Mesophotic and Deep Benthic Communities Restoration: Progress Updates and Planned Activities for 2025

May 6th, 2025

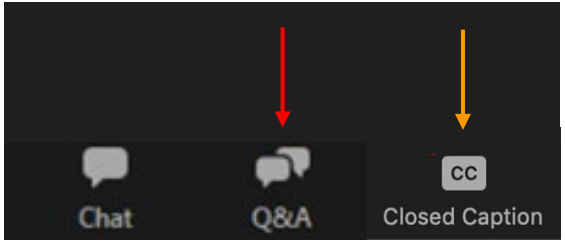
DWH Mesophotic & Deep Benthic Communities Restoration

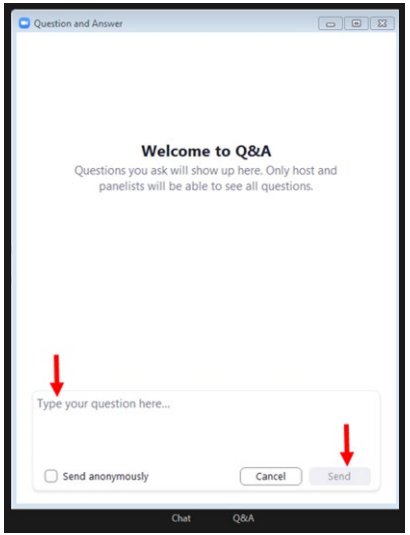
Photo: NOAA, Oceaneering International, Inc.

Webinar Participation

DWH Mesophotic & Deep Benthic Communities Restoration

- Please use the “Q&A” box to type questions for the Q&A session at the end
- Auto-generated closed captions are available
- Webinar recording and slides will be posted on www.gulfspillrestoration.noaa.gov
- A link to the recording will be sent to all registrants





Thank You Webinar Partners!

University of Rhode Island InnerSpace Center

- **Mission:** The Inner Space Center connects diverse audiences to a global network of exploration in real time. We enable scientists and students to participate remotely in expeditions while engaging with the general public to enhance the broader impacts of their research.
- Partnered with NOAA & MDBC Restoration portfolio via the Ocean Exploration Cooperative Institute
    - Collaborating to help connect the public with the restoration work and the team members that make it happen through livestreams, public presentations, videos, and more

MDBC Webinar Overview

DWH Mesophotic & Deep Benthic Communities Restoration

- *Deepwater Horizon* Oil Spill Background
- Overview of 2024 Field Activities
- Planned 2025 Field Activities
- Individual Project Updates
  - Mapping, Ground-Truthing, & Predictive Habitat Modeling
  - Habitat Assessment and Evaluation
  - Coral Propagation Technique Development
  - Active Management & Protection
- Accessing MDBC Portfolio Products & Resources
- Q&A Session

