

# FY22 NOAA Ocean Exploration Competitive Grant Program Fiscal Report

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## Introduction

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

With priority placed on exploration of deep waters and the waters of the U.S. Exclusive Economic Zone, NOAA Ocean Exploration applies the latest tools and technologies to explore previously unknown areas of the ocean, making discoveries of scientific, economic, and cultural value. These mechanisms range from NOAA-operated NOAA Ship *Okeanos Explorer*, competitive grants, investments in cooperative institutes, and collaboration with various federal, state, academic, philanthropic, and private-sector entities.

Through the annual ocean exploration competitive funding opportunity (program authority 33 USC 3403(a)), NOAA Ocean Exploration solicits and funds projects that advance ocean exploration, technology, and maritime heritage. These funding opportunities have supported more than 396 lab-based and/or expedition-based projects since its inception in 2001. Throughout its history, NOAA Ocean Exploration's competitive grant program has supported over 495 entities and 217 principal investigators (PIs).

This report highlights NOAA Ocean Exploration's Fiscal Year 2022 (FY22) funding opportunity and provides select summary data for prior funding years (FY18-22) to demonstrate trends.

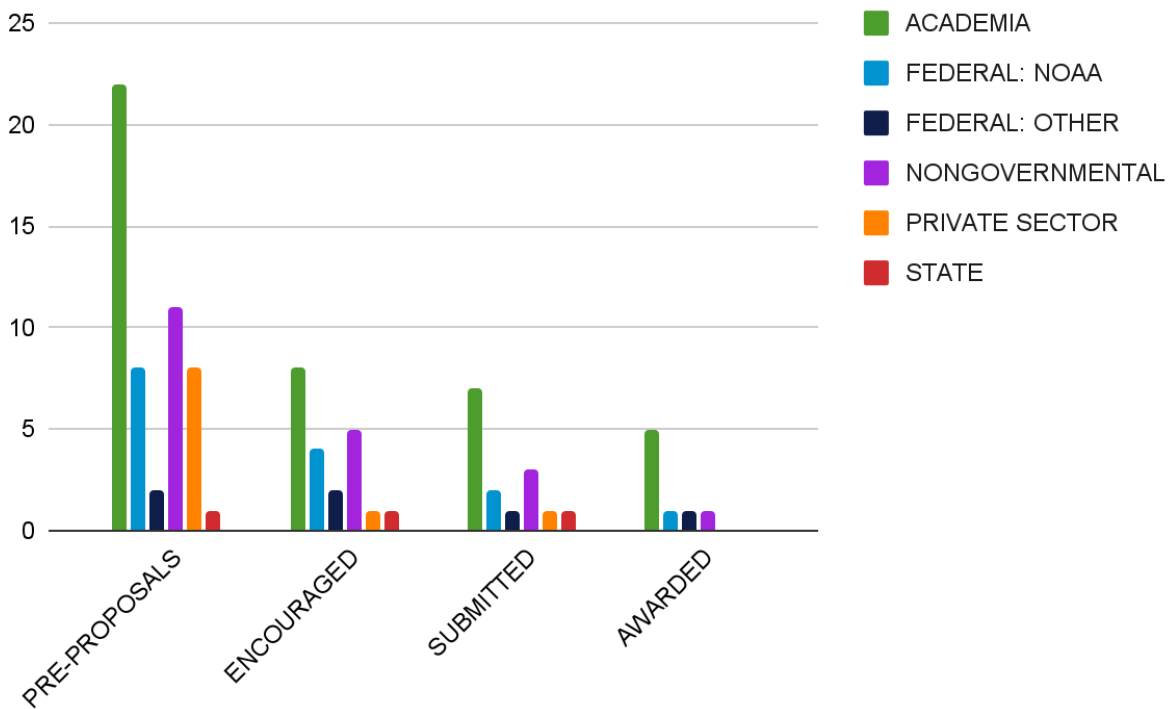
# FY22 Year in Review

## Overview and Summary Metrics

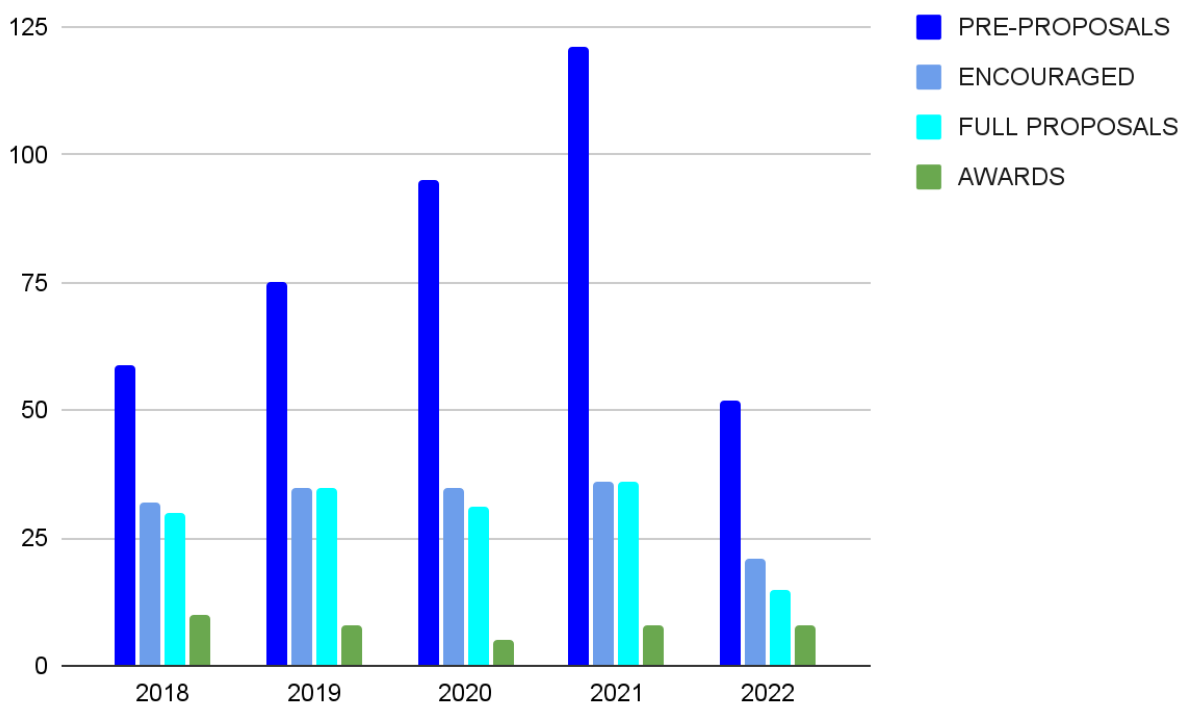
For the FY22 funding opportunity, NOAA Ocean Exploration priorities included exploration of the biological, chemical, and physical ocean environments and areas to inform future characterization, research, and responsible ocean stewardship in unknown or poorly explored U.S. deepwater areas in waters 200 meters and deeper; technological innovation or novel application to advance deep-ocean exploration objectives; and exploration and discovery of underwater cultural heritage sites and objects to enrich