



# Ocean Exploration and Research

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## Cruise Report: EX-19-02, ROV and Mapping Shakedown (ROV & Mapping)

**Gulf of Mexico**

**Pascagoula, MS to Key West, FL  
(May 12 – May 24, 2019)**

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**September 25, 2019**

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## Abstract

This shakedown mission, which began in Pascagoula, Mississippi on May 12, 2019 and concluded on May 24, 2019 in Key West, Florida, came after the winter scheduled drydock and dockside shipyard repair period. While underway, 24-hour operations focused on preparing deep-sea mapping and water column sonars and remotely operated vehicle (ROV) systems for the remainder of 2019 expeditions.

Three “engineering dives” were conducted during the first part of the expedition. The dives allowed members of the Global Foundation for Ocean Exploration to calibrate the ROV’s ultra short baseline (USBL) positioning system, test a new suction sampling device, test on-ship data transfer and telepresence systems, and train new team members. As the dives focused on testing new equipment, no physical samples were collected for later analyses. During the third ROV dive on May 16, while conducting an "engineering dive" to test new remotely operated vehicle (ROV) equipment, the team made an unexpected – and exciting – discovery: the wreck of what is likely a mid-19th century wooden sailing vessel.

Mapping shakedown operations during the expedition included calibrating the ship's EM302 multibeam sonar (used to map the seafloor and water column) and the EK60 split-beam sonar (used to explore the water column), integrating and calibrating a new Simrad EK80 split-beam sonar (for further water column exploration), and installing and testing a new sonar synchronization unit (K-Sync – to reduce potential interference between different sonars). Thorough documentation of the mapping work accomplished during this cruise is contained in a separate report (Mapping Data Acquisition and Processing Report Cruise EX-19-02: ROV and Mapping Shakedown) that can be accessed in the NOAA Library with doi#: 10.25923/3d1e-h304.

All of these operations were completed in order to ensure the collection of high-quality data throughout the remainder of the year.

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## 1. Introduction

The NOAA Office of Ocean Exploration and Research (OER) is the only U.S. federal program dedicated to exploring our deep ocean, closing the prominent gap in our basic understanding of U.S. deep waters and seafloor and delivering the ocean information needed to strengthen the economy, health, and security of our nation. Using the latest tools and technology, OER explores previously unknown areas of our deep ocean, making discoveries of scientific, economic, and cultural value. Through live video streams, online coverage, training opportunities, and real-time events, OER allows scientists, resource managers, students, members of the general public, and others to actively experience ocean exploration—expanding available expertise, cultivating the next generation of ocean explorers, and engaging the public in exploration activities. From this exploration, OER makes the collected data needed to understand our ocean publicly available, so we can maintain the health of our ocean, sustainably manage our marine resources, accelerate our national economy, and build a better appreciation of the value and importance of the ocean in our everyday lives.

NOAA Ship *Okeanos Explorer* is the only U.S. federal vessel dedicated to exploring our largely unknown ocean for the purpose of discovery and the advancement of knowledge. America’s future depends on understanding the ocean. Exploration supports NOAA mission priorities and national objectives by providing a broad diversity of data and information about the deep ocean to anyone who needs it.

In close collaboration with government agencies, academic institutions, and other partners, OER conducts deep-sea exploration expeditions using advanced technologies on NOAA Ship *Okeanos Explorer*. From mapping and characterizing previously unseen seafloor to collecting and disseminating information about deep waters and seafloor—and the resources they hold—this work establishes a foundation of information and fills data gaps. Data collected on the ship adhere to federal open-access data standards and are publicly available shortly after an expedition ends. This ensures the delivery of reliable scientific data needed to identify, understand, and manage key elements of the ocean environment. As the only federal program dedicated to ocean exploration, OER is uniquely situated to lead partners in delivering critical deep-ocean information to managers, decision makers, scientists, and the public, leveraging federal investments to meet national priorities.

## 2. Expedition Overview

EX-19-02 focused on conducting a shakedown of the remotely operated vehicle (ROV) and mapping systems onboard the NOAA Ship *Okeanos Explorer* in preparation of the 2019 field season.

EX-19-02 was also one of several NOAA Ship *Okeanos Explorer* expeditions from 2018 to 2021 contributing to NOAA's Atlantic Seafloor Partnership for Integrated Research and Exploration (ASPIRE), a major multi-year, multi-national, collaborative ocean exploration program focused on raising our collective knowledge and understanding of the North Atlantic Ocean. Building on previous work in the North Atlantic, including the 2011-2014 Atlantic Canyons Undersea Mapping Expeditions (ACUMEN), NOAA's ASPIRE campaign will provide data to inform research planning and management decisions in the region, by broadening both the geographic focus to include more of the U.S. Atlantic and Canada, and the scope of partnerships to include U.S. federal agencies, such as U.S. Geological Survey (USGS) and Bureau of Ocean Energy Management (BOEM), as well as international partners from Canada and Europe.

The ship transited from Pascagoula, MS on May 12th and ended in Key West, FL on May 24th. Three ROV engineering test dives were completed, with the final dive fortuitously discovering a shipwreck site.

### Rationale for Exploration

This was a dedicated shakedown cruise, with the primary purpose to fully prepare the scientific systems on the ship for the upcoming field season of exploration. This cruise also served to move the *Okeanos Explorer* from a shipyard location in Pascagoula, MS to Key West, FL in order to be in position for planned exploration work off the southeast U.S. coast.

### 3. Objectives

The mapping-related objectives of the EX-19-02 shakedown were to ensure that all mapping systems and equipment were fully operational, including conducting a GPS Azimuth Measurement Subsystem (GAMS) calibration of the APPLANIX POSMV, performing a patch test for the EM 302 multibeam, and calibrating the EK 60/80 split-beam sonars. In addition to routine shakedown operations, EX-19-02 also focused on integrating two new EK 80 wide band transceivers (WBTs) and a new sonar synchronization device (K-Sync), as well as collecting backscatter calibration data for an updated backscatter (BS) correction file from Kongsberg. Acoustic data (multibeam, split-beam, and sub-bottom) were collected outside of calibration operations, including focused mapping conducted in the U.S. EEZ in the Florida Straits between the Florida Keys and Cuba.

Key ROV shakedown objectives included:

1. Conduct full system checks for both vehicles - including all lights, cameras, thrusters, science equipment, navigation equipment, hydraulics, etc.
2. Complete integration of new joyboxes in control room and test all commands and functions on both *Deep Discoverer* and *Seirios*.

3. Test new suction sampler capabilities and simulate typical science collections with sampler.
4. Conduct typical vehicle and ship movements to simulate normal dive operations.
5. Calibrate and test the ultra short baseline (USBL) positioning system.

Additional objectives for this cruise are further detailed in the EX-19-02 Project Instructions, which are archived in the NOAA Central Library.

#### 4. List of Participants

The list of participating personnel for EX1902 is shown in Table 1.

##### Mission Personnel

Table 1: Full list of seagoing mission party members and their affiliations.

