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Ocean Exploration and Research

Cruise Report: EX-17-03
Discovering the Deep: Exploring Remote Pacific Marine Protected Areas (ROV and Mapping)

U.S. Marine Protected Areas in the Central and Western Pacific

March 7, 2017 to March 29, 2017
Āpia, Sāmoa, to Āpia, Sāmoa

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Abstract

From March 7 to 29, 2017, the National Oceanic and Atmospheric Administration (NOAA) Office of Ocean Exploration and Research (OER) and partners conducted a 23-day, telepresence-enabled expedition on NOAA Ship *Okeanos Explorer* to collect critical baseline data and information about unknown and poorly understood deepwater areas surrounding the Howland and Baker Unit of the Pacific Remote Islands Marine National Monument (PRIMNM), the Republic of Kiribati's Phoenix Islands Protected Area (PIPA), and around New Zealand's Territory of Tokelau as a part of a three-year Campaign to Address Pacific monument Science, Technology, and Ocean NEeds (CAPSTONE). The goal of the expedition was to use remotely operated vehicle (ROV) dives in combination with mapping operations to increase scientific understanding of deep-sea ecosystems of this region, as well as to provide a foundation of publicly-accessible data to support further exploration, research, and management activities.

Using OER's dual-body ROV, the expedition conducted 19 ROV dives that ranged in depth from 300 to 5,862.9 meters. Hundreds of species were observed, including first-time in situ observations of some species and previously unseen behaviors of others; several significant range extensions were also documented. During the expedition, 171 total samples were collected from both biological and geological samples with 80 biological samples collected (38 primary 128 associated and commensal taxa), some of which may be undescribed species. While five rock samples were collected for geological composition analysis and age dating. During the expedition, over 30,100 square kilometers were mapped using high-resolution sonars, including areas with previously limited seafloor mapping.

All data collected during the expedition, including video, environmental, mapping, oceanographic, and meteorological data, have been made publically available through the national archives.

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Table of Contents

Figures

Tables

1. Introduction

By leading national efforts to explore the ocean and make ocean exploration more accessible, the NOAA Office of Ocean Exploration and Research (OER) is filling gaps in basic understanding of deep waters and the seafloor, providing deep-ocean data, information, and awareness. Exploration within the U.S. Exclusive Economic Zone (EEZ) and international waters was conducted as part of the three-year Campaign to Address Pacific monument Science, Technology, and Ocean NEeds (CAPSTONE), a foundational science initiative to collect deepwater baseline information to support science and management decisions in and around the U.S. marine protected areas in the central and western Pacific. This effort supported key NOAA, national, and international goals to better understand and manage the ocean and its resources.

Using the latest tools and technology, OER explores unknown areas of the deep ocean. NOAA Ship *Okeanos Explorer* is one such tool. Working in close collaboration with government agencies, academic institutions, and other partners, OER conducts deep-sea exploration expeditions using advanced technologies on *Okeanos Explorer*, mapping and exploring unknown or poorly understood areas of the ocean. . Collected data about deep waters and the seafloor—and the resources they hold—establishes a foundation of information and fills gaps in the unknown.

All data collected during *Okeanos Explorer* expeditions adhere to federal open-access data standards and are publicly available shortly after an expedition ends. This ensures the delivery of reliable scientific data needed to identify, understand, and manage key elements of the ocean environment.

Exploring, mapping, and characterizing in and around the U.S. EEZ are necessary for a systematic and efficient approach to advancing the development of ocean resources, promoting the protection of the marine environment, and accelerating the economy, health, and security of our nation. As the only federal program dedicated to ocean exploration, OER is uniquely situated to lead partners in delivering critical deep-ocean information to managers, decision makers, scientists, and the public, leveraging federal investments to meet national priorities.

1.1 CAPSTONE

Data collected during expeditions on *Okeanos Explorer* from 2015-2017 directly contributed to the three-year CAPSTONE initiative

(https://oceanexplorer.noaa.gov/okeanos/explorations/capstone/welcome.html, Last accessed March 2021) to collect deepwater baseline data and information to support science and management decisions in and around U.S. Marine National Monuments and Sanctuaries located throughout the Pacific. This initiative served as an opportunity for NOAA and the nation to highlight the uniqueness and importance of these designated areas. The primary goal of all *Okeanos Explorer* expeditions in this campaign was to obtain baseline characterizations of the poorly known deepwater areas and resources in these extensive marine protected areas (MPAs).

2. Expedition Overview

From 7, March, 2017 to 29, March, 2017, OER and partners conducted a telepresence-enabled ocean exploration expedition on *Okeanos Explorer* to collect critical baseline data and information, and to improve knowledge about unexplored and poorly understood deepwater areas of the Pacific Remote Islands Marine National Monument (PRIMNM), the Republic of Kiribati's Phoenix Islands Protected Area (PIPA), and New Zealand's Territory of Tokelau—all of which are found in the central and western Pacific. The *Discovering the Deep: Exploring Remote Pacific Marine Protected Areas* expedition (EX-17-03) was part of a series of expeditions contributing to the CAPSTONE campaign.

2.1 Rationale for Exploration

The PRIMNM was established by President Bush in January 2009 through Presidential Proclamation 8336, and then expanded upon by President Obama in September 2014 with Presidential Proclamation 9173. The area, jointly managed by NOAA and the U.S. Fish and Wildlife Service (USFW), now covers 495,189 square miles (1,282,534 square kilometers) in the central Pacific Ocean. The NOAA Pacific Islands Fisheries Science Center's (PIFSC's) Rapid Assessment and Monitoring Program (RAMP) has conducted near-shore and shallow-water ecosystem assessments of the area since 2000, establishing baseline ecosystem assessments and initiating long-term monitoring trends for these unexplored areas. However, this expedition was the first to explore the deep-sea ecosystem of the PRIMNM.As part of the planning for this expedition, NOAA collaborated with the scientific and management community to assess the exploration needs and data gaps in unknown and poorly understood areas of this region.

Data and information from this expedition will help to improve scientific understanding of the deep-ocean habitats of the central and western Pacific within and around the PRIMNM, the PIPA, and Tokelau—and will broaden scientific understanding of marine life, ecosystem functions, and climate change processes. They will also inform deep-sea management plans for

habitat areas of particular concern (HAPCs), MPAs, and national marine sanctuaries; support local scientists and managers seeking to understand and manage deep-sea resources; and stimulate subsequent exploration, research, and management activities.

2.2 Objectives

Operations for this cruise were conducted 24 hours per day and included exploration within several MPAs. The expedition commenced on March 7, 2017, in Āpia, Sāmoa (13°51.03' S, 171°45.08'W, and concluded on March 29, 2017, in Āpia, Sāmoa. Exploration mapping occurred in Tokelau waters, the PIPA, the Howland and Baker Unit of the PRIMNM, the National Marine Sanctuary of American Sāmoa (NMSAS), and within the waters of the Independent State of Sāmoa. This expedition helped to establish a baseline of data and information in the region to catalyze further exploration, research, and management activities.

NOAA Ship *Okeanos Explorer* cruises, in general, have a large number of objectives that can be categorized as being either scientific or programmatic in nature. Typically, science objectives are specific to a particular cruise or set of cruises, whereas programmatic objectives (i.e., operations, telepresence, data management, and education and outreach) are mostly common to all cruises. Below are brief descriptions of the science and programmatic objectives for EX-17-03.

2.2.1 Science Objectives

The expedition addressed scientific themes and priority areas put forward by NOAA scientists and resource managers, BOEM, USGS, and the broad ocean science community indicated in the EX-17-03 Project Instructions found at https://repository.library.noaa.gov/view/noaa/14789 (Last accessed December 2020). The primary objective of the expedition was to survey deepwater areas offshore, within, and around the PRIMNM and the PIPA to provide baseline data and information to support science and management needs. Specifically, this expedition sought to:

- Acquire data to support priority Monument and Sanctuaries science and management needs, including habitat surveys in recently expanded boundary areas.
- Identify and characterize vulnerable marine habitats—particularly potential locations for high-density deep-sea coral and sponge communities.
- Explored seamounts within the Prime Crust Zone (PCZ). The PCZ is the area of the Pacific with the highest expected concentration of deep-sea minerals, including rare metals and rare earth elements.

- Collect information on the geologic history of central Pacific seamounts, including those that are—or may be—relevant to scientific understanding of plate tectonics and subduction zone biology and geology.
- Provide a foundation of publicly-accessible data and information products to spur further exploration, research, and management activities.
- Collect high-resolution bathymetry in areas with no or low-quality mapping data.
- Acquire a foundation of ROV, sonar, and oceanographic data to better understand the characteristics of the water column and fauna that live there.
- Engage a broad spectrum of the scientific community and the public in telepresence-based exploration.

2.2.2 Programmatic Objectives

Mapping and ROV Operations

Mapping objectives during each NOAA Ship *Okeanos Explorer* cruise were to collect high-resolution acoustic data. Data were collected from all four types of sonars on the ship: EM 302 multibeam, EK60 echo sounder, 3.5 kHz sub-bottom profiler (SBP), and acoustic Doppler current profilers (ADCPs). Mapping data were acquired during transits, as well as on specific targets identified by the science team. Data from these systems were processed as quickly as possible in order to generate daily mapping products that supported ROV operations. Data quality was high, as a result of proper instrument maintenance, careful planning of the surveys, and appropriate calibration of the instruments. The standard operating procedure (SOP) for the multibeam sonar is to obtain sound velocity profiles at regular intervals—no longer than six hours—using expendable bathythermographs (XBTs).

ROV objectives were to obtain high-quality video and sensor data on exploration targets to achieve the science objectives. This most often involved surveying benthic habitats and features in priority areas (e.g., deep corals and related benthic ecosystems, canyons, and seamounts), as well as occasionally surveying in midwater for water column organisms. Benthic surveys were not only used to characterize the habitats in each target area, but also to ground truth the acoustic data with visual data (i.e., video). Additionally, limited sampling operations were conducted to target potential new species, new records, rare morphotypes, or other biological and geological samples that were needed to gain a better understanding of the dive site.

Telepresence

Telepresence objectives were to provide real-time, high-quality video and audio during ROV dives to as wide a shoreside audience as possible. This audience included the general public, students, and a globally distributed shore-based science teamTelepresence was used to help

achieve the science objectives by extending the science team well beyond those onboard the ship. Shorebase scientists actively engaged with the at-sea team via teleconference or instant messaging (Cantwell et al, 2020). Telepresence also helped to achieve the expedition's education and outreach objectives through live ship-to-shore events.

Data Management

Data management objectives were to collect, process, distribute, and archive cruise data as quickly and efficiently as possible. Effective data management provided a foundation of publicly-accessible information products to spur further exploration, research, and management activities; it also stimulated interest in the deep-sea environment and the excitement of exploration.

Education and Outreach

Education and outreach objectives included the engagement of the general public in ocean exploration through live video and a variety of other web-based products, both during and after each cruise. Web content included topical essays written before the cruise, daily updates, mission logs, highlight videos, still imagery, and mapping products—all of which are posted on the OER expedition website at https://oceanexplorer.noaa.gov/okeanos/explorations/ex1703/welcome.html (Last accessed March 2021). Additional activities, including live telepresence events and ship tours, helped to expand the reach of this expedition and are summarized in section 8.

3. Participants

EX-17-03 included onboard mission personnel as well as shore-based science personnel who participated remotely via telepresence technology. See **Table 1** and **Table 2** for lists of onboard and shore-based personnel who supported EX-17-03.

Table 1. EX-17-03 onboard mission team personnel.

Name (First, Last)	Title	Affiliation
Brian Kennedy	Expedition Coordinator	OER
Amanda Demopoulos	Biology Science Lead	USGS
Steven Auscavitch	Biology Science Lead	UCAR/Temple
Katharine Weathers	Sample Data Manager	NOAA National Centers for Environmental Information (NCEI)
Derek Sowers	Mapping Lead	OER/ERT, Inc.

Jason Meyer	Mapping Watch Lead	University Corporation for Atmospheric Research (UCAR)
Karl McLetchie	Engineering Team	Global Foundation for Ocean Exploration (GFOE)
Fernando Aragon	Engineering Team	GFOE
David Casagrande	Engineering Team	GFOE
Andy Lister	Engineering Team	GFOE
Levi Unema	Engineering Team	GFOE
Jeff Laning	Engineering Team	GFOE
Andrew O'Brien	Engineering Team	GFOE
Sean Kennison	Engineering Team	GFOE
Don Liberatore	Engineering Team	GFOE
Annie White	Engineering Team	GFOE
Joe Biscotti	Engineering Team	GFOE
Emily Narrow	Engineering Team	GFOE
Chris Ritter	Engineering Team	GFOE
Caitlin Bailey	Engineering Team	GFOE
Roland Brian	Engineering Team	GFOE
Adrienne Copeland	Web Coordinator	OER
LTJG Nikolai Pawlenko	Expedition Coordinator Trainee	OER

Table 2. EX-17-03 shore-based science team members.

Name	Email	Affliction
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4. Methodology

To accomplish its objectives, EX-17-03 used the:

- Dual-bodied ROV system (ROVs *Deep Discoverer* and *Seirios*) to conduct daytime seafloor and water column surveys, as well as to collect a limited number of samples to help further characterize the deepwater fauna and geology of the region.
- Sonar systems (Kongsberg EM 302 multibeam sonar, Knudsen 3260 SBP, Simrad EK60 split-beam sonars, and Teledyne ADCPs) to conduct mapping operations at night and when the ROVs were on deck.
- High-bandwidth satellite connection to provide real-time ship-to-shore communications (telepresence).

All ROV and Mapping data collected by NOAA were covered by a data management plan (Appendix A) to ensure they are archived and publicly accessible. 4.1 ROV Seafloor Surveys

ROV dive operations supported the expedition objectives in Section 2.2 and included high-resolution visual surveys of seafloor as well as geological and biological sampling. During each dive, the ROVs descended to the seafloor and then moved from waypoint to waypoint, documenting the geology and biology of the area. Each ROV dive was approximately 7.5-10 hours, conditions and logistics permitting. Dives were primarily conducted during the day

(operations described in detail by Quattrini et al., 2015, and Kennedy et al., 2019). Additional information about the general process of site selection, collaborative dive planning, scientific equipment on the ROVs, and the approach to benthic exploration used on *Okeanos Explorer* can be found in Kennedy et al. (2019).

Onboard and shore-based scientists identified each encountered organism to the lowest taxon possible based on data available during real-time assessment that was generally tracked in the Eventlog. Additionally, they provided geological interpretations of the observed substrate throughout each ROV seafloor survey. These geological and biological observations were recorded using SeaScribe as the primary annotation tool with Ocean Networks Canada's SeaTube.

4.2 Sampling Operations

A limited number of geological and biological samples were collected on the seafloor using the manipulator arms and biological and geological collection boxes on ROV *Deep Discoverer.* For each collected specimen, the date, time, latitude, longitude, depth, salinity, temperature, and dissolved oxygen content were recorded at the time of collection. Geological specimen collections targeted samples for age dating and geochemical composition. Biological specimen collections targeted samples that represented potential new species, range extensions of animals not previously known to occur in the region, or dominant species in the area.

For each sample collected, the date, time, latitude, longitude, depth, salinity, temperature, and dissolved oxygen (DO) content were recorded at the time of collection. Geological samples were acquired for age dating and geochemical composition analysis. Biological collections targeted samples that represented potential new species, range extensions of animals not previously known to occur in the region, dominant species at the site, and/or rare morphotypes. Samples targeted to contribute to central and western Pacific connectivity studies were also collected.

After vehicle recovery, samples were examined for associated organisms, labeled, photographed, and entered into a database with all relevant metadata. Any associated organisms found were separated from primary samples and processed separately as "commensal" samples.

Geological samples were air dried and placed in rock bags or small containers, depending on the size of the sample. These samples were shipped to the Marine and Geological Repository at Oregon State University (OSU) after the conclusion of the 2017 expeditions. The samples were photographed and their data were entered into the university's online database. Thin and

polished sections have been made for each hard-rock sample. Descriptions and photos were included in the database.

Once specimens were brought back onto the deck of the ship, they were examined for commensal organisms, labeled, photographed, and inventoried into a database containing all relevant metadata. Any commensal organisms found were separated from the sample and processed separately. Geological samples were air dried and placed in rock bags. These samples were then shipped to the Marine Geology Repository at Oregon State University after the 2017 expeditions, where they were analyzed in the laboratory for their chemical composition and geologic age. Biological samples were processed for DNA extractions using a kit provided by the Ocean Genome Legacy (OGL). For this purpose, a small subsample, consisting of not more than 1 cm^2 of tissue, was removed from the original sample and processed using the OGL DNA extraction kit. For most collected specimens, the remainder of the biological sample was preserved in 95% ethanol. Some of these specimens were also frozen. For select taxa, vouchers or subsamples were preserved in 10% buffered formalin for future histological examinations, with some of the subsamples transferred to 70% ethanol after three days. Full details about specimens collected during EX1703 can be found in Section 7.2.1.

At the conclusion of the 2017 expeditions, all DNA samples were sent to OGL for DNA sequencing and storage, whereas the biological specimens preserved in ethanol and formalin will be sent to the National Museum of Natural History, Smithsonian Institution, for taxonomic identification and permanent storage. Some corals and sponges may also be subsampled for accession at the Bernice Pauahi Bishop Museum in Honolulu, Hawai'i.

4.3 Acoustic Operations

Acoustic operations included Kongsberg EM 302 multibeam, Simrad EK60 split-beam, Knudsen SBP, and ADCP data collection all found in the EX-17-03 mapping data report. (https://repository.library.noaa.gov/view/noaa/14853, Last accessed March 2021). The schedule of mapping operations included overnight transits and whenever the ROVs were on deck. Lines were planned to maximize edge matching of existing data or filling of data gaps in areas with incomplete bathymetry coverage. In regions with no existing data, exploration transit lines were planned to optimize potential discoveries. Targeted mapping operations were conducted EX-17-03 in the vicinity of (1) American Sāmoa, (2) the Independent State of Sāmoa, (3) New Zealand's Territory of Tokelau, (4) the Republic of Kiribati's PIPA, and (5) the U.S. EEZ around the Howland and Baker Unit of the PRIMNM.

4.3.1 Multibeam Sonar (Kongsberg EM 302)

Multibeam seafloor mapping data were collected using the Kongsberg EM 302 sonar, which operates at a frequency of 30 kilohertz (kHz). Multibeam mapping operations were conducted during all overnight transits between ROV dive sites. Multibeam data quality was monitored in real time by acquisition watchstanders. Ship speed was adjusted to maintain data quality as necessary.

Whenever possible, transits were designed to maximize coverage over seafloor areas with no previous high-resolution mapping data. In these focus areas, line spacing was generally planned to ensure 30% overlap between lines at all times. Cutoff angles in the Seafloor Information System (SIS) software were generally adjusted on both the port and starboard sides to ensure the best balance between data quality and coverage. Overnight surveys were also completed in areas that were previously mapped with a lower-resolution multibeam sonar system.

Additionally, multibeam mapping operations were conducted directly over planned ROV dive sites to collect seafloor mapping data to help refine dive plans. These operations collected data about seafloor depth (i.e., bathymetry), seafloor acoustic reflectivity (i.e., seafloor backscatter), and water column reflectivity (i.e., water column backscatter).

Background data used to guide exploratory multibeam mapping operations included mapping data collected during *Okeanos Explorer* cruises, notably EX-17-01, the SRTM30 grid, and all multibeam data archived with NOAA's National Center for Environmental Information (NCEI). Some dive planning and mapping operations were conducted using bathymetric grids created using all available bathymetry archived at NCEI and their AutoGrid tool. Smith and Sandwell (1997) satellite altimetry data were also used to plan operations.

4.3.2 Sub-Bottom Profiler (Knudsen Chirp 3260)

The primary purpose of the Knudsen Chirp 3260 (3.5 kHz) sonar is to image sediment layers underneath the seafloor to a maximum depth of about 80 m below the seafloor, depending on the specific sound velocity of the substrate. The SBP was operated simultaneously with the multibeam sonar during mapping operations to provide supplemental information about the sedimentary features underlying the seafloor.

4.3.3 Split-Beam Sonars (Simrad EK60)

NOAA Ship *Okeanos Explorer* is equipped with five Kongsberg EK60 split-beam sonar transducers operated at frequencies of 18, 38, 70, 120 and 200 kHz. These sonars were used continuously (aside from the 38 kHz, which interferes with the multibeam during mapping operations) throughout the cruise during both overnight mapping operations and daytime ROV

operations. The sonars provided calibrated target strength measurements on water column features such as dense biological layers or schools of fish.

4.3.4 Acoustic Doppler Current Profiler (Teledyne Workhorse Mariner and Teledyne Ocean Surveyor ADCPs)

Okeanos Explorer is equipped with two ADCPs: a Teledyne Workhorse Mariner (300 kHz) and a Teledyne Ocean Surveyor (38 kHz). However, only the 300 kHz ADCP was operational during this expedition. This ADCP had a reliable range of approximately 60 meters throughout the expedition and provided information on the speed and direction of currents underneath the ship. They were used throughout ROV dives to support safe deployment and recovery of the vehicles.

4.3.5 Expendable Bathythermograph (XBT) Systems

XBTs were collected every six hours and applied in real time using SIS. Sound speed at the sonar head was determined using sound speed from a flow-through thermosalinograph (TSG).