U.S. maritime history and inform decisions concerning site, feature, or object preservation and potential seafloor use. Proposals submitted for this year were focused in the Pacific Ocean in support of the [Report on the Workshop to Identify National Ocean Exploration Priorities in the Pacific](#). Further information can be found in funding opportunity number NOAA-OAR-OER-2022-2006910.

In FY22, NOAA Ocean Exploration:

- Received 52 pre-proposals (\$27,801,244), encouraged 21 full proposals (\$10,678,405), received 15 full proposals (\$7,493,638), and recommended 8 proposals for funding (\$4,000,369), each between \$214,064 and \$749,981, totaling \$4,000,369 (see **Figure 1**). While FY22 did see a drop in the number of pre-proposals received, overall there was an increasing trend in both number of submissions and requested funds for FY18-22 (see **Figure 2**).
- Funded 3 general ocean exploration proposals, 2 technology proposals, and 3 maritime heritage proposals.
- Funded 31 ship/submersible days at sea.
- Funded 8 principal investigators from:
  - Academia (5)
  - Federal government, NOAA (1)
  - Federal government, other than NOAA (1)
  - Nongovernmental organization (1)
- Directly supported 2 graduate students.
- Funded 29 entities across 29 U.S. states, with additional 13 partners outside of the USA.
- Leveraged \$0 in external support secured by funded PIs as shared costs, in-kind contributions, etc.



**Figure 1.** Distribution of FY22 NOAA Ocean Exploration funding opportunity pre-proposals received, pre-proposals encouraged to submit as full proposals, full proposals received, and proposals awarded funding across different sectors of ocean exploration, including academic, federal (NOAA and other), nongovernmental (e.g., philanthropic), private sector, and state entities.



**Figure 2.** Distribution of NOAA Ocean Exploration funding opportunity pre-proposals received, pre-proposals encouraged to submit as full proposals, full proposals received, and projects awarded funding, FY18-22.

