10 knots or less when piloting vessels at or within the ranges described above from marine mammals and sea turtles. Operators shall be particularly vigilant to watch for turtles at or near the surface in areas of known or suspected turtle activity, and if practicable, reduce vessel speed to 5 knots or less.
6. If despite efforts to maintain the distances and speeds described above, a marine mammal or turtle approaches the vessel, put the engine in neutral until the animal is at least 50 feet away, and then slowly move away to the prescribed distance.
7. Marine mammals and sea turtles should not be encircled or trapped between multiple vessels or between vessels and the shore.
8. Do not attempt to feed, touch, ride, or otherwise intentionally interact with any ESA-listed marine species.

No contamination of the marine environment should result from project-related activities.

9. A contingency plan to control toxic materials is required.
10. Appropriate materials to contain and clean potential spills will be stored at the work site, and be readily available.
11. All project-related materials and equipment placed in the water will be free of pollutants. The project manager and heavy equipment operators will perform daily pre-work equipment inspections for cleanliness and leaks. All heavy equipment operations will be postponed or halted should a leak be detected, and will not proceed until the leak is repaired and equipment cleaned.

12. Fueling of land-based vehicles and equipment should take place at least 50 feet away from the water, preferably over an impervious surface. Fueling of vessels should be done at approved fueling facilities.
13. Turbidity and siltation from project-related work should be minimized and contained through the appropriate use of effective silt containment devices and the curtailment of work during adverse tidal and weather conditions.

A plan will be developed to prevent debris and other wastes from entering or remaining in the marine environment during the project.

## APPENDIX C: VESSEL STRIKE AVOIDANCE MEASURES AND INJURED OR DEAD PROTECTED SPECIES REPORTING

### Vessel Strike Avoidance Measures and Injured or Dead Protected Species Reporting

NOAA Fisheries Service has determined that collisions with vessels can injure or kill protected species (e.g., endangered and threatened species, and marine mammals). The following standard measures are recommended to reduce the risk associated with vessel strikes or disturbance of these protected species. NOAA Fisheries Service should be contacted to identify any additional conservation and recovery issues of concern for protected species in your operating area.

**Protected Species Identification Training**

Vessel crews should use an Atlantic and Gulf of Mexico reference guide that helps identify the species of marine mammals and sea turtles that might be encountered in U.S. waters of the Atlantic Ocean, including the Caribbean and Gulf of Mexico. Additional training should be provided regarding information and resources available regarding federal laws and regulations for protected species, ship strike information, critical habitat, migratory routes and seasonal abundance, and recent sightings of protected species.

**Vessel Strike Avoidance**

The following measures must be taken in order to avoid causing injury or death to marine mammals and sea turtles:

1. Vessel operators and crews will maintain a vigilant watch for marine mammals and sea turtles to avoid striking sighted protected species.
2. When whales are sighted, maintain a distance of 100 yards or greater between the whale and the vessel.
3. When sea turtles or small cetaceans are sighted, attempt to maintain a distance of 50 yards or greater between the animal and the vessel whenever possible.
4. When small cetaceans are sighted while a vessel is underway (e.g., bow-riding), attempt to remain parallel to the animal's course. Avoid excessive speed or abrupt changes in direction until the cetacean has left the area.
5. Reduce vessel speed to 10 knots or less when mother/calf pairs, groups, or large assemblages of cetaceans are observed near an underway vessel, when safety permits. A single cetacean at the surface may indicate the presence of submerged animals in the vicinity; therefore, prudent precautionary measures should always be exercised. The vessel will attempt to route around the animals, maintaining a minimum distance of 100 yards whenever possible.
6. Whales may surface in unpredictable locations or approach slowly moving vessels. When an animal is sighted in the vessel's path or in close proximity to a moving vessel, reduce speed and shift the engine to neutral. Do not engage the engines until the animals are clear of the area.

### Additional Requirements for the North Atlantic Right Whale

1. If a sighted whale is believed to be a North Atlantic right whale, federal regulation requires a minimum distance of 500 yards be maintained from the animal (50 CFR
224.103 (c)).

