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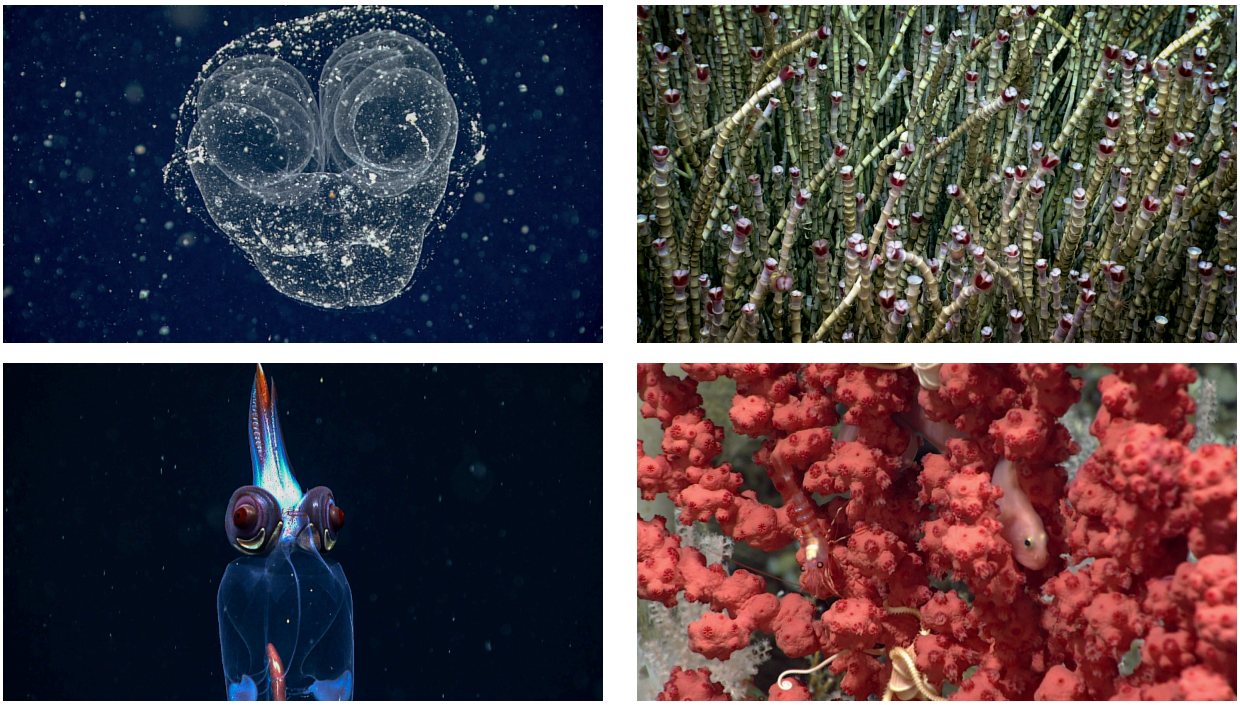
Expedition Report: EX2304, Seascape Alaska 3: Aleutians Remotely Operated Vehicle Exploration and Mapping



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Abstract

From July 14 - 25, 2023 (Kodiak, Alaska, to Dutch Harbor, Alaska), NOAA Ocean Exploration conducted the Seascape Alaska 3: Aleutians Remotely Operated Vehicle Exploration and Mapping expedition (EX2304). This remotely operated vehicle (ROV) and acoustic mapping exploration expedition offshore of the Aleutian Island Chain included the completion of 8 ROV dives (two were aborted before reaching the seafloor), which were conducted in seafloor depths ranging from 533 m to 2,807 m for approximately 22.5 hours of bottom time and resulted in the collection of 95 samples. EX2304 also mapped 16,475 sq. km of seafloor (16,433 sq. km within the U.S. Exclusive Economic Zone). All data associated with this expedition have been archived and are publicly available through the NOAA archives.

Region of Operation: Aleutian Islands Continental Shelf

Ports: Kodiak, Alaska, to Dutch Harbor, Unalaska, Alaska

Bounding Coordinates: 170.0208292°W, 52.3406943°N, 151.5586569°W, 56.9020365°N

Expedition Dates: July 14 - July 25, 2023

Expedition Type: ROV and Mapping

Theme Keywords: Seascape Alaska, ROV, Ocean Mapping

Place Keywords: Alaska, Aleutian Islands

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1. Introduction

NOAA Ocean Exploration is dedicated to exploring the unknown ocean, unlocking its potential through scientific discovery, technological advancements, and data delivery. By working closely with partners across public, private, and academic sectors, we are filling gaps in our basic understanding of the marine environment. This allows us, collectively, to protect ocean health, sustainably manage our marine resources, accelerate our national economy, better understand our changing environment, and enhance appreciation of the importance of the ocean in our everyday lives.

With priority placed on exploration of deep waters and the waters of the U.S. Exclusive Economic Zone (EEZ), NOAA Ocean Exploration applies the latest tools and technologies to explore previously unknown areas of the ocean, making discoveries of scientific, economic, and cultural value. By making collected data publicly available in increasingly innovative and accessible ways, we provide a unique and centralized national resource of critical ocean information. And, through live exploration video, online resources, training and educational opportunities, and public events, we share the excitement of ocean exploration with people around the world and inspire and engage the next generation of ocean scientists, engineers, and leaders.

NOAA Ocean Exploration uses NOAA Ship *Okeanos Explorer* to conduct much of this work. Data collected by NOAA Ocean Exploration on NOAA Ship *Okeanos Explorer* during EX2403 will contribute to Seascape Alaska. Seascape Alaska is a multiyear, multipartner cooperative research campaign with an aim to create accessible, high-quality modern seabed data for Alaskan waters to support U.S. research, resource management, sustainable economic growth, and the health and security of Americans. The goal of Seascape Alaska is working to fully map the U.S. waters off Alaska through collaborative efforts among federal, tribal, state, and nongovernmental partners with a wide range of interests and dependencies on mapping data across coastal and ocean waters throughout the U.S. EEZ.

NOAA Ocean Exploration's expeditions on *Okeanos Explorer* contribute to the National Strategy for Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone and Seabed 2030.

2. Expedition Overview

From July 14 to July 25, 2023, NOAA Ocean Exploration and partners conducted a telepresence-enabled ocean exploration expedition on *Okeanos Explorer* to map, explore, and characterize ecologically and economically important deepwater habitats and subduction zone environments in unexplored regions off Alaska (EX2304).

During the 12 days at sea, 8 remotely operated vehicle (ROV) dives were conducted (two were aborted before reaching the seafloor) and 16,475 sq. km of bathymetric data were collected (see **Figure 1**). Section 5 provides details about the expedition schedule and unplanned events. A station log detailing the location of each operation conducted is provided as a supplemental file to this expedition report.

The names, roles, and affiliations of science team members are in **Appendix A**.

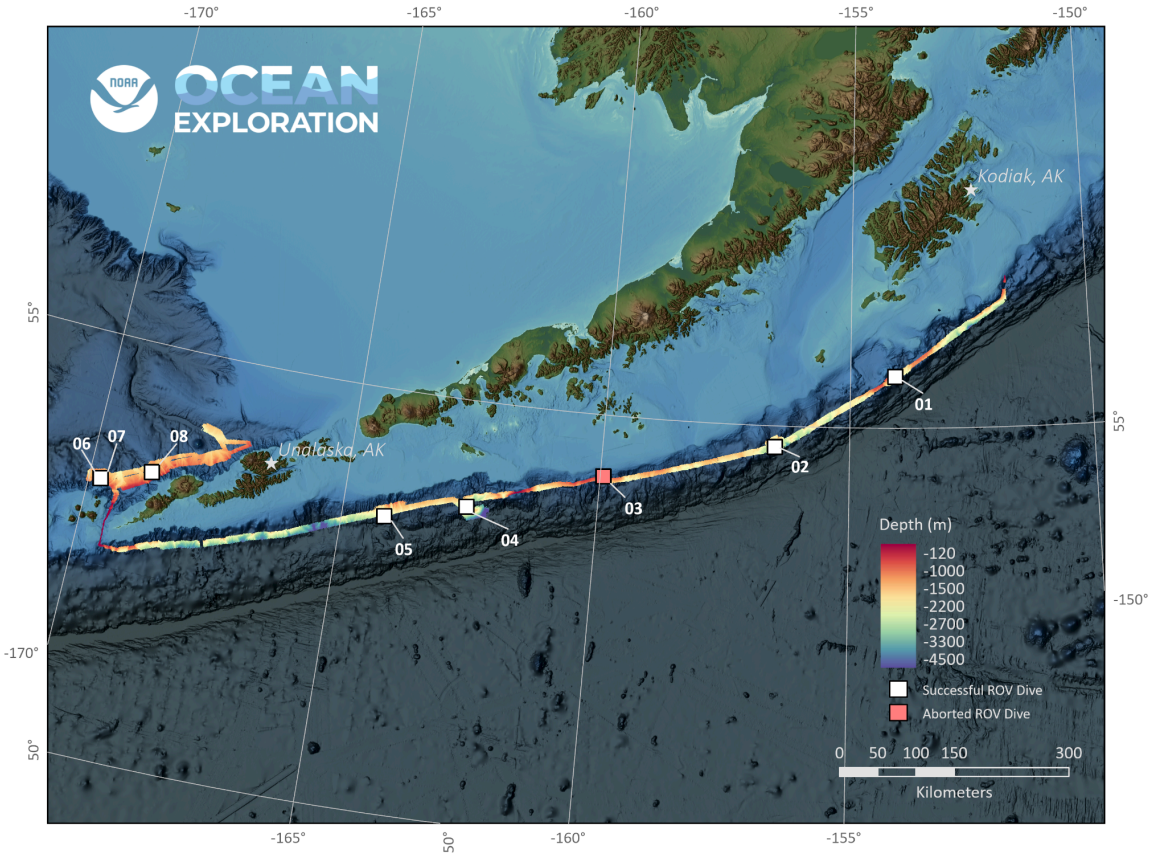

Figure 1. Map showing EX2304's track, ROV dive sites, and bathymetric data collected. *Note that two of the 8 ROV dives (Dive 03 and 06) were aborted prior to reaching the seafloor.*

2.1 Rationale for Exploration

As part of the planning for this expedition, NOAA Ocean Exploration collaborated with the ocean science and management communities to assess exploration needs and data gaps in unknown and poorly known areas around Alaska. To define the operating area for this expedition, we considered the NOAA Ocean Exploration conducted 2022 call for input, results from the 2023 Alaska Marine Science Symposium, and known priorities from resource managers.

Alaska's coastline is longer than that of any other U.S. state or territory and is approximately one-third of the entire U.S. coastline. Despite representing the largest distinct region of the U.S. Exclusive Economic Zone (EEZ), Alaska's waters remain one of the least explored areas in the United States. According to the "Progress Report on Unmapped U.S. Waters" (IOCM 2023), only 34% of Alaskan waters had been mapped to modern standards (100 meters) as of January 2023. Additionally, many of the deepwater habitats of the Gulf of Alaska, Aleutian Islands, and the Aleutian trench remain largely unexplored.

Mapping and exploring Alaska's deep waters will provide baseline information needed to sustainably manage and protect these areas. Filling data gaps and increasing the understanding of this region has far-reaching benefits, including safer navigation and community access, hazard mitigation, preservation of marine habitats and heritage, a deeper comprehension of natural resources, and fisheries management.

Data and information from this expedition will inform deep-sea management plans for habitat areas of particular concern, marine protected areas, 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.

This expedition contributed to ongoing collaborations with the NOAA Alaska Fisheries Science Center, the Deep Sea Coral Research and Technology Program, the United States Geological Survey, Bureau of Ocean Energy Management, Fisheries and Oceans Canada, University of Alaska, University of Gothenburg, University of Idaho, Senckenberg Research Institute and Natural History Museum, U.S. Environmental Protection Agency, and the Woods Hole Oceanographic Institute.

2.2 Objectives

EX2304 addressed scientific themes and priority areas put forward by NOAA scientists and partners listed above, as well as the broad ocean science and management communities. The primary objective of the expedition was to explore deepwater areas offshore of the Aleutian Islands to provide baseline information to support science and management needs. Briefly, this expedition sought to:

- Collect high-resolution bathymetry in areas with no or low-quality mapping data.
- Investigate biogeographic patterns of deep-sea ecosystems and connectivity across Alaskan waters for use in broader comparisons of deepwater habitats throughout the northern Pacific Ocean.
- Map, survey, and sample geological features to better understand the geological context of the region.
- Acquire a foundation of ROV, sonar, and oceanographic data to better understand the characteristics of the water column and fauna that live there.
- Collect biology, geology, and water samples for environmental DNA (eDNA) analysis as dictated by expedition priorities and for public access.
- Identify, map, and explore the diversity and distribution of benthic habitats, including fish habitats, deep-sea coral and sponge communities, chemosynthetic communities, and biological communities that colonize or aggregate around shipwrecks.
- Explore U.S. maritime heritage by identifying and investigating sonar anomalies as well as characterizing shipwrecks with video investigation.
- Engage a broad spectrum of the scientific community and the public in telepresence-based exploration.
- Provide a foundation of publicly accessible data and information products to spur further exploration, research, and management activities.

A full list of expedition objectives is in “Project Instructions: EX2304, Seascape Alaska 3: Aleutians Remotely Operated Vehicle Exploration and Mapping” (Hoy, 2023).

