

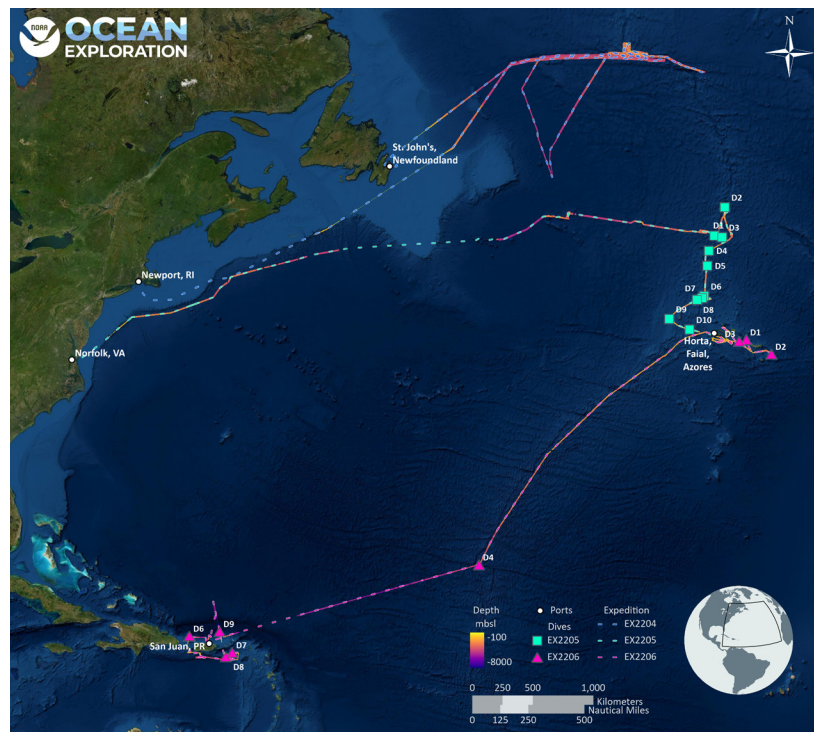
NOAA SHIP *OKEANOS EXPLORER* May 14 - September 2, 2022

Voyage to the Ridge 2022 was a series of expeditions on NOAA Ship *Okeanos Explorer* led by NOAA Ocean Exploration to explore areas of the North Atlantic Ocean. The expeditions mark the office's final contributions to the [Atlantic Seafloor Partnership for Integrated Research and Exploration \(ASPIRE\)](#) campaign. ASPIRE is a major multiyear, multinational collaborative field program focused on raising collective knowledge and understanding of the region.

EXPEDITION SUMMARY

[Voyage to the Ridge 2022](#) was a series of three telepresence-enabled ocean exploration expeditions on NOAA Ship *Okeanos Explorer* that totaled 74 days at sea. Mapping operations and remotely operated vehicle (ROV) dives focused on the collection of baseline information about unexplored and poorly understood deepwater areas of the Charlie-Gibbs Fracture Zone, Mid-Atlantic Ridge, and Azores Plateau. A series of dives in deepwater areas in the vicinity of Puerto Rico and the U.S. Virgin Islands also built off previous work done by NOAA Ocean Exploration in the region in [2015](#), [2018](#), and [March](#) and [April 2022](#).

Data collected during Voyage to the Ridge 2022 will help close gaps in our understanding of the North Atlantic's geological context and past and future geohazards, the diversity and distribution of coral and sponge communities, and how populations of deep-sea species are related across these regions and throughout the deepwater Atlantic basin. Mapping data collected during these expeditions filled major data gaps in the region and will contribute to Seabed 2030 goals for mapping unexplored regions of Earth's ocean basins. Major Voyage to the Ridge 2022 accomplishments are summarized below.



Summary map showing bathymetry collected and number dive sites for all three Voyage to the Ridge 2022 expeditions. Courtesy NOAA Ocean Exploration, Voyage to the Ridge 2022.

ACHIEVING ASPIRE GOALS

Each ASPIRE expedition has its own objectives that support the goals of the larger campaign. Some of these goals are highlighted here with relevant accomplishments from Voyage to the Ridge 2022.

Goal: Improve knowledge of unexplored areas within the U.S. Exclusive Economic Zone (EEZ) and other deep-sea areas to inform management needs for sensitive habitats, geological features, and potential resources and to increase understanding of deep-sea ecosystem connectivity across the Atlantic basin.