2. Vessels entering North Atlantic right whale critical habitat are required to report into the Mandatory Ship Reporting System.

3. Mariners should check with various communication media for general information regarding avoiding ship strikes and specific information regarding North Atlantic right whale sighting locations. These include NOAA weather radio, U.S. Coast Guard NAVTEX broadcasts, and Notices to Mariners.

**Injured or Dead Protected Species Reporting**

Vessel crews will report sightings of any injured or dead protected species immediately, regardless of whether the injury or death is caused by your vessel.

Report marine mammals regional Stranding Hotline

Report sea turtles to the regional Stranding Network

If your vessel is responsible for the injury or death, the responsible parties will remain available to assist the respective salvage and stranding network as needed. In addition, if the injury or death was caused by a collision with your vessel, you must notify the NMFS Regional Office immediately of the strike by telephone or by fax. The report should include the following information:

a. the time, date, and location (latitude/longitude) of the incident;

b. the name and type of the vessel involved;

c. the vessel's speed during the incident;

d. a description of the incident;

e. water depth;

f. environmental conditions (e.g., wind speed and direction, sea state, cloud cover, and visibility);

g. the species identification or description of the animal, if possible; and

h. the fate of the animal.

**APPENDIX D: MARINE MAMMAL AND SEA TURTLE STRANDING CONTACTS**
**Marine Mammals** (http://www.nmfs.noaa.gov/pr/health/coordinators.htm)

**Alaska** (AK)
Aleria Jensen (Aleria.Jensen@noaa.gov), Stranding Coordinator
National Marine Fisheries Service
P.O. Box 21668
Juneau, AK 99802
Phone: (907) 586-7248
Fax: (907) 586-7012

Barb Mahoney (Barbara.Mahoney@noaa.gov), Assistant Stranding Coordinator
National Marine Fisheries Service
P.O. Box 43
Anchorage, AK 99513
Phone: (907) 271-3448
Fax (907) 271-3030

**Northeast/ Greater Atlantic** (ME, NH, MA, RI, CT, NY, NJ, PA, DE, MD, VA)
Mendy Garron (Mendy.Garron@noaa.gov), Stranding Coordinator
National Marine Fisheries Service
55 Great Republic Drive
Gloucester, MA 01930
Phone: (978) 281-9300
Fax: (978) 281-9394

Stranding and Entanglement Hotline: (866) 755-NOAA (866-755-6622)
Jamison Smith (Jamison.Smith@noaa.gov), East Coast Disentanglement Coordinator
Phone: (978) 281-9336
Fax: (978) 281-9394

**Southeast** (NC, SC, GA, FL, AL, MS, LA, TX, PR, VI)
Blair Mase-Guthrie (Blair.Mase@noaa.gov), Stranding Coordinator
National Marine Fisheries Service
75 Virginia Beach Drive
Miami, FL 33149
Phone: (305) 361-4586
Fax: (305) 361-1462

Erin Fougeres (Erin.Fougeres@noaa.gov), Stranding Program Administrator

National Marine Fisheries Service
263 13th Avenue South
St. Petersburg, FL 33701
Phone: (727) 824-5312
Fax: (727) 824-5309

**West Coast**
Brent Norberg (Brent.Norberg@noaa.gov), Stranding Coordinator (WA/OR)
National Marine Fisheries Service
7600 Sand Point Way NE
Seattle, WA 98115
Phone: (206) 526-6550
Fax: (206) 526-6736
Large Whale Entanglement Hotline: 1-877-SOS-WHALE (1-877-767-9425)

Kristin Wilkinson (Kristin.Wilkinson@noaa.gov), Assistant Stranding Coordinator (WA/OR)
Phone: (206) 526-4747

Justin Viezbicke (Justin.Viezbicke@noaa.gov), Stranding Coordinator (CA)
National Marine Fisheries Service
501 West Ocean Boulevard, Suite 4200
Long Beach, CA 90802
Phone: (562) 980-3230
Fax: (562) 980-4027

