

Windows to the Deep 2018: Exploration of the Southeast U.S. Continental Margin (EX1805 and EX1806)

NOAA Ship *Okeanos Explorer*
May 22 – July 2, 2018



Ocean Exploration
and Research

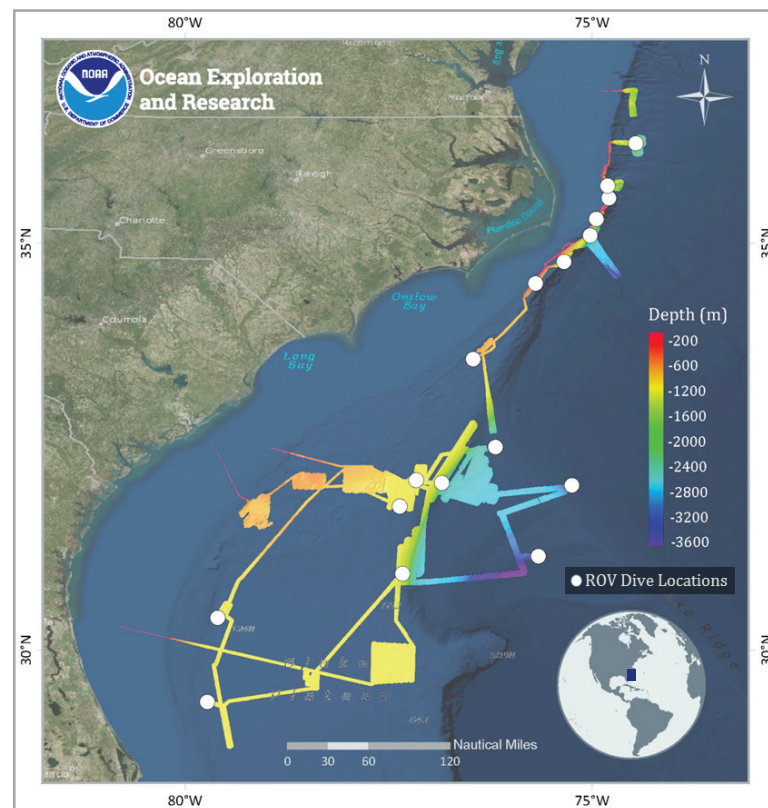


Windows to the Deep 2018: Exploration of the Southeast U.S. Continental Margin was NOAA Ship *Okeanos Explorer*'s first expedition of the [Atlantic Seafloor Partnership for Integrated Research and Exploration \(ASPIRE\)](#) campaign, a major multi-year, multi-national collaborative field program focused on raising collective knowledge and understanding of the North Atlantic Ocean.

Expedition Summary

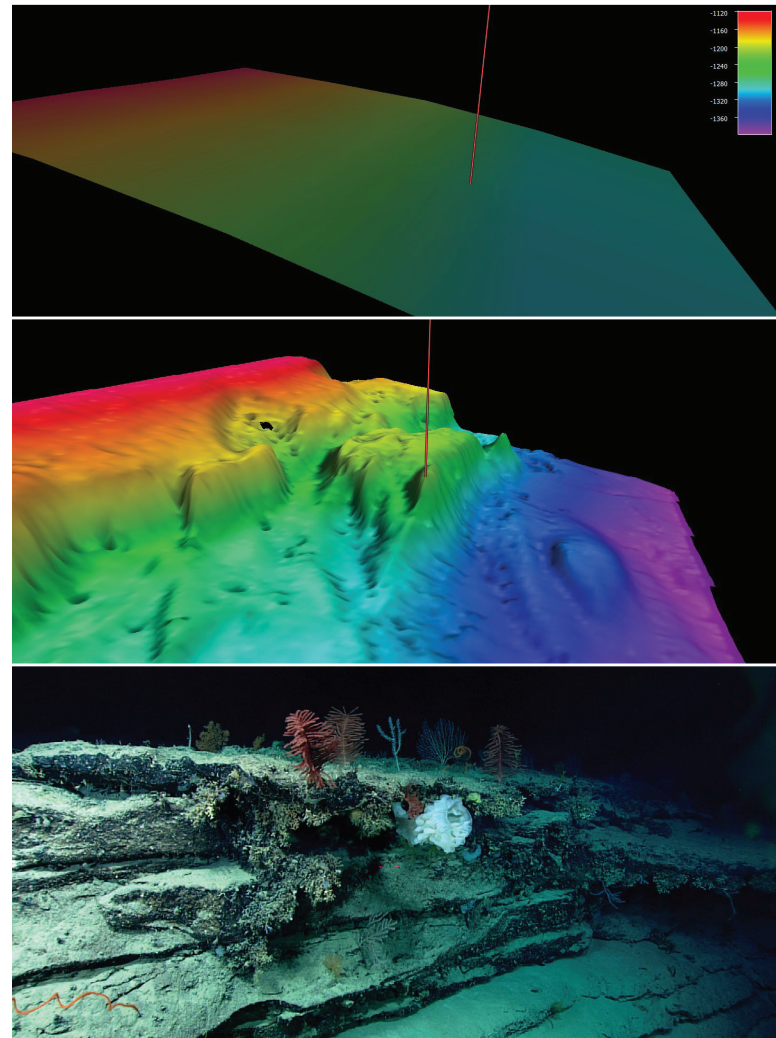
The Windows to the Deep 2018: Exploration of the Southeast U.S. Continental Margin was a 36-day telepresence-enabled expedition to collect critical information and acquire data on priority exploration areas identified by the ocean management and scientific communities. This expedition involved exploration of a diversity of features across the southeast U.S. continental margin with mapping and remotely operated vehicle (ROV) operations targeting areas with potential to host deep-sea coral and sponge communities, maritime heritage sites, a landslide feature, and water column sonar anomalies of possible cold seeps where gas bubbles emanate from the seafloor. Mapping data collected during this expedition filled major data gaps in the region and will contribute to [Seabed 2030](#) goals for mapping unexplored regions of Earth's oceans. This expedition also [marked over 400 ROV dives](#) for NOAA Ship *Okeanos Explorer*. Major accomplishments of this expedition are summarized below.

