

# E/V NAUTILUS 2022 EXPEDITIONS

Scientist Ashore Community Call  
February 16, 2022



**NAUTILUS LIVE**  
OCEAN EXPLORATION TRUST







**Explore** the ocean,  
seeking out **new discoveries**  
in the fields of geology, biology,  
maritime history, and  
archaeology while pushing the  
boundaries of  
**STEM education** and  
**technological innovation.**





# PRIORITIES

## DRIVERS FOR OET'S EXPLORATION PROGRAM

Aligning with NOAA & other sponsor priorities

Federal NOMECS Strategy

Seabed 2030

UN Decade of Ocean Science

Biden/Harris Administration priorities (e.g. 30 by 30, climate change)

Blue Economy & building STEM workforce

STEM Education

Justice, Equity, Diversity & Inclusion

Collaboration





Papahānaumokuākea  
Marine National Monument

Hawai'i

Johnston  
Atoll

Wake  
Island

Guam

Pacific Remote Islands  
Marine National Monument

Kingman Reef &  
Palmyra Atoll

Howland &  
Baker Islands

Jarvis

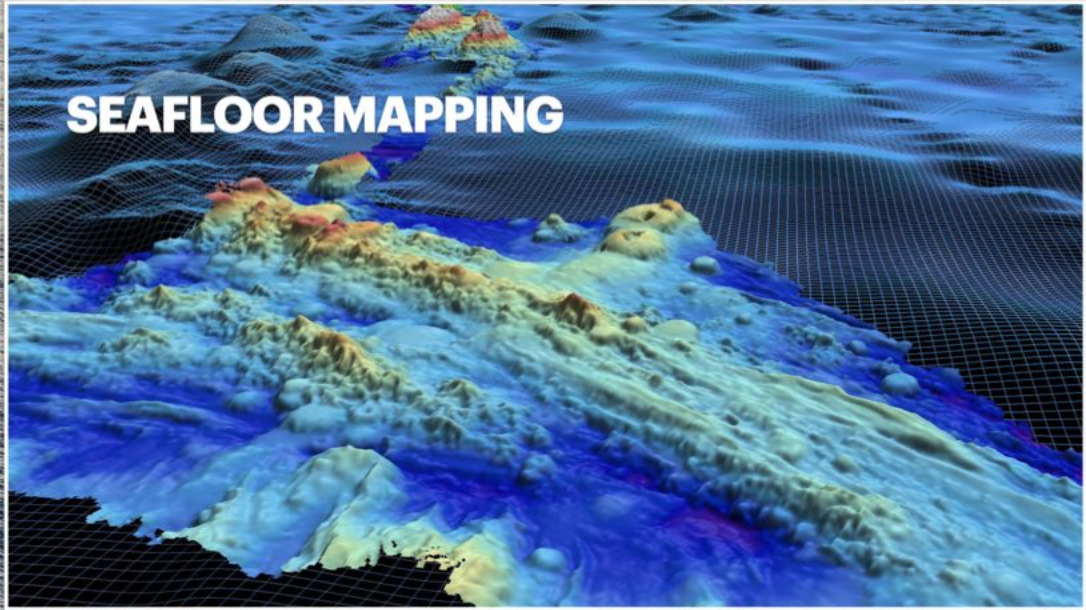
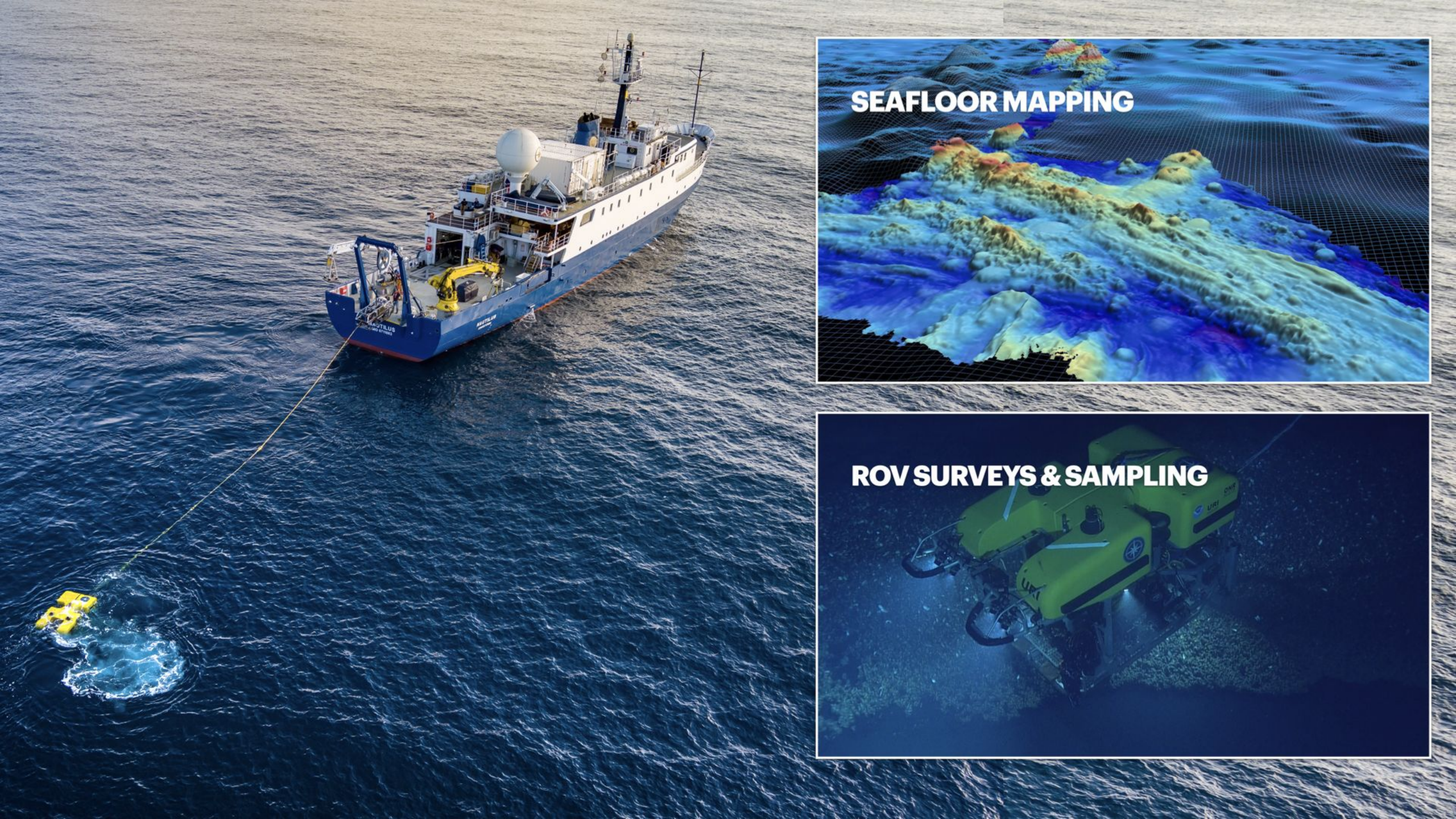
American  
Samoa

2022



**NAUTILUS LIVE**  
OCEAN EXPLORATION TRUST



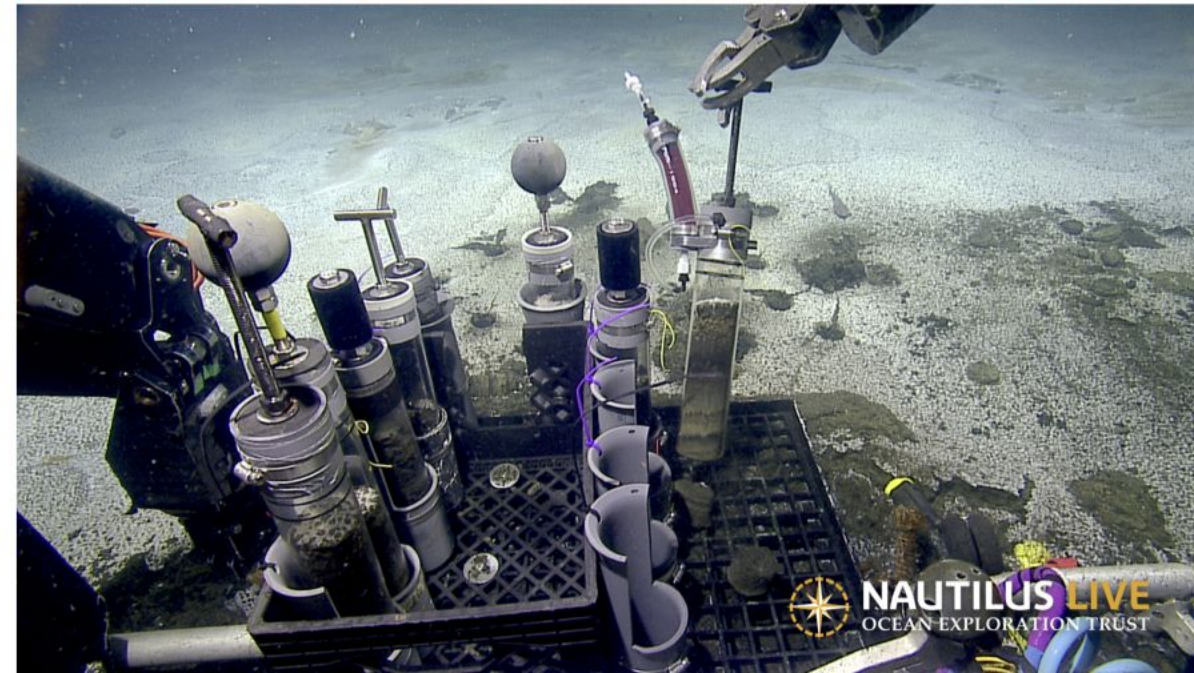
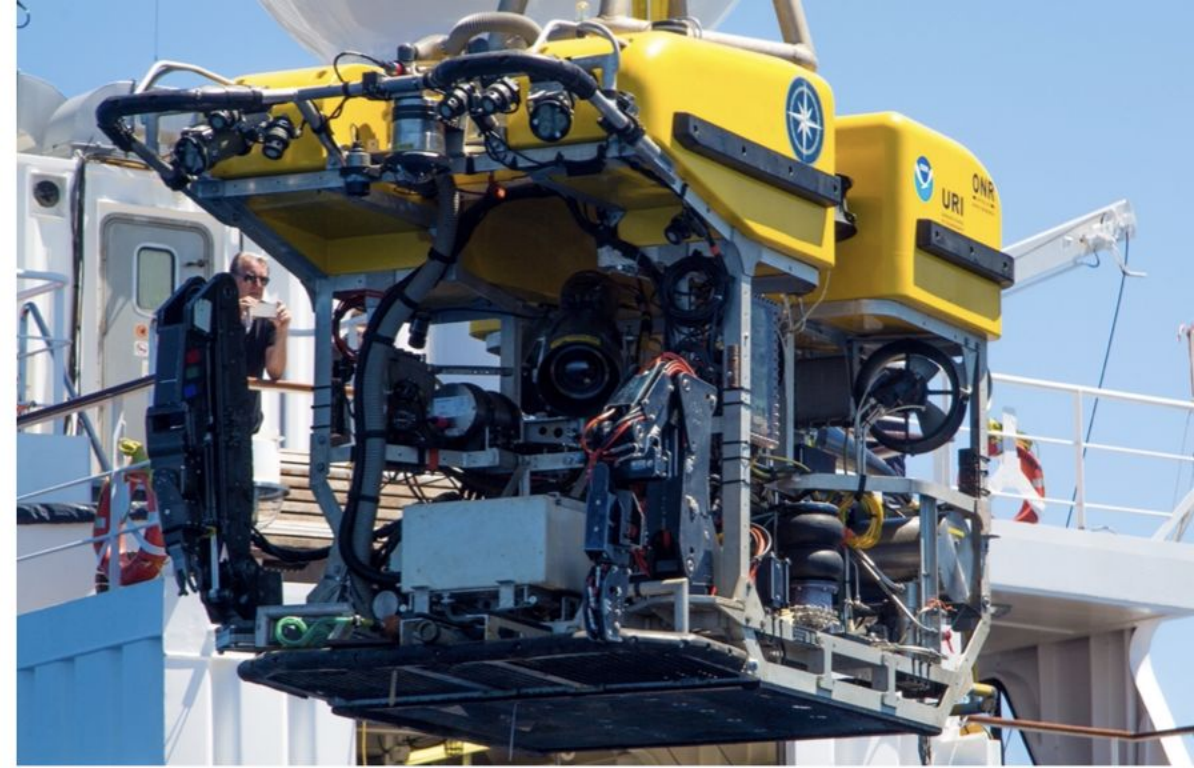