Justin Greenman (Justin.Greenman@noaa.gov), Assistant Stranding Coordinator (CA)
Phone: (562) 980-3264

**Pacific Islands** (HI, Guam, American Samoa, Commonwealth of the Northern Mariana Islands)
David Schofield (David.Schofield@noaa.gov), Stranding Coordinator
1601 Kapiolani Boulevard, Rm 1110
Honolulu, HI 96814
Phone: (808) 944-2269
Fax: (808) 973-2941
**Sea Turtles** (http://www.nmfs.noaa.gov/strandings.htm)

**Northeast/ Greater Atlantic** (ME, NH, MA, RI, CT, NY, NJ, PA, DE, MD, VA)
http://www.greateratlantic.fisheries.noaa.gov/prot_res/stranding/

| | | |
|---|---|---|
| Kate Sampson | Sea Turtle Stranding & Disentanglement Coordinator | 978-282-8470 |

**Southeast** (NC, SC, GA, FL, AL, MS, LA, TX, PR, VI)

***http://www.sefsc.noaa.gov/species/turtles/stranding_coordinators.htm***

**West Coast**
http://www.westcoast.fisheries.noaa.gov/protected_species/sea_turtles/marine_turtles.html
To report a dead, injured or stranded sea turtle, please call: ***1-800-853-1964***

**Pacific Islands** (HI, Guam, American Samoa, Commonwealth of the Northern Mariana Islands)
***http://www.pifsc.noaa.gov/marine_turtle/***
Report stranded, entangled, or injured marine turtles by calling the Turtle Research Program at(808) 725-5730, or see the Marine Turtle Stranding Contact Information page for more numbers. http://www.pifsc.noaa.gov/marine_turtle/strandings.php

| | |
|---|---|
| MEMORANDUM FOR: | Cathy Tortorici, Director<br>ESA Interagency Coordination Division (F/PRS)<br>National Marine Fisheries Service |
| FROM: | Zdenka S. Willis, Director Zdenka S. Willis<br>U.S. Integrated Ocean Observing System (IOOS®) Program<br>National Ocean Service |
| DATE: | January 4th, 2016 |
| SUBJECT: | Endangered Species Consultation on the IOOS® Programmatic Environmental Assessment |

In November 2014, in response to correspondence from my office, you provided a biological opinion with respect to potential impacts on species listed under the Endangered Species Act that may be impacted by actions described in the U.S. Integrated Ocean Observing System (IOOS®) Programmatic Environmental Assessment (PEA). Subsequent to that consultation, the U.S. IOOS Office revised the PEA to expand the alternatives considered. The Draft PEA proposed an alternative that would allow for full implementation of the IOOS based on estimates developed in 2010. Since that time, budget authorizations have not allowed for implementation of the Full Capabilities Build Out Alternative. Therefore, IOOS reevaluated the impacts based on recent budget proposals that are more consistent with current budget authorizations.

The attached Final PEA was prepared and forwarded to your office for review. A new Proposed Action was included that encompasses the same activities identified in the Draft PEA, but at reduced levels due to funding restraints (i.e., referred to as the Proposed Action/Preferred Alternative). No new actions were proposed. This memorandum is to verify that the potential impacts on listed species identified for the Proposed Alternative in the Final PEA are of similar nature but reduced magnitude than those identified in the Draft PEA, on which the biological opinion was based.

In the Final PEA, IOOS remains committed to implementing the measures agreed to in the November 2014 Biological Opinion to avoid, reduce, or mitigate any potential impacts on listed species. Thank you for your assistance in this consultation. If you have any questions, please contact me or Ms. Regina Evans at regina.evans@noaa.gov or 301-713-3290 x110.

cc: Jessica Snowden, IOOS Program
Regina Evans, IOOS Program

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

December 22, 2015

Zdenka S. Willis
Director, U.S. Integrated Ocean Observing System (IOOS)
NOAA National Ocean Service
1100 Wayne Avenue
Silver Spring, MD 20910

Dear Ms. Willis:

Thank you for sharing the Revised Draft Programmatic Environmental Assessment (PEA) for the NOAA U.S. Integrated Ocean Observing System (IOOS) and for requesting programmatic Essential Fish Habitat (EFH) review pursuant to section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). We have reviewed the Revised Draft PEA and have determined that the EFH Conservation Recommendations originally provided in Buck Sutter's July 7, 2014 letter apply to the Revised Draft PEA. We have no further Conservation Recommendations to provide at this time.

