

# Evolving Requirements for Data and Information Management

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National Centers for Environmental Information

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Northern Gulf Institute/Mississippi State University  
National Centers for Environmental Information

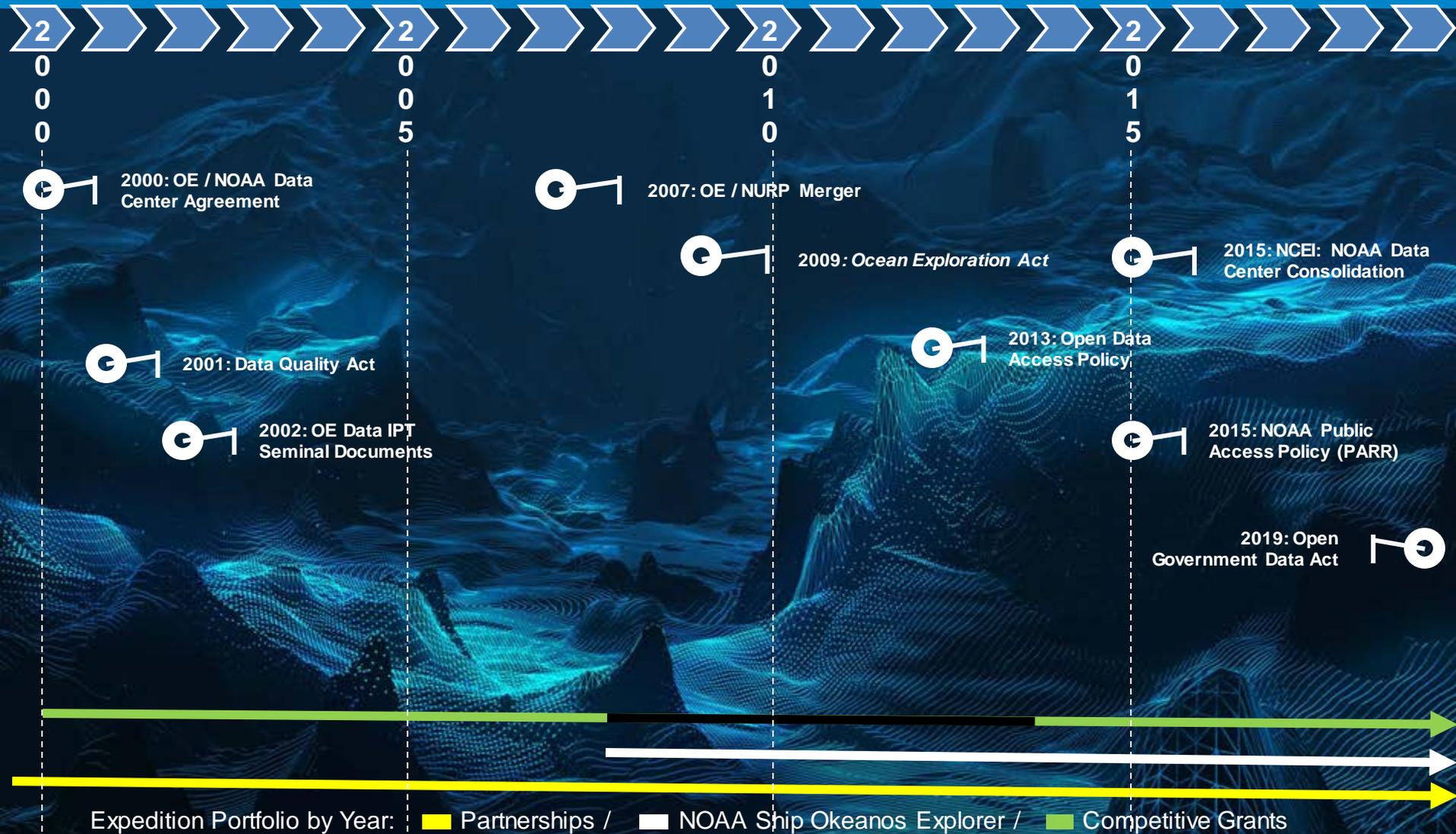


**Ocean Exploration  
and Research**

# OER Mission and the Data Imperative

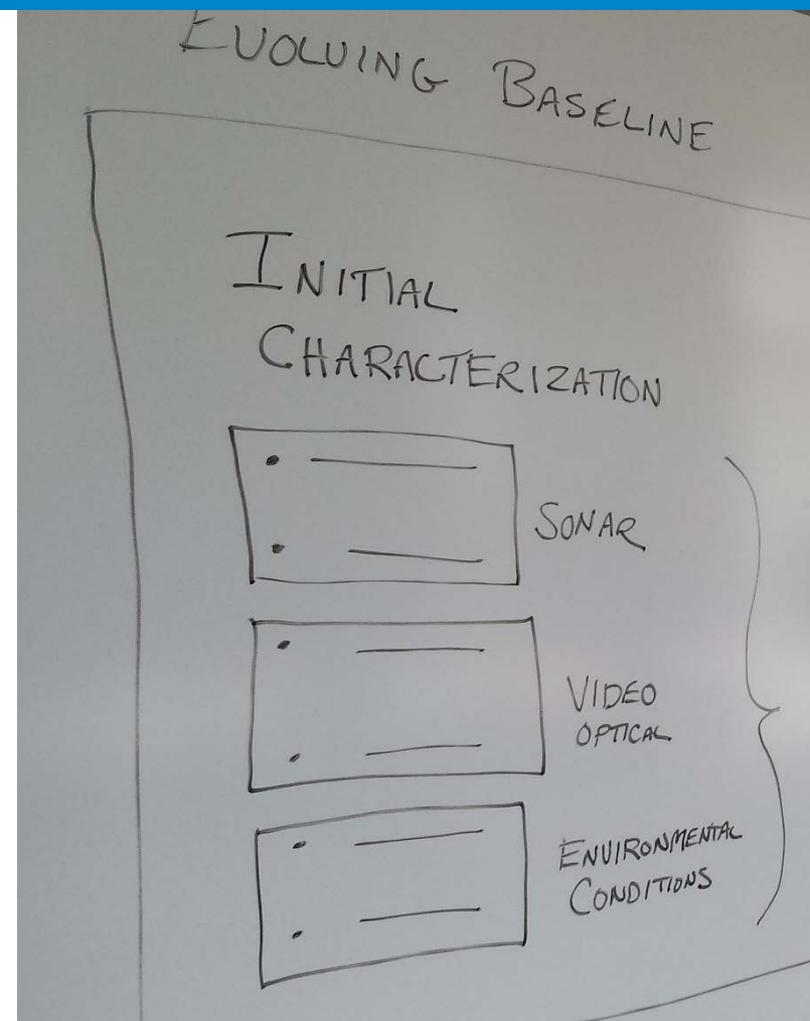
- OER's mission is to explore the deep ocean:
  - map to modern standards
  - conduct baseline characterization
  - make that data and information available *and accessible* to whomever needs it in a form that is *useful* for science, for decisions, for general information about the ocean
- If ocean exploration results are not available, accessible, and reusable, we have not succeeded in our mission

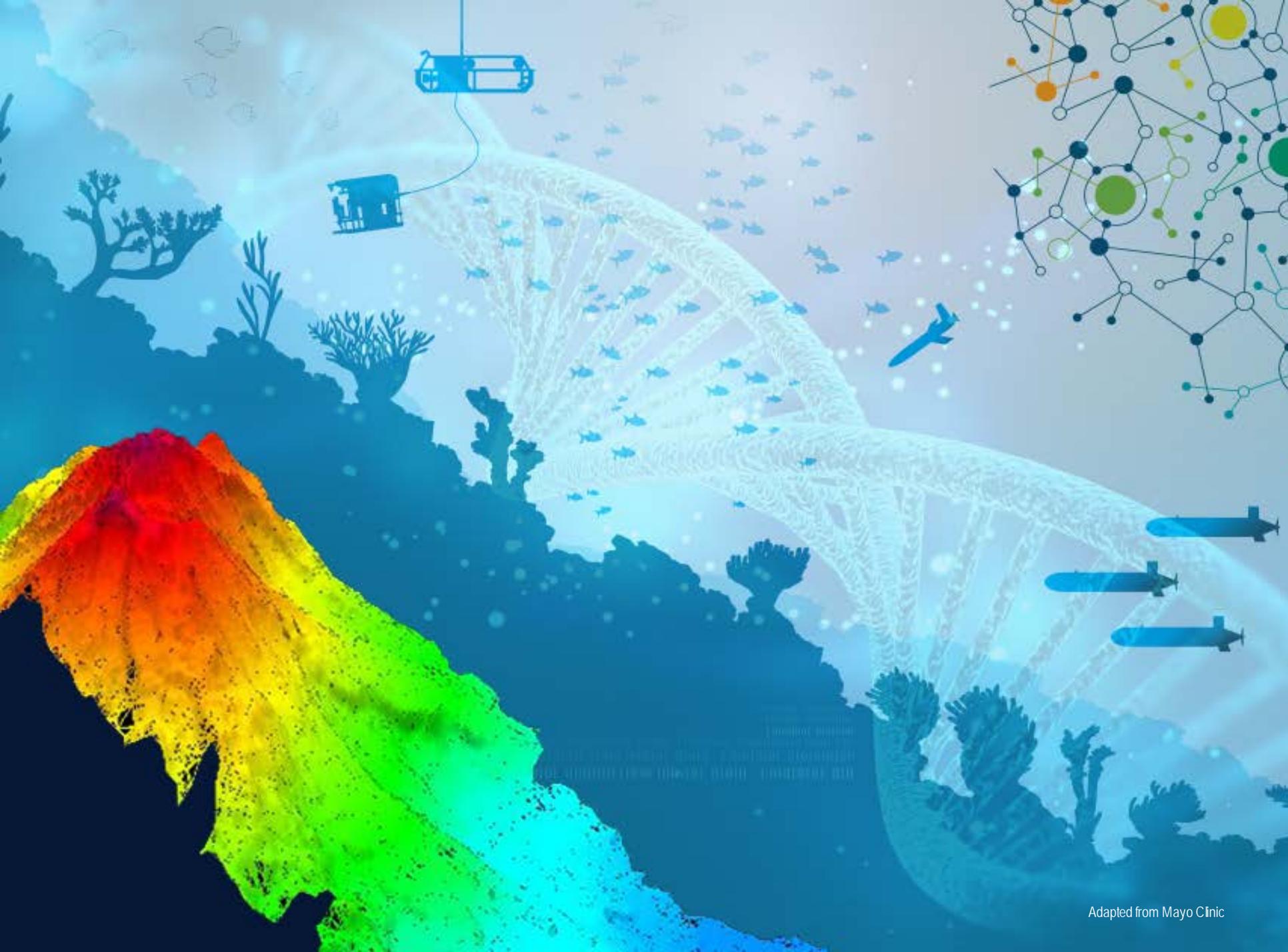
# Data Management: *Evolution in a changing landscape*



# Evolving View of Characterization

- 2008-2015
  - Sonar (multibeam/mapping operations)
  - Video (ROV operations)
  - Some oceanographic data
- 2015-2018
  - Water Column?
  - Acoustics?
  - Other measurements?
- 2019
  - Processes
  - Connectivity
  - Rapid evolution





# OER's conceptual model for an expedition

- We explore a 3-D polygon
- We need to think in terms of:
  - How all data collected by the expedition in that polygon might relate
  - Developing new CONOPS using gliders, other platforms and sensors (Deep Argo? Saildrone? Silixia?)
  - Integrating data collected in that polygon in an extended time domain (e.g. moored arrays, Argo floats).