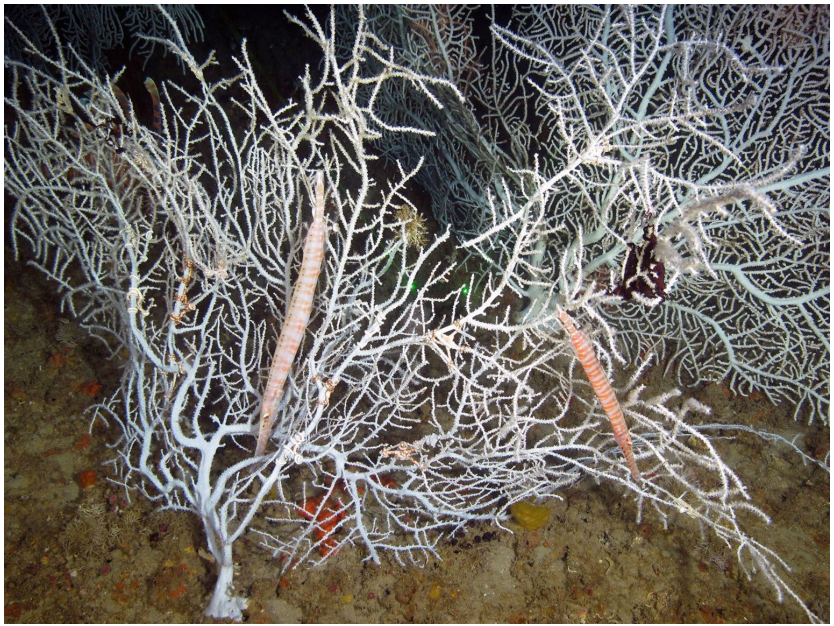


Photo: NOAA, UNCW Undersea Vehicles Program

Common Acronyms

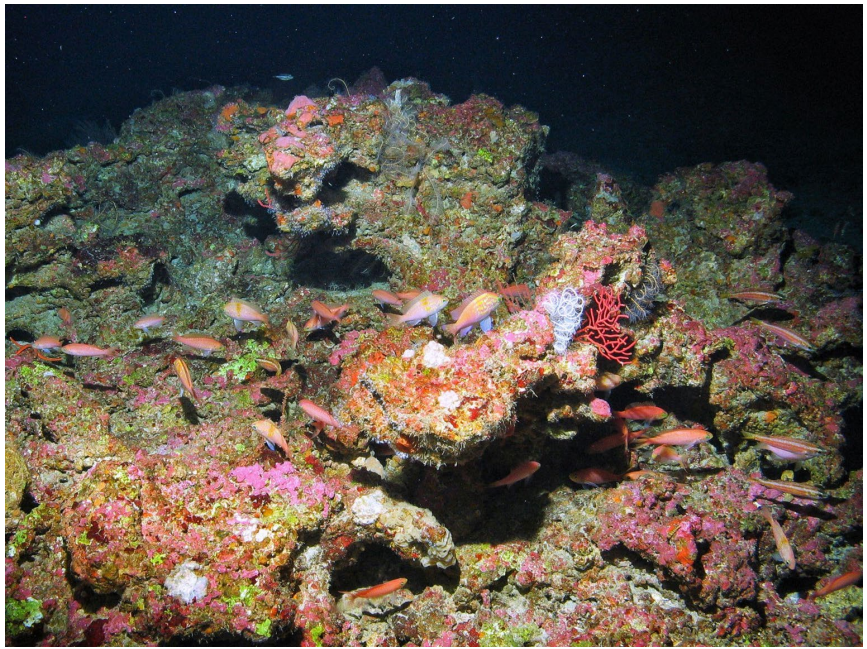


Photo: NOAA, Marine Applied Research & Exploration

- **MDBC** = Mesophotic & Deep Benthic Communities
- **MGM** = Mapping, Ground-Truthing, & Predictive Habitat Modeling
- **HAE** = Habitat Assessment and Evaluation
- **CPT** = Coral Propagation Technique Development
- **AMP** = Active Management & Protection

Deepwater Horizon
Oil Spill Background

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Mesophotic & Deep Benthic Communities Restoration

Photo: NOAA, Oceaneering International, Inc.

Deepwater Horizon Incident

Photo: Georgia Department of Natural Resources

- Largest marine oil spill in U.S. history
- >1.5 million gallons of oil released into the ocean every day for 87 days
- Extensive impacts to organisms such as fish, sea turtles, dolphins, whales, birds, and seafloor communities
- Washed up onto more 1,300 miles of shoreline from Texas to Florida