3. Methodology

The primary systems used throughout EX2304 to accomplish objectives were:

- Sonar systems (Kongsberg EM 304 multibeam sonar, Knudsen 3260 sub-bottom profiler, Simrad EK60 and EK80 split-beam sonars, and Teledyne acoustic Doppler current profilers) to conduct seabed and water column mapping operations, and provide situational awareness for ROV operations.
- NOAA Ocean Exploration’s dual-bodied ROV system (ROVs *Deep Discoverer* and *Seirios*)

to conduct daytime seafloor and water column visual surveys, as well as to collect a limited number of samples to help further characterize the deepwater fauna and geology of the region.
- A high-bandwidth satellite connection to provide real-time ship-to-shore communications (telepresence).

The following sections further detail the equipment and procedures used by NOAA Ocean Exploration during expeditions on *Okeanos Explorer*.

3.1 Acoustic Operations

Acoustic operations included Kongsberg EM 304 multibeam sonar, Simrad EK60 and EK80 split-beam sonar, Knudsen 3260 sub-bottom profiler, and acoustic Doppler current profiler (ADCP) data collection to map the seafloor, sub-seafloor, and water column, as well as to provide operational information for ROV dives. Standard survey operations include concurrent collection of multibeam, split-beam, and sub-bottom sonar data synchronized using a Kongsberg Synchronization Unit (K-Sync) with the EM 304 set as the master. The ADCPs were secured during standard surveying operations due to interference with other sonars, but were used to collect data when entering and exiting port and during ROV operations. During conductivity, temperature, and depth system (CTD) and ROV operations, the EM 304 multibeam sonar and Knudsen sub-bottom profiler were secured to allow the ADCPs and split-beam sonars to collect data.

Mapping operations were planned to maximize edge matching of existing data or to fill data gaps in areas with incomplete bathymetric coverage. In regions with no existing data, lines were optimized for potential discoveries and to complete relatively large continuous areas to support interpretation of features from bathymetry and backscatter. Targeted mapping operations were conducted adjacent to dive locations. Mapping operations were carried out during overnight transits and other intervals between ROV dives.

More information about general equipment calibration procedures, data collection, processing, reporting, and archiving is in the “NOAA Ocean Exploration Deepwater Exploration Mapping Procedures Manual” (Hoy et al. 2020).

3.1.1 Equipment and Data Collection Methods

Detailed descriptions of mapping equipment, annual calibrations, and capabilities on *Okeanos Explorer* are in the “NOAA Ship *Okeanos Explorer* Mapping Systems Readiness Report 2023” (Candio et al. 2023). Any deviations from the readiness report are noted in the following sections.

Supplemental files may be added to the readiness report throughout the year if changes to the equipment are made, such as mid-season calibrations. Users of mapping data from EX2304 should refer to the 2023 readiness report to see if any supplemental files report changes that may affect their analysis.

3.1.1.1 Multibeam Sonar

Okeanos Explorer is equipped with a 26 kHz Kongsberg EM 304 MKII multibeam sonar. The multibeam sonar was used to collect seafloor bathymetry, seafloor backscatter, and water column backscatter. Bathymetric and seafloor backscatter data are stored in .kmall files as beam-averaged backscatter values and as full time-series values (snippets) within each beam. Water column backscatter data are stored separately in .kmwcd files.

Throughout the expedition, mapping watchstanders monitored multibeam data quality in real time. Ship speed was adjusted to maintain data quality and sounding density as necessary, and line spacing was planned to ensure one-quarter to one-third swath-width overlap between lines, depending on the environmental conditions and impact on the quality of the outer swath regions. Maximum angles in the Seafloor Information System (SIS) were generally left open (75°/75°) during transits to maximize data collection and were adjusted on the port and starboard sides to ensure the best data quality and coverage. If outer beams were returning obviously spurious soundings (e.g., due to attenuation or low grazing angle), beam angles were gradually reduced and monitored closely until a high-quality swath was obtained.

Real-time surface sound speed values were provided by a Reson SV70 sound velocity probe mounted in close proximity to the EM 304 transducer and were monitored in SIS for deviations from the values determined by sound speed casts. Sound speed profiles were collected every six hours or more frequently as dictated by local oceanographic conditions (typically every two hours when operating in more dynamic areas).

Vessel positioning and attitude was measured by Applanix POS MV V5 and Kongsberg Seapath 380 positioning systems during data collection. This redundancy allows for either system to be the primary source of positioning/attitude for the multibeam data in the event that one of them fails. Positioning/attitude data were applied to the multibeam data in real time and were stored in .kmall files. The primary system applied in post-processing is noted in the processing logs.

Additionally, multibeam mapping operations were conducted directly over planned ROV dive sites to collect seafloor mapping data to help refine dive plans.

3.1.1.2 Sub-Bottom Profiler

Okeanos Explorer is equipped with a Knudsen 3260 sub-bottom profiler with a central frequency of 3.5 kHz. This sonar was used to collect echogram images of shallow geological layers underneath the seafloor to a maximum depth of approximately 80 m below the seafloor. Phase,

range, and gain were monitored and optimized for data collection. New files were created when changes were made to pulse lengths and/or power settings.

3.1.1.3 Split-Beam Sonars

Okeanos Explorer is equipped with a suite of five Simrad EK60 and EK80 split-beam sonars: three general purpose transceivers (GBTs), the 18, 120, and 200 kHz sonars, and two wide-band transceivers (WBTs), the 38 and 70 kHz sonars. These quantitative scientific echosounders were calibrated to identify the target strength of water column acoustic reflectors (e.g., deep scattering layers, fish, gas bubbles from seeps), providing additional information about water column characteristics and anomalies.

Calibrations were performed during EX2305 (following data collection), and these calibration values will be most appropriate for the EX2304 dataset. The calibration files are archived with the sonar data, and the calibration report is available as a supplemental file to the 2023 mapping readiness report (Candio et al. 2023).

The split-beam sonars were used continuously throughout EX2304 during overnight mapping operations and daytime ROV operations. EK60 and EK80 data were used during ROV water column transects to detect the depth of the deep scattering layers.

3.1.1.4 Acoustic Doppler Current Profiler

Okeanos Explorer is equipped with two acoustic Doppler current profilers (ADCPs), a Teledyne Workhorse Mariner (300 kHz) and a Teledyne Ocean Surveyor (38 kHz). Depending on environmental conditions, the 300 kHz system provides ocean current data to a depth of approximately 70 m, and the 38 kHz system provides data to a depth of approximately 1,200 m. The ADCPs were used to gather data prior to ROV and CTD deployments to assess currents in support of safe operations.

3.1.2 Data Processing and Quality Assessment Methods

3.1.2.1 Multibeam Sonar Bathymetry and Seabed Backscatter

Full-resolution multibeam files (.kmall) were imported into QPS Qimera and then processed and cleaned of noise and artifacts. Outlier soundings were removed using multiple methods, including automatic filtering and/or manual cleaning with the swath and subset editing tools. The default sound speed scheduling method used was “Nearest-in-Time; SVP Crossfade 60 sec.” If another method was used, it was noted in the multibeam processing log that is archived with the dataset. Gridded digital terrain models were created using the weighted moving average algorithm and were exported in multiple formats using QPS Fledermaus. Daily bathymetric surfaces were created and sent to shore.

Each line of cleaned full-resolution data was exported to a .gsf file (Level-01 data). The processed and cleaned files were used to create a static surface in QPS Qimera. This final surface was re-projected to the field geographic WGS84 reference frame in QPS Fledermaus and saved as an .sd file for archiving. Using QPS Fledermaus, this .sd bathymetric grid file was then exported as ASCII .xyz, color .tif, floating point .tif, and Google Earth .kmz files. The .gsf files were used to create daily backscatter mosaics using QPS Fledermaus FMGT.

All products maintain horizontal referencing to WGS84 (G1762) and vertical referencing to the assumed mean waterline (based on the waterline measured during the annual shakedown expedition). The draft values for *Okeanos Explorer* used during the expedition are in **Table 1** for the purpose of further post-processing, if desired by the user. Positioning data files for post-processing be requested by sending an email to ex.expeditioncoordinator@noaa.gov.

Table 1. *Okeanos Explorer*'s draft at the beginning and end of EX2304.

Location	Start of Expedition (07/14/2023)	End of Expedition (07/25/2023)
Forward	16' 7.5''	16' 0.5''
Aft Starboard	15' 6''	15' 7''
Aft Port	15' 9''	16' 1''

3.1.2.2 Multibeam Sonar — Water Column

EM 304 water column files (.kmwcd) were reviewed in QPS FM Midwater or Qimera for anomalies (e.g., gas seeps and hydrothermal plumes). EM 304 files (.kmwcd) that include observed water column anomalies are flagged in the dataset's relevant processing logs. Locations of observed anomalies are provided in the data package (.shp and .csv files). All products maintain horizontal referencing to WGS84 (G1762) and vertical referencing to the assumed mean waterline.

3.1.2.3 Split-Beam Sonars

No anomalies were observed during this expedition.

Calibration reports and files are archived with the split-beam data.

3.1.2.4 Sub-Bottom Profiler

Using Natural Resources Canada's SEGYJp2 software, the raw files (.sgy) from the sub-bottom profiler were processed for gain to produce the clearest image of sub-bottom layers. The gain processed files were converted to jpeg images (.jpg) and shapefile tracklines (.shp).

3.1.2.5 Sound Speed

Raw sound speed profiles collected from expendable bathythermographs (XBTs) were processed using HydrOffice Sound Speed Manager and archived as .asvp files.

3.1.3 Data Collection and Processing Software

Table 2 provides a list of the data collection and processing software versions used during EX2304.

Table 2. Versions of data collection and processing software used during EX2304.

Software	Purpose	Version
SIS	EM 304	5.11.1
EK80	EK suite	21.15.2
EchoControl	Knudsen	4.09
UHDAS	ADCPs	14.04
AMVERSEAS	Autolaunch XBT	9.3.6
WinMK21	XBT	3.0.2
K-Sync	Synchronization	1.9.0
Qimera	Bathymetry	2.5.3
FMGT	Backscatter	7.10.3
FM Midwater	Water Column	7.9.4
Sound Speed Manager	Sound Speed Profiles	2021.1.6
NRCan (SegJp2)	Sub-Bottom	1.0
Fledermaus 7	Visualization/Data Analysis	7.8.12

3.2 ROV Operations

ROV dive operations supported the expedition objectives in Section 2.2 and included high-resolution visual surveys of seafloor and water column habitats as well as geological and biological sampling. Each ROV dive was approximately 8-10 hours, conditions and logistics permitting. 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) and Quattrini et al. (2015).

During each benthic dive, the ROVs descended to the seafloor and then moved from waypoint to waypoint, documenting the geology and biology of the area. Water column exploration was conducted via transects during dedicated water column dives and augmented benthic dives. Transects ranged from 20 to 50 minutes, depending on the dive's objectives, conditions, and

seafloor depth. Specific transect depths and times are noted in the dive summaries (which are attached to this report as supplemental files).

During dives, science team members on ship and shore identified each organism observed to the lowest taxon possible based on data available during real-time assessment and provided geological interpretations of the observed substrate. These observations were recorded using a cloud-based, crowd-sourced annotation system developed by Ocean Networks Canada called SeaTube. They will go through quality control at the University of Hawai'i's Deep-Sea Ecology Lab prior to archiving.

Detailed information about ROV operations is in the "NOAA Ocean Exploration ROV and Telepresence Deepwater Exploration Procedures Manual" (Galvez et al., in-prep).

3.3 Sampling Operations

A limited number of geological, biological, and water samples were collected on the seafloor using ROV *Deep Discoverer*'s manipulator arms and associated tools and stored in the bioboxes, rock boxes, rotary suction sampler jars, and Niskin bottles as well as Niskin bottles mounted on the CTD. The primary purpose of the sampling operations was to collect voucher samples that will be publicly available for site characterization. In addition, geological samples were collected for rock type description, and biological samples were collected of organisms that represented potential new species, range or depth extensions, dominant species at a site, and/or rare morphotypes, and to support biological connectivity studies.

At the time of collection, the date, time, latitude, longitude, depth, salinity, temperature, and dissolved oxygen content were recorded for each sample.

After vehicle recovery, samples were examined for associated organisms, labeled, photographed, and entered into the Sampling Operations Database Application (SODA, Gottfried et al. 2023) with all relevant metadata. Any associated organisms found were separated from primary samples and processed separately as "associate" samples.

Detailed information about sampling operations is in the "NOAA Ocean Exploration Sampling Procedures Manual" (Dunn et al. 2023).

3.3.1 Geological Samples

Geological samples were air dried and placed in rock bags or small containers depending on the size of the sample. These samples will be shipped to the Marine and Geological Repository at Oregon State University after the conclusion of the NOAA Ocean Exploration field season on *Okeanos Explorer*. The samples will be sectioned, photographed, and their data will be entered

into the university's online database. Polished thin sections will be made for each lithified sample.

3.3.2 Biological Samples

Biological samples were subsampled for inclusion in the Smithsonian National Museum of Natural History Biorepository for future DNA barcoding and DNA extraction. For this purpose, a small subsample (~1 cm^2) was removed from the original sample and placed in 95% analytical grade ethanol (EtOH).