# OER's Data Access and Use Requirement

- NOAA Ship *Okeanos Explorer* retires in 2023-24. There is no dedicated replacement; OER will begin operate from multiple platforms soon
- By 2025, OER must be heavily invested in autonomy
- The new CONOPS that will result mean much more complex and diverse data work flows, more diverse data types, and radically increased data volume

# THE PAST

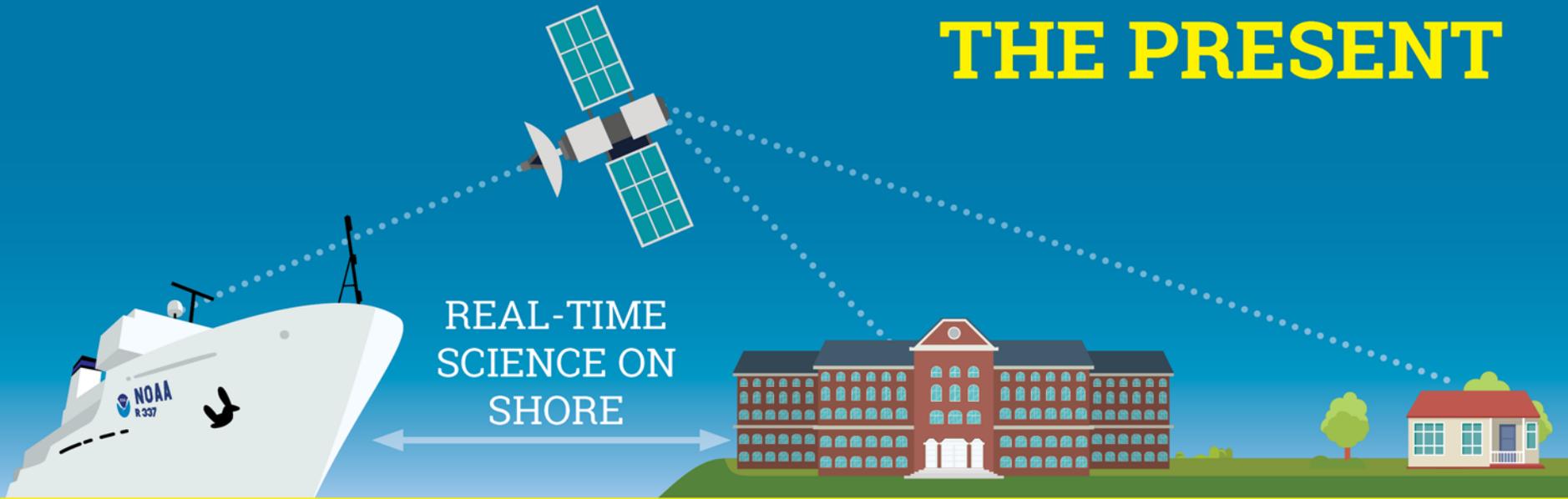
SCIENCE  
AT SEA



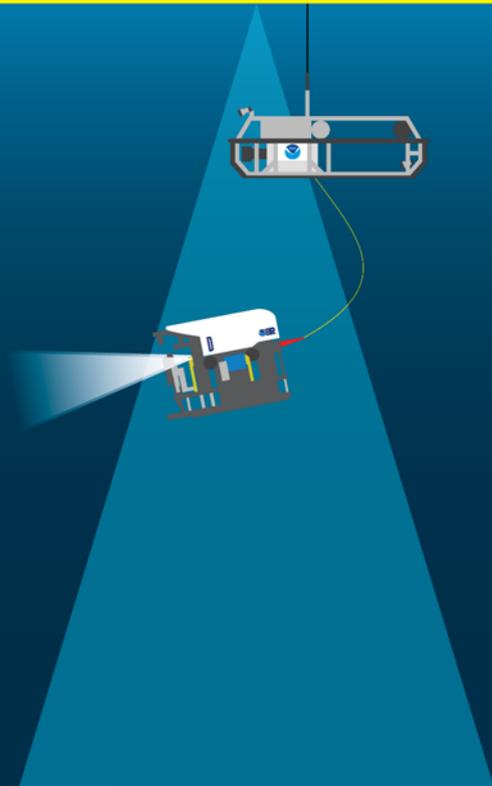
SCIENTIFIC  
PAPERS

DATA AVAILABILITY: **2+ YEARS**

# THE PRESENT



OPEN ACCESS DATA



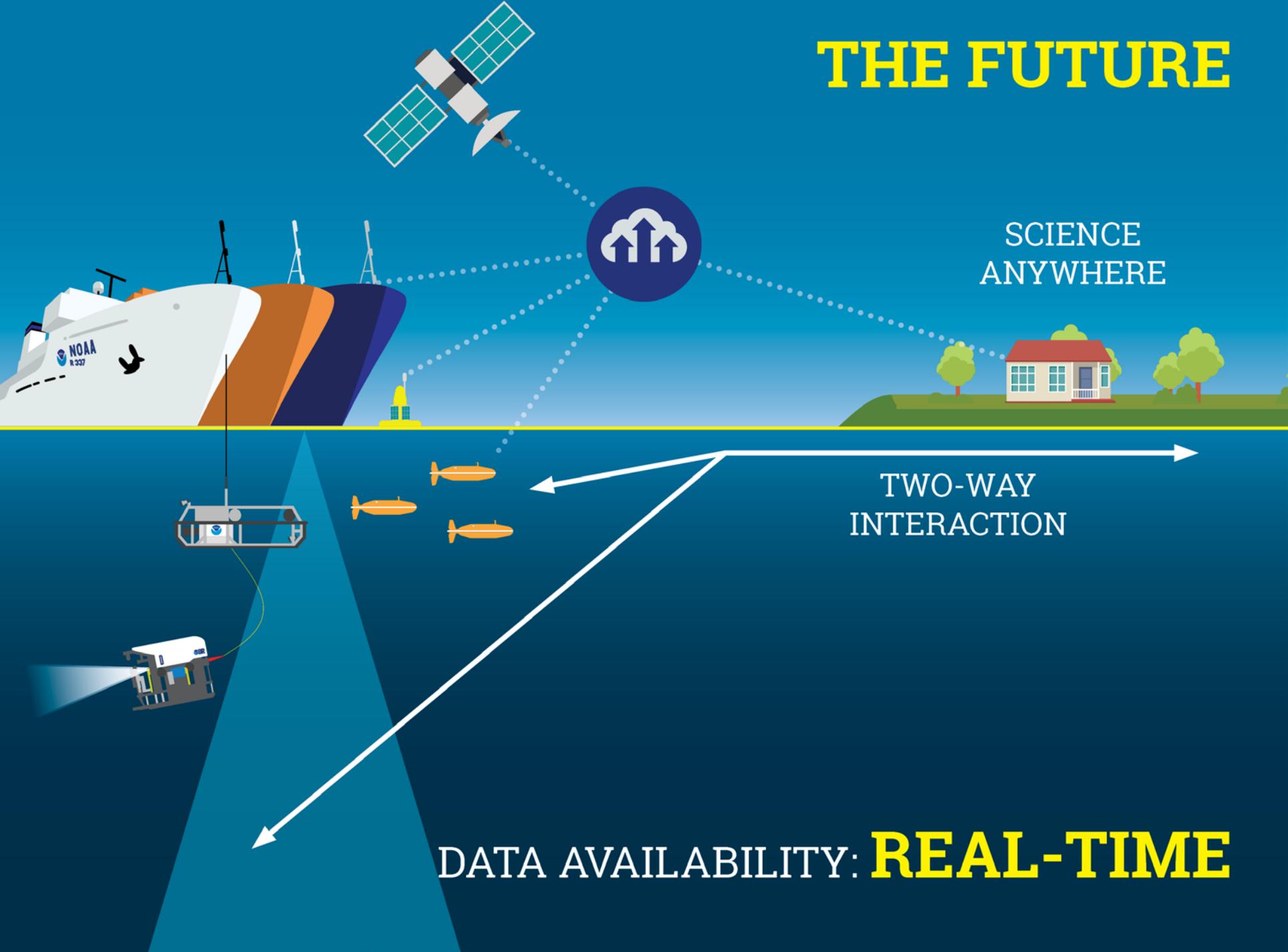
DATA AVAILABILITY: **6 WEEKS**

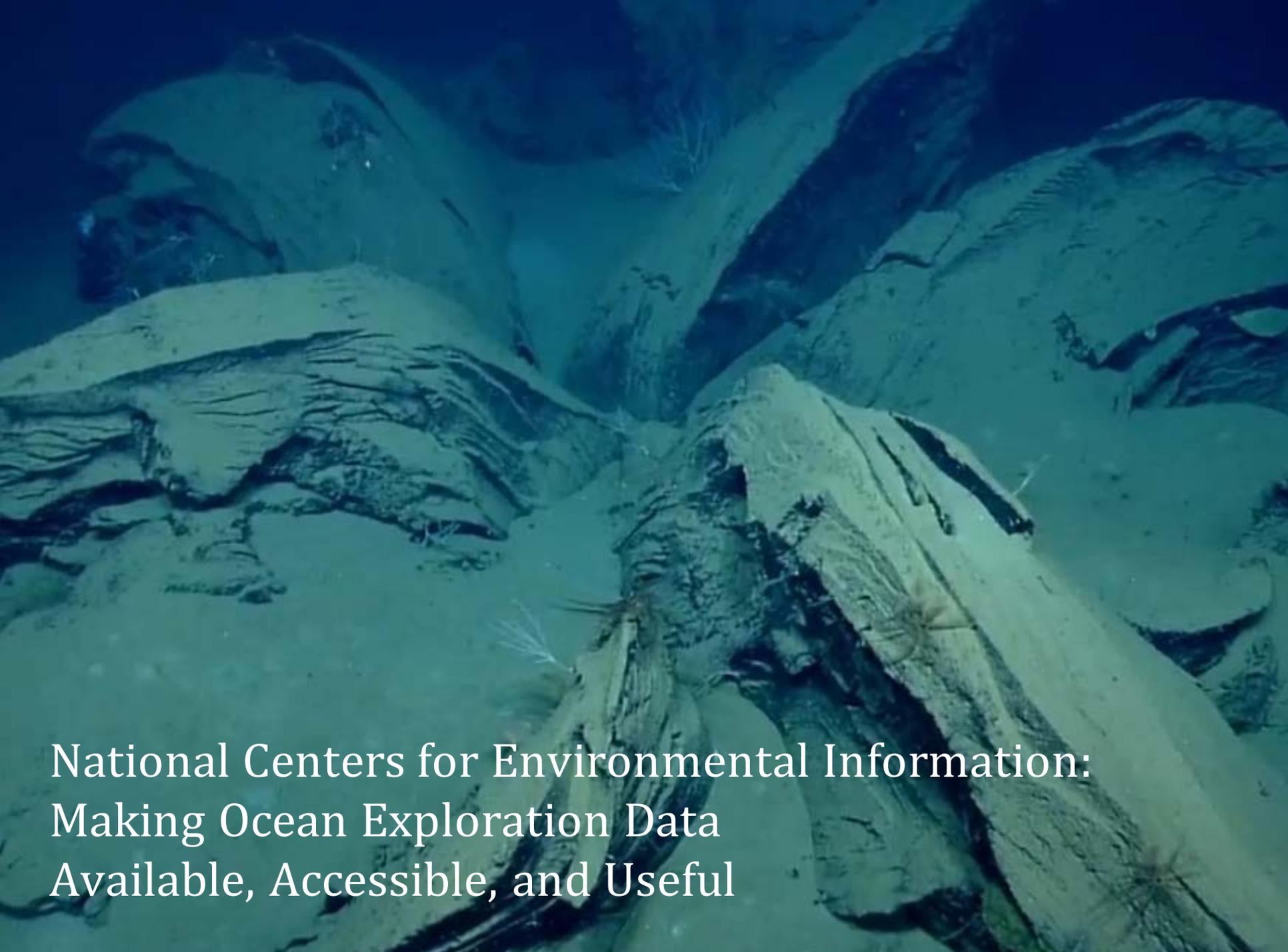
# THE FUTURE

SCIENCE  
ANYWHERE

TWO-WAY  
INTERACTION

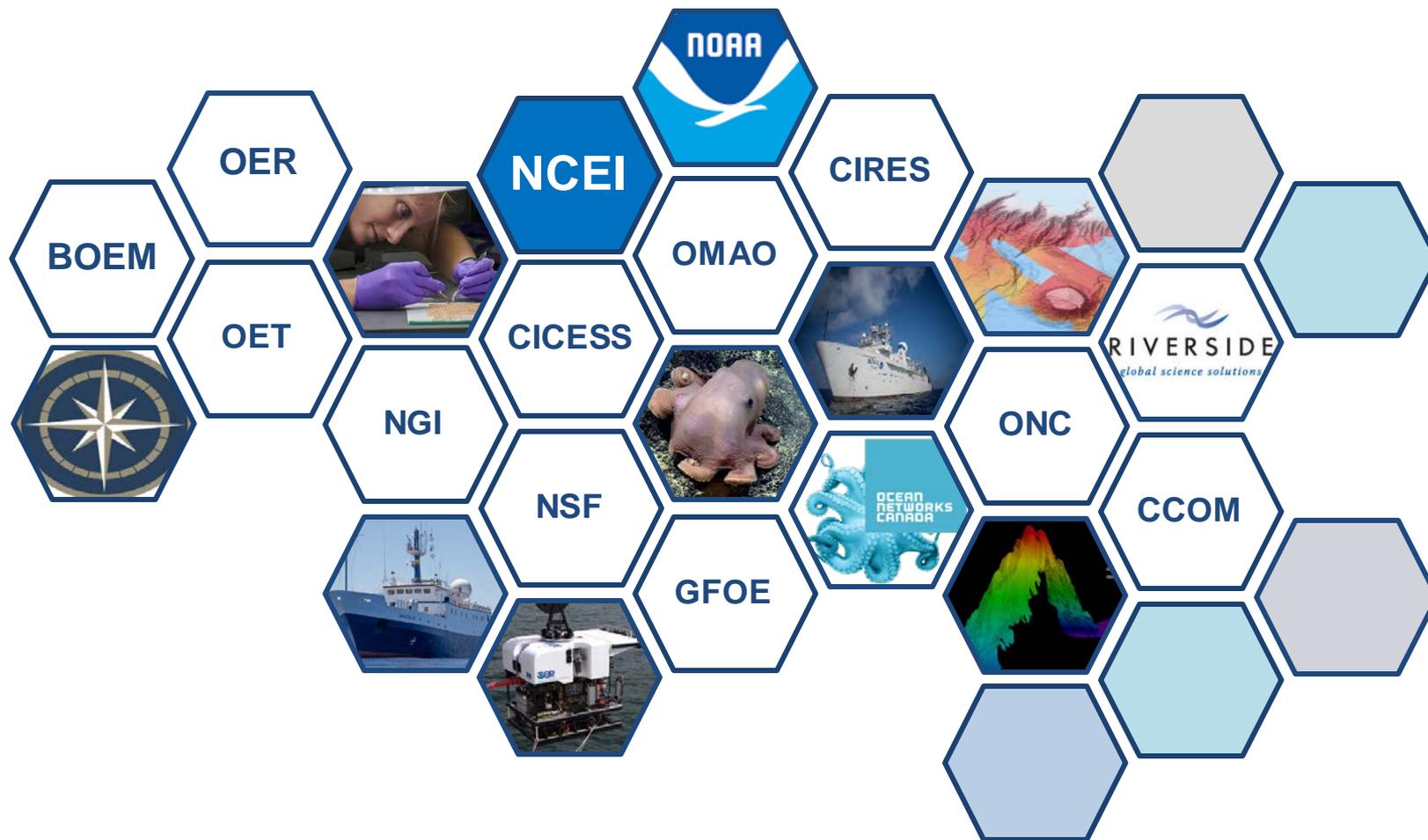
DATA AVAILABILITY: **REAL-TIME**

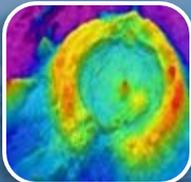


An underwater photograph of a rocky seabed. The rocks are light-colored, possibly white or light grey, and are covered in various marine organisms, including what appear to be sponges and other invertebrates. The water is a deep blue-green color, and the lighting is somewhat dim, creating a moody atmosphere. The rocks are arranged in a way that suggests a complex geological structure, with some flat surfaces and some more jagged, vertical formations.

