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**FISCAL YEARS**

# **2016-2020**

**OCEAN EXPLORATION**  
**FUNDING OPPORTUNITY REPORT**

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# ABOUT THIS REPORT

The NOAA Office of Ocean Exploration and Research (OER) is the only federal program dedicated to exploring the deep ocean, closing prominent gaps in our basic understanding of U.S. deep waters and the 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. To better understand our ocean, OER makes exploration data available to the public. This allows us, collectively, to more effectively maintain ocean health, 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.

To this end, through its annual ocean exploration competitive funding opportunity, OER solicits and funds proposals that advance ocean exploration, technology, and marine archaeology. While specific funding topics may vary from year to year, in recent years OER supported:

- Ocean exploration to inform management, sustainable use, and conservation of marine resources in poorly explored deep ocean areas of the U.S. Exclusive Economic Zone (areas proposed for exploration and/or initial characterization must be at water depths of 200 m or more);
- Application of new or novel use of existing ocean technologies or innovative methods to increase the scope and efficiency of acquiring ocean exploration data and improve usability of and access to ocean exploration data; and
- Discovery and exploration of marine archaeological sites to inform decisions on management and preservation, advance our understanding of the human past, and identify sources of potential environmental impacts.

OER solicits pre-proposals for initial internal review and encourages applicants who address the priorities of the funding announcement to submit full proposals. Full proposals are reviewed through mail and panel reviews by external subject matter experts, and then OER makes recommendations for funding based on these reviews.

In this report, OER highlights the Fiscal Year (FY) 2020 funding opportunity and provides summary data from the FY16-20 funding opportunities.

## OVERVIEW AND SUMMARY METRICS

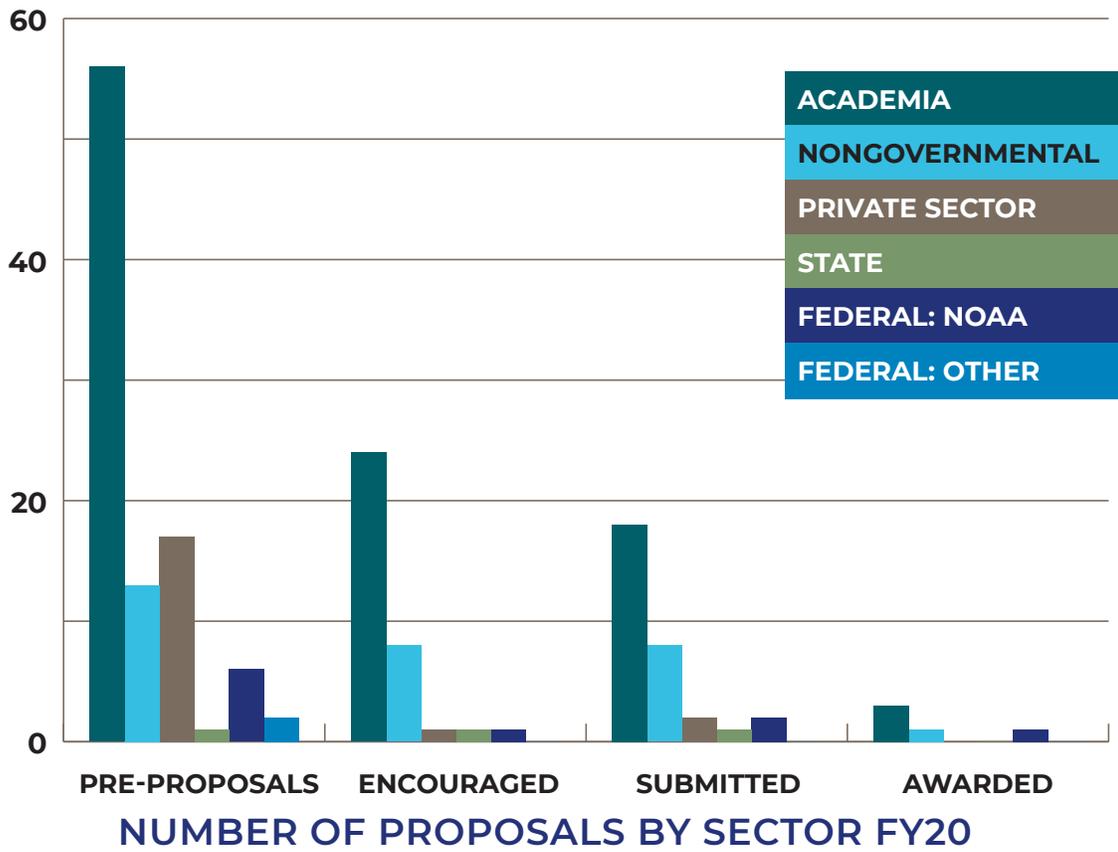
For the FY20 competition, OER solicited proposals for ocean exploration that may inform ocean-related segments of the U.S. economy, also referred to as the Blue Economy, and projects that support the goals of Seabed 2030, an international collaboration to fully map the global ocean by the year 2030. Priorities were focused on interdisciplinary exploration of unknown or poorly known areas of the ocean, processes, and resources; discovery and initial exploration of marine archaeology; and technological innovation to advance ocean exploration objectives.

In FY20, OER:

- Received 95 pre-proposals (\$47,723,738), encouraged 35 full proposals (\$17,993,901), received 31 full proposals (\$15,493,490), and awarded funds to 5 proposals (\$2,360,527).
- Funded 1 general ocean exploration proposal, 2 marine archaeology proposals, 1 technology proposal, and 1 marine archaeology/technology proposal (applicants were able to select multiple themes).
- Funded 141 ship/submersible days.
- Funded principal investigators from academia (3), the federal government (NOAA) (1), and a nongovernmental organization (1).
- Funded 19 institutions across 8 U.S. states and Canada.
- Secured over \$4,500,000 in leveraged support.

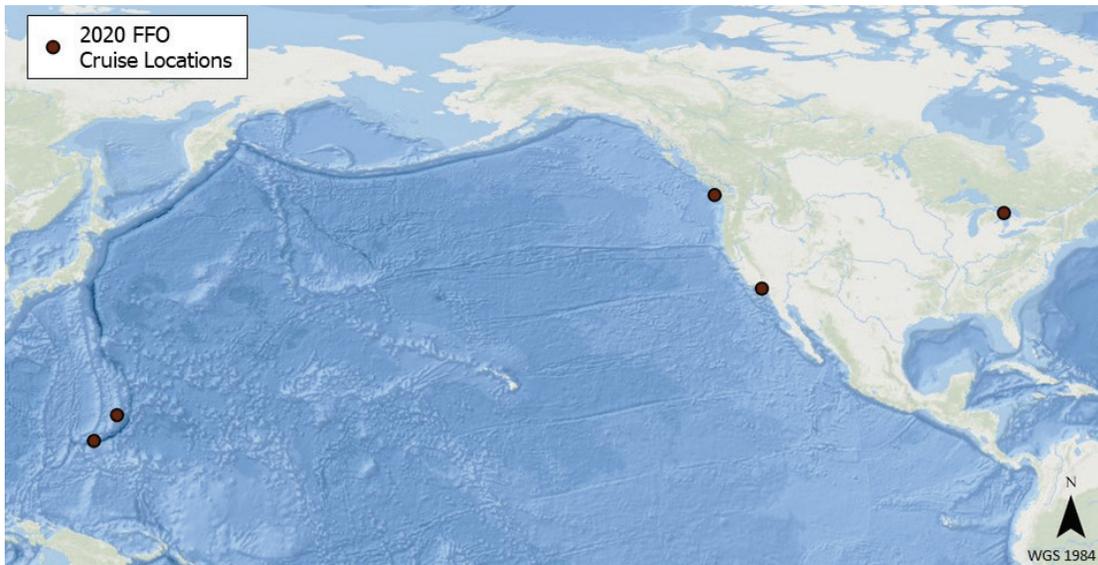
## PRE-PROPOSALS AND PROPOSALS

OER requires applicants to submit pre-proposals. After an internal evaluation of these pre-proposals, OER encourages qualified applicants to submit full-proposals. In FY20, OER received pre-proposals from academia, federal agencies (NOAA and others), nongovernmental organizations, the private sector, and a state agency. OER received full proposals from academia, NOAA, nongovernmental organizations, the private sector, and a state agency. OER funded proposals from academia, NOAA, and a nongovernmental organization.