If the IOOS program chooses to further revise the Draft PEA based on additional comments, or if any changes are made to expand the IOOS activities within the PEA, NOS must notify the National Marine Fisheries Service (NMFS) Office of Habitat Conservation to discuss whether the programmatic EFH Conservation Recommendations should be revised. Every five years or sooner, as appropriate, NMFS will review the programmatic EFH Conservation Recommendations for the IOOS PEA and determine whether they should be updated to account for new information.

Pursuant to section 305(b)(4)(B) of the MSFCMA, IOOS is required to respond to this letter within 30 days of their receipt.

If you have any questions concerning this letter, please do not hesitate to contact me or Janine Harris of my staff at 301.427.8635.

Sincerely,

Patricia A. Montanio
Director, Office of Habitat Conservation



Printed on Recycled Paper

February 2, 2016

MEMORANDUM FOR: THE RECORD

FROM: Zdenka S. Willis, Director Zdenka S. Willis
U.S. Integrated Ocean Observing System (IOOS®) Program Office

SUBJECT: Incorporation of Comments from the National Marine Fisheries Service, Protected Resources, Permits and Conservation Division into the U.S. IOOS® Programmatic Environmental Assessment and Determination of No Reasonable Likelihood of Incidental Take

BACKGROUND

In 2010, the U.S. Integrated Ocean Observing System® (IOOS®) Program Office developed a Programmatic Environmental Assessment (PEA) to analyze the potential environmental impacts associated with the implementation of U.S. IOOS® Program technologies and activities, including installation, operation, and maintenance. These impacts were analyzed at a programmatic level, evaluating the affected environment and potential environmental consequences from a broad perspective. The area analyzed encompasses the regions of influence (ROIs) for each Regional Association (RA) in which the IOOS® Program currently operates. The programmatic analysis supports future, location-specific analysis, as required, which would focus on the potential issues related to that location and consultation and permitting requirements.

The U.S. IOOS® is composed of six subsystems that represent a collection of components organized to accomplish a specific function or set of functions. These functions include the collection and dissemination of data necessary to measure, track, explain, and predict events related directly and indirectly to weather and climate change, natural climate variability, and interactions between the oceanic and atmospheric environments, including the Great Lakes environment.

Subsequent to the 2010 PEA, the U.S. IOOS® Program Office revised the PEA to expand the alternatives considered. The Draft PEA proposed an alternative that would allow for full implementation of the IOOS® based on estimates developed in 2010. Since that time, budget authorizations have not allowed for implementation of the Full Capabilities Build Out Alternative. Therefore, IOOS® reevaluated the impacts based on recent budget proposals that are more consistent with current budget authorizations.

DISCUSSION

The PEA analyzed the potential impacts of U.S. IOOS® activities on marine mammals and their habitats. The vessels that would be used for oceanographic mooring deployments and routine maintenance activities typically remain on-station or move very slowly and therefore, would not pose a collision threat to marine mammals. Gliders, AUVs, and drifters also operate at very low speeds (0.5 knots) and therefore have unlikely potential for collisions with marine mammals. These gliders have been in operation since 2008 (i.e., for more than 20,000 days) with no report of interference with marine mammals. Additionally, sonar systems would operate at frequencies much higher than those that would audible by marine mammals and the Doppler Current Profilers would operate at approximately 38 kHz, which is well below the level that may interfere with marine mammal and fish behavior. Therefore, it was determined, and stated in the PEA that only negligible adverse impacts on marine mammals would be expected from the continued operation of the U.S. IOOS® Program.