Conducted 17 ROV dives ranging in depth from 325 to 3,436 meters to improve knowledge of unexplored areas within the U.S. Exclusive Economic Zone (EEZ) and in deepwater areas previously mapped for the [U.S. Extended Continental Shelf Project](#) to inform management needs for sensitive habitats, maritime heritage sites, and potential resources. Data collected can be used to increase understanding of deep-sea ecosystem connectivity across the Atlantic basin.



Overview map showing seafloor bathymetry and ROV dives completed during the **Windows to the Deep 2018** expedition (EX1805 and EX1806). Map courtesy of the NOAA Office of Ocean Exploration and Research.

- Collected 175 biological (53 primary and 122 associates) and 38 geological specimens. Biological specimens were representatives of new records, potential new species, dominant fauna, or were collected to support trans-Atlantic connectivity studies. Geological samples will be used to better understand the geologic history of this region, as well as to characterize habitat substrate.
 - Collected six biological samples to support trans-Atlantic connectivity studies including *Geodia pachydermata*, *Bathypathes* sp., *Leiopathes* sp., *Anthomastus* sp., *Lophelia pertusa*, and *Pheronema* sp.
- The Windows to the Deep 2018 Expedition and previous *Okeanos Explorer* mapping efforts, revealed one of the largest areas of potential deep-sea coral reef habitat that has been discovered to date in U.S. waters. Through both mapping and visual surveys, this expedition added substantial evidence that the numerous mounds on the Stetson Mesa offshore of Florida and Georgia appear to be the slow accumulation of *Lophelia pertusa* coral skeletal material over hundreds of thousands of years. This expedition only explored three mounds, but all were rich with live coral stands at their crests. New data highlights the vastness of potential deep-sea coral habitat in this region.
- Conducted ROV dives and mapping operations in two areas managed by the South Atlantic Fisheries Management Council (SAFMC) - the Stetson Miami Terrace Deep Coral Habitat Area of Particular Concern (HAPC) and Cape Fear *Lophelia* Banks Marine Protected Area (MPA).
 - Mapped over 7,400 square kilometers and conducted three dives in the Stetson Miami Terrace Deep Coral HAPC that revealed high-density coral communities at each site. Two of these communities were also highly diverse.
 - Conducted an ROV dive in Cape Fear MPA, [documenting several large wreckfish](#) (*Polyprion americanus*), a commercially important species managed by the SAFMC.
- Discovered a high diversity of deep-sea corals and sponges on low relief, intraslope terraces (terraced features between a depth of 1,000 to 4,000 meters) along the Blake Escarpment in areas with no previous exploration.
- Explored two potential archeological sites to support the Bureau of Ocean Energy Management (BOEM) and NOAA maritime heritage programs.
 - Characterized the [Blake Ridge Wreck](#) and collected data that was used by BOEM to make a [3D photogrammetry model](#). This wreck was originally discovered by a team from Duke University in 2015 and is likely an early 19th century wreck.
 - Conducted targeted overnight mapping operations to search for other potential shipwrecks in an area suspected to contain many due to the World War II Battle of the Atlantic, as well as merchant ships lost at sea along the