# ROV SURVEY & SAMPLING

## CAPABILITIES

- ROV *Hercules* (4000 m), Towsled *Argus* (6000 m)
- 250 lb payload for samples/equipment
- Mission configurable standard sampling tools
  - 11" push cores (up to 8)
  - 5-L Niskins (up to 6)
  - Suction sampling system (up to 8x 3-L)
  - CTD, oxygen optode, temp probe, scanning sonars
  - configurable sample boxes & crates
- Flexibility for user-installed technologies/sensors

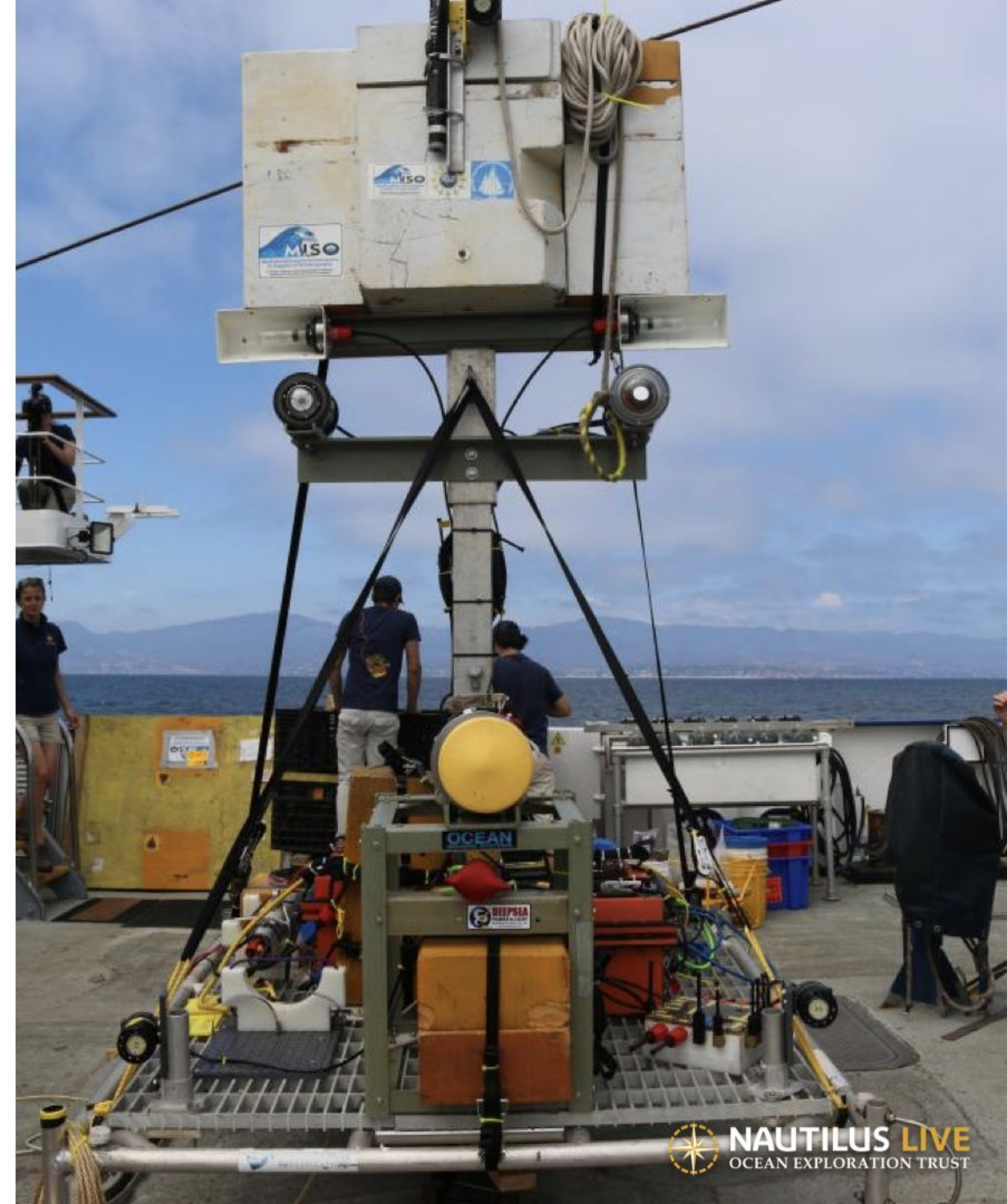




# GUEST TECHNOLOGIES

## EXAMPLES: ROV & OVER-THE-SIDE DEPLOYED

- **VISUAL**
  - Still cameras (OSU Sexton, WHOI-MISO Mesocam)
  - NGS Deep Sea drop cameras
- **SELF-LOGGING INSTRUMENTS**
  - MAPR (miniature autonomous plume recorder)
  - Passive acoustics
  - Waverider buoys
  - Argo biogeochemical floats
- **MAPPING**
  - LiDAR
  - NORBIT high-resolution sonar
- **SAMPLING DEVICES**
  - Gastights
  - *In situ* water filtration
  - Mass spectrometer
  - Soft grippers for coral sampling





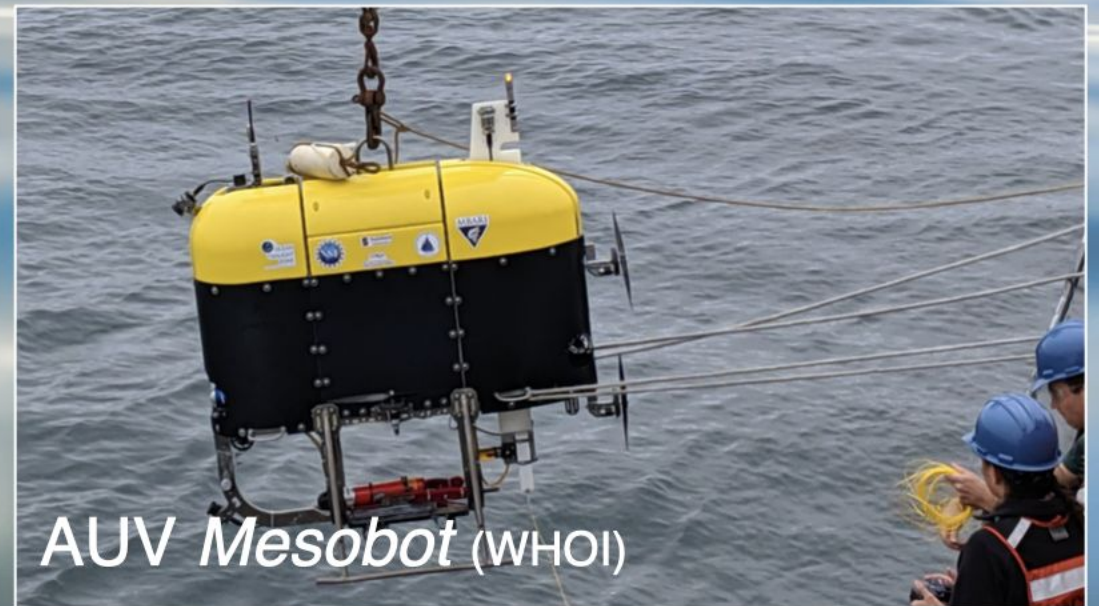
# UNCREWED SYSTEMS



USV DriX (UNH)



HROV NUI (WHOI)



AUV Mesobot (WHOI)

oeci





# EDUCATION & OUTREACH

## SHARING STORIES WITH THE WORLD

- Science & Engineering Internships
- Science Communication Fellowships
- Live ship-to-shore Broadcasts  
(‘Ōlelo Hawai‘i & English)
- K-12 educational resources  
(Spanish & English)
- NautilusLive.org website
- Social media
- Media production





# WHO'S ABOARD NAUTILUS?

SCIENCE PARTY = 33 PPL

**LEAD SCIENTIST(S)** — (1-2 leads) Represents the interests of the broader ocean exploration community and fosters collaboration to ensure broad and inclusive science objectives are met. Author cruise and dive plans. Typically participate on expedition in person.

