



Appendices

Final Programmatic Environmental Impact Statement for Surveying and Mapping Projects in U.S. Waters for Coastal and Marine Data Acquisition



National Oceanic and Atmospheric Administration

National Ocean Service

November 2022

**APPENDIX A: SUMMARY OF NOS PROGRAM OFFICES AND THEIR USE OF
ACTIVE ACOUSTIC DATA COLLECTION TECHNOLOGY**

Office of Coast Survey

The Office of Coast Survey carries out NOAA's surveying and charting responsibility pursuant to the Coast and Geodetic Survey Act of 1947 and the Ocean and Coastal Mapping Integration Act of 2009. The Office of Coast Survey's area of responsibility includes United States (U.S.) waters extending seaward to the limits of the U.S. Exclusive Economic Zone (U.S. EEZ) – well over 3 million square nautical miles (nm²) of U.S. waters. The program collects hydrographic data and creates and maintains marine charts and other products to support safe navigation for commercial shipping, the fishing industry, recreational boaters, and state and local governments. Hydrographic data are collected with Office of Coast Survey vessels, NOAA Office of Marine and Aviation Operations (OMAO) vessels, chartered (contracted) vessels, and opportunistically from other government, academic, and industry mapping efforts. The data and data products also support military and government operations. NOAA has identified 500,000 nm² within the U.S. EEZ as “navigationally significant waters,” which are areas in greater need of modern hydrographic surveying. The Coast Survey Development Laboratory (CSDL) explores, develops, and transitions emerging technologies and techniques for charting, hydrographic, and oceanographic systems to support safe and efficient marine navigation and a healthy and sustainable coastal environment. The Joint Hydrographic Center, with its University of New Hampshire academic partner, conducts applied research and development on hydrographic and ocean mapping topics.

The Office of Coast Survey acquires hydrographic data to update the nation's nautical charts with the accuracy essential to maintain the public trust in navigational products. The public may access survey data at NOAA's National Centers for Environmental Information (NCEI), formerly the National Geophysical Data Center, and nautical charts are available from a variety of sources, including Coast Survey's website. Office of Coast Survey activities include surveying navigationally significant areas annually using four OMAO ships (all of which are equipped with survey boats or “launches”), six navigation response team (NRT) survey boats, a 54-foot research vessel, and chartered vessels operated by private contractors.

The Office of Coast Survey contracts approximately half of its hydrographic survey projects. Contractors often use the same vessels from year to year, regardless of whether the vessels are chartered (i.e., “vessels of opportunity”) or owned by the contract firm. During transits, contractors operate under all of the normal regulations for vessels in the area, using shipping lanes, recommended routes, and natural channels as appropriate. Currently, the Coast Survey Development Laboratory is evaluating the use of Autonomous Underwater Vehicles (AUVs) and uncrewed surface vehicles (USVs) as tools for hydrographic surveying. The use of AUVs and USVs could greatly increase survey efficiency. Additionally, AUVs could be used for marine incident response and port security surveys due to their small size and flexible deployment options. The Office of Coast Survey funds hydrographic and ocean mapping research at the Joint Hydrographic Center via cooperative agreement.

Center for Operational Oceanographic Products and Services

The Center for Operational Oceanographic Products and Services (CO-OPS) and its predecessors have gathered oceanographic data along our nation's coasts for over 200 years. CO-OPS is the authoritative source for accurate, reliable, and timely measurements that support safe and efficient maritime commerce, sound coastal management, and recreation. CO-OPS maintains over 200 continuously operating water level stations throughout the U.S. and its territories, data from which support water level forecasts and real time observations, determination of water level based datums, and monitoring of long term trends in mean sea level (msl). The National Water Level Observation Network (NWLON) provides historical and present-day water level information to understand the patterns of water level trends and

high tide events. The entire collection of water level data forms the basis of many NOAA products and services that have evolved to support both national and local needs. CO-OPS also developed and maintains the Physical Oceanographic Real-Time System (PORTS[®]), a tool that integrates real-time environmental observations, forecasts, and other geospatial information from measurements of water levels, currents, salinity, and meteorological parameters (e.g., winds, atmospheric pressure, air and water temperatures). CO-OPS disseminates observations and predictions derived from these data to improve the safety and efficiency of maritime commerce and coastal resource management. The Ocean Systems Test and Evaluation Program (OSTEP) lab explores, develops, and transitions emerging technologies and techniques for collecting tidal and current data and oceanographic systems to support safe and efficient marine navigation and a healthy and sustainable coastal environment.