In November 2008, the NMFS Office of Protected Resources issued Letters of Concurrence under the ESA and MMPA stating that no adverse impacts to ESA-listed species, designated and proposed critical habitats, or marine mammals would be expected from implementation of the IOOS® Program.

A Revised Draft PEA was prepared and forwarded to National Marine Fisheries Service (NMFS), Protected Resources Division (PRD) for review on 16 October, 2015. In response to a request for comments by the U.S. IOOS® Program Office on the Revised Draft IOOS® PEA, PRD provided comments via email on November 2, 2015 from Mr. Ben Laws, NMFS Incidental Take Program. The comments requested inclusion of information on the frequencies and sound levels of active acoustic devices that were previously included in the public review Draft PEA, dated November 2014. In response to these comments, Table 1-2, *Representative Types of Active Acoustic Sensors Proposed for Use by U.S. IOOS®* was added to the Final PEA.

CONCLUSION

The commitments to the conservation measures and best management practices that were identified in the consultations and included in the Draft PEA were retained in their entirety. The language in the Draft EA stating that additional tiered analysis and consultation could be necessary once site-specific locations are determined, remains in the PEA. Based on the discussions with Mr. Laws and Mr. Zach Hughes, also of the Incidental Take Program, the U.S. IOOS® Program Office has determined that the proposed action does not have a reasonable likelihood of resulting in the incidental take of marine mammals. Additionally, it was determined that impacts would be negligible to minor and would not require additional consultation. Therefore, the U.S. IOOS® Program Office has made a determination that a MMPA authorization is not warranted.

# Appendix I

## Consultation Regarding Cultural Resources

**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Ms. Judith E. Bittner
State Historic Preservation Officer
Department of Natural Resources
550 W. 7th Avenue
Suite 1260
Anchorage, AK 99501-3557

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Ms. Bittner,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

The U.S. IOOS Program consists of eleven Regional Associations (RAs), which in cooperation with the U.S. IOOS Office, deploys a variety of technologies to collect, analyze, and share data with other research organizations. The RAs operate in all U.S. states and territories. At this point in time, the specific locations of most of the actions that may affect historic properties have not been identified. As discussed in the revised draft PEA, additional review will be conducted for specific actions that may affect historic properties and consultation will be initiated with your office as required at that time.

At this time, we are making the revised draft PEA available for your review and comment. You can access the PEA at: http://www.ioos.noaa.gov/about/governance/environmental_compliance.html.
Any comments should be returned by March 11, 2016 to:

Ms. Regina Evans
U.S. Integrated Ocean Observing System Program
1315 East West Highway, 2nd Floor
Silver Spring, Maryland 20910
regina.evans@noaa.gov

If you have any questions or concerns, please contact Ms. Evans at (301) 713-3290, ext. 110, or via email at regina.evans@noaa.gov.

Sincerely,

Zdenka S. Willis

Zdenka S. Willis
Director, U.S. IOOS

**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Ms. Lisa D. Jones
State Historic Preservation Officer
Alabama Historical Commission
468 South Perry Street
Montgomery, AL 36104

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Ms. Jones,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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Any comments should be returned by March 11, 2016 to:

Ms. Regina Evans
U.S. Integrated Ocean Observing System Program
1315 East West Highway, 2nd Floor
Silver Spring, Maryland 20910
regina.evans@noaa.gov

If you have any questions or concerns, please contact Ms. Evans at (301) 713-3290, ext. 110, or via email at regina.evans@noaa.gov.

Sincerely,

Zdenka S. Willis

Zdenka S. Willis
Director, U.S. IOOS

**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Ms. Julianne Polanco
State Historic Preservation Officer
Office of Historic Preservation
1725 23rd Street
Suite 100
Sacramento, CA 95816

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Ms. Polanco,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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Any comments should be returned by March 11, 2016 to:

Ms. Regina Evans
U.S. Integrated Ocean Observing System Program
1315 East West Highway, 2nd Floor
Silver Spring, Maryland 20910
regina.evans@noaa.gov

If you have any questions or concerns, please contact Ms. Evans at (301) 713-3290, ext. 110, or via email at regina.evans@noaa.gov.