For most of the biological samples, the remainder of the sample was also preserved in 95% ethanol. For select taxa, vouchers or subsamples were preserved in 10%, 5%, or 4% buffered formalin per recommendations from taxonomic experts and guidance provided by the Smithsonian National Museum of Natural History. Details of the preservation of each biological sample are in the associated metadata record. All voucher samples and subsamples were shipped to the Smithsonian National Museum of Natural History for long-term archiving and public access.

3.3.3 Water/eDNA Samples

As many as five 1.7 liter water samples per dive were collected in ROV Niskin bottles for eDNA analysis.

Once on board the ship, water samples were filtered using a 0.45 µm filter, and the filters were fixed with DNA/RNA Shield, a preservative that keeps DNA stable at room temperature. For each dive's set of water samples, a negative control of tap water was processed at the same time. Details of the timing and associated collection data for each water sample are in the associated metadata record. All eDNA samples were shipped to the Smithsonian National Museum of Natural History for further processing (DNA extraction and sequencing), long-term archiving, and public access.

3.4 Conductivity, Temperature, and Depth

CTD measurements were collected with the integrated ROV CTD system (Seabird (SBE) 9/11+). This system records data from the CTD, dissolved oxygen (DO), and oxygen reduction potential (ORP) sensors on every dive.

3.5 Sun Photometer Measurements

NOAA Ocean Exploration gathers limited at-sea measurements aboard *Okeanos Explorer* to support a 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.

4. Environmental and Historical Compliance

General records of multi-expedition environmental and historical compliance are in the "NOAA Ship *Okeanos Explorer* FY23 Field Season Instructions" as appendices (Cuellar 2023).

Overviews of expedition-specific compliance activities are provided below. Copies of associated records of compliance are in **Appendix B**.

4.1 Environmental Compliance

In accordance with the National Environmental Policy Act (NEPA), NOAA Ocean Exploration incorporates appropriate and thorough consideration of potential environmental impacts into the planning and execution of its activities. NOAA Administrative Order 216-6A and its 2017 companion manual outline the agency's specific procedures for ensuring NEPA compliance.

For all 2023 Okeanos Explorer expeditions, NOAA Ocean Exploration completed environmental reviews using categorical exclusion worksheets, consistent with Section 4 of the NEPA companion manual. Additional evaluations were conducted to ensure that potential effects on species and habitats protected under the Endangered Species Act (ESA), Marine Mammal Protection Act (MMPA), Magnuson-Stevens Act (MSA), and National Marine Sanctuaries Act (NMSA) were negligible.

On March 14, 2022, NOAA Ocean Exploration received a Programmatic Letter of Concurrence and associated Project Design Criteria from the NOAA Fisheries ESA Interagency Cooperation Division. This documentation affirmed that the proposed activities may affect, but are not likely to adversely affect, ESA-listed species or their designated or proposed critical habitats. These documents will be submitted as supplemental materials in the NOAA Repository.

NOAA Ocean Exploration also requested an Essential Fish Habitat (EFH) consultation under Section 304 of the Magnuson-Stevens Act for expeditions in the North Pacific, Eastern Pacific, Central Pacific, and Alaska regions during the 2023 field season. An EFH Letter of Acknowledgment, received on August 3, 2022, from NOAA's Office of Habitat Conservation, confirmed that the expeditions would not adversely impact EFH.

Given the offshore nature of most proposed activities, interactions with marine mammals protected under the MMPA or seabirds protected under the Migratory Bird Treaty Act (MBTA)

were considered unlikely. In the event of any such encounters, impacts were expected to be negligible due to the implementation of established best management practices developed in coordination with relevant regulatory agencies.

Based on the results of these reviews and consultations, a categorical exclusion was determined to be the appropriate level of NEPA analysis. No extraordinary circumstances were identified that would require preparation of an environmental assessment or environmental impact statement.

5. Schedule

Table 3 provides a day by day breakdown of EX2304. The expedition was impacted by a sailing delay due to circumstances outside of the control of the program. The program used this time for additional mobilization activities and training.

Table 3. EX2304 schedule.

Date (UTC)	Activity
06/23	Mobilization begins in Dutch Harbor, AK.
6/27-28	ROV mobilization continued with a dunk test of D2 and Seirios. Training continued for Science Leads, Mapping Watch Leads, and other new team members.
6/29	Mobilization and training continued. Mission personnel were given a tour of NOAA Ship *Fairweather.*
6/30	Mobilization and training continued.
7/1	Mobilization and training continued. Mission personnel were provided a tour of the Alutiiq Museum, and visited the Kodiak History Museum and Wildlife Visitor Center.
7/2-7/3	Mobilization and training continued.
7/4	Fourth of July Holiday and Kraft manipulator practice.
7/5	Mobilization and training continued. Dunk Test of D2 and Seirios.
7/6	Mobilization and training continued. Hazmat waste was removed from the vessel with the help of the NOAA Kodiak Lab's Hazmat Officer. The biology Science Lead was given a tour of the NOAA Kodiak Lab.
7/7-7/9	Mobilization and training continued.
7/10	Mobilization and training continued. Dunk Test with full walk-through, including sampling operations. Measurements were taken to establish the waterline. All-hands with mission team.
7/11	Mobilization and training continued. Mission personnel were given a tour of the *Okeanos Explorer's* Engine Room and a tour of the USCG Hangar 1 (aircrafts) and Hangar 3 (helicopters).

Date (UTC)	Activity
7/12-7/13	Mobilization and training continued.
7/14	Departure from Kodiak, AK at 0830. Transit mapping commenced en route to Dive 01.
7/15	Dive 01 conducted in the water column, consisting of five standard transects. Overnight transit mapping towards Dive 02.
7/16	Dive 02 conducted on a steep escarpment west of Big Bend Canyon. Overnight mapping operations en route to Dive 03.
7/17	Dive 03 was aborted during descent due to deteriorating weather conditions. Overnight mapping operations en route to Dive 04.
7/18	Dive 04 was an extended dive conducted on Sanak Seep, and included midwater transects on the ascent. Overnight mapping operations en route to Dive 05.
7/19	Dive 05 was conducted on a scarp north of Lone Knoll. On ascent, a mechanical issue halted the winch due to fraying 0.68 cable. This was ultimately resolved, and the vehicles were recovered at 0200.
7/20	Focused mapping operations were conducted while the ROV team repaired the winch and cable.
7/21	Dive 06 was aborted due to a medical emergency during descent. Following recovery, the ship prepared for a medical evacuation.
7/22	Medical evacuation completed via small boat transfer.
7/23	Dive 07 was conducted on a mound north of Uliaga Island. Overnight mapping operations en route to Dive 08.
7/24	Dive 08 was conducted in Umnak Canyon. The ship then began transiting to port in Unalaska, AK.
7/25	Arrival at Dutch Harbor, Unalaska, AK. Commenced demobilization.
7/26-27	Demobilization and Mission Team departure.

6. Results

This section details the results of EX2304. Metrics for the expedition's major scientific work are in **Table 4**. A station log detailing the location of each operation conducted is provided as a supplemental file to this expedition report.

Table 4. Summary of scientific metrics for EX2304.

Metrics	Totals
Days at Sea	12
Days at Sea in U.S. Waters	12

Metrics	Totals
Linear km Mapped by EM 304	2,694
Sq. km Mapped by EM 304	16,475
Sq. km Mapped by EM 304 in U.S. Waters (and deeper than 200 m)	16,433
Vessel CTD Casts	0
XBT Casts	48
ROV Dives	8
ROV Dives in U.S. Waters	8
Maximum ROV Seafloor Depth (m)	2,807.4
Minimum ROV Seafloor Depth (m)	532.5
Total Time on Bottom (hh:mm:ss)	22:24:29
Water Column Survey Time (hh:mm:ss)	03:32:53
Total ROV Time (hh:mm:ss)	56:52:00
Potential Undescribed or Novel Species and New Records Observed*	3
Dives During Which Living Corals and Sponges Were Observed	4
Dives During Which Chemosynthetic Communities Were Observed	1
Dives During Which Active Seeps/Vents Were Observed	1
Dives During Which Diverse Benthic Communities Were Observed	2
Total Samples	95
Biological Samples (Primary)	22
Biological Associate Samples	31
Geological Samples	6
Geological Associate Samples	1
eDNA Water Samples (including 7 blanks)	35
Actively Participating Scientists, Students, and Resource Managers	42

* Organisms unknown to science or an extension of their known range of geolocation or depth

6.1 Acoustic Operations Results

NOAA Ocean Exploration mapped 16,475 sq. km of seafloor during the 12 days at sea for EX2304. Of the 16,475 sq. km mapped, 16,433 sq. km was deeper than 200 m and within the U.S. Exclusive Economic Zone and Territorial Sea. The expedition (EX2304) made significant contributions to the Seascape Alaska campaign goals to map the U.S. waters off Alaska. EX2304 also contributed to the broader exploration and characterization priorities identified as part of the National Ocean Mapping, Exploration, and Characterization (NOMEC) strategy.

Acoustic mapping data are generally sent to the NOAA archives within 120 days of the end of an expedition. The 2023 mapping readiness report describes the data archived for each dataset, including file formats (Candio et al. 2023). Information about proprietary software and freeware that can handle the varying data types is in the "NOAA OER Deepwater Exploration Mapping Procedures Manual" (Hoy et al. 2020).

6.2 ROV Operations Results

Seafloor depth ranges explored during the 6 successful ROV dives were between 532.5 and 2807.4 m. During these dives, the ROVs spent approximately 22.5 hours conducting benthic exploration and 3.5 hours conducting water column exploration. **Tables 5 and 6** contain dive-specific information.

Table 5. Summary information for the 8 ROV dives conducted during EX2304.

Dive #	Site Name	Date (yyyymmdd)	On Bottom Latitude (dd)	On Bottom Longitude (dd)	Max Depth (m)	Min Depth (m)	Dive Duration (hh:mm:ss)	Bottom Time (hh:mm:ss)	Water Column Exploration Time (hh:mm:ss)
1	Aleutians Water Column	7/15/23	55.60289° N	154.07186° W	2164	N/A	5:58:10	N/A	2:30:56
2	Big Bend Canyon	7/16/23	54.75286° N	156.52509° W	2324.3	2139.4	8:14:28	5:17:56	N/A
3	South Shumagin Islands*	7/17/23	54.28025° N	159.93617° W	N/A	N/A	1:42:00	N/A	N/A
4	Sanak Seep	7/18/23	53.74866° N	162.58825° W	2030.7	2016.3	9:48:08	4:30:01	1:01:57
5	Lone Knoll Scarp**	7/19/23	53.50477° N	164.17038° W	2807.4	2743.4	16:25:05	2:56:00	N/A
6	Uliago Mound*	7/21/23	53.29323° N	169.77545° W	N/A	N/A	1:03:27	N/A	N/A
7	Uliago Mound	7/23/23	53.29347° N	169.77597° W	783.2	532.5	8:14:08	6:35:01	N/A
8	Umnak Canyon Wall	7/24/23	53.50038° N	168.81864° W	1479.1	1429.6	5:26:34	3:05:31	N/A

* Dive was aborted prior to reaching the seafloor.

** Dive had a late recovery due to mechanical issues upon ascent.

Table 6. Summary of scientific metrics for the 8 ROV dives conducted during EX2304.

Dive #	Site Name	Corals/ Sponges	Chemo-synthetic Community	Active Seeps & Vents	Diverse Benthic Community	Primary/ Associate Biological Samples	Primary/Associate Geological Samples	Water Samples / Blank
1	Aleutians Water Column	N/A	N/A	N/A	N/A	5/0	0/0	5/1
2	Big Bend Canyon	Yes	No	No	No	4/5	4/0	5/1
3	Shumigan Scarp	N/A	N/A	N/A	N/A	0/0	0/0	0
4	Sanak Seep	No	Yes	Yes	Yes	3/10	1/0	5/1
5	Lone Knoll Scarp	Yes	No	No	No	1/0	0/0	4/1
6	Uliaga Mound	N/A	N/A	N/A	N/A	0/0	0/0	1/1
7	Uliaga Mound	Yes	No	No	Yes	6/11	1/0	5/1
8	Umnak Canyon	Yes	No	No	No	3/5	0/1	3/1

6.3 Sampling Operations Results

A total of 95 samples were collected during EX2304: 7 geological samples, 22 biological samples, 31 associate biology samples (specimens attached to primary biological or geological samples), and 35 water samples for eDNA analysis, including 7 blanks (**Table 6** includes results by dive). **Appendix C** contains complete inventories of geological, biological, and water samples.

There were 6 geological samples that were purposely collected (primary samples) as well as 1 sample that were incidentally collected (associate samples). In total, these samples amounted to 7 individuals. Highlights are noted in Section 6. **Table D1** in **Appendix C** contains full details about the geological samples collected.

There were 22 biological samples that were purposely collected (primary samples) as well as 31 samples that were incidentally collected (associate samples). In total, these samples amounted to 53 individuals. Highlights are noted in Section 6. **Table D2** in **Appendix C** contains full details about the biological samples collected.

There were 28 water samples collected for eDNA analysis and 7 blanks, for a total of 35 water samples submitted. **Table D3** in **Appendix C** contains full details about the water samples collected.

6.5 Engagement

EX2304 engaged with audiences around the world, opening a window of understanding into the deep sea. Highlights included:

- 42 Scientists, Students, and Resource Managers actively participated in the the expedition
- Live video feeds received nearly 50,900 views, and web content received over 21,800 page views during EX2304.
- Nearly 250 news/web articles were published covering EX2304. Stories appeared in national and local media outlets and on websites throughout the country, including the Miami Herald, MSN, the Associated Press, and the Weather Channel. This coverage amplified the impact of the expedition, increasing the audience reached.