CO-OPS' water level stations and PORTS Program use hydroacoustic tools associated with their tidal gauges and water level stations. A number of water level stations and current survey applications require implementation of an Acoustic Doppler Current Profiler (ADCP) along with an acoustic water level sensor that operates above the water.

For maritime navigation in harbors and coastal waterways, real-time water level information reduces risks to life, property, and the coastal environment. Real-time water level data from a nearby gauge provides mariners with the tide levels to inform decision-making to avoid groundings. This information is collected through ADCPs in the form of side-lookers, bottom-lookers, or bottom mounted devices, depending on the specific PORTS station requirements.

National Centers for Coastal Ocean Science

The National Centers for Coastal Ocean Science (NCCOS) conducts and funds research in support of NOS core priorities. In addition, NCCOS research focuses on four thematic priority areas: 1) coastal change: vulnerability, mitigation, and restoration; 2) marine spatial ecology; 3) stressor impacts and mitigation (e.g., harmful algal blooms) and 4) social science. NCCOS conducts work nationally through its facilities located in Silver Spring, MD; Charleston, SC; Beaufort, NC; Oxford, MD; and Kasitsna Bay, AK and funds external grant recipients nationwide through the Competitive Research Program. The majority of the NCCOS hydroacoustics survey work is conducted through the Biogeography Branch, which develops detailed benthic habitat and fish distribution maps via hydroacoustic or visual methods (e.g., self-contained underwater breathing apparatus (SCUBA) diving, remotely operated vehicle (ROV) surveys, video cameras, etc.). The results of these data are used, among other things, to: (1) identify areas that may be high priorities for management or protection; (2) inform renewable energy infrastructure or aquaculture; and (3) understand the mechanisms that influence the distribution and connectivity of fishery resources.

NCCOS hydroacoustic activities currently involve developing innovative ecosystem maps, models, and assessments to guide communities in managing coastal ecosystems. Multibeam, single/splitbeam and side-scan sonar data are used to develop benthic seafloor habitat or cultural resource maps, as well as maps on the distribution and biomass of fishery resources. NCCOS also uses ROVs, AUVs, drop cameras, and divers to ground truth the benthic habitat maps for accuracy. NCCOS conducts mapping and other survey work nationwide in estuaries, and in marine ecosystems – especially in marine protected areas (MPAs), National Marine Sanctuaries, and coral reefs. Habitat maps enhance the ability of coastal managers and policy makers to assess, protect, and preserve the condition of marine ecosystems and are essential tools for ocean planning and ecosystem management. By providing the baseline data on the ecological condition of reefs and other natural resources, these data can show conservation efficacy over

time. They are most often used by federal and state planners to identify areas in need of enhanced management (e.g., protection of fish spawning areas and deep coral habitats) and facilitate informed decisions and proper placement of offshore energy development and aquaculture, as well as the examination of proposed changes in national marine sanctuary boundaries. Through acoustic sonar technologies, NCCOS has advanced understanding of the connectivity, distribution, abundance, ecology, and ecological condition of marine ecosystems. These ecosystems are often difficult to survey due to their remoteness (i.e., deep-sea habitats).

Office for Coastal Management

The Office of Coastal Management (OCM) is composed of four principal programs: Coastal Zone Management Program, National Estuarine Research Reserve System, Coral Reef Conservation Program (CRCP), and Digital Coast Program. Major components of the Coastal Zone Management Program include federal consistency, nonpoint pollution control, and coastal zone enhancements. Thirty-four states and territories currently participate in the voluntary partnership. OCM provides annual cooperative agreements to these states for diverse projects that manage and enhance coastal areas. There are 29 National Estuarine Research Reserves to which NOAA provides annual funding and technical guidance. Much of the day-to-day management is conducted by states or universities, in coordination with state and local partners. These reserves aim to protect and study important estuaries that, collectively, encompass more than 1.3 million acres. Program goals are purposefully broad and could include use of a wide array of hydroacoustic methods, such as tracking fish habitat utilization. The Coral Reef Conservation Act of 2000 established the CRCP to protect, conserve, and restore the nation's coral reefs. The Program brings together expertise from across NOAA to address impacts from climate change and related ocean acidification, land-based sources of pollution and unsustainable fishing practices. It partners with state and territorial governments, academic institutions, non-governmental organizations (NGOs), and community groups. The Program provides annual funds to support coral conservation projects and scientific studies to address the three primary threats. Finally, NOAA developed Digital Coast to provide coastal data and the tools, training, and other information necessary to make those data useful. Data sets range from economic data to satellite imagery and are designed to be most useful to the coastal management community.