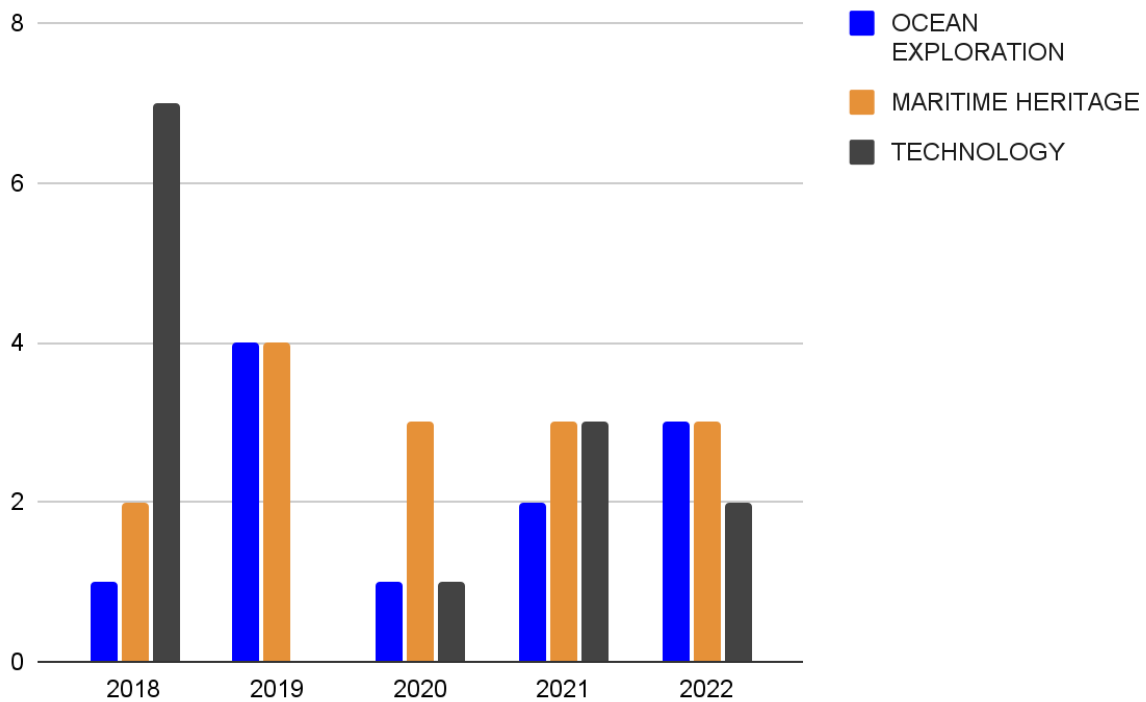
The eight projects funded through the Ocean Exploration Fiscal Year 2022 Funding Opportunity are noted in **Table 1**. More details about each project are in **Appendix A**.

**Table 1.** Funded projects for the Ocean Exploration Fiscal Year 2022 Funding Opportunity (arranged alphabetically by project title).

Project Title	PI, Entity	Theme	Expected Close Out
AUV-Based Acoustic Mapping and Characterization of Seafloor Hydrothermal Discharge	Xu, Guangyu University of Washington	Technology	June 2024
Characterizing Variability in Pacific Northwest Methane Seeps Using a Fleet of Small AUVs	McNeil, Craig University of Washington	Exploration	June 2024
Exploring Attu’s Underwater Battlefield and Offshore Environment	Raupp, Jason East Carolina University	Maritime Heritage	June 2023

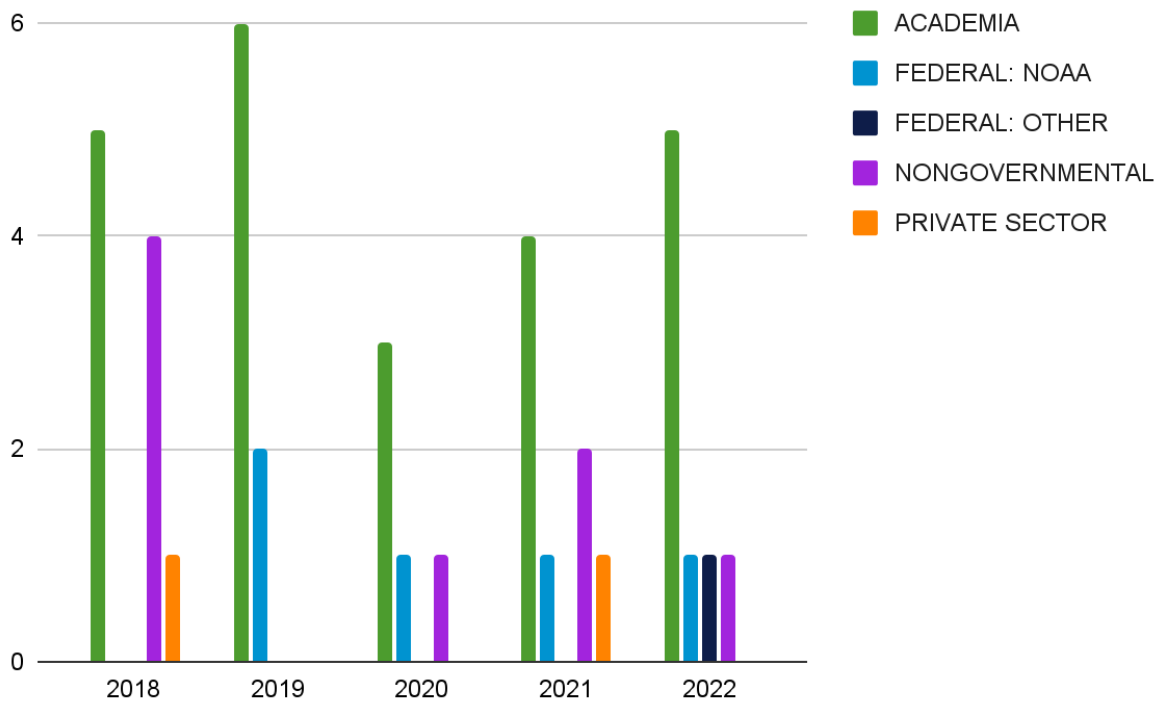
Project Title	PI, Entity	Theme	Expected Close Out
Exploring the Biodiversity of Remote Pacific Ocean Deep-Sea Coral Communities With eDNA	Everett, Meredith NOAA Northwest Science Fisheries Center	Exploration	June 2024
Exploring Deepwater WWII Battlefields in the Pacific Using Emerging Technologies	McKinnon, Jennifer Ships of Exploration and Discovery Research	Maritime Heritage	June 2024
Exploring Pelagic Biodiversity of the Gulf of Alaska and the Impact of Its Seamounts	Hopcroft, Russell University of Alaska Fairbanks	Exploration	June 2024
Guam: A Biogeographic and Maritime Cultural Landscape Exploration of a WWII Amphibious Battlefield	Wright, Anne National Park Service Submerged Resource Center	Maritime Heritage	June 2024
Machine Learning-Based Automated Detection of Seafloor Gas Seeps	Skarke, Adam Mississippi State University	Technology	June 2024