Sincerely,

Zdenka S. Willis

Zdenka S. Willis
Director, U.S. IOOS

.

**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Ms. Kristina Scott
State Historic Preservation Office
One Constitution Plaza
2nd Floor
Hartford, CT 06103

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Ms. Scott,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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Any comments should be returned by March 11, 2016 to:

Ms. Regina Evans
U.S. Integrated Ocean Observing System Program
1315 East West Highway, 2nd Floor
Silver Spring, Maryland 20910
regina.evans@noaa.gov

If you have any questions or concerns, please contact Ms. Evans at (301) 713-3290, ext. 110, or via email at regina.evans@noaa.gov.

Sincerely,

Zdenka S. Willis

Zdenka S. Willis
Director, U.S. IOOS

.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Mr. Robert F. Bendus
State Historic Preservation Officer
Division of Historical Resources
500 South Bronough Street
Tallahassee, FL 32399-0250

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Mr. Bendus,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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Any comments should be returned by March 11, 2016 to:

Ms. Regina Evans
U.S. Integrated Ocean Observing System Program
1315 East West Highway, 2nd Floor
Silver Spring, Maryland 20910
regina.evans@noaa.gov

If you have any questions or concerns, please contact Ms. Evans at (301) 713-3290, ext. 110, or via email at regina.evans@noaa.gov.

Sincerely,

Zdenka S. Willis

Zdenka S. Willis
Director, U.S. IOOS

**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Ms. Lynda Bordallo Aguon
State Historic Preservation Officer
Historic Resources Division
490 Chalan Palasyo
Agana Heights, Guam 96910

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Ms. Bordallo Aguon,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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U.S. Integrated Ocean Observing System Program
1315 East West Highway, 2nd Floor
Silver Spring, Maryland 20910
regina.evans@noaa.gov

If you have any questions or concerns, please contact Ms. Evans at (301) 713-3290, ext. 110, or via email at regina.evans@noaa.gov.

Sincerely,

Zdenka S. Willis

Zdenka S. Willis
Director, U.S. IOOS

**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Ms. Suzanne Case
State Historic Preservation Office
1151 Punchbowl Street
Suite 555
Honolulu, HI 96813

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Ms. Case,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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U.S. Integrated Ocean Observing System Program
1315 East West Highway, 2nd Floor
Silver Spring, Maryland 20910
regina.evans@noaa.gov

If you have any questions or concerns, please contact Ms. Evans at (301) 713-3290, ext. 110, or via email at regina.evans@noaa.gov.

Sincerely,

Zdenka S. Willis

Zdenka S. Willis
Director, U.S. IOOS

**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Mr. Garth Madison
State Historic Preservation Officer
Historic Preservation Agency
313 South 6th street
Springfield, IL 62701

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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Any comments should be returned by March 11, 2016 to:

Ms. Regina Evans
U.S. Integrated Ocean Observing System Program
1315 East West Highway, 2nd Floor
Silver Spring, Maryland 20910
regina.evans@noaa.gov

If you have any questions or concerns, please contact Ms. Evans at (301) 713-3290, ext. 110, or via email at regina.evans@noaa.gov.

Sincerely,

Zdenka S. Willis

Zdenka S. Willis
Director, U.S. IOOS

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Mr. Cameron F. Clark
State Historic Preservation Officer
Historic Preservation & Archaeology
402 W. Washington Street
W256
Indianapolis, IN 4624

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Mr. Clark,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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At this time, we are making the revised draft PEA available for your review and comment. You can access the PEA at: http://www.ioos.noaa.gov/about/governance/environmental_compliance.html. Any comments should be returned by March 11, 2016 to:

Ms. Regina Evans
U.S. Integrated Ocean Observing System Program
1315 East West Highway, 2nd Floor
Silver Spring, Maryland 20910
regina.evans@noaa.gov

If you have any questions or concerns, please contact Ms. Evans at (301) 713-3290, ext. 110, or via email at regina.evans@noaa.gov.