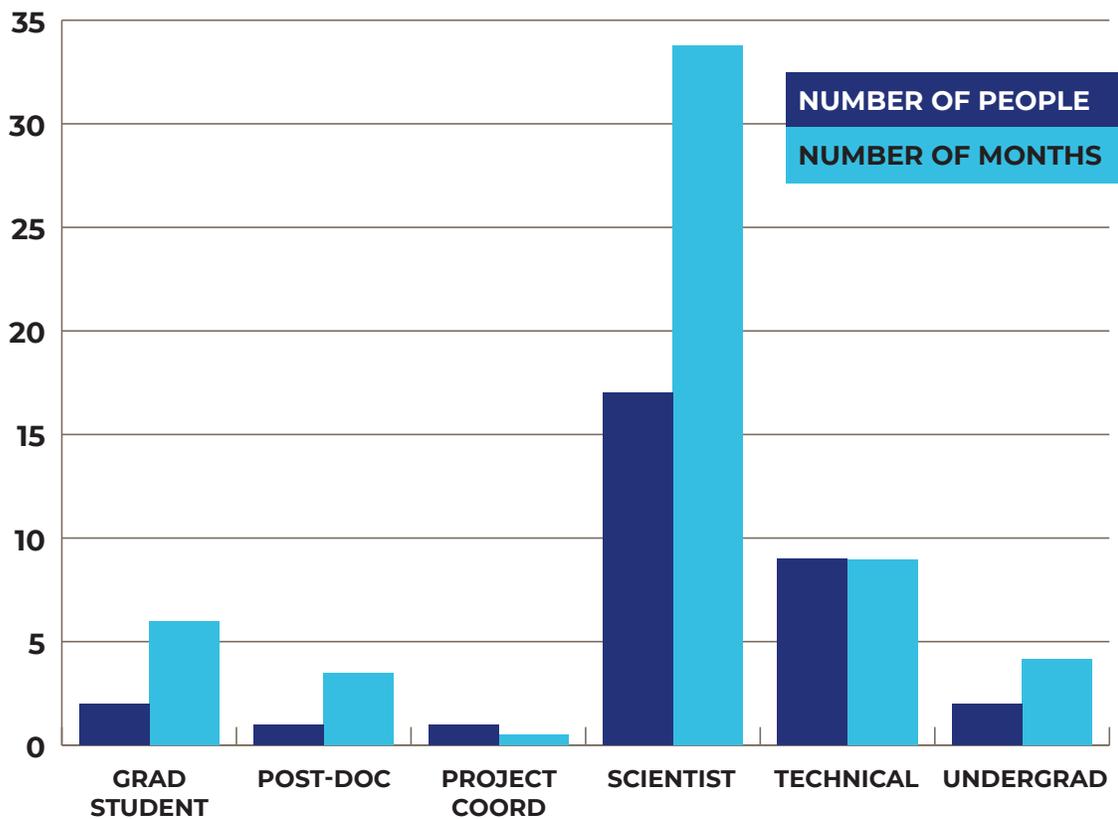
## AWARDS

OER funded 5 projects in FY20, 1 in the Great Lakes, 2 off the U.S. West Coast, and 2 in the Mariana region.



MAP OF FY20 FUNDED PROJECT SITES

OER supported a total of 32 personnel and 56.9 personnel months through the FY20 funding opportunity. This included undergraduate students, graduate students, post-doctoral researchers, project coordinators, scientists, and technicians/technical advisors.



## NUMBER/TYPE OF PERSONNEL AND PERSONNEL MONTHS FY20

The 5 projects funded through the Ocean Exploration Fiscal Year 2020 Funding Opportunity are summarized below in alphabetical order by project title:

### **COORDINATED SIMULTANEOUS PHYSICAL-BIOLOGICAL SAMPLING BY ADCP-EQUIPPED OCEAN GLIDERS**

**PRINCIPAL INVESTIGATOR: WU-JUNG LEE, INSTITUTION: UNIVERSITY OF WASHINGTON**

Despite their critical role in marine ecosystems, the economy, and our food supply chain, midtrophic-level animals like zooplankton and small fish, which are both predators and prey, are among the least understood animals in the ocean. Currently, researchers lack the tools they need to effectively study these animals at large spatial and temporal scales. To address this gap, this research team will develop new ways for long-term, large-scale data collection related to these important resources. Operating in Juan de Fuca Canyon offshore Washington, the team will equip autonomous underwater gliders with acoustic Doppler current profilers (ADCPs). These instruments are usually used to measure the speed and direction of ocean currents, but they can also be used to detect and quantify animals as they move

through the water column. The team will demonstrate how ADCPs can be used to simultaneously collect needed physical and biological data in a manner that is easier and cheaper than current ship-based efforts. This project will deliver broadly adoptable ways to collect, process, and analyze data about these midtrophic animals and has the potential to greatly advance the study of living marine resources. By providing a more complete picture of the ecosystem, these new technologies and processes will better enable resource managers to make policy decisions that support sustainable resource management.

## **DEEPWATER AUV SURVEYS OF WWII U.S. CULTURAL ASSETS IN THE SAIPAN CHANNEL**

**PRINCIPAL INVESTIGATOR: ERIC TERRILL, INSTITUTION: SCRIPPS INSTITUTION OF OCEANOGRAPHY, UNIVERSITY OF CALIFORNIA, SAN DIEGO**

During World War II, U.S. airbases in the Northern Mariana Islands played a pivotal role in the war outcome by supporting thousands of B-29 aircraft flying long-range bombing missions to Japan. Several military planes crashed in nearby waters. The research team will explore the waters off Tinian and Saipan to locate and document U.S. planes (mostly B-29s) lost during the war. Their work will build on existing data, most notably U.S. Navy and NOAA seafloor maps that led to the discovery of a B-29 by researchers on NOAA Ship *Okeanos Explorer* in 2016. The team will use state-of-the-art scientific methods and technologies, including shipboard systems; a fleet of autonomous underwater vehicles (AUVs) equipped with side-scan sonars, light imaging capabilities, a sub-bottom profiler, and multibeam sonar; and a remotely operated vehicle to conduct archaeological surveys, map the seafloor in the region, and characterize the neighboring seabed habitat. This project will provide an inventory of aircraft crash sites off Tinian and Saipan and data for site management and preservation; advance the efficiency, accuracy, and cost effectiveness of deepwater archaeology; and promote an increased awareness of maritime cultural heritage through technologies that make underwater archaeological sites remotely accessible (e.g., 3-D models). Finally, it will document and honor the final resting place of 76 U.S. service members who lost their lives in these waters.

## **DISCOVERING THE SUBMERGED PREHISTORY OF THE ALPENA-AMBERLEY RIDGE IN CENTRAL LAKE HURON**

**PRINCIPAL INVESTIGATOR: JOHN O'SHEA, INSTITUTION: UNIVERSITY OF MICHIGAN**

Now submerged beneath Lake Huron, the Alpena-Amberley Ridge was once a dry land corridor that divided the lake in two. Researchers have found evidence of human occupation on the ridge dating back 10,000 years, including stone hunting structures that are among the oldest dated examples on the planet. Building on previous work, the research team will explore the ridge, part of which lies in the Thunder Bay National Marine Sanctuary. This project has three primary components: mapping, site identification/documentation, and model assessment. The research team will produce a 3-D representation of the ancient landscape and its environment and use mapping data to target features of potential archaeological interest for investigation with a remotely operated vehicle and by scuba-trained archaeologists. They will also evaluate a model designed to predict the location of

underwater archaeological resources in the region. This project has the potential to greatly enhance our understanding of early human occupation of the Great Lakes region and provide important information to aid in managing the unique archaeological resources preserved beneath Lake Huron. In addition, it will be incorporated into Science in the Sanctuary, a local public school program, and serve as the basis for a traveling museum exhibit highlighting the archaeological finds and the underwater landscape of the Alpena-Amberley Ridge.