**EXPEDITION LEAD** — (1 lead) Coordinates expedition planning and implementation, including integration of plans amongst expedition teams. Keeps all stakeholders informed of progress and evolving plans.

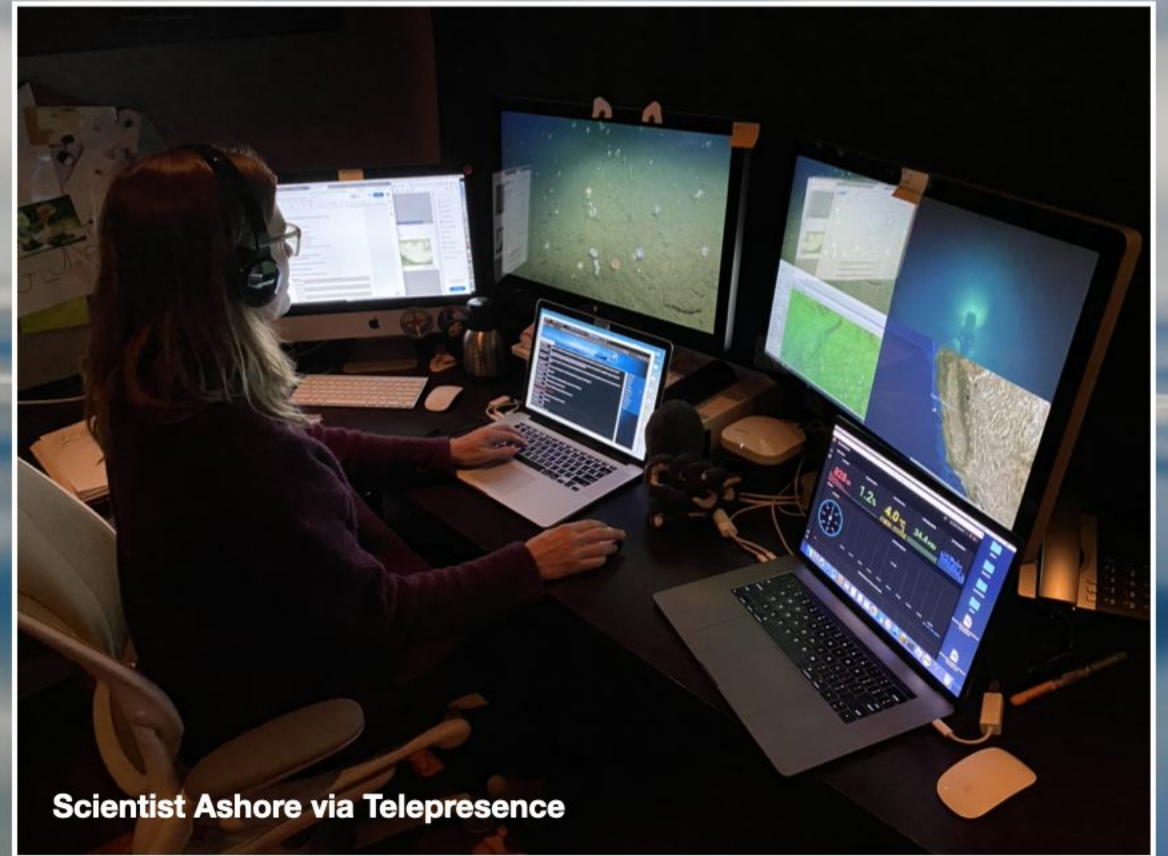
**WATCH LEADERS** — (3 leads) Subject matter experts that guide ROV operations on behalf of broader community interests. Onboard liaisons with Scientists Ashore.

**SCIENCE & OPERATIONS TEAM** — ROV pilots, navigators/mappers, video engineers, data loggers, partner vehicle teams, communications & outreach

**EDUCATION PROGRAM PARTICIPANTS** — Science Communication Fellows, Science & Engineering Internship Program participants, OECI graduate students & interns



# WHO'S "ABOARD" NAUTILUS?

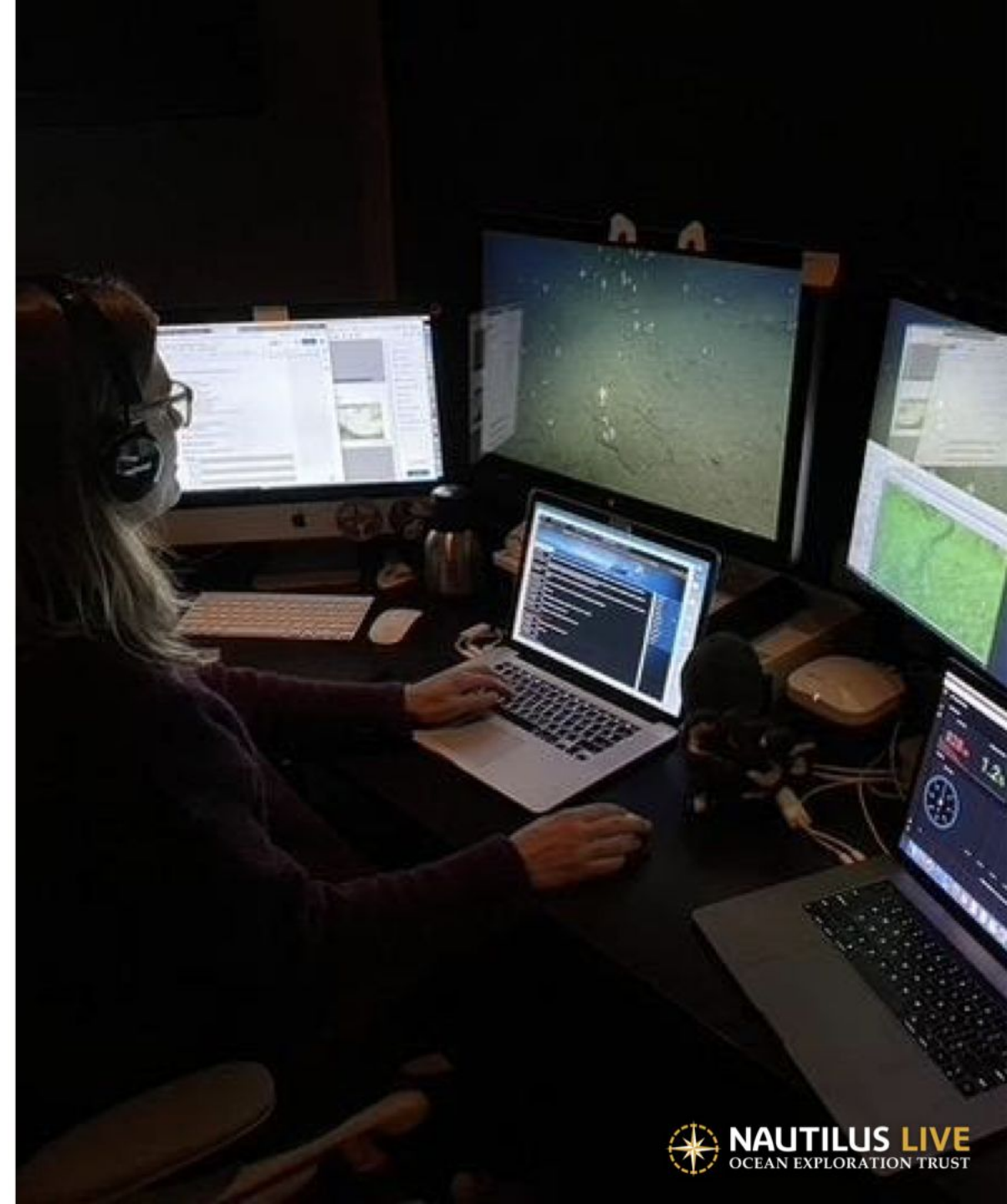




# SCIENTIST ASHORE PROGRAM

## EXPANDING OPPORTUNITIES FOR PARTICIPATION

- **PLANNING**
  - Provide input on expedition plans and sampling objectives
  - Scientist Ashore Interest Form
  - Questions? email us at [science@oet.org](mailto:science@oet.org)
- **DURING EXPEDITIONS**
  - Contribute via OET's Scientist Ashore Portal & text-based chat
  - Assist with dive and sampling objectives
  - Receive daily updates & dive plans (email)
- **POST-EXPEDITIONS**
  - Open access to samples & data
  - Participate aboard future expeditions