#	Name (First, Last)	Title	Affiliation
1	Derek Sowers	Co-Expedition Coordinator	Cherokee Nation Strategic Programs, NOAA Ocean Exploration and Research
2	Shannon Hoy	Co-Expedition Coordinator	Cherokee Nation Strategic Programs, NOAA Ocean Exploration and Research
3	Kevin Jerram	Mapping Watch Lead	University Corporation for Atmospheric Research
4	Neah Baechler	Mapping Watch Lead	University Corporation for Atmospheric Research
5	Christopher Dunn	LTJG	NOAA's Office of Exploration and Research
6	Adrienne Copeland	EK Sonar Lead	University of Hawaii at NOAA's Office of Exploration and Research
7	Rachel Medley	Chief, Expeditions and Exploration Division	NOAA's Office of Exploration and Research
8	Treyson Gillespie	Explorer-in-Training	University Corporation for Atmospheric Research
9	Bobby Mohr	GFOE OPS	Global Foundation for Ocean Exploration
10	Fernando Aragon	Data/Software	Global Foundation for Ocean Exploration
11	Joshua Carlson	GFOE OPS	Global Foundation for Ocean Exploration
12	Mark Durbin	Data/VSAT	Global Foundation for Ocean Exploration
13	Jim Meyers	Data/Software	Global Foundation for Ocean Exploration
14	Levi Unema	Electrical	Global Foundation for Ocean Exploration
15	Sean Kennison	Mechanical / OPS Training	Global Foundation for Ocean Exploration

16	Karl McLetchie	Mechanical	Global Foundation for Ocean Exploration
17	Chris Ritter	Mechanical	Global Foundation for Ocean Exploration
18	Lars Murphy	Mechanical	Global Foundation for Ocean Exploration
19	Annie White	Video	Global Foundation for Ocean Exploration
20	Caitlin Bailey	Video	Global Foundation for Ocean Exploration
21	Roland Brian	Video/VSAT	Global Foundation for Ocean Exploration
22	Brian Doros	Video	Global Foundation for Ocean Exploration
23	Tony (Lee) Arnold	Mechanical	Global Foundation for Ocean Exploration
24	Tony Dalheim	Technician	Kongsberg Underwater Technology, Inc.
25	Jason Baluyot	Technician	Teledyne

## 5. Methodology

In order to accomplish its objectives, the expedition made use of NOAA Ship *Okeanos Explorer's*:

1. dual-bodied ROV system (ROVs *Deep Discoverer* and *Seirios*) to conduct daytime seafloor surveys,
2. mapping systems (Kongsberg EM 302 multibeam sonar, Knudsen 3260 sub-bottom profiler, Kongsberg EK60 single beam sonars, and Teledyne Acoustic Doppler Current Profilers) to conduct mapping operations,
3. high-bandwidth satellite connection for real-time ship-to-shore communications.

### 5.1 ROV Operations

ROV dive operations were conducted to support the expedition shakedown objectives of system calibration, testing, and personnel training. Summaries of the three ROV dives completed on the cruise are provided below.

DIVE ID: EX1902\_ENGINEERING\_DIVE01

Dive Name: Engineering Dive 1

LOCATION: Gulf of Mexico

OBJECTIVES: Test winter upgrades and maintenance to D2 and Seirios. Test new suction sampler. Test new Pilot/Copilot joyboxes. Train on new systems and continue to train new pilots/copilots.

SUMMARY: Successful first return dive after winter maintenance and upgrades. Tested new suction sampler. Tested and trained with the new pilot control joyboxes. Flat, muddy bottom chosen to provide safe environment for testing.

DIVE ID: EX1902\_ENGINEERING\_DIVE02

Dive Name: Engineering Dive 2

LOCATION: Gulf of Mexico

OBJECTIVES: Deep dive to test all systems at higher ocean pressure and verify proper operation. Test winter upgrades and maintenance to D2 and Seirios. Test new suction sampler. Test new Pilot/Copilot joyboxes. Train on new systems and continue to train new pilots/copilots.

SUMMARY: Continued testing of D2 and Seirios systems, including suction sampler and topside joyboxes. Dive depth of ~3000m allowed the ROV team to ensure all systems still operated correctly even at greater ocean pressure and lower temperatures, both of which change the physical and mechanical properties of the vehicles.

DIVE ID: EX1902\_ENGINEERING\_DIVE03

Dive Name: Engineering Dive 3

LOCATION: Gulf of Mexico

OBJECTIVES: Continued testing of winter upgrades and maintenance to D2 and Seirios. Test new suction sampler. Test new Pilot/Copilot joyboxes. Train on new systems and continue to train new pilots/copilots. Practice “standard operational mode” to mimic typical dive operations (waypoints, sampling, high-quality imaging.)

SUMMARY: Final dive for testing. Continued testing all systems and conducted “dress rehearsal” of standard expedition operations such as ship moves and waypoints, camera zooms and imaging, sampling practice, adjusting lighting, etc. Discovered unknown copper-clad shipwreck in final hour of dive and switched to Underwater Cultural Heritage (UCH) operational mode with live stream of the video to onshore archeology team, conference call, and focus on imaging. The planned dive was extended an additional three hours to enable characterization of the shipwreck, including completing imagery transects needed to build a photomosaic of the wreck. Observations were recorded using Ocean Networks Canada SeaScribe/SeaTube annotation system.

## 5.2 Specimen Collections

Specimen collection practice work was conducted with the new suction sampler device on the ROV *Deep Discoverer*. No specimens were collected for preservation and archiving on the cruise since it was a shakedown cruise and no sample data manager was onboard.



## 5.3 Seafloor Mapping

Mapping operations included Kongsberg EM 302 multibeam, Kongsberg EK60 singlebeam, Knudsen sub-bottom profile, and Acoustic Doppler Current Profiler (ADCP) data collection. Apart from calibration work, multibeam lines were planned to maximize either edge matching of existing data or data gap filling in areas where existing bathymetry coverage existed. In regions with no existing data, exploration transit lines were planned to optimize potential discoveries. Targeted mapping operations were conducted in the Straits of Florida to add new high resolution bathymetric coverage in this region. Thorough documentation of the mapping work accomplished during this cruise is contained in a separate report (Mapping Data Acquisition and Processing Report Cruise EX-19-02: ROV and Mapping Shakedown) that can be accessed in the NOAA Library with the following doi: 10.25923/3d1e-h304.

### *5.3.1 Multibeam Sonar (Kongsberg EM 302)*

Multibeam seafloor mapping data were collected using the Kongsberg EM 302 sonar, which operates at a frequency of 30 kHz. Multibeam mapping operations were conducted during all overnight transits between ROV dive sites, and mostly continuously for the remainder of the cruise after ROV work was completed. Multibeam mapping operations collected data on seafloor depth (i.e., bathymetry), seafloor acoustic reflectivity (i.e., seafloor backscatter), and water column reflectivity (i.e., water column backscatter).

### *5.3.2 Sub-Bottom Profiler (Knudsen Chirp 3260)*

The primary purpose of the Knudsen Chirp 3260 (3.5 kHz) sonar is to image sediment layers underneath the seafloor to a maximum depth of about 80 meters below the seafloor. The sub-bottom profiler was operated simultaneously with the multibeam sonar during mapping operations (except during multibeam calibration work) in order to provide supplemental information about the sedimentary features underlying the seafloor.