Sincerely,

Zdenka S. Willis

Zdenka S. Willis
Director, U.S. IOOS

**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Ms. Pam Breaux
State Historic Preservation Officer
Office of Historic Preservation
1051 North Third Street
Room 405
Baton Rouge, LA 70802

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Ms. Breaux,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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1315 East West Highway, 2nd Floor
Silver Spring, Maryland 20910
regina.evans@noaa.gov

If you have any questions or concerns, please contact Ms. Evans at (301) 713-3290, ext. 110, or via email at regina.evans@noaa.gov.

Sincerely,

Zdenka S. Willis

Zdenka S. Willis
Director, U.S. IOOS

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Mr. Earle G. Shettleworth, Jr.
State Historic Preservation Officer
Maine Historic Preservation Commission
55 Capitol Street
65 State House Station
Augusta, ME 04333-0065

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Mr. Shettleworth, Jr.,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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Silver Spring, Maryland 20910
regina.evans@noaa.gov

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Sincerely,

Zdenka S. Willis

Zdenka S. Willis
Director, U.S. IOOS

**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Ms. Elizabeth Hughes
State Historic Preservation Officer
Maryland Historical Trust
100 Community Place
3rd Floor
Crownsville, MD 21032-2023

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Ms. Hughes,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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regina.evans@noaa.gov

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Sincerely,

Zdenka S. Willis

Zdenka S. Willis
Director, U.S. IOOS

**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Ms. Brona Simon
State Historic Preservation Officer
Massachusetts Historical Commission
220 Morrissey Boulevard
Boston, MA 02125

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Ms. Simon,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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Silver Spring, Maryland 20910
regina.evans@noaa.gov

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Sincerely,

Zdenka S. Willis

Zdenka S. Willis
Director, U.S. IOOS

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Mr. Brian D. Conway
State Historic Preservation Office
702 West Kalamazoo, 5th Floor
P.O. Box 30740
Lansing, MI 48909-8240

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Mr. Conway,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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1315 East West Highway, 2nd Floor
Silver Spring, Maryland 20910
regina.evans@noaa.gov

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Sincerely,

Zdenka S. Willis

Zdenka S. Willis
Director, U.S. IOOS

**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Mr. Stephen Elliot
State Historic Preservation Office
345 Kellogg Blvd, W.
St. Paul, MN 55102-1903

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Mr. Elliot,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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1315 East West Highway, 2nd Floor
Silver Spring, Maryland 20910
regina.evans@noaa.gov

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Sincerely,

Zdenka S. Willis

Zdenka S. Willis
Director, U.S. IOOS

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Ms. Katie Blount
State Historic Preservation Officer
MDAH Historic Preservation Division
P.O. Box 571
Jackson, MS 39205-0571

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Ms. Blount,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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Silver Spring, Maryland 20910
regina.evans@noaa.gov

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Sincerely,

Zdenka S. Willis

Zdenka S. Willis
Director, U.S. IOOS

**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Ms. Elizabeth H. Muzzey
State Historic Preservation Officer
Division of Historical Resources
19 Pillsbury Street
2nd Floor
Concord, NH 03301-3570

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Ms. Muzzey,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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U.S. Integrated Ocean Observing System Program
1315 East West Highway, 2nd Floor
Silver Spring, Maryland 20910
regina.evans@noaa.gov

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Sincerely,

Zdenka S. Willis

Zdenka S. Willis
Director, U.S. IOOS

**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Mr. Bob Martin
State Historic Preservation Officer
Historic Preservation Office
P.O. Box 420
Trenton, NJ 08625-0420

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Mr. Martin,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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Sincerely,

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Director, U.S. IOOS

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US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Ms. Ruth L. Pierpont
Deputy State Historic Preservation Officer
Division for Historic Preservation
P.O. Box 189
Waterford, NY 12188-0189

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Ms. Pierpont,

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Sincerely,

Zdenka S. Willis

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Director, U.S. IOOS

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Mr. Kevin Cherry
State Historic Preservation Office
109 E. Jones Street
2nd Floor
Raleigh, NC 27601

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Mr. Cherry,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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Sincerely,