7. Data Access

All data collected during NOAA Ocean Exploration expeditions and associated products are made publicly available via the NOAA archives, NOAA's National Centers for Environmental Information (NCEI), the NOAA Institutional Repository, and the Smithsonian National Museum of Natural History and Oregon State University sample repositories, unless protected (e.g., data associated with specific maritime heritage sites). Data collected by NOAA must be covered by a data management plan to ensure they are archived and publicly accessible. The data management plan for EX2304 is in the "Project Instructions: EX2304, Seascape Alaska 3: Aleutians Remotely Operated Vehicle Exploration and Mapping" (Hoy, 2023).

The primary tools for accessing data collected during this expedition and archived at NCEI are the EX2304 data landing page, the NOAA Ocean Exploration Data Atlas, and the NOAA Ocean Exploration Video Portal. Refer to the NOAA Ocean Exploration Data Access web pages for help navigating expedition data. Other resources include the NOAA Ocean Exploration Data (NCEI) ArcGIS online group, which provides access to all NOAA Ocean Exploration geospatial data services managed by NCEI, including the geospatial data layers found in the data atlas, and the NOAA Ocean Exploration Data Management website.

NCEI makes data publicly available over time as quality-control measures are completed, data are released, and publications and related materials are published. Thus, not all data and products will be made available at the same time. To access data and products from EX2304 that are not yet public, request assistance by submitting a data request form or sending an email to oer.info.mgmt@noaa.gov.

7.1 Digital Data/Product Locations

The locations for directly accessing specific types of digital data collected during EX2304 and products documenting expedition results (at the time of writing this report) are provided in **Table 7**.

Table 7. Online locations for direct access to digital data collected during EX2304 and products documenting expedition results (at the time of writing this report).

Data/Product Type	Description
EM 304 Bathymetry and Backscatter Data	EM 304 bathymetric and backscatter data, supporting informational logs, and ancillary files are available through NCEI's Bathymetric Data Viewer
Water Column Data (EM 304 and EK60/EK80)	EM 304 and EK60/EK80 water column data, supporting data, and informational logs are available through NCEI's Water Column Sonar Data Viewer

Data/Product Type	Description
Knudsen 3260 Sub-Bottom Profiler Data	Sub-bottom data, supporting data, and informational logs are available in NCEI's Trackline Geophysical Data Viewer
ADCP Data	ADCP raw data are available through the NCEI Global Ocean Currents Database
Sound Speed Profiles	Ancillary sound speed profiles are available with the mapping data through NCEI's Bathymetric Data Viewer and the expedition's oceanographic dataset
Oceanographic Dataset	Oceanographic data and products are available from NCEI. These data include data from shipboard sensors, including navigational data, meteorological data (wind), and oceanographic data (bathythermograph, sound velocity probe, thermosalinograph); additional data and products include profile data (CTD and XBT), event logs, images, ROV ancillary data, and sample data
SeaTube Annotations	Annotations from ROV dives with associated video (with a snapshot capability) and geospatial and sensor data are available through Sea Tube
Dive Summaries	Individual ROV dive summaries and associated ROV dive data are available as supplemental files to this report.
Reports and Papers	Reports and peer-reviewed papers are available through the NOAA Ocean Exploration Library Guide and the NOAA Institutional Repository

7.2 Physical Sample Repositories

The following repositories archive samples collected during NOAA Ocean Exploration expeditions on *Okeanos Explorer*. More information about how to access physical samples is on the NOAA Ocean Exploration website and within the NOAA Ocean Exploration Sampling Procedures Manual (Dunn et al., 2023).

Biological Samples

Department of Invertebrate Zoology
Smithsonian National Museum of Natural History, Museum Support Center
MRC 534, 4210 Silver Hill Road, Suitland, MD 20746

DNA and eDNA Samples

Biorepository
Smithsonian National Museum of Natural History, Museum Support Center
4210 Silver Hill Road, Suitland, MD 20746

Geological Samples

Marine and Geology Repository

OSU Marine & Geology Repository
4700 SW Research Way
Corvallis, OR 97333

References

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Appendix A: EX2304 Science Team Members

EX2304 included onboard mission personnel (**Table A1**) as well as shore-based science personnel (**Table A2**) who participated remotely via telepresence.

Table A1. EX2304 onboard mission team personnel.

Name	Role	Affiliation
Shannon Hoy	Expedition Coordinator	NOAA Ocean Exploration
Rhian Waller	Science Lead	UCAR
Jennifer Aschoff	Science Lead	UCAR
Marcel Peliks	Mapping Watch Lead	UCAR
Anna Coulson	Mapping Watch Lead	UCAR
Anna Lienesch	Sample Data Manager	NCEI
Jennifer Green	Sample Data Manager	NCEI
Patrick Cooper	AI Specialist	NOAA Ocean Exploration
Chris Ritter	GFOE Team Lead	Global Foundation for Ocean Exploration
Olivia Andrus	Engineering Team	Global Foundation for Ocean Exploration
Fernando Aragon	Engineering Team	Global Foundation for Ocean Exploration
Caitlin Bailey	Engineering Team	Global Foundation for Ocean Exploration
Roland Brian	Engineering Team	Global Foundation for Ocean Exploration
Art Howard	Engineering Team	Global Foundation for Ocean Exploration
Nate Kenney	Engineering Team	Global Foundation for Ocean Exploration
Sean Kennison	Engineering Team	Global Foundation for Ocean Exploration
Tsimafei Lazouski	Engineering Team	Global Foundation for Ocean Exploration
Jon Mefford	Engineering Team	Global Foundation for Ocean Exploration
Bobby Mohr	Engineering Team	Global Foundation for Ocean Exploration
Andy O'Brien	Engineering Team	Global Foundation for Ocean Exploration
Levi Unema	Engineering Team	Global Foundation for Ocean Exploration
Chris Wright	Engineering Team	Global Foundation for Ocean Exploration

Table A2. EX2304 shore-based science team members who participated via telepresence.

Name	Role	Affiliation
Steve Auscavitch	Shore-based Scientist	Boston University
Jennifer Beaumont	Shore-based Scientist	NIWA
Lara Beckmann	Shore-based Scientist	University of Gothenburg
Merlin Best	Shore-based Scientist	Fisheries & Oceans Canada
Kelley Brumley	Shore-based Scientist	
Sam Candio	Shore-based Scientist	NOAA Ocean Exploration
Kasey Cantwell	Shore-based Scientist	NOAA Ocean Exploration
Robert Carney	Shore-based Scientist	Louisiana State University
Jamie Conrad	Shore-based Scientist	U.S. Geological Survey
Christina Conrath	Shore-based Scientist	NOAA Alaska Fisheries Science Center
Emily Crum	Communications Coordinator	NOAA Ocean Exploration
John Deitz	Shore-based Scientist	
Meredith Everett	Shore-based Scientist	NOAA
Scott France	Shore-based Scientist	University of Louisiana and Lafayette
Tamara Frank	Shore-based Scientist	Nova Southeastern University
Ervan Garrison	Shore-based Scientist	University of Georgia
Pam Goddard	Shore-based Scientist	NOAA
Sam Greenaway	Shore-based Scientist	NOAA
Elaina Jorgensen	Shore-based Scientist	NOAA
Christopher Kelley	Shore-based Scientist	University of Hawaii
Logan Kline	Shore-based Scientist	NOAA Ocean Exploration
Christopher Knowlton	Shore-based Scientist	URI Inner Space Center

Name	Role	Affiliation
Dhugal Lindsay	Shore-based Scientist	JAMSTEC
Tara Luke	Shore-based Scientist	Stockton University
Christopher Mah	Shore-based Scientist	Smithsonian-National Museum of Natural History (Invertebrate Zoology)
Kelly Markello	Shore-based Scientist	California Academy of Sciences
George Matsumoto	Shore-based Scientist	MBARI
Asako Matsumoto	Shore-based Scientist	
Cheryl Morrison	Shore-based Scientist	U.S. Geological Survey
Thomas Morrow	Shore-based Scientist	NOAA Ocean Exploration
Christian Nilsson	Shore-based Scientist	University of Gothenburg
Christa Rabenold	Shore-based Scientist	NOAA Ocean Exploration
Gord Rees	Shore-based Scientist	Ocean Networks Canada
Sean Rooney	Shore-based Scientist	NOAA Alaska Fisheries Science Center
Chris Rooper	Shore-based Scientist	Fisheries and Oceans Canada
Carolyn Ruppel	Shore-based Scientist	U.S. Geological Survey
Robert Stone	Shore-based Scientist	Auke Bay Marine Laboratory (retired)
Kenneth Sulak	Shore-based Scientist	U.S. Geological Survey
Michael Vecchione	Shore-based Scientist	NOAA and Smithsonian
Les Watling	Shore-based Scientist	University of Hawaii
Alexis Weinnig	Shore-based Scientist	U.S. Geological Survey
Mary Wicksten	Shore-based Scientist	Texas A&M University

Appendix B: EX2304 Environmental Compliance Documentation

The Endangered Species Act (ESA) Programmatic Letter of Concurrence covering this expedition is attached to this document as a supplement.

Figure B1. EFH Consultation letter

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
650 Capitol Mall Suite 5-100
Sacramento, California 95814

August 3, 2022

Refer to NMFS No: [WCRO-2022-01863]

Genene Fisher
Deputy Director
NOAA Office of Ocean Exploration and Research
Silver Spring, Maryland 20910

Re: Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for Deep-Sea Exploration Activities Aboard NOAA Ship *Okeanos Explorer* in 2022-2024

Dear Ms. Fisher:

NOAA's National Marine Fisheries Service (NMFS) has reviewed the NOAA Office of Ocean Exploration and Research's (OER) letter dated July 1, 2022 requesting an abbreviated essential fish habitat (EFH) consultation for the field activities to be conducted aboard the NOAA Ship *Okeanos Explorer* in the West Coast and Alaska Regions in 2022-2024. Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and the Fish and Wildlife Coordination Act (FWCA) require federal agencies to consult with us on all actions that may adversely affect EFH and other aquatic resources. The EFH consultation process is guided by the requirements of our EFH regulations at 50 CFR 600 Subpart K, which mandates the preparation of EFH assessments and generally outlines each agency's obligations in this consultation process. In support of this consultation process, you provided a notice of the proposed action and your agency's conclusion regarding impacts on EFH. Your request references previously completed EFH consultations between NOAA Fisheries Greater Atlantic and Southeast Regions and OER and NOAA's National Centers of Coastal Ocean Science (NCCOS) for similar research activities conducted in U.S. federal waters of the Gulf of Mexico, South Atlantic Bight and Caribbean in 2018-2020 and activities in the Greater Atlantic Region and Southeast Atlantic from 2019 to 2021. After reviewing the above information, NMFS provides this response pursuant to section 305(b)(4)(A) of the MSA and the FWCA.

Proposed Action

NOAA Ship *Okeanos Explorer* expeditions in 2022 thru 2024 will contribute to the West Coast Expanding Pacific Research and Exploration of Submerged Systems (EXPRESS) campaign and the regional Seascape Alaska campaign. EXPRESS is the latest evolution of the multi-year, multi-ship campaign that will help develop mitigation measures for operations occurring in the region and continued support of marine protected areas. Other initiatives include the Nippon Foundation-GEBCO Seabed 2030 initiative and the National Strategy for Ocean Mapping, Exploring, and Characterizing the United States Exclusive Economic Zone (NOMEC), which looks to produce a bathymetric map of the world ocean floor by 2030.

Consistent with previous expeditions in the Gulf of Mexico, western Atlantic, and Pacific, OER will work with the scientific community and public to characterize unknown and poorly-known areas through telepresence-based exploration including deep water mapping systems. Mapping and remotely operated vehicle (ROV) operations generally occur in water depths of 200 meters (m) and greater. During OER operations, expedition teams would conduct: seafloor, sub-bottom and water column mapping using multibeam, split-beam, sub-bottom profiler and acoustic Doppler current profiler (ADCP) sonar systems; oceanographic data collection primarily using the vessel's CTD rosette and expendable bathythermographs (XBTs); and seafloor and water column data collection using an integrated, two-body ROV system and additional unmanned surface vehicles (USVs) and autonomous underwater

vehicle systems (AUVs). Using ROV and AUV systems during expeditions to visually investigate unknown and poorly known deep water habitats within and around priority areas will help to establish baseline habitat characterization and species inventories for scientists and managers.

Magnuson-Stevens Fishery Conservation and Management Act Comments

Action Area and Essential Fish Habitat Affected by the Project

The action areas covered by this request encompass the marine environment in the areas around the North Pacific Ocean, Eastern Pacific Ocean, the Gulf of Alaska (GOA) and the eastern Aleutian Chain, and the vessel transit areas between ports, including but not limited to ports of call located in North America and Pacific Islands. Separate EFH consultations will be submitted for operations located in the Pacific Island Region.