Each year, NOAA Ocean Exploration attempts to balance the distribution of funds across the three themes (ocean exploration, technology, and maritime heritage). Final allocation of funds is based on the number of project proposals received in each of the three focus areas. Both the theme ranking and overall competition rank are evaluated. **Figure 3** shows the distribution of awards by theme for FY18-22.

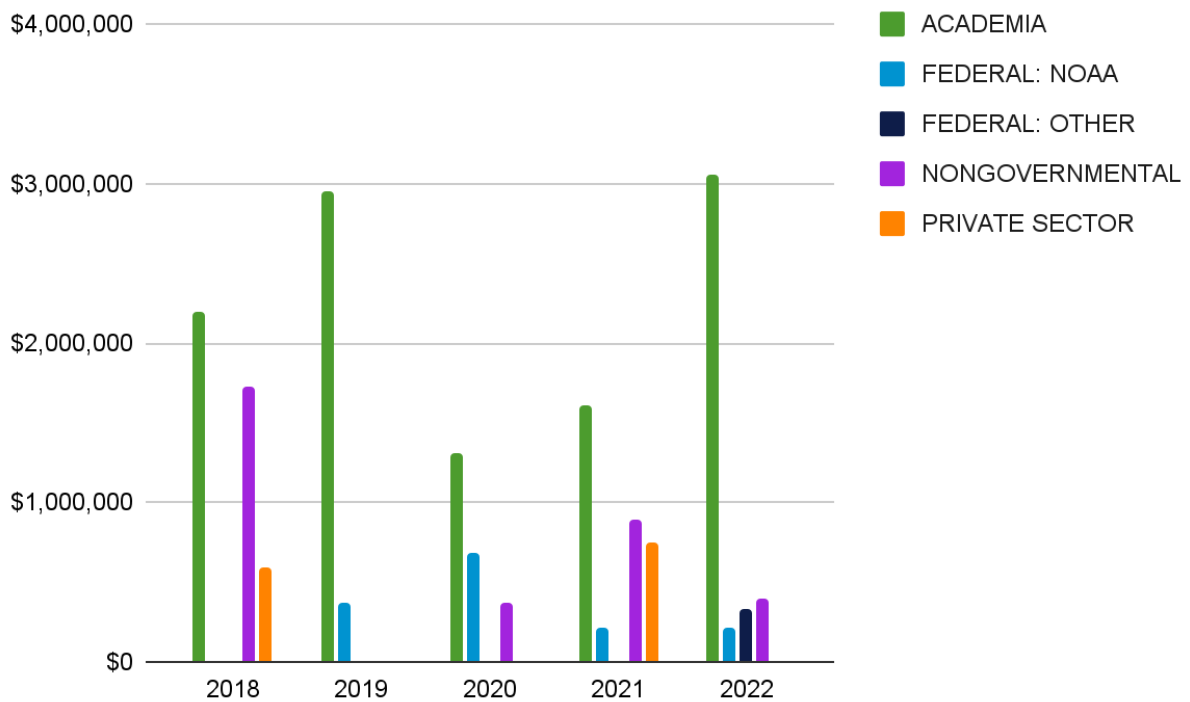


**Figure 3.** Distribution of NOAA Ocean Exploration funding opportunity awards by theme, FY18-22. The FY19 competition did not include a technology theme. Applicants before FY20 were able to select multiple themes, so some projects may be represented in multiple categories.