# 2022 OCEAN EXPLORATION TRUST EXPEDITIONS

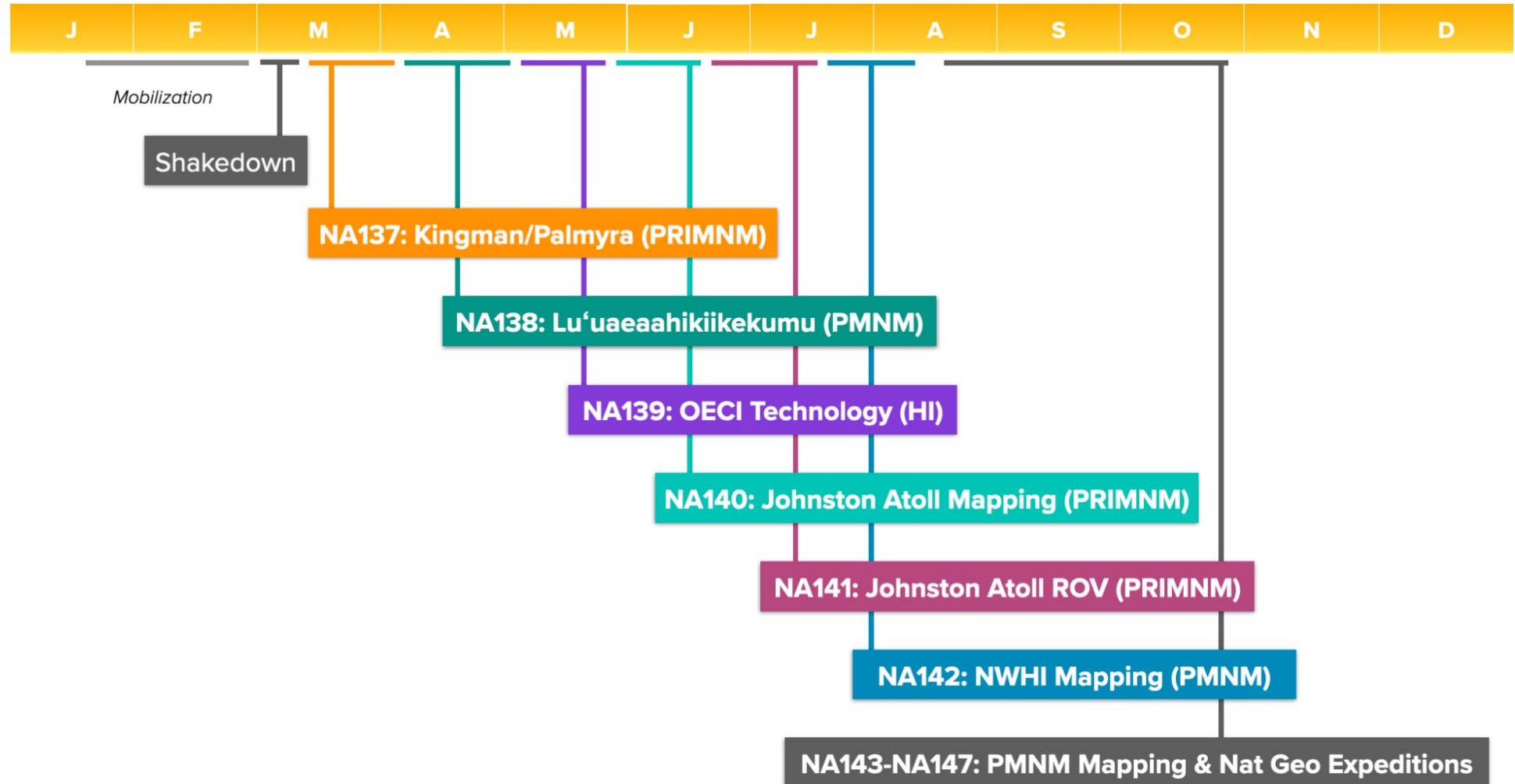
## SEASON AT A GLANCE





# 2022 OCEAN EXPLORATION TRUST EXPEDITIONS

## SEASON AT A GLANCE





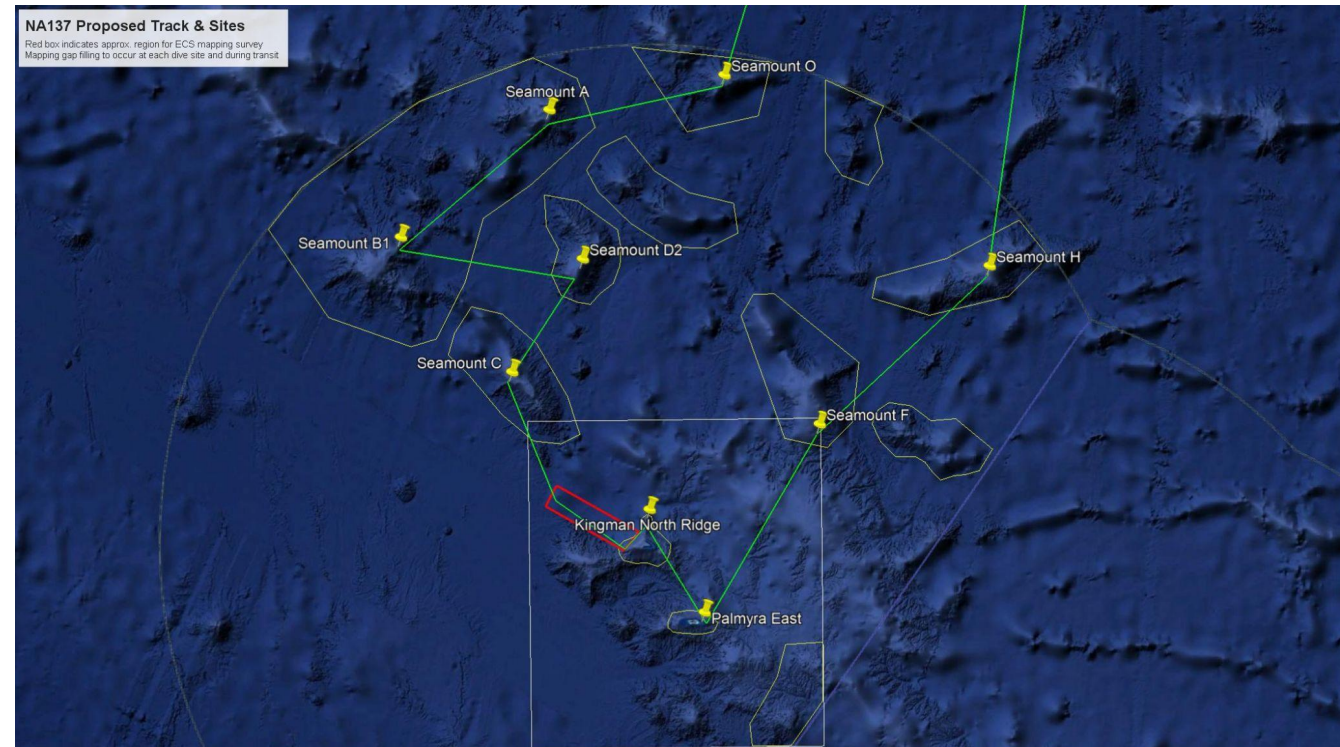
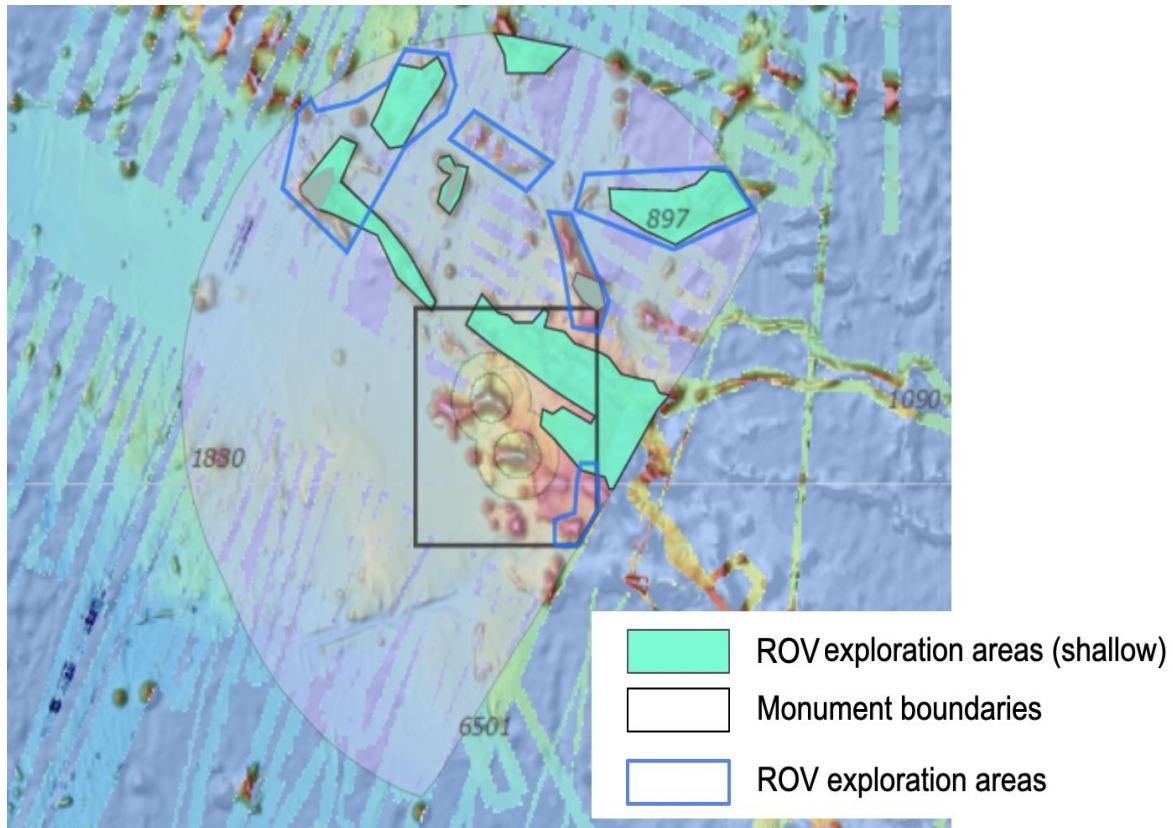
# Kingman Reef & Palmyra Atoll

NA137 | 14 March - 4 April (22 days)

**Lead Scientists:** Steve Auscavitch (Boston University)  
 Dwight Coleman (University of Rhode Island)  
 Adam Soule (University of Rhode Island)  
 Katie Kelley (University of Rhode Island)

Expedition objectives:

- 12-13 dives between 200-3500m aimed at biological & geological characterization
- Gap-fill mapping for dive site selection



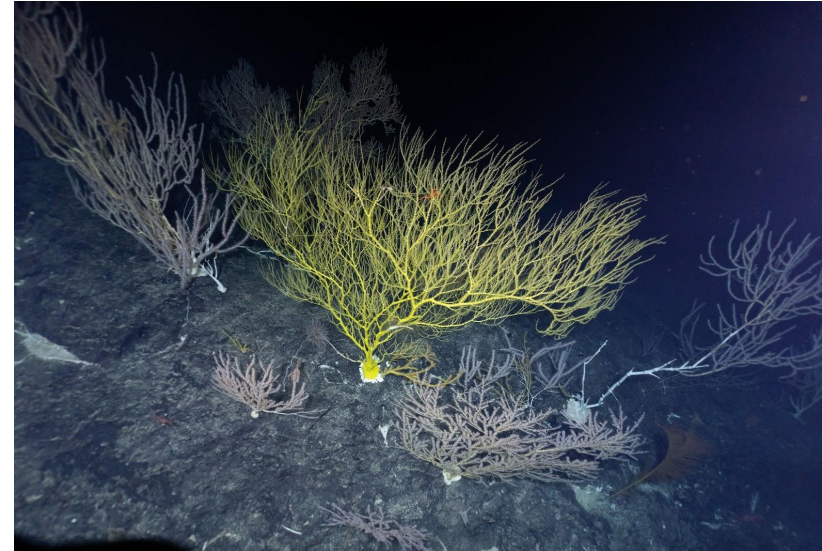


# Kingman Reef & Palmyra Atoll

NA137 | 14 March - 4 April

Sampling and observation objectives:

- Rock collections for crust for ferromanganese crust geochemistry and seamount age dating.
- Collect biology that represent possible new species, records, or associations that contribute to biogeographic knowledge of the area.
- Identifying dense and diverse biological communities, including deep-water sponges and corals.
- Collecting water samples to profile eDNA associated with benthic communities.