National Centers for Environmental Information:  
Making Ocean Exploration Data  
Available, Accessible, and Useful

# Outward-facing Data Management





# National Centers for Environmental Information

## Scientific Data Stewardship

Digital Atlas

*Okeanos Explorer* Atlas

OER Video Portal

Water Column Sonar Portal

Deep Sea Coral Data Portal

World Ocean Database

Regional Climatology

Bathymetric Data Viewer

TSG Database

Joint Archive for Sea Level

Benthic Animal Identification Guide

NASA Maritime Aerosol Network

# Community of Practice



**LEARN**



**INNOVATE**



**DEVELOP**



**LEVERAGE  
TECHNOLOGY**



**COLLABORATE**

# *Learn: Creating and Archiving Born-Digital Video*

## Federal Agency Digitization Guidelines Initiative Audio-Visual Working Group

- Library of Congress
- National Archives and Records Administration
- Smithsonian Institution

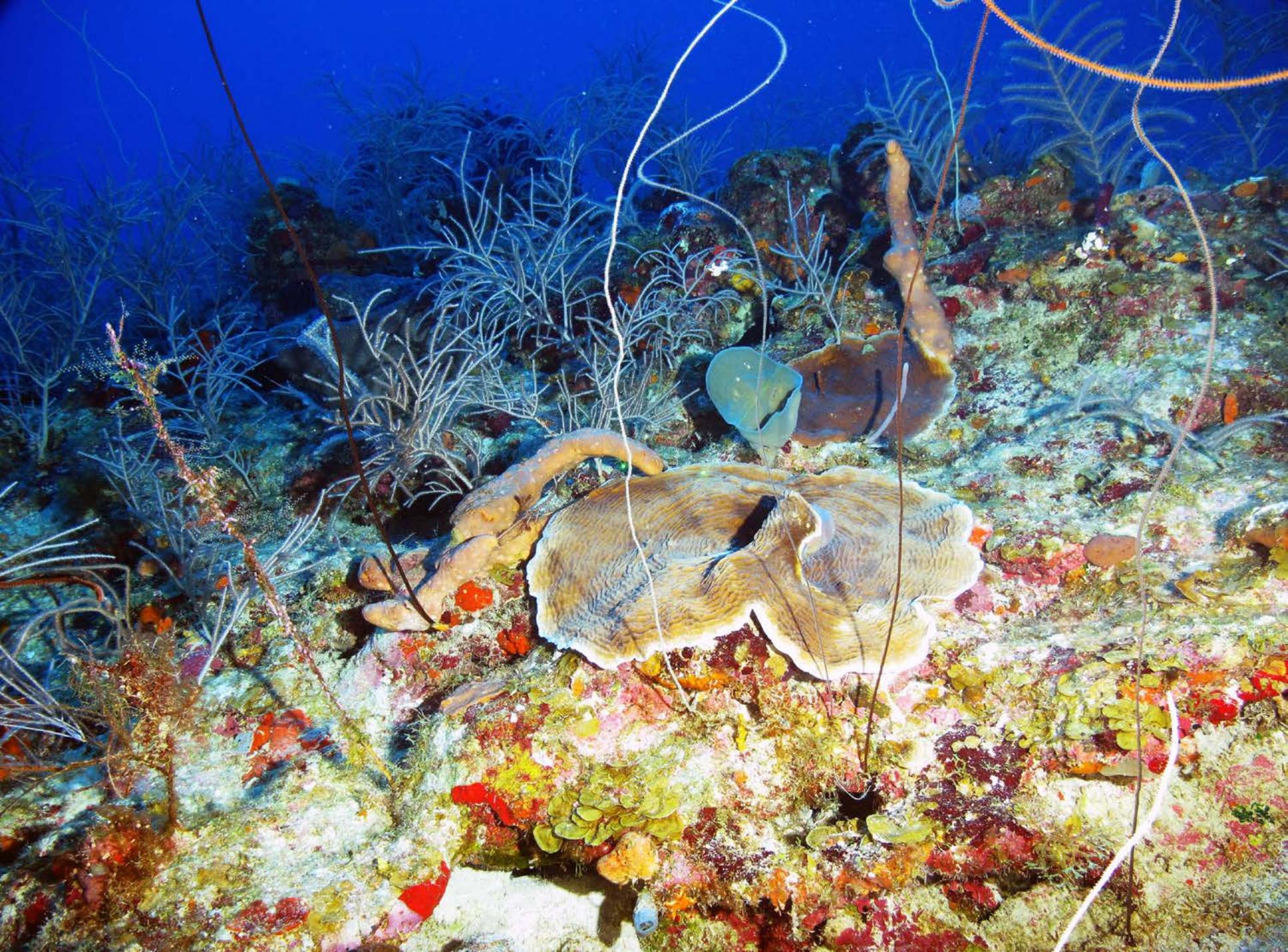
### Fiscal '15 Report

- Federal Case Studies (OER one of eight case studies)
- Recommendations
- Resources

[http://www.digitizationguidelines.gov/guidelines/video\\_bornDigital.html](http://www.digitizationguidelines.gov/guidelines/video_bornDigital.html)