Between FY18 and FY22, NOAA Ocean Exploration funded proposals received from academia, federal agencies, nongovernmental organizations, and the private sector. Overwhelmingly, academia has received the most funds (see **Figures 4** and **Figure 5** for distribution of awards and funds). Reasons for disproportionate funding may include academics’ reliance on grant funding as their primary funding source. NOAA Ocean Exploration recognizes that nongovernmental and private-sector entities have an increasing role in ocean exploration, maritime heritage, and technology development, and NOAA Ocean Exploration continues to consider opportunities to engage these entities.



**Figure 4.** Distribution of NOAA Ocean Exploration funding opportunity awards by sector, FY18-22.

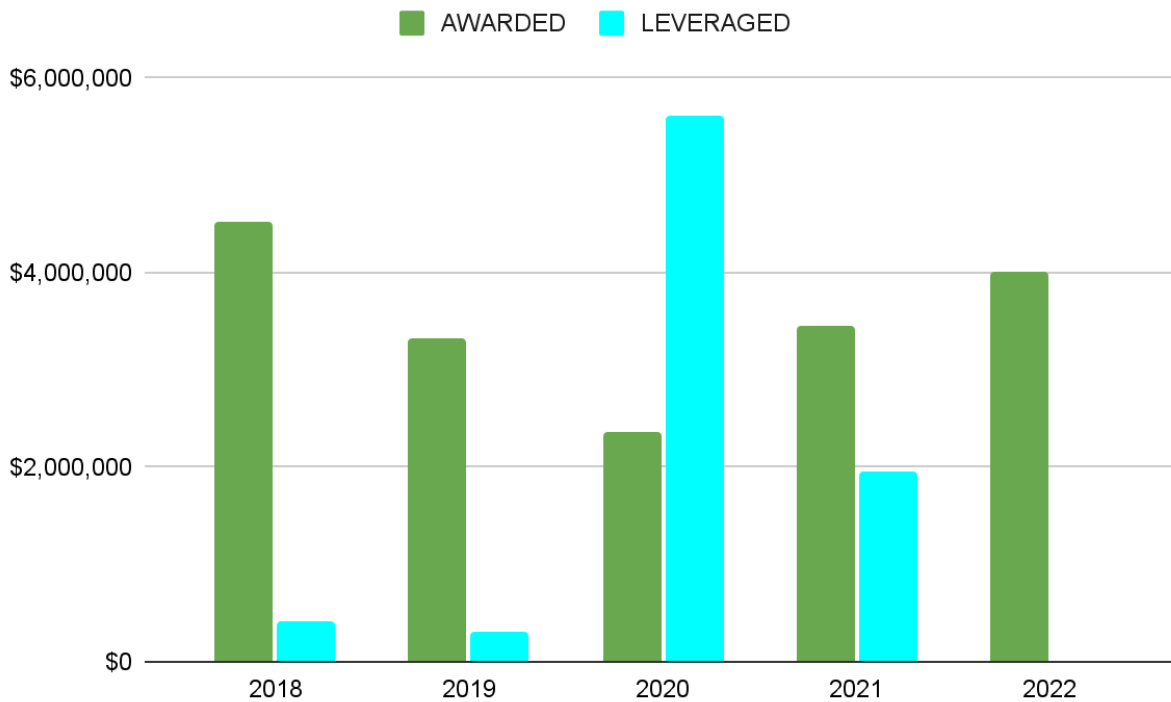


**Figure 5.** Distribution of NOAA Ocean Exploration funding opportunity funds by sector, FY18-22.

In support of these opportunities, NOAA Ocean Exploration encourages interdisciplinary exploration that can be accomplished through partnerships between academia, government agencies, nongovernmental organizations, the private sector, and state entities. In this way, the NOAA Ocean Exploration funding opportunity supports collaboration networks across the entire ocean exploration community.