### *5.3.3 Split-beam Sonars (Kongsberg EK60/EK80)*

NOAA Ship *Okeanos Explorer* is equipped with four Kongsberg EK60 split-beam sonar transducers operated at frequencies of 18, 70, 120 and 200 kHz. These sonars were used frequently during the cruise to test a new sonar syncing device and evaluate interference among sonars.

### *5.3.4 Acoustic Doppler Current Profiler (Teledyne Workhorse Mariner ADCP)*

NOAA Ship *Okeanos Explorer* is equipped with two ADCPs: a Teledyne Workhorse Mariner (300 kHz) and a Teledyne Ocean Surveyor (38 kHz). The ADCPs provided information on the speed and direction of

currents underneath the ship. They were used throughout ROV dives to support safe deployment and recovery of the vehicles, and were also run during sonar interference testing.

#### 5.4 Sun Photometer Measurements

OER gathers limited at-sea measurements aboard NOAA Ship *Okeanos Explorer* in order to support a NASA-led, long-term research effort that assesses marine aerosols. Onboard personnel collected georeferenced sun photometer measurements on sunny days during the expedition in order to collect data to support the Maritime Aerosol Network (MAN) component of the Aerosol Robotic Network (AERONET). AERONET is a network of sun photometers which measure atmospheric aerosol properties around the world. MAN compliments AERONET by conducting sun photometer measurements on ships of opportunity in order to monitor aerosol properties over the global ocean. Sun photometer measurements were conducted as time allowed on cloud-free days.

#### 6. Clearances and Permits

Pursuant to the National Environmental Policy Act (NEPA), NOAA OER is required to include in its planning and decision-making processes appropriate and careful consideration of the potential environmental consequences of actions it proposes to fund, authorize and/or conduct. NOAA's Administrative Order (NAO) 216-6A Companion Manual describes the agency's specific procedures for NEPA compliance. Among these is the need to review all proposed NOAA-supported field projects for their environmental effects. An Environmental Review Memorandum has been completed for this survey, in accordance with Section 4 of the Companion Manual (Appendix B). Based on this review, a categorical exclusion was determined to be the appropriate level of NEPA analysis for this expedition, as no extraordinary circumstances existed that required the preparation of an environmental assessment or environmental impact statement.

Informal consultation was initiated under Section 7 of the Endangered Species Act (ESA), requesting NOAA Fisheries' Protected Resources Division concurrence with our biological evaluation determining that *Okeanos Explorer* operations conducted as part of ASPIRE, may affect, but are not likely to adversely affect, ESA-listed marine species. The informal consultation was completed on August 8, 2018 when NOAA OER received a signed letter from the Regional Administrator of South East Regional Office, stating that NMFS concurs with OER's determination that conducting proposed ASPIRE cruises are not likely to adversely affect ESA-listed marine species (Appendix B). OER has completed consultation with NOAA's Habitat Conservation Division on potential ASPIRE impacts of our operations to Essential Fish Habitat (EFH). They concurred that our operations would not adversely affect EFH provided adherence to our proposed procedures and their guidance stated in the letter (Appendix B).

Additionally, OER received a Letter of Acknowledgement (LOA) from NMFS for operations in the Southeast Deepwater MPAs and areas deemed as a Habitat Areas of Particular Concern (HAPCs).

## 7. Expedition Schedule

Table 2 shows the schedule of operations for the cruise.

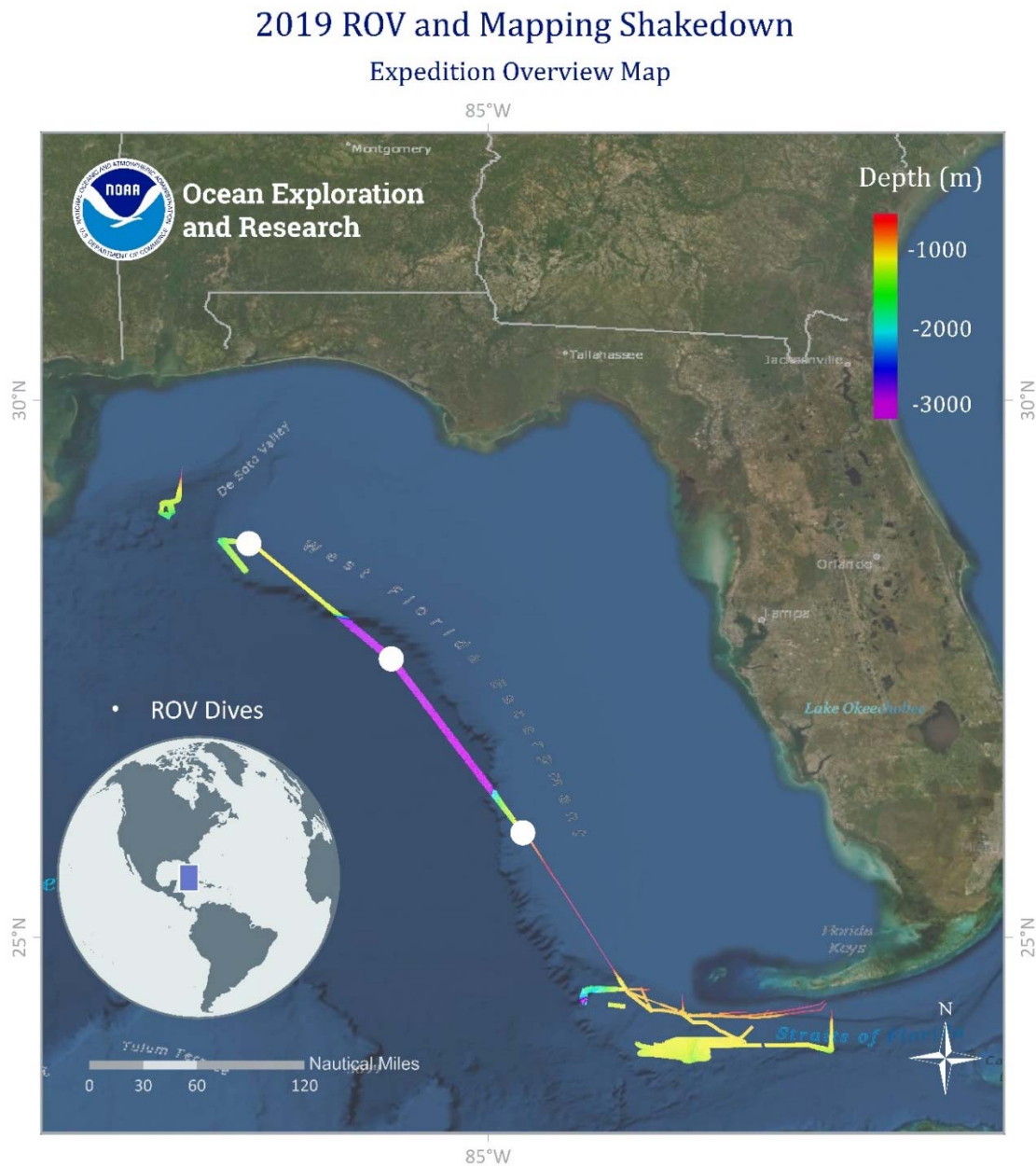
Table 2. Schedule of operations on EX-19-02