# WRESTLEMANIA

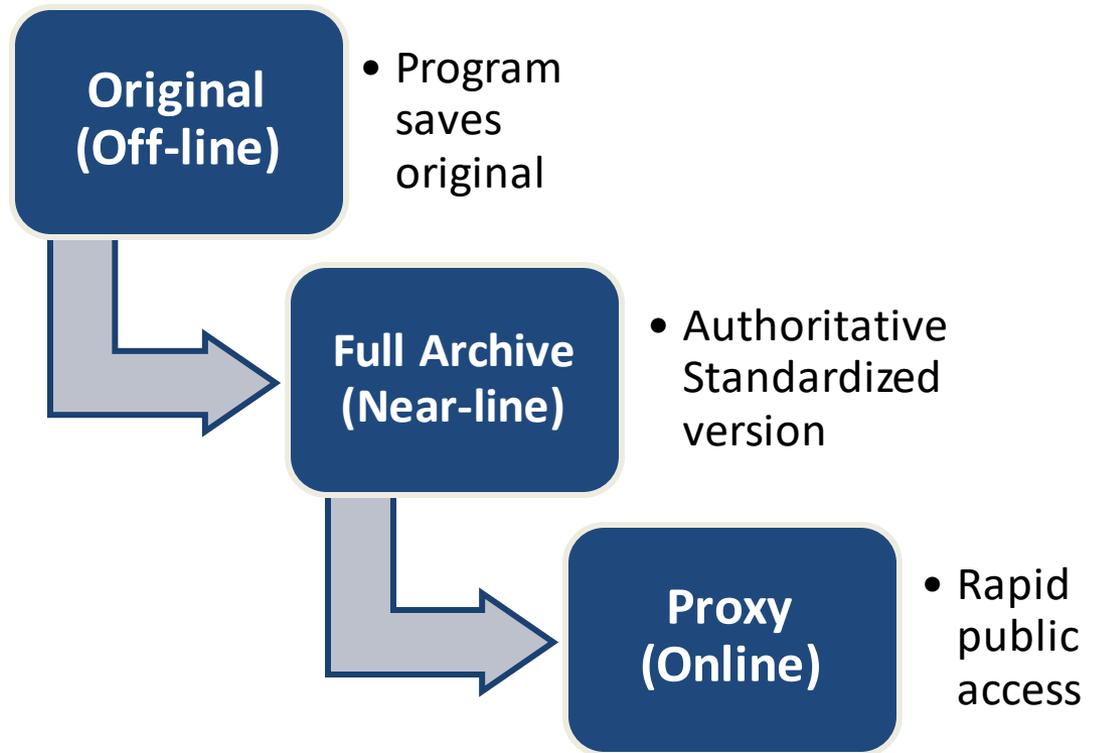




# Learn: National Science Foundation

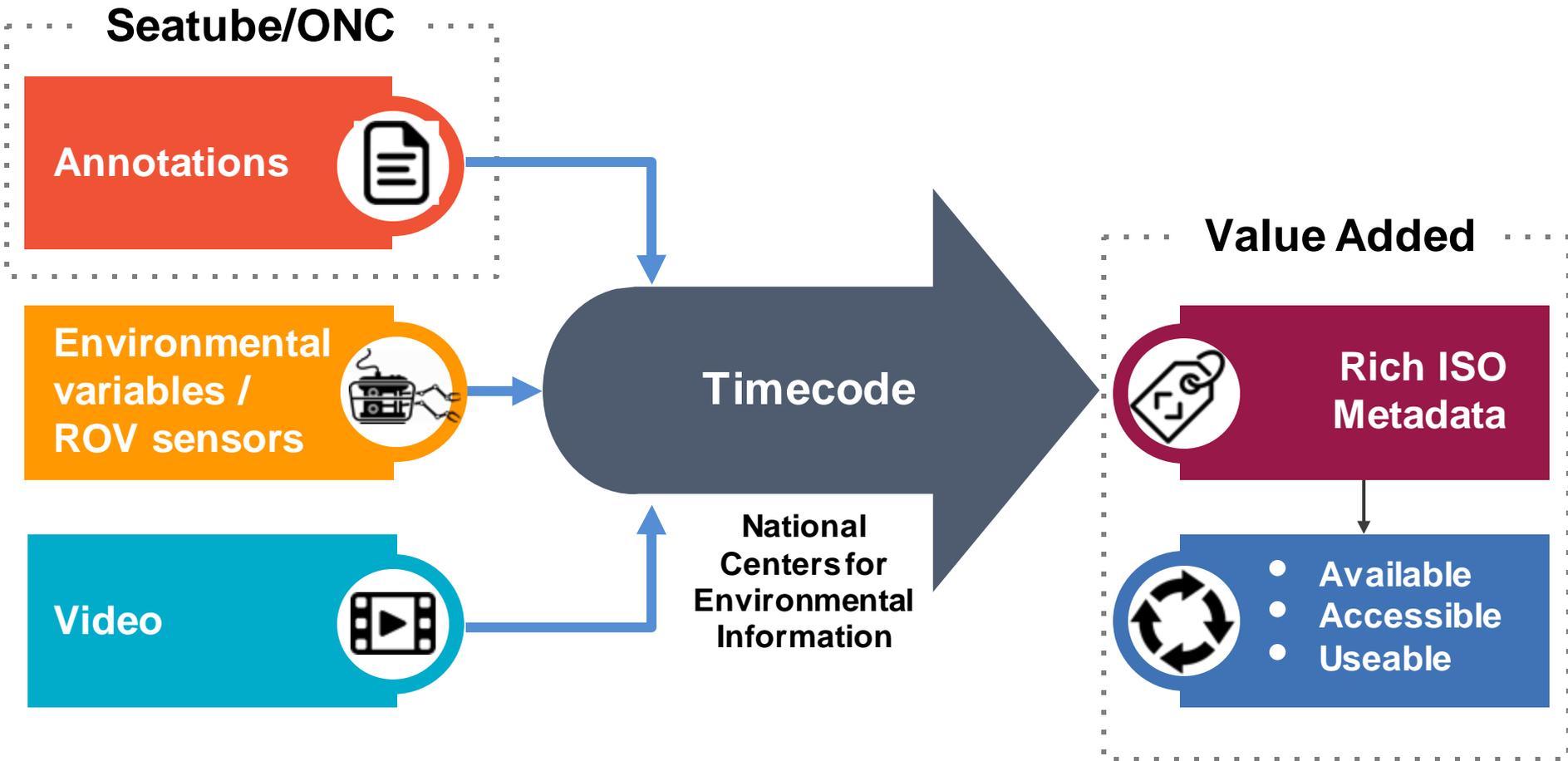
## 2016 Video Workshop: *Establishing Community Standards for Underwater Video Acquisition, Tagging, Archiving, Access*

- Recording
- File Naming Conventions
- Video Formats
- Compression
- Metadata Priorities
- Timecode embedding
- Audio Channels
- Annotation / Event Logs
- Archive / Open Access





# Innovate: Video Data Management



# Innovate: Video Data Management

## SEARCH

### OER Video Portal

Search, discover and access video data from OER sponsored missions on NOAA Ship *Okeanos Explorer* and other vessels. Please use [this form](#) to share your feedback on the OER Video Portal.

#### Keywords

Apply  OR  AND to multiple keywords (separate with commas)

Match keywords  anywhere  exactly

To choose from a specific dive NN use DIVENN.

Autocomplete

#### Observation Dates

Start date:  (YYYY-MM-DD)

End date:  (YYYY-MM-DD)

#### Depth Range

Min. Depth (in meters):  Max. Depth (in meters):

#### Video Type

Segment  Stream  Highlight

#### Camera Location (for Segments)

Camera Platform  ROV  Other

Multiple selections are allowed. Use Click/Shift-Click for lists, Click/Ctrl-Click for multiples. To unselect use Ctrl-Click.

#### Dive Site Names

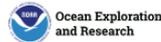
- All locations
- AT 251
- Ahyi Seamount
- Alba Seamount in Russian Federation Mn Crust Lease Block 65
- Alvin Canyon - Mid 2
- Alvin Canyon - Shallow 1

#### Cruises

All  Okeanos Explorer  Other vessels

- All cruises
- Mid and Southeast US ROV and Mapping (EX1903L2)
- 2019 Field Season Shakedown (EX1902)
- Puerto Rico and Virgin Islands (EX1811)
- Mid and Southeast US (EX1806)

OER Video Portal [Feedback](#) | [Help](#)



#### Geographic Coverage

Hold the "shift" key and drag to select an area.



Intersecting  Full

West:

## RESULTS

Searching for:

Keywords: octopus\*

Depth Range: At 4000m or below

1 to 8 of 8

Put 8 records into Basket

Video segment from DIVE01 of ROV Exploration at 2016-02-27T22:32:08Z for 219 seconds  
EX1603\_VID\_20160227T223208Z\_ROVHD\_OCTOPUS recorded at 4289.1 m and 4290.3 m. Keywords include: OCTOPUS

Video segment from DIVE01 of ROV Exploration at 2016-02-27T22:32:16Z for 248 seconds  
EX1603\_VID\_20160227T223216Z\_PTMAN\_OCTOPUS recorded at 4288.4 m and 4290.3 m. Keywords include: NECKER

Video segment from DIVE01 of ROV Exploration at 2016-02-27T22:33:15Z for 176 seconds  
EX1603\_VID\_20160227T223315Z\_CPHD\_ROV\_VIEW recorded at 4289.4 m and 4273.7 m. Keywords include: NECKER

Video segment from DIVE10 of ROV Exploration at 2016-02-27T22:33:44Z for 49 seconds  
EX1404L3\_VID\_20140930T195844Z\_CPHD\_OCTOPUS recorded at 4595.3 m and 4597.5 m. Keywords include: SEAMOUNT

Video segment from DIVE19 of Puerto Rico and



## ACCESS



Video segment from DIVE01 of ROV Exploration of the Papahānaumokuākea Marine National Monument (EX1603) recorded at 2016-02-27T22:32:08Z for 219 seconds  
EX1603\_VID\_20160227T223208Z\_ROVHD\_OCTOPUS.mov recorded by the HD camera on the ROV at East of Necker between 4289.1 m and 4290.3 m. Keywords include: OCTOPUS

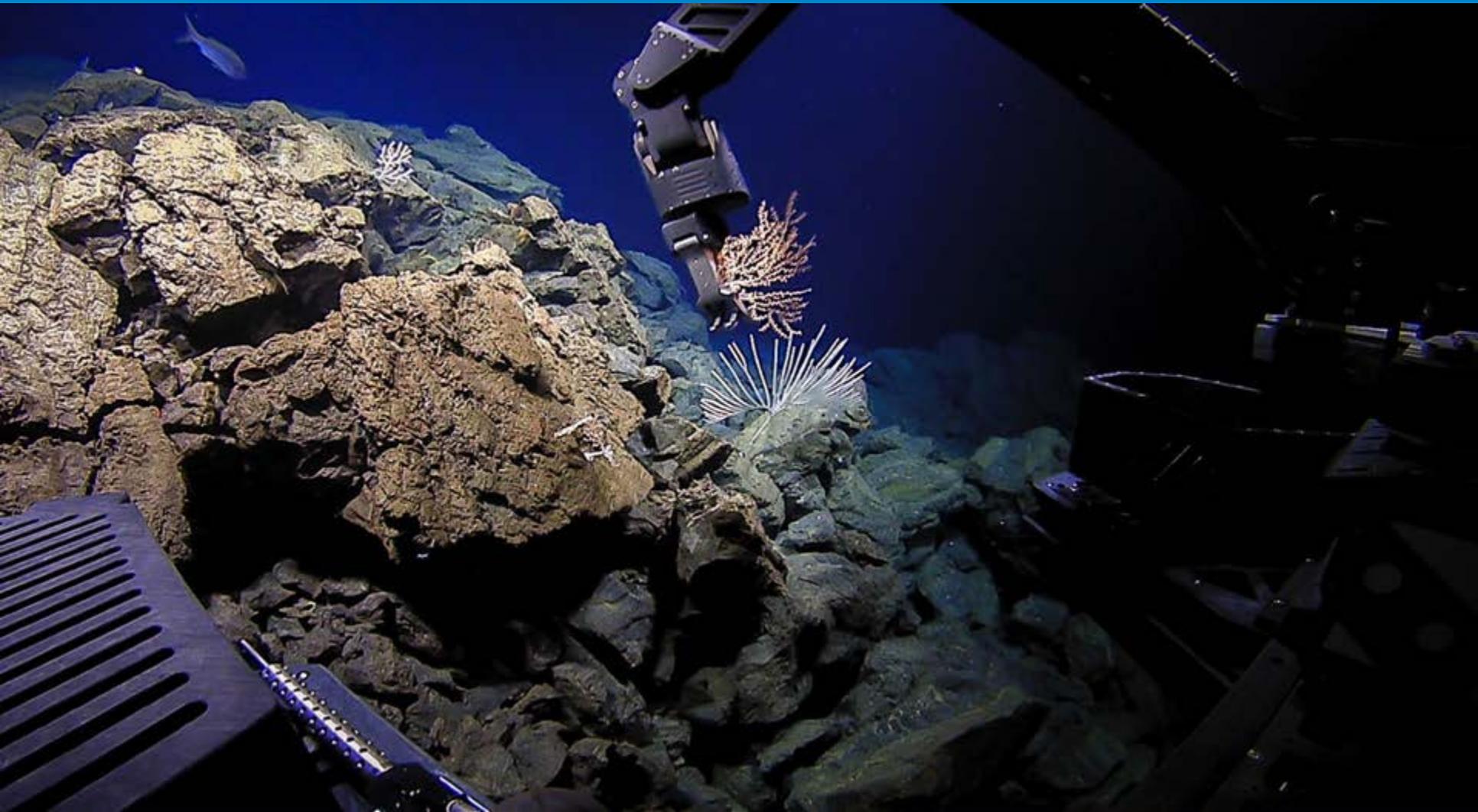
[Video Details](#) [Dive Summary](#) [Feedback](#)

# *Innovate: Sharing Video Management Approaches*

- Lessons learned
  - Video guidance shared across NOAA
  - Best practices and templates
- Legacy data integration
  - Career collections and key expeditions available online
  - Recovery from disparate media
  - Data now available in standard formats
- Benefits for Future
  - Legacy data recovery has implications for machine learning
  - Reinforces need for data architecture in advance