4.4 Post-cruise Scientific Annotations

At the conclusion of EX1703, a detailed analysis and quality assurance/ quality control of the ROV video collected was carried out at the University of Hawai'i's Hawaii Undersea Research Laboratory (HURL), under the direction of Dr. Christopher Kelley (supported by NOAA's Deep Sea Coral Research and Technology Program). The annotation creation process analyzed video from benthic exploration using Video Annotation and Reference System (VARS), created by the Monterey Bay Aquarium Research Institute and customized for the University of Hawai'i. VARS was used to generate records of animals from ROV dive video captured while on the seafloor. Animal records were catalogued and characterized with their in situ environmental data including habitat, substrate, water chemistry, and geographic location. Animals were identified using the OER Benthic Deepwater Animal Identification Guide (https://oceanexplorer.noaa.gov/okeanos/animal_guide/animal_guide.html, Last accessed March 18, 2021).

Additional information about the annotations collected during CAPSTONE expeditions can be found in Kennedy et al., 2019.

4.5 Eventlog

During ROV dives, participating researchers communicate between ship and shore using the Eventlog. The Eventlog is a persistent chat room where all comments, discussions, and requests are logged and provided a UTC timestamp that can later be correlated to the operations,

location, and data feeds collected by the ship. The chat server facilitates the first-order annotation of cruise activities, serving as a digital version of scientists' daily logs and enabling input from multiple users. Eventlog users were encouraged to use "dive codes", which are three-to-five letter shorthand codes that are used to standardize and speed the recording of observations in the Eventlog. The dive codes are included in Appendix B.

4.4 Conductivity, Temperature, and Depth (CTD)

During OER's *Okeanos Explorer* expeditions, CTD measurements are normally collected by two different methods. The most frequent method, which was conducted on this expedition, is with the integrated ROV CTD system. This system records CTD and associated sensors on every ROV dive. Additional sensors installed on both of the CTDs include measured light scattering sensor (LSS), DO, and oxygen reduction potential (ORP).

4.5 Sun Photometer Measurements

OER gathers limited at-sea measurements aboard *Okeanos Explorer* to support a National Aeronautics and Space Administration (NASA)-led, long-term research effort that assesses marine aerosols. As time allowed on cloud-free days, onboard personnel collected georeferenced sun photometer measurements for the Maritime Aerosol Network (MAN) component of the Aerosol Robotic Network (AERONET). AERONET is a network of sun photometers that measure atmospheric aerosol properties around the world. MAN complements AERONET by conducting sun photometer measurements on ships of opportunity to monitor aerosol properties over the global ocean. More information about this NASA Survey of Opportunity can be found in Appendix C.

5. Clearances and Permits

OER consulted with the Independent State of Sāmoa's Ministry of Foreign Affairs and Trade (MFAT) to conduct marine scientific research (MSR) in areas requiring consent within the PRIMNM and PIPA during the period of February 2017 to April 2017 for the *Okeanos Explorer*. OER received a letter of acknowledgement on January 23, 2017 (Appendix D). The Independent State of Sāmoa's Ministry of Natural Resources and Environment (MNRE) fully supported the research of seafloor mapping operations, ensuring it would provide reliable and useful information—primarily in areas where high-resolution bathymetry data did not exist and in areas of interest to the Independent State of Sāmoa—by consenting to permits for the collection of Samoan biological and non-biological resources (Appendix E and Appendix F) as a part of the initial scientific collection permit for the 2017 CAPSTONE *American Sāmoa* expedition.

Pursuant to the National Environmental Policy Act (NEPA), OER is required to include in its planning and decision-making processes appropriate and careful consideration of the potential environmental consequences of actions it proposes to fund, authorize, and/or conduct. The companion manual (https://www.nepa.noaa.gov/docs/NOAA-NAO-216-6A-Companion-Manual-01132017.pdf) for NOAA Administrative Order 216-6A describes the agency's specific procedures for NEPA compliance.

An environmental review memorandum was completed for all *Okeanos Explorer* expeditions in 2017 in accordance with Section 4 of the companion manual in the form of a categorical exclusion worksheet (Appendix H). Based on this review, a categorical exclusion was determined to be the appropriate level of NEPA analysis necessary, as no extraordinary circumstances existed that required the preparation of an environmental assessment or environmental impact statement.

OER conducted an analysis on the potential impacts to marine mammal species as a result of *Okeanos Explorer*'s oceanographic research and seafloor mapping under the Marine Mammal Protection Act (MMPA). It was determined that, due to the high-frequencies, narrow beamwidths, relatively low source levels of the onboard sonars, and transient nature of the expeditions, it is unlikely that activities aboard *Okeanos Explorer* would meet the definition of harassment under the MMPA.

As required under Section 7 of the Endangered Species Act (ESA), OER conducted an informal consultation with the NMFS Office of Protected Resources to request their concurrence with OER's biological evaluation determining that *Okeanos Explorer* operations conducted as part of CAPESTONE may affect, but are not likely to adversely affect, ESA-listed marine species. In a letter (Appendix I) from the NOAA Pacific Islands Regional Office (PIRO), the chief of the ESA Interagency Cooperation Division in the NMFS Office of Protected Resources wrote that NMFS concurs with OER's determination that proposed CAPSTONE expeditions are not likely to adversely affect ESA-listed marine species.

In addition, OER consulted with ONMS and NMSAS on potential impacts of CAPSTONE operations to essential fish habitat (EFH) in the Independent State of Sāmoa, American Sāmoa, PRINMN, and PIPA regions, issuing permits for work in American Sāmoa on January 19, 2017 (Appendix G), and on November 30, 2016 (Appendix J), which cover activities within the region.

6. Schedule and Map

EX-17-03 was a total of 23 days at sea, from March 7, 2017, to March 29, 2017. It departed from Āpia, Sāmoa, and returned to port in Āpia, Sāmoa. See **Table 3** for a day-by-day breakdown of EX-17-03. There were 19 scheduled dives, with nine of these dives within the U.S.

waters (see **Table 6** for details). See **Figure 1** for a map of EX-17-03's track, dive sites, and bathymetry collected.

Table 3. EX-17-03 schedule.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
3/5	**3/6**	**3/7** Mobilization at Āpia, Sāmoa	**3/8** Dive 01: Swains Atoll	**3/9** *Okeanos Explorer* began transiting from Swains Island to Pao Pao Seamount in the Tokelau Seamount Chain.	**3/10** Dive 02: Pao Pao Seamount First dive in the Tokelau Seamount Chain. Overnight Mapping	**3/11** Dive 03: Carondelet Reef Southwest ridge of Carondelet Reef within the PIPA. Overnight Mapping
3/12 Dive 04: Unnamed Seamount 1 PIPA ("Athena") Unnamed seamount in the Tokelau Seamount Chain. It was the second dive within the PIPA. Overnight Mapping	**3/13** Dive 05: Polo Seamount Dive was on Polo Seamount, in the Tokelau Seamount Chain, and was the third dive within the PIPA. Overnight Mapping	**3/14** Dive 06: Unnamed Seamount West of Winslow Reef This dive, west of the Winslow Reef complex, was within the U.S. EEZ. Overnight Mapping	**3/15** Dive 07: Titov Seamount 1 Titov Seamount was the first dive within the PRIMNM. Overnight Mapping	**3/16** Dive 08: Baker Island Shallow Dive along the NW ridge of Baker Island in the PRIMNM. Overnight Mapping	**3/17** Dive 09: Howland Island Deep 1 The deepest dive at Howland Island in the PRIMNM. Overnight Mapping	**3/18** Dive 10: Howland Island Shallow The fourth dive within the PRIMNM traversed the north slope of Howland Island. Overnight Mapping
3/19 Dive 11: Howland Island Deep 2 This dive continued the dive track from Dive 09, transiting a ridge feature at Howland Island in the PRIMNM. Overnight	**3/20** Dive 12: Baker Islands Deep In the vicinity of Baker Island, this dive explored along a steep slope on the southern ridge of Baker Island. Overnight Mapping	**3/21** Dive 13: Titov 2 This was the second dive at Titov Seamount. Overnight Mapping	**3/22** Dive 14: Unnamed Seamount West of Winslow Reef PIPA This dive was on an unnamed seamount within the Winslow Reef Area in the PIPA. Overnight Mapping	**3/23** Dive 15: Unnamed Seamount ("Teutana Seamount") This dive was on an unnamed seamount and was the sixth dive within the PIPA. Overnight Mapping	**3/24** Dive 16: Hadal Trough ("Kinono") This was the deepest dive of the expedition, Southwest of the Phoenix Islands. Overnight Mapping	**3/25** Dive 17: unnamed seamount (Maibua in Kiribati meaning "broken in two") Steep slope along the western side of unnamed seamount north of

Mapping						Carondelet Reef within the PIPA. Overnight Mapping
3/26 Dive 18: unnamed seamount ("Te Kaitira") This was the last dive within the PIPA, and it was conducted at the base of a steep wall on an unnamed seamount. Overnight Mapping	**3/27** Dive 19: Ufiata Seamount This was the last dive of the expedition at the base of a steep slope at Ufiata Seamount, which is within the Tokelau Seamount Chain. Overnight Mapping	**3/28** Mapping back to port at Āpia, Sāmoa Added EX-17-03 data to previous mapping data in the area. Overnight Mapping	**3/29** Expedition Complete *Okeanos Explorer* arrived back in Āpia, Sāmoa.			

The expedition focused on acquiring data about priority exploration areas identified by the ocean management and scientific communities, building on the previous PRIMNM and PIPA expeditions. The EX-17-03 expedition consisted of exploration of deep-sea coral and sponge communities, bottomfish habitats, undersea canyons, and a variety of chemosynthetic habitats including cold seeps, mud volcanoes, and brine pools.

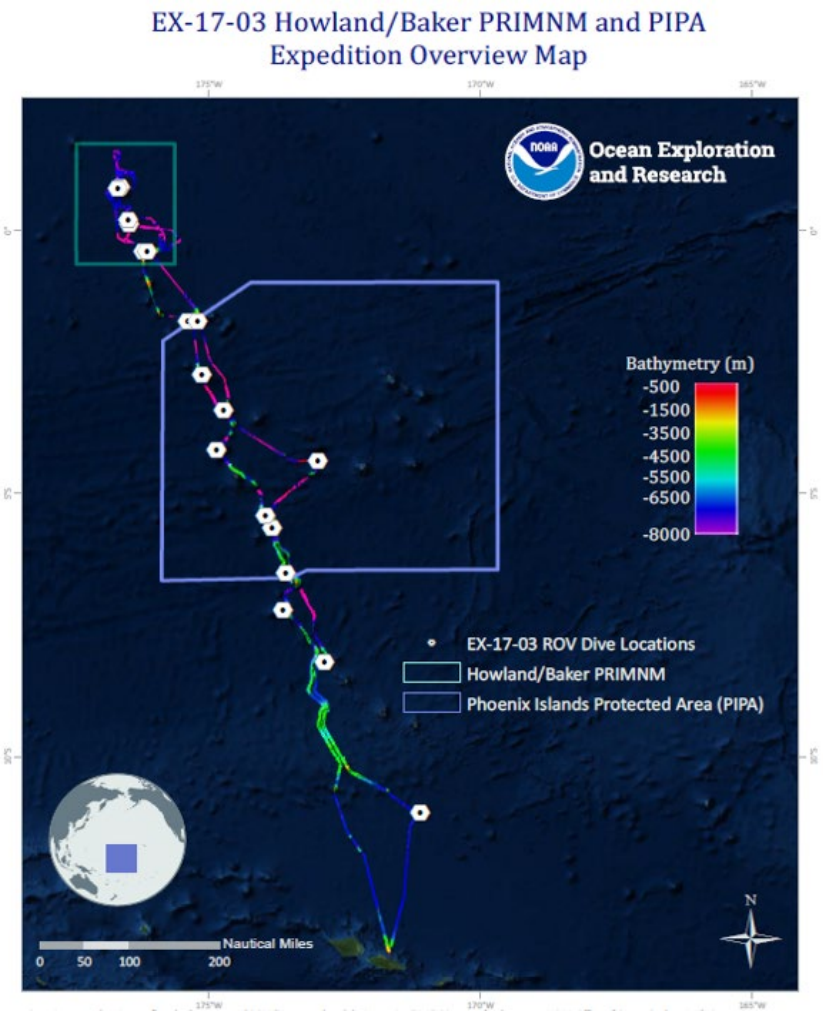

Figure 1. Summary map showing EX-17-03's track, 19 ROV dive sites, and bathymetry data collected.

7. Results[1]

Metrics for EX-17-03's major exploration and scientific accomplishments are summarized in **Table 4** and **Table 5**. More detailed results are presented in the subsections that follow.

Table 4. Summary of exploration metrics for EX-17-03.

Exploration Metrics	Totals
Days at sea	23
Days at sea in U.S. EEZ	9
Linear km mapped by EM 302	5,100
Square km covered by EM 302	30,341

[1] If you are unable to access the results noted here, contact ex.expeditioncoordinator@noaa.gov.

Square km covered by EM 302 in U.S. EEZ	11,292
Vessel CTD casts	0
XBT casts	46
ROV dives	19
ROV dives in U.S. EEZ	9
Maximum ROV seafloor depth (m)	5862.9
Minimum ROV seafloor depth (m)	300
Total time on bottom (hh:mm:ss)	113:33:25
Total ROV time (hh:mm:ss)	152:33:31

Table 5. Summary of scientific metrics for EX-17-03.

Scientific Metrics	Totals
Total samples	171
Biological samples (primary)	38
Biological associate samples	52
Biological subsamples	76
Geological samples	4
Geological associate samples	1
Actively participating scientists, students, and resource managers	48

7.1 ROV Survey Results

Depth ranges explored during the 19 ROV surveys were between 300 and 5,862.9 meters. During the 19 dives, the ROVs spent a total of 113:33:25 hours on the bottom and total time the ROV was in the water 152:33:31 hours (see **Table 5** for more cumulative results). See **Table 6** for dive-specific information for each of the dives.

Table 6. Summary information for the 19 ROV dives conducted during EX-17-03.

Date (mmddyyyy)	Dive #	Site Name	On Bottom Latitude (dd)	On Bottom Longitude (dd)	Max Depth (m)	Dive Duration (hh:mm:ss)	Bottom Time (hh:mm:ss)
03082017	01	Swains Atoll	11°, 02.868' S	171°, 06.666' W	1161.3	08:00:16	06:29:47
03102017	02	Pao Pao	07°, 11.405' S	173°, 38.085' W	535.6	08:11:53	07:15:46
03112017	03	Carondelet Reef	05°, 37.936' S	173°, 50.260' W	1842.3	08:09:06	06:01:12
03122017	04	Unnamed seamount 1 PIPA (Athena)	04°, 09.016' S	174°, 51.260' W	1228.2	08:09:26	06:43:54
03132017	05	Polo Seamount	02°, 43.683' S	175°, 07.864' W	2140.7	08:16:51	05:44:18
03142017	06	Unnamed Seamount West of Winslow Reef	01°, 41.898' S	175°, 23.732' W	1560.9	08:25:03	06:22:52
03152017	07	Titov Seamount 1	00°, 23.219' S	176°, 12.148' W	1879.2	08:03:57	05:28:27
03162017	08	Baker Island Shallow	00°, 12.729' N	176°, 29.192' W	725.5	07:25:39	06:07:23
03172017	09	Howland Island Deep 1	00°, 48.155' N	176°, 40.435' W	2420.1	07:51:07	05:07:56
03182017	10	Howland Island Shallow	00°, 50.095' N	176°, 37.525' W	587.7	07:24:00	06:08:38
03192017	11	Howland Deep 2	00°, 48.247' N	176°, 40.452' W	2226.9	08:07:27	05:35:16
03202017	12	Baker Islands Deep	00°, 08.849' N	176°, 27.641' W	1858.7	08:05:29	06:06:08
03212017	13	Titov 2	00°, 22.680' S	176°, 07.972' W	1226.7	07:54:25	06:14:46
03222017	14	Unnamed Seamount West of Winslow Reef PIPA	01°, 42.259' S	175°, 12.340' W	1535.5	08:00:51	06:03:59
03232017	15	Unnamed Seamount "Teutana Seamount"	03°, 23.971' S	174°, 44.146' W	1325.4	06:30:44	04:57:31
03242017	16	Hadal Trough "Kinono"	04°, 22.512' S	172°, 59.870' W	5862.9	09:50:59	03:38:00
03252017	17	Unnamed Seamount (Maibua	05°, 24.081' S	173°, 57.690' W	750.9	08:01:26	07:10:40

		in Kiribati meaning "broken in two")					
03262017	18	Unnamed Seamount "Te Kaitira"	06°, 29.513' S	173°, 35.007' W	2104.9	08:07:07	05:43:50
03272017	19	Ufiata Seamount	08°, 12.100' S	172°, 51.995' W	998.7	07:57:45	06:33:02

7.1.1 Dive Highlights by Region

Two-thirds of the sites within the PRIMNM had high density of biological communities and a third with high fish diversity and abundance. Of the 6 dives, Titov and Howland “shallow” dives (2/6 dives) were characterized by high density and biological communities along with high diversity. Baker Island shallow dive had high densities of fishes.

Of the 8 dives conducted in PIPA, 6 were characterized as high-density coral/biological sites (Carondelet Reef, Polo Seamount, and unnamed seamounts (Dives 3, 15, 17, 18). Two of the eight dives represented high diversity sites (Carondelet Reef and unnamed seamount from dive 18). Some of the largest octocoral fans for the entire expedition were observed dive 18 (“te kaitira”).

Of the 2 dives in the Tokelau region, the Pao Pao had the highest diversity of corals and commercial fish compared to Ufiata which had precious corals. High densities of large bamboo corals were found throughout the US Winslow dive all the way to the summit. A large unknown plexauid colony with lots of associates was also observed. Dives in the Swains, notability higher diversity and abundance of corals and other taxa compared to other dives in the American Samoa region.

Dive 03, first dive in PIPA took place in the Carondelet Reef which yielded the most diverse benthic invertebrates communities observed throughout the expedition. Over 32 putative species of deep-water corals were observed as well as >20 other invertebrate species along a depth gradient between 1840 to 1580 meters. Different deep-sea coral assemblages were often displayed on the site depending on the slope of the underlying substrate with vertical faces having largely different dominant species compared to less steep slopes and promotories.

Dive 04, occurred at the unnamed Seamount Athena within the PIPA. Observations during this dive included post-mating cannibalism among 2 individuals of Chiroteuthis sp. deep-water squids. Possible molluscan egg cases on a series of Chrysogorgiid *octocorals* throughout the dive track. Deep-water corals were abundance on this site, particularly small precious coral colonie cf. *Pleurocorallium* sp. An increase in particulate matter or marine snow was observed

at this site, which was consistent with the abundance of deep-sea corals and near-bottom planktonic gelatinous fauna.

High densities of *Pleurogorgia sp*. observed on rocky vertical surfaces were observed during Dive 05 at the Polo Seamount. The summit community on the ridge of the seamount was covered in coral and sponge garden.

During Dive 14 at the Winslow Reef Unnamed Seamount, there were an extraordinarily large specimen similar to *Walteria*, which are species of glass sponges covering a large portion of the deep hard substrate. The specimen is estimated to be >1 meter in length. Imagery of an in situ dumbo octopod *Grimpteuthis sp*. was captured sitting on the seafloor as well as displaying swimming behavior. Sea spider (*pycnogonida*) predation were observed during several instances preying on a variety of cnidarian taxa including anemones and a cup coral. A 3.7 meter gorgonian *Iridogorgia magnispiralis* was also recorded during this expedition.

Dive 15 occurred on the Unnamed McKean (Teutana) during the expedition. High N-S currents on the seafloor in the area gave rise to large colonies of deep-sea octocorals with large primniod fans cf. *Calyptrophora* and *Paracalyptrophora sp*. Cidarid urchins were predating upon the branch tips of large primnoid spp during this expedition. A rare observation of a bentho-pelagic velvet whalefish was made shortly after the vehicle touched down on the seafloor.

Dive 16 was conducted at the Hadal Trough, which allowed a rare opportunity to examine hadal fauna in situ at 5900 meters in depth in the Phoenix Islands Protected Area. Hadal depths are rarely studied this data will provide a base line for future lines of inquiry and inform resource and management decisions. An abundance of deep-water crustaceans, echinoderms, carnivorous sponges, and even one fish were observed. With a rare observation of a live monoplacophoran mollusc. Two coral taxa were observed, one sea pen *Umbellula sp*. and one abyssal black coral *Abyssopathes sp*. The black coral and mollusk are likely new species.

The Unnamed Seamount (Maibua) detected during mapping operations, provided a glimpse of a possible geological failure along the western edge of the seamount during Dive 17. Much of the vertical substrate covered by comatulid crinoids at the base of the trackline around 740 meters. Maibua has a robust fish community with 15+ species reported and a high number of *Oreosomatid Dories*. Several large gold corals >1.5 meters tall were found near the summit. Underlying coral in the area were determined to be bamboo coral that was overtaken by the gold coral.

Dive 18 at the Unnamed Seamount (Te Kaitria) has diverse and high density of large ancient paragorgiid octocorals, *Iridogorgia sp*. corals, and glass sponges (*Hexactinellida*). On the vertical

structures along the transect, a high abundance and density of *Pleurogorgia* and *Narella sp*. were seen.