## **PALEOLANDSCAPES, PALEOECOLOGY, AND CULTURAL HERITAGE ON THE SOUTHERN CALIFORNIA CONTINENTAL SHELF**

**PRINCIPAL INVESTIGATOR: AMY GUSICK, INSTITUTION: NATIONAL HISTORY MUSEUM OF LOS ANGELES COUNTY**

Archaeological evidence found at coastal sites in Southern California suggests the region was once populated by early maritime hunter-gatherers and that similar sites, inundated by sea-level rise approximately 20,000-8,000 years ago, are likely to also exist on the seafloor. Building off their previous work, the research team will search for and study ancient landforms, unique environmental features, and archaeological sites on the submerged landscape of the Southern California continental shelf. Using both traditional (sub-bottom sonar) and emerging methods (controlled source electromagnetic technology), the team will map the seafloor in the project area to identify features that may have once attracted occupation, like ancient channels and estuaries and tar seep deposits. They will use this information to target sites for exploration and sample collection with a remotely operated vehicle. The researchers will incorporate findings into existing maps and models to improve understanding of the project area's ancient landscape, how it changed over time, and the reasons for those changes, as well as the importance of the region in the history of human migration to the Americas. Findings will also be used to inform the protection of the region's archaeologically and biologically sensitive landscapes.

## **SUBMARINE RING OF FIRE: HYDROTHERMAL HUNT IN THE NORTHERN MARIANA BACK-ARC**

**PRINCIPAL INVESTIGATOR: DAVID A. BUTTERFIELD, INSTITUTIONS: NOAA PACIFIC MARINE ENVIRONMENTAL LAB AND UNIVERSITY OF WASHINGTON**

Hydrothermal vents support abundant life despite their extreme conditions and produce critical minerals, making them particularly interesting and important to explore. Vents have been documented in the southern and central parts of the Mariana back-arc as part of a larger investigation of the region, but little is known about the northern part. To complete the investigation, the research team will explore the northern half of the Mariana back-arc to identify and characterize active hydrothermal vent sites and their biological and mineral resources. During the first leg of the two leg expedition, the team will use ship-based systems and an autonomous underwater vehicle with a towed conductivity, temperature, and depth (CTD) instrument package to search for, identify, and map new vent sites. During the second leg, they will use a remotely operated vehicle (ROV) to visually explore the sites and collect geological, chemical, and biological samples. Video of the ROV dives will be streamed live online with commentary.

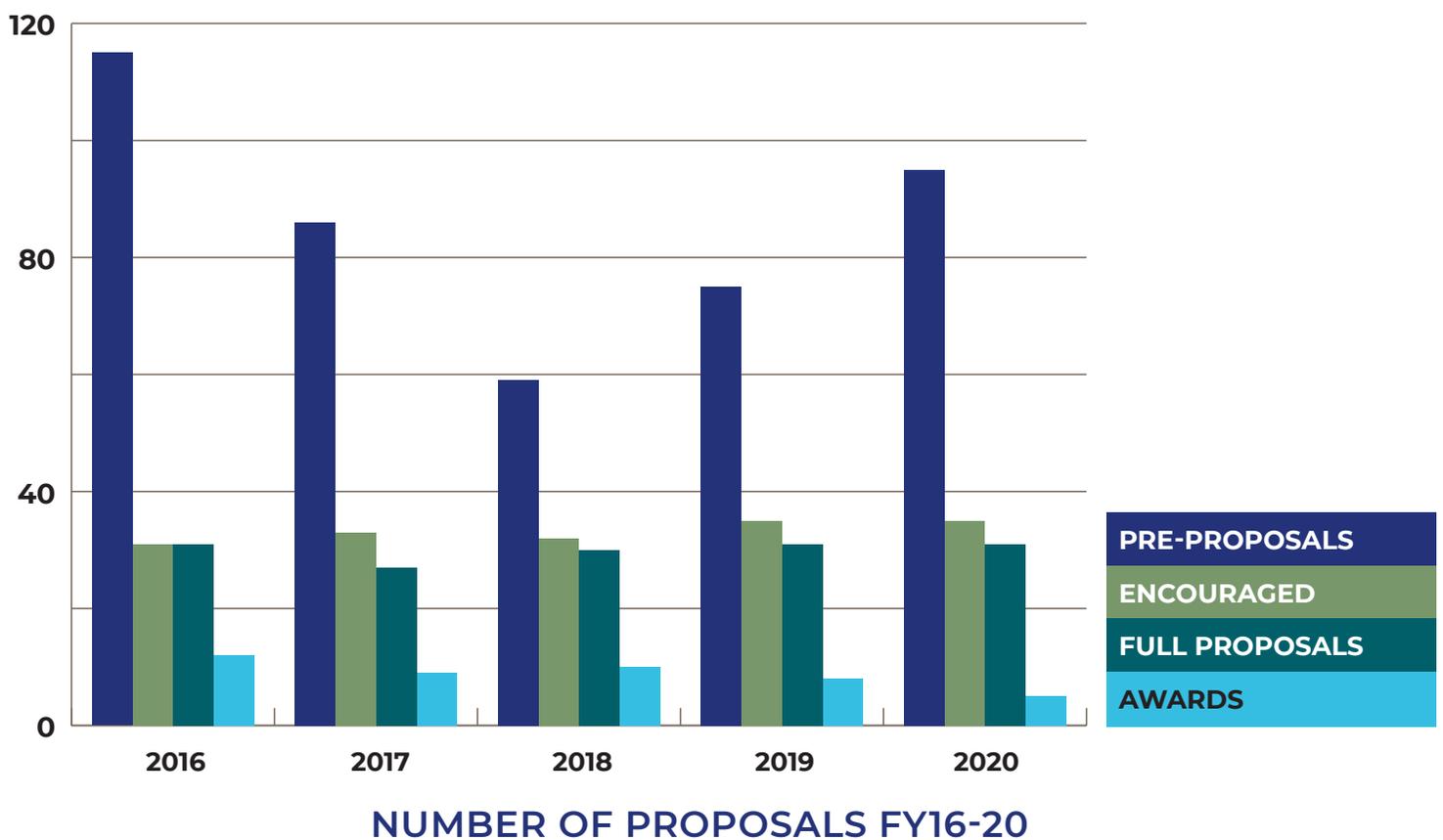
This expedition will expand our understanding about ecosystem connectivity within and beyond the Mariana region and about how geology and geochemistry shape biodiversity. In addition, it will directly support the management and stewardship of resources within the nearby Mariana Trench Marine National Monument.