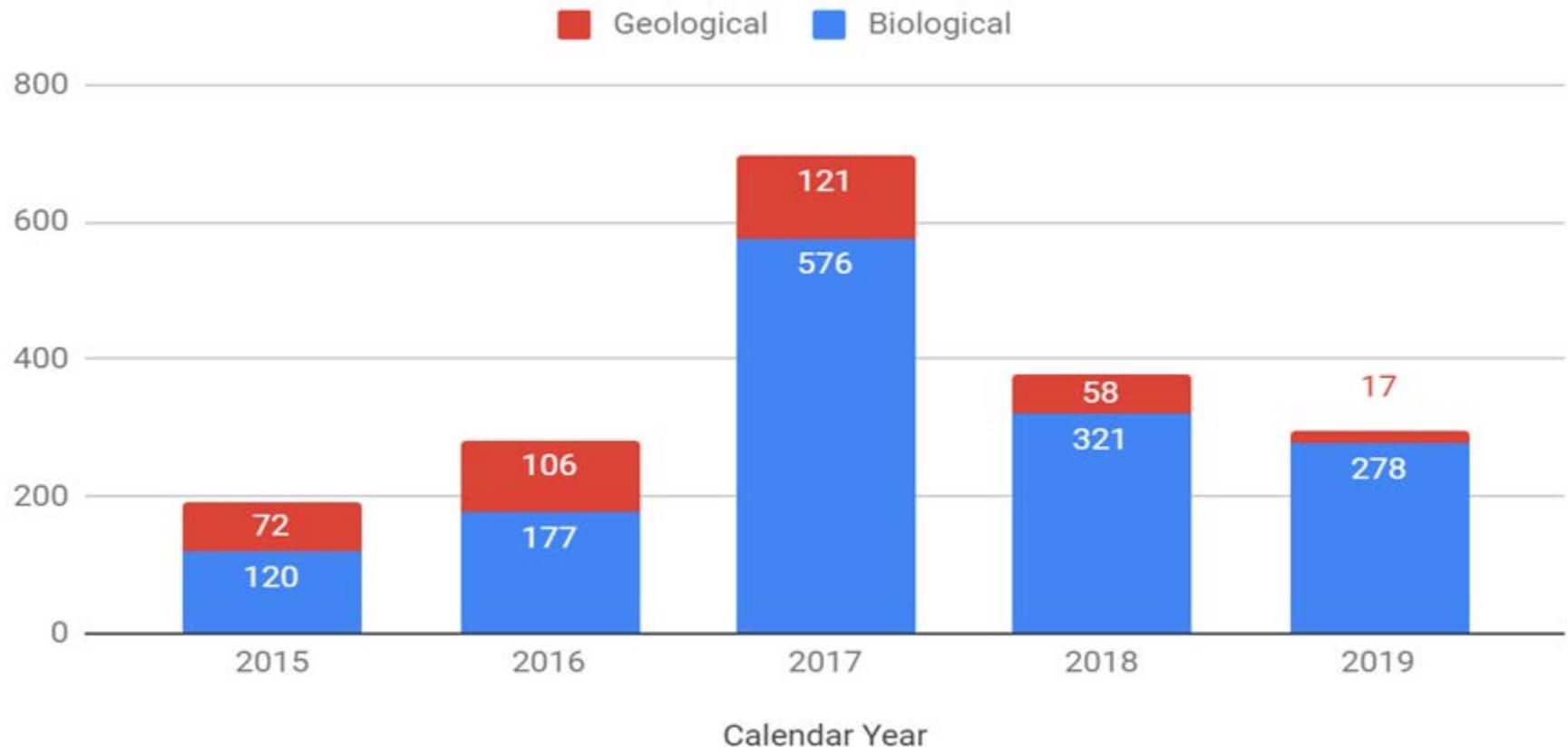


# *Develop:* End-to-end Sample Data Management

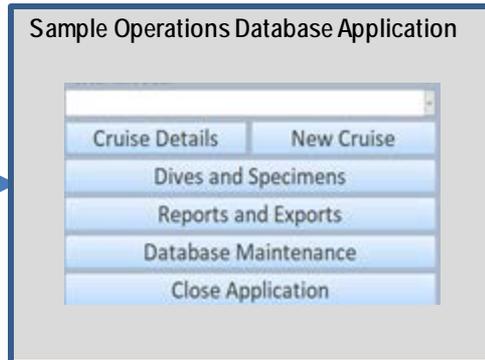
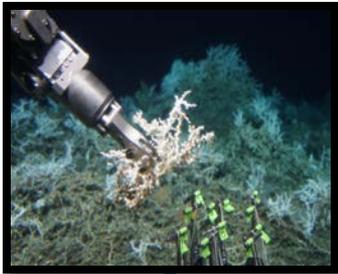


# *Develop:* End-to-end Sample Data Management

## Specimens Collected on Okeanos Explorer



# Develop: End-to-end Sample Data Management



○  
**Sample management**

○  
**Electronic records**

○  
**Public access to physical and digital data**

# Develop: Sample Data Access



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National Museum of Natural History

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NMNH Home | NMNH Research & Collections | Invertebrate Zoology | Collections

## Search the Department of Invertebrate Zoology

**Keyword Search Results - Grid View**

<input type="checkbox"/>	Catalog#	Kind of Object	Scientific Name	Family	Phylum
<input type="checkbox"/>	1424234	Specimen/Lot	Victorgorgia sp.	Anthothelidae	Cnidaria
<input type="checkbox"/>	1453702	Specimen/Lot	Victorgorgia sp.	Anthothelidae	Cnidaria
<input type="checkbox"/>	1453729	Specimen/Lot	Walteria sp.	Euplectellidae	Porifera
<input type="checkbox"/>	1453785	Specimen/Lot	Walteria sp.	Euplectellidae	Porifera
<input type="checkbox"/>	1453738	Specimen/Lot	Walteria sp.	Euplectellidae	Porifera
<input type="checkbox"/>	1453775	Specimen/Lot	Walteria sp.	Euplectellidae	Porifera
<input type="checkbox"/>	1465275	Specimen/Lot	Walteria sp.	Euplectellidae	Porifera
<input type="checkbox"/>	1507320	Specimen/Lot	cf. Aphanipathes sp.	Aphanipathidae	Cnidaria
<input type="checkbox"/>	1292604	Specimen/Lot	cf. Bathycrinus sp.	Bathycrinidae	Echinodermata
<input type="checkbox"/>	1424212	Specimen/Lot	cf. Jasonisis sp.	Isididae	Cnidaria

Page 158 of 159 | Clear Selections | Export as KML | Export Selected Results

Invertebrate Zoology Collections | **Keyword Search** | Search by Field | Help | Feedback

Victorgorgia sp. : Anthothelidae : Gorgonacea : Anthozoa : Cnidaria

### Specimen/Lot

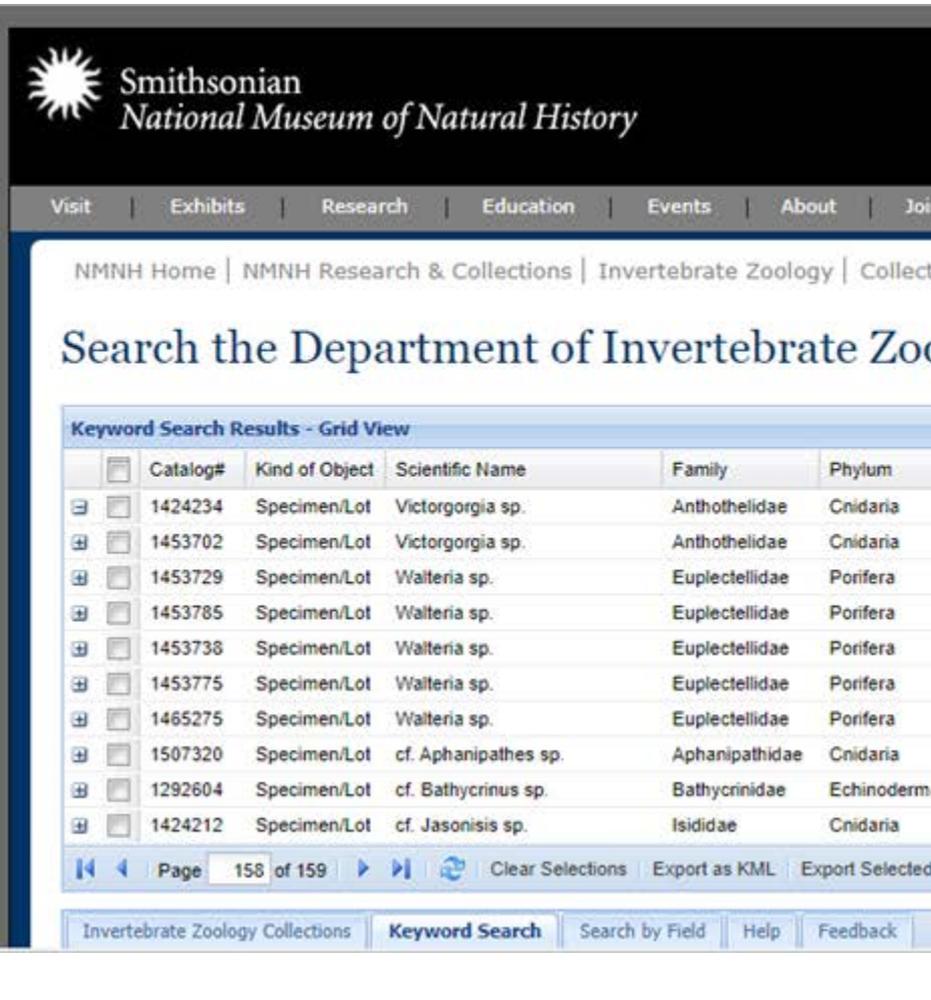
Catalog Number: USNM 1424234  
 Scientific Name: Victorgorgia sp.  
 Identified By: Kelley, Christopher, University of Hawaii at Manoa (UNITED STATES)  
 Date Identified: 2016  
 Classification: Animalia, Cnidaria, Anthozoa, Octocorallia, Gorgonacea, Scleraxonia, Anthothelidae

Common Name: Octocorals  
 Collection Name: NOAA Collections  
 Specimen Count: 1  
 Preparation: Ethanol - 95%  
 Date Collected: 16 Aug 2016 (UTC\_DateTime 20160816T004623)  
 Ocean: North Pacific Ocean  
 Country: United States  
 Precise Locality: Southwestern most seamount from Wake  
 Centroid Latitude: 16.5591  
 Centroid Longitude: 165.345  
 Expedition Name: Deepwater Wonders of Wake  
 Vessel: Deep Discoverer ROV; Okeanos Explorer R/V  
 Cruise: EX1606  
 Depth (m): 1215.48  
 Notes: Genomic DNA from this specimen has been deposited in the Ocean Genome Legacy (OGL) collection at Northeastern University. See "Other Numbers" for OGL Extract ID(s).

Other Numbers (Type | Value):  
 Specimen Number | EX1606\_20160816T004623\_D2\_DIVE14\_SPEC03BIO  
 Extract ID (DNA) | E26091  
 Extract ID (DNA) | E26696  
 Primary Collector #: EX1606\_20160816T004623\_D2\_DIVE14\_SPEC03BIO  
 Accession Number: 2078414  
 EZID: <http://n2t.net/ark:/65665/339470450-4010-4941-9b24-c676ff43b531>



# Develop: Sample Data Access



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National Museum of Natural History

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NMNH Home | NMNH Research & Collections | Invertebrate Zoology | Collections

## Search the Department of Invertebrate Zoology

Keyword Search Results - Grid View

<input type="checkbox"/>	Catalog#	Kind of Object	Scientific Name	Family	Phylum
<input type="checkbox"/>	1424234	Specimen/Lot	Victorgorgia sp.	Anthothelidae	Cnidaria
<input type="checkbox"/>	1453702	Specimen/Lot	Victorgorgia sp.	Anthothelidae	Cnidaria
<input type="checkbox"/>	1453729	Specimen/Lot	Walteria sp.	Euplectellidae	Porifera
<input type="checkbox"/>	1453785	Specimen/Lot	Walteria sp.	Euplectellidae	Porifera
<input type="checkbox"/>	1453738	Specimen/Lot	Walteria sp.	Euplectellidae	Porifera
<input type="checkbox"/>	1453775	Specimen/Lot	Walteria sp.	Euplectellidae	Porifera
<input type="checkbox"/>	1465275	Specimen/Lot	Walteria sp.	Euplectellidae	Porifera
<input type="checkbox"/>	1507320	Specimen/Lot	cf. Aphanipathes sp.	Aphanipathidae	Cnidaria
<input type="checkbox"/>	1292604	Specimen/Lot	cf. Bathycrinus sp.	Bathycrinidae	Echinodermata
<input type="checkbox"/>	1424212	Specimen/Lot	cf. Jasonisis sp.	Isididae	Cnidaria

Page 158 of 159 | Clear Selections | Export as KML | Export Selected

Invertebrate Zoology Collections | **Keyword Search** | Search by Field | Help | Feedback

Museum samples are only as valuable as the data associated with them.