7.1.2 Accessing ROV Data

OER Digital Atlas

ROV data from EX-17-03 are archived at NCEI and available through OER's Digital Atlas https://www.ncei.noaa.gov/maps/oer-digital-atlas/mapsOE.htm?cruiseNum=EX1703 (Last accessed March 2021). To access these data, click on the Search tab, enter "EX1703" in the Enter Search Text field, and click Search. Click on the point that represents EX-17-03 to access data options. In the pop-up window, select the ROV Data Access tab for links to the ROV dive data, which is organized by dive.

ROV Dive Summaries

Individual ROV dive summaries and associated ROV dive data are archived at NCEI and available on their *Okeanos Explorer* website at https://www.ncei.noaa.gov/waf/okeanos-rov-cruises/ex1703/ (Last accessed March 2021).[2]

ROV Dive Video

To search, preview, and download dive video for *Okeanos Explorer*, go to the OER Video Portal at https://www.nodc.noaa.gov/oer/video/ (Last accessed March 2021).

SeaScribe and SeaTube V2

OER works closely with Ocean Networks Canada to implement SeaTube V2 at https://data.oceannetworks.ca/SeaTubeV2 (Last accessed March 2021), a web-based annotation interface for ROV operations for expeditions aboard *Okeanos Explorer*. SeaTube v2 is the digital equivalent to a scientist's logbook. It is used by onboard and shore-based scientists to log real-time observations on a variety of topics alongside the primary annotation tool of SeaScribe. To watch a video of a dive and search and export annotations, click on the Videos tab and select "NOAA," "2017," "Howland/Baker Islands EX1703 (Mar 2017)" under the Expeditions collapsible menu. All 19 dives can be selected from this list.

7.2 Sampling Operations Results

A total of 95 samples were collected during EX-17-03: four geological samples, 38 biological samples, and 53 associate samples (see **Table 5** for more cumulative results).

[2] ROV dive summaries are typically available 90 days after an ROV cruise. For access in the interim, contact ex.expeditioncoordinator@noaa.gov.

The geological samples included carbonate rock samples and sedimentary rock. See **Table 7** for full details of the geological samples collected.

Table 7. Inventory of geological samples collected during EX-17-03.

Field Identification	Field Identification	Site Name	UTC_DateTime	Latitude (dd)	Longitude (dd)	Depth (m)
EX1703_D12_01G	Mn-crusted basalt	Baker Islands Deep	20170319T214245	0.148430005	-176.4593353	1760.219971
EX1703_D15_01G	Mn-crusted basalt	Unnamed Seamount "Teutana Seamount"	20170322T223742	-3.400860071	-174.7338104	1172.130005
EX1703_D16_01G	Mn-Coated Rock	Hadal Trough "Kinono"	20170323T214437	-4.375390053	-172.9978943	5859.540039
EX1703_D19_01G	FeMn crusted rock	Ufiata Seamount	20170326T204307	-8.201180458	-172.8664703	954.039978

There were 38 biological samples that were purposely collected (primary samples) as well as 52 samples that were incidentally collected (associate samples). In total, these samples amounted to 90 individuals. The biological samples included a variety of corals, known animals, and potential new species as seen in **Figure 2**. See **Table 8** for full details of the biological samples collected.

Table 8. Inventory of biological samples collected during EX-17-03.

Sample#	Field Identification	Site Name	UTC_DateTime	Latitude (dd)	Longitude (dd)	Depth (m)
DIVE01_SPEC01BIO	*Hexactinellida*	Swains Island	20170307205042	-11.04759	-171.1112	1111.81
DIVE01_SPEC02BIO	*Acanthogorgiidae*	Swains Island	20170307214200	-11.04733	-171.1109	1100.65
DIVE01_SPEC02BIO_A01	*Ophiuridae*	Swains Island	20170307214200	-11.04733	-171.1109	1100.65
DIVE01_SPEC02BIO_A02	*Hydrozoa*	Swains Island	20170307214200	-11.04733	-171.1109	1100.65
DIVE02_SPEC01BIO	*Primnoidae*	Pao Pao	20170309211255	-7.19076	-173.6351	464.36
DIVE02_SPEC01BIO_A01	*Chirostylidae*	Pao Pao	20170309211255	-7.19076	-173.6351	464.36
DIVE02_SPEC02BIO	*Plexauridae*	Pao Pao	20170309215423	-7.1909	-173.6351	449.29

DIVE02_SPEC02BIO_A01	*Asteroschematidae*	Pao Pao	20170309215423	-7.1909	-173.6351	449.29
DIVE02_SPEC02BIO_A02	*Aplocophoran*	Pao Pao	20170309215423	-7.1909	-173.6351	449.29
DIVE02_SPEC02BIO_A03	*Polychaeta*	Pao Pao	20170309215423	-7.1909	-173.6351	449.29
DIVE02_SPEC03BIO	*Narella sp.*	Pao Pao	20170309233130	-7.19258	-173.6361	327.01
DIVE02_SPEC03BIO_A01	*Actiniaria white*	Pao Pao	20170309233130	-7.19258	-173.6361	327.01
DIVE02_SPEC03BIO_A02	*Ophiuroidea*	Pao Pao	20170309233130	-7.19258	-173.6361	327.01
DIVE03_SPEC01BIO	*Paragorgia sp.*	Carondelet Reef	20170310201405	-5.63227	-173.8378	1841.11
DIVE03_SPEC01BIO_A01	*Asteroschematidae*	Carondelet Reef	20170310201405	-5.63227	-173.8378	1841.11
DIVE03_SPEC02BIO	*Isididae*	Carondelet Reef	201703111717	-5.62989	-173.8389	1636.38
DIVE03_SPEC03BIO	*Hexactinellida*	Carondelet Reef	201703114803	-5.62945	-173.8389	1624.78
DIVE03_SPEC03BIO	*Hexactinellida*	Carondelet Reef	201703114803	-5.62945	-173.8389	1624.78
DIVE03_SPEC03BIO_A01	*Ophiuroidea*	Carondelet Reef	201703114803	-5.62945	-173.8389	1624.78
DIVE03_SPEC03BIO_A02	*Crinoidea*	Carondelet Reef	201703114803	-5.62945	-173.8389	1624.78
DIVE03_SPEC03BIO_A03	*Polychaeta*	Carondelet Reef	201703114803	-5.62945	-173.8389	1624.78
DIVE04_SPEC01BIO	*Phrynocrinidae*	Unnamed Seamount (Athena)	20170311212533	-4.14966	-174.8532	1154.07
DIVE04_SPEC02BIO	*Sibogagorgia sp.*	Unnamed Seamount (Athena)	20170311220523	-4.14952	-174.8527	1126.99
DIVE04_SPEC02BIO_A02	*Ophiuroidea*	Unnamed Seamount (Athena)	20170311220523	-4.14952	-174.8527	1126.99
DIVE04_SPEC02BIO_A03	*Ophiuroidea*	Unnamed Seamount (Athena)	20170311220523	-4.14952	-174.8527	1126.99
DIVE04_SPEC02BIO_A04	*Ophiuroidea*	Unnamed Seamount (Athena)	20170311220523	-4.14952	-174.8527	1126.99
DIVE04_SPEC03BIO	*Victorgorgia sp.*	Unnamed Seamount (Athena)	201703121022	-4.1479	-174.8516	1043.3
DIVE04_SPEC03BIO_A01	*Ophiuroidea*	Unnamed	201703121022	-4.1479	-174.8516	1043.3

		Seamount (Athena)				
DIVE05_SPEC01BIO	*Isididae - branching-unknown*	Polo	20170312222950	-2.72833	-175.1291	2050.86
DIVE05_SPEC01BIO	*Isididae - branching-unknown*	Polo	20170312222950	-2.72833	-175.1291	2050.86
DIVE05_SPEC01BIO_A01	*Crinoidea*	Polo	20170312222950	-2.72833	-175.1291	2050.86
DIVE05_SPEC01BIO_A02	*Glyptalasma sp.*	Polo	20170312222950	-2.72833	-175.1291	2050.86
DIVE06_SPEC01BIO	*Isididae branched*	Unnamed Seamount	20170313214841	-1.69766	-175.3943	1510.22
DIVE06_SPEC01BIO_A01	*Crinoidea*	Unnamed Seamount	20170313214841	-1.69766	-175.3943	1510.22
DIVE06_SPEC01BIO_A02	*Myzostome*	Unnamed Seamount	20170313214841	-1.69766	-175.3943	1510.22
DIVE06_SPEC01BIO_A03	*Crinoidea*	Unnamed Seamount	20170313214841	-1.69766	-175.3943	1510.22
DIVE06_SPEC01BIO_A04	*Aplacophoran*	Unnamed Seamount	20170313214841	-1.69766	-175.3943	1510.22
DIVE06_SPEC02BIO	*Isididae*	Unnamed Seamount	20170313220926	-1.69762	-175.3943	1512.57
DIVE06_SPEC03BIO	*Isididae*	Unnamed Seamount	20170313232218	-1.69691	-175.3928	1431.36
DIVE06_SPEC04BIO	*Plexauridae*	Unnamed Seamount	2017031413208	-1.69726	-175.3917	1370
DIVE06_SPEC04BIO_A01	*Ophiuroidea*	Unnamed Seamount	2017031413208	-1.69726	-175.3917	1370
DIVE06_SPEC04BIO_A02	*Crinoidea*	Unnamed Seamount	2017031413208	-1.69726	-175.3917	1370
DIVE06_SPEC05BIO	*Halosauridae - Halorsaurus*	Unnamed Seamount	Unknown	-	-	-
DIVE06_SPEC05BIO	*Halosauridae - Halorsaurus*	Unnamed Seamount	Unknown	-	-	-
DIVE06_SPEC05BIO	*Halosauridae - Halorsaurus*	Unnamed Seamount	Unknown	-	-	-
DIVE07_SPEC01BIO	*Callogorgia*	Titov	20170314222807	-0.38808	-176.2014	1759.66
DIVE07_SPEC01BIO_A01	*Ophiuroidea*	Titov	20170314222807	-0.38808	-176.2014	1759.66
DIVE07_SPEC02BIO	*Swiftia sp.*	Titov	20170314224756	-0.38803	-176.2012	1747.7
DIVE07_SPEC02BIO_A01	*Ophiuroidea*	Titov	20170314224756	-0.38803	-176.2012	1747.7
DIVE07_SPEC02BIO_A02	*Amphipoda*	Titov	20170314224756	-0.38803	-176.2012	1747.7
DIVE07_SPEC03BIO	*Chrysogorgidae*	Titov	20170314232337	-0.38835	-176.2012	1719.6
DIVE07_SPEC03BIO_A01	*Polychaeta*	Titov	20170314232337	-0.38835	-176.2012	1719.6

DIVE07_SPEC03BIO_A02	*Amphipoda*	Titov	20170314232337	-0.38835	-176.2012	1719.6
DIVE08_SPEC01BIO	*Primnoidae*	Baker Island	2017031615221	0.21211	-176.4845	436.54
DIVE09_SPEC01BIO	*Cladorhizidae*	Howland Island	20170316213634	0.80329	-176.6742	2346.35
DIVE09_SPEC01BIO_A01	*Polychaeta*	Howland Island	20170316213634	0.80329	-176.6742	2346.35
DIVE09_SPEC02BIO	*Walteria sp.*	Howland Island	20170316234328	0.80353	-176.6743	2290.07
DIVE09_SPEC02BIO	*Walteria sp.*	Howland Island	20170316234328	0.80353	-176.6743	2290.07
DIVE09_SPEC02BIO_A01	*Ophiuridae*	Howland Island	20170316234328	0.80353	-176.6743	2290.07
DIVE09_SPEC02BIO_A02	*Cteneophore*	Howland Island	20170316234328	0.80353	-176.6743	2290.07
DIVE09_SPEC02BIO_A02	*Cteneophore*	Howland Island	20170316234328	0.80353	-176.6743	2290.07
DIVE09_SPEC02BIO_A03	*Crinoidea*	Howland Island	20170316234328	0.80353	-176.6743	2290.07
DIVE09_SPEC02BIO_A04	*Cirripedia*	Howland Island	20170316234328	0.80353	-176.6743	2290.07
DIVE09_SPEC02BIO_A05	*Hydrozoa*	Howland Island	20170316234328	0.80353	-176.6743	2290.07
DIVE09_SPEC02BIO_A06	*Hydrozoa*	Howland Island	20170316234328	0.80353	-176.6743	2290.07
DIVE09_SPEC02BIO_A07	*Aplcophoran*	Howland Island	20170316234328	0.80353	-176.6743	2290.07
DIVE09_SPEC02BIO_A08	*Amphipoda*	Howland Island	20170316234328	0.80353	-176.6743	2290.07
DIVE10_SPEC01BIO	*Calyptrophora sp.*	Howland Island	20170317210958	0.83484	-176.6253	544.54
DIVE10_SPEC02BIO	*Demospongiae*	Howland Island	20170317235520	0.83374	-176.6254	424.5
DIVE10_SPEC02BIO	*Demospongiae*	Howland Island	20170317235520	0.83374	-176.6254	424.5
DIVE10_SPEC02BIO_A01	*Galatheidae*	Howland Island	20170317235520	0.83374	-176.6254	424.5
DIVE10_SPEC02BIO_A02	*Brachyura*	Howland Island	20170317235520	0.83374	-176.6254	424.5
DIVE10_SPEC02BIO_A03	*Ophiuridae*	Howland Island	20170317235520	0.83374	-176.6254	424.5
DIVE10_SPEC02BIO_A04	*Isopoda*	Howland Island	20170317235520	0.83374	-176.6254	424.5

DIVE11_SPEC01BIO	*Chrysogorgiidae*	Howland Island	20170318204428	0.80398	-176.6743	2226.58
DIVE11_SPEC02BIO	*Goniasteridae*	Howland Island	20170318213238	0.80489	-176.673	2175.43
DIVE12_SPEC02BIO	*Isididae*	Baker Island	2017032012841	0.14878	-176.4558	1495.54
DIVE12_SPEC03BIO	*Isididae*	Baker Island	2017032013344	0.14867	-176.4558	1495.68
DIVE13_SPEC01BIO	*Thouarella sp*	Titov Seamount	20170320211059	-0.37761	-176.1322	1179.89
DIVE13_SPEC02BIO	*Plexauridae*	Titov Seamount	201703213156	-0.37607	-176.1314	1142.22
DIVE13_SPEC02BIO_A01	*Actiniaria pink*	Titov Seamount	201703213156	-0.37607	-176.1314	1142.22
DIVE13_SPEC02BIO_A02	*Actiniaria pink*	Titov Seamount	201703213156	-0.37607	-176.1314	1142.22
DIVE13_SPEC02BIO_A03	*Ophiuroidea*	Titov Seamount	201703213156	-0.37607	-176.1314	1142.22
DIVE13_SPEC02BIO_A03	*Ophiuroidea*	Titov Seamount	201703213156	-0.37607	-176.1314	1142.22
DIVE13_SPEC02BIO_A03	*Ophiuroidea*	Titov Seamount	201703213156	-0.37607	-176.1314	1142.22
DIVE13_SPEC02BIO_A03	*Ophiuroidea*	Titov Seamount	201703213156	-0.37607	-176.1314	1142.22
DIVE13_SPEC02BIO_A03	*Ophiuroidea*	Titov Seamount	201703213156	-0.37607	-176.1314	1142.22
DIVE13_SPEC02BIO_A03	*Ophiuroidea*	Titov Seamount	201703213156	-0.37607	-176.1314	1142.22
DIVE13_SPEC02BIO_A03	*Ophiuroidea*	Titov Seamount	201703213156	-0.37607	-176.1314	1142.22
DIVE13_SPEC02BIO_A03	*Ophiuroidea*	Titov Seamount	201703213156	-0.37607	-176.1314	1142.22
DIVE14_SPEC01BIO	*Iridogorgia sp.*	Winslow Reef Complex PIPA	2017032213359	-1.70353	-175.2023	1304.41
DIVE14_SPEC01BIO_A01	*Ctenephore*	Winslow Reef Complex PIPA	2017032213359	-1.70353	-175.2023	1304.41
DIVE15_SPEC02BIO	*Plexauridae*	Unnamed Seamount	20170322232658	-3.4011	-174.7336	1117.73
DIVE15_SPEC02BIO_A01	*Ophiuroidea*	Unnamed Seamount	20170322232658	-3.4011	-174.7336	1117.73
DIVE16_SPEC02BIO	*Antipatharia*	Hadal Trough	2017032410307	-4.37707	-172.9963	5772.36
DIVE17_SPEC01BIO	*Zoantharia*	Unnamed Seamount	2017032513010	-5.40318	-173.959	489.84

DIVE17_SPEC01BIO	*Zoantharia*	Unnamed Seamount	2017032513010	-5.40318	-173.959	489.84
DIVE18_SPEC01BIO	*Paragorgia sp.*	Te Kaitira	20170325232102	-6.49159	-173.5817	1902.028
DIVE18_SPEC01BIO_A01	*Zoantharia*	Te Kaitira	20170325232102	-6.49159	-173.5817	1902.028
DIVE18_SPEC01BIO_A02	*Ophiuroidea*	Te Kaitira	20170325232102	-6.49159	-173.5817	1902.028
DIVE18_SPEC02BIO	*Primnoidae*	Te Kaitira	20170325233700	-6.4916	-173.5816	1899.482
DIVE18_SPEC02BIO_A01	*Ophiuroidea*	Te Kaitira	20170325233700	-6.4916	-173.5816	1899.482
DIVE19_SPEC02BIO	*Coralliidae*	Ufiata Seamount	2017032714445	-8.1973	-172.8677	751.03
DIVE19_SPEC02BIO_A01	*Hydrozoa*	Ufiata Seamount	2017032714445	-8.1973	-172.8677	751.03
DIVE19_SPEC02BIO_A02	*Aplocophoran*	Ufiata Seamount	2017032714445	-8.1973	-172.8677	751.03

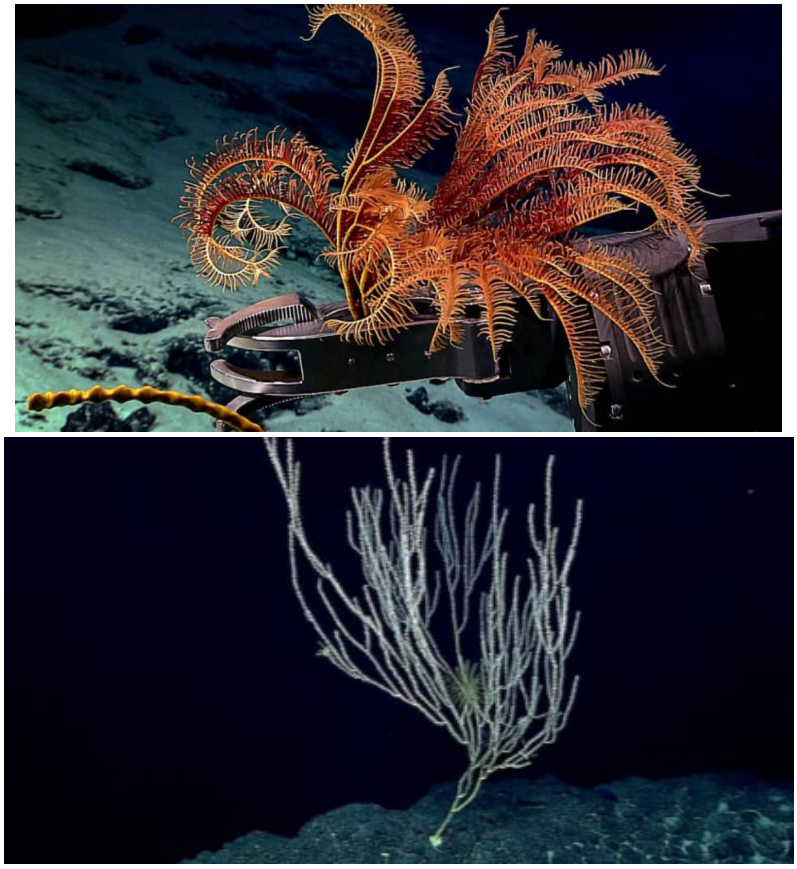

Figure 2: (Top image) ROV *Deep Discoverer*'s manipulator jaws are gently grasping the crown of a stalked crinoid (*Phrynocrinidae*) for a collection. This crinoid species had previously only been observed in the Celebes Sea, off Indonesia. (Bottom image) *Isididae* (branched/unknown) at Polo Seamount.

7.2.1 Sample Repositories

The following repositories archive samples collected during expedition EX-17-03 on *Okeanos Explorer*.

- Invertebrate Zoology Collections, National Museum of Natural History, Smithsonian Institution, Museum Support Center, MRC 534, 4210 Silver Hill Road, Suitland, MD 20746
  Contact: Abigail Reft, ReftAJ@si.edu
  Website: https://invertebrates.si.edu/LoanPolicy.html
- Ocean Genome Legacy Center, Northeastern University, 430 Nahant Road, Nahant, MA 01908
  Contact: Hannah Appiah-Madson, h.appiah-madson@northeastern.edu
  Website: https://www.northeastern.edu/ogl/
- Marine and Geology Repository, Oregon State University
  Burt 346, Corvallis, OR 97331-5503
  Contact: Kevin Konrad, Konradke@geo.oregonstate.edu
  Website: http://osu-mgr.org/noaa-ex/

7.3 Acoustic Operations Results

During EX-17-03, multibeam mapping operations results included 5,100 linear kilometers (km) mapped and 30,341 square km covered (11,292 of these in the U.S. EEZ). During this cruise 19 ROV dives were successfully attempted and conducted. **Figure 1** shows detailed coverage areas of operations for EX-17-03.