*(All times listed are local ship time, which was -5 hours from UTC)*

Sun	Mon	Tues	Wed	Thur	Fri	Sat
5	6 Mission personnel (including Roger Davis) arrive (Pascagoula, MS) for Alongside portion of EX-19-02	7 Alongside portion of shakedown	8 Alongside portion of shakedown	9 Alongside portion of shakedown	10 Remaining mission personnel arrive. Alongside portion of shakedown.	11 Last day of alongside mobilization.
12 Depart Pascagoula, MS and commence EX-19-02. Transit to MB patch test.	13 Complete MB patch test and collected data for the deep modes for backscatter calibration.	14 ROV engineering Dive 1 (~1300 m). Overnight transit to dive location 2.	15 ROV engineering Dive 2 (~3000 m). Overnight transit to dive location 3.	16 ROV engineering Dive 3 (~600 m). Overnight transit to shallow backscatter calibration site.	17 Complete backscatter calibration. Overnight transit to small boat location.	18 Small boat transfer. Most of Global Foundation for Ocean Exploration (GFOE) team departs. Mapping personnel arrive. Transit to EK calibration/K-Sync testing location.
19 Attempted EK calibration during the day with no successes due to excessive macroalgae. K-Sync operational and overnight testing occurred.	20 Attempted EK calibration during the day at a new site with no successes due to excessive currents. Again overnight K-Sync testing occurred.	21 10 successful EK calibrations completed despite strong currents. Again overnight K-Sync testing occurred and transit to small boat transfer location.	22 Small boat transfer, Kongsberg tech departing and Teledyne tech arriving. Testing of Underway CTD (UCTD) unsuccessful. Opportunistic multibeam surveying overnight.	23 Opportunistic multibeam surveying and finalizing all shakedown troubleshooting objectives.	24 Arrive Key West, Florida.	25

## 8. Expedition Map

EX1902 transited from Pascagoula, MS on May 12, 2019 and ended in Key West, FL on May 24, 2019. The cruise summary map is shown in Figure 1.



Overview map showing bathymetry mapping coverage completed during the 2019 ROV and Mapping Shakedown cruise. White circles represent ROV dive locations. Map created by NOAA Office of Ocean Exploration and Research (NOAA-OER).

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community  
Sources: Esri, GEBCO, NOAA, National Geographic, DeLorme, HERE, Geonames.org, and other contributors

**Figure 1.** Map showing the locations of the 3 ROV dives and bathymetry data collected during EX1902.

## 9. Results

Depth ranges explored during ROV surveys were between 1019 m and 3233 m. During the 3 dives, the ROV spent a total of 18 hours on the bottom. Table 3 summarizes key information about each of the engineering dives.

Table 3. Summary information for the 3 ROV dives conducted during EX1902.

Dive #	Date	Site name	On Bottom Location	Off Bottom Location	Max Depth	Bottom Time	Water Column Transect Time	Dive Duration
1	5/14/19	Dive 1 - Initial	28° 40.06' N 87° 13.414' W	28° 40.069' N 87°, 13.434' W	1019.0 m	3:42:40	0	5:07:30
2	5/15/19	Dive 2 - Deep	27° 35.788' N 85° 53.961' W	27° 35.836' N 85° 54.037' W	3233.0 m	4:25:28	0	8:15:04
3	5/16/19	Dive 3 - Shipwreck	25° 58.891' N 84° 40.568' W	25° 58.938' N 84° 40.361' W	547.0 m	10:05:31	0	10:54:10

Engineering dive #3 unexpectedly discovered a shipwreck. This wreck location was not previously documented by any source, and discovery of a wreck via an ROV-based sonar is extremely rare. The wreck was discovered near the planned ending time of the dive. OER, the ROV Team, and the Commanding Officer agreed to extend the dive another three hours in order to enable exploration and documentation of the wreck site. High-definition video was recorded by the ROVs as the team systematically explored the wreck site. The video imagery was carefully collected to enable the creation of a complete photomosaic of the wreck site by a specialist onshore at the Bureau of Ocean Energy Management.

Utilizing the telepresence capabilities of the ship, a team of onshore archeologists was quickly able to view the live video stream of the wreck and join a conference call to discuss the site and help guide the ROV pilots for an optimal site investigation. Those who joined the live stream suspect that the wreck is that of a sailing vessel built sometime in the mid-19th century, perhaps a schooner or brig, measuring roughly 37.8 meters (124 feet) long. The vessel is wooden with apparent copper sheathing covering the bottom of its hull. Experts were able to infer the time period of the vessel's origination based on a number of construction features, including the form of the stem and bow, the body of the hull, and the remains of the windlass. However, this information does not indicate the age of the vessel at the time it was lost, which could have been decades later. Initial observations also noted apparent copper and iron artifacts at the site, but no diagnostic artifacts reflecting the vessel's rig, trade, nationality, or crew were identified during the dive. Figures 2, 3, and 4 provide digital photo images of the wreck as viewed from the *Deep Discoverer* ROV.





Figure 2. A low-resolution photomosaic of the wreck site, produced by Bureau of Ocean Energy Management Marine Archaeologist Scott Sorset using video imagery collected during the dive. A higher-resolution version will be developed eventually, providing another tool for studying this shipwreck. *Image courtesy of the Bureau of Ocean Energy Management.*