# Lu‘uaeahikiiekumu at Lili‘uokalani Ridge



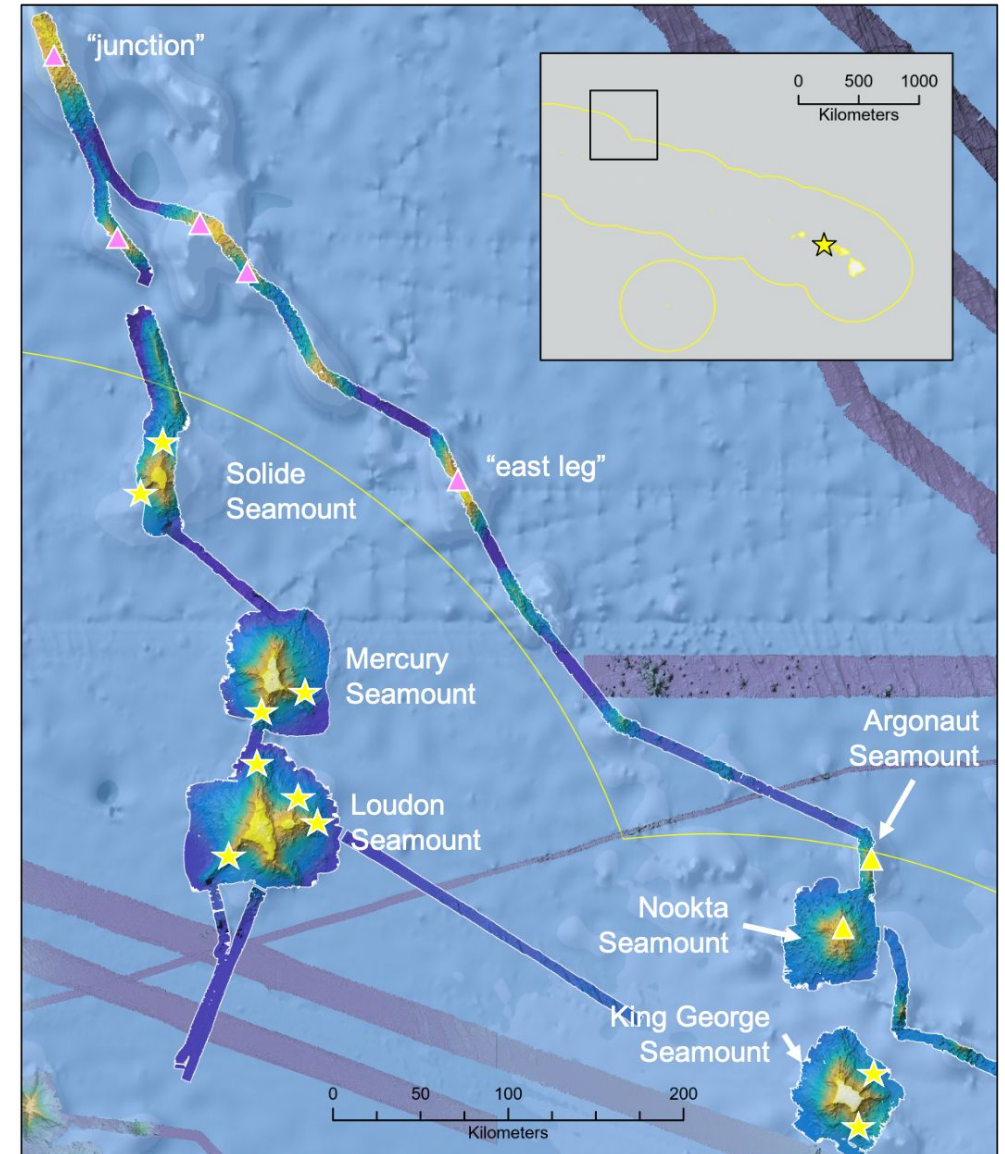
NA138 | 7 April - 1 May (24 days)

**Lead Scientists:** Beth Orcutt (Bigelow Laboratory for Ocean Sciences)  
Chris Kelley (University of Hawai‘i-emeritus)  
Randy Kosaki (NOAA PMNM)

The ‘Ōlelo Hawai‘i expedition name Lu‘uaeahikiiekumu represents the journey to and the work looking at the source and foundation of the oceans and islands through ROV dives.

## Goals:

- Document the biological diversity of unexplored seamounts within the Papahānaumokuākea Marine National Monument (PMNM), particularly for deep-sea corals, sponges and fishes
- Collect rock samples for determining the origin and age of the seamounts
- Determine the microbial ecosystem services and mineral content of minerals crusts that form on the rocks of the seamounts





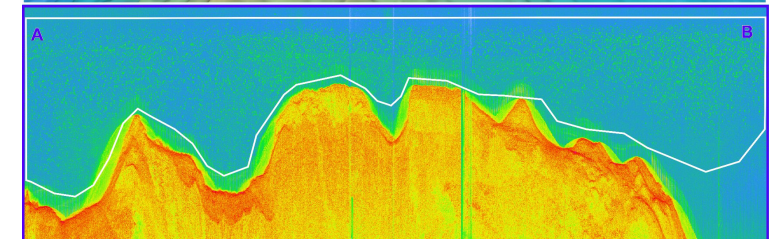
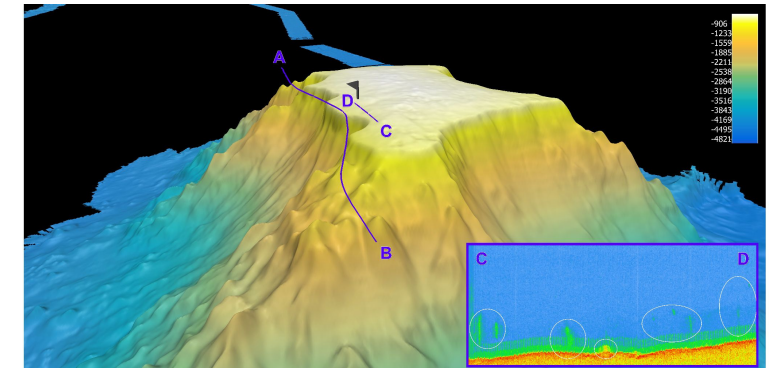
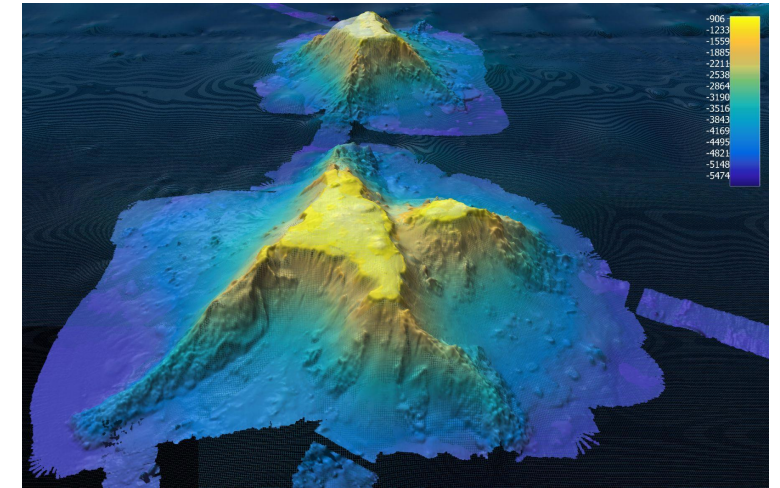
# Lu'uaeahikiiekumu at Lili'uokalani Ridge



NA138 | 7 April - 1 May (24 days)

## Specific Objectives:

- Conduct ROV surveys and additional multibeam sonar mapping of the Lili'uokalani seamounts located in the northern part of the poorly explored expansion area of the PMNM.
- Collect basaltic rock samples from each of the seamounts for geochemical dating analyses to determine their age and process by which they formed and examine why a fork exists in this seamount trail.
- Determine if these seamounts support extensive, high density coral and sponge communities similar to those discovered on the Hawaiian Ridge or the Voyager Seamounts farther south. Also determine if several of these seamounts support commercially valuable fisheries species.
- Collect specimens, particularly of corals, sponges, and their associates, that may be new records for the central Pacific or new species to science.
- Collect samples of basalt and attached ferromanganese crusts to examine mineral content and microbial ecosystem services.
- Collect water samples for eDNA analysis.





# OEI Tech Challenge

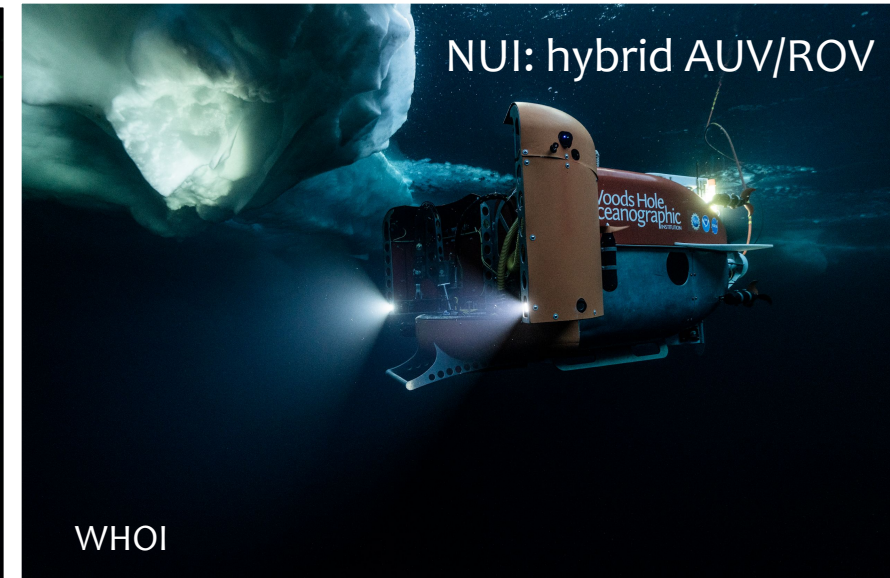
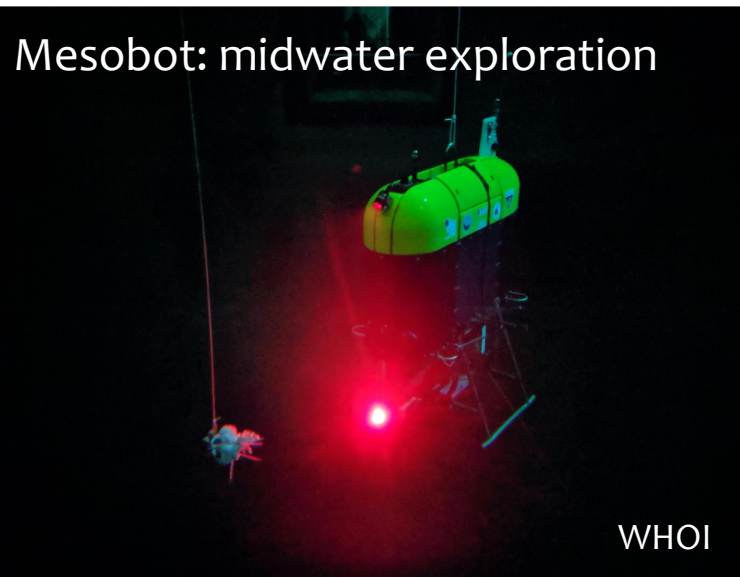
NA139 | 6 - 22 May (16 days)