Prior to the Windows to the Deep 2018 expedition, this section of the Blake Escarpment appeared to be an area of low slope with no distinct features based on satellite altimetry. Image A shows satellite altimetry (Smith and Sandwell, 2014) at Dive 04 on “Blake Escarpment South”. During EX1805, multibeam mapping revealed a series of terraced features (image B); and ROV exploration during EX1806 documented a highly diverse and dense community of deep-sea corals and sponges that were observed throughout the dive (image C). Red mark in bathymetry images indicates the location of the ROV dive.

busy trade routes of the U.S. East Coast. [Dive 13](#) investigated a sonar anomaly, dubbed “Big Dipper,” with very strong backscatter, roughly the size and shape of a ship known to have sunk in the area offshore North Carolina; ROV imagery revealed that this site was not a shipwreck, but instead a biologically diverse rocky habitat that was home to a significant concentration of fish and corals.

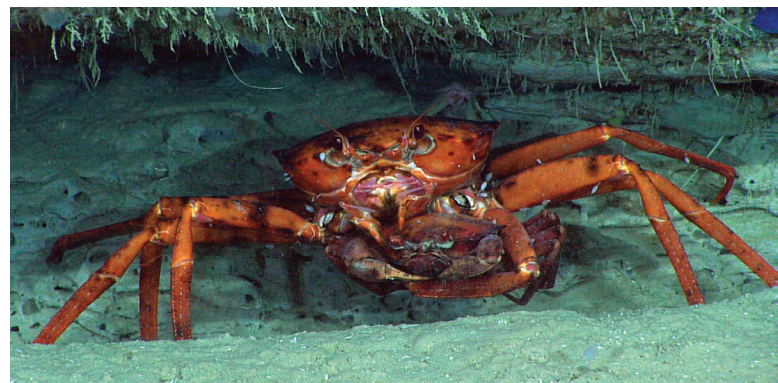
- o Additional review of mapping data collected during this expedition is currently ongoing by the marine archaeology community which may provide additional targets for future expeditions in the region.



An octant discovered during the dive on Blake Ridge Wreck. This wreck was originally discovered by a team from Duke University in 2015 and is likely an early 19th century wreck. Other indicative artifacts imaged during the dive included bottles of wine, ceramic jugs, containers for food and other liquids, a small sewing kit with a pile of brass buttons, a slate, a vase, a tobacco pipe, and a comb. *Image courtesy of the NOAA Office of Ocean Exploration and Research, Windows to the Deep 2018.*

Located and characterized deep-sea coral, sponge, and chemosynthetic communities.

- Documented three dive sites with high biological diversity and six medium diversity sites. Six dive sites had high biological abundance/density or high biomass.
- Observed deep-sea corals and sponges on every dive except one, which was a dedicated gas seep exploration dive.
- Conducted two dives that targeted water column anomalies. Both dives identified evidence of methane seepage, with bacterial mats and fauna typically associated with chemosynthetic habitats and active bubble seepage in this region.
- Observed several potential new species, recorded significant depth and geographic range extensions for several fish and coral species, and documented the presence of commercially important species - including red crab (*Chaceon quinquedens*) and golden crab (*Chaceon fenneri*) - in areas not previously investigated.



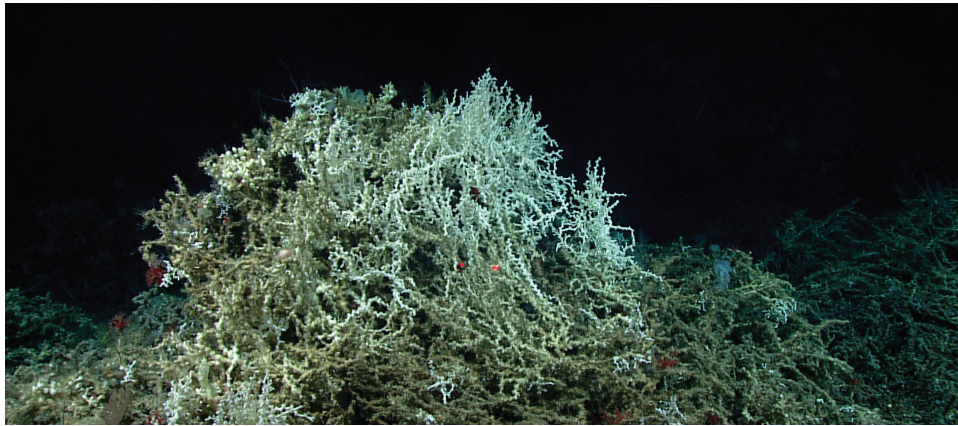
A pair of golden crabs (*Chaceon fenneri*) occupy an outcrop during the dive at Richardson Scarp. Based on their behavior the scientists speculated that the pair was mating. *Image courtesy of the NOAA Office of Ocean Exploration and Research, Windows to the Deep 2018.*

Characterized water column habitats using acoustics, visual observations, and emerging technologies.