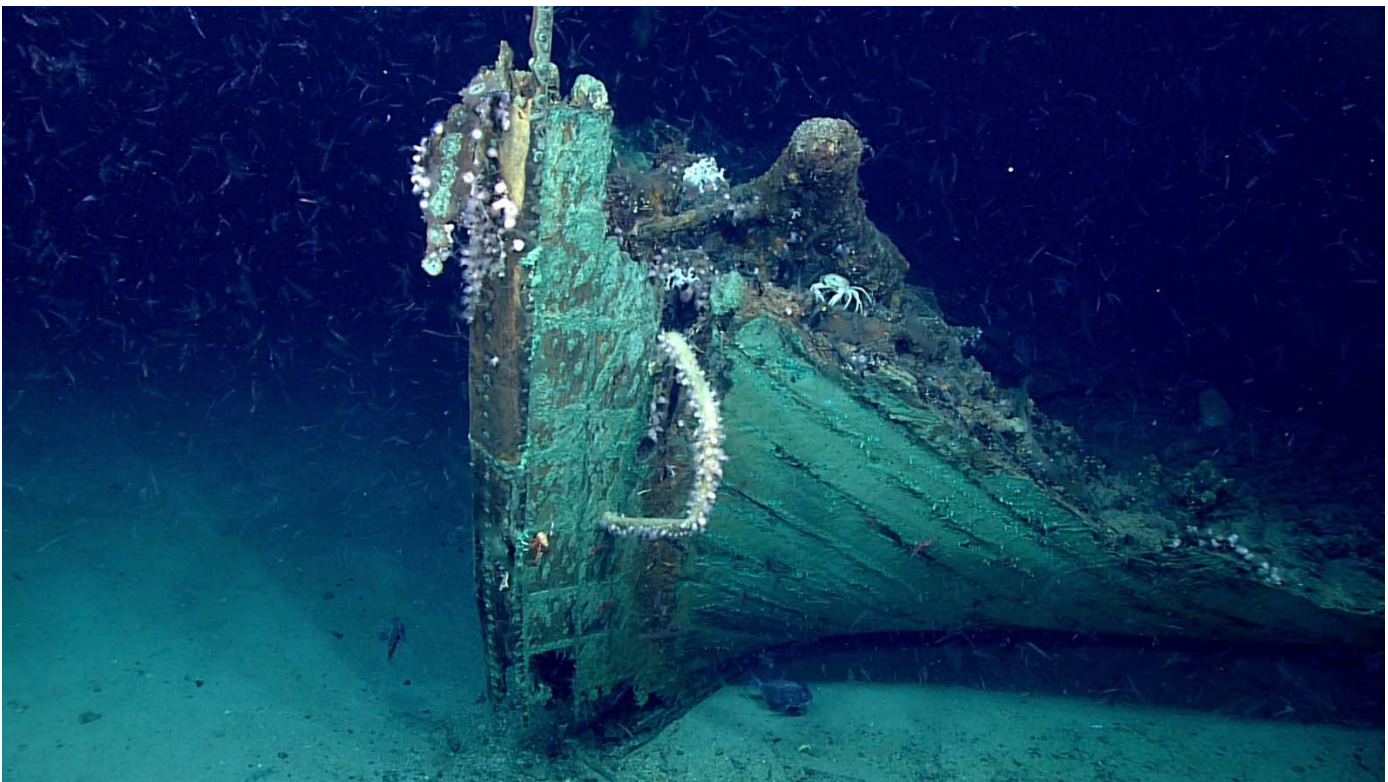


Figure 3. A close-up view of the bow. Marine life is prevalent on the wreck, except on the copper sheathing which still retains its antifouling ability to keep the hull free of marine organism like *Teredo*

*navalis* (shipworm) that would otherwise burrow into the wood and consume the hull or barnacles that would reduce the vessel's speed. *Image courtesy of the NOAA Office of Ocean Exploration and Research.*

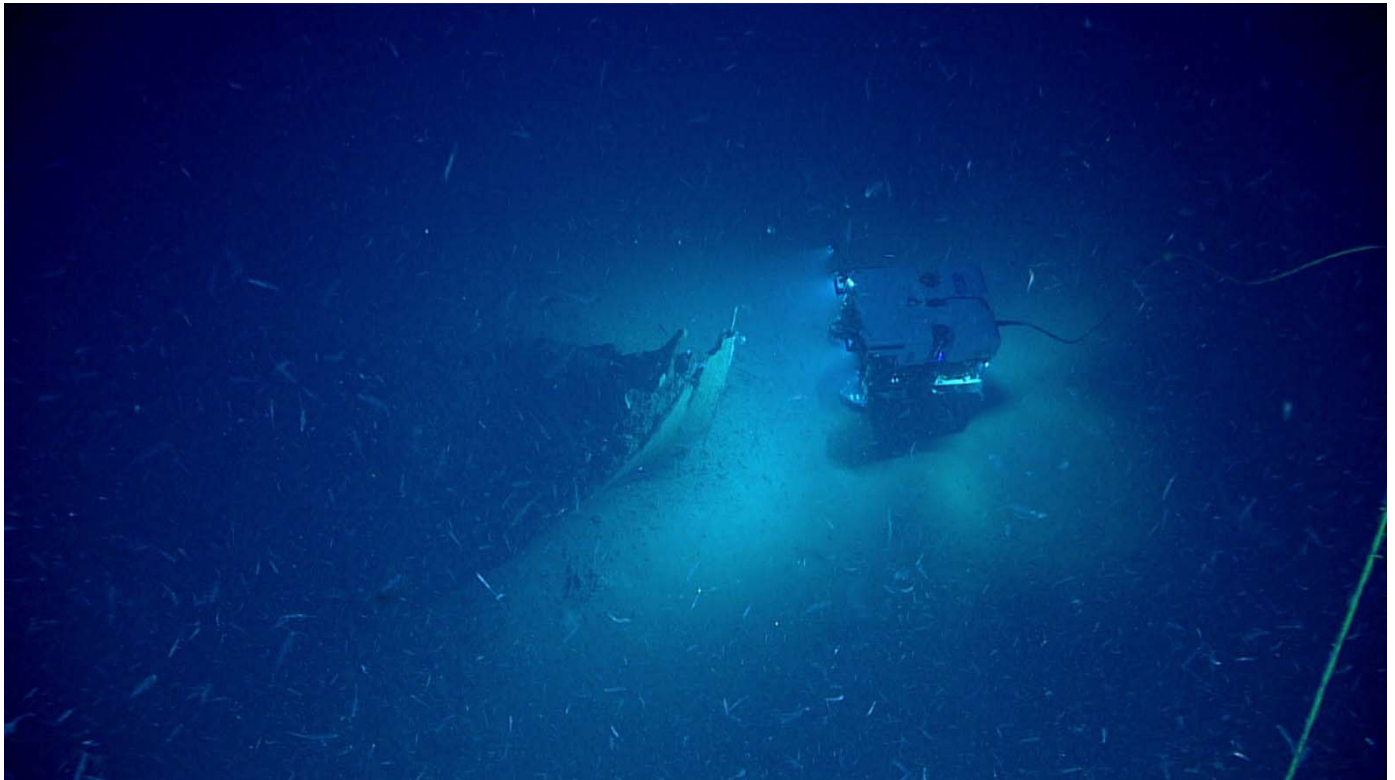


Figure 4. ROV *Deep Discoverer* approaching the bow of the shipwreck. *Image courtesy of the NOAA Office of Ocean Exploration and Research.*

### 9.1 Accessing ROV Data

Data from this expedition is available through OER's Digital Atlas:

[https://www.ncddc.noaa.gov/website/google\\_maps/OE/mapsOE.htm](https://www.ncddc.noaa.gov/website/google_maps/OE/mapsOE.htm). To specifically access data from this expedition, use the "Enter Search Text" feature on the "Search" tab and type in "EX1902" in the text box available. Click on the dot that represents the expedition (the map will center around this dot), which will provide options for data access. ROV dive data organized by dive can be found here:

<https://service.ncddc.noaa.gov/rdn/oer-rov-cruises/ex1902>

### 9.2 Seafloor Mapping

Summary mapping statistics for the cruise are provided in Table 4.

Table 4. Mapping Statistics for EX-19-02.