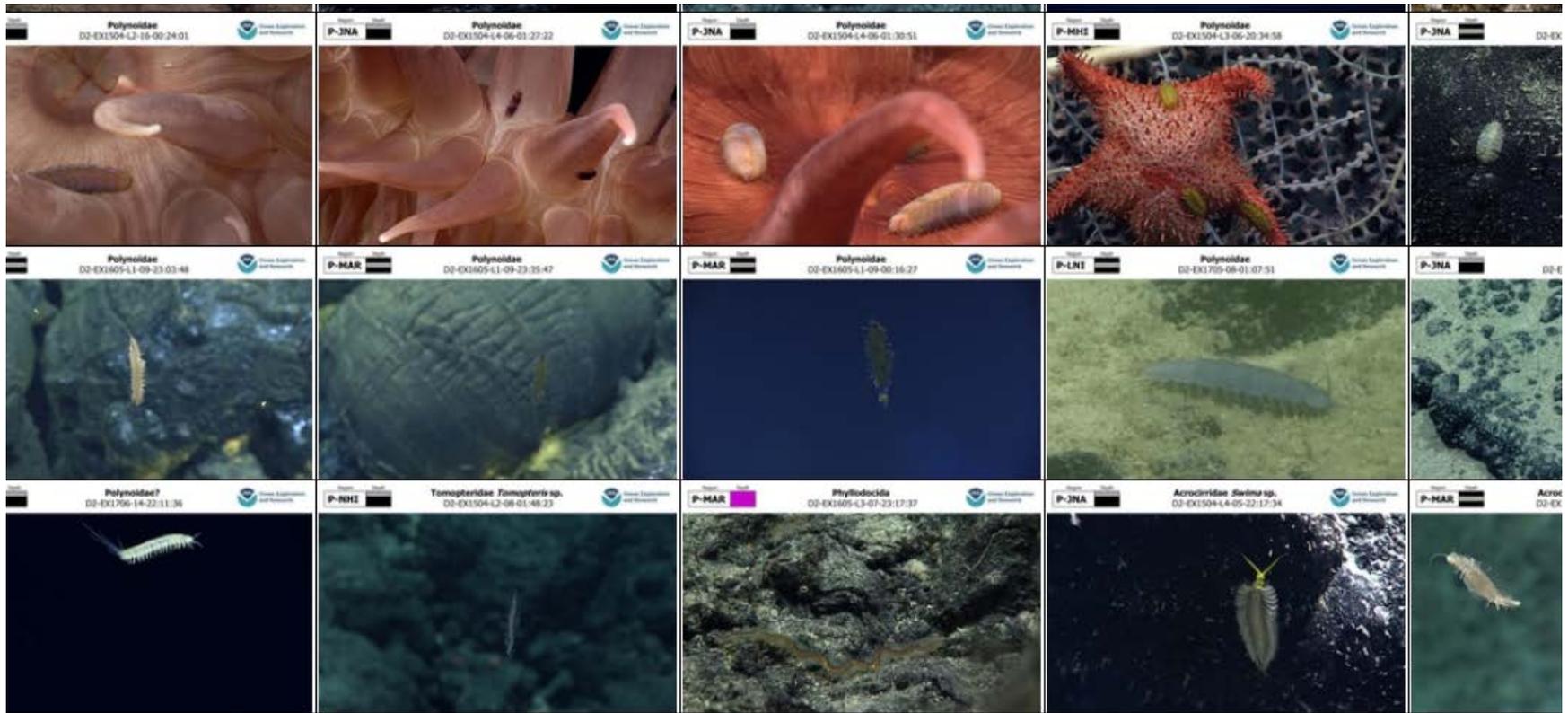
The *Okeanos* collected material has extremely high scientific value because of the finely detailed electronic data associated with it.

SODA ensures that all this data remains associated with the proper samples, and streamlines importing that information to the Smithsonian Natural History Museum catalog with minimal (if any) errors, where that data is publicly available to anyone interested.

As a result, the *Okeanos* samples remain high quality for scientific studies performed now and well into the future.

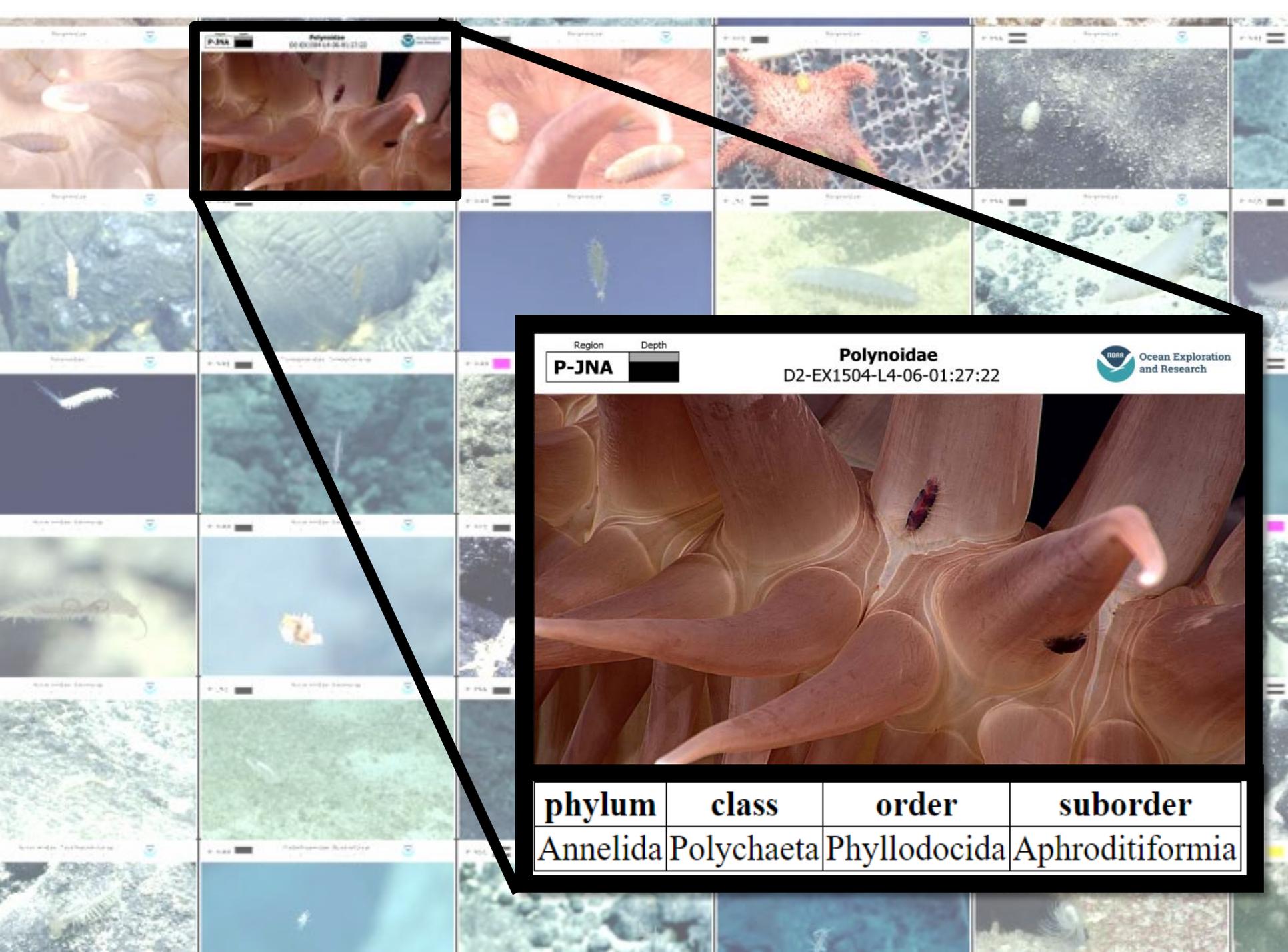
Dr. Abigail Reft,  
Smithsonian National Museum  
of Natural History

# Develop: Sample Data Analysis



[https://oceanexplorer.noaa.gov/oceanos/animal\\_guide/animal\\_guide.html](https://oceanexplorer.noaa.gov/oceanos/animal_guide/animal_guide.html)

## Benthic Deepwater Animal Identification Guide



Region Depth  
**P-JNA** [redacted]  
**Polynoidea**  
D2-EX1504-L4-06-01:27:22  
NOAA Ocean Exploration and Research



phylum	class	order	suborder
Annelida	Polychaeta	Phyllodocida	Aphroditiformia

# The Value of Collaboration

OER is a key partner for the DSCRTP. As the major NOAA funder of deep-sea exploration and research, OER's expertise, research, and information products are central to the DSCRTP mission. As a management-oriented research program, the DSCRTP complements OER's work and directly links it to resource managers' needs.

Together, our programs have been able to leverage additional ship time, make connections between exploration and management needs, and achieve more together than either program could alone.

***Thomas Hourigan, Ph.D.***

*Chief Scientist,*

*Deep Sea Coral Research and Technology Program*

# Leverage: NOAA's GeoPlatform



The screenshot shows the NOAA's GeoPlatform homepage. At the top left is the NOAA logo. To its right, the text reads "WELCOME TO NOAA's GeoPlatform" followed by "Providing geospatial data, maps, and analytics in support of NOAA's mission". Below this are four featured content cards: "Digital Elevation Models Global Mosaic (Color Shaded Relief)", "Get Into Your Sanctuary", "Marine Debris Removal & Assessment in the Northwestern Hawaiian", and "National Storm Surge Hazard Maps". A navigation arrow is visible on the right side of the featured cards. Below the featured cards is a paragraph of text: "NOAA's GeoPlatform is a GIS application using Esri's ArcGIS Online. The website is available to the public for browsing. Only NOAA staff have the ability to create accounts and may create their own account by logging in using their NOAA CAC or LDAP credentials. If you need help please submit a request on the NOAA Esri Central Support website." At the bottom of the screenshot is a grid of ten icons representing different NOAA programs: Charting Geodesy, Climate, Education, Fisheries, Marine Aviation, Oceans Coasts, Research, Sanctuaries, Satellites, and Weather.

WELCOME TO  
**NOAA's GeoPlatform**  
Providing geospatial data, maps, and analytics in support of NOAA's mission

**Digital Elevation Models Global Mosaic (Color Shaded Relief)**

**Get Into Your Sanctuary**

**Marine Debris Removal & Assessment in the Northwestern Hawaiian**

**National Storm Surge Hazard Maps**

NOAA's GeoPlatform is a GIS application using Esri's ArcGIS Online. The website is available to the public for browsing. Only NOAA staff have the ability to create accounts and may create their own account by logging in using their NOAA CAC or LDAP credentials. If you need help please submit a request on the [NOAA Esri Central Support website](#).

Charting Geodesy

Climate

Education

Fisheries

Marine Aviation

Oceans Coasts

Research

Sanctuaries

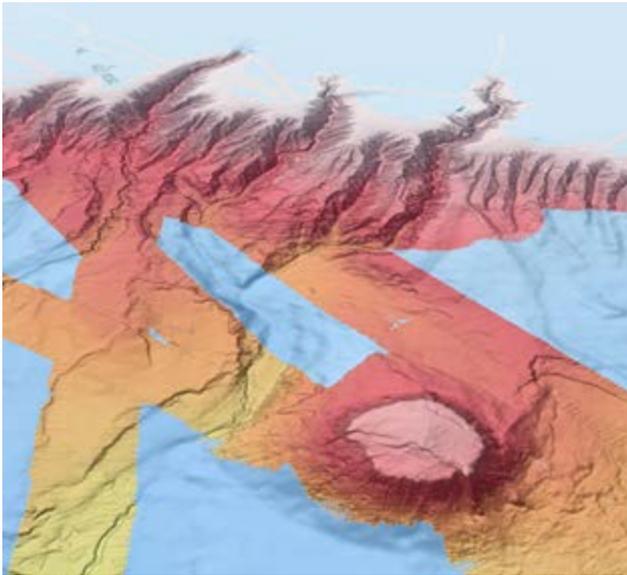
Satellites

Weather

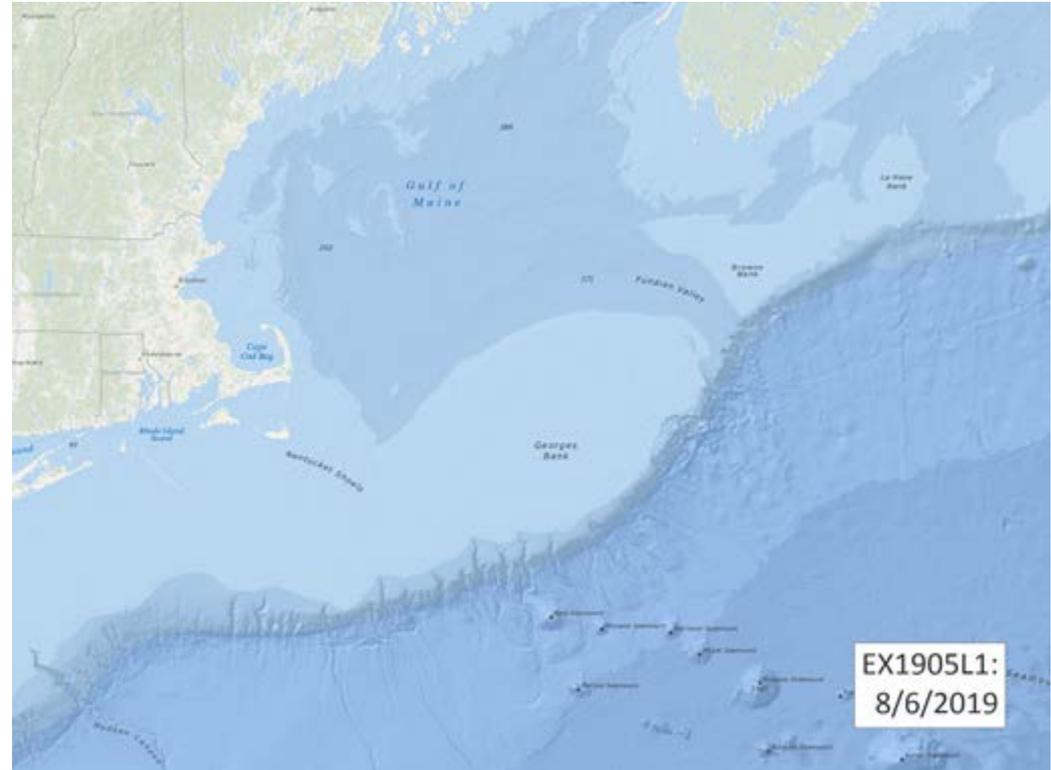
<https://noaa.maps.arcgis.com/home/index.html>