Close to the PIPA, *Okeanos Explorer* explored an unusual deep trough feature approximately 105 km in length and up to 6,350 m deep, as shown in **Figure 3**. **Figure 4** is a 3D representation of the Titov Seamount created using Fledermaus software. This unique structure has a top of around eight kilometers in length.

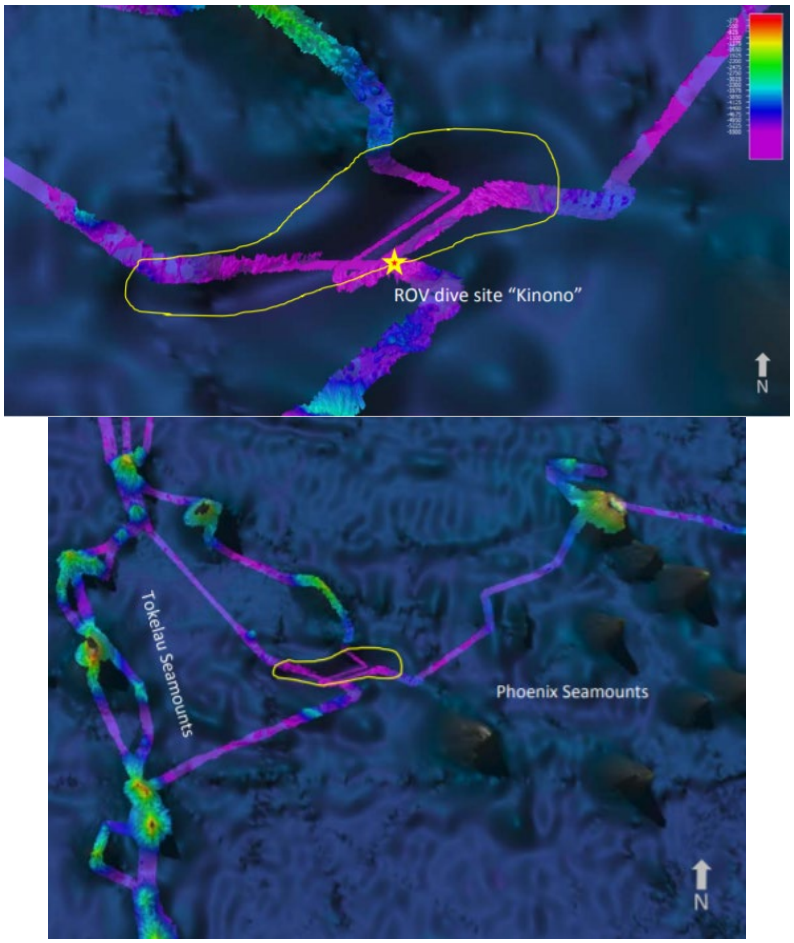

Figure 3. Top image: Bathymetry data from the *Okeanos Explorer* shown with the SRTM30 grid. Yellow outline indicated the vicinity of the hadal trough. The star represents the location of the ROV dive. Colored bar represents bathymetry depth in meters. Bottom Image: Location of the deep feature relative to the Phoenix and Tokelau Seamount groups.

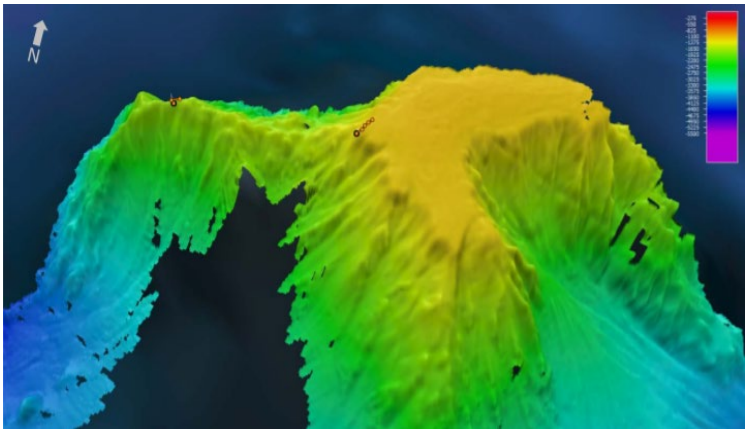

Figure 4. Titov Seamount bathymetry data collected during EX-17-03 in a 3D perspective. Orange points on the figure show the location of two ROV dives conducted on the seamount. Colored bar represents bathymetry depth in meters.

Additional information about the mapping conducted during EX-17-03, including data quality assessments, is in the EX-17-03 mapping data report https://repository.library.noaa.gov/view/noaa/14853 (Last accessed March 2021).

7.3.1 Acoustic Operations Data Access

Multibeam Sonar (Kongsberg EM 302)

The multibeam dataset for the expedition is archived at NCEI and accessible through their Bathymetric Data Viewer at https://maps.ngdc.noaa.gov/viewers/bathymetry/ (Last accessed March 2021). To access these data, click on the Search Bathymetric Surveys button, select "NOAA Ship Okeanos Explorer" from the Platform Name dropdown menu, and "EX1703" from the Survey ID dropdown menu. Click OK, and the ship track for the cruise will appear on the map. Click the ship track for options to download data.

Sub-Bottom Profiler (Knudsen Chirp 3260)

The SBP was not run during any of EX-17-03's ROV dive operations, but generally was operated during multibeam mapping operations. These data are archived at NCEI and accessible through their Trackline Geophysical Data Viewer at https://maps.ngdc.noaa.gov/viewers/geophysics/ (Last accessed March 2021). To access these data, select "Subbottom Profile" under Marine Surveys and click on Search Marine Surveys. In the pop-up window, select "EX1703" in the Filter by Survey IDs dropdown menu. Click OK, and the ship track for the cruise will appear on the map. Click the ship track for options to download data.

Split-beam Sonars (Simrad EK60)

EK60 water column data for EX-17-03 are archived at NCEI and available through their Water Column Sonar Data Viewer at https://www.ngdc.noaa.gov/maps/water_column_sonar/index.html (Last accessed March 2021). To access these data, click on the Additional Filters button, deselect "All" next to Survey ID, and select "EX1703" from the Survey ID list. Click OK, and the ship track for the cruise will appear on the map. Click on the ship track for options to download data.

Acoustic Doppler Current Profilers (Teledyne Marine Workhorse Mariner and Teledyne Ocean Surveyor ADCPs)

ADCP data collected at each ROV dive location are archived at NCEI and available through their Global Ocean Currents Database at https://www.nodc.noaa.gov/gocd/sadcp_oer_inv.html (Last accessed December 2020). Access these data by searching the table for the expedition identifier "EX1703".

7.4 Conductivity, Temperature, and Depth (CTD) Measurements

CTD profile data from EX-17-03 are archived at NCEI and available through OER's Digital Atlas at https://www.ncei.noaa.gov/maps/oer-digital-atlas/mapsOE.htm (Last accessed March 2021). To access these data, click on the Search tab, enter "EX1703" in the Enter Search Text field, and click Search. Click on the point that represents EX-17-03 to access data options. In the pop-up window, select the Data Access tab for a link to download the CTD profile data.

7.5 Sun Photometer Measurements

Sun photometer measurements are available through NASA's MAN component of AERONET at https://aeronet.gsfc.nasa.gov/new_web/maritime_aerosol_network.html (Last accessed December 2020). Access these data by searching the table for "2017", "*Okeanos Explorer*," and "Pacific Ocean". Click on the links to download the data (note: there may be more than one entry for *Okeanos Explorer* in a region in a given year).

7.6 Engagement

EX-17-03 engaged with audiences around the world, opening a window of understanding into the deep sea. Highlights are listed below:

- Live video feeds received over 2,700,000 views, and web content received 25,300 visits during EX-17-03.
- Live interactions and ship tours were conducted to engage a diversity of audiences. Nearly 100 people toured the *Okeanos Explorer* while in port of Āpia, Sāmoa. Tours included the Independent State of Sāmoa's MNRE and Ministry of Agriculture and Fisheries (MFE), Secretariat of the Pacific Regional Environment Programme (SPREP), and a delegation from Tokelau.
- News/web articles covered EX-17-03. Stories appeared in national and local media outlets and on websites throughout the country, including the New York Times, Deep Sea News, Samoa Observer, Newsweek, and ABC News. This coverage amplified the impact of the expedition, increasing the audience reached.

8. Summary

The *Discovering the Deep: Exploring Remote Pacific Marine Protected Areas* expedition was a 23-day, telepresence enabled cruise to collect critical baseline information about unknown and poorly known deepwater areas in the Howland and Baker Unit of the PRIMNM, American Sāmoa, the PIPA, and New Zealand's Territory of Tokelau. The goal of the expedition was to use ROV dives in combination with seafloor mapping operations to increase the understanding of deep-sea ecosystems and collect scientific information to support future management

decisions and new lines of inquiry. During the expedition, 19 ROV dives were conducted, ranging from 300 to 5,862.9 meters (984 to 19,235 feet), to investigate the diversity and abundance of largely unknown pelagic fauna.

Hundreds of different species of animals—including several potential new species were observed during EX-17-03 as a part of the three year CAPSTONE campaign. Newly observed behaviors and numerous significant range extensions—were also observed. These included the following observations:

- Surveyed the biological and geological variability of benthic habitats—including precious coral habitats, bottomfish fishery habitats, and manganese-encrusted habitats at seamounts.
- Conducted ROV dives in previously unexplored areas—with seven dives in the Howland and Baker Units of the PRIMNM, eight dives in the PIPA, two dives in Tokelauan waters, and one dive at Swains Atoll in the NMSAS.
- Mapped more than 30,100 square kilometers of seafloor.
- Observed more than 300 discrete taxa of organisms including significant coral and sponge communities.
- Collected 38 primary specimens and 128 associates and subsamples, including deep-sea corals, sponges, squat lobsters, and brittle stars.
- Observed more than 40 undescribed species, range extensions, new depth records, and/or new behavioral observations.
- Investigated a variety of different geological features including seamounts, atolls, manganese-encrusted sea floor, a deep trough within the PIPA, and the waters around islands.
- Explored for the first time—at a depth of 5,800 meters—a deep hadal trough, which is atypical for this region of the ocean due to the depth.
- Collected more than 13 TB of data including video and still imagery, multibeam sonar and single beam echo sounder measurements, subbottom profiles, current profiles, CTD, and DO measurements.
- Received more than 2.7 million views of the live videos via multiple social media platforms including Facebook and YouTube.
- More than 48 scientists and students participated from the U.S, New Zealand, Japan, Russia, and Trinidad and Tobago participated as members of the science team.

9. References

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Appendix A: Data Management Plan

Data Management Plan
Okeanos Explorer (EX1703): Howland/Baker
PRIMNM and PIPA (ROV/Mapping)

Ocean Exploration and Research

OER Data Management Objectives
Work with onboard data managers to ensure the most efficient handling and documentation of data from ship to archive and access; refine protocols for onboard data management activities, including sampling operations; refine procedures for incorporating telestream video data into the video data pipelines.

1. General Description of Data to be Managed

1.1 Name and Purpose of the Data Collection Project

Okeanos Explorer (EX1703): Howland/Baker PRIMNM and PIPA (ROV/Mapping)

1.2 Summary description of the data to be collected.

Operations will include the use of the ship's deep water mapping systems (Kongsberg EM302 multibeam sonar, EK60 split-beam fisheries sonars, Knudsen 3260 chirp sub-bottom profiler sonar, and Teledyne Acoustic Doppler Current Profilers), XBT and Underway CTD casts in support of multibeam sonar mapping operations, OER's 6000 m two-body ROV Deep Discoverer and Seirios, and the ship's high-bandwidth satellite connection for continuous real-time ship-to-shore communications.

1.3 Keywords or phrases that could be used to enable users to find the data.

expedition, exploration, explorer, marine education, noaa, ocean, ocean discovery, ocean education, ocean exploration, ocean exploration and research, ocean literacy, ocean research, OER, science, scientific mission, scientific research, sea, stewardship, systematic exploration, technology, transformational research, undersea, underwater, Davisville, mapping survey, multibeam, multibeam backscatter, multibeam sonar, multi-beam sonar, noaa fleet, okeanos, okeanos explorer, R337, Rhode Island, scientific computing system, SCS, single beam sonar, singlebeam sonar, single-beam sonar, sub-bottom profile, water column backscatter, oceans, Tokelau, Kiribati, Phoenix Islands, Phoenix Islands Protected Area, PIPA, Howland and Baker Unit, Pacific Remote Islands Marine National Monument, PRIMNM, American Samoa, Apia, Samoa, CAPSTONE, Campaign to Address Pacific monument Science, Technology, and Ocean Needs, monuments, telepresence, Prime Crust Zone, PCZ, vulnerable marine habitats, high density deep sea coral and sponge communities, deep sea minerals, rare metals, rare earth elements, Central Pacific Seamounts, plate tectonics, subduction zone biology, subduction zone geology

1.4 If this mission is part of a series of missions, what is the series name?

Okeanos ROV Cruises

1.5 Planned or actual temporal coverage of the data.

Dates: 3/7/2017 to 3/29/2017

1.6 Planned or actual geographic coverage of the data.

Latitude Boundaries:	-12.22	to	1.57
Longitude Boundaries:	-177.91	to	-169.09

1.7 What data types will you be creating or capturing and submitting for archive?

Cruise Plan, Cruise Summary, Data Management Plan, Highlight Images, Quick Look Report, ADCP, CTD (processed), CTD (product), CTD (raw), Dive Summaries, EK60 Singlebeam Data, Expedition Cruise Report, HDCS, NetCDF, Mapping Summary, Multibeam (image), Multibeam (processed), Multibeam (product), Multibeam (raw), Raw Video (digital), SCS Output (compressed), SCS Output (native), Sub-Bottom Profile data, Sample Logs, Water Column Backscatter, XBT (raw), Highlight Video, HL Image captions/credits, HL Video captions/credits, Bottom Backscatter, Sample Analysis Reports, Publication, Raw video inventory logs

1.8 What platforms will be employed during this mission?

NOAA Ship Okeanos Explorer, Deep Discoverer ROV, SEIRIOS Camera Sled

2. Point of Contact for this Data Producing Project

Overall POC:	Brian Kennedy, Telepresence Lead, NOAA Office of Ocean Exploration and Research, brian.kennedy@noaa.gov
Title:	Expedition Coordinator
Affiliation/Dept:	NOAA Office of Ocean Exploration and Research
E-Mail:	brian.kennedy@noaa.gov
Phone:	7065402664

3. Point of Contact for Managing the Data

Data POC Name:	Andrew O'Brien, Katharine Weathers, Susan Gottfried
Title:	Onboard Data Manager, Sample Data Manager, Stewardship Data Manager
E-Mail:	andrew.obrien@tgfoe.org, katharine.weathers@noaa.gov, susan.gottfried@noaa.gov

4. Resources

4.1 Have resources for management of these data been identified? True

4.2 Approximate percentage of the budget devoted to data management. (specify % or "unknown")

unknown

5. Data Lineage and Quality

5.1 What is the processing workflow from collection to public release?

SCS data shall be delivered in its native format as well as an archive-ready, documented, and compressed NetCDF3 format to NCEI-MD; multibeam data and metadata will be compressed and delivered in a bagit format to NCEI-CO

5.2 What quality control procedures will be employed?

Quality control procedures for the data from the Kongsberg EM302 is handled at UNH CCOM/JHC. Raw (level-0) bathymetry files are cleaned/edited into new data files (level-1) and converted to a variety of products (level-2). Data from sensors monitored through the SCS are archived in their native format and are not quality controlled. Data from CTD casts and XBT firings are archived in their native format. CTDs are post-processed by the data management team as a quality control measure and customized CTD profiles are generated for display on the Okeanos Atlas (explore.noaa.gov/okeanosatlas).

Okeanos Explorer (EX1703): Howland/Baker PRIMNM and PIPA (ROV/Mapping)

6. Data Documentation

6.1 Does the metadata comply with the Data Documentation Directive? True

6.1.1 If metadata are non-existent or non-compliant, please explain:

not applicable

6.2 Where will the metadata be hosted?

Organization:	An ISO format collection-level metadata record will be generated during pre-cruise planning and published in an OER catalog and Web Accessible Folder (WAF) hosted at NCEI-MS for public discovery and access. The record will be harvested by data.gov.
URL:	https://www.ncddc.noaa.gov/oer-waf/ISO/Resolved/2017
Meta Std:	ISO 19115-2 Geographic Information with Extensions for Imagery and Gridded Data will be the metadata standard employed; a NetCDF3 standard for oceanographic data will be employed for the SCS data; the Library of Congress standard, MAchine Readable Catalog (MARC), will be employed for NOAA Central Library records.

6.3 Process for producing and maintaining metadata:

Metadata will be generated via xml editors or metadata generation tools.

7. Data Access

7.1 Do the data comply with the Data Access Directive? True

7.1.1 If the data will not be available to the public, or with limitations, provide a valid reason.

Not Applicable

7.1.2 If there are limitations, describe how data are protected from unauthorized access.

Account access to mission systems are maintained and controlled by the Program. Data access prior to public accessibility is documented through the use of Data Request forms and standard operating procedures.

7.2 Name and URL of organization or facility providing data access.

Org:	National Centers for Environmental Information
URL:	https://explore.noaa.gov/digitalatlas

7.3 Approximate delay between data collection and dissemination. By what authority?

Hold Time: not applicable

Authority: not applicable

7.4 Prepare a Data Access Statement

No data access constraints, unless data are protected under the National Historic Preservation Act of 1966.

8. Data Preservation and Protection

8.1 Actual or planned long-term data archive location:

Data from this mission will be preserved and stewarded through the NOAA National Centers for Environmental Information. Refer to the Okeanos Explorer FY16 Data Management Plan at NOAA's EDMC DMP Repository (EX_FY16_DMP_Final.pdf) for detailed descriptions of the processes, procedures, and partners involved in this

collaborative effort.

8.2 If no archive planned, why?

8.3 If any delay between data collection and submission to an archive facility, please explain.

30-90 days following cruise end

8.4 How will data be protected from accidental or malicious modification or deletion?

Data management standard operating procedures minimizing accidental or malicious modification or deletion are in place aboard the Okeanos Explorer and will be enforced.

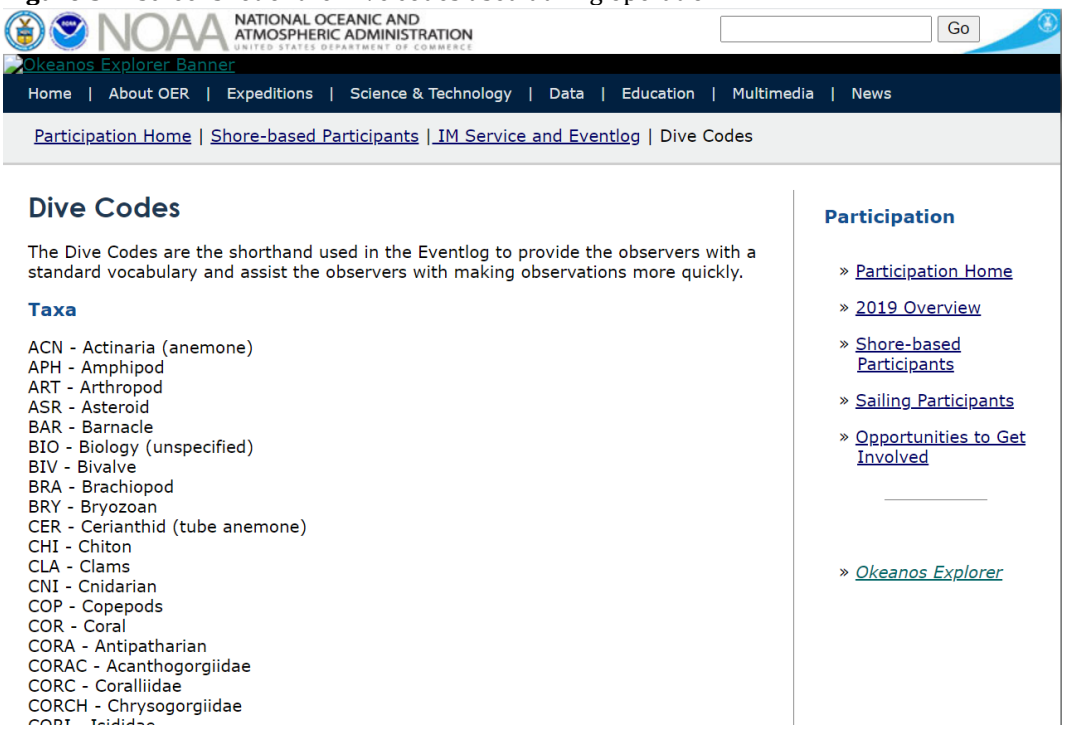
8.5 Prepare a Data Use Statement

Data use shall be credited to NOAA Office of Ocean Exploration and Research.

Appendix B: Dive Codes

To view the full Dive codes for samples collected during EX-17-03 please visit: https://oceanexplorer.noaa.gov/okeanos/collaboration-tools/im-eventlog/dive-codes.html (Last accessed March 2021).