<b>Dates</b>	<b>May 12 – 24, 2019</b>
<b>Departure Port</b>	<b>Pascagoula, MS</b>
<b>Arrival Port</b>	<b>Key West, FL</b>
<b>Days at Sea</b>	<b>13</b>
<b>EM 302 Linear Kilometers Mapped</b>	<b>2373</b>
<b>EM 302 Square Kilometers Mapped</b>	<b>8123</b>
<b>EM 302 Number/Data Volume of raw (.all) bathymetric and bottom backscatter files</b>	<b>217 files/ 18.2 GB</b>
<b>EM 302 Number/Data volume of raw (.wcd) water column files</b>	<b>217 files / 53.3 GB</b>
<b>EK60 Number/Data volume singlebeam files</b>	<b>646 / 150 GB</b>
<b>Knudsen Sub-bottom Number/Data volume files</b>	<b>160 / 1.07 GB</b>
<b>Number of XBT Casts</b>	<b>39</b>
<b>Number of CTD Casts</b>	<b>5</b>

Mapping operations included EM 302 multibeam, EK 60/80 split-beam, and Knudsen 3260 sub-bottom profile data collection.

Survey lines were planned to maximize either bathymetry edge matching of existing data or data gap filling in areas where existing bathymetry coverage existed. In regions with no existing data, lines were planned to optimize potential exploration discoveries.

Throughout the cruise multibeam data quality was monitored in real time by acquisition watchstanders. Ship speed was adjusted to maintain data quality as necessary and line spacing was planned to ensure at least ¼ swath width overlap between lines. Cutoff angles in the multibeam acquisition software Seafloor Acquisition System (SIS) were generally left wide open for maximum exploration data collection and routinely adjusted on both the port and starboard side to ensure the best data quality and coverage. Data were corrected for sound velocity in real time using the Reson SVP-70 data at the sonar head, and profiles from Expendable Bathythermographs (XBTs) that were conducted at intervals no greater than 6 hours, or as dictated by local oceanographic conditions.

Simrad EK 60/80 split-beam water column sonar data were collected during most of the cruise, except when calibration lines were being conducted for the multibeam sonar. Figure 3 shows the EK 60/80 kHz data collected during EX-19-02.

Thorough documentation of the mapping work accomplished during this cruise is contained in a separate report (Mapping Data Acquisition and Processing Report Cruise EX-19-02: ROV and Mapping Shakedown) that can be accessed in the NOAA Library with doi#: 10.25923/3d1e-h304.



### 9.2.1 Mapping Data Access

#### ***Multibeam Sonar (Kongsberg EM 302)***

The multibeam dataset for the expedition is archived at NOAA's NCEI, and accessible from the following online map viewer service: <https://maps.ngdc.noaa.gov/viewers/bathymetry/>. To access data from this expedition use the "Search Bathymetric Surveys" function, selecting "NOAA Ship OKEANOS EXPLORER" as the Platform Name, "NOAA Office of Ocean Exploration and Research" as the Source Institution, and type "EX1902" in as the Survey ID. Click "OK" and the ship track for the expedition will appear on the map. If you click on the ship track, options to download data will appear.

#### ***Sub-Bottom Profiler (Knudsen Chirp 3260)***

The sub-bottom profiler was not run during any ROV dive operations, but generally was operated during multibeam mapping operations. Geophysical data for the area covered by the expedition can be located at NOAA's NCEI's online Geophysical Data Viewer: <https://maps.ngdc.noaa.gov/viewers/geophysics/>. To access data from this expedition use the "Search Marine Surveys" function, and enter "EX1902" in as the Survey ID. Click "OK" and the ship track for the expedition will appear on the map. Click on the ship track for options to download data.

#### ***Split-beam Sonars (Kongsberg EK60)***

EK60 water column data for the expedition can be accessed from the following online data portal: [https://www.ngdc.noaa.gov/maps/water\\_column\\_sonar/index.html](https://www.ngdc.noaa.gov/maps/water_column_sonar/index.html). To access data from this expedition, use the "Additional Filters" tool, and select "EX1902" under Survey ID. Click "OK" and the ship track for the expedition will appear on the map. Click on the ship track for options to download data.

#### ***Acoustic Doppler Current Profiler (Teledyne Marine Workhorse Mariner ADCP)***

ADCP data for the expedition were collected at each ROV dive location, and can be accessed from this data portal: [https://www.nodc.noaa.gov/gocd/sadcpl\\_oer\\_inv.html](https://www.nodc.noaa.gov/gocd/sadcpl_oer_inv.html). Data can be found by searching for the cruise identification number "EX1902".

#### **Sun Photometers Measurements**

Sun photometer measurements were taken on the expedition as time and a clear sky allowed. More information about AERONET can be found here:

[https://aeronet.gsfc.nasa.gov/new\\_web/maritime\\_aerosol\\_network.html](https://aeronet.gsfc.nasa.gov/new_web/maritime_aerosol_network.html).

## 10. References

The 2019 NOAA Ship *Okeanos Explorer* Survey Readiness Report can be obtained in the NOAA Central Library or by contacting the NOAA OER mapping team at [oar.oer.exmappingteam@noaa.gov](mailto:oar.oer.exmappingteam@noaa.gov).

The EX-19-02 Project Instructions can be obtained from the NOAA Central Library. The EX-19-02 Data Management Plan is an appendix of the project instructions.

EX-19-02 EK 60 / 80 Calibration Report can be obtained in the NOAA Central Library or by contacting the NOAA OER mapping team at [oar.oer.exmappingteam@noaa.gov](mailto:oar.oer.exmappingteam@noaa.gov)

## 11. Appendices

## 11.1 Appendix A: EX1902 Data Management Plan

### Data Management Plan

#### Okeanos Explorer (EX1902): 2019 Field Season Shakedown

##### *OER Data Management Objectives*

*Data targeted for the NOAA archives will be documented and stewarded according to the normal standard operating procedures in place for Okeanos Explorer missions.*

### **1. General Description of Data to be Managed**

#### **1.1 Name and Purpose of the Data Collection Project**

Okeanos Explorer (EX1902): 2019 Field Season Shakedown

#### **1.2 Summary description of the data to be collected.**

Data from three ROV engineering dives, EM302 multibeam sonar data including backscatter, EK60 and EK80 sonar data

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

expedition, exploration, explorer, marine education, noaa, ocean, ocean discovery, ocean education, ocean exploration, ocean exploration and research, ocean literacy, ocean research, OER, science, scientific mission, scientific research, sea, stewardship, systematic exploration, technology, transformational research, undersea, underwater, Davisville, mapping survey, multibeam, multibeam backscatter, multibeam sonar, multi-beam sonar, noaa fleet, okeanos, okeanos explorer, R337, Rhode Island, scientific computing system, SCS, single beam sonar, singlebeam sonar, single-beam sonar, sub-bottom profile, water column backscatter, shakedown, UCTD, EK80, suction sampler, Key West, Pascagoula, oceans

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

Okeanos Mapping Cruises

**1.5 Planned or actual temporal coverage of the data.**

Dates: 3/12

/19 to

3/24/2019

**1.6 Planned or actual geographic coverage of the data.**

Latitude Boundaries: 24.55 to 30.34

Longitude -88.57 to -81.81

Boundaries:

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

Cruise Summary, Data Management Plan, Bottom Backscatter, Dive Summaries, EK60 Singlebeam Data, EK80 Echosounder, Multibeam (image), Multibeam (processed), Multibeam (product), Multibeam (raw), Raw Video (digital), Sample Logs, SCS Output (compressed), SCS Output (native), Water Column Backscatter

**1.8 What platforms will be employed during this mission?**

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

**2. Point of Contact for this Data Producing Project**

Overall POC: Shannon Hoy (shannon.hoy@noaa.gov)

**3. Point of Contact for Managing the Data**

Data POC Name: Megan Cromwell

Title: Okeanos Explorer Data Manager

E-Mail: megan.cromwell@noaa.gov

**4. Resources**

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

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

**5. Data Lineage and Quality**

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

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

**5.2 What quality control procedures will be employed?**

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

## **6. Data Documentation**

profiles are generated for display on the Okeanos Explorer Atlas

### **6.1 Does the metadata comply with the Data Documentation Directive?**

True

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

not applicable

#### **6.2 Where will the metadata be hosted?**

An ISO format collection-level metadata record will be generated during pre-cruise planning and published in an OER catalog and Web Accessible Folder (WAF) hosted at NCEI-MS for public discovery and access. The record will be harvested by data.gov.