- Conducted midwater exploration at depths ranging from 300 to 950 meters during three dives to investigate the diversity and abundance of this largely unknown pelagic fauna.
- Made multiple observations of a species of [medusa jellyfish](#) (*Cyanea* sp.) in the deep waters above Keller Canyon. This species is typically observed in shallow waters, which raises new questions about shallow and deep water connectivity in the area.

Extended bathymetric mapping coverage in the U.S. EEZ and international waters in support of Seabed 2030.

- Mapped more than 29,600 square kilometers, an area larger than the State of Maryland.
- Made new insights into this region, including the discovery of previously unknown intraslope terraced feature; newly mapped karstic features on the northern portion of the Blake Plateau; unusually flat seafloor terrain when compared to predictions made by satellite altimetry on the southern Blake Plateau; and numerous likely biogenic ridges and mounds offshore Florida, Georgia, and South Carolina. Due to their size, these features cannot be resolved from satellite data and were only revealed in detail using the ship-mounted multibeam sonar.



A stand of *Lophelia pertusa* at the top of one of the biogenic mounding features explored within the Deep Water Coral Habitat Area of Particular Concern along the Stetson Miami Terrace. Image courtesy of the NOAA Office of Ocean Exploration and Research, *Windows to the Deep* 2018.

Collected mapping data and conducted ROV dives to support enhanced predictive capabilities for vulnerable marine habitats and submarine geohazards.

- Discovered numerous areas of deep-sea coral and sponge habitat, which has not only improved our understanding of this region, but has habitat modeling implications that may apply to many other places in the world.
- Conducted one ROV dive on the toe of the Currituck landslide feature, one of the largest submarine landslides on the U.S. East Coast, to better understand past submarine geohazards.

Engaged over 140 scientists, resource managers, and students, which is a record high for *Okeanos Explorer* missions.

- Participants were from 21 U.S. states and four international countries including Russia, Portugal, Japan, and Norway.

Documented several rarely observed predation events. Highlights included:

- An [Atlantic Midshipmen](#) (*Porichthys plectrodon*) [opportunistically grabbing a barracudina](#) in the family Paralepididae as it swam by during the dive at Pea Island.
- A [lithodid crab ripping a brittle star apart](#) along a sedimented ridge south of Pamlico Canyon.
- [Inter-species predation activity](#) between two crabs (*Neolithodes* sp. and *Chaceon* sp.) along a scarp feature in the Richardson Hills area.



Virginia Sea Grant, members of NOAA Atlantic Hydrographic Branch, and students tour NOAA Ship *Okeanos Explorer* at the conclusion of the expedition in Norfolk, VA. Image courtesy of VA Sea Grant, Lisa Sadler.

Engaged with audiences around the world, opening a window of understanding into the deep sea.

- Conducted six ship tours for 66 people, including tours for the SAFMC, the Mid-Atlantic Regional Council on the Ocean, Virginia Sea Grant, NOAA partners, South Carolina Aquarium, Patriots Point Naval and Maritime Museum staff, and students from the College of Charleston.
- Conducted 16 live interactions, 18 live streaming events at partner locations, and a Reddit Science 'Ask Me Anything'. Over 8,670 people were engaged during these events.
- Over 80 news articles covered the expedition. Stories about the expedition appeared in national media as well as local outlets in landlocked areas and on both coasts, including the front page of Charleston's *Post and Courier*. Several outlets published multiple stories about the expedition. International audiences were also engaged with articles in French, Italian, Spanish, Russian, Chinese, Indian, Cambodian, and Vietnamese, as well as several articles by news outlets in the United Kingdom.
- Live video feeds received over 245,700 views during the expedition. Web content received 17,400 visits during the second leg of the expedition, with more than 54,000 additional views coming in the weeks immediately following the cruise, largely due to exposure on social media and subsequent media interest.

Data collected during this expedition is intended to inform initial characterization of the areas visited and includes multibeam, single beam, subbottom, ADCP, XBT, CTD 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. [Oceanexplorer.noaa.gov](https://oceanexplorer.noaa.gov) will provide a direct link to the expedition data archive on the expedition website once available.

For More Information

oceanexplorer.noaa.gov/okeanos/explorations/ex1806/welcome.html



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