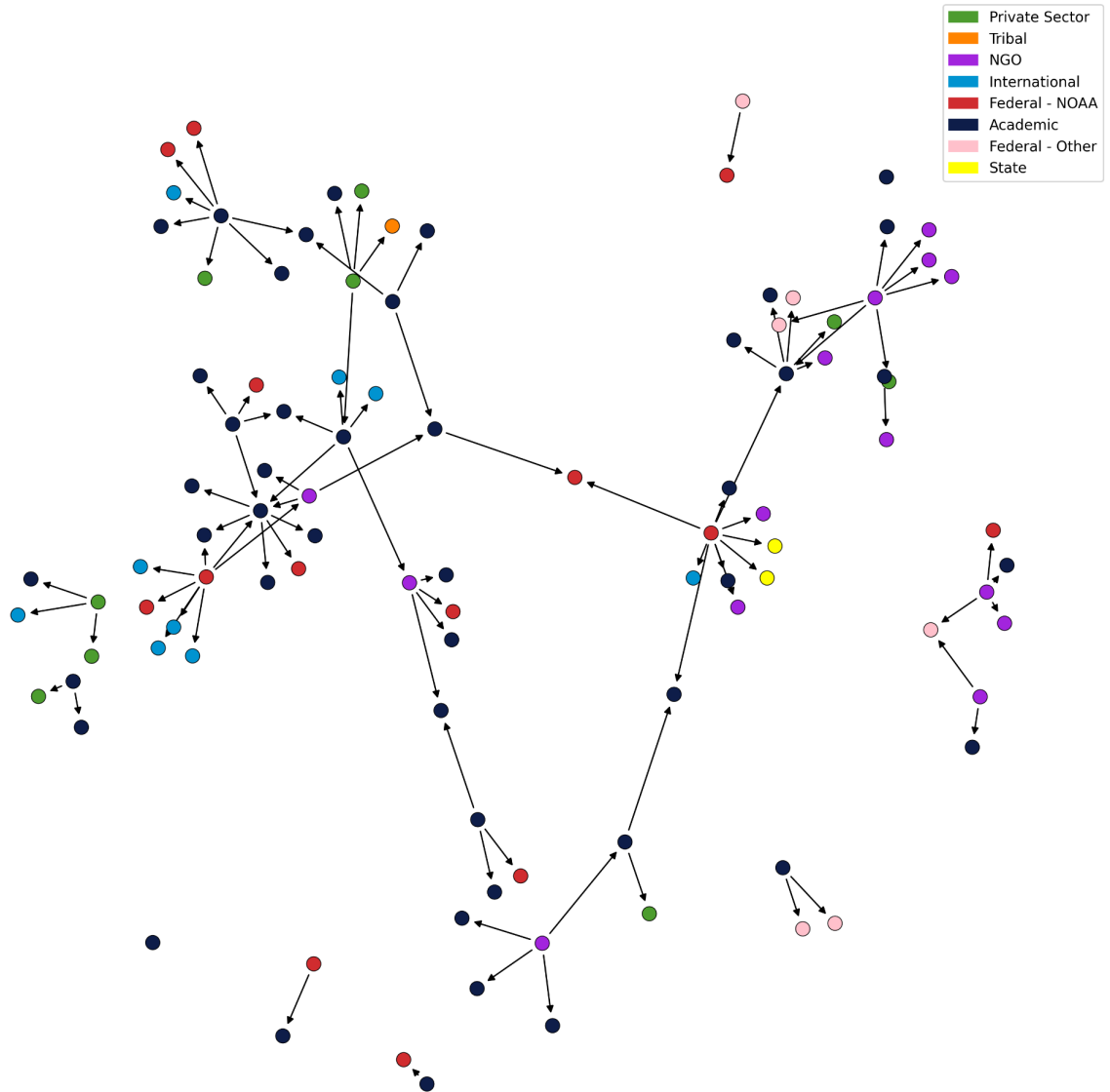
Funded proposals often leverage additional support in the form of cost-sharing, ship time, in-kind contributions, and other services, resources, and personnel time not covered by NOAA Ocean Exploration funding. Funded projects leveraged over 8.2 million in additional support between FY18 and FY22 (see **Figure 6**). In FY22, leveraged support included ship time, platform assets, and salary funding. Leveraged support (both technical and monetary) is opportunistic and is controlled by factors external to NOAA Ocean Exploration. Sometimes this support includes funding from other agencies or entities. Leveraged support and outside funding are not required to receive funding via the NOAA Ocean Exploration funding opportunity.





**Figure 6.** Funding awarded via the NOAA Ocean Exploration funding opportunity and support leveraged, FY18-22.

PIs, co-PIs, and other significant contributors funded by NOAA Ocean Exploration between FY18 and FY22 represent a variety of entities both domestically and internationally. **Figure 7** is a visual representation of the collaborative nature of NOAA Ocean Exploration-funded projects and shows the wide reach of NOAA Ocean Exploration’s funding opportunity beyond the eight principal investigators who were directly funded. The directionality of the arrows in **Figure 7** indicates the direction of collaboration from awarded entities to collaborating entities. Each point in the network represents one entity and may represent multiple projects if awards were given to multiple principal investigators from an entity between FY18 and FY22. This institutional network depicts 92 relationships between 100 unique entities. These collaborations have resulted in the inclusion of sectors that did not directly receive NOAA Ocean Exploration funding between FY18 and FY22, specifically state and foreign entities.



**Figure 7.** Network of principal investigators, co-principal investigators, and other significant contributors collaborating as a result of the NOAA Ocean Exploration FY18-22 funding opportunities.

## Grants Closeout During FY22

Nine grants were closed out during FY22. The final reports and publications for these projects will be archived with the [NOAA Institutional Repository](#) once available.

## Acknowledgments

The authors would like to thank those staff members who contributed to the “FY22 Annual NOAA Ocean Exploration Competitive Grant Program Fiscal Report.” We would like to especially thank the FY22 awardees; the NOAA Ocean Exploration competitive grant team of Ashley Marranzino, Caitlin Adams, Chris Beaverson, Katharine Egan, Steve Hammond, Patrick Cooper, Phil Hartmeyer, Chrissy Ortiz, and James Kot, whose support makes this program possible; Christa Rabenold for editorial support; Matt King for his document design expertise; and Anna Lienesch for ensuring that this report is publicly available in the NOAA Central Library and is readily accessible.