URL: <https://www.ncddc.noaa.gov/oer-waf/ISO/Resolved/2019>

Meta Std: ISO 19115-2 Geographic Information with Extensions for Imagery and Gridded Data will be the metadata standard employed.

**6.3 Process for producing and maintaining metadata:**

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

**7. Data Access**

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

True

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

Not Applicable

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

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

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

NOAA National Centers for Environmental Information <https://www.ncei.noaa.gov>

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

Hold: none  
Time: not applicable  
Authority:

**7.4 Prepare a Data Access Statement**

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

## **8. Data Preservation and Protection**

### **8.1 Actual or planned long-term data archive location:**

Data from this mission will be preserved and stewarded through the NOAA National Centers for Environmental Information. Refer to the Okeanos Explorer Data Management Plan at NOAA's EDMC DMP Repository

for detailed descriptions of the processes, procedures, and partners involved in this collaborative effort.

### **8.2 If no archive planned, why?**

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

60-90 days

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

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

### **8.5 Prepare a Data Use Statement**

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



## 11.2 Appendix B: Environmental Compliance

Form Version: September 2017

### Categorical Exclusion (CE) Evaluation Worksheet

**Project Identifier:** EX1902

**Date Review Completed:** 3/14/2019

**Completed by:** Shannon Hoy (Physical Scientist)

**OAR Functional Area:** OER

**Worksheet File Name:** 2019-03-OER-CE-EX1902

#### 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 to perform multiple calibration procedures of NOAA Ship Okeanos Explorer's systems to prepare for the upcoming field season. These actions include confirming operational status and calibrating the ship's sonars, sound velocity profiling equipment, and the remotely operated vehicles: Seirios and Deep Discover. The EX1902 expedition will conduct operations in the U.S. exclusive economic zone (EEZ) in the Gulf of Mexico, beginning in Pascagoula, Mississippi and ending in Key West, Florida. The expedition is currently scheduled to depart from Pascagoula, Mississippi (30° 20.36'N, 88° 34.50'W) on May 12, 2019, and end in Key West, Florida (24° 33.304'N, 81° 46.799'W) on May 24, 2019. See EX1902 project instructions for more details.

- 3. Which class of CE in Appendix E of the NAO 216-6A Companion Manual is applicable to this action and why?**

- a.** G3: Topographic, bathymetric, land use and land cover, geological, hydrologic mapping, charting, and surveying services that do not involve major surface or subsurface land

disturbance and involve no permanent physical, chemical, or biological change to the environment.

- b. The topical scope of this action is consistent with CE number G3 in Appendix E of the Companion Manual to NOAA Administrative Order (NAO) 216-6A: Topographic, bathymetric, land use and land cover, geological, hydrologic mapping, charting, and surveying services that do not involve major surface or subsurface land disturbance and involve no permanent physical, chemical, or biological change to the environment. The EX1902 expedition will conduct calibrations of sonars which will involve no permanent physical, chemical or biological change to the environment.

## Step 2. Extraordinary Circumstances Consideration

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

No. The NOAA Ship Okeanos Explorer will be operating in remote deep-sea areas of the Gulf of Mexico. Expedition EX1902 will conduct post dry-dock ship shakedown operations. All operation areas are underwater and therefore have no human presence, (see Figure 1 of EX1902 project instructions for generalized operating locations). This action does not involve any procedures or outcomes known to result in impacts on human health and safety more than would be negligible.

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

This expedition will not occur in areas of the Gulf of Mexico with unique environmental characteristics such as sanctuary boundaries or within historically or culturally significant areas. Furthermore, any effects caused by sonar calibration and ROV testing during this expedition will negligible on the seabed and water column.

### 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?

OER has taken measures to ensure that any effects on species or habitats protected by the ESA, MMPA, MSA or NMSA meet the definition of negligible. In 2018, an informal consultation was initiated under section 7 of the Endangered Species Act (ESA), requesting NOAA Fisheries' Protected Resources Division concurrence with our biological evaluation determining that NOAA Ship Okeanos Explorer operations conducted during the 2018-2019 field seasons, including those to be undertaken during the EX1902 expedition, are not likely to adversely affect ESA-listed marine species. The informal consultation was completed on August 8, 2018 when OER received a signed Letter of Concurrence from the Chief ESA Interagency Cooperation

Division in the NOAA Office of Protected Species, stating that NMFS concurs with OER's determination that operations conducted during NOAA Ship Okeanos Explorer 2018-2019 field seasons are not likely to adversely affect ESA-listed marine species. The ESA section 7 letter of concurrence is provided as an appendix D in the EX1902 project instructions.

Given the offshore focus of most of our proposed work, it is improbable that we will encounter marine mammals protected under the MMPA or sea birds protected under the MBTA. If we did encounter any such protected animals, our impacts would be negligible because of the best management practices to which we adhere to avoid or minimize environmental impacts. These best management practices are outlined in the appendices of the EX1902 project instructions.

OER also initiated a request for an abbreviated essential fish habitat (EFH) consultation for expeditions by NOAA Ship Okeanos Explorer in 2018-2020 to the Greater Atlantic Region, including the operating area of EX1902. On July 19, 2018 OER received a letter from the Assistant Regional Administrator for the NOAA Office of Habitat Conservation stating that these expeditions will not adversely impact EFH. This letter is provided in appendix E of the EX1902 project instructions.

**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?**

No. The cruise operations will be in 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, and 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 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 protections 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)?**

No, the NOAA Ship Okeanos Explorer will be operating in remote and offshore areas of the Gulf of Mexico during EX1902 (see Figure 1 in EX1902 project instructions for map of planned locations). There are no communities within or near the geographic scope of the cruise and the cruise does not involve actions known or likely to result in adverse impacts on human health.

**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?**

No. During EX1902, NOAA Ship Okeanos Explorer will not make landfall in areas other than commercial ports in Pascagoula, Mississippi and Key West, Florida. The ship and OER mission team will comply with all applicable local and federal regulations regarding the prevention or spread of invasive species. At the completion of every ROV dive or CTD cast, the 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?**

The proposed action will not result in a potential violation of Federal, State, or local law or requirements imposed for protection of the environment. The expedition coordinator obtained authorizations for this expedition via several consultations on ESA Section-7 and EFH outlined in sections 4-7 above.