Natural Resource Damage Assessment

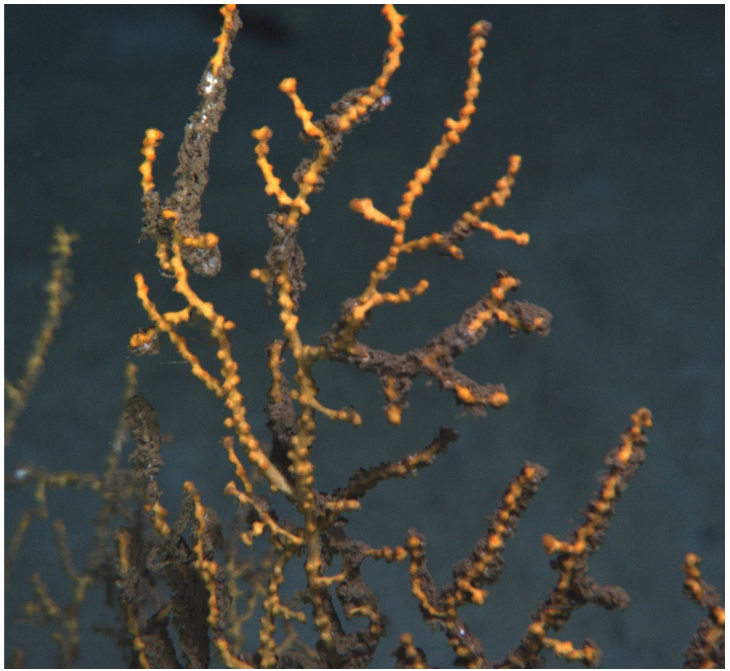
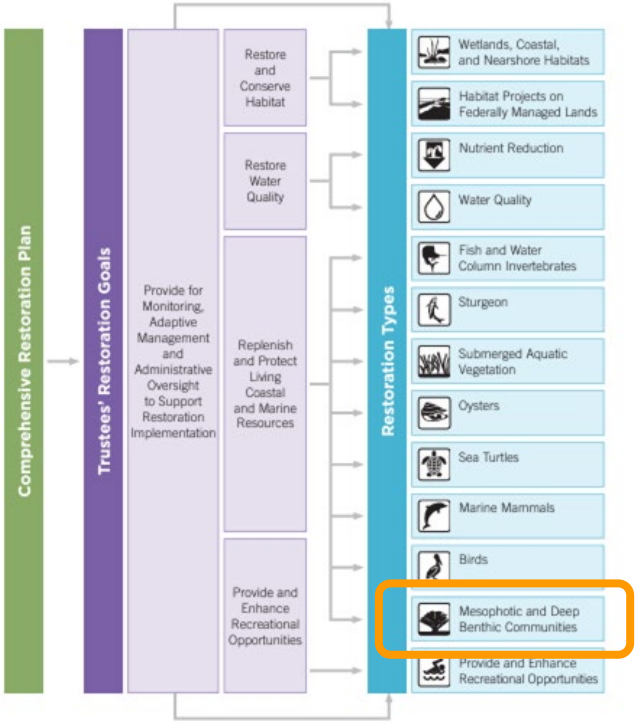


Photo: Lophelia II/Woods Hole Oceanographic Institution

- Federal and State agencies, as the Deepwater Horizon Natural Resource Damage Assessment Trustee Council, assessed natural resource injuries
- Injuries occurred at all trophic levels to virtually all species and habitats impacted by the oil
- Deep-sea habitats were impacted with oil deposited onto at least 400mi^2 of seafloor
- Quantified injury to over 770mi^2 of benthic habitat, substantial losses to corals and other deep-sea species

Settlement & Programmatic Restoration Plan

- 2016 settlement: up to $8.8 billion to make the public whole for injuries to natural resources
- Programmatic Restoration Plan guides all subsequent restoration work
- 13 Restoration Types identified in the plan → Mesophotic and Deep Benthic Communities
- $273 Million designated for MDBC restoration



Restoring Mesophotic & Deep Benthic Communities

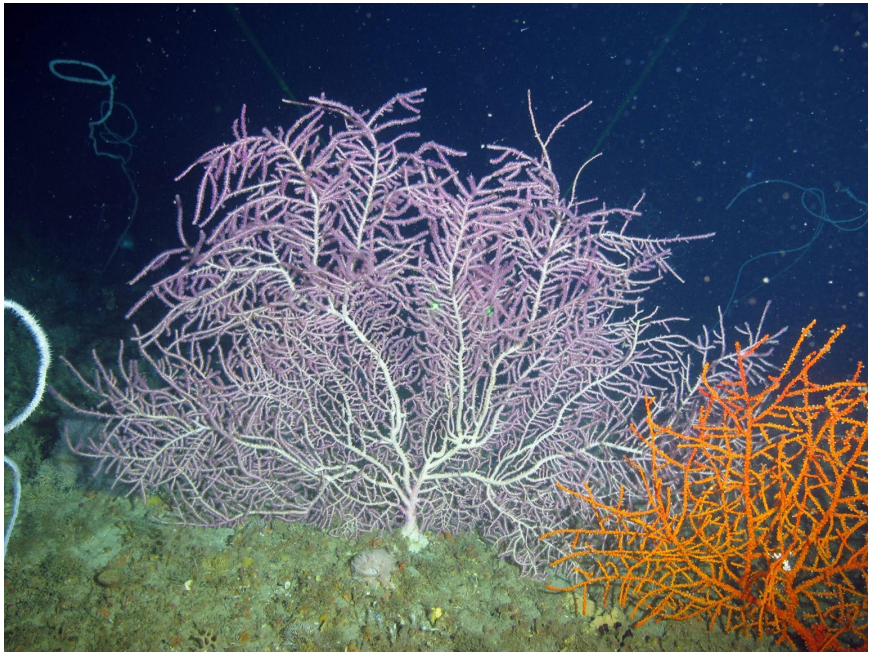


Photo: NOAA, UNCW Undersea Vehicles Program

Long-term Restoration Goals:

- Restore mesophotic and deep benthic invertebrate and fish abundance and biomass for injured species.
- Actively manage valuable MDBC to protect against multiple threats and provide a framework for monitoring, education, and outreach.
- Improve understanding of MDBC to inform better management and ensure resiliency.

2024 Field Activities Overview

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Mesophotic & Deep Benthic Communities Restoration

Photo: NOAA, Oceaneering International, Inc.

2024 Field Activities Overview

10 ships used, including the R/V *Point Sur* and NOAA ships *Nancy Foster* and *Pisces*

35 public livestreams at sea or in labs

14 missions

~200 days spent at sea

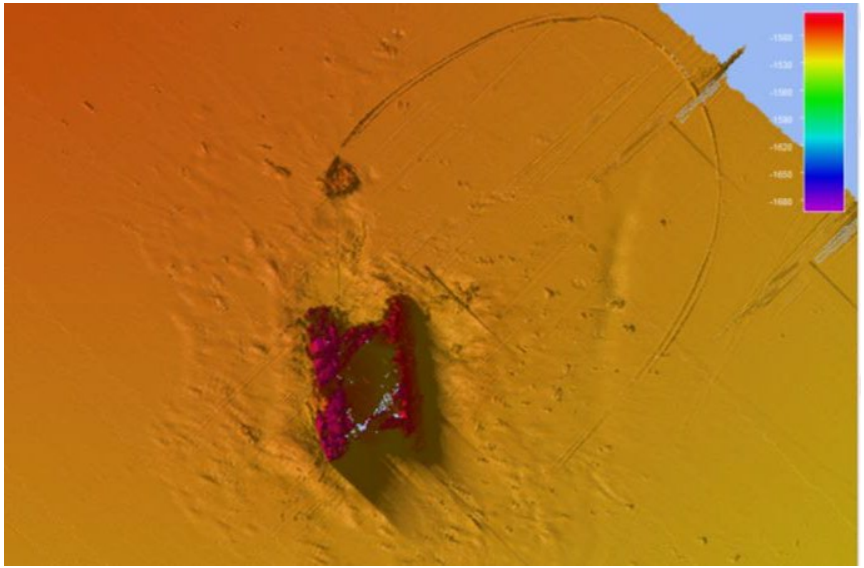
500 at-sea transects completed with remotely operated vehicles (ROVs)

6,000+ square kilometers of seafloor mapped with ship-based tech and autonomous underwater vehicles (AUVs)

2024 Field Activities Overview

Mapping, Ground-Truthing, and Predictive Habitat Modeling

- Mapped seafloor around *Deepwater Horizon* wreck and nearby habitat at 1m resolution
- Collected more than 2,300 square miles of seafloor bathymetry data
- Trialed new sensors to improve detail of seafloor data collected by AUVs
- Collected imagery and sediment sample data to validate and refine predictive habitat models



Credit: NOAA, University of Southern Mississippi

2024 Field Activities Overview

Habitat Assessment and Evaluation

- Video transects, still images, and coral colony images support characterization of habitat and assessment of coral growth and recovery
- Collected biological, water, and sediment samples
- Deployed ARMS and landers on the seafloor to better understand organisms that inhabit MDBC and collect long-term environmental data