Figure 5. A screenshot of the Dive codes used during operation.



Appendix C: NASA Maritime Aerosols Network Survey of Opportunity

Survey or Project Name

Maritime Aerosol Network

Lead POC or Principle Investigator (PI & Affiliation)

POC: Dr. Alexander Smirnov

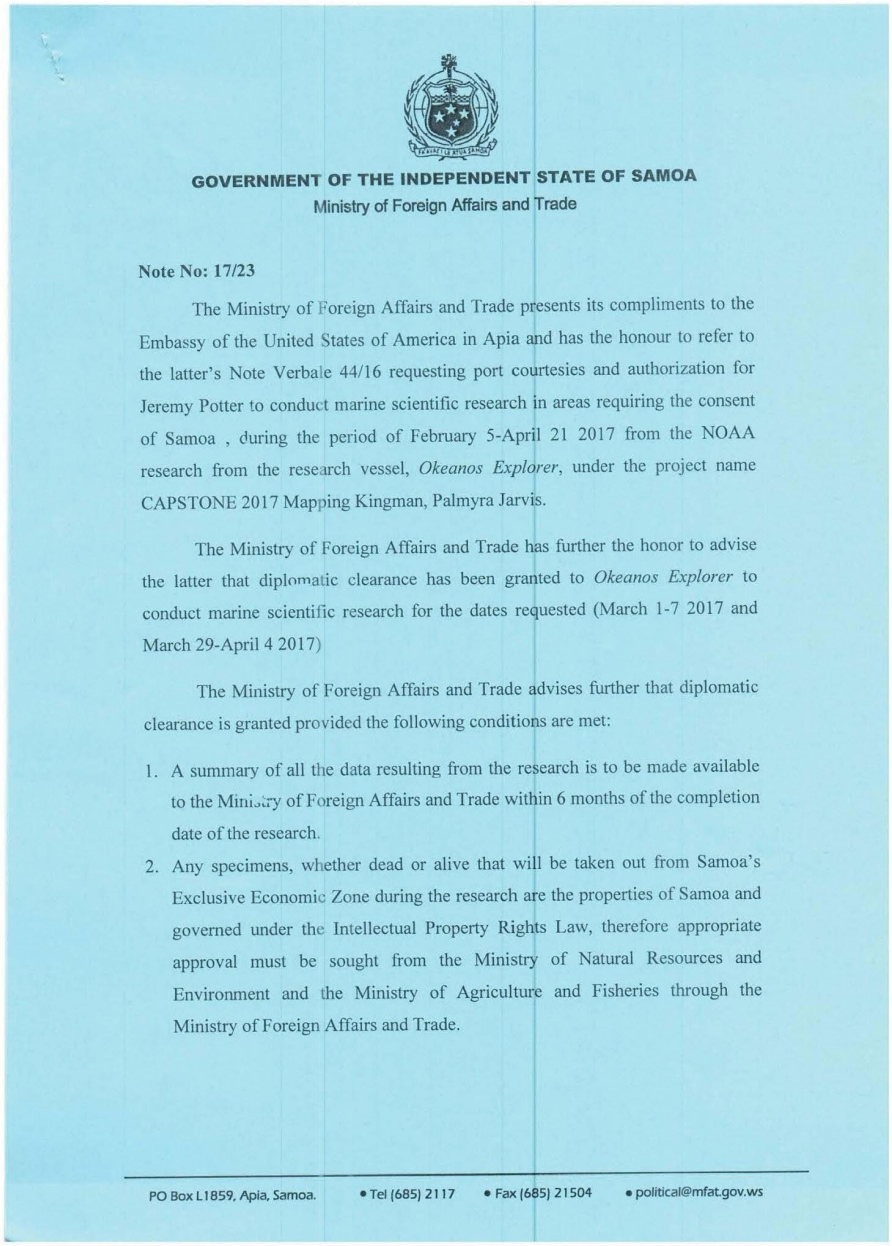
Supporting Team Members Ashore

Supporting Team Members Aboard (if required)

Activities Description(s)(Include goals, objectives and tasks)

The Maritime Aerosol Network (MAN) component of AERONET provides ship-borne aerosol optical depth measurements from the Microtops II sun photometers. These data provide an alternative to observations from islands as well as establish validation points for satellite and aerosol transport models. Since 2004, these instruments have been deployed periodically on ships of opportunity and research vessels to monitor aerosol properties over the World Oceans.

Appendix D: Independent State of Sāmoa MFAT MSR Approval



GOVERNMENT OF THE INDEPENDENT STATE OF SAMOA
Ministry of Foreign Affairs and Trade

Note No: 17/23

The Ministry of Foreign Affairs and Trade presents its compliments to the Embassy of the United States of America in Apia and has the honour to refer to the latter's Note Verbale 44/16 requesting port courtesies and authorization for Jeremy Potter to conduct marine scientific research in areas requiring the consent of Samoa , during the period of February 5-April 21 2017 from the NOAA research from the research vessel, *Okeanos Explorer*, under the project name CAPSTONE 2017 Mapping Kingman, Palmyra Jarvis.

The Ministry of Foreign Affairs and Trade has further the honor to advise the latter that diplomatic clearance has been granted to *Okeanos Explorer* to conduct marine scientific research for the dates requested (March 1-7 2017 and March 29-April 4 2017)

The Ministry of Foreign Affairs and Trade advises further that diplomatic clearance is granted provided the following conditions are met:

1. A summary of all the data resulting from the research is to be made available to the Ministry of Foreign Affairs and Trade within 6 months of the completion date of the research.
2. Any specimens, whether dead or alive that will be taken out from Samoa's Exclusive Economic Zone during the research are the properties of Samoa and governed under the Intellectual Property Rights Law, therefore appropriate approval must be sought from the Ministry of Natural Resources and Environment and the Ministry of Agriculture and Fisheries through the Ministry of Foreign Affairs and Trade.

PO Box L1859, Apia, Samoa. • Tel (685) 2117 • Fax (685) 21504 • political@mfat.gov.ws

3. At the completion of the research and before departing from Samoa, the team leader must discuss with or communicate to the Ministry of Foreign Affairs and Trade appropriate aspects of the research and explain preliminary findings.

The Ministry of Foreign Affairs and Trade avails itself of this opportunity to renew to the Embassy of the United States of America in Apia the assurances of its highest consideration.

23rd of January 2017

Embassy of the United States of America
APIA

MINISTRY OF FOREIGN AFFAIRS AND TRADE
SAMOA

Appendix E: Independent State of Sāmoa MNRE Letter of Support

Government of Samoa

MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT

Matāgaluega o Puna'oa Faalenatura ma le Siosiomaga

Level 3, Tui Atua Tupua Tamasese Efi Building (TATTE), Sogi, P.O Private Bag, Apia, SAMOA.
Website: http://www.mnre.gov.ws/

Telephone: (+685) 67200
Fax: (+685) 23176
Email: info@mnre.gov.ws

Please address all correspondence to the Chief Executive Officer, Private Bag, Apia, Samoa.

Faamolemole faatuatusi uma mai fesootaiga ma i le Ofisa Sili.

10 January 2017

Craig Russell
Program Manager
Okeanos Explorer Explorations
NOAA Office of Ocean Exploration and Research

Dear Mr. Craig Russell,

APPROVAL TO CONDUCT RESEARCH ONBOARD THE NOAA SHIP *OKEANOS EXPLORER* IN THE WATERS OF SAMOA

I acknowledge receipt of your letter dated on 16th December 2016, regarding the above subject matter. I am also in receipt of your Bioprospecting Application for research permit dated on the same date.

The Ministry of Natural Resources and Environment (MNRE) is fully supportive of this research of seafloor mapping operations to ensure it will provide reliable and useful information primarily in areas where high resolution seafloor bathymetry data currently does not exist and in addition, priority areas of interest to Samoa. This will provide baseline data and invaluable scientific data for Samoa oceanographers, marine researchers and managers in order to make informed decisions with regards to the sustainable use and management of our marine resources.

A Memorandum of Agreement (MOA) must be signed between MNRE and NOAA and any other relevant party to the research, to ensure effective collaboration and working relationship in relation to conducting the research and outline conditions and agreeable responsibilities; in any requirements specified in the MOA. There will be fee(s) applied as part of the requirements of our process.

That said, the Ministry is fully supportive of this scientific exploration in the waters of Samoa.

Please do not hesitate to contact Mrs. Tauti Fuatino Leota (Assistant Chief Executive Officer of the Division of Environment and Conservation) on e-mail: fuatino.leota@mnre.gov.ws or Ms. Maria Satoa on email: maria.satoa@mnre.gov.ws or telephone (685) 67200 for further information.

Sincerely,

Suluimalo Amataga Penaia
CHIEF EXECUTIVE OFFICER

Cc: Chief Executive Officer
Ministry of Foreign Affairs and Trade

Dr. Alan P. Leonardi

Ocean Exploration and Research

5

Director, Office of Ocean Exploration and Research

NOAA

United States Department of Commerce

Ministry of Natural Resources and Environment
Division of Environment & Conservation

For Official Use Only:		
Date Application was received:		
date	month	year
21	12	2016
Full Payments made: Yes		No
Receipt No. _____		
MNRE official stamp:		

CONSENT APPLICATION FOR COLLECTION OF SAMOA'S BIOLOGICAL AND NON-BIOLOGICAL RESOURCES

Samoa as a party to the Convention on Biological Diversity (CBD) has a complete sovereign right over its biological and non biological resources

1. APPLICANT: (Please type in all required information)

Name: Craig Russell	**Institution:** US NOAA, Office of Ocean Exploration and Research
Nationality: United States of America	**Country of domicile:** United States
Passport number:	**Current Address:** 7600 Sand Point Way NE Seattle, WA 98115, US
	Samoan address: Port of Apia, Samoa
Phone Number: 206-526-4803	**Permanent Address:** 7600 Sand Point Way NE Seattle, WA 98115 United States of America
Fax Number: none	**E-Mail Address:** craig.russell@noaa.gov

2. PURPOSE OF COLLECTION

2.1 What is the purpose of the collection? (Please provide supporting evidence)

Oceanographic data (depth, backscatter, ocean currents) data will be collected using acoustic devices including multibeam sonar, single beam sonar, sub-bottom profiler and Acoustic Doppler Current Profiler (ADCP)

2.2 How will the information be collected (e.g. by reference books, note taking,

Ocean Exploration and Research

All the acoustic data will be digitally collected.

2.3 What tests/laboratory analysis will be carried out on the material to be collected and what is the purpose of each test?

No tests or laboratory analysis will be carried out onboard. These data sets will be freely made available through a national archive and will aid in developing better bathymetric maps of the world oceans.

3. DETAILS OF WHAT IS TO BE COLLECTED

3.1 List and name the materials to be collected

No physical materials will be collected

3.2 List any other material to be collected (soil symbionts, etc.):

Not applicable

4. COLLECTION: Not applicable

4.1 Persons to be involved in the collection

Name	Address	Qualifications
CAPT Mark Wetzler, NOAA	NOAA Ship *Okeanos Explorer* 1897 Ranger Loop, Ford Island Bldg. 184 Honolulu, HI 96818	Commanding Officer NOAA Ship *Okeanos Explorer*
Brian Kennedy	1315 East West Highway, Silver Spring, MD 20905	Expedition coordinator
Kelley Elliott	1315 East West Highway, Silver Spring, MD 20905	Expedition coordinator
Elizabeth Lobecker	1315 East West Highway, Silver Spring, MD 20905	Expedition coordinator
Derek Sowers	1315 East West Highway, Silver Spring, MD 20905	Expedition coordinator
Michael White	1315 East West Highway, Silver Spring, MD 20905	Expedition coordinator
TBD Science Team	TBD	TBD
TBD Remotely Operated Vehicle Engineering Team	TBD	TBD
TBD Data Management Team	TBD	TBD
TBD Video Team	TBD	TBD
TBD Mapping Team	TBD	TBD
Ship's Officers and Crew	TBD	TBD

*TBD: To be decided

4.2 Proposed area(s) and dates of collection (if known)

The acoustic data will be collected while transiting through Samoan waters. Expedition dates extend from January 18 through April 21, 2017. Expedition dates and approximate locations of the track lines are summarized in the following tables.

Expedition Dates (subject to changes customary of research expeditions):

Expedition	Date	Activities
EX1701	**18 Jan 2017**	Depart Honolulu, Hawaii, USA
	10 Feb 2017	Arrive Pago Pago, American Samoa
EX1702	**16 Feb 2017**	Depart Pago Pago, American Samoa
	02 March 2017	Arrive Apia, Samoa
EX1703	**17 March 2017**	Depart Apia, Samoa
	29 March 2017	Arrive Apia, Samoa
EX1704	**04 April 2017**	Depart Apia
	21 April 2017	Arrive Pago Pago, American Samoa

Transits:

Transit through Samoan waters		
	Approximate Latitude (+N,-S)	Approximate Longitude (+E,-W)
EX1701 - Enter Samoan waters	-12.551	-170.892
EX1701 - Depart Samoan waters	-13.453	-170.819
EX1702 - Enter Samoan waters	-14.076	-171.056
EX1703 - Depart Samoan waters	-12.418	-171.391
EX1703 - Enter Samoan waters	-12.132	-171.971
EX1704 - Depart Samoan waters	-13.941	-170.985

Focused Mapping Areas:

Upolu (North Mapping area bounding box)	
Latitude	Longitude
-13.612	-171.489
-13.645	-171.451
-13.630	-171.252

-13.730	-171.208
-13.956	-171.313
-13.903	-171.376
-13.883	-171.508
-13.770	-171.560

Upolu (South Mapping area bounding box)	
Latitude	Longitude
-13.977	-171.957
-14.090	-171.380
-13.968	-171.296
-14.057	-171.217
-14.232	-171.148
-14.236	171.306
-14.146	-171.965

4.3 Specify expected number or quantity of material to be collected (if known)

No physical material will be collected.

4.4 Describe how collection will be physically performed

No physical collection will be performed.

4.5 List the in-country entities likely to benefit from the activity and in what way.

It is in the best interest of all stakeholders to fully understand the extent of living marine resources that exist in the largely unexplored deep sea. The information and data generated by this project will enable baseline characterization of deepwater areas within Samoa, and the data collected will inform resource managers including the Ministry of Natural Resources and the Environment and the Ministry of Agriculture and Fisheries. The acquisition of high-resolution seafloor mapping data is an essential precursor to making significant biological, geological, archaeological and oceanographic discoveries. These data are both expensive and difficult to acquire - all collection costs are funded by the US Government and its domestic partners.

In addition, the vessel port calls at the port of Apia provide education and outreach opportunities. Ship tours are planned to introduce local students, teachers and officials to deep-sea exploration technologies, and share the findings of cruise activities. These are all opportunities to bring attention to the deep-water habitats and resources in Samoa.

4.6 To what degree will reliance be made on traditional knowledge?

No traditional knowledge will be used or relied on for planned activities.

4.7 Please specify whether specimens collected are listed in Appendix I, II or III of the Convention on International Trade of Endangered Species of Wild Fauna and Flora (CITES).

Not applicable (No specimen will be collected)

5. POTENTIAL IMPACTS

5.1 Describe the potential impacts of the activity. Include:

This is a research project of limited size or magnitude with only short-term effects on the environment and for which any cumulative effects are negligible. As expected with ocean research with limited time or presence in the marine environment, project operations do not have the potential to result in any lasting changes to the environment.

5.2 Describe the nature of any expected research and development plans

The goal of NOAA Ship *Okeanos Explorer* operations to is provide a foundation of publicly accessible data and information products to enable follow-on exploration, research and management activities. The data and information we collect is made publicly accessible as soon as possible after the cruise to enable interested students, scientists and managers to access and use the data. Anyone can use the data once available through the National Centers for Environmental Information.

A standard suite of data and information products are generated for each cruise. Standard data and products include: a cruise plan, multibeam and XBT raw and processed data (including seafloor bathymetry and backscatter, and water column backscatter data), EK60 raw data, ADCP raw data, Knudsen 3260 sub-bottom profiler raw data, mapping data report, and the cruise report.

These data and products are made publicly accessible to ANYONE through the National Centers for Environmental Information and NOAA OER's Digital Atlas within 30-90 days of cruise completion. Once these data are publicly available, we will notify key management groups and scientists interested in the data, including MNRE. Furthermore, our team develops and presents expedition summaries and key findings in various venues including by not limited to: our oceanexplorer.noaa.gov website, an annual Oceanography Supplement publication and major ocean science conferences.

6. FUNDING

6.1 How is the collection supported and by whom?

NOAA Ship *Okeanos Explorer* is a public vessel of the United States of America. Funding for *Okeanos Explorer* originates from the federal budget of the United States of America, specifically the Department of Commerce and the National Oceanic and Atmospheric Administration. NOAA has agreed to provide the ship, multibeam and other sonar systems, and their own technicians required for this cruise.

Signature of Applicant:

Date: 12/16/2016

Application Approved by:

Chief Executive Officer
MNRE

Appendix F: American Sāmoa DMWR Permit

SCIENTIFIC PERMITS SERIES NO: 2017/001

January 19, 2017

This Constitutes the Department's official action on:
SCIENTIFIC COLLECTION PERMITS APPLICATION SERIES NO: 001
NAME OF APPLICANT: KELLY P. ELLIOTT
ADDRESS OF APPLICANT: 1315 East-West Hwy
SSMC3 RM 10262, Silver Spring MD 20910

TITLE OF PROPOSED STUDY: 2017 CAPSTONE American Samoa Expedition

ACTION: X **APPROVED**
____ **DISAPPROVED**

IF APPROVED, EFFECTIVE DURATION OF PERMIT: February 1 to April 30, 2017

IF APPROVED, SPECIFY CONDITIONS: Regular update of activities and copies of relevant request to the Department of Marine & Wildlife Resources.

REASONS FOR DISAPPROVAL: N/A

NAME OF SIGNATURE OF PERMITTING OFFICIAL:
Selaina Tuimavave Vaitautolu
Acting Director
Dept. Marine & Wildlife Resources

DEPARTMENT OF MARINE AND WILDLIFE RESOURCES
AMERICAN SAMOA GOVERNMENT
P.O. BOX 3730
Pago Pago, AS 96799 U.S.A.

SCIENTIFIC STUDY & COLLECTION PERMIT APPLICATION

This application must be completed prior to all scientific studies requiring the observation, collection, handling, &/or manipulation of live or dead entities of both marine and wildlife species whether in part or in whole.

NAME OF APPLICANT: Kelley P. Elliott
ADDRESS: 1315 East-West Hwy, SSMC3 RM 10262, Silver Spring, MD 20910, USA
EMAIL ADDRESS: Kelley.Elliott@noaa.gov
INSTITUTIONAL AFFILIATION: U.S. Department of Commerce, National Oceanic and Atmospheric Instution, Office of Ocean Exploration and Research
INSTITUTIONAL ADDRESS: 1315 East-West HWY, SSMC3 10th Floor, Silver Spring MD 20910

TITLE OF STUDY: 2017 CAPSTONE American Samoa Expedition

OBJECTIVES OF STUDY:
NOAA Ship *Okeanos Explorer* is the nation's first and only federal vessel with a mandate to systematically explore our mostly unknown ocean for the purpose of discovery and the advancement of knowledge. The 2017 CAPSTONE American Samoa Expedition is a part of a major multi-year foundational science effort focused on deepwater areas of U.S. marine protected areas (MPAs) in the central and western Pacific. The overarching goal of the multi-year CAPSTONE project is to extend and improve the understanding of the distribution and diversity of deepwater habitats within MPAs, and collect data and information to support priority monument and sanctuary science and management needs.

The fundamental driver of the multi-leg American Samoa Expedition is to better understand unknown and poorly known areas of our ocean which include diverse living marine resources, and unique geologic phenomena. Data and information from the cruises will build on previous work, and provide a foundation of baseline data to improve management and spur further exploration and research. NOAA priorities for the work include a combination of science, education, outreach, and open data objectives that will support management decisions at multiple levels.

- Acquire data to support priority Monument and Sanctuary science and management needs;
- Explore the diversity of benthic habitats and features (e.g. seamounts, hydrothermal vents, deep-sea coral habitats, bottom fish habitats);
- Identify and map vulnerable marine habitats – particularly high-density deep-sea coral and sponge communities;

- Investigate the geologic history of Pacific seamounts, including potential relevance to plate tectonics and subduction zone biology and geology; and
- Engage a broad spectrum of the scientific community and public in telepresence-based exploration; and
- Provide a foundation of publicly accessible data and information products to spur further exploration, research, and management activities.

Operations will use the ship's deep water mapping systems, NOAA's 6000m remotely operated vehicles (ROV), Conductivity Temperature Depth (CTD) rosette, underway CTD, and a high-bandwidth satellite connection for real-time ship to shore communications. Like previous expeditions in the Gulf of Mexico, western Atlantic, Hawai'i and Indonesia, NOAA will work with the scientific community and public to characterize unknown and poorly-known areas through telepresence-based exploration. Data and information from the Expedition will be made publicly available to provide a foundation of publicly-accessible baseline information to improve management and spur further exploration and research.

We propose to conduct activities within the American Samoa Exclusive Economic Zone, including within the Rose Atoll Marine National Monument, the National Marine Sanctuary of American Samoa and within territorial waters to explore and improve understanding of the distribution and diversity of deep water habitats. The activity would occur during five cruises from February 1 to April 30, 2017. Operations will be focused in 250 meters and deeper. No activities would occur on land.