**Lead Scientists:** Robert Ballard (OET)  
Larry Mayer (UNH)  
Dana Yoerger (WHOI)  
Andy Bowen (WHOI)

## Goals:

Building on 2021 at-sea trials, this expedition will continue to test and demonstrate operational capabilities that have three autonomous vehicles:

- communicating with each other while they are simultaneously deployed
- being re-tasked based on information gained from a partner vehicle
- demonstrating further advances in tele-operations with operators back on shore.





# Johnston Atoll

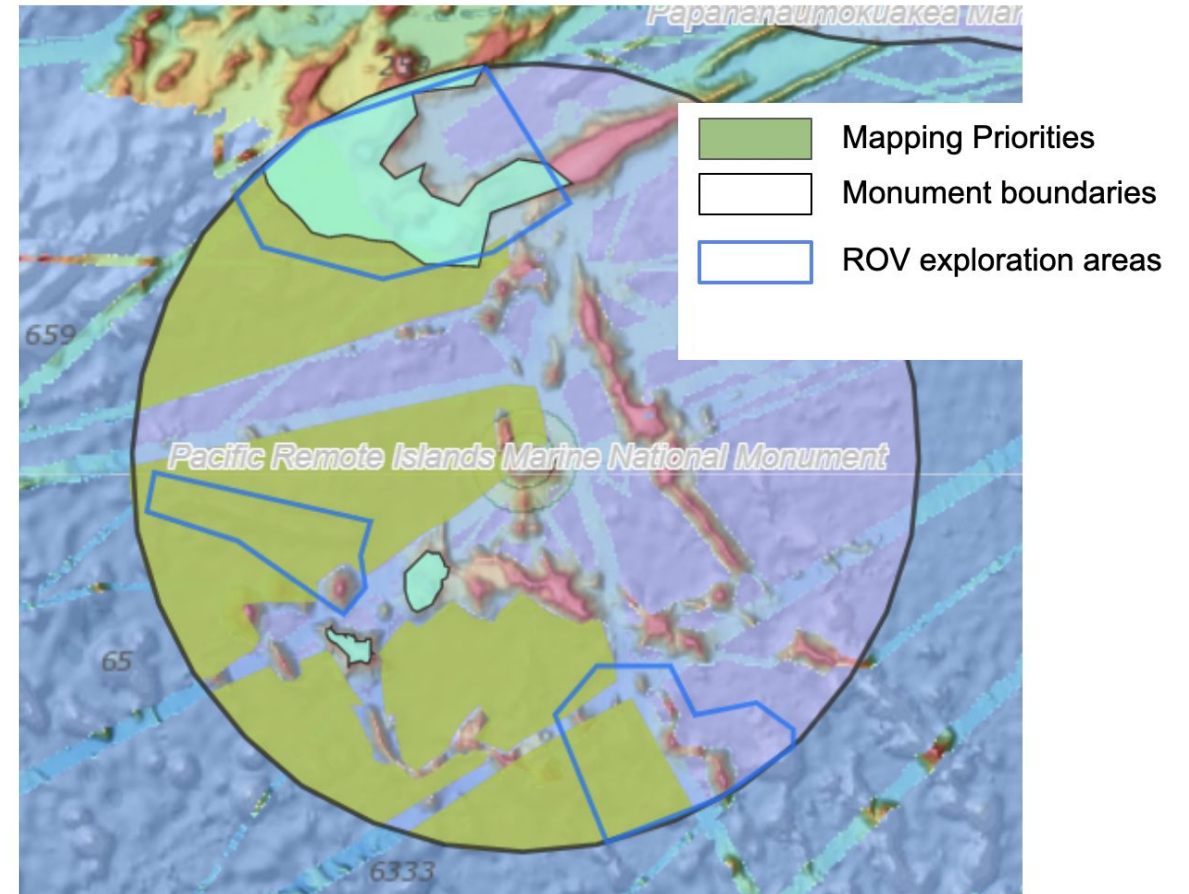
NA141 | 20 June - July 14 (24 days)

Lead Scientists: TBC

ROV cruise at Johnston Atoll in the Pacific Remote Islands Marine National Monument. Preceding by an expedition to map priority areas of interest.

## Goals:

- Conducting surveys of the density and diversity of benthic habitats of Johnston Atoll including deep-water corals, sponges, and fish habitats
- Acquiring physical and chemical data in support of conservation and exploration goals for remote units of PRIMNM, including dissolved oxygen and eDNA samples
- Collect rock samples to identify mineral crusts and age date the geological features of the region.

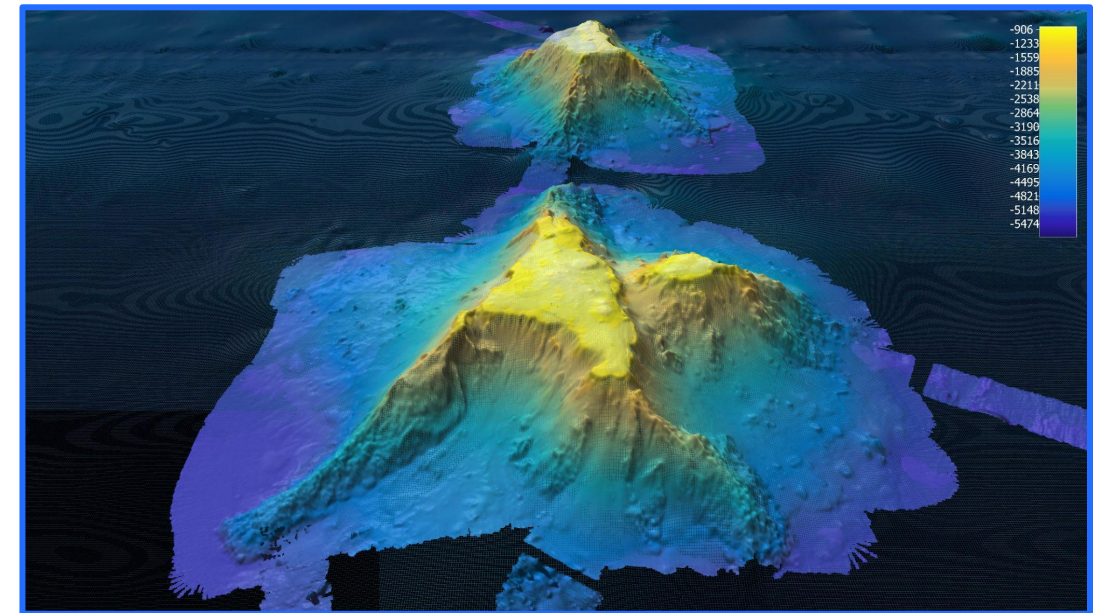




# SEAFLOOR MAPPING

## 2022 Season Overview

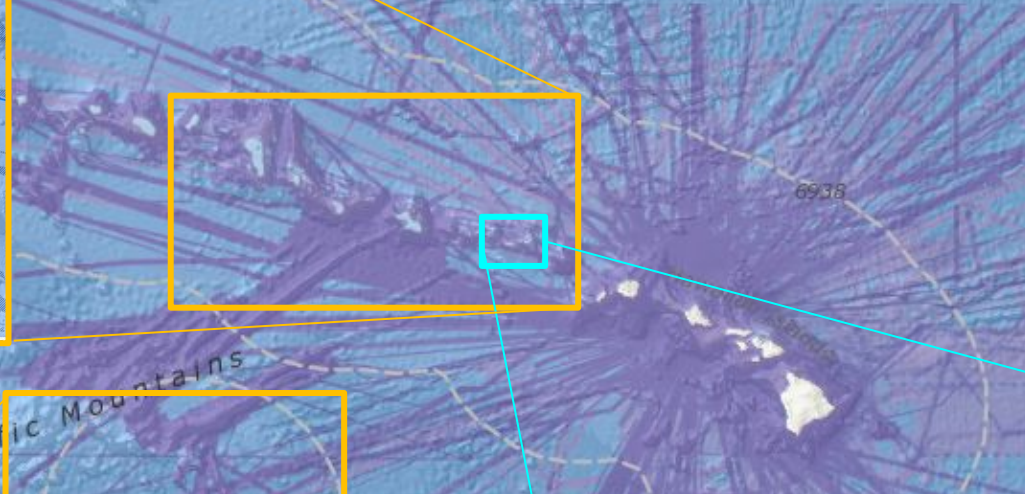
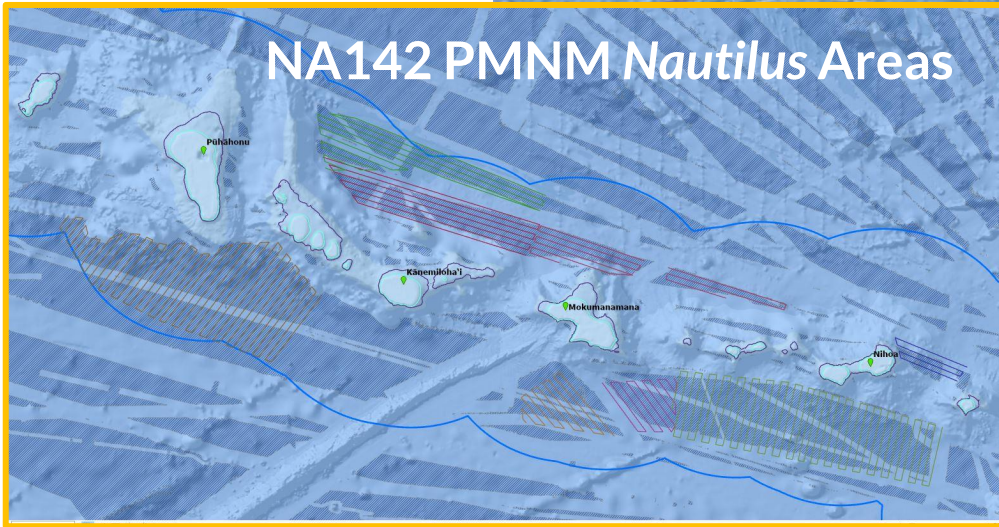
- **NA140 | 25 May - 18 June:** ~24 day mapping cruise at Johnston Atoll in PRIMNM funded by NOAA OECL.
- **NA142 | 16 July - 8 August:** ~23 day mapping cruise in PMNM with *Nautilus* multibeam echosounder and University of New Hampshire's ASV DriX funded by NOAA OECL and Office of Coast Survey.
- **August-October:** mapping in PMNM funded by NOAA OECL.
- **NA137, NA138 & NA141 ROV cruises:** mapping on transit and between dives