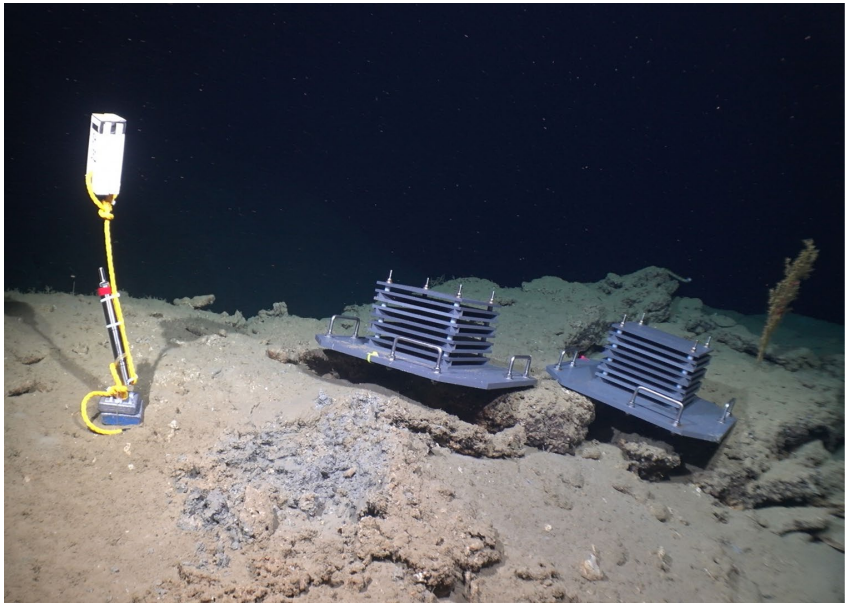


Photo: NOAA, Pelagic Research Services

2024 Field Activities Overview

Coral Propagation Technique Development

- Live coral samples collected by ROV, technical, and saturation divers and transported to labs/aquariums for further study to support restoration
- Continued coral propagation tests, including first *in situ* fragmentation
- Technical divers monitored health and growth of coral fragments, settlement on artificial substrates

Photo: Sophia Melville/University of Rhode Island InnerSpace Center

2024 Field Activities Overview

Active Management and Protection

- Collaborative NOAA - Navy saturation diving mission to remove or mitigate threats to MDBC
  - Mooring installations
  - Marine debris removal
  - Invasive lionfish removal
- Telepresence capabilities installed on the 3 ships resulting in 35 livestream programs for the public

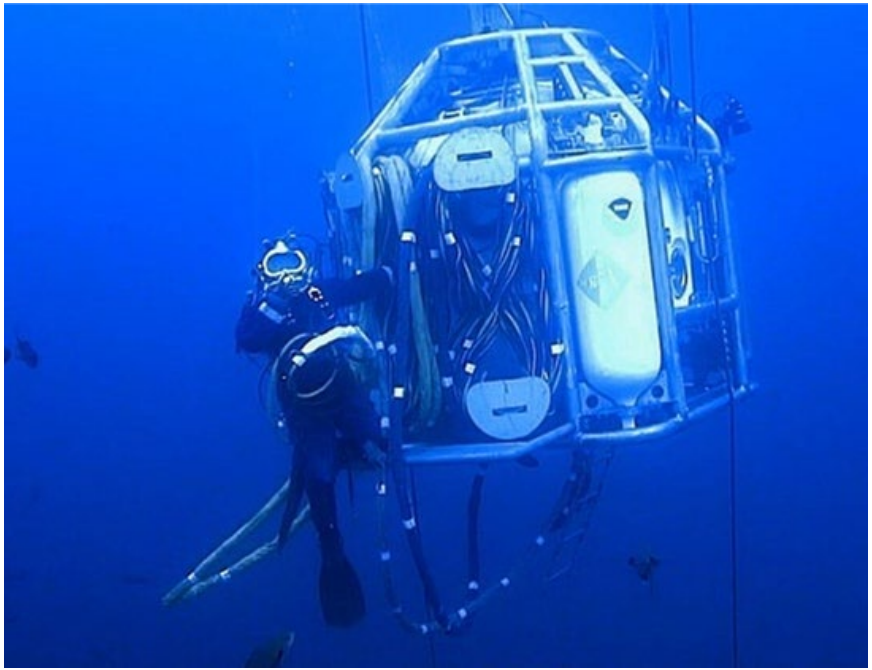


Photo: NOAA, C-Innovation, LLC.

2025 Planned Field Activities

DWH Mesophotic & Deep Benthic Communities Restoration

Photo: NOAA, Oceaneering International, Inc.