# Leverage: NOAA's GeoPlatform

New geospatial web services



Shaded relief imagery,  
3D visualization



Near real-time updates, automatically  
updated when ship is at sea

Web Services: Okeanos Explorer Bathymetric Grids

# Leverage: NOAA's GeoPlatform

Content Groups

1 - 20 of 22 Filters Type: Layers X Clear filters

Filters

Only search in NOAA GeoPlatform

Item Type Clear

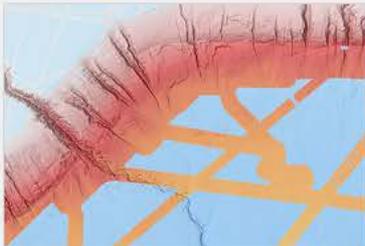
- Maps
- Layers
  - Feature Layers
  - Tile Layers
  - Map Image Layers
  - Imagery Layers
  - Scene Layers
  - Tables
  - Layer Files
- Scenes
- Apps
- Tools
- Files

> Location

> Date Modified

> Tags

> Shared



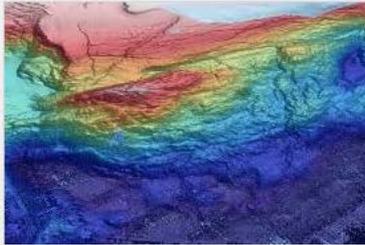
### Okeanos Explorer Bathymetric Grids

Imagery Layer by ncej\_noaa

An image service providing access to multibeam bathymetric products collected by the NOAA Ship Okeanos Explorer.

Created: Apr 4, 2016 Updated: Sep 17, 2019 View Count: 2,065

🔄 ☆ ⋮



### Multibeam and Okeanos Mosaics 3D

Web Scene by Jesse.Varner\_noaa

Created: Sep 25, 2019 Updated: Sep 25, 2019 View Count: 5

📄 ☆ ⋮



### NOAA Office of Ocean Exploration and Research 2018 Call for Input Results (Southeast U.S. Region)

Web Map by kasey.cantwell\_noaa

Areas submitted for consideration as part of the NOAA Office Of Ocean Exploration and Research's 2018 Call for Input in the Southeast U.S. Region

Created: Apr 16, 2019 Updated: Apr 19, 2019 View Count: 414

🔄 ☆ ⋮

# Leverage: NOAA's GeoPlatform

Home ▾ My Map New Ma

Details Add ▾ Basemap

Save ▾ Share Print ▾ Directions Measure Bookmarks Find address or place

About Content Legend

Contents

- Okeanos Explorer Ship Tracks - Stennis Map Service
- Okeanos Explorer Bathymetric Grids
- Deep-Sea Corals
- GEBCO 2019 Basemap (NOAA NCEI Visualization)

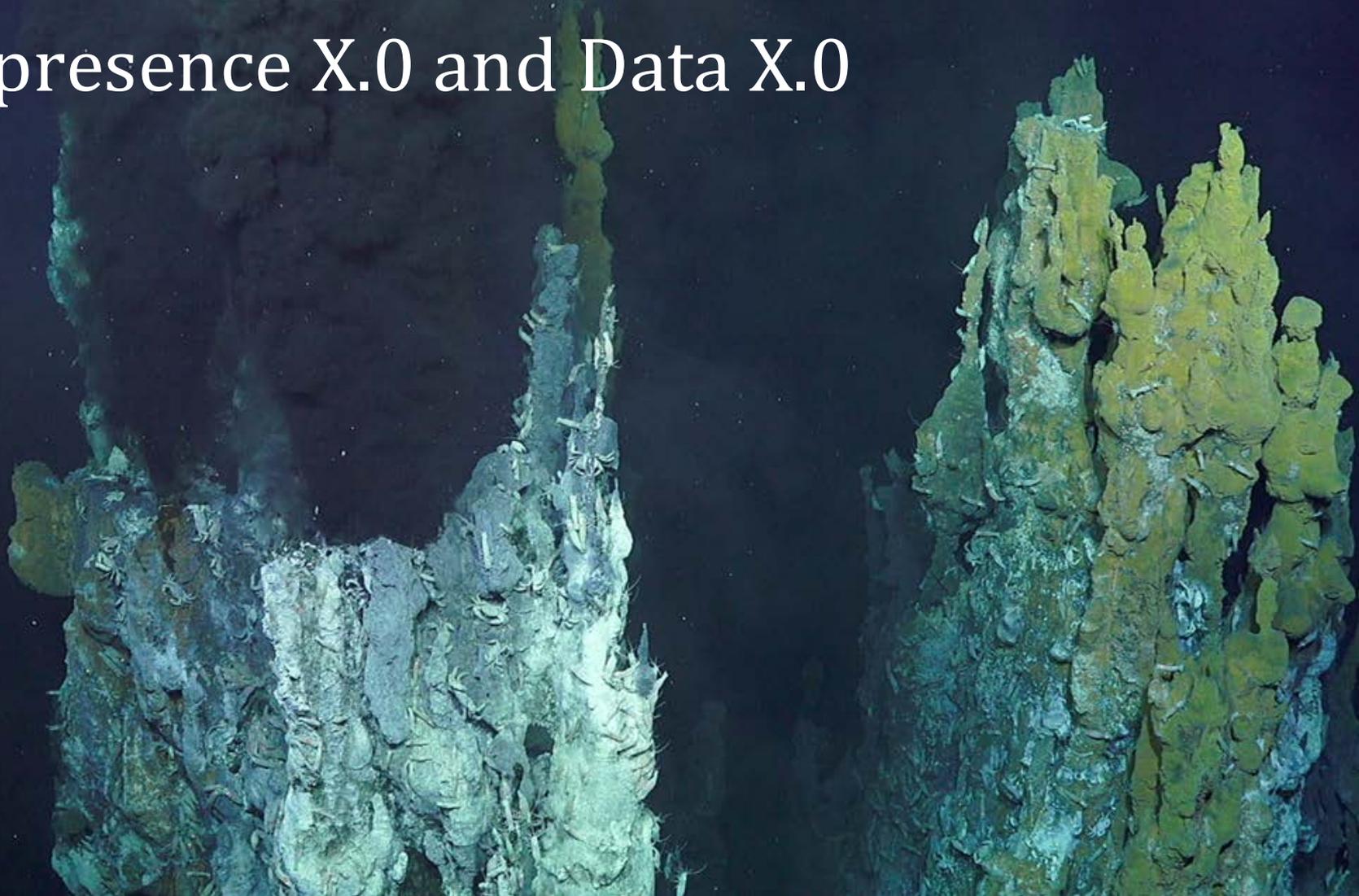
The screenshot displays the NOAA GeoPlatform interface. The main map shows the Caribbean Sea and surrounding landmasses, overlaid with bathymetric grids and ship tracks. A popup window titled '(1 of 1759) Locations: stony coral (cup coral)' provides detailed information for a specific observation. The popup includes the following data:

Scientific Name	Stenocyathus vermiformis
Vernacular Name	stony coral (cup coral)
Category	
Observation Date	1868-05-04
Depth (m)	314.00
Latitude	24.28
Longitude	-81.06
Location Accuracy (m)	>1000m
Sample ID	CoWCoG 685
Data	NA
Actions	<a href="#">Zoom to</a> <a href="#">Get Directions</a>

Trust Center Contact Us Report Abuse Contact Us

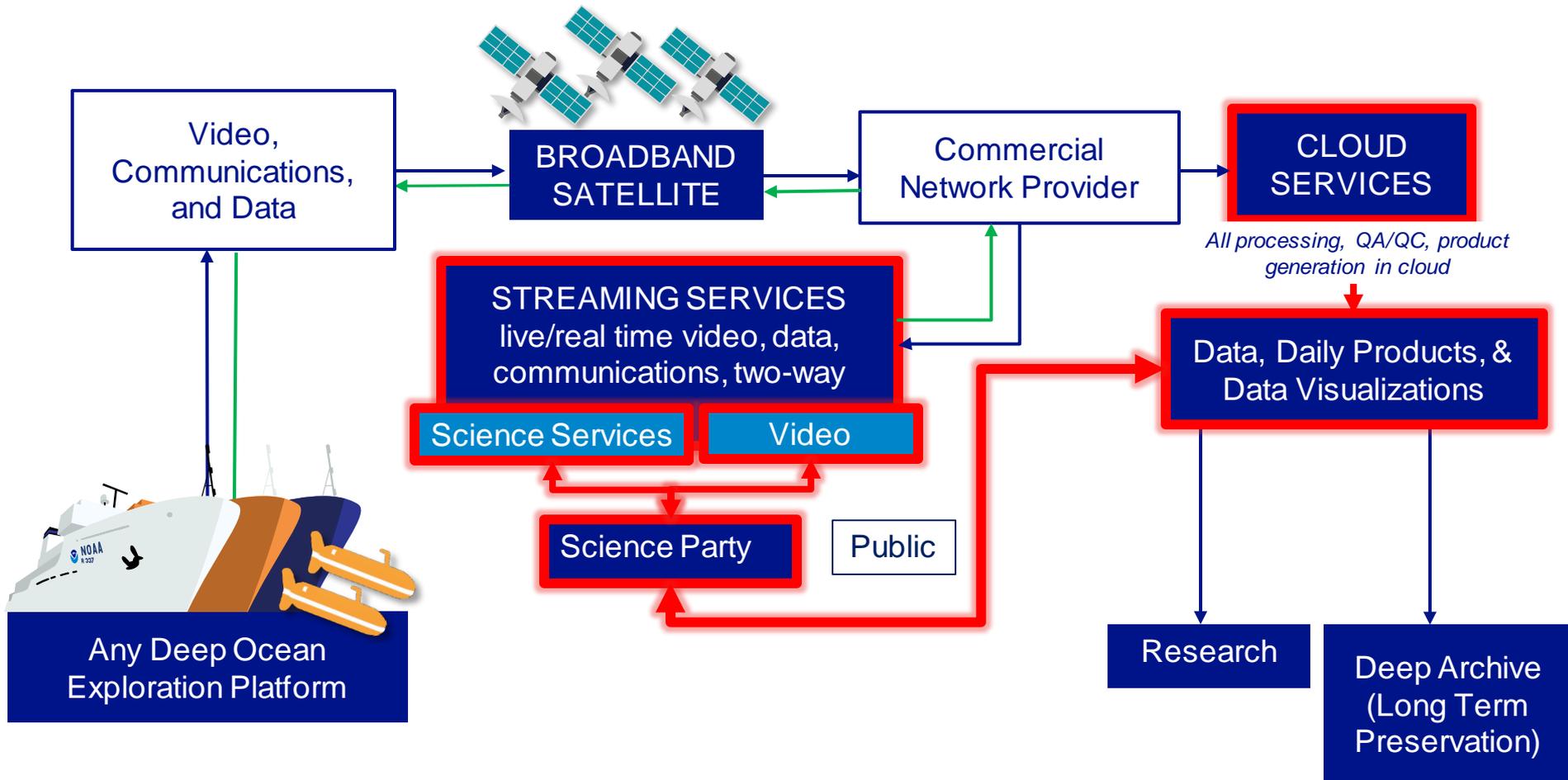
NOAA National Centers for Environmental Information, National Marine Fisheries Service Office of Habitat Conservation