- Conducted 19 ROV dives ranging in depth from 347 to 6,012 meters (1,138 to 19,724 feet). Data collected during these dives can be used to increase understanding of deep-sea ecosystem connectivity across the Atlantic basin.
- Collected 66 primary biological samples and 141 associates, 23 geological samples, and 86 water samples.
 - Biological samples were generally collected because they represent new records, potential new species, or dominant fauna.
 - Geological samples will be used to better understand the geological history of this region as well as to characterize habitat substrate.
 - Water samples were collected for environmental DNA (eDNA) processing using ROV *Deep Discoverer*. eDNA is the genetic material shed by organisms in the water column. Scientists can process eDNA to make new discoveries about marine life.
- Collected new mapping data within the Charlie-Gibbs Marine Protected Area and [Charlie-Gibbs Fracture Zone Hope Spot](#).
- Collected some of the first known *in situ* imagery of various fishes along the Mid-Atlantic Ridge and Azores Plateau, including during a dive to explore an [unnamed seamount within the OSPAR Mid-Atlantic Ridge North of the Azores \(MARNA\)](#) marine protected area.
- Observed, on three separate dives on the Mid-Atlantic Ridge and Azores Plateau, several sublinear [sets of “mysterious” holes](#) in the sediment on the seafloor. While the holes look



This rather large ctenophore in the genus *Aulacocotena* was collected at a depth of 900 meters (2,953 feet) during one of two Voyage to the Ridge 2022 dives to explore the water column. The ctenophore may represent a new species.

almost human made, the little piles of sediment around them suggest they had been excavated from below. Their origin remains unknown.

- Documented several potential range extensions of marine organisms, including the easternmost observation of a rock pen and possibly the first Atlantic record of a coprophagous snail on a crinoid, both seen while exploring a prominent axial valley ridge in international waters north of the Azores.
- Observed an **unidentified blue organism** while exploring southwest of St. Croix. Scientists think it may be a soft coral, sponge, or tunicate, but at the moment, it remains a taxonomic mystery.
- Documented a rarely observed **aggregation of sea urchins** (*Conolampas sigsbei*) that included at least 35 individuals. Each urchin appeared to have a cluster of debris on the apex of its body, leading scientists to liken the debris to “hats.”
- Conducted two dives to explore the water column, one within the OSPAR MARNA marine protected area and the other on the Azores Plateau.



Voyage to the Ridge Expedition 2 geology science lead Ashton Flinders watches from the control room of NOAA Ship *Okeanos Explorer* as a rock sample is collected during a dive.

Goal: Locate and characterize deep-sea coral, sponge, and chemosynthetic communities.

- Discovered an extensive reef of brightly colored yellow coral in the genus *Eguchipsammia* living on top of dead coral rubble while exploring an unnamed seamount on the western flank of the Mid-Atlantic Ridge rift valley, within the OSPAR MARNA marine protected area. Scientists hypothesize that these kinds of reefs may be more common along the Mid-Atlantic Ridge than previously known.
- Explored the Moytirra Vent Field, which is the only deep high-temperature hydrothermal vent known between the Azores and the Reykjanes Ridge, south of Iceland. The dive, scientists



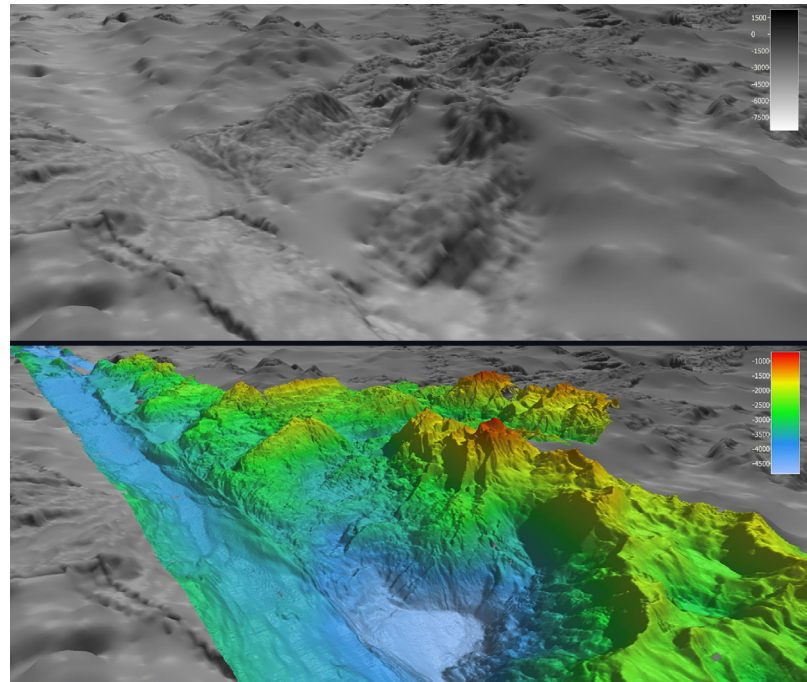
Remotely operated vehicle Deep Discoverer traverses over a field of live, yellow coral in the genus *Eguchipsammia* growing over the top of dead coral rubble seen during much of Dive 01 of the second Voyage to the Ridge 2022 expedition.

explored inactive vent areas and sampled rocks and biology to characterize areas like these that are potential targets of interest for deep-sea mining in the future.

- Documented the presence of corals and/or sponges on 18 dives, with six of these sites exhibiting high diversity.

Goal: Extend bathymetric mapping coverage in the U.S. Exclusive Economic Zone (EEZ) and international waters in support of Seabed 2030.

- Mapped more than 152,430 square kilometers (58,854 square miles) of seafloor, an area larger than the state of Florida.
- Completed the largest continuous mapping survey effort to date over the Charlie-Gibbs Fracture Zone, collecting bathymetric data along this geologically fascinating and ecologically exceptional region.
- Mapped several new mound features in the North Atlantic that were previously unmapped and unknown.