2025 Planned Field Activities

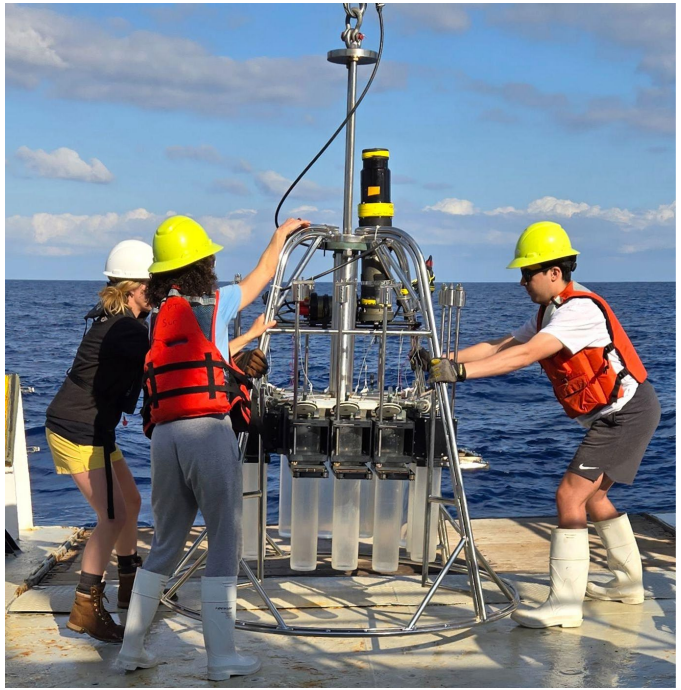


Photo: Kaitlin Kovacs/USGS

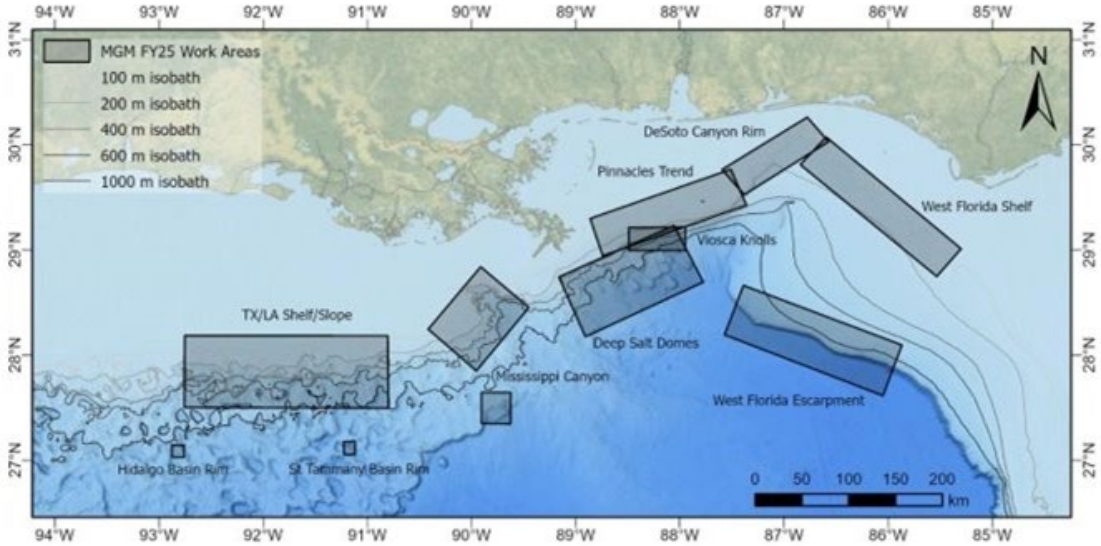
Partners

- United States Geological Survey
- Marine Applied Research & Exploration
- National Marine Sanctuary Foundation
- Ocean Exploration Cooperative Institute
- Woods Hole Oceanographic Institute
- U.S. Navy, Naval Surface Warfare Center
- Pelagic Research Services
- Ryan Marine Services, Inc.
- Civilian Tech Diver Corps (coordinated by Moody Gardens Aquarium)
- NOAA Office of Marine and Aviation Operations
- Florida Institute of Oceanography
- and many more…

2025 Field Activities Overview

Mapping, Ground-Truthing, and Predictive Habitat Modeling:

- Priority areas selected based on data needs of HAE and CPT teams
- Deployed *Eagle Ray* AUV
- Deploy new REMUS 620 AUVs
- Ship-based multibeam mapping
- ROV transects to ground-truth predictive habitat models