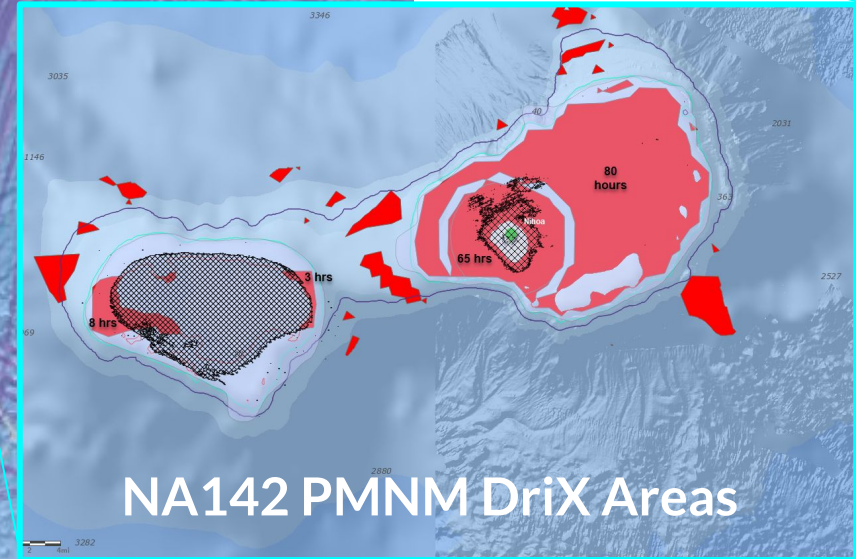
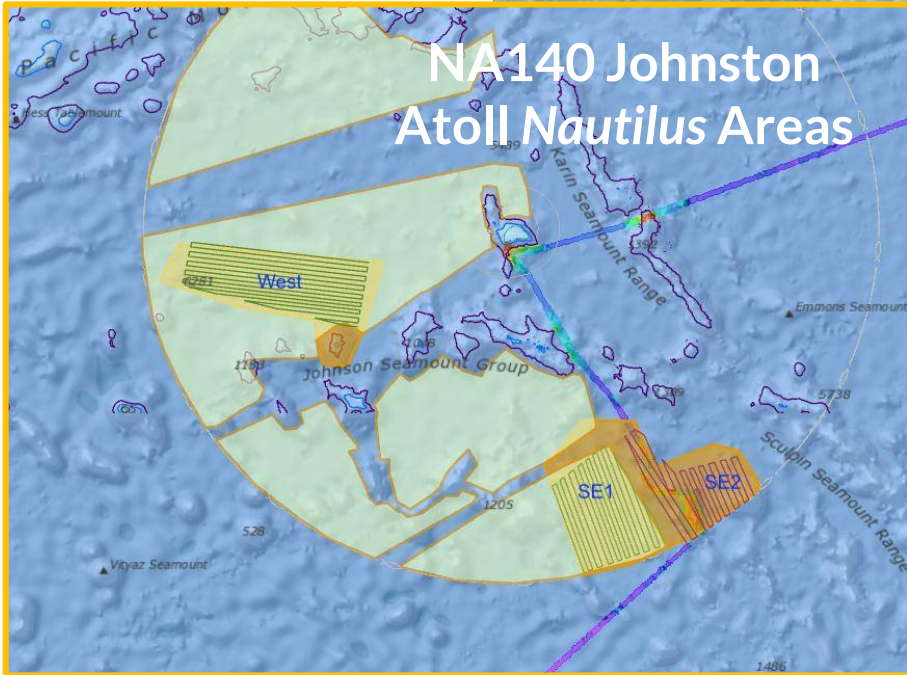


# NA140 & NA142 Mapping Cruises

## NA142 PMNM Nautilus Areas



## NA140 Johnston Atoll Nautilus Areas





# Open Sample and Data Access

## R2R Repository: ID & Locate datasets



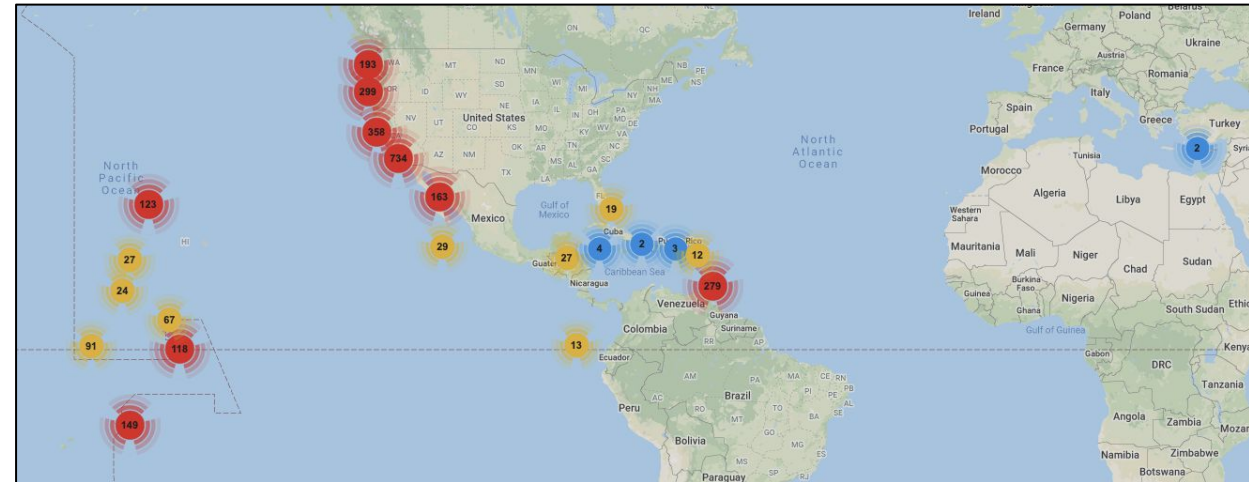
Nautilus

Operator: Ocean Exploration Trust

Select Cruise ID

CRUISE ID	SUMMARY	START DATE	START PORT	END DATE	END PORT
NA122	Project: Southern California EEZ Mapping Chief: OET Data Manager	2020-11-10	Los Angeles	2020-12-05	Los Angeles
NA124	Project: Southern California Biomes Chief: OET Data Manager	2020-10-27	Los Angeles	2020-11-06	Los Angeles

## Collections: Find & request



- 2016-2021 data  
<https://www.rvdata.us/search/vessel/Nautilus>
- Direct Data requests to OET for complete cruise archives  
<https://nautiluslive.org/science/data-management>

- **Biological** voucher specimens & DNA:  
Harvard's Museum of Comparative Zoology
- **Geological** (rocks & short sediment cores):  
University of Rhode Island's Graduate School of Oceanography Marine Geological Samples Lab



# Scientist Ashore Sample Accommodation

Examples of wet lab sample processing capacity

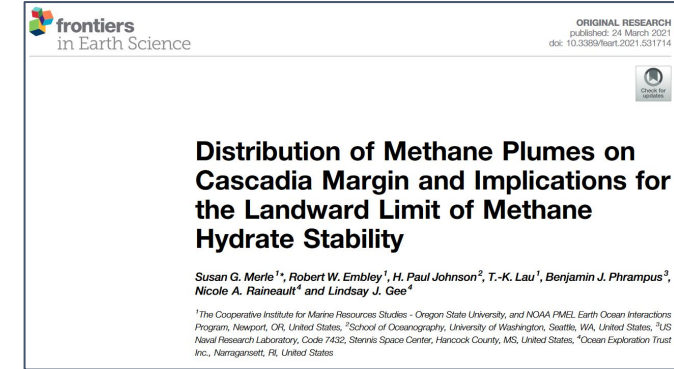
- Environmental DNA (eDNA)
- Seawater sampling (POM, carbonate chemistry)
- Targeted biological sampling
- Microplastics
- Core sectioning, sediments, and infauna

Sign up as a Scientist Ashore and send sampling requests via the Scientist Ashore Interest Form or via email: [science@oet.org](mailto:science@oet.org)