DESCRIPTION OF SPECIMEN(S) TO BE COLLECTED, IF ANY:
During ROV operations, only very selective specimens that have the potential to contribute significant scientific discoveries will be collected. On average only 4-6 total biological and geological specimens will be collected per dive. Biologic samples will focus on potential new species or new records for the region, and the dominant morphotype animal (such as a coral or sponge) in a habitat. When possible, only a sub-sample will be taken of biologic specimens (e.g., only a piece or branch of corals and sponges will be collected, not the entire organism). Selective rock specimens, that have the potential to contribute significant scientific discoveries, as outlined in the expedition goals, will also be targeted. These are expected to include rocks from seamounts and manganese-coated rocks. When possible, rock samples will be selected in a way to minimize disturbance to the surrounding environment and to minimize the take of attached organisms. All samples will be preserved onboard and made freely and publicly accessible to the science community through National Repositories.

Water samples may also be collected using our CTD rosette instrument. The CTD instrument package is used to obtain conductivity, temperature, depth and other oceanographic data (dissolved oxygen, light scattering, oxygen reduction potential). At least one, and potentially several, CTD casts are planned for this cruise. CTD casts would be conducted at selected sites including locations where ROV dives are conducted to allow for an improved understanding of the environmental conditions by measuring the physical or chemical properties of the water column overlying or hosting a particular habitat. No water samples have been requested at this time, however if they are requested and collected they would likely be frozen for later analysis. The results from any analysis would be made publicly available.

DESCRIBE COLLECTION METHODS TO BE USED:

ROV Operations: biological and geological specimens

The purpose of conducting ROV operations is to conduct interdisciplinary site characterization at priority targets in American Samoa. Interdisciplinary site characterization would be achieved by visually surveying priority targets while simultaneously acquiring environmental data with in situ sensors mounted on the ROVs (conductivity, temperature and depth; dissolved oxygen; light scattering; and oxygen reduction potential). ROV targets include seamounts, hydrothermal vents, deep-sea coral and sponge communities and bottom fish habitats. The combined dives will enable scientists and managers to have a better understanding of the diversity and distribution of deep water habitats in American Samoa including the Rose Atoll Marine National Monument and National Marine Sanctuary of American Samoa, and should contribute to enhanced protection of these resources.

The *Okeanos Explorer* is equipped with a dedicated, fully integrated, two-body ROV system. ROV operations are conducted primarily during daylight hours while the vessel is stopped and holding station using dynamic positioning. ROV operations will typically take place within several meters of the seafloor, and are conducted in a way to minimize seafloor disturbances. On occasion, the ROV is set down on the seafloor in order to acquire very close imagery of habitats or features of interest or to collect samples. The ROV also has a temperature probe that may be shallowly inserted into the seafloor sediment to measure the depth or temperature of features of interest.

During these dives, limited sampling operations are planned with the ROV to collect very selective specimens that have the potential to contribute significant scientific discoveries. These specimens would be collected using the ROV's manipulator arms or scoop. Biological specimen collections will focus on potential new species or new records for the region, and the dominant morphotype animal (such as a coral or sponge) in a habitat. When possible, only a sub-sample will be taken of biological specimens (e.g., only a piece or branch of corals and sponges will be collected, not the entire organism). Selective rock specimens, that have the potential to contribute significant scientific discoveries, as outlined in the expedition goals, will also be targeted. These are expected to include rocks from seamounts and manganese-coated rocks. When possible, rock samples will be selected in a way to minimize disturbance to the surrounding environment and to minimize the take of attached organisms. On average only 4-6 total biological and geological specimens will be collected per dive.

CTD Rosette: water samples and sensor data

Water samples may also be collected using our CTD rosette instrument. The CTD instrument package is used to obtain conductivity, temperature, depth and other oceanographic data (dissolved oxygen, light scattering, oxygen reduction potential). The instrument is attached to an open cylindrical steel frame approximately 1.15 m in diameter and 1.4 m high with a 24-position rosette carousel containing 24 2.5 L Niskin bottles for collecting water samples. The system would be lowered to a maximum depth of 6800 m by an embedded scientific winch and wire while the vessel would be stopped and hold station using dynamic positioning. The average time to conduct a CTD casts varies from one to several hours depending on water depth (the CTD is

lowered through the water column at 60m/min). CTD casts would be conducted at selected sites including locations where ROV dives are conducted to allow for an improved understanding of the environmental conditions by measuring the physical or chemical properties of the water column overlying or hosting a particular habitat. No water samples have been requested at this time, however if they are collected they would likely be frozen for later analysis. The results from any analysis would be made publicly available.

Mapping Operations: acoustic data

The ship will conduct sonar mapping operations at all times during non-ROV or non-CTD rosette operations throughout the cruise. NOAA Ship *Okeanos Explorer* has a suite of scientific sonars, each with a unique exploration application. All of these systems are routinely used by the ocean science community and have provided invaluable scientific data for oceanographers, marine researchers and managers. Each sonar's acoustic signal is designed to be narrowly focused to provide precise information about a specific, narrowly defined area of the seafloor or water column beneath the ship. The sonars include a Kongsberg EM302 30 kHz multibeam system; 18 kHz, 38 kHz, 70 kHz, 120 kHz, 200 kHz and 333 kHz Kongsberg EK60 split-beam fisheries sonars (the 333 kHz and 38 kHz will not be operational since we don't currently have the hardware general purpose transceiver to run it, but is included just in case); a Knudsen 3.5 kHz chirp sub-bottom profiler sonar; and 300 kHz and 38 kHz Teledyne Acoustic Doppler Current Profilers (ADCPs). The multibeam maps broad swaths for seafloor bathymetry/backscatter and water column feature detection (e.g. gaseous seeps), the split-beam sonars gather calibrated target strength measurements of biologic and gaseous targets in the water column, the sub-bottom profiler provides data useful for interpreting sub-seafloor geology, and the ADCPs provide information about current velocity and direction at various depths through a water column profile. Additionally, expendable bathythermographs (XBTs) and the ship's UnderwayCTD (UCTD) will be deployed at regular intervals in association with multibeam data collection. All of these systems are routinely used by this exploration vessel.

DURATION OF STUDY OR COLLECTION PERIOD:

The activity would occur during five cruises from February 1 to April 30, 2017. The requested dates cover a conservative estimate of the timing that NOAA Ship *Okeanos Explorer* will arrive in American Samoa and can commence work in the region, through a few days after the last cruise departs and is likely to conduct work in American Samoa. During the cruises, 15 deployments of the ROV are planned in American Samoan waters, resulting in 120 hours total dive time (~8 hours for each dive). The Expedition cruise legs, dates and focus areas are below:

EX-17-01 (January 18 – February 10, 2017): 24-day mapping cruise from Honolulu, HI to Pago Pago, American Samoa with focused mapping work in: Kingman/Palmyra and Jarvis units of the Pacific Remote Islands Marine National Monument (PRIMNM); the Pheonix Islands Protected Area (PIPA) part of Kiribati; Tokelau and Swains Island Unit of the National Marine Sanctuary of American Samoa (NMSAS).

EX-17-02 (February 16 – March 2, 2017. Pago Pago, American Samoa - Apia, Samoa): 14-day cruise with daytime remotely operated vehicle (ROV) dives and overnight CTD rosette and mapping operations focused on American Samoan waters.

EX-17-03 (March 7 - 29, 2017. Apia, Samoa - Apia, Samoa): A 23-day cruise with daytime remotely operated vehicle dives and overnight CTD rosette and mapping operations focused on PIPA and the Howland/Baker Unit of the PRIMNM. One dive is planned in the Swains Island unit of the National Marine Sanctuary of American Samoa at either the start or end of the cruise.

EX-17-04 (April 4 – April 21, 2017. Apia, Samoa - Pago Pago, American Samoa): An 18-day mapping cruise focused on American Samoa including unmapped or poorly mapped areas of the Rose Atoll Marine National Monument and National Marine Sanctuary of American Samoa deeper than ~250m.

EX-17-05 (April 27 – May 19, 2017. Pago Pago, AS to Honolulu, HI): A 23-day cruise with daytime remotely operated vehicle (ROV) dives and overnight CTD rosette and mapping operations focused on the Cook Islands and the Jarvis and Kingman/Palmyra Units of the PRIMNM. One dive is planned in or just outside of the Aunu'u Unit of the National Marine Sanctuary of American Samoa at the start of the cruise.

SPECIFIC LOCATION(S) OF STUDY &/or COLLECTING/SAMPLING AREA(S): Mapping, ROV and CTD rosette operations will focus in depths generally between 250 and 6,500 meters, with some mapping planned. CTD rosette operations have been requested in waters south of Tutuila and at Vailulu'u seamount. No activities would occur on land.

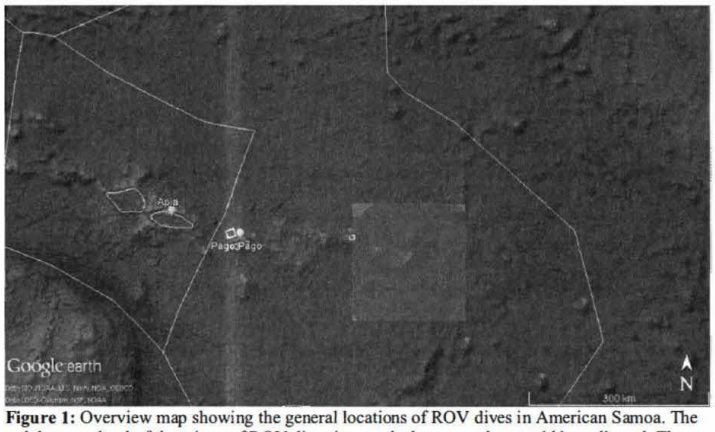


Figure 1: Overview map showing the general locations of ROV dives in American Samoa. The red dots are the draft locations of ROV dive sites, and where samples would be collected. The yellow boxes are priority areas for focused mapping surveys. Focused overnight mapping operations will be planned during the cruise based on available time. The light blue polygons are the boundaries of the Rose Atoll Marine National Monument and National Marine Sanctuary of

American Samoa. The green labelled dots are the port locations of Pago Pago, American Samoa and Apia, Samoa. The white line is the publicly available Exclusive Economic Zone of American Samoa and Samoa.

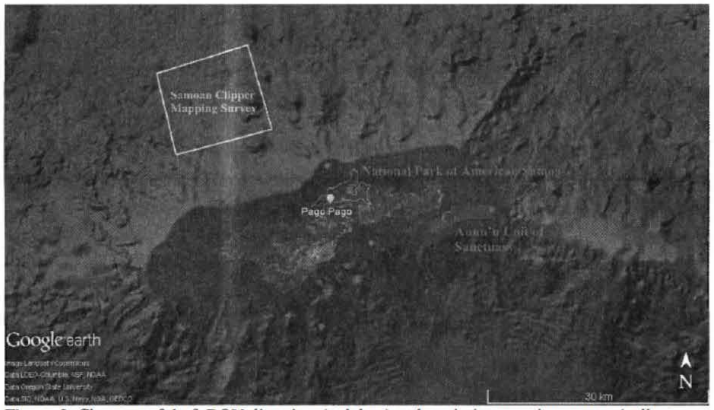


Figure 2. Close-up of draft ROV dive sites (red dots) and a priority mapping survey (yellow polygon) near Tutuila Island. The green polygon is the boundaries of the National Park of American Samoa (which extends to 100m offshore), and the light blue polygon is the Aunu'u unit of the National Marine Sanctuary of American Samoa. The requested sonar mapping survey is to support efforts to find a lost plane and maritime archaeology procedures will be employed during the survey to protect location information.

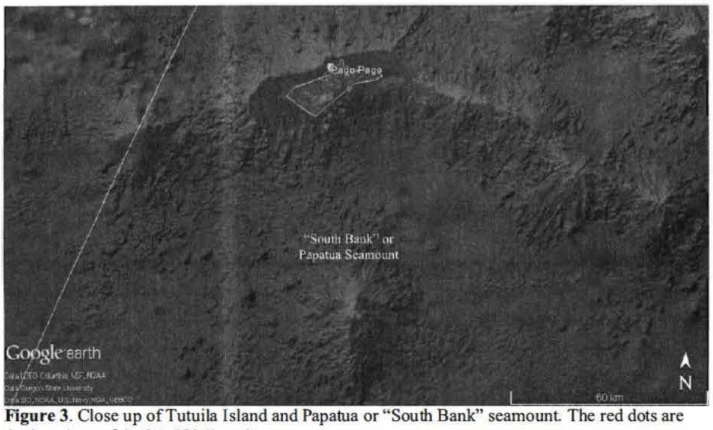


Figure 3. Close up of Tutuila Island and Papatua or "South Bank" seamount. The red dots are the locations of draft ROV dive sites.

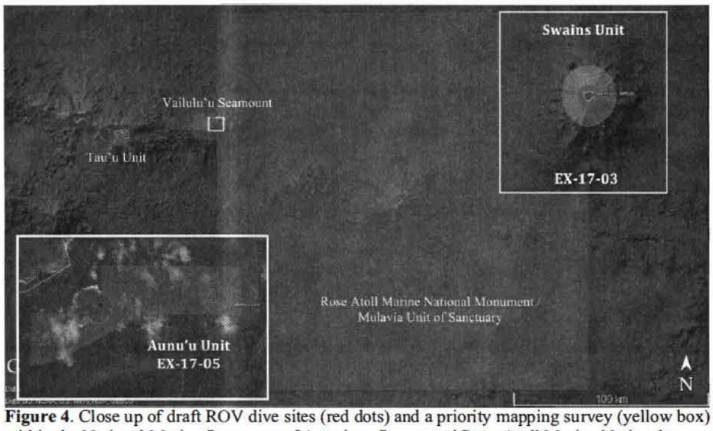


Figure 4. Close up of draft ROV dive sites (red dots) and a priority mapping survey (yellow box) within the National Marine Sanctuary of American Samoa and Rose Atoll Marine National Monument (the light blue boxes).

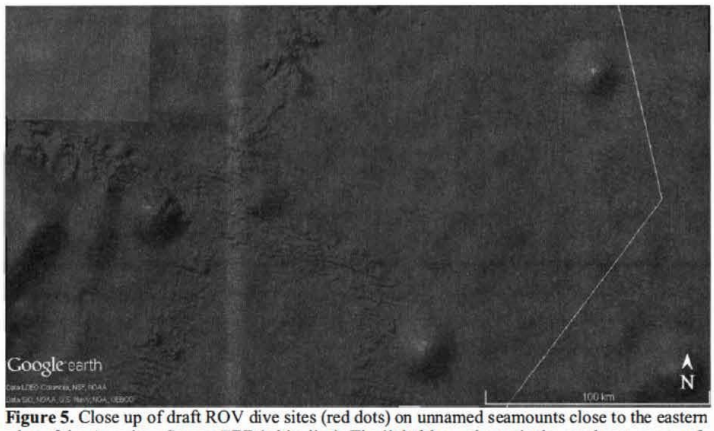


Figure 5. Close up of draft ROV dive sites (red dots) on unnamed seamounts close to the eastern edge of the American Samoa EEZ (white line). The light blue polygon is the southeast corner of Rose Atoll Marine National Monument. Mapping operations will need to be conducted overtop of the seamounts the night/morning prior to the dive to finalize the dive track.

Figure 6. Overview map showing areas where seafloor mapping activities are planned – especially during EX-17-02 and EX-17-04 cruises. The orange polygons are mapping survey

areas requested by the science and management community. Mapping operations will focus on areas 250 meters and deeper.

IF HANDLING &/OR MANIPULATION OF LIVE ANIMALS, DESCRIBE PROTOCOL(S):

ROV Operations:
Once a sample is brought onboard, it will be photographed, documented, and information entered into a sample database. Rocks will be dried and photographed. Aliquots of coral and sponge specimens will be preserved for taxonomic analysis (ethanol), genetic analysis (CHAOS or other buffer), and in some cases, histological examination (10% buffered formalin). All other animals will be preserved in either formalin or ethanol, depending on which preservative is more desirable for the particular taxa.

An additional small tissue sample will be taken of all biological specimens when doing so will not be overly destructive to the specimen. This tissue sample will be preserved onboard for later genomic DNA and RNA extraction at the Ocean Genome Legacy Center (OGL) in Northeastern University.

All samples will remain on the ship until it returns to Honolulu, HI in summer 2017. The samples will then be taken to OER Science Advisor, Dr. Chris Kelley's lab at the University of Hawaii at Manoa for temporary storage. There they will be prepared and transferred to a repository (with preliminary identification provided along with photographs and a deed of gift).

IF SAMPLES COLLECTED WILL BE SUBJECTED TO FURTHER PROCESSING (e.g., genetic analysis or other biochemical analysis, museum prep), DESCRIBE HOW AND WHERE:

All biological and geological samples will be provided to a public repository to be described and made publicly accessible to the scientific research community. Scientists can then request access to the samples to conduct additional analysis, however this is outside the scope of our project.

FINAL DISPOSITION OF SAMPLES OR ANIMALS:
Selected coral and sponge specimens will be split, with one piece going to Bishop Museum in Hawaii, and the other to the Smithsonian to ensure access to as many researchers as possible. If it is determined that splitting will be too destructive to a particular specimen, it will be provided to the Smithsonian Institution intact in order to provide public access to as many researchers as possible. Crustaceans and any other organisms found on the corals and sponges will be provided to the Smithsonian. All other animals will be provided to the Smithsonian.

Tissue samples will be provided to the Ocean Genome Legacy Center (OGL) at Northeastern University. The results of genomic analysis are made publicly available through OGLs website.

All geological samples will be sent to the Oregon State University's Marine Geology Repository to be made publicly accessible. OSU will receive the samples, curate them, describe them from a

petrology point of view (e.g. mineral content, texture, alteration, rock name), microphotograph them and prepare them for future redistribution.

No water samples have been requested at this time, however if they are collected they would likely be frozen for later analysis. The results from any analysis would be made publicly available through the NOAA's National Centers for Environmental Information.

JUSTIFICATION FOR REQUEST TO COLLECT, SAMPLE, HANDLE, &/OR MANIPULATE ANIMALS OF PARTS THEREOF:
The acquisition of high-resolution seafloor mapping data is an essential precursor to making significant biological, geological, archaeological and oceanographic discoveries. The *Okeanos Explorer* cruises will collect seafloor mapping data in areas previously unmapped with sonar or modern sonar, and to supplement previous work. These maps form the basis for selecting ROV dive targets.

ROV dives take the next major step in baseline habitat characterization by using the ROV system to visually investigate unknown and little known deep water habitats within American Samoa identified as priority scientists and managers. CTD casts may be conducted to collect additional information about the physical and chemical properties of the water column, including at sites of interest identified from mapping and ROV investigation.

These dives will be the next step in a baseline habitat characterization, and directly contribute to a better understanding of the deep water habitats, ecosystems and geology of American Samoa. The dives will enable scientists and managers to have a better understanding of the diversity and distribution of deepwater habitats. It is this understanding that enables effective management decisions, and provides continuous support for the monuments, sanctuaries and their protection of these resources. The collective understanding established from the multi-year CAPSTONE expeditions will increase understanding of deep-sea biogeographic patterns across the Central and Western Pacific.

PROJECTED STARTING DATE OF STUDY:
The starting date of the first cruise is January 18th, however the ship will not arrive in American Samoan waters until early February. I have listed project dates of February 1 (the start date) to April 30, 2017. The requested dates cover a conservative estimate of the timing that NOAA Ship *Okeanos Explorer* will arrive in American Samoa and can commence work in the region, through a few days after the last cruise departs and is likely to conduct work in American Samoa. The Expedition cruise legs, dates and focus areas are detailed in the "Duration of Study or Collection Period" section above.

NAME OF LOCAL COLLABORATOR(S) &/OR LOCAL INSTITUTIONAL AFFILIATION,
Local managers have identified many of the priority sites for acoustic mapping and remotely operated vehicle dives in American Samoan waters. The names and affiliations of key partners are included below:

Genevieve (Gene) Brighouse*

National Marine Sanctuary of American Samoa, Superintendent
**We have met with the entire Sanctuary team and will be collaborating with them closely, especially on outreach activities.*

Fatima Sauafea-Le'au
NOAA Fisheries - PIRO
Habitat Conservation Division
American Samoa Field Office

Brian Peck
Rose Atoll Marine National Monument, Superintendent
Rose Atoll National Wildlife Refuge, Manager
US Fish and Wildlife Service

Dr. Tim Clark
Marine Ecologist
National Park of American Samoa

We also met with representatives from other American Samoa agencies in November 2016 to share our draft project plans and request additional input and feedback. This included Dr. Ruth Matagi-Tofiga, Director of the Department of Marine and Wildlife Resources. Other agencies and officials included the Office of Samoan Affairs, the American Samoa Governor's Coral Reef Advisory Group, American Samoa Environmental Protection Agency, and the American Samoa Power Authority.

OTHER COLLABORATING SCIENTISTS:
Dr. Chris Kelley, CAPSTONE Science Advisory, University of Hawaii at Manoa
Dr. Santiago Herrera, Biology Science Team Lead, Lehigh University
Dr. Matthew Jackson, Geology Science Team Lead, University of California Santa Barbara
Elizabeth Lobecker, Physical Scientist/Mapping Lead, NOAA Office of Ocean Exploration and Research

SIGNATURE OF APPLICANT: _____

DATE: Jan. 3, 2017

MAIL or RETURN THIS FORM TO THE ADDRESS ON THE TOP OF THE FRONT PAGE.