## Sources for Additional Information

Searchable online table for past NOAA Ocean Exploration funding opportunity projects from FY14 through present: <https://oceanexplorer.noaa.gov/about/funding-ops/ffo-recipients.html>

NOAA Ocean Exploration and Research bibliography:  
<https://libguides.library.noaa.gov/oceanexplorationbib>

More information about NOAA Ocean Exploration’s competitive grant program and contacts:  
<https://oceanexplorer.noaa.gov/about/funding-ops/welcome.html>

## Appendix A: Abstracts of FY22 Funded Projects

**Title:** AUV-Based Acoustic Mapping and Characterization of Seafloor Hydrothermal Discharge

**Principal Investigator:** Guangyu Xu, University of Washington

**Theme:** Technology

**Abstract:** Hydrothermal vents often feature a variety of unique biological communities and metal-rich deposits, making them important to society and economies. However, most hydrothermal vent sites discovered to date are on the deep-ocean floor at great depths below the sea surface. Because of the inherent difficulties of deep-sea exploration and the inadequacy of existing vent-characterization techniques, the majority of the known hydrothermal vent fields remain poorly studied, and many sites are yet to be discovered. To advance our knowledge about hydrothermal vents, this research team will develop an innovative approach to identifying, locating, and characterizing hydrothermal discharge using an autonomous underwater vehicle (AUV) equipped with coordinated multibeam sonars. After a robust evaluation program, which will include computer simulations and laboratory experiments at an engineering tank facility, the new approach will be demonstrated at an active hydrothermal vent site off the Oregon/Washington coast. Anticipated outputs include seafloor bathymetry, 3D acoustic plume images, quantitative vent maps, and 3D panoramic images of vent sites. By extending the capabilities of AUVs, this project will deliver an efficient approach to collecting comprehensive baseline data about hydrothermal activity needed by researchers and policy makers.

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**Title:** Characterizing Variability in Pacific Northwest Methane Seeps Using a Fleet of Small AUVs

**Principal Investigator:** Craig McNeil, University of Washington

**Theme:** Exploration

**Abstract:** Methane is a potent greenhouse gas, and it's released into the ocean from the seafloor as gas bubbles via methane seeps. Despite the prevalence of seeps along continental margins, data is limited, and their impacts on the ocean and atmosphere, both positive and negative, are poorly understood. To advance our knowledge about methane seeps, this research team will develop and demonstrate an approach to efficiently and effectively map and characterize methane seeps over wide areas. This approach will use easily deployable and relatively inexpensive autonomous underwater vehicles equipped with imaging sonars and custom sensors to find and map seeps and measure associated bubbles and dissolved methane right at the source and up through the water column. The team will demonstrate their approach at known seep sites off the coasts of Washington and Oregon with the goal of

improving our understanding of how methane from these seeps influences life on the seafloor and in the water column as well as its role in the global carbon cycle.

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**Title:** Exploring Attu’s Underwater Battlefield and Offshore Environment

**Principal Investigator:** Jason Raupp, East Carolina University

**Theme:** Maritime Heritage

**Abstract:** Attu in Alaska’s Aleutian Islands is the site of the only World War II (WWII) battle fought on North American soil. In 2019, the Attu Battlefield and associated airfields were incorporated into the Aleutian Islands WWII National Monument. Nevertheless, few people know about the battle, the larger campaign, or their significance to the nation, and Attu’s underwater battlefield is completely undocumented. To bring attention to this chapter in U.S. history, this research team will inventory Attu’s maritime heritage sites. To do so, they will use an innovative synthetic aperture sonar system both towed behind a research vessel and deployed on an uncrewed underwater vehicle to map the seafloor and detect targets. A remotely operated vehicle will be used to capture follow-up video and still photographs. In addition to discovering and documenting WWII maritime heritage sites, this team also seeks to answer questions about Attu’s pre-war maritime history and hire Alaska Native consultants to contribute to our understanding of Attu’s marine environment and the Unangax<sup>^</sup> (oo-naan-gah)/Sasignan population displaced by the U.S. government during the war. Finally, this work will provide a foundation for further work to locate missing in action U.S. and Japanese service personnel.

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**Title:** Exploring the Biodiversity of Remote Pacific Ocean Deep-Sea Coral Communities With eDNA

**Principal Investigator:** Meredith Everett, NOAA Northwest Science Fisheries Center

**Theme:** Exploration

**Abstract:** Deep-sea corals and the animals that live among them are an important component of community biodiversity in the deep-sea worldwide. Despite the growing interest in resource development in the deep ocean, there has been little research on the impacts it may have on deep-sea benthic communities. And, since they’re difficult to access, they’re difficult to study. This research team will use environmental DNA (eDNA) and voucher specimens collected from deep waters around remote islands and seamounts in the Pacific to improve our understanding of the biodiversity and biogeographic boundaries of deep-sea coral communities in the remote tropical region of the Pacific. Their work will involve identifying deep-sea coral species from voucher specimens, developing an eDNA reference database using these specimens, and using

this database to analyze eDNA samples collected in deep-sea coral communities across the region. This work will provide protocols and baseline data, which will facilitate further exploration and research and inform management of marine protected areas in the region.