In May, during the first Voyage to the Ridge 2022 expedition, NOAA Ocean Exploration completed the largest continuous mapping survey effort to date over the Charlie-Gibbs Fracture Zone. These images show satellite-derived bathymetry data (top) in comparison to the high-resolution bathymetry data (bottom) collected during Voyage to the Ridge 2022 using the multibeam system on NOAA Ship *Okeanos Explorer*.

Goal: Enhance predictive capabilities for vulnerable marine habitats and submarine geohazards.

- Documented several sonar anomalies and potential plumes over Condor Seamount on the Azores Plateau which may be due to fissures caused by nearby earthquake swarms.
- Discovered and explored landslide deposits and evidence of faulting on the Azores Plateau, observing poorly sorted pyroclastic/volcanoclastic materials as well as polished rocks along fault planes that may be evidence of slickensides.
- Filled in gaps in understanding of the geology of waters around Puerto Rico and St. Croix. Collected metasediments on Mona Block and clayey sediments in the Puerto Rico Trench for further analyses.

Goal: Leverage and improve international collaboration and partnerships in order to map and explore priority areas of the North Atlantic and contribute to the Galway Statement on Atlantic Ocean Cooperation and the Atlantic Ocean Research Alliance’s deep-sea mapping and exploration efforts.

- Served as a major field contribution to the [iAtlantic](#) research program spanning the Atlantic basin. Voyage to the Ridge 2022 expeditions were highlighted as part of an iAtlantic side event at the United Nations Oceans Conference in Lisbon, Portugal.
- Hosted Dr. Joana Xavier, an internationally recognized deep-sea biologist with extensive knowledge of ecosystems in the vicinity of the Azores, onboard *Okeanos Explorer* as a biology science lead during the third expedition.
- 46 scientists from Europe and Canada.
- Worked with partners to establish an Exploration Command Center (ECC) at the University of the Azores to enable real-time participation by scientists and students from the Azores in ROV dives.
- Collected new mapping data within the Charlie-Gibbs Marine Protected Area, Milne Seamount Complex Marine Protected Area, and the Mid-Atlantic Ridge North of the Azores Marine Protected Area. These data will contribute to international efforts to better characterize and conserve these important marine regions.

ENGAGING THE SCIENTIFIC COMMUNITY AND THE PUBLIC

NOAA Ship *Okeanos Explorer* is a leading platform for telepresence-enabled exploration, which allows shore-based scientists and managers to fully engage in an expedition and enables members of the public to experience deep-sea exploration and the wonders of science and discovery in real time. Highlights of this engagement during Voyage to the Ridge 2022 are listed below.

Engaged over 170 scientists, resource managers, and students, with participation from 6 international countries including Canada, Portugal, Japan, Norway, Italy, and the United Kingdom.

Engaged with audiences around the world, opening a window of understanding into the deep ocean through live interactions, live video feeds, expedition web content, and media/web



NOAA Ocean Exploration Operations Chief Kasey Cantwell talks with visitors to NOAA Ship *Okeanos Explorer* during ship tours conducted while the vessel was in port in Horta, Azores.

stories, including:

- More than 184,500 views to live video feeds throughout Voyage to the Ridge 2022.
- Nearly 70,000 views to expedition web content posted during Voyage to the Ridge 2022, with more than 23,200 additional views coming in the month following the third and final expedition.
- More than 500 news outlets/websites shared expedition news, including stories about the “mysterious” holes found near the Mid-Atlantic Ridge during the second expedition and the unknown blue organisms seen off St. Croix during the third expedition. Stories were picked up by outlets such as the New York Times, Miami Herald, Forbes, NPR, and Newsweek, to name a few.
- More than 3,300 views received of a large live interaction streamed to social media.
- Nearly 100 participants reached via four smaller live interactions.

Additionally, 29 local stakeholders were able to tour Okeanos Explorer and learn more about Voyage to the Ridge 2022 and NOAA Ocean Exploration’s mission and objectives while the ship was in port in Horta, Azores. And, keeping with the office’s goal of training the next generation of ocean explorations, three students participated in the first Voyage to the Ridge 2022 expedition as Explorer-in-Training interns.

COLLECTING AND SHARING DATA

Data collected during Voyage to the Ridge 2022 will inform initial characterization of the areas visited and include multibeam, single beam, sub-bottom, ADCP (acoustic Doppler current profiler), XBT (expendable bathythermograph), CTD (conductivity, temperature, and depth), and dissolved oxygen profiles; surface oceanographic and meteorological sensors; video and imagery; and physical specimens. All data from this expedition will be publicly available through national archives. A direct link to the expedition data archive will be provided on the Voyage to the Ridge 2022 website once the data are available.

By leading national efforts to explore our ocean and making ocean exploration more accessible, NOAA Ocean Exploration is filling gaps in the basic understanding of U.S. deep waters and seafloor. This work provides critical deep-ocean data, information, and awareness needed to maintain the health of our ocean, sustainably manage our marine resources, accelerate economies, and build a better appreciation of the value and importance of the ocean in our everyday lives.