FOR OFFICE USE ONLY

APPLICATION SERIES No. _____

DATE APPLICATION RECEIVED: _____

RECEIVED BY: _____

APPLICATION FEE Receipt No. & Amount: _____

REVIEWER'S COMMENTS:

This is an important research initiative to explore and understand the deep-water habitats of American Samoa. These are habitats that are generally out of reach but the technologies borned by this expedition will map and sample environments and living things in the deep.

RECOMMENDED ACTION: Approve

NAME AND SIGNATURE OF REVIEWER: Dr. Domingo Ochavillo

DATE: 9 January 2017

Appendix G: NMSAS Permit

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE

National Marine Sanctuary of American Samoa
P.O. Box 4318
Pago Pago, AS 96799

January 19, 2017

MEMORANDUM FOR: THE RECORD

FROM: Gene Brighouse
National Marine Sanctuary of American Samoa

SUBJECT: Decision Memo for Permit # NMSAS-2017-001

The National Oceanic and Atmospheric Administration's National Marine Sanctuary Program (NMSP) has decided to issue permit number NMSAS-2017-001 to Kelley Elliott for the project entitled: 2017 American Samoa Expedition. This memorandum documents the rationale for this decision and compliance with all required consultations generated by this action.

BACKGROUND

Project Summary:
NOAA Ship Okeanos Explorer is the nation's first and only federal vessel with a mandate to systematically explore our mostly unknown ocean for the purpose of discovery and the advancement of knowledge. Operating under a partnership with NOAA's Office of Ocean Exploration and Research and the Office of Marine and Aviation Operations, the 2017 CAPSTONE American Samoa Expedition is a part of a major multi-year foundational science effort focused on deepwater areas of U.S. marine protected areas (MPAs) in the central and western Pacific. The overarching goal of the CAPSTONE project is to extend and improve the understanding of the distribution and diversity of deepwater habitats within MPAs, and collect data and information to support priority monument and sanctuary science and management needs.

Data and information from the Expeditions will provide a foundation of publicly-accessible baseline information to improve management and spur further exploration and research. Like previous expeditions in the Gulf of Mexico, western Atlantic, Hawai'i and Indonesia, NOAA will work with the scientific community and public to characterize unknown and poorly-known areas through telepresence-based exploration. Operations will use the ship's deep water mapping systems, NOAA's 6000m remotely operated vehicles (ROV), underway CTD, CTD rosette, and a high-bandwidth satellite connection for real-time ship to shore communications.

We propose to conduct activities in and around the National Marine Sanctuary of American Samoa to explore and improve understanding of the distribution and diversity of deep water habitats. The activity would occur during five cruises from February 1 to April 30, 2017. Operations will be focused in 250 m and deeper. No activities would occur on land.

Direct impacts:
A standard suite of operations are conducted on Okeanos Explorer and have been determined to not have the potential to result in any lasting changes to the environment. As defined in Sections 5.05 and 6.03.c.3 (a) of NAO 216-6, this is a research project of limited size or magnitude or with only short-term effects on the environment and for which any cumulative effects are negligible. Full details of the potential short-term impacts are described in the attached Categorical Exclusion.

Indirect impacts:
No indirect impacts on sanctuary resources will result from this activity.

Cumulative impacts:
A standard suite of operations are conducted on Okeanos Explorer and have been determined to not have the potential to result in any lasting changes to the environment. As defined in Sections 5.05 and 6.03.c.3 (a) of NAO 216-6, this is a research project of limited size or magnitude or with only short-term effects on the environment and for which any cumulative effects are negligible. Full details of the potential short-term impacts are described in the attached Categorical Exclusion.

Site-specific impacts and review criteria:
Activity shall be conducted with adequate safeguards for the environment. Environment shall be returned to, or will regenerate to, the condition which existed before the activity occurred.

NATIONAL ENVIRONMENTAL POLICY ACT

Categorical Exclusion:
After reviewing NOAA Administrative Order (NAO) 216-6, including the criteria used to determine significance, the NMSP has concluded that the issuance of this permit would not have a significant effect, individually or cumulatively, on the human environment. Further, we have determined that the proposed action is categorically excluded from the requirement to prepare an environmental assessment or environmental impact statement in accordance with Section 6.03c.3(a) Research Program of NAO 216-6, specifically:

The proposed research activity is of limited size and magnitude and, based on analysis of past projects in the permitted activity area, has been found to have negligible cumulative effects. I certify that this action is not likely to result in significant impacts as defined at 40 CFR 1508.27 and is not an exception to this CE category as defined by section 5.05c of NAO 216-6.

Based on this, the NMSP has concluded that an environmental assessment is not warranted for the issuance of this permit.

MAGNUSON-STEVENS ACT / ESSENTIAL FISH HABITAT

Section 305(b) (2) of the Magnuson-Stevens Fishery Conservation and Management Act requires any federal action agency to complete an Essential Fish Habitat consultation for any action authorized by the agency that may adversely affect EFH. The issuance of this permit will

adversely impact designated EFH within National Marine Sanctuary of American Samoa. Therefore, consultation with NMFS Pacific Islands Regional Office was conducted on November 30, 2016. Recommendations to minimize or mitigate for impacts to EFH have been taken into consideration and incorporated into the final action.

MARINE MAMMAL PROTECTION ACT

The issuance of this permit is not likely to result in the take of any marine mammal protected under the Marine Mammal Protection Act. Therefore, a separate permit to take a marine mammal is not required.

COASTAL ZONE MANAGEMENT ACT

The NMSP has determined that the proposed activity is not reasonably likely to affect any land or water use or natural resource of the coastal zone of American Samoa. In addition, national marine sanctuary permits and authorizations are not listed under the American Samoa Coastal Zone Management Program (CZMP) as activities that generally require a consistency determination. Furthermore, American Samoa CMP has not contacted the NOAA Office of Ocean and Coastal Resource Management with a request to review this permit. Therefore, a federal consistency determination is not required for this action.

ENDANGERED SPECIES ACT

The NMSP has determined that the proposed activity is not likely to adversely affect ESA-listed marine species. Consultation with the National Marine Fisheries Service Pacific Islands Regional Office as required by Section 7 of the Endangered Species Act was conducted on January 14, 2016. Recommendations generated through consultation have been taken into consideration and incorporated into the final action.

NATIONAL HISTORIC PRESERVATION ACT

Section 106 of the National Historic Preservation Act requires federal agencies to consider the impact of their actions on historic properties. The NMSP has determined that the proposed activity is not likely to affect any historic properties. No consultations with the Advisory Council on Historic Preservation, State Historic Preservation Officer, or Tribal Historic Preservation Officer were conducted.

OTHER CONSULTATIONS

No other consultations were required or considered for this action.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE

National Marine Sanctuary of American Samoa
P.O. Box 4318
Pago Pago, AS 96799

January 19, 2017

Ms. Kelley Elliott
NOAA Office of Ocean Exploration and Research (OER
1315 East-West Hwy
SSMC3 Room 10262
Silver Spring, MD 20910

Dear Ms. Elliott:

The National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries (ONMS) has approved the issuance of permit number NMSAS-2017-001 to conduct activities within National Marine Sanctuary of American Samoa (sanctuary) for research purposes. Activities are to be conducted in accordance with the permit application and all supporting materials submitted to the sanctuary, and the terms and conditions of permit number NMSAS-2017-001 (enclosed).

This permit is not valid until signed and returned to the ONMS. Retain one signed copy and carry it with you while conducting the permitted activities. Additional copies must be signed and returned, by either mail or email, to the following individuals within 30 days of issuance and before commencing any activity authorized by this permit:

Gene Brighouse Superintendent National Marine Sanctuary of American Samoa P.O. Box 4318 Pago Pago, AS 96799 Gene.Brighouse@noaa.gov	National Permit Coordinator NOAA Office of National Marine Sanctuaries 1305 East-West Highway (N/ORM6) SSMC4, 11th Floor Silver Spring, MD 20910 nmspermits@noaa.gov

Your permit contains specific terms, conditions and reporting requirements. Review them closely and fully comply with them while undertaking permitted activities.

If you have any questions, please contact Gene Brighouse at 011-684-633-6500. Thank you for your continued cooperation with the ONMS.

Sincerely,

Gene Brighouse
Superintendent

Enclosure

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE

National Marine Sanctuary of American Samoa
P.O. Box 4318
Pago Pago, AS 96799

NATIONAL MARINE SANCTUARY of AMERICAN SAMOA
RESEARCH PERMIT

Permittee:
Ms. Kelley Elliott
NOAA Office of Ocean Exploration and Research (OER
1315 East-West Hwy
SSMC3 Room 10262
Silver Spring, MD 20910

Permit Number: NMSAS-2017-001
Effective Date: February 1, 2017
Expiration Date: April 30, 2017

Project Title: 2017 American Samoa Expedition

This permit is issued for activities in accordance with the National Marine Sanctuaries Act (NMSA), 16 USC §1431 *et seq.*, and regulations thereunder (15 CFR Part 922). All activities must be conducted in accordance with those regulations and law. No activity prohibited in 15 CFR Part 922 is allowed except as specified in the activity description below.

Subject to the terms and conditions of this permit, the National Oceanic and Atmospheric Administration (NOAA), Office of National Marine Sanctuaries (ONMS) hereby authorizes the permittee listed above to conduct research activities within National Marine Sanctuary of American Samoa (NMSAS or sanctuary). All activities are to be conducted in accordance with this permit and the permit application received January 03, 2017. The permit application is incorporated into this permit and made a part hereof; provided, however, that if there are any conflicts between the permit application and the terms and conditions of this permit, the terms and conditions of this permit shall be controlling.

Permitted Activity Description:
The following activities are authorized by this permit:

Permitted research activities utilizing methods as described in the research application include: Damaging, destroying or possessing any invertebrate, coral, bottom formation or marine plant; Alteration of seabed; collection of bottom-dwelling species throughout the sanctuary.

Specimens to be collected are very unlikely to already reside in a repository as the dives and collections are discovery-based. Only very selective specimens that have the potential to contribute significant scientific discoveries will be collected during ROV operations. Biologic samples will focus on potential new species or new records for the region, and the dominant morphotype animal (such as a coral or sponge) in a habitat. Selective rock specimens, that have the potential to contribute significant scientific discoveries, as outlined in the expedition goals, will also be targeted. These are expected to include rocks from seamounts and manganese-coated rocks.

When possible, only a sub-sample will be taken of biologic specimens (e.g., only a piece or branch of corals and sponges will be collected, not the entire organism). When possible, rock samples will be selected in a way to minimize disturbance to the surrounding environment and to minimize the take of attached organisms. All samples will be preserved onboard and made freely and publicly accessible to the science community through National Repositories.

No further violation of sanctuary regulations is allowed.

Permitted Activity Location:
The permitted activity is allowed only in the following location(s):

Throughout the sanctuary.

Special Terms and Conditions:

The permittee may not anchor within the Sanctuary boundaries.

The permittee may not permanently mark any of the reefs.

The permittee shall submit an annual report of all activities conducted under this permit to the NMSAS Permit Coordinator no later than one year from completion of field activities. The report should include a synopsis of research results to date, as well as information regarding daily activities such as location (latitude and longitude) and depth of surveys, discovery or disturbance of historical artifacts, or equipment lost. Appropriate photographs that may be used by NOAA are appreciated, and will be credited to the photographer.

Any scientific publications and/or reports resulting from activities conducted under the authority of this permit must include the notation that the activity was conducted under permit number NMSAS-2017-001. Additionally, the permittee and his/her respective institution(s) are required to acknowledge during any media coverage (press releases, video/photo, or other means) that the research activities occurred within the NMSAS and under permit.

NOAA reserves the right to place an observer aboard the ship engaged in operations conducted under this permit. The NOAA observer(s) may document the permittee's activities for the purpose of determining whether the permitted activities are conducted in accordance with the terms and conditions of this permit and the applicable statute and regulations. The NOAA observer(s) may also provide limited advice and technical assistance, if requested by the permittee. The NOAA observer(s) will not be present for the purpose of safety of permittees, nor for the purpose of approval of activities not specifically authorized by this permit.

General Terms and Conditions:

1. Within 30 (thirty) days of the date of issuance, the permittee must sign and date this permit for it to be considered valid. Once signed, the permittee must send copies, via mail or email, to the following individuals:

Gene Brighouse Superintendent National Marine Sanctuary of American Samoa P.O. Box 4318 Pago Pago, AS 96799 Gene.Brighouse@noaa.gov	National Permit Coordinator NOAA Office of National Marine Sanctuaries 1305 East-West Highway (N/ORM6) SSMC4, 11th Floor Silver Spring, MD 20910 nmspermits@noaa.gov

2. It is a violation of this permit to conduct any activity authorized by this permit prior to the ONMS having received a copy signed by the permittee.

3. This permit may only be amended by the ONMS. The permittee may not change or amend any part of this permit at any time. The terms of the permit must be accepted in full, without revision; otherwise, the permittee must return the permit to the sanctuary office unsigned with a written explanation for its rejection. Amendments to this permit must be requested in the same manner the original request was made.

4. All persons participating in the permitted activity must be under the supervision of the permittee, and the permittee is responsible for any violation of this permit, the NMSA, and sanctuary regulations for activities conducted under, or in junction with, this permit. The permittee must assure that all persons performing activities under this permit are fully aware of the conditions herein.

5. This permit is non-transferable and must be carried by the permittee at all times while engaging in any activity authorized by this permit.

6. This permit may be suspended, revoked, or modified for violation of the terms and conditions of this permit, the regulations at 15 CFR Part 922, the NMSA, or for other good cause. Such action will be communicated in writing to the applicant or permittee, and will set forth the reason(s) for the action taken.

7. This permit may be suspended, revoked or modified if requirements from previous ONMS permits or authorizations issued to the permittee are not fulfilled by their due date.

8. Permit applications for any future activities in the sanctuary or any other sanctuary in the system by the permittee might not be considered until all requirements from this permit are fulfilled.

9. This permit does not authorize the conduct of any activity prohibited by 15 CFR § 922, other than those specifically described in the "Permitted Activity Description" section of this permit. If the permittee or any person acting under the permittee's supervision

conducts, or causes to be conducted, any activity in the sanctuary not in accordance with the terms and conditions set forth in this permit, or who otherwise violates such terms and conditions, the permittee may be subject to civil penalties, forfeiture, costs, and all other remedies under the NMSA and its implementing regulations at 15 CFR Part 922.

10. Any publications and/or reports resulting from activities conducted under the authority of this permit must include the notation that the activity was conducted under National Marine Sanctuary Permit NMSAS-2017-001 and be sent to the ONMS officials listed in general condition number 1.

11. This permit does not relieve the permittee of responsibility to comply with all other federal, state and local laws and regulations, and this permit is not valid until all other necessary permits, authorizations, and approvals are obtained. Particularly, this permit does not allow disturbance of marine mammals or seabirds protected under provisions of the Endangered Species Act, Marine Mammal Protection Act, or Migratory Bird Treaty Act. Authorization for incidental or direct harassment of species protected by these acts must be secured from the U.S. Fish and Wildlife Service and/or NOAA Fisheries, depending upon the species affected.

12. The permittee shall indemnify and hold harmless the Office of National Marine Sanctuaries, NOAA, the Department of Commerce and the United States for and against any claims arising from the conduct of any permitted activities.

13. Any question of interpretation of any term or condition of this permit will be resolved by NOAA.

Your signature below, as permittee, indicates that you accept and agree to comply with all terms and conditions of this permit. This permit becomes valid when you, the permittee, countersign and date below. Please note that the expiration date on this permit is already set and will not be extended by a delay in your signing.

Kelley R. Elliott 1-26-17

Ms. Kelley Elliott Date
NOAA Office of Ocean Exploration and Research (OER

1-19-17

Gene Brighouse Date
Superintendent
National Marine Sanctuary of American Samoa

0 document(s) attached.

Appendix H: Categorical Exclusion

January 2017

Categorical Exclusion (CE) Determination Worksheet

Project Title: EX-17-03, Howland/Baker PRIMNM and PIPA (ROV/Mapping)

Date Review Completed: February 22, 2017

Completed by: Craig Russell, NOAA Office of Ocean Exploration and Research

Signature:

Step 1. CE applicability

1. **What is the proposed federal action?**
   The proposed action is to collect baseline mapping data using the NOAA Ship *Okeanos Explorer*'s sonar systems and to conduct baseline characterizations of unexplored areas using NOAA's two-body remotely operated vehicle (ROV) and CTD rosette system on the NOAA Ship *Okeanos Explorer*.

   The expedition will commence on March 7th, 2017 in Apia, Samoa (13°51.03' S, 171°45.08'W) and conclude on March 29, 2017 in Apia, Samoa (13°51.03' S, 171°45.08'W) to conduct operations in the vicinity of Howland/Baker, Pacific Remote Island Marine National Monument (PRIMNM), National Marine Sanctuary of American Samoa (NMSAS) and Phoenix Islands Protected Area (PIPA). See Project Instructions EX-17-03 for more details.

2. **Which class of CE in Appendix E of the NAO 216-6A Companion Manual is applicable to this action and why?**
   The topical scope of this action is consistent with CE number E4 in Appendix E of the Companion Manual to NOAA Administrative Order (NAO) 216-6A:

   Activities that remotely survey or observe living resources in the field using non-invasive techniques, which have little to no potential to adversely affect the environment or interfere with organisms or habitat.

Step 2. Extraordinary Circumstances Consideration

3. **Would the action result in adverse effects on human health or safety that are not negligible?**
   No. The NOAA Ship *Okeanos Explorer* will be operating in remote deep sea areas of the

1

Pacific Ocean. Expedition EX-17-03, an expedition of the NOAA CAPSTONE campaign, will focus operations in PIPA and the Howland Baker unit of PRIMNM with some operations in Tokelau and Samoa. (see ***Table 1 of EX-17-03 Project Instructions:*** *Bounding coordinates of the EX-17-03 operating area*) and does not involve any procedures or outcomes known to result in impacts on human health and safety more than would be negligible.

4. **Would the action result in adverse effects on an area with unique environmental characteristics that are not negligible?**

This survey/expedition overlaps with the following areas with unique environmental characteristics: the Pacific Remote Island Marine National Monument (PRIMNM), the National Marine Sanctuary of American Samoa (NMSAS), the territorial waters of American Samoa, and the Pacific Island Protection Area (PIPA). However, the survey effects will be negligible or less than negligible, based on determinations made by management authorities affiliated with these areas. The expedition is being planned and conducted in partnership with NOAA National Marine Fisheries Service (NMFS) Pacific Islands Regional Office (PIRO) Marine National Monument Program (MNMP) to ensure no more than negligible effects on these Pacific Island areas with unique environmental characteristics. Though NOAA research is exempted from standard permit requirements to work in the PRIMNM, OER made requests and received approvals to conduct operations in the abovementioned protected areas.

5. **Would the action result in adverse effects on species or habitats protected by the ESA, MMPA, MSA, NMSA, or MBTA that are not negligible?**

OER has taken measures to ensure that any effects on species or habitats protected by the ESA, MMPA, MSA or NMSA meet the definition of "negligible." In January 2016, a request from OER was submitted to the NMFS PIRO Protected Resources Division to initiate consultation under Section 7 of the ESA. Accompanying this request was a biological assessment that described the planned operations proposed for 2016-2017 expeditions in the Pacific and identified all ESA-listed species, including corals, in the vicinity of the operations. On February 7, 2016, OER received a letter that concurred with our determination that these 2016-2017 operations are not likely to adversely affect ESA-listed species. The ESA Section 7 concurrence letter is provided as Appendix X in the Project Instructions document for EX-17-03.

Given the offshore focus area of our work, it is highly improbable that we will encounter marine mammals protected under the MMPA or sea birds protected under the MBTA. If we did encounter any marine mammals or seabirds, our effect would be negligible because of the best management practices to which we adhere to avoid or minimize environmental impacts.

OER also initiated a request for a Magnuson-Stevens Essential Fish Habitat (EFH) consultation for this same series of cruises and subsequently received a determination that the proposed cruises will not reduce the quality and/or quantity of EFH, provided there is adherence to the OER proposed procedures and the NMFS guidance conveyed via email from NMFS PIRO's Richard Hall, dated November 30, 2016.

See the response to question #4 regarding measures taken to ensure that any effects meet the definition of "negligible" with respect to the NMSA.

6. **Would the action result in the potential to generate, use, store, transport, or dispose of hazardous or toxic substances, in a manner that may have a significant effect on the environment?**
   No. The cruise operations will be in compliance with FEC 07 Hazardous Materials and Hazardous Waste Management Requirements for Visiting Scientific Parties (or superseding OMAO procedures) to ensure generation, use, storage, transport, and disposal of such substances will not result in significant impacts.

7. **Would the action result in adverse effects on properties listed or eligible for listing on the National Register of Historic Places authorized by the National Historic Preservation Act of 1966, National Historic Landmarks designated by the Secretary of the Interior, or National Monuments designated through the Antiquities Act of 1906; Federally recognized Tribal and Native Alaskan lands, cultural or natural resources, or religious or cultural sites that cannot be resolved through applicable regulatory processes?**
   During EX-17-03, we will not visit sites that fall under any of these categories.