# FISCAL YEARS 2016-2020 REVIEW

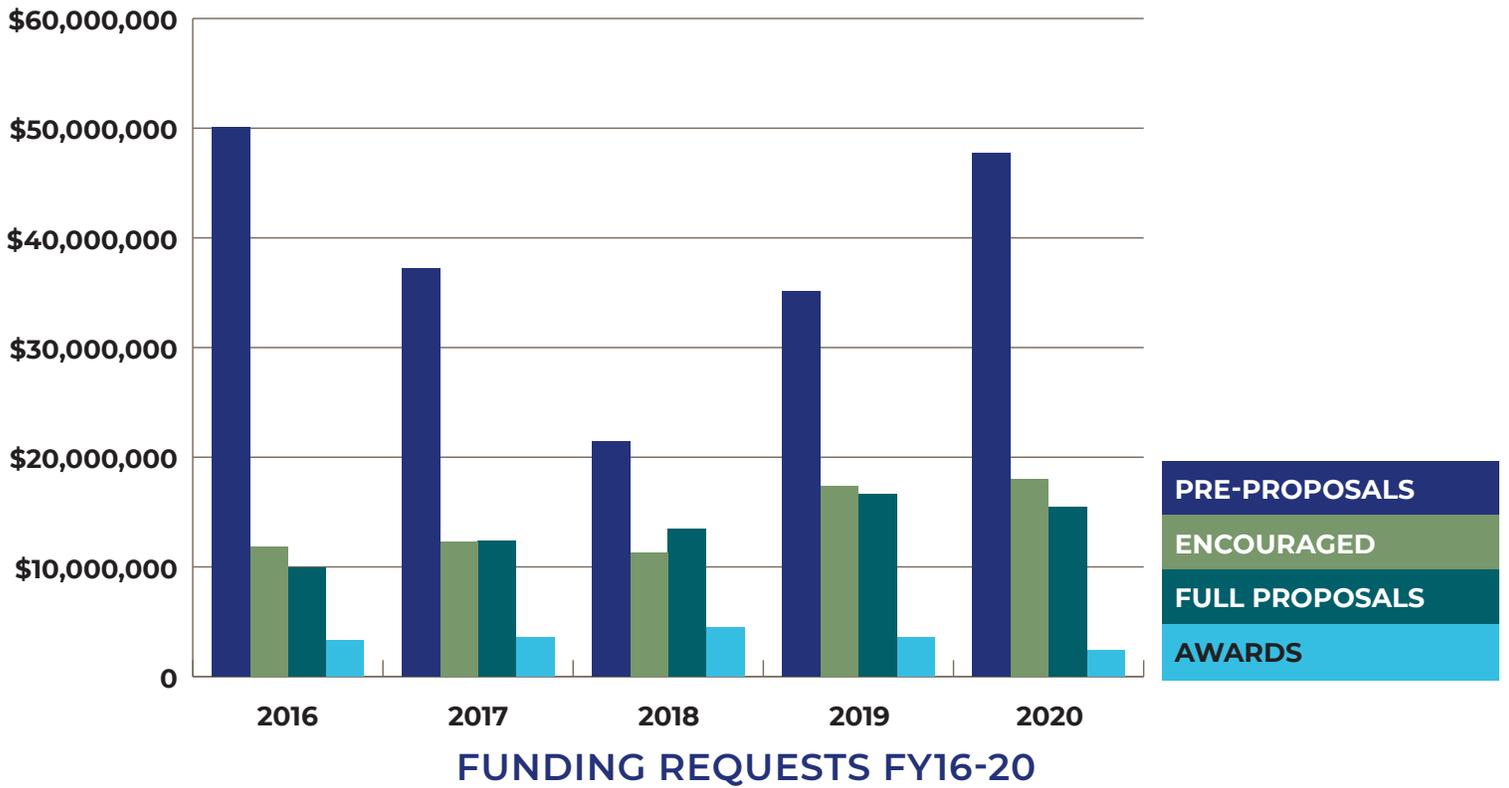
Between FY16 and FY20, OER received a total of 430 pre-proposals (\$191,690,135), encouraged submission of 166 full proposals (\$70,685,223), reviewed 150 full proposals (\$67,849,393), and awarded funding to 44 proposals (\$17,369,587). Through the funded proposals, OER secured over 20 million dollars in leveraged support. During this time period, OER funded 42 unique principal investigators, 91 unique institutions (including co-principal investigators and significant contributors), 185 personnel, and 472 personnel months.

## PRE-PROPOSALS AND PROPOSALS

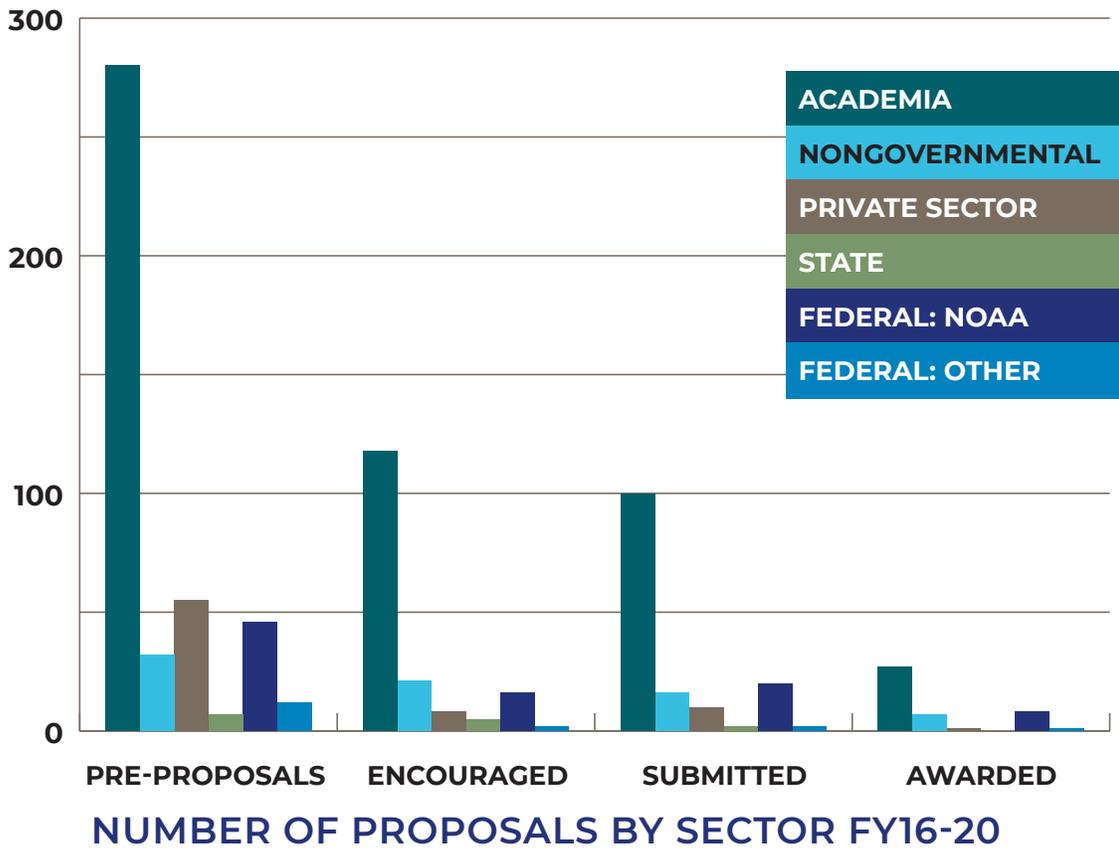
Typically, OER's internal review of pre-proposals results in the encouragement of about 30 full proposals.



The number of proposals funded by OER each year depends on available funds and funding requests from qualified proposals.