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**Title:** Exploring Deepwater WWII Battlefields in the Pacific Using Emerging Technologies

**Principal Investigator:** Jennifer McKinnon, Ships of Exploration and Discovery Research, Inc.

**Theme:** Maritime Heritage

**Abstract:** The U.S. victory over Japan in the Battle of Saipan in the Northern Mariana Islands in 1944 was a decisive moment for World War II (WWII) in the Pacific. Today, the landing beaches for the U.S. invasion are part of a U.S. National Historic Landmark District. Despite their significance, the subsea remains of the battle (shipwrecks, tanks, amphibious vehicles, aircraft, and more) remain unexplored. This research team will use emerging technologies to locate, explore, and characterize the offshore battlefield's maritime heritage resources. They will apply artificial intelligence to lidar data to locate and identify these resources and use remotely operated vehicle photogrammetric modeling to document them. In addition, at each site they will collect environmental DNA to better understand its biodiversity and employ military veteran divers, as part of a citizen science rehabilitative therapy training program, to gather the data. The results of this project will help marine resource managers understand the socioeconomic value of these important archaeological and biological resources (e.g., for tourism and fisheries) and increase public appreciation and understanding of WWII maritime heritage.

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**Title:** Exploring Pelagic Biodiversity of the Gulf of Alaska and the Impact of Its Seamounts

**Principal Investigator:** Russell Hopcroft, University of Alaska Fairbanks

**Theme:** Exploration

**Abstract:** The northern Gulf of Alaska is a region of high productivity and supports some of the nation's largest commercial fisheries. But, ocean warming and deoxygenation are raising concerns about the future of the region's poorly understood deep waters and the fish and invertebrates that live there. This research team has devised a novel, multipronged exploration program to investigate the diversity and distribution of these deep-ocean animals. Building on previous work, their program includes acoustic, photographic, video, and physical and molecular (DNA) inventories of the small animals (zooplankton and micronekton) in the water column, like fish, crustaceans, gelatinous animals, and squid. Special attention will be given to how seamounts and changing biomass of gelatinous animals (due to a warming ocean) impact water column communities. By integrating state-of-the-art acoustic sensing and sampling

methods, including a towed imaging system, this project will add to our understanding of the ecology of the northern Gulf of Alaska, the connections between its shelf and ocean habitats, and its response to changing conditions. It will also help us better manage the important resources provided by the region.

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**Title:** Guam: A Biogeographic and Maritime Cultural Landscape Exploration of a WWII Amphibious Battlefield

**Principal Investigator:** Anne Wright, National Park Service Submerged Resource Center

**Theme:** Maritime Heritage

**Abstract:** During World War II (WWII), Guam was a strategic military location for both the United States and Japan. In July 1944, U.S. troops invaded and secured the Japanese-held island. There has not been a comprehensive inventory of the submerged resources related to the invasion, but evidence suggests there is likely a significant amount of WWII-related cultural resources on the seafloor near the landing beaches of Asan and Agat (now units of the War in Pacific National Historical Park). This research team will use autonomous underwater and remotely operated vehicles and divers to identify, map, and document submerged resources related to the invasion (e.g., shipwrecks, aircraft, amphibious vehicles, and artillery). They will also assess war-related impacts on the coast, seafloor, and barrier coral reef to investigate how damage to the reef may have impacted the island's ecosystem and coastal vulnerability. This project will further our understanding of one of the most significant invasions of the WWII Pacific theater as well as how it may have shaped the natural environment in the area today.

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**Title:** Machine Learning-Based Automated Detection of Seafloor Gas Seeps

**Principal Investigator:** Adam Skarke, Mississippi State University

**Theme:** Technology

**Abstract:** Seafloor gas seeps are hotspots of deep-sea biodiversity, an important part of the global carbon cycle, indicators of potential marine geohazards, and an energy production resource. However, the deep ocean is largely unexplored, and most seeps are discovered through manual visual analysis of water column sonar imagery, which is time consuming, costly, and inconsistent, so a lot remains to be learned about their extent, abundance, and contribution to global scale processes. Recognizing the importance of seeps and the significant potential for further seep discovery, this research team will develop an efficient and cost-effective machine learning-based software system to automatically detect gas seeps in mapping sonar water column data. The system, trained and validated using a database of known seeps, will allow detection of seeps in newly collected or archived multibeam sonar water column data

and has the potential to rapidly advance the scope and efficiency of global seafloor seep discovery in support of ocean research, resource management, and economic development.