8. **Would the action result in a disproportionately high and adverse effect on the health or the environment of minority or low-income communities, compared to the impacts on other communities (EO 12898)?**
   No, the NOAA Ship *Okeanos Explorer* will be operating in remote deep sea areas of the Pacific Ocean (see table 1, EX 17-03 Cruise Plan Instructions). There are no communities within or near the geographic scope of the cruise, and the cruise does not involve actions known or likely to result in adverse impacts on human health.

9. **Would the action contribute to the introduction, continued existence, or spread of noxious weeds or nonnative invasive species known to occur in the area or actions that may promote the introduction, growth, or expansion of the range of the species?**

No. During EX-17-03 the ship will not make landfall in areas other than commercial ports. The ship and OER mission team will comply with all applicable local and federal regulations regarding the prevention or spread of invasive species. At the completion of every ROV dive or CTD cast, the ROVs will be thoroughly rinsed with fresh water and completely dried to prevent spreading organisms from one site to another. Also the Engineering Department aboard the NOAA Ship *Okeanos Explorer* attends yearly Ballast Management Training in accordance with NOAA Form 57-07-13 NPDES VGP Annual Inspection and Report to prevent the introduction of invasive species.

10. Would the action result in a potential violation of Federal, State, or local law or requirements imposed for protection of the environment?

The proposed action **will not** result in any violations of Federal, State, or local law or requirements imposed for protection of the environment. The survey coordinators obtained (or are in the process of obtaining) authorizations and/or consultations pursuant to applicable laws. See responses to questions #4, 5, and 6 for details.

11. Would the action result in highly controversial environmental effects?

No. The exploration activities will be localized and of short duration in any particular area at any given time. Given this project's scope and breadth, no notable or lasting changes or highly controversial effects to the environment will result.

12. Does the action have the potential to establish a precedent for future action or an action that represents a decision in principle about future actions with potentially significant environmental effects?

No. While each cruise contributes to the overarching goal of exploring, mapping, and sampling the ocean, every cruise is independently useful and not connected to subsequent cruises.

13. Would the action result in environmental effects that are uncertain, unique, or unknown?

No. The techniques and equipment used are standard for this type of field activity.

14. Does the action have the potential for significant cumulative impacts when the proposed action is combined with other past, present and reasonably foreseeable future actions, even though the impacts of the proposed action may not be significant by themselves?

By definition, actions that a federal agency classifies as a categorical exclusion have no potential, individually or cumulatively, to significantly affect the environment. This cruise is consistent

with a class of CE established by NOAA, and there are no extraordinary circumstances for this action that may otherwise result in potentially significant impacts.

Appendix I: ESA Section 7 Letter of Concurrence

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Pacific Islands Regional Office
1845 Wasp Blvd., Bldg 176
Honolulu, Hawaii 96818
(808) 725-5000 • Fax: (808) 725-5215

Mr. John McDonough
Deputy Director
NOAA Office of Ocean Exploration and Research

Dear Mr. McDonough:

This letter responds to your January 14, 2016 Request for Consultation by the Office of Exploration and Research (OER) regarding efforts aboard the NOAA vessel *Okeanos Explorer* with the proposed action consisting of activities to explore and improve understanding of the distribution and diversity of deep water habitats in the Pacific, and in particular in the Marine National Monuments. You have requested our concurrence under Section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. §1531 et seq.), with your determination that the proposed action may affect but is not likely to adversely affect green, hawksbill, leatherback, olive ridley, and north Pacific loggerhead sea turtles; Main Hawaiian Islands false killer whale distinct population segment, humpback whales, blue whales, fin whales, sei whales, sperm whales, north Pacific right whales, the Indo-West Pacific and Central Pacific distinct population segment of the scalloped hammerhead shark, Hawaiian monk seals; and the coral species *Acropora globiceps, A. jacquelineae, A. retusa, A. speciosa, Euphyllia paradivisa, Isopora crateriformis,* and *Seriatopora aculeata.*

Proposed Action/Action Area: The proposed activity is more fully described in your request for consultation and the associated biological evaluation (CAPSTONE 2016). The proposed action (Okeanos Explorer cruises) includes the use of various ship and submersible-deployed electronic systems to collect data on the distribution and diversity of deep water habitats in the Marine National Monuments. The activity would occur during two years with up to 20 research cruises scheduled between February 2016 and December 2017. The expedition teams (26 crew and up to 20 rotating scientists and/or technicians on each cruise leg) would be authorized to conduct mapping and Remotely Operated Vehicle (ROV) surveys using the Okeanos Explorer's multibeam, split beam, subbottom profiler and acoustic Doppler current profiler (ADCP) sonar systems, utilizing the ship's conductivity-temperature-depth (CTD) sampling rosette for various water measurements and deploying an ROV. No activities are scheduled to occur on land.

The suite of sonars aboard the vessel includes a Kongsberg EM302 30 kHz multibeam system, which collect bathymetry and backscatter data; several Simrad EK 60 split-beam sonars that

range from 18 to 333 kHz which are designed to gather measurements of biological and gaseous targets in the water column; and a Knudsen 3.5 kHz chirp sub-bottom profiler. The 300 kHz and 38 kHz ADCPs provide information about current velocity and direction at various depths. Sonar mapping activities will be conducted throughout the proposed action area and during transits to and from sites where operations will be conducted in an effort to fill in gaps in data knowledge and to build on data already collected. The maps generated from these activities will improve understanding of the geology and important biological habitats in the project area.

Conductivity, temperature and depth data will be collected by both an Underway CTD and a CTD rosette instrument. The CTD rosette, which is deployed while the ship is stopped and holding dynamic position, is lowered by a winch and wire to a maximum depth of 6800 m to collect water samples through 24 2.5 L niskin bottles. The CTD rosette will be deployed at select sites where ROV operations are conducted to allow for an improved understanding of the environmental conditions at that particular site. The deployment and retrieval of the CTD rosette takes up to several hours (depending on depth), while the Underway CTD can be deployed while the ship is moving, saving hours of time and fuel. The instrument is mounted on the stern railing and outfitted with a re-useable probe that is deployed and retrieved through the use of motorized spool. The Underway CTD will be used to collect water column profiles to a maximum depth of 700 m.

ROV operations will be designed to provide interdisciplinary site characterization at priority targets in and around monuments, sanctuaries and protected areas, through visual observation of priority targets while acquiring environmental data with onboard sensors. Sampling will be focused on corals and sponges, but will target specimens believed to be new species or new records for an area. No ESA-listed corals would be sampled. As many as 200 deployments of the ROV may occur during the 2016 – 17 field season resulting in 1600 hours of total dive time. The dives will better enable scientists and managers to understand the diversity and distribution of deep water habitats.

The action area covered by the accompanying biological evaluation encompasses the marine environments of Papahānaumokuākea Marine National Monument (PMNM); Oahu and the big island of Hawai'i; the area south and west of Molokai, Lana'i, and Kaho'olawe, the Geologists Seamounts located about 100 nm south of Honolulu; the Musicians Seamounts located about 150 nm NNE of Nihoa Island; all of the Pacific Remote Island Areas composing the Pacific Remote Islands Marine National Monument (PRIMNM); the Commonwealth of the Northern Marianas Islands (CNMI) and the Marianas Trench Marine National Monument (MTMNM); the vicinity of American Samoa and the National Marine Sanctuary of American Samoa (NMSAS); the Rose Atoll Marine National Monument (RAMNM); and the vessel transit areas between Honolulu, Hawai'i, Guam, Saipan, Kwajalein, Pago Pago where ESA-listed marine species or their habitats may be impacted by the proposed activities.

Species That May Be Affected: OER determined that the proposed action may affect but is not likely to adversely affect green sea turtles (*Chelonia mydas*), hawksbill sea turtles (*Eretmochelys imbricata*), North Pacific distinct population segment of loggerhead sea turtles (*Caretta caretta*),

olive ridley sea turtles (*Lepidochelys olivacea*), leatherback sea turtles (*Dermochelys coriacea*), Main Hawaiian Islands false killer whale distinct population segment (*Pseudorca crassidens*), humpback whales (*Megaptera novaeangliae*), sperm whales (*Physeter macrocephalus*), fin whales (*Balaenoptera physalus*), blue whales (*Balaenoptera musculus*), sei whales (*Balaenoptera borealis*), north pacific right whales (*Eubalaena japonica)*, the Indo-West Pacific and Central Pacific distinct population segments of the scalloped hammerhead shark (*Sphryna lewini*), Hawaiian monk seals (*Neomonachus schauinslandi*), Hawaiian monk seal critical habitat and the coral species *Acropora globiceps, A. jacquelineae, A. retusa, A. speciosa, Euphyllia paradivisa, Isopora crateriformis,* and *Seriatopora aculeata*. Detailed information about the biology, habitat, and conservation status of sea turtles can be found in their recovery plans and other sources at http://www.nmfs.noaa.gov/pr/species/turtles/. The same can be found for Hawaiian monk seals and cetaceans at http://www.nmfs.noaa.gov/pr/species/mammals/; and more information on listed corals can be found at http://www.fpir.noaa.gov/PRD/prd_coral.html.

Critical Habitat: The proposed action would take place within designated monk seal critical habitat. Critical habitat was designated under the ESA for the Hawaiian monk seal on April 30, 1986 and revised on May 26, 1988 (53 FR 18988) and again on August 21, 2015 (80 FR 50926). Designated critical habitat includes all beach areas, lagoon waters, and ocean waters out to a depth of 200 m around Kure Atoll; Midway Islands (except Sand Island), Pearl and Hermes Reef, Lisianski Island, Laysan Island, Gardner Pinnacles, French Frigate Shoals, Necker Island, Maro Reef, and Nihoa Island, and includes the seafloor and all subsurface waters and habitat within 10 meters of the seafloor. Around the Main Hawaiian Islands, critical habitat extends in designated areas from the beach out to the 200 meter depth contour, and includes the seafloor and subsurface waters within 10 meters of the seafloor.

Analysis of Effects: In order to determine that a proposed action is not likely to adversely affect listed species, NMFS must find that the effects of the proposed action are expected to be insignificant, discountable, or beneficial as defined in the joint USFWS-NMFS Endangered Species Consultation Handbook: (1) insignificant effects relate to the size of the impact and should never reach the scale where take occurs; (2) discountable effects are those that are extremely unlikely to occur; and (3) beneficial effects are positive effects without any adverse effects (USFWS & NMFS 1998). This standard, as well as consideration of the probable duration, frequency, and severity of potential interactions, was applied during the analysis of effects of the proposed action on ESA-listed marine species, as is described in detail in the OER consultation request. The OER determined that the risk of collisions with vessels and the risk of entanglement would be discountable; and that the risk from exposure to elevated noise level, disturbance from human activity, as well as exposure to wastes and discharges would result in insignificant effects on ESA-listed sea turtles, marine mammals, sharks and corals; and that the potential effects of the proposed action to designated or proposed critical habitat would also be insignificant.

Considering the information and assessments presented in the OER consultation request, and in the best scientific information available about the biology and expected behaviors of the ESA-listed marine species considered in this consultation; NMFS agrees that: 1) the list of ESA-listed species and critical habitats potentially exposed to the effects of the action is correct, 2) the suite

of identified stressors is comprehensive, and 3) the assessment of exposure risk and significance of exposure to those stressors is accurate. Therefore, NMFS agrees that:

- the risk of collisions with vessels for marine mammals, turtles, sharks and the listed coral species in the action area is discountable;
- the risk of entanglement with marine mammals, sea turtles and sharks is discountable; and,
- ESA-listed species in the action area are unlikely to respond to anticipated elevated noise levels, disturbance from human activity, and exposure to wastes and discharges. Further, if any response were to occur, it would be temporary in nature and never reach the scale where it would affect the individual's health, and as such, have insignificant effects.

Conclusion: NMFS concurs with your determination that conducting the proposed Okeanos Explorer cruises are not likely to adversely affect ESA-listed marine species. This concludes your consultation responsibilities under the ESA for species under NMFS's jurisdiction. However, this consultation focused solely on compliance with the ESA. Additional compliance review that may be required of NMFS for this action (such as assessing impacts on Essential Fish Habitat) would be completed by NMFS Habitat Conservation Division in separate communication, if applicable.

ESA Consultation must be reinitiated if: 1) a take occurs; 2) new information reveals effects of the action that may affect listed species or designated critical habitat in a manner or to an extent not previously considered; 3) the identified action is subsequently modified in a manner causing effects to listed species or designated critical habitat not previously considered; or 4) a new species is listed or critical habitat designated that may be affected by the identified action.

If you have further questions please contact Richard Hall on my staff at (808) 725-5018. Thank you for working with NMFS to protect our nation's living marine resources.

Sincerely,

Michael D. Tosatto
Regional Administrator

cc: Justin Rivera, Papahanaumokuakea Marine National Monument
Aaron Nadig, ESA Section 7 Program, USFWS, Honolulu

NMFS File No.: PIR-2016-9774
PIRO Reference No.: I-PI-16-1347-AG

Literature Cited

Campaign to Address Pacific Monument Sciecne, Technology and ocean Needs (CAPSTONE) 2016. Request for Informal Consultation. Letter from John McDonough to Ann Garrett dated January 14, 2016 and attachments.

U.S. Fish and Wildlife Service and National Marine Fisheries Service. 1998. Endangered Species Consultation Handbook. Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act.
http://www.nmfs.noaa.gov/pr/pdfs/laws/esa_section7_handbook.pdf

Appendix J: EFH Consultation

Kelley Elliott - NOAA Federal <kelley.elliott@noaa.gov>

EFH Consultation Response for CAPSTONE cruises

Richard Hall - NOAA Federal <richard.hall@noaa.gov> Wed, Nov 30, 2016 at 4:21 PM
To: Kelley Elliott - NOAA Affiliate <kelley.elliott@noaa.gov>
Cc: Ian Lundgren - NOAA Affiliate <ian.lundgren@noaa.gov>, Samantha Brooke <samantha.brooke@noaa.gov>, Kasey Cantwell - NOAA Affiliate <kasey.cantwell@noaa.gov>

Kelley,

On November 14, 2016, the Office of Exploration and Research (OER), through personal communication, initiated a request for an Essential Fish Habitat consultation for a series of cruises by the NOAA Ship *Okeanos Explorer*. The cruises would run from early-December 2016 through late-September 2017, and include the waters around the Main Hawaiian Islands, the Musician Seamounts (north of Hawaii), the American Samoa Archipelago; Johnston, Howland, Baker, Jarvis, Kingman and Palmyra Atolls of the Pacific Remote Islands, and portions of the Cook Islands. The operational minimum depth during the cruises would be 250 m, with the majority of the cruise activities would be in water depths over 500 m.

The Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855 et seq.) requires review of federally permitted projects for potential impacts to EFH (§305(b)). Pursuant to this authority, I have reviewed and provided comments as necessary for the Habitat Conservation Division of NOAA's Pacific Islands Regional Office.

The proposed cruises are the final legs of the larger 2-year Campaign to Address Pacific Monuments Science, Technology and Ocean Needs (CAPSTONE Project), which is designed to improve the understanding of the distribution and diversity of deepwater habitats within the Pacific monuments and protected areas.

The primary activities to be conducted during this series of cruises would be: remotely operated vehicle (ROV) dives to conduct engineering trials and sonar calibration and testing during two shakedown cruises scheduled for the waters of the Main Hawaiian Islands (no biological or geological samples would be collected); and mapping and ROV dives in the waters of American Samoa, West Samoa, the Pacific Remote Islands, the Musician Seamounts, and portions of the Cook Islands. Five cruises would be dedicated mapping cruise, resulting in 92 days of constant mapping, while six cruises would be combined ROV and mapping cruises which would result in approximately 96 ROV dives and 110 days of overnight mapping. Other activities to be performed during the cruises would include: deployment and recovery of a conductivity-temperature-depth (CTD) sampling rosette and underway CTDs, and possible deployment of Argo floats to acquire ocean chemistry data. During ROV dives various biological and geological samples would be collected.

In order to avoid/minimize impacts to EFH, the OER and the *Okeanos Explorer* have proposed to institute the following procedures:

- The vessel would employ the use of dynamic positioning during ROV dives (no anchoring);
- ROVs would be operated in a manner to avoid seafloor disturbance, and setting the ROV on the seafloor will be held to a minimum. For those situations when the ROV does make contact with the seafloor, visual observations will confirm that the area is sand, mud, or hard-bottom;
- Sample collections would be limited (typically 4 - 6 total rocks and primary biological specimens per dive) that represent new species, new records, or the dominant morphotype animal in a community. Clonal biological specimens (corals, sponges) would be subsampled; and
- Instruments deployed to collect water samples and current data (except for expendable instruments) would not be allowed to contact the seafloor;

In addition to the management practices proposed by OER and the *Okeanos Explorer*, NMFS provides the following guidance to further avoid/minimize impacts to EFH from the proposed cruise activities and vessel operations:
1. Except in an emergency, the vessel should not anchor while at sea;
2. The vessel should adhere to MARPOL discharge regulations at all times during the proposed cruises;
3. The ROV should be thoroughly rinsed between dives, allowed to dry, and checked for the presence of biological

organisms to prevent the spread of invasive or non-endemic species from one location to another.
4. The use detergents and other pollutants which may be washed into the marine environment should be avoided or held to a minimum;

Based on my review of the documents provided, and through our personal communications, NOAA Fisheries has determined that the proposed cruises of the NOAA Ship *Okeanos Explorer* would not adversely affect EFH provided adherence to OER proposed procedures and the NMFS guidance made above. Thank you for the opportunity to review the plans for the upcoming field season of the *Okeanos Explorer*, and to provide our comments. This completes your obligation to consult with our office with regards to EFH for this series of actions. If you have any questions or comments feel free to contact me at your convenience.

--
Richard Hall
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808-725-5018

Appendix K: Acronyms

3D—Three-dimensional
ADCP—Acoustic Doppler Current Profiler
AERONET—Aerosol Robotic Network
BOEM—Bureau of Ocean Energy Management
CAPSTONE—Campaign to Address Pacific monuments Science, Technology, and Ocean NEeds
CIT—Chiba Institute of Technology
CTD—Conductivity, temperature, and depth
DNA—Deoxyribonucleic acid
DO—Dissolved oxygen
DSCRTP—NOAA Deep Sea Coral Research and Technology Program
ECC—Exploration Command Center
ECS—Extended continental shelf
EEZ—Exclusive Economic Zone
EFH—Essential Fish Habitat
EK60—Kongsberg 18 kHz split-beam fisheries sonar
EM 302—Kongsberg Maritime 30 kHz multibeam system
ESA—Endangered Species Act
EtOH—Ethyl alcohol, or ethanol
EX—NOAA Ship *Okeanos Explorer*
FAU—Florida Atlantic University
FeMn—Ferro-manganese
FSU—Florida State University
GFOE—Global Foundation for Ocean Exploration
GFOE—Global Foundation for Ocean Exploration
HBOI—Harbor Branch Oceanographic Institute
JAMSTEC—Japan Agency for Marine-Earth Science and Technology
kHz—Kilohertz
LSS—Light scattering sensor
MAN—Maritime Aerosol Network
MFAT—Independent State of Sāmoa's Ministry of Foreign Affairs and Trade
MFE—Independent State of Sāmoa's Ministry of Fisheries and Agriculture
MMPA—Marine Mammal Protection Act
Mn—Manganese
MNRE—Independent State of Sāmoa's Ministry of Natural Resources and Environment
MPA—Marine Protected Area
MSR—Marine scientific research
NASA—National Aeronautics and Space Administration
NCCOS—NOAA National Centers for Coastal Ocean Science
NCEI—NOAA National Centers for Environmental Information
NEPA—National Environmental Policy Act
NMFS—NOAA National Marine Fisheries Service

NMSAS—National Marine Sanctuary American Sāmoa
NOAA—National Oceanic and Atmospheric Administration
OER—NOAA Office of Ocean Exploration and Research
ONMS—NOAA Office of National Marine Sanctuaries
ORP—Oxygen reduction potential
OSU—Oregon State University
PCZ—Prime Crust Zone
PIFSC—NOAA Pacific Islands Fisheries Science Center
PIPA—Phoenix Islands Protected Area
PIRO—NOAA Pacific Islands Regional Office
PRIMNM—Pacific Remote Islands Marine National Monument
RAMP—NOAA Rapid Assessment and Monitoring Program
RAS—Russian Academy of Sciences
ROV—Remotely operated vehicle
SBP—Sub-bottom profiler
SEDCI—NOAA Southeast Deep Coral Initiative
SIO—Scripps Institution of Oceanography
SIS—Seafloor Information Software
SOEST—UH School of Ocean & Earth Science & Technology
SOP—Standard operating procedure
SPREP—Secretariat of the Pacific Regional Environment Programme
TAMU—Texas A&M University
TB—Terabytes
TSG—Thermosalinograph
UCAR—University Corporation for Atmospheric Research
UConn—University of Connecticut
UCSB—University of California, Santa Barbara
UH—University of Hawai'i at Mānoa
ULL—University of Louisiana at Lafayette
UNH—University of New Hampshire
USFW—U.S. Fish and Wildlife Service
USGS—U.S. Geological Survey
USNM—National Museum of Natural History
VARS—Video Annotation and Reference System
WHOI—Woods Hole Oceanographic Institution
XBT—Expendable bathythermographs