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**National Oceanic and Atmospheric Administration**
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Mr. Burt Logan
State Historic Preservation Office
800 E. 17th Avenue
Columbus, OH 43211

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Mr. Logan,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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Director, U.S. IOOS

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**National Oceanic and Atmospheric Administration**
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1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Ms. Lisa Sumption
State Historic Preservation Office
725 Summer Street, NE
Suite C
Salem, OR 97301

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Ms. Sumption,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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Sincerely,

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Director, U.S. IOOS

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**National Oceanic and Atmospheric Administration**
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Mr. James M. Vaughan
State Historic Preservation Officer
Historical and Museum Commission
400 North Street
2nd Floor
Harrisburg, PA 17120-0093

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Mr. Vaughan,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

The U.S. IOOS Program consists of eleven Regional Associations (RAs), which in cooperation with the U.S. IOOS Office, deploys a variety of technologies to collect, analyze, and share data with other research organizations. The RAs operate in all U.S. states and territories. At this point in time, the specific locations of most of the actions that may affect historic properties have not been identified. As discussed in the revised draft PEA, additional review will be conducted for specific actions that may affect historic properties and consultation will be initiated with your office as required at that time.

At this time, we are making the revised draft PEA available for your review and comment. You can access the PEA at: http://www.ioos.noaa.gov/about/governance/environmental_compliance.html. Any comments should be returned by March 11, 2016 to:

Ms. Regina Evans
U.S. Integrated Ocean Observing System Program
1315 East West Highway, 2nd Floor
Silver Spring, Maryland 20910
regina.evans@noaa.gov

If you have any questions or concerns, please contact Ms. Evans at (301) 713-3290, ext. 110, or via email at regina.evans@noaa.gov.

Sincerely,

Zdenka S. Willis

Zdenka S. Willis
Director, U.S. IOOS

**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Mr. Edward Sanderson
State Historic Preservation Officer
Historical Preservation and Heritage Commission
150 Benefit Street
Old State House
Providence, RI 02903

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Mr. Sanderson,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Mr. W. Eric Emerson
State Historic Preservation Office
8301 Parklane Road
Columbia, SC 29223

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Mr. Emerson,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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**National Oceanic and Atmospheric Administration**
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1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Mr. Mark Wolfe
State Historic Preservation Officer
Texas Historical Commission
1511 Colorado Street
Austin, TX 78701

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Mr. Wolfe,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Ms. Julie Langan
State Historic Preservation Officer
Department of Historic Resources
2801 Kensington Avenue
Richmond, VA 23221

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Ms. Langan,

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Sincerely,

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Director, U.S. IOOS

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
US Integrated Ocean Observing System (IOOS®)
1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Ms. Allyson Brooks
State Historic Preservation Officer
Department of Archaeology and Historic Preservation
1110 S. Capitol Way
Suite 30
Olympia, WA 98501

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Ms. Brooks,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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1315 East West Highway, Rm. 2620
Silver Spring, Maryland 20910

February 9, 2016

Mr. Jim Draeger
State Historic Preservation Officer
Wisconsin Historical Society
816 State Street
Madison, WI 53706-1482

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Mr. Draeger,

The National Oceanic and Atmospheric Administration (NOAA), U.S. Integrated Ocean Observing System (IOOS®) Office is notifying you of the availability of the revised draft Programmatic Environmental Assessment (PEA) for the U.S. IOOS Program. The revised draft PEA evaluates the environmental impacts of its proposed buildout of data collection systems and considers enhancements to its infrastructure and technologies to improve its capabilities to collect, analyze, and disseminate information on the natural and anthropomorphic effects on the ocean, coastal, and Great Lakes environments.

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February 9, 2016

Ms. Laura T. Ogumoro
State Historic Preservation Officer
Department of Community and Cultural Affairs
1341 Ascension Court
Capital Caller Box 10007
Saipan, MP 96950

RE: Revised Draft Programmatic Environmental Assessment for the U.S. Integrated Ocean Observing System (IOOS®) Program

Dear Ms. Ogumoro,

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