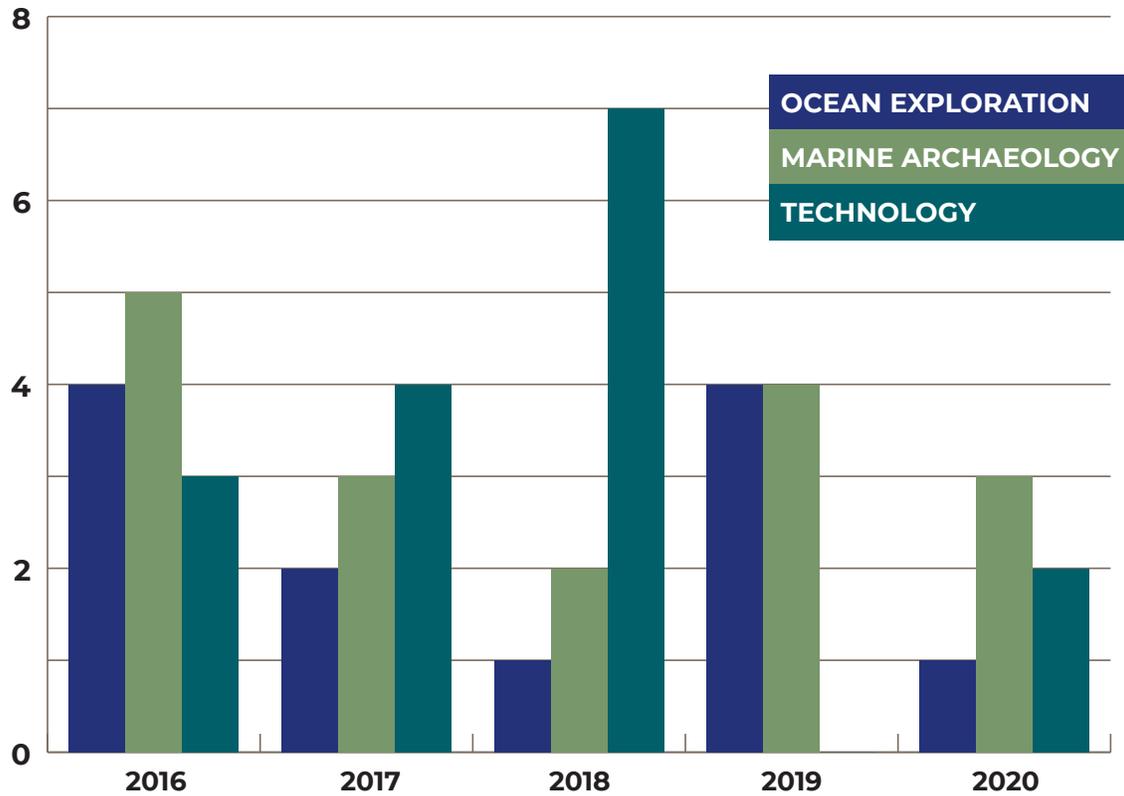
Between FY16 and FY20, OER received pre-proposals and full proposals from academia, federal agencies (NOAA and other), nongovernmental organizations, the private sector, and state agencies.



# AWARDS

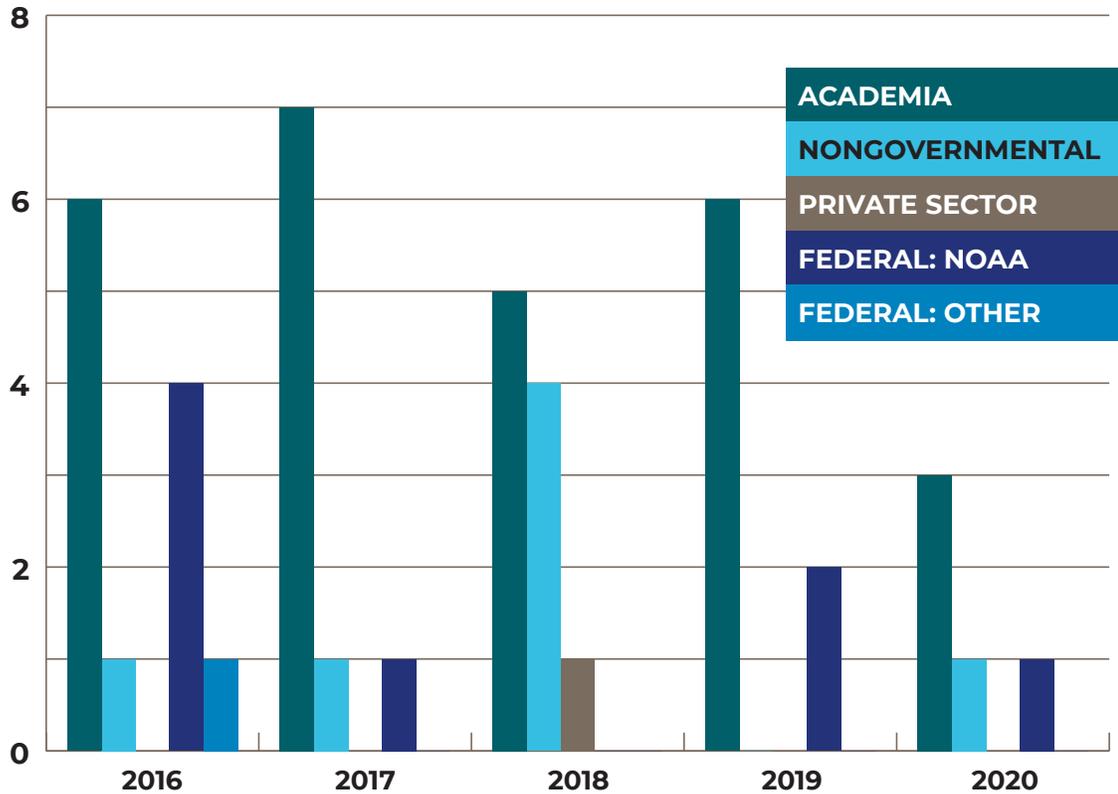
OER solicits and funds proposals in the following focus areas: ocean exploration, technology, and marine archaeology. OER aims to balance the distribution of funds across the three focus areas each year.

Note: Applicants were able to select multiple themes, so some projects may be represented in multiple categories.

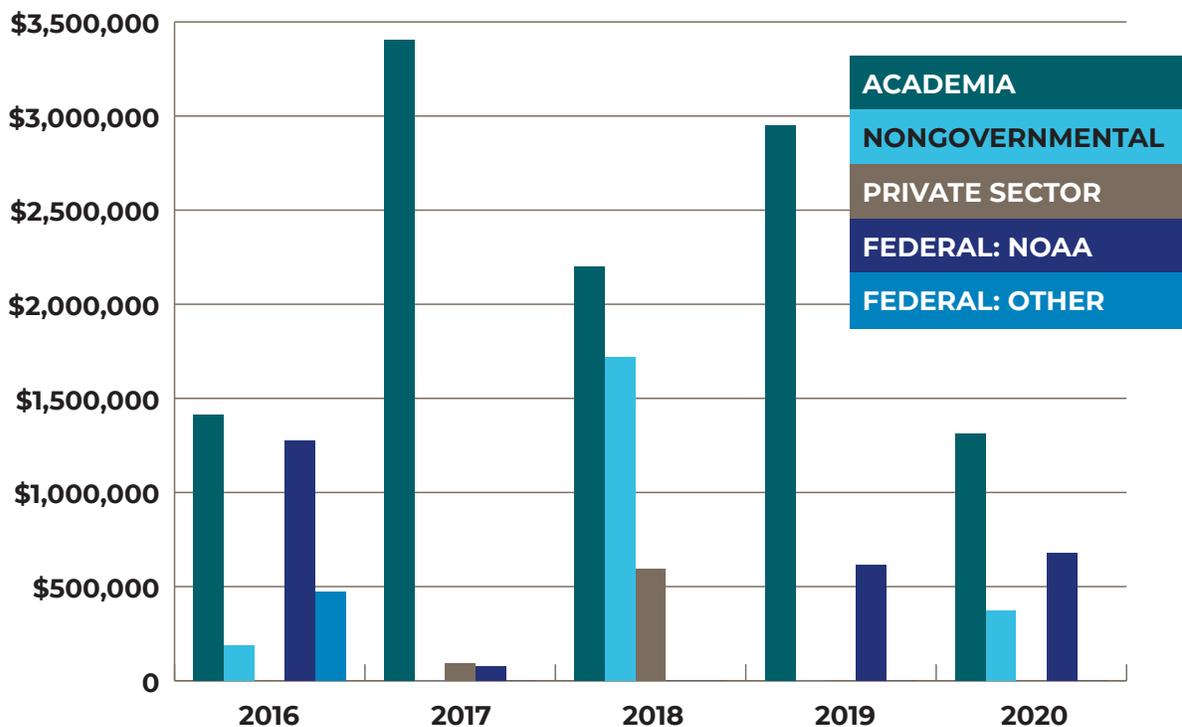


NUMBER OF AWARDS BY THEME FY16-20

Between FY16 and FY20, OER funded proposals from academia, federal agencies, nongovernmental organizations, and the private sector.