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

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

**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?**

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

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

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

**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?**

By definition, actions that a federal agency classifies as a categorical exclusion have no potential, individually or cumulatively, to significantly affect the environment. This cruise is consistent with a class of CE established by NOAA and there are no extraordinary circumstances for this action that may otherwise result in potentially significant impacts.

**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.

**Signature:** CANTELAS.FRANK.J.1  
365855087

Digitally signed by  
CANTELAS.FRANK.J.1365855087  
Date: 2019.03.25 12:23:12 -04'00'

**Signed by:** Frank Cantelas, Deputy Director (Acting)

**Date Signed:** March 25/2019

# ESA Section 7 Concurrence Letter



UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL MARINE FISHERIES SERVICE  
Silver Spring, MD 20910

AUG 08 2018

Refer to NMFS No: FPR-2018-9276

Commander William Mowitt  
Deputy Director  
Office of Ocean Exploration and Research  
1315 East West Highway  
Silver Spring, Maryland 20910

RE: Concurrence Letter for the National Oceanic and Atmospheric Administration's Office of Ocean Exploration and Research's Marine Operation Activities on the National Oceanic and Atmospheric Administration Ship *Okeanos Explorer* for the 2018 through 2019 Field Seasons

Dear Mr. Mowitt:

On July 6, 2018, the National Marine Fisheries Service (NMFS) received your request for a written concurrence that the National Oceanic and Atmospheric Administration (NOAA) Office of Ocean Exploration and Research's marine operations activities on the NOAA Ship *Okeanos Explorer* for the 2018 through 2019 field seasons under the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 et seq.) is not likely to adversely affect species listed as threatened or endangered or critical habitats designated under the ESA. This response to your request was prepared by NMFS pursuant to section 7(a)(2) of the ESA, implementing regulations at (50 C.F.R. §402), and agency guidance for preparation of letters of concurrence.

We reviewed the consultation request document and related materials submitted by your office. We requested that your office update the acoustic thresholds submitted in the biological evaluation to match NMFS's 2018 acoustic technical guidance (NMFS 2018a). This assisted NMFS's ESA Interagency Cooperation Division to determine the total amount of disturbance from acoustic sources during the 2018 through 2019 field season on the NOAA Ship *Okeanos Explorer* is not likely to adversely affect ESA listed species within the action area. In addition, our assessment considered prior analyses and determinations on recent ESA informal consultations which had the same activities in similar geographic locations and the implementation of all mitigation measures included in your biological evaluation (NMFS 2017; 2018b). Based on our knowledge, expertise, and the materials submitted in your request for informal consultation, we concur with the Office of Ocean Exploration and Research's conclusions that the proposed action is not likely to adversely affect ESA-listed species and/or designated critical habitat.

This concludes consultation under the ESA for species and/or designated critical habitat under NMFS's purview on the NOAA Office of Ocean Exploration and Research's marine operation activities on the NOAA Ship *Okeanos Explorer* for the 2018 through 2019 field seasons.





Reinitiation of consultation is required and shall be requested by the NOAA Office of Ocean Exploration and Research or by NMFS where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (a) take occurs; (b) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered in this consultation; (c) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not previously considered in this consultation; or (d) if a new species is listed or critical habitat designated that may be affected by the action (50 C.F.R. §402.16).

We look forward to further cooperation with you on other projects to ensure the conservation of our threatened and endangered marine species and designated critical habitat. If you have any questions on this consultation, please contact me at (301) 427-8495 or by email at [cathy.tortorici@noaa.gov](mailto:cathy.tortorici@noaa.gov) or Jonathan Molineaux at (301) 427-8440 or by email at [jonathan.molineaux@noaa.gov](mailto:jonathan.molineaux@noaa.gov).

Sincerely,



Cathryn E. Tortorici  
Chief, ESA Interagency Cooperation Division  
Office of Protected Resources

### Literature Cited

- NMFS. (2017). *Concurrence letter for activities to be conducted for National Centers for Coastal Ocean Science-led activities as part of the Southeast Deep Coral Initiative in 2017 through 2019*. Silver Spring, Maryland: National Marine Fisheries Service, Office of Protected Resources.
- NMFS. (2018a). *2018 Revision to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0)*. NOAA Technical Memorandum. U.S. Department of Commerce.
- NMFS. (2018b). *ESA Section 7 Consultation regarding to the proposed issuance of an Incidental Harassment Authorization to Garden State Offshore Energy for upcoming surveys*. Gloucester, Massachusetts: National Marine Fisheries Service, Greater Atlantic Regional Fisheries Office.


# EFH Concurrence Letter



UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration  
NATIONAL MARINE FISHERIES SERVICE  
GREATER ATLANTIC REGIONAL FISHERIES OFFICE  
55 Great Republic Drive  
Gloucester, MA 01930-2276

**JUL 19 2018**

MEMORANDUM FOR: Daniel Wagner, Ph.D.  
Expedition Coordinator, Cherokee Nation Strategic Programs  
NOAA Office for Ocean Exploration and Research

FROM: Louis A. Chiarella   
Assistant Regional Administrator, Habitat Conservation Division

SUBJECT: Essential Fish Habitat (EFH) Consultation for Deep-Sea  
Exploration Activities occurring within the Greater Atlantic  
Region aboard NOAA Ship *Okeanos Explorer* in 2018-2020

This responds to your request for an abbreviated EFH consultation for the field activities to be conducted aboard the NOAA Ship *Okeanos Explorer* in the Greater Atlantic Region between July 2018 and December 2020. During this time, up to 33 different research expeditions will be undertaken to collect critical baseline information in unknown or poorly known areas of the region at depths of 250 m or deeper through telepresence-based exploration. Specific activities to be undertaken include the use of deep-water mapping systems such as multi-beam, single beam, sub-bottom profiler and acoustic Doppler current profiler (ACDP) sonar systems, and the use of remotely operated vehicles (ROV), the ship's conductivity-temperature-depth (CTD) rosette, underway CTD, and high-bandwidth satellite connection for real-time ship to shore communications. New technologies and novel applications may be tested during the research expeditions. These technology demonstration projects are still under development at this time and will be evaluated individually for environmental impact. Your consultation request supplements a previously completed EFH consultation between NOAA's National Centers of Coastal Ocean Science (NCCOS) and NOAA Fisheries Southeast Regional Office (SERO) for research activities to be conducted in U.S. federal waters of the Gulf of Mexico, South Atlantic Bight and Caribbean in 2017-2019 using NOAA ships *Okeanos Explorer* and *Nancy Foster*.

As specified in the Magnuson Stevens Fishery Conservation and Management Act (MSA), EFH consultation is required for federal actions that may adversely affect EFH. We have reviewed information provided on the proposed activities as well as the protective measures and best management practices incorporated into the action and have determined that adverse impacts have been minimized to the extent practicable. As such, we have no EFH conservation recommendations to provide pursuant to Section 305(b)(2) of the MSA. Further EFH consultation on this action is not necessary unless future modifications are proposed that would change the basis of our determination.

cc: GAR/HCD- K. Greene  
SERO/HCD-V. Fay, D. Dale