# The Future of Data: Direct-to-Cloud-to-Users with Telepresence X.0 and Data X.0

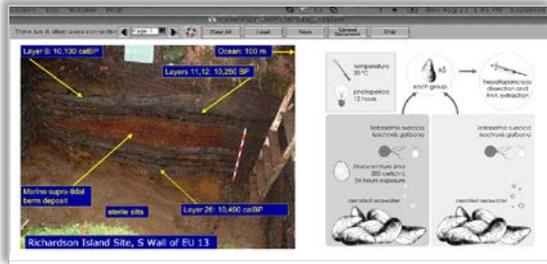




# Science Benefits: Telepresence X.0 and Data X.0



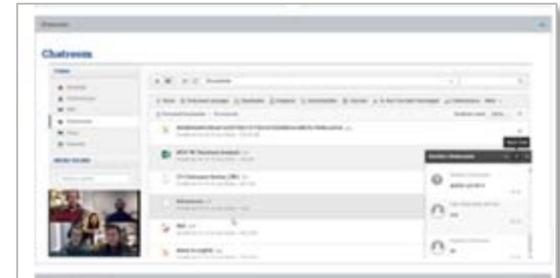
# Interactive Science Tools from Web Services



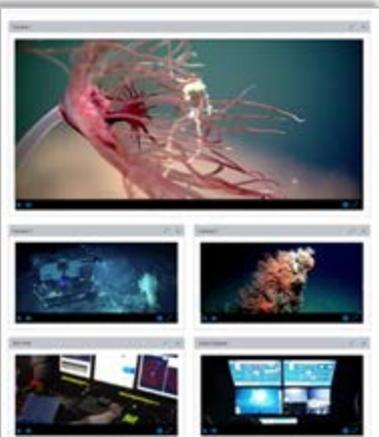
VIRTUAL WHITEBOARD

Combining output from multiple web services to:

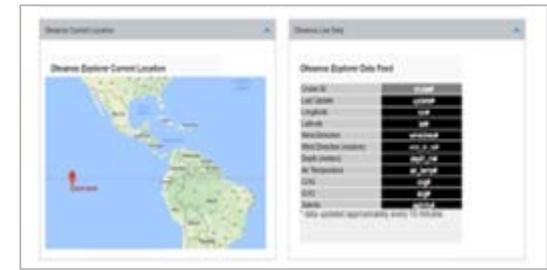
- drive operations;
- verify data quality; and,
- develop intelligent data in near-real time



CHAT LOG



VIDEO CAMERA DISPLAYS



ENVIRONMENTAL VARIABLES

Time	Latitude	Longitude	Depth	Depth	Action
17-Nov-2018 18:09:45	17.0429	-17.0501	700.4	SeaSurface	⊞
17-Nov-2018 18:14:00	17.0428	-17.0505	700.0	SeaSurface	⊞
17-Nov-2018 18:18:24	17.0423	-17.0500	700.0	SeaSurface	⊞
17-Nov-2018 18:18:47	17.0424	-17.0511	700.0	SeaSurface	⊞
17-Nov-2018 18:18:42	17.0424	-17.0511	700.0	SeaSurface	⊞
17-Nov-2018 18:19:40	17.0421	-17.0512	700.4	SeaSurface	⊞
17-Nov-2018 18:22:12	17.0426	-17.0505	700.0	SeaSurface	⊞
17-Nov-2018 18:22:07	17.0428	-17.0504	700.0	SeaSurface	⊞
17-Nov-2018 18:23:22	17.0426	-17.0505	700.4	SeaSurface	⊞
17-Nov-2018 18:26:11	17.0428	-17.0507	700.4	SeaSurface	⊞
17-Nov-2018 18:27:04	17.0429	-17.0506	700.0	SeaSurface	⊞
17-Nov-2018 18:28:10	17.0420	-17.0506	700.4	SeaSurface	⊞
17-Nov-2018 18:28:18	17.0425	-17.0509	700.0	SeaSurface	⊞
17-Nov-2018 18:29:40	17.0424	-17.0500	700.4	SeaSurface	⊞
17-Nov-2018 18:31:00	17.0424	-17.0507	700.0	SeaSurface	⊞
17-Nov-2018 18:31:17	17.0425	-17.0508	700.0	SeaSurface	⊞
17-Nov-2018 18:33:13	17.0426	-17.0512	700.1	SeaSurface	⊞
17-Nov-2018 18:34:32	17.0423	-17.0509	700.1	SeaSurface	⊞

ANNOTATION LOG



3D VISUALIZATIONS

# Science Benefits: the Virtual Whiteboard

The screenshot displays a virtual whiteboard interface within a web browser window. The browser title is "Conference Room Interview\_Elizabeth". The interface includes a video feed on the left with three participants, a toolbar at the top with options like "Page 1", "Clear All", "Load", "Save", "Upload Document", and "Chat", and a text area on the right with a font dropdown set to "Arial".

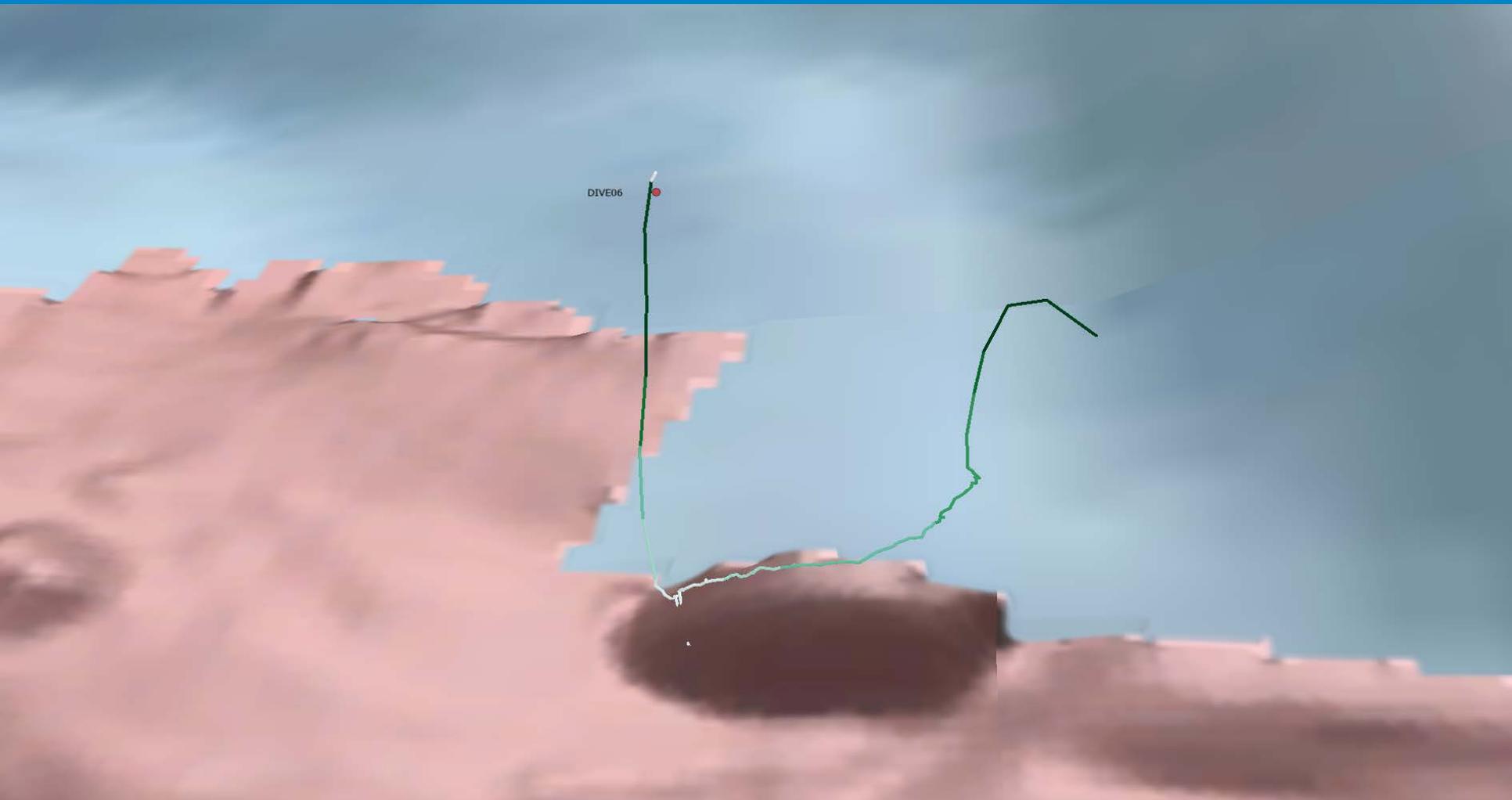
The main content area is divided into two sections:

- Left Section:** A photograph of a geological site with several annotations in blue boxes and yellow arrows:
  - "Layer 6: 10,100 calBP" (top left)
  - "Ocean: 100 m" (top right)
  - "Layers 11,12: 10,250 BP" (middle)
  - "Marine supra-tidal berm deposit" (bottom left)
  - "sterile silts" (bottom center)
  - "Layer 26: 10,490 calBP" (bottom right)
  - "Richardson Island Site, S Wall of EU 13" (bottom)
- Right Section:** A biological experiment diagram showing a workflow:
  - Inputs: "temperature 20 °C" and "photoperiod 12 hours".
  - Process: "each group" (with a magnifying glass icon and "x5") leading to "hepatopancreas dissection and RNA extraction".
  - Two experimental groups are shown:
    - Group 1: *Tetraselmis suecica* and *Isochrysis galbana* with "Prorocentrum lima 200 cells/mL 24 hours exposure" and "aerated seawater".
    - Group 2: *Tetraselmis suecica* and *Isochrysis galbana* with "aerated seawater".
  - Output: Two drawings of mussel shells.

Envisioning the **Virtual Whiteboard** for collaborative scientific analysis

- Support annotations and future data accessibility and usability
- Contributes to scientific understanding

# Operational Guidance: 3D Chemistry Model



# Integrated GIS Analysis Tools

Office of Ocean Exploration and Research    Prototype Data Discovery and Access App    OER Website

- OER Expedition Information 19
- Okeanos Explorer Ship Tracks 22
- OER Submersible Dives 41
- OER CTD Collection 83
- OER Sampling Activities 0
- OER Geological Samples Collection 0
- OER Biological Specimens Collection 0
- OER Images and Videos 0

The map displays the Gulf of Maine and Georges Bank region. It features a color-coded bathymetry overlay and numerous orange lines representing ship tracks. Various data points are marked with alphanumeric codes and depth values (e.g., 60, 61, 64, 67, 70, 72, 73, 74, 75, 77, 79, 82.5, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100). A scale bar indicates 60 miles, and the coordinates are -70.968 43.061 Degrees.

**Add Data**

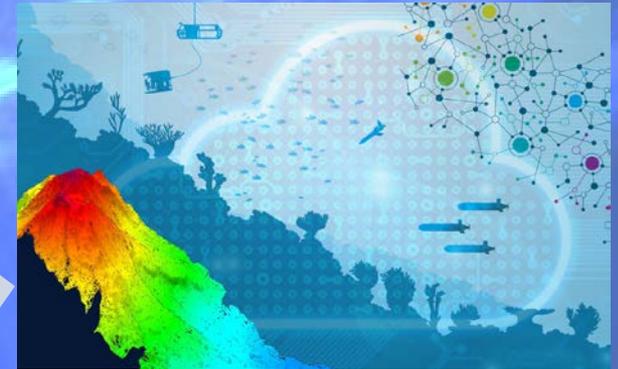
Search	URL	File
My Organization	sea surface	

Within map...    Type    Relevance

- Near-Real-Time Surface In-Situ Observati...  
Map Service by NOAA.GeoPlatform  
REMOVE    DETAILS
- Sea Surface Temperature Monthly Avera...  
Image Service by ncei\_noaa  
REMOVE    DETAILS
- Gridded Surface Weather and Marine W...  
Map Service by NOAA.GeoPlatform  
ADD    DETAILS
- S7CAs for WebApp v1c 20180301  
Feature Service by Dean.Szumylo\_noaa  
ADD    DETAILS
- Section 7 Consultation Areas v1c 201803...  
Feature Service by Dean.Szumylo\_noaa  
ADD    DETAILS

<< < > >> 20 Items    LAYERS

# Data Management Evolution



**EXPLORE:**  
2002: Archive  
Define and document  
best data management  
practices

**EXPERIENCE:**  
2010: Access  
Best practices  
implemented and  
refined aboard NOAA  
Ship *Okeanos Explorer*

**UNDERSTAND:**  
2019: Reuse  
Ocean Exploration  
data readily accessible  
and usable

**EMPOWER USERS:**  
2024: Service Economy  
Telepresence X.0 and Data X.0  
will empower users to build  
their own experience



**Ocean Exploration  
and Research**



**National Centers for  
Environmental Information**