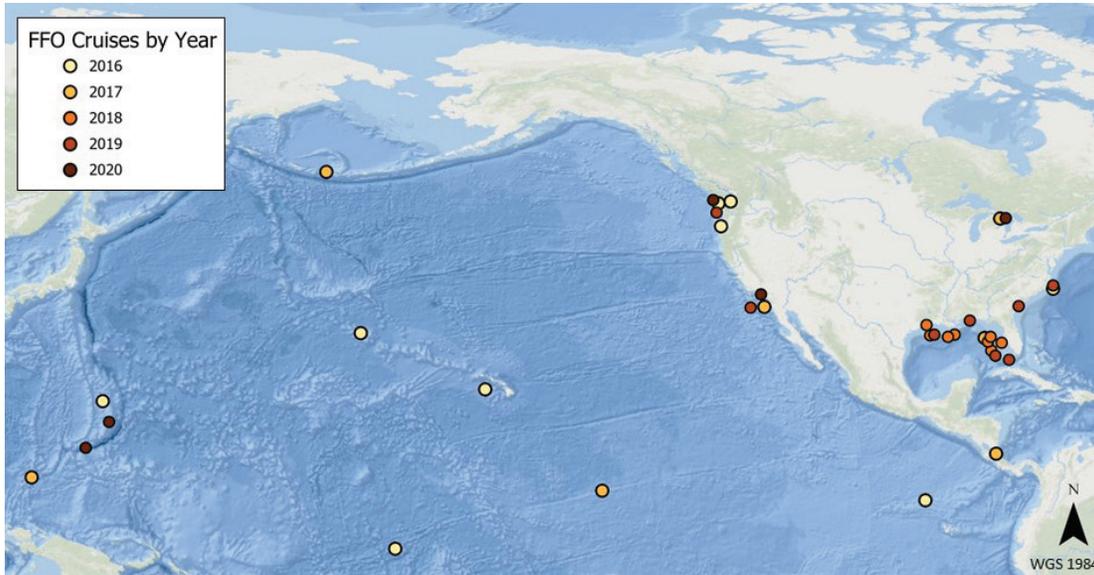


NUMBER OF AWARDS BY SECTOR FY16-20



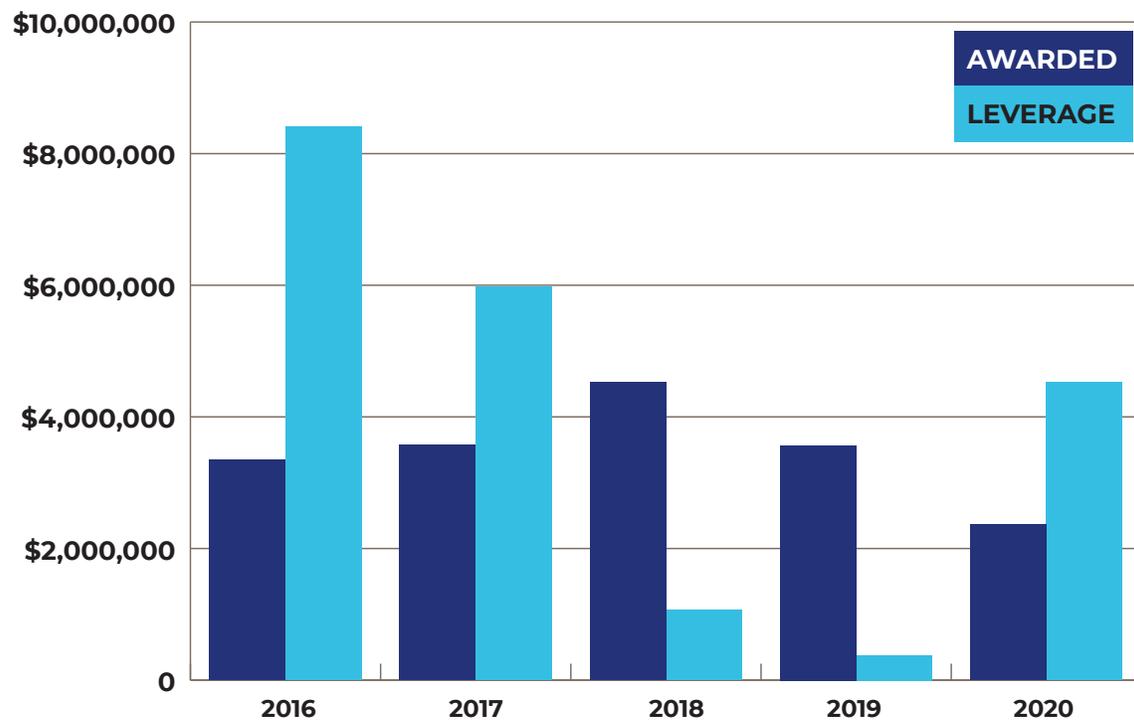
DISTRIBUTION OF FUNDS BY SECTOR FY16-20

OER funded 44 projects between FY16 and FY20, including expeditions and technology demonstrations, at 42 sites around the world.



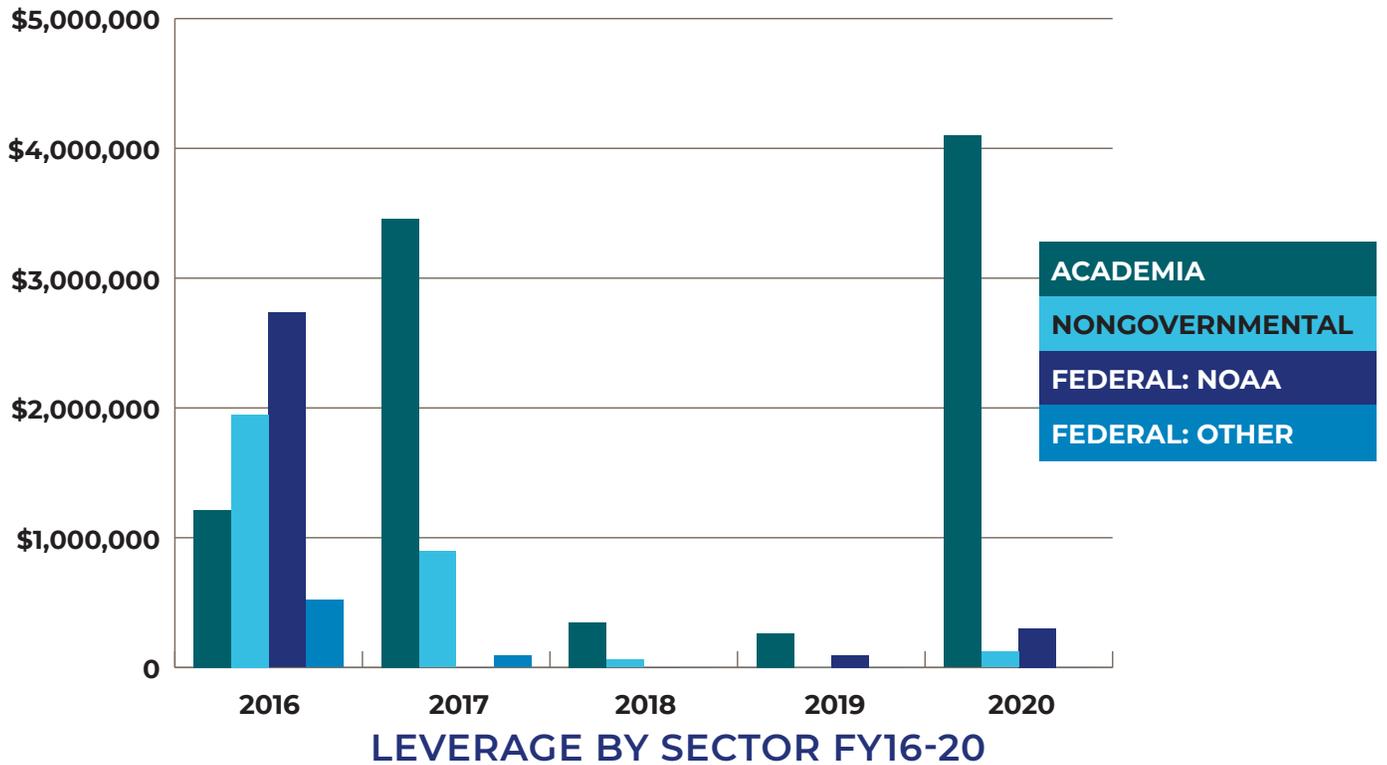
**MAP OF FY16-20 FUNDED PROJECT SITES**

Funded proposals often leverage additional support in the form of cost-sharing, ship time, in-kind contributions, and other services, resources, and personnel time not covered by OER funding. Funded projects leveraged over 20 million dollars between FY16 and FY20.