U.S. West Coast

OER anticipates spending the majority of the FY2022 and FY2024 field season along the U.S. Pacific Coast contributing to the EXPRESS campaign. This work will also address priorities identified from the 2020 Consortium for Ocean Leadership (COL) workshop. Mapping priorities include filling in the gaps in current mapping coverage deeper than 200 m with high-resolution data offshore of California, Oregon, and Washington, and providing baseline data for further exploration. ROV and AUV exploration priorities are to be determined depending on the needs of ocean resource managers and partners and the ocean science community, and are anticipated to include geological hazards, deep sea corals, seamounts, and critical minerals/seeps. Operations in the Pacific Ocean are expected to commence in October, 2022. The majority of these surveys will take place in the U.S. Exclusive Economic Zone (EEZ) but may deviate in track lines, locations, and timing for various reasons (e.g., crew safety, inclement weather, mechanical issues).

The proposed field activities off the West Coast occur within EFH for various federally managed fish species within the Pacific Coast Groundfish, Pacific Coast Salmon, Coastal Pelagic Species, and Highly Migratory Species Fishery Management Plans (FMPs). In addition, the project would occur within rocky reef and "areas of interest," which are designated as habitat areas of particular concern (HAPC) for various federally managed fish species within the Pacific Coast Groundfish FMP. Although the proposed field activities would occur primarily in deeper waters, the proposed action could occur within the vicinity of other HAPCs identified in the Pacific Coast Groundfish and Pacific Coast Salmon FMPs, including canopy kelp, seagrasses, or estuaries, such as when leaving or returning to ports. HAPC are described in the regulations as subsets of EFH which are rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area. Designated HAPC are not afforded any additional regulatory protection under the MSA; however, federal projects with potential adverse impacts to HAPC will be more carefully scrutinized during the consultation process.

Alaska

NOAA OER's operations in the region during FY2023 will focus on supporting the existing SeaScape Alaska effort. Mapping operation priorities include gaps in mapping coverage deeper than 200 m offshore of the GOA, and the eastern Aleutian chain. ROV and AUV exploration priorities include geological hazards, deep sea corals, seamounts, and critical minerals/seeps. OER plans to conduct operations in Alaskan waters with a concentrated effort in the GOA and the eastern Aleutian Chain. Weather conditions and transit times may impact operations causing exact start and end dates to vary by a few days or weeks expanding the duration of corresponding expeditions. The GOA can be accessible as early as April, and the Aleutians are best from June to September.

The North Pacific Fishery Management Council (NPFMC) has identified EFH for nearshore marine waters in the vicinity of the GOA and the eastern Aleutian Chain to include EFH for all five species of Pacific salmon. There are no anadromous rivers in the project area. The proposed project location is designated as EFH for groundfish and scallops. The proposed field activities off the coast of Alaska occur within EFH for various federally managed fish species within the Bering Sea and Aleutian Islands Groundfish, Gulf of Alaska Groundfish, Scallop, and Salmon FMPs. HAPCs within EFH are areas where fisheries management identifies a need to conserve sensitive, rare habitats from anthropogenic activities such as fishing practices or developmental stress. In order to protect HAPCs, certain habitat protection areas and habitat conservation zones have been designated. The following HAPCs have

been designated in the project area: Alaska Seamount Habitat Protection Areas, GOA Coral Habitat Areas of Particular Concern and Bowers Ridge Habitat Conservation Zone. As noted previously, there are no additional regulatory protections under the MSA for HAPCs; however, federal projects with potential adverse impacts to HAPC will be more carefully scrutinized during the consultation process.

Effects of the Action

The NMFS West Coast and Alaska Regions have reviewed information provided on the proposed activities, as well as the conservation measures and best management practices incorporated into the action to address adverse effects to EFH. Adverse effects to EFH would include bottom disturbance, increased turbidity, impacts associated with sample collection, and increased sound. However, the proposed action includes measures to avoid, minimize, or otherwise offset those adverse effects to EFH. For instance, to the extent practicable, hard-bottom and other sensitive habitats (e.g., corals, seagrass) would be avoided when anchoring or operating equipment, machinery will maintain an appropriate altitude off the bottom, cameras and other technology will be used to detect and avoid collisions, and speed and the type of equipment used will be adjusted depending upon the environmental conditions. In addition, only portions of specimens will be collected whenever possible to avoid mortality and minimize adverse effects to associated habitats. Increased sound in the marine environment from vessel operation or sonar emissions would only be expected to result in temporary behavioral effects. Therefore, in our joint assessment of the overall activity including the experimental design, the nature of collection, and the scope of the proposed activities, we have no additional EFH conservation recommendations to provide pursuant to Section 305(b)(2) of the MSA.

Supplemental Consultation

Pursuant to 50 CFR 600.920(l), OER must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH conservation recommendations.

Fish and Wildlife Coordination Act Comments

The purpose of the FWCA is to ensure that wildlife conservation receives equal consideration, and is coordinated with other aspects of water resources development [16 U.S.C. 661]. The FWCA establishes a consultation requirement for Federal departments and agencies that undertake any action that proposes to modify any stream or other body of water for any purpose, including navigation and drainage [16 U.S.C 662(a)]. Consistent with this consultation requirement, NMFS provides recommendations and comments to Federal action agencies for the purpose of conserving fish and wildlife resources. The FWCA allows the opportunity to offer recommendations for the conservation of species and habitats beyond those currently managed under the MSA.

As described in the EFH effects analysis, NMFS has determined that bottom habitat, potentially including biogenic and rocky reef habitats, will be negatively impacted by proposed project activities. Given the importance of this habitat to a variety of fish and wildlife species, the proposed conservation measures to avoid or minimize adverse effects to EFH are also considered necessary to address negative impacts to fish and wildlife resources managed under the FWCA.

Thank you for consulting with NMFS and considering our comments. If you have any questions regarding this response, please contact Eric Chavez via email at Eric.Chavez@noaa.gov or Charlene Felkley at Charlene.Felkley@noaa.gov for questions related to the West Coast or Alaska, respectively.

Sincerely,

Ryan J. Wulff
Assistant Regional Administrator
for Sustainable Fisheries
West Coast Region

HARRINGTON.GRETCHEN.ANNE.1365893833
Digitally signed by HARRINGTON.GRETCHEN.ANNE.1365893833
Date: 2022.08.04 14:27:22 -08'00'

Gretchen Harrington
Assistant Regional Administrator
for Habitat Conservation
Alaska Region

Figure B2. State of Alaska Aquatic Resource Permit

STATE OF ALASKA
DEPARTMENT OF FISH AND GAME
P.O. Box 115526
JUNEAU, ALASKA 99811-5526

Permit No. **CF-23-105**

Expires: **9/30/2023**

AQUATIC RESOURCE PERMIT
(For Scientific/Collection Purposes)

This permit authorizes: **Kelley Suhre**
(whose signature is required on page 2 for permit validation)
of
NOAA/Office of Ocean Exploration and Research
1315 East Way Hwy., Silver Spring, MD 20910
(202)689-4587 kelley.suhre@noaa.gov

to conduct the following activities from **June 20, 2023** to **September 30, 2023** in accordance with AS 16.05.930, AS 16.05.340(b) and 5 AAC 41.600.

Purpose: This expedition series is in support of Seascape Alaska to map, explore and characterize the US Exclusive Economic Zone (NOMEC). Data collected will establish a baseline in these areas to catalyze further exploration, research, and management activities.

Location: Gulf of Alaska from Southeast Alaska to Unalaska within 3nm and within the US EEZ.

Species: See **Species List** on page 2.

Method of Collection: Remote operated vehicle on NOAA Ship *Okeanos Explorer*

Disposition: Species will be preserved. See **Stipulations** section.

A COLLECTION REPORT IS DUE October 30, 2023. See **Stipulations** section for more information. Data from such reports are considered public information. Reports must be submitted to the Alaska Department of Fish and Game, Division of Commercial Fisheries, PO Box 115526, Juneau, AK 99811-5526, attention Permit Coordinator (907-465-4724; dfg.fmpd.permitcoordinator@alaska.gov). A report is required whether or not collecting activities were undertaken.

GENERAL CONDITIONS, EXCEPTIONS AND RESTRICTIONS

1. This permit must be carried by person(s) specified during approved activities who shall show it on request to persons authorized to enforce Alaska's fish and game laws. This permit is nontransferable and will be revoked or renewal denied by the Commissioner of Fish and Game if the permittee violates any of its conditions, exceptions or restrictions. No redelegation of authority may be allowed under this permit unless specifically noted.
2. No specimens taken under authority hereof may be sold, bartered, traded, or consumed. All specimens must be deposited in a public museum or a public scientific or educational institution unless otherwise stated herein. Subpermittees shall not retain possession of live animals or other specimens.
3. The permittee shall keep records of all activities conducted under authority of this permit, available for inspection at all reasonable hours upon request of any authorized state enforcement officer.
4. Permits will not be renewed until detailed reports, as specified in the Stipulation section, have been received by the department.
5. UNLESS SPECIFICALLY STATED HEREIN, THIS PERMIT DOES NOT AUTHORIZE the exportation of specimens or the taking of specimens in areas otherwise closed to hunting and fishing; without appropriate licenses required by state regulations; during closed seasons; or in any manner, by any means, at any time not permitted by those regulations.

Peter Bangs 6/14/2023
Assistant Director
Division of Commercial Fisheries

Authorized Personnel: The following personnel may participate in collecting activities under terms of this permit:

Sam Candio, Shannon Hoy, Abby Letts, Thomas Morrow, Sam Cuellar, Kelley Suhre and Kasey Cantwell.

Employees and volunteers under the direct supervision of, and in the presence of, one of the authorized personnel listed above may participate in collecting activities under terms of this permit.

CF-23-105 ***continued (page 2 of 2)***

Stipulations:

1. Permits will indicate the number of specimens that may be taken by species and life stage. Sampling or collecting activities must stop when the maximum allowable number of specimens is obtained. All live fish, shellfish, and aquatic plants collected in excess of the number specified on the permit must be released immediately and unharmed at the capture location, unless otherwise specified in the permit. All unintended mortalities must be recorded and returned to capture site waters.
2. Up to 2 individuals of each unknown species may be killed and saved for later identification.
3. Specimens collected under the authority of this permit are ONLY to be used for the purposes outlined in this permit.
4. The permit number must be displayed on the holding tanks. All aquarium systems (open and closed) may be inspected by an ADF&G Fish Health Services Pathologist.
5. Destroyed specimens must be double-bagged and placed in a sanitary landfill.
6. A copy of this permit, including any amendments, must be made available at all field collection sites and project sites for inspection upon request by a representative of the department or a law enforcement officer.
7. Issuance of this permit does not absolve the permittee from compliance in full with any and all other applicable federal, state, or local laws regulations, or ordinances.
8. **A report of collecting activities, referencing this aquatic resource permit, must be submitted 30 days after the expiration of this permit.** This report must summarize the number of all specimens, including bycatch, captured by date, location, depth of capture, species, size (weight and length where appropriate), age (where appropriate), sex, numbers, and the fate of those specimens. A report is required whether or not collecting activities were undertaken.
9. **A report of research activities, referencing this aquatic resource permit, must be submitted within 6 months after the expiration of this permit.** This report should present the research conducted in a format similar to a scientific paper including the following: introduction (objective of the study plan and hypothesis), methods, and results. The report is ad-hoc and intended to show that the specimens were used in a scientific method and allows for the evaluation of potential cumulative effects from multiple projects in the same area, but is not intended to be a full peer-reviewed scientific paper.
10. Failure to comply with the conditions of this permit will result in the loss of future permitting privileges.
11. PERMIT VALIDATION requires permittee's signature agreeing to abide by permit conditions before beginning collecting activities:

_____
Signature of Permittee

ecc: Ethan Ford, Aaron Dupuis, Kevin Schaberg
CF Division Files
Alaska Wildlife Troopers – Sitka, Seward, Kodiak, Unalaska

Common Name	Scientific Name	Number
Black corals	Antipatharia spp.	up to 11 samples per species per location, up to 50 total
Black corals	Leiopathes spp.	up to 11 samples per species per location, up to 150 total
Black corals	Bathypathes "alternata"	up to 11 samples per species per location, up to 50 total
Stony corals	Scleractina spp.	up to 11 samples per species per location, up to 50 total
Unknown biological specimens	unknown	up to 11 samples per species per location, up to 100 total
Worm	Annelida	up to 11 samples per species per location, up to 150 total
Jellyfish	Ctenophora	up to 11 samples per species per location, up to 150 total
Starfish, sea urchin, or sea cucumber	Echinoderm	up to 11 samples per species per location, up to 150 total
Shellfish	Mollusc	up to 11 samples per species per location, up to 150 total
Fishes	Chordata	up to 11 samples per species per location, up to 150 total
Corals, sea anemones, jellyfish	Cnidarian	up to 11 samples per species per location, up to 150 total
Sponges	Porifera	up to 11 samples per species per location, up to 150 total
Worms	Polychaete	up to 11 samples per species per location, up to 150 total
Aquatic invertebrates	Bryozoan	up to 11 samples per species per location, up to 150 total
ribbed and proboscis worms	Nemertea	up to 11 samples per species per location, up to 150 total
Malacostracan crustaceans	Amphipods	up to 11 samples per species per location, up to 150 total
Marine chordate animals	Tunicate	up to 11 samples per species per location, up to 150 total
Decapods	Crustacean	up to 11 samples per species per location, up to 150 total
Slugs and Snails	Gastropod	up to 11 samples per species per location, up to 150 total

Figure B3. U.S. Fish & Wildlife Service Designated Port Exception Permit

Page 1 of 1
DESIGNATED PORT EXCEPTION PERMIT
SCIENTIFIC PURPOSES

Permit Number: D80153
Date Effective: 07/13/2023 Date Expires: 07/27/2025

Issuing Office:

Department of the Interior
U.S. FISH AND WILDLIFE SERVICE
Office of Law Enforcement
1875 Century Boulevard, Suite 380
Atlanta, GA 30345
Tel: 404-679-7195
Email: permitsEastLE@fws.gov

BRIAN DOWNIE
Legal Instruments Examiner
Digitally signed by BRIAN DOWNIE
Date: 2023.07.27 09:21:28 -04'00'

Permittee:
NOAA OCEAN EXPLORATION
1315 EAST-WEST HWY, SSMC3 2300
SILVER SPRING, MARYLAND 20910
US

Name and Title of Principal Officer
KASEY CANTWELL - OPERATIONS CHIEF

Authority: Statutes and Regulations: 16 USC 1538 (f); 50 CFR SUBPART 13, 50 CFR 14.