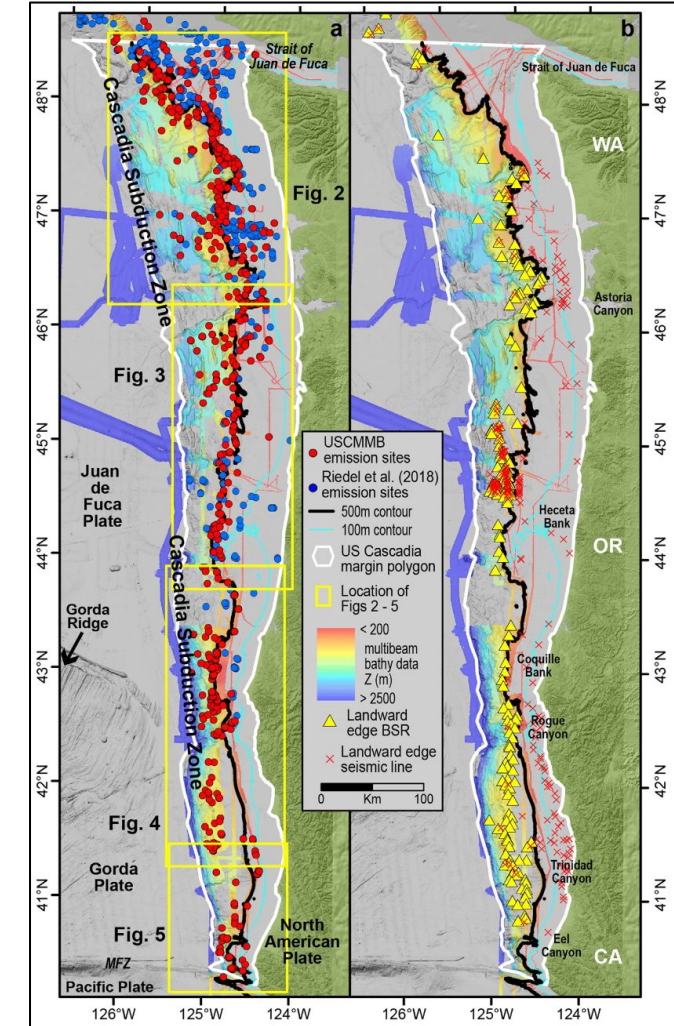
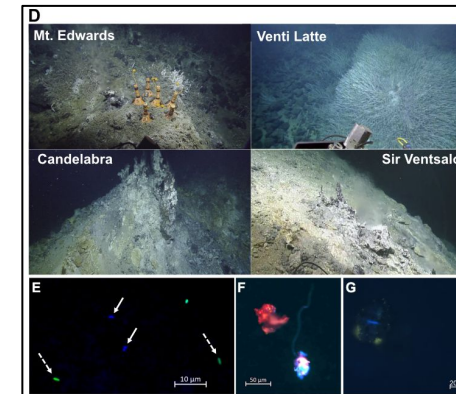




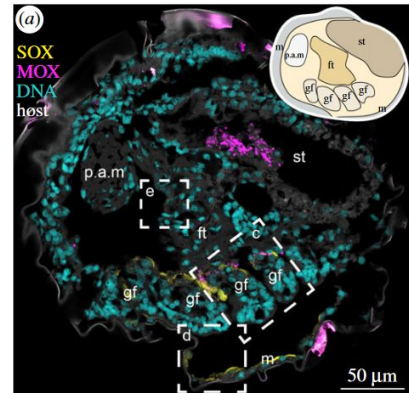
# 2021 Publications Using E/V Nautilus Data



Publication updates? Send  
to [science@oet.org](mailto:science@oet.org)



## PROCEEDINGS B



Coming together—symbiont acquisition  
and early development in deep-sea  
bathymodioline mussels

Maximilian Franke<sup>1,3</sup>, Benedikt Geier<sup>1</sup>, Jörg U. Hammel<sup>2</sup>, Nicole Dubilier<sup>1,3</sup>  
and Nikolaus Leisch<sup>1</sup>

<sup>1</sup>Max Planck Institute for Marine Microbiology, Celsiusstrasse 1, 28359 Bremen, Germany

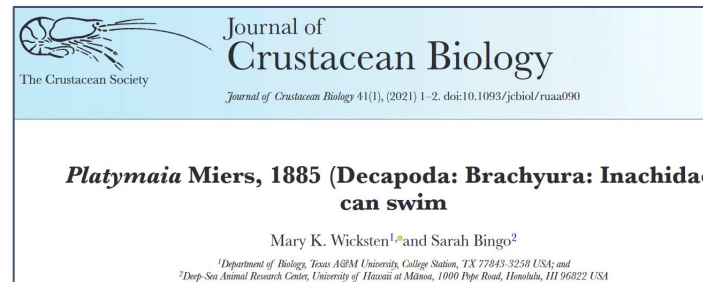
<sup>2</sup>Helmholtz-Zentrum Hereon, Institute of Materials Physics, Max-Planck-Strasse 1, 21502 Geesthacht, Germany

<sup>3</sup>MARUM—Zentrum für Marine Umweltwissenschaften, University of Bremen, Leobener Strasse 2, 28359 Bremen, Germany

## Protistan grazing impacts microbial communities and carbon cycling at deep-sea hydrothermal vents

Sarah K. Hu<sup>a,1</sup>, Erica L. Herrera<sup>a</sup>, Amy R. Smith<sup>a</sup>, Maria G. Pachiadaki<sup>b</sup>, Virginia P. Edgcomb<sup>c</sup>, Sean P. Sylva<sup>a</sup>,  
Eric W. Chan<sup>d</sup>, Jeffrey S. Seewald<sup>a</sup>, Christopher R. German<sup>c</sup>, and Julie A. Huber<sup>a</sup>

<sup>a</sup>Department of Marine Chemistry and Geochemistry, Woods Hole Oceanographic Institution, Woods Hole, MA 02543; <sup>b</sup>Department of Biology, Woods Hole Oceanographic Institution, Woods Hole, MA 02543; <sup>c</sup>Department of Geology & Geophysics, Woods Hole Oceanographic Institution, Woods Hole, MA 02543; and <sup>d</sup>School of Earth, Environment, and Marine Sciences, The University of Texas Rio Grande Valley, Edinburg, TX 78539



*Crustacean Research 2021* Vol.50: 103–106

©Carcinological Society of Japan. doi: 10.18353/crustacea.50.0\_103

Observations in life of *Eiconaxius baja* Kensley, 1996 (Crustacea,  
Decapoda, Axiidea, Axiidae), a sponge commensal lobster

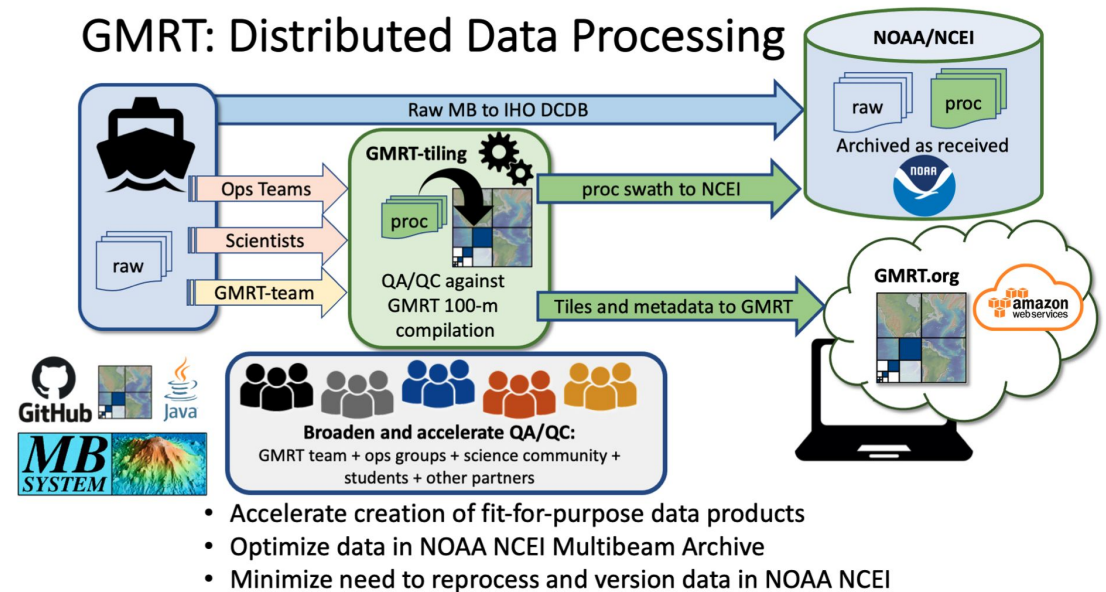
Mary K. Wicksten



# Mapping Data Archive & Access

- Raw multibeam and subbottom data – ALL & SEG Y
- Processed multibeam data – edited files, grid files, backscatter mosaic, KML, ArcGIS project
- Map products and images for outreach and education

- OET archive and access – data request
- OER Digital Atlas
- 2016+ Rolling Deck to Repository to NCEI
- GMRT and Seabed 2030 >100 km<sup>2</sup>
- 2021 cruise products to MGDS





# SCIENCE PORTAL

REGISTRATION OPENING SOON

Science Portal features:

- Science chat with shipboard scientists
- Live streaming ROV video
- Live vehicle and ship sensor data feeds
- Live webmap
- Follow cruises to access expedition documents and receive daily updates
- Submit input on research interests and site locations

The image displays two views of the OET Science Portal. The top view is the main website landing page, titled "OET SCIENTISTS ASHORE PORTAL". It features a navigation bar with links: OET Science Portal, Expeditions, Chat, Grafana, Events, Documentation, Participants, and Dashboard. The main content area lists six expeditions in a grid:

- NA137: KINGMAN REEF & PALMYRA ATOLL** (Mar 14 - Apr 4, 2022)
- NA138: LU·UAEAAHIKIKEKUMU (PMNM LILI·UOKALANI RIDGE)** (Apr 7 - May 1, 2022)
- NA139: OECI TECHNOLOGY INTEGRATION** (May 6 - May 21, 2022)
- NA140: JOHNSTON ATOLL MAPPING** (May 25 - Jun 18, 2022)
- NA141: JOHNSTON ATOLL MAPPING** (Jun 20 - Jul 13, 2022)
- NA142: DUAL-TECHNOLOGY SEAFLOOR MAPPING IN PMNM** (Jul 16 - Aug 8, 2022)

A "See All Expeditions" button is located at the bottom right of the grid.

The bottom view is a screenshot of the portal's dashboard. It includes a top navigation bar with the same links as the website. The dashboard is divided into several sections:

- NA Science Ashore**: A map showing expedition locations and data points.
- Events**: A section for "Sealog for Vehicles v2.0.7" with tabs for ALL, MEDIA, and SCIENCE. It includes a "Type new event" form with a "Submit" button.
- Chat**: A section for "general" chat with a list of participants and a message input field.
- Grafana**: A section for "General / Realtime Data" showing various data feeds and charts.



# What's Next?

- **February:**
  - Science Portal registration opening soon
  - Sharing Expedition Overviews and starting planning meetings
  - Email [science@oet.org](mailto:science@oet.org) with input/questions
  - Schedule live ship-to-shore connections with classes, camps, or community events
- **March-October:** Expeditions underway
  - Cruise plan shared prior to expedition
  - Ship reports (Sit Reps) & Dive plans emailed throughout cruises
  - Engage with shipboard scientists through Science Portal
- **October-December:** Expedition reporting
  - Request data & samples







Questions?  
[science@oet.org](mailto:science@oet.org)