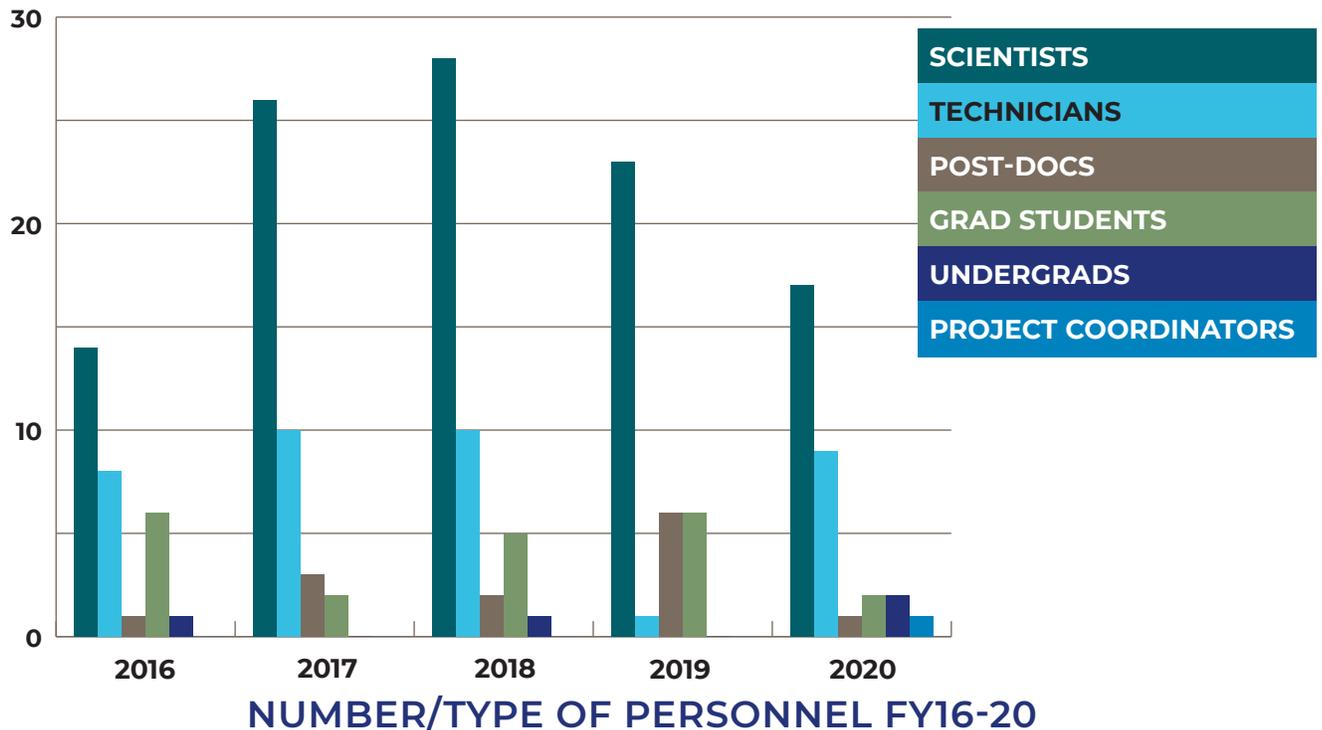


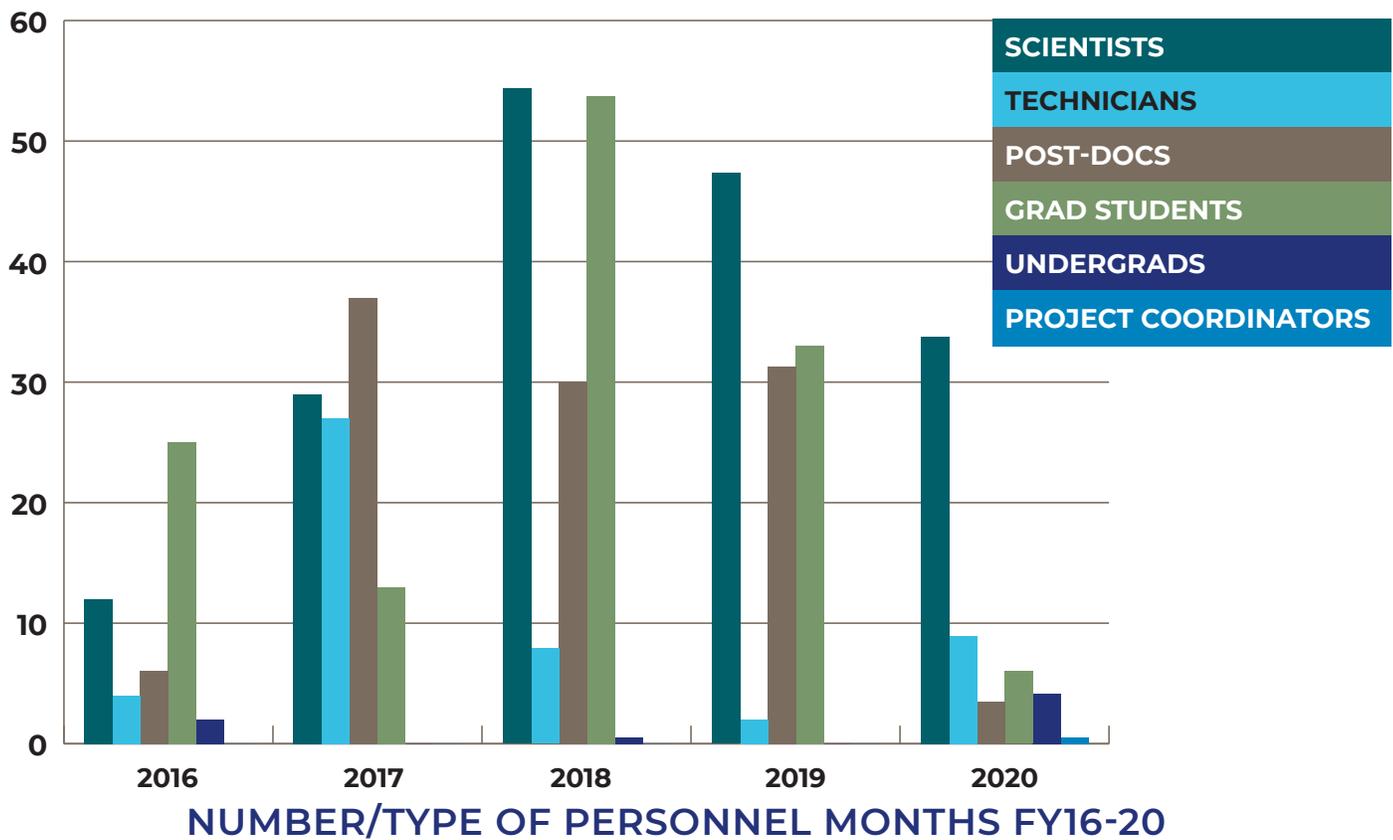
**FUNDING AWARDED AND SUPPORT LEVERAGED FY16-20**

Support leveraged by sector varied across fiscal years. The absence of leverage in the chart below suggests there was either no leverage from or funding to a particular sector in a given fiscal year.