Location where authorized activity may be conducted:
DH-Dutch Harbor, AK KO-Kona, HI NEWPORT, OREGON KODIAK, ALASKA SEWARD, ALASKA

Reporting requirements:
PERMITEE IS REQUIRED TO MAINTAIN RECORDS PER 50 CFR 13.
ACCEPTANCE OF THIS PERMIT AUTHORIZES INSPECTION PER 50 CFR 13.

Authorizations and Conditions:

A. General conditions set out in Subpart D of 50 CFR 13, and specific conditions contained in Federal regulations cited above, are hereby made a part of this permit. All activities authorized herein must be carried out in accord with and for the purposes described in the application submitted. Continued validity, or renewal of this permit is subject to complete and timely compliance with all applicable conditions, including the filing of all required information and reports.
B. The validity of this permit is also conditioned upon strict observance of all applicable foreign, state, local tribal, or other federal law.
C. Valid for use by permittee named above.
D. Permittee is responsible for requesting renewal of permit at least 30 days prior to the expiration date as outlined in 50 CFR 13. Service Law Enforcement Officers will not clear shipments presented for import or export under expired permits.
E. Permittee is authorized to import/export wildlife and/or wildlife products at the port(s) specified above.
F. Permittee must also comply with inspection and clearance procedures as outlined in 50 CFR 14, upon importation/exportation of wildlife and/or wildlife products.
G. Permittee must comply with additional permit conditions as set forth in 50 CFR 14.31.
H. Permittee must contact U.S. Fish & Wildlife Service Officers at least 72 hours prior to the proposed import/export at the following location(s): DH-DUTCH HARBOR, AK - Wildlife Inspector (phone: (907) 271-6198) KO-KONA, HI - Wildlife Inspector (phone: (808) 861-8525) NEWPORT, OREGON - Wildlife Inspector (phone: (206) 241-0191) KODIAK, ALASKA - Wildlife Inspector (phone: (907) 271-6198) SEWARD, ALASKA - Wildlife Inspector (phone: (907) 271-6198).

Figure B4. CITES Introduction from the Sea Permit

FORM 3-201A (1/97)

CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES OF WILD FAUNA AND FLORA

☐ EXPORT PERMIT
☐ RE-EXPORT CERTIFICATE
☒ OTHER CERTIFICATE(see block 9)

Page 1 of 2

1. Original Permit/Certificate No.
23US33698E/9

2. Valid until
2023-09-19

3. Permittee (name and address, country)
NOAA OFFICE OF EXPLORATION AND RESEARCH
1315 EAST WEST HWY
SSMC3, ROOM 10229
SILVER SPRING, MARYLAND 20910
U.S.A.

4. Consignee (name and address, country)
INTRODUCTION FROM THE SEA

5. Special Conditions
ALL APPLICABLE FOREIGN, LOCAL, STATE, OR OTHER FEDERAL LAWS, INCLUDING THOSE REQUIRING PERMITS, MUST BE OBSERVED.

PERMIT MAY BE COPIED FOR MULTIPLE SHIPMENTS. PERMITTEE TO RETAIN ORIGINAL.

PERMITTEE MUST COMPLETE BLOCK(S) 11 (QUANTITY) PRIOR TO EACH SHIPMENT.

DOES NOT AUTHORIZE ACTIVITIES UNDER ESA.

CONDITIONS CONTINUE ON PAGE 2.

THIS REPLACES AND AMENDS 22US33698E/9 ISSUED 2022-09-20.

For live animals, only valid if the transport conditions comply with the CITES Guidelines for Transport of Live Animals or, in the case of air transport, with IATA Live Animals Regulations.

5a. Purpose of Transaction
S

6. U.S. Management Authority
Department of the Interior
U.S. FISH AND WILDLIFE SERVICE
DIVISION OF MANAGEMENT AUTHORITY
BRANCH OF PERMITS, MS: IA
5275 LEESBURG PIKE
FALLS CHURCH VA 22041-3803

2023-05-15
Issuing Date

United States Management Authority
AUTHORITY: Endangered Species Act of 1973 (16 USC 1531 et. seq.)

7/8. Common Name and Scientific name (genus and species) of Animal or Plant	9. Description of Part or Derivative, including identifying marks or numbers (age/sex if live)	10. Appendix No. and Source
A. Common Name: BLACK CORAL Scientific Name: ANTIPATHARIA	9. INTRODUCTION FROM THE SEA: FRAGMENT OR BRANCH OF CORAL.	10. 2 X 11. Quantity (including units): NO 11a. Total Exported/Quota

12. Country of Origin	Permit/Certificate No.	Date of Issue	12b. Breeding Operation No.
HIGH SEAS			
12a. Country of Last Re-export	Re-export Certificate No.	Date of Issue	12c. Pre-Convention: Date of Acquisition

B. Common Name / Scientific Name	9. Description of Part or Derivative, including identifying marks or numbers (age/sex if live)	10. Appendix No. and Source
B. Common Name: STONY CORAL Scientific Name: SCLERACTINIA	9. INTRODUCTION FROM THE SEA: FRAGMENT OR BRANCH OF CORAL.	10. 2 X 11. Quantity (including units): NO 11a. Total Exported/Quota

12. Country of Origin	Permit/Certificate No.	Date of Issue	12b. Breeding Operation No.
HIGH SEAS			
12a. Country of Last Re-export	Re-export Certificate No.	Date of Issue	12c. Pre-Convention: Date of Acquisition

13. Export / Re-export Endorsement:
The official who inspects shipment upon exportation / re-exportation must enter the total quantities of specimens being exported / re-exported in this block.

See Block 7	Quantity
A	
B	

14. Bill of Lading/Air Way-Bill Number

Port of Exportation / Re-exportation

Total No. of Shipping Containers

15. This document valid only with inspecting official's ORIGINAL stamp, signature and date in this block.

Inspecting Official's Stamp, Signature and Date

	SPECIAL PERMIT CONDITIONS	Department of the Interior U.S. Fish and Wildlife Service Division of Management Authority Falls Church, VA 22041 UNITED STATES OF AMERICA	Page 2 of 2 1. Original Permit/Certificate No. 23US33698E/9

5/6. THIS PERMIT IS ISSUED UNDER AUTHORITY OF THE ENDANGERED SPECIES ACT OF 1973 (16 U.S.C. 1531 et seq.) BY:

Falls Church, VA — Place

2023-05-15 — Issuing Date

United ... rity

PERMITTEE: NOAA OFFICE OF EXPLORATION AND RESEARCH

Special Permit Conditions

1. Samples collected from coral: Samples collected from coral may be brought into the United States under this Introduction from the Sea (IFS) certificate provided the conditions of 2 through 6 are met.

2. No samples may be obtained from coral that are permanently removed from the wild for the sole purpose of collecting samples, or for other than scientific or management purposes approved and carried out by appropriate wildlife authorities.

3. No coral colony may be killed intentionally for the purpose of collecting samples.

4. Care must be taken when handling live coral colonies to minimize any possibility of injury. If, for any reason, any wild or captive-held coral colony dies or incurs a debilitating injury solely as a result of being restrained for sample collection, or while having the sample collected, further collection of samples must be suspended until methods are evaluated and, if appropriate, modified to prevent further incidences of injury or death. If two or more coral colonies die or incur debilitating injuries within a 6-month period, sample collection must be suspended and the Division of Scientific Authority contacted in writing within 7 days of the death of the second individual. Before further sampling will be authorized a written account of the details of the event, and recommendations to resolve the situation, must be submitted for a review of sampling procedures (point of contact: Dr. Rosemarie Gnam, Chief, Division of Scientific Authority, MS: IA, 5275 Leesburg Pike, Falls Church, VA 22041-3803; tel. 703-358-1708; fax 703-358-2276).

5. The applicant must maintain a record of all samples collected under this certificate which must be made available to the Division of Scientific Authority upon request. This record should include for each introduction from the sea: the species and type(s) of specimens, date(s) collected, the date shipped, the location(s) of collection and name of person who collected the sample(s), conditions under which samples were collected (salvage or wild-caught), authorizing government agency, and any mortalities or debilitating injuries that may have occurred as a result, directly or indirectly, of the collection activities.

6. The applicant must maintain copies of all CITES certificates used to obtain and introduce from the sea all specimens and these documents must be made available to the Division of Scientific Authority upon request.

15. EXPORT/RE-EXPORT/IMPORT ENDORSEMENT: I, the inspecting official, certify that the information provided above is accurate. This document is valid only with inspecting official's ORIGINAL stamp, signature and date in this block.

Inspecting Official's Stamp, Signature and Date

Figure B5. NEPA Categorical Exclusion for EX2304

Categorical Exclusion (CE) Evaluation Worksheet

Project Identifier: EX2304

Date Review Completed: 4/18/2023

OAR NEPA Project Lead: Amanda Maxon, Environmental Compliance Specialist, Contractor, NOAA Office of Ocean Exploration and Research

OAR Functional Area: OER

Worksheet File Name: 2023-04-OER-E3-EX2304

Step 1. CE applicability

1. **Is this federal financial assistance, including via grants, cooperative agreements, loans, loan guarantees, interest subsidies, insurance, food commodities, direct appropriations, and transfers of property in place of money?**

   no

2. **What is the proposed federal action?**

   The proposed action is the NOAA's Office of Exploration and Research (OER) to complete a remotely operated vehicle (ROV) and mapping expedition using the NOAA Ship Okeanos Explorer focused on exploring deep waters (greater than 250 m for ROV operations and greater than 200 m for mapping operations) in U.S. waters off Alaska and in the High Seas. Acoustic Doppler Current Profiler (ADCPs) are run in shallow waters <50 meters when the vessel enters and exits ports to gather data on currents ensuring that the vessel heading alignment angles are correct in a non-destructive manner to support sampling operations.

   Operations will be conducted 24 hours per day and consist of ROV dives, conductivity, temperature, and depth casts, mapping operations (primarily overnight), and full shore-based participation via telepresence. Expedition operations will include using NOAA Ship Okeanos Explorer's deepwater mapping systems (Kongsberg EM 304 multibeam, EK60/EK80 split-beam sonars, Knudsen 3260 Chirp sub-bottom profiler, and Teledyne acoustic Doppler current profilers), expendable bathythermograph (XBTs) in support of multibeam sonar mapping operations, conductivity, temperature, depth profiler

1

(CTD) casts, OER's two-body ROV system (Deep Discoverer and Seirios), and high-bandwidth satellite connection for continuous ship-to-shore communications.

The EX2304 2023 Seascape Alaska: Aleutians Exploration (ROV and Mapping) expedition will commence on June 28, 2023 from Kodiak, Alaska and will conclude in Dutch Harbor, Alaska on July 25, 2023. EX2304 will focus operations in U.S. waters off Alaska in the Aleutian Islands with the focus on ROV and mapping priorities for approximately 28 days at sea.The exact start and end dates may vary by a few days to months depending on weather and other logistical considerations. Mapping and ROV operations will be conducted at depths between 200 and 6,000 m. The actions during this expedition demonstrate independent utility and they are not connected to any other federal actions.

3. **Which class of CE in Appendix E of the NAO 216-6A Companion Manual is applicable to this action and why?**
   a. E3: Activities to collect aquatic, terrestrial, and atmospheric data in a non-destructive manner.
   b. The topical scope for this action is consistent with the CE number E3 in Appendix E of the Companion Manual to NOAA Administrative Order (NAO) 216-6A: to collect aquatic, terrestrial, and atmospheric data in a non-destructive manner. The expedition will use remote sensing, video, images, and a limited number of physical samples to collect baseline information on unexplored deep-water (>250m) areas off the U.S. waters off the Aleutian Islands near Alaska and in the high seas. The use of conductivity, temperature, and depth instruments from a platform. During EX2304, operations deployment, operation, and retrieval of a limited number of ROVs, ASVs, AUVs, buoys, moorings, or similar instrumentation to conduct non-destructive sampling and collection of data from those instruments once installed, including physical, chemical, and biological measurements, and visual data will take place during the expedition. The limited number of biological and geological samples collected will follow OER's Best Management Practices and procedures to ensure the wellbeing and protection of organisms in and near the areas of operations.

      Additionally, EX2304 will conduct mapping operations which will involve no permanent physical, chemical, or biological changes to the environment in areas deeper than 200 meters in depth. This expedition will additionally perform mapping survey operations to collect critical baseline information to support priority NOAA science and management needs to ensure that the platform is ready for the 2023 field season.