OCM provides funds to coastal states and National Estuarine Research Reserves to conduct site-specific sonar benthic mapping exercises, though this occurs infrequently. OCM also provides funds to other levels of government (state, local, foreign), as well as to academia and non-profits, via grants, cooperative agreements, or contracts.

The CRCP provides funds to other parts of NOAA (e.g., NCCOS, Office of National Marine Sanctuaries [ONMS], and National Marine Fisheries Service [NMFS]), which may engage in hydroacoustic work. These “action offices” conduct any necessary NEPA analyses of those activities. In addition, CRCP develops and implements contracts, MOUs, and grants to federal, foreign, state, and local governments, as well as academia and NGOs.

Some of the projects that have been funded through OCM include:

- Side scan sonar in the Hudson River;
- Acoustic backscatter imagery; and
- Benthic habitat mapping in the Tortugas area of south Florida and other areas as part of the Marine Cadastre for ocean use planning.

Office of National Marine Sanctuaries

ONMS is the federal agency that oversees the fifteen sites in the National Marine Sanctuary System and two Marine National Monuments. Together, these protected areas encompass more than 600,000 square miles of ocean and Great Lake waters. National Marine Sanctuaries have been established via acts of Congress or an administrative process for focused, long-term management. The two Marine National Monuments (Papahānaumokuākea and Rose Atoll) were designated by Presidential proclamation under the Antiquities Act.

Sanctuaries and monuments contain unique resources, including: deep ocean habitats, kelp forests, coral and temperate reefs, whale migration corridors, deep-sea canyons, and historically significant shipwrecks and other underwater archaeological sites. Organizationally, the Sanctuary System is divided into four regions: Northeast and Great Lakes; Southeast Atlantic, Gulf of Mexico, and Caribbean; West Coast; and Pacific Islands. The mission of ONMS is to identify, protect, conserve, and enhance the natural and maritime heritage resources, values, and qualities of the National Marine Sanctuary System for present and future generations. The National Marine Sanctuaries Act (NMSA) is the governing statute for all designated sanctuaries. The act authorizes the U.S. Secretary of Commerce to designate as national marine sanctuaries areas of the marine environment or Great Lakes with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archeological, educational, or aesthetic qualities.

Each sanctuary and marine national monument conducts a number of field operations that support management, research, and education objectives. Sanctuary vessel operations include all activities conducted on the water from an ONMS small boat or via an ONMS-sponsored mission. These include, but are not limited to, research, education, outreach, marine or cultural resource and habitat assessments, restoration activities, marine mammal disentanglement, and law enforcement. All ONMS vessels must comply with the operational protocols and procedures in the NOAA Small Boats Policy (NAO 209-125).

Hydroacoustic operations may include the use of AUVs, ROVs, and towed gliders; bathymetric and seafloor habitat mapping; and remote sensing. Underwater sampling platforms such as AUVs, ROVs, and ocean gliders may feature acoustic sensors that can be deployed to monitor whales and their habitat, survey the seafloor for entanglement threats, and monitor water quality and ocean conditions (e.g., detecting hypoxia and ocean acidification).

ONMS vessels may be used to deploy passive acoustic monitoring equipment that is anchored to the sea floor and may also tow or deploy drifting passive acoustic monitoring equipment. Passive acoustic devices are used to study biological and anthropogenic sound and behavior of marine animals. Some equipment and instruments, such as ROVs, hydrophones, and towed camera systems, may be tethered to the ship and towed behind a vessel, or are otherwise operated from a vessel. AUVs are ROVs that are usually launched from the ship with a pre-programmed navigation route and then recovered once the AUV track has been completed. All of the technologies are operated pursuant to valid permits and regulations.

Other acoustic equipment may be deployed using snorkelers or SCUBA divers, or from vessels. Towing missions normally occur monthly to quarterly. Equipment, such as hydrophones or other acoustic receivers, is often deployed within a sanctuary by anchoring it with cable ties, brackets, or clamps to existing infrastructure (e.g., buoys, channel markers), weights, or lengths of rebar that have been installed by SCUBA divers using hammers or pneumatic drills. In some cases, acoustic tags may be attached to fish to monitor movement and to marine mammals for tracking and research pursuant to NMFS, Endangered

Species Act (ESA), and Marine Mammal Protection Act (MMPA) permits. OMAO vessels are used to deploy AUVs, ROVs, towed magnetometers, multibeam echo sounders, and side scan sonars in order to inventory resources and document new maritime heritage sites. Aircraft use lidar in nearshore areas for long-term monitoring and to characterize shallow-water benthic and intertidal habitats.

Diver surveys are sometimes used to supplement normal remote sensing surveys and are particularly helpful in shallow areas of high topographical complexity. Divers working to ground-truth remotely sensed information may be stationary at a single site or towed behind a boat at approximately 3 knots/hour when surveying larger areas of the marine environment.

Office of Response and Restoration

The Office of Response and Restoration (ORR) is a center of expertise in preparing for, evaluating, and responding to threats to coastal environments, including oil and chemical spills, releases from hazardous waste sites, and marine debris. Within ORR, the Emergency Response Division provides scientific expertise for responses to oil and chemical spills in U.S. marine and coastal waters. Its efforts facilitate spill prevention, preparedness, response, and restoration at national and local levels. The Assessment and Restoration Division conducts natural resource damage assessments with the objective of restoring natural resources injured by releases of oil and hazardous substances in marine and coastal waters. The Marine Debris Division (MDD) undertakes national and international efforts focused on researching, reducing, and preventing debris in the marine environment.

ORR hydroacoustic data collection may include the use of various devices such as ADCPs and echo sounders to track and map oil plumes and to characterize fish and plankton presence. ORR's MDD funds marine debris research, prevention, and removal activities. Since 2006, the MDD has supported more than 135 removal projects across the country and has removed more than 12 million pounds of debris from the oceans. To accomplish this, the MDD may perform and fund activities that use sensing technologies for the detection and subsequent removal of submerged marine debris. These technologies include: multibeam and side-scan sonar, side-imaging sonar, ROVs and AUVs with cameras or other sensors attached, diver towed video, and propeller cameras. The sonar systems typically used by the MDD-funded projects are commercially-available, low powered, high frequency systems, not fundamentally different from those used by most recreational boats and fishing vessels.

Integrated Ocean Observing System

The Integrated Ocean Observing System (IOOS) is a national-regional partnership that provides observational coastal data, forecasts, and new tools to improve safety, enhance the economy, and protect the environment. Integrated ocean information is available in near real time, as well as retrospectively, and improves NOAA's ability to understand and predict coastal storms, wave heights, and sea level change. The IOOS Program Office is organized into two divisions that implement policies, protocols, and standards to implement IOOS and oversee daily operations and coordination: (1) Operations Division (Ops) and (2) Regions, Budget, and Policy (RB&P). Ops coordinates the contributions of federally-owned observing and modeling systems and develops and integrates non-federal observing and modeling capacity into the system in partnership with IOOS regions. Ops serves as the system architect for data processing, management, and communications in accordance with standards and protocols established by the National Ocean Council, and leads nationwide program integration for modeling development, undersea glider operations, high frequency radar, and animal telemetry. RB&P oversees functions such as management, budgeting, execution, policy, and regional and external affairs. Additionally, RB&P initiates

and maintains relationships to encourage participation in U.S. IOOS by federal agencies, non-federal groups, and industries.

Technologies deployed and observational activities under the IOOS program can be categorized as: 1) passive sensors and instrumentation; 2) vessels and sampling; 3) AUVs, gliders, and drifters; 4) moorings, marine stations, buoys, and fixed arrays; 5) high frequency radar; 6) sonar; and 7) lidar.

Marine vessels, including personal watercraft, may be used to implement, operate, and maintain aspects of the IOOS program. Activities may range in size and involve 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.

Office of National Geodetic Survey

The National Geodetic Survey (NGS) has, for more than 200 years, provided the nation with geodetic and geographic positioning services. NGS provides a common reference framework, the National Spatial Reference System (NSRS), for establishing the coordinate positions of all geographic and geospatial data. The foundational elements – latitude, longitude, elevation, shoreline information, and their changes over time – contribute to informed decision making and impact a wide range of important activities including mapping and charting, navigation, flood risk determination, transportation, land use, and ecosystem management.

NGS delineates the shoreline through various photogrammetric sources, including tide-coordinated stereo aerial photographs, commercial satellite imagery, Light Detection and Ranging (lidar), and related remote sensing technologies. The data-gathering process results in a vector database of the national shoreline and products such as high-resolution aerial frame photographs, orthoimagery, and coastal lidar data sets.

processing, management, and communications in accordance with standards and protocols established by the National Ocean Council, and leads nationwide program integration for modeling development, undersea glider operations, high frequency radar, and animal telemetry. RB&P oversees functions such as management, budgeting, execution, policy, and regional and external affairs. Additionally, RB&P initiates and maintains relationships to encourage participation in U.S. IOOS by federal agencies, non-federal groups, and industries.