OER supported 185 personnel between FY16 and FY20 for 472 personnel months. Personnel type included undergraduate students, graduate students, post-doctoral researchers, project coordinators, scientists, and technicians/technical advisors.

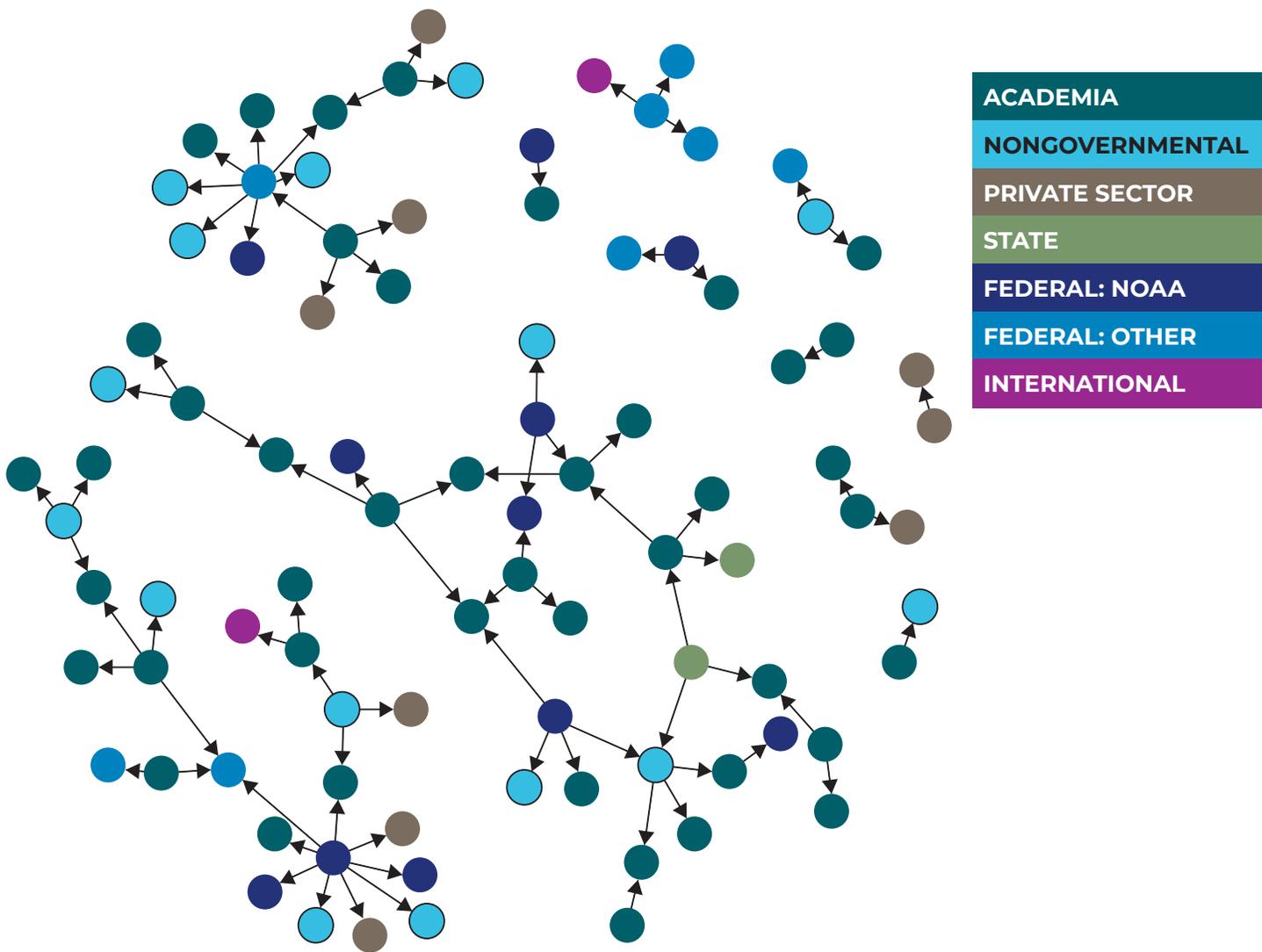




The competitive funding opportunity supports collaboration networks across the ocean exploration community. OER encourages interdisciplinary exploration often accomplished through partnerships between academia, government agencies, nongovernmental organizations, and the private sector.

Principal investigators, co-principal investigators, and other significant contributors funded by OER between FY16 and FY20 linked institutions across sectors both domestically and internationally. The directionality of the arrows in the figure below indicate the directionality of collaboration from awarded institutions to collaborating institutions. Each point in the network represents one institution and may represent multiple projects if multiple awards were given to principal investigators from an institution between FY16 and FY20.

This institutional network depicts 82 relationships between 91 unique entities, resulting in 3 large networks and 8 smaller networks. The figure below is a visual representation of the collaborative nature of OER-funded research and shows the wide reach of OER’s annual competitive funding opportunity beyond the 42 principal investigators who were directly funded. These collaborations have resulted in the inclusion of sectors that did not directly receive OER funding between FY16 and FY20, such as state and foreign entities.



## COLLABORATION NETWORKS FY16-20

OER funding supported expeditions, field operations, and technology demonstrations related to ocean exploration, technology, and marine archaeology. Many of these projects are featured on the OER website (see the links below for access to the web coverage for a specific project).

## WEB COVERAGE FY16-20

FISCAL YEAR	TITLE
FY19	Bioprospecting for Industrial Enzymes and Drug Lead Compounds in an Ancient Submarine Forest
FY19	Gradients of Blue Economic Resources in and Around Deep-sea Methane Seeps
FY19	Wimble Shoals: An Exploration and Characterization of Submerged Cultural and Sediment Resources
FY18	Advancing eDNA as a Tool for Exploration in Deepwater Environments
FY18	From Aggregations to Individuals: Exploring Migrating Deep Sea Scattering Layers Through Multiscale-Multimode Technologies in the Gulf of Mexico
FY18	Microbial Stowaways: Exploring Shipwreck Microbiomes in the Deep Gulf of Mexico
FY18	Paleolandscapes and the ca. 8,000 BP Shoreline, Gulf of Mexico, Outer Continental Shelf
FY18	Development of Innovative Techniques for Exploring Novel Submarine Springs on the Gulf of Mexico Outer Continental Shelf
FY17	Exploration of Biodiversity and Ecosystem Structure on Seamounts in the Western Clarion-Clipperton Zone (CCZ)
FY17	Submerged Cultural Resource Survey of the Kiska Island National Historic Landmark Maritime Battlefield
FY17	Aviators Down! The Search for Tuskegee and Free French World War II Aircraft in Thunder Bay National Marine Sanctuary
FY17	The Sigsbee Deep Expedition
FY17	Peleliu's Forgotten WWII Battlefield
FY16	Battlefield Archaeology and Benthic Habitat Mapping on the Outer Continental Shelf: Exploring Advanced Data Acquisition Technologies to Characterize Maritime Archaeological Resources and the Living Environment off the Mid Atlantic

FISCAL YEAR	TITLE
FY16	Pushing the Boundaries: Using Advanced Technology to Locate and Rapidly Assess Cultural Sites in Multiple Underwater Environments within NOAA's Thunder Bay National Marine Sanctuary
FY16	Exploring the Sunken Heritage of the Battle of Midway: Honoring the Legacy of the 75th Anniversary of the Turning Point in the Pacific War
FY16	Exploring the Deep Mariana Back-Arc Basin Within the U.S. Exclusive Economic Zone to Link Biodiversity, Geochemistry and Geophysics
FY16	Timing of U.S. Atlantic Margin Methane Seepage Relative to Major Climate and Oceanographic Change
FY16	The Current Wall: Exploring the Bathyal Biogeography of the Emperor Seamounts
FY16	Exploration of the Seamounts of the Phoenix Islands Protected Area