Step 2. Extraordinary Circumstances Consideration

4. Would the action result in adverse effects on human health or safety that are not negligible?

The actions of the NOAA Ship Okeanos Explorer will take place in remote deep-sea (>200m) areas located offshore of the Aleutian Islands, Alaska, and in the high seas with a focus on waters within the U.S EEZ. All operations are underwater and will have no human presence in the area besides those on onboard the EX2304. The vessel will transit through different depths as it moves from the ports of call to the areas of operations in deeper waters. These actions do not involve any procedures or outcomes known to result in impacts on human health and safety.

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

While the Okeanos Explorer is operating within the U.S. EEZ where majority of operations would take place, the effects will be negligible as acoustic mapping and ROV operations are considered transient and would not cause any permanent impact on the seabed or within the water column. The procedures that are employed when operating acoustic systems impacts are well-documented and would follow the accepted best management practices for all operations onboard the vessel to ensure that the level of impact is below minor to the point of being barely detectable. The best management practices can be found in the FY23 field season instructions and EX2304 expedition report. Expedition operations are planned and reviewed before any actions are taken in order to determine whether there would be the potential for adverse effects on the area.

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

The activities are not likely to have a negative effect on species or habitats protected by the ESA, MMPA, MSA, NMSA, or MBTA. According to NOAA Fisheries, there are 7 ESA endangered and threatened species found along Alaska. The Okeanos Explorer operations will abide by the Best Management Practices and Mitigation Measures developed in collaboration with the various regulatory and federal agencies to ensure that operations in the these sectors would not result in any activities having adverse effects on the species or habitats protected under ESA, MMPA, MSA, NMSA, or MBTA. Mitigation measures and Best Management Practices are provided to the expedition coordinators and the ship before operations are taken to ensure that they are following the actions developed to minimize or limit adverse effects on species or habitats in the proposed action area.

7. **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?**

   The expedition operations will be in the compliance with FEC 07 Hazardous Materials and Hazardous Waste Management Requirements for Visiting Scientific Parties (or the OMAO procedure that supersedes it) to ensure generation, use, storage, transport, an disposal of such substances will not result in significant impacts.

8. **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?**

   The proposed action will not result in adverse or indirect effects that cannot be resolved through applicable regulatory processes since we will not be operating within listed or eligible properties, lands, resources or sites coming under the umbrella of protection referenced above.

9. **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)?**

   The NOAA Ship Okeanos Explorer will be operating in the remote and offshore areas along Alaska and the Aleutian Islands as the EX transits between the priority areas and dive targets during EX2304. There are no communities within or near the geographic scope of the expedition due to activities operating in areas greater than 200 meters. The expedition does not involve actions known or likely to result in adverse impacts on health or the environment of minority or low income communities.

10. **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?**

    During EX2304, NOAA Ship Okeanos Explorer will not make landfall in areas other than commercial ports in Kodiak, Alaska and Dutch Harbor, Alaska. 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 CTD and ROV dive, the equipment 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.

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

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. The proposed actions will not result in any Federal, State, or local law violations or requirements imposed for protection of the environment. OER received a ESA Programmatic Letter of Concurrence and Project Design Criteria letter dated March 14, 2022 from the NMFS ESA Interagency Cooperation Division for ESA Section 7 that concurs with OER's determination that the proposed action may affect, but is not likely to adversely affect ESA-listed species and their designated or proposed critical habitat in the action areas. The ESA Programmatic Letter of Concurrence and its Project Design Criteria will be provided in the EX2304 expedition report.

Given the offshore focus of most of our proposed work, it was determined that it is not likely that we will encounter marine mammals protected under the MMPA, or sea birds protected under the MBTA as they are often found in territorial and state waters. If we did encounter any such protected animals, our impacts would be negligible because of the best management practices that were developed with relevant agencies that we adhere to avoid or minimize environmental impacts. These best management practices and project designed criteria are outlined in the FY23 Field Season Instructions.

OER requested a Essential Fish Habitat (EFH) consultation under section 304 of the Magnuson-Stevens Fishery Conservation and Management Act for expeditions conducted by the NOAA Ship Okeanos Explorer during its 2023 field season in the North Pacific Ocean, Eastern Pacific Ocean, Central Pacific Ocean, and Alaska. The EFH Letter of Acknowledgement was received on August 3, 2022 from the Assistant Regional Administrator for the NOAA Office of Habitat Conservation stating that the FY23 expeditions will not adversely impact EFH. This letter will additionally be included in the EX2304 expedition report.

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

No, the exploration activities are considered small and minimal following the best available information about effects of the equipment to support determination that activities would be localized and be short in duration in any particular area at any given time with no notable or lasting changes to the environment. Given the project's scope and breath, no notable or lasting changes or highly controversial effects to the environment by mapping operations conducted onboard the Okeanos Explorer. Any effects would be small and considered minimal as the vessel transits through the area of interest continuously using acoustic sound sources which have been analyzed to determine the effects that may occur during operations.

13. 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?

The decision to take this action will not result in growth-inducing changes, compel future actions with potential impacts, or foreclose options for future actions. Each expedition is independently useful and is not connected to subsequent federal actions.

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

The techniques and equipment used are standard for this type of field study, and the effects are well known and assessed to determine whether the actions may result in environmental effects that are uncertain, unique, or unknown.

15. 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?

The techniques and equipment used are standard for this type of field study, and the effects are well known and assessed to determine whether the actions may result in environmental effects that are uncertain, unique, or unknown.

CE Determination

☑I have determined that a Categorical Exclusion is the appropriate level of NEPA analysis for this action and that no extraordinary circumstances exist that would require preparation of an environmental assessment or environmental impact statement.

☐I have determined that an environmental assessment or environmental impact statement is required for this action.

OAR Decision Maker's Name: David Turner

OAR Decision Maker's Position/Title: Acting Deputy Director, NOAA Office of Ocean Exploration and Research (OER)

Date Signed: 05-10-2023

David Turner

Appendix C: Inventories of Geological, Biological, and eDNA Water Samples

Tables C1-C3 provide inventories of the geological, biological, and water samples for eDNA analysis collected during EX2304.

Table C1. Inventory of geological samples collected during EX2304.

Dive #	Site Name	Sample #*	Sample ID	Preservation	Collection Rationale	Date (yyyymmdd)	UTC Time (hhmmss)	Latitude (dd)	Longitude (dd)	Depth (m)	Weight (kg)
02	Big Bend Canyon	EX2304_D02_03G	Rounded basalt cobble	Dried	Characteristic of Site	20230716	184831	54.7531	-156.5259	2319	0.04
02	Big Bend Canyon	EX2304_D02_05G	Tuff-volcanic rock	Dried	Characteristic of Site	20230716	195133	54.7537	-156.5272	2282.9	0.04
02	Big Bend Canyon	EX2304_D02_10G	Tuff- volcanic Rock	Dried	Characteristic of Site	20230716	220133	54.7547	-156.5289	2208.4	0.09
02	Big Bend Canyon	EX2304_D02_12G	Igneous Rock	Dried	Characteristic of Site	20230716	224632	54.7555	-156.5292	2163.1	0.52
04	Sanak Seep	EX2304_D04_04G	Carbonate Rock	Dried	Characteristic of Site	20230718	204322	53.7488	-162.5898	2024.3	2.01
07	Uliaga Mound Take 2	EX2304_D07_08G	Basalt	Dried	Characteristic of Site	20230723	212332	53.2927	-169.7783	661.8	2.45
08	Umnak Canyon	EX2304_D08_03B_A01G	sediment			20230724	182321	53.5004	-168.8183	1472.6	0.002

* Geological sample numbers with "_A##" indicate associate samples.

Table C2. Inventory of biological samples collected during EX2304.

Dive #	Site Name	Sample #*	Field Sample ID	Preservative	Collection Rationale	Date (yyyymmdd)	UTC Time (hhmmss)	Latitude (dd)	Longitude (dd)	Depth (m)	Salinity (ppt)	Temp (C)	Dissolved Oxygen (mg/l)
01	Aleutians Water Column	EX2304_D01_02B	Botrynema brucei	5% Formalin	Characteristic of Site	20230715	181926	55.6004	-154.0727	2161.7	34.60	1.84	2.09
01	Aleutians Water Column	EX2304_D01_04B	Solmissus	5% Formalin	Characteristic of Site	20230715	193214	55.6003	-154.0744	899.8	34.31	3.28	0.46

Dive #	Site Name	Sample #*	Field Sample ID	Preservative	Collection Rationale	Date (yyyymmdd)	UTC Time (hhmmss)	Latitude (dd)	Longitude (dd)	Depth (m)	Salinity (ppt)	Temp (C)	Dissolved Oxygen (mg/l)
01	Aleutians Water Column	EX2304_D01_07B	Bolinopsis	5% Formalin	Characteristic of Site	20230715	211415	55.5995	-154.0774	499.5	34.11	4.01	0.69
01	Aleutians Water Column	EX2304_D01_08B	Siphonophorae	95% EtOH	Characteristic of Site	20230715	212515	55.5992	-154.0783	503.6	34.11	4.00	0.68
01	Aleutians Water Column	EX2304_D01_10B	Bargmannia	95% EtOH	Characteristic of Site	20230715	221410	55.5978	-154.0837	300.8	33.92	4.45	1.40
02	Big Bend Canyon	EX2304_D02_03G_A01B	Cladorhiza	95% EtOH		20230716	184831	54.7531	-156.5259	2319	34.60	1.85	2.19
02	Big Bend Canyon	EX2304_D02_04B	Cladorhiza bathycrinoides	95% EtOH	Rare Fauna	20230716	192519	54.7538	-156.5269	2307.6	34.59	1.86	2.13
02	Big Bend Canyon	EX2304_D02_06B	Porifera	95% EtOH	Characteristic of Site	20230716	210408	54.7544	-156.5283	2243.1	34.60	1.82	2.21
02	Big Bend Canyon	EX2304_D02_08B	Cladorhiza corona	95% EtOH	Rare Fauna	20230716	211654	54.7544	-156.5284	2237.2	34.60	1.83	2.20
02	Big Bend Canyon	EX2304_D02_08B_A01B	fish eggs	95% EtOH		20230716	211654	54.7544	-156.5284	2237.2	34.60	1.83	2.20
02	Big Bend Canyon	EX2304_D02_09B	Parastenella	95% EtOH	Characteristic of Site	20230716	214255	54.7547	-156.5287	2219.4	34.60	1.82	2.20
02	Big Bend Canyon	EX2304_D02_09B_A01B	Amphipoda	95% EtOH		20230716	214255	54.7547	-156.5287	2219.4	34.60	1.82	2.20
02	Big Bend Canyon	EX2304_D02_12G_A01B	Cladorhiza	95% EtOH		20230716	224632	54.7555	-156.5292	2163.1	34.60	1.79	2.32
02	Big Bend Canyon	EX2304_D02_12G_A02B	Porifera	95% EtOH		20230716	224632	54.7555	-156.5292	2163.1	34.60	1.79	2.32
04	Sanak Seep	EX2304_D04_02B	Sponge Bacteria Unknown	95% EtOH	Characteristic of Site	20230718	194022	53.7479	-162.5898	2013.1	34.57	1.95	1.80
04	Sanak Seep	EX2304_D04_02B_A01B	Pycnogonida	95% EtOH		20230718	194022	53.7479	-162.5898	2013.1	34.57	1.95	1.80
04	Sanak Seep	EX2304_D04_02B_A02B	Gastropoda	95% EtOH		20230718	194022	53.7479	-162.5898	2013.1	34.57	1.95	1.80

Dive #	Site Name	Sample #*	Field Sample ID	Preservative	Collection Rationale	Date (yyyymmdd)	UTC Time (hhmmss)	Latitude (dd)	Longitude (dd)	Depth (m)	Salinity (ppt)	Temp (C)	Dissolved Oxygen (mg/l)
04	Sanak Seep	EX2304_D04_02B_A03B	Polychaeta	95% EtOH		20230718	194022	53.7479	-162.5898	2013.1	34.57	1.95	1.80
04	Sanak Seep	EX2304_D04_02B_A04B	Amphipoda	95% EtOH		20230718	194022	53.7479	-162.5898	2013.1	34.57	1.95	1.80
04	Sanak Seep	EX2304_D04_03B	Vesicomyidae	95% EtOH	Characteristic of Site	20230718	194550	53.7484	-162.5883	2011.1	34.58	1.93	1.79
04	Sanak Seep	EX2304_D04_03B_A01B	Siboglinidae	95% EtOH		20230718	194550	53.7484	-162.5883	2011.1	34.58	1.93	1.79
04	Sanak Seep	EX2304_D04_03B_A02B	Patellogastropoda	95% EtOH		20230718	194550	53.7484	-162.5883	2011.1	34.58	1.93	1.79
04	Sanak Seep	EX2304_D04_03B_A03B	Patellogastropoda	95% EtOH		20230718	194550	53.7484	-162.5883	2011.1	34.58	1.93	1.79
04	Sanak Seep	EX2304_D04_03B_A04B	Gastropoda	95% EtOH		20230718	194550	53.7484	-162.5883	2011.1	34.58	1.93	1.79
04	Sanak Seep	EX2304_D04_06B	Siboglinidae	95% EtOH	Characteristic of Site	20230718	231212	53.7479	-162.5871	2015.8	34.58	1.91	1.86
04	Sanak Seep	EX2304_D04_06B_A01B	Tritonia	95% EtOH		20230718	231212	53.7479	-162.5871	2015.8	34.58	1.91	1.86
04	Sanak Seep	EX2304_D04_06B_A02B	Patellogastropoda	95% EtOH		20230718	231212	53.7479	-162.5871	2015.8	34.58	1.91	1.86
05	Lone Knoll Scarp	EX2304_D05_03B	Virgularia	95% EtOH	Rare Fauna	20230719	194416	53.5047	-164.1704	2803.8	34.64	1.60	3.28
07	Uliaga Mound Take 2	EX2304_D07_03B	Paragorgia	95% EtOH	New or Unusual Morphotype	20230723	175540	53.2935	-169.7760	779.4	34.12	3.49	0.92
07	Uliaga Mound Take 2	EX2304_D07_03B_A01B	Polychaeta	95% EtOH		20230723	175540	53.2935	-169.7760	779.4	34.12	3.49	0.92
07	Uliaga Mound Take 2	EX2304_D07_04B	Primnoa	95% EtOH	Connectivity Study	20230723	182210	53.2934	-169.7763	774.9	34.12	3.51	0.91
07	Uliaga Mound Take 2	EX2304_D07_05B	Alaskagorgia	95% EtOH	Lab Assessment Required for ID	20230723	193143	53.2932	-169.7767	747.4	34.19	3.34	0.82

Dive #	Site Name	Sample #*	Field Sample ID	Preservative	Collection Rationale	Date (yyyymmdd)	UTC Time (hhmmss)	Latitude (dd)	Longitude (dd)	Depth (m)	Salinity (ppt)	Temp (C)	Dissolved Oxygen (mg/l)
07	Uliaga Mound Take 2	EX2304_D07_05B_A01B	Gorgonocephalus	95% EtOH		20230723	193143	53.2932	-169.7767	747.4	34.19	3.34	0.82
07	Uliaga Mound Take 2	EX2304_D07_05B_A02B	Ophiuroidea	95% EtOH		20230723	193143	53.2932	-169.7767	747.4	34.19	3.34	0.82
07	Uliaga Mound Take 2	EX2304_D07_07B	Heteropolylpus	95% EtOH	Range Extension	20230723	211027	53.2928	-169.7782	666.5	34.15	3.42	0.78
07	Uliaga Mound Take 2	EX2304_D07_08G_A01B	Primnoidae	95% EtOH		20230723	212332	53.2927	-169.7783	661.8	34.15	3.44	0.80
07	Uliaga Mound Take 2	EX2304_D07_08G_A02B	Hydrozoa	95% EtOH		20230723	212332	53.2927	-169.7783	661.8	34.15	3.44	0.80
07	Uliaga Mound Take 2	EX2304_D07_08G_A03B	Porifera	95% EtOH		20230723	212332	53.2927	-169.7783	661.8	34.15	3.44	0.80
07	Uliaga Mound Take 2	EX2304_D07_08G_A04B	Porifera	95% EtOH		20230723	212332	53.2927	-169.7783	661.8	34.15	3.44	0.80
07	Uliaga Mound Take 2	EX2304_D07_08G_A05B	Porifera	95% EtOH		20230723	212332	53.2927	-169.7783	661.8	34.15	3.44	0.80
07	Uliaga Mound Take 2	EX2304_D07_08G_A06B	Caryophyllia	95% EtOH		20230723	212332	53.2927	-169.7783	661.8	34.15	3.44	0.80
07	Uliaga Mound Take 2	EX2304_D07_08G_A07B	Bryozoa	95% EtOH		20230723	212332	53.2927	-169.7783	661.8	34.15	3.44	0.80
07	Uliaga Mound Take 2	EX2304_D07_08G_A08B	Stylaster	95% EtOH		20230723	212332	53.2927	-169.7783	661.8	34.15	3.44	0.80
07	Uliaga Mound Take 2	EX2304_D07_09B	Muriceides	95% EtOH	Potential Undescribed Species	20230723	214549	53.2927	-169.7785	654.4	34.11	3.52	0.90
07	Uliaga Mound Take 2	EX2304_D07_11B	Isidella tentaculum	95% EtOH	Rare Fauna	20230723	233242	53.2918	-169.7798	571.8	34.09	3.56	1.02
08	Umnak Canyon	EX2304_D08_03B	Chondrocladia Sponge	95% EtOH	Characteristic of Site	20230724	182321	53.5004	-168.8183	1472.6	34.49	2.25	1.11
08	Umnak Canyon	EX2304_D08_03B_A02B	Ophiacantha	95% EtOH		20230724	182321	53.5004	-168.8183	1472.6	34.49	2.25	1.11

Dive #	Site Name	Sample #*	Field Sample ID	Preservative	Collection Rationale	Date (yyyymmdd)	UTC Time (hhmmss)	Latitude (dd)	Longitude (dd)	Depth (m)	Salinity (ppt)	Temp (C)	Dissolved Oxygen (mg/l)
08	Umnak Canyon	EX2304_D08_03B_A03B	scale worm	95% EtOH		20230724	182321	53.5004	-168.8183	1472.6	34.49	2.25	1.11
08	Umnak Canyon	EX2304_D08_04B	Nearchaster	95% EtOH	New or Unusual Morphotype	20230724	183841	53.5005	-168.8182	1472.6	34.49	2.24	1.13
08	Umnak Canyon	EX2304_D08_05B	Hydroida	95% EtOH	Characteristic of Site	20230724	201013	53.4999	-168.8164	1445.8	34.47	2.30	1.07
08	Umnak Canyon	EX2304_D08_05B_A01B	Amphipoda	95% EtOH		20230724	201013	53.4999	-168.8164	1445.8	34.47	2.30	1.07
08	Umnak Canyon	EX2304_D08_05B_A02B	Florometra	95% EtOH		20230724	201013	53.4999	-168.8164	1445.8	34.47	2.30	1.07
08	Umnak Canyon	EX2304_D08_05B_A03B	Ophiacantha	95% EtOH		20230724	201013	53.4999	-168.8164	1445.8	34.47	2.30	1.07

* Biological sample numbers with "_A##" indicate associate samples.

Table C3. Inventory of water samples collected for eDNA analysis during EX2304.

Dive #	Site Name	Sample #	Field Identification	Final Preservative	Date (yyyymmdd)	UTC Time (hhmmss)	Latitude (dd)	Longitude (dd)	Depth (m)	Salinity (ppt)	Temp (°C)	Dissolved Oxygen (mg/l)
01	Mississippi Mud	EX2201_D01_01W	Longmire's	eDNA	20220224	20:43:41	29.21242	-87.87331	489.5	34.95	7.94	3.71
01	Aleutians Water Column	EX2304_D01_01W	2160m	DNA/RNA Shield	20230715	180907	55.6004	-154.0725	2159.3	34.599	1.84	2.15
01	Aleutians Water Column	EX2304_D01_03W	900m transect	DNA/RNA Shield	20230715	193011	55.6003	-154.0743	898.8	34.31	3.28	0.43
01	Aleutians Water Column	EX2304_D01_05W		DNA/RNA Shield	20230715	201613	55.6006	-154.0730	701.4	34.23	3.67	0.50
01	Aleutians Water Column	EX2304_D01_06W	500m depth	DNA/RNA Shield	20230715	210208	55.5998	-154.0760	502.1	34.11	4.01	0.69
01	Aleutians Water Column	EX2304_D01_09W	300m	DNA/RNA Shield	20230715	214439	55.5988	-154.0799	301.5	33.92	4.42	1.40

Dive #	Site Name	Sample #	Field Identification	Final Preservative	Date (yyyymmdd)	UTC Time (hhmmss)	Latitude (dd)	Longitude (dd)	Depth (m)	Salinity (ppt)	Temp (°C)	Dissolved Oxygen (mg/l)
01	Aleutians Water Column	EX2304_D01_BLW	Blank Water Specimen	DNA/RNA Shield								
02	Big Bend Canyon	EX2304_D02_01W	Deep Scattering Layer	DNA/RNA Shield	20230716	164337	54.7525	-156.5206	300.9	33.97	4.06	0.64
02	Big Bend Canyon	EX2304_D02_02W	On bottom eDNA	DNA/RNA Shield	20230716	180416	54.7528	-156.5251	2320.9	34.60	1.85	2.17
02	Big Bend Canyon	EX2304_D02_07W	Mid dive 2240m	DNA/RNA Shield	20230716	210503	54.7543	-156.5282	2241.5	34.60	1.82	2.21
02	Big Bend Canyon	EX2304_D02_11W	2185M	DNA/RNA Shield	20230716	222107	54.7553	-156.5285	2185.5	34.60	1.82	2.18
02	Big Bend Canyon	EX2304_D02_13W	End of dive	DNA/RNA Shield	20230716	230942	54.7558	-156.5293	2140.1	34.61	1.78	2.31
02	Big Bend Canyon	EX2304_D02_BLW	Blank Water Specimen	DNA/RNA Shield								
04	Sanak Seep	EX2304_D04_01W	Deep Scattering Layer 240m	DNA/RNA Shield	20230718	174650	53.7508	-162.5889	241.6	33.90	4.49	1.58
04	Sanak Seep	EX2304_D04_05W	Over the tube worms	DNA/RNA Shield	20230718	220231	53.7482	-162.5886	2009.7	34.58	1.89	2.00
04	Sanak Seep	EX2304_D04_07W	BBL eDNA sample above seep	DNA/RNA Shield	20230718	232748	53.7479	-162.5869	1965.5	34.57	1.95	1.83
04	Sanak Seep	EX2304_D04_08W	900m transect	DNA/RNA Shield	20230719	003915	53.7476	-162.5843	903.1	34.31	3.21	0.48
04	Sanak Seep	EX2304_D04_09W	700m depth transect	DNA/RNA Shield	20230719	010634	53.7477	-162.5840	700.7	34.22	3.62	0.46
04	Sanak Seep	EX2304_D04_BLW	Blank Water Specimen	DNA/RNA Shield								
05	Lone Knoll Scarp	EX2304_D05_01W	Deep Scattering Layer	DNA/RNA Shield	20230719	175510	53.5049	-164.1680	251.3	33.91	4.10	0.91
05	Lone Knoll Scarp	EX2304_D05_02W	On bottom	DNA/RNA Shield	20230719	192833	53.5047	-164.1704	2802.1	34.67	1.60	3.27

Dive #	Site Name	Sample #	Field Identification	Final Preservative	Date (yyyymmdd)	UTC Time (hhmmss)	Latitude (dd)	Longitude (dd)	Depth (m)	Salinity (ppt)	Temp (°C)	Dissolved Oxygen (mg/l)
05	Lone Knoll Scarp	EX2304_D05_04W	Sediment Plane	DNA/RNA Shield	20230719	214904	53.5086	-164.1734	2766.2	34.64	1.62	3.12
05	Lone Knoll Scarp	EX2304_D05_05W		DNA/RNA Shield	20230719	221934	53.5072	-164.1699	2743.5	34.64	1.61	3.12
05	Lone Knoll Scarp	EX2304_D05_BLW	Blank Water Specimen	DNA/RNA Shield								
06	Uliaga Mound	EX2304_D06_01W	Deep Scattering Layer	DNA/RNA Shield	20230721	191140	53.2931	-169.7754	281.6	33.72	4.00	3.16
06	Uliaga Mound	EX2304_D06_BLW	Blank Water Specimen	DNA/RNA Shield								
07	Uliaga Mound Take 2	EX2304_D07_01W	Deep Scattering Layer	DNA/RNA Shield	20230723	170339	53.2943	-169.7715	180.9	33.41	4.11	6.67
07	Uliaga Mound Take 2	EX2304_D07_02W	Lower Deep Scattering 50m off bottom	DNA/RNA Shield	20230723	172935	53.2934	-169.7749	754.1	34.11	3.53	0.92
07	Uliaga Mound Take 2	EX2304_D07_06W		DNA/RNA Shield	20230723	210038	53.2928	-169.7782	668.1	34.14	3.45	0.85
07	Uliaga Mound Take 2	EX2304_D07_10W	600m depth	DNA/RNA Shield	20230723	230704	53.29198	-169.7796	595.3	34.08	3.55	1.05
07	Uliaga Mound Take 2	EX2304_D07_12W	End of Dive	DNA/RNA Shield	20230724	000803	53.2914	-169.7804	531.1	34.07	3.57	1.05
07	Uliaga Mound Take 2	EX2304_D07_BLW	Blank Water Specimen	DNA/RNA Shield								
08	Umnak Canyon	EX2304_D08_01W	Deep Scattering Layer	DNA/RNA Shield	20230724	164738	53.5010	-168.8139	200.1	33.54	4.24	4.65
08	Umnak Canyon	EX2304_D08_02W	50m off bottom	DNA/RNA Shield	20230724	173503	53.5006	-168.8184	1425.3	34.47	2.33	1.04
08	Umnak Canyon	EX2304_D08_06W	Coming off bottom	DNA/RNA Shield	20230724	205716	53.4995	-168.8150	1428.7	34.47	2.33	1.04

Dive #	Site Name	Sample #	Field Identification	Final Preservative	Date (yyyymmdd)	UTC Time (hhmmss)	Latitude (dd)	Longitude (dd)	Depth (m)	Salinity (ppt)	Temp (°C)	Dissolved Oxygen (mg/l)
08	Umnak Canyon	EX2304_D08_BLW	Blank Water Specimen	DNA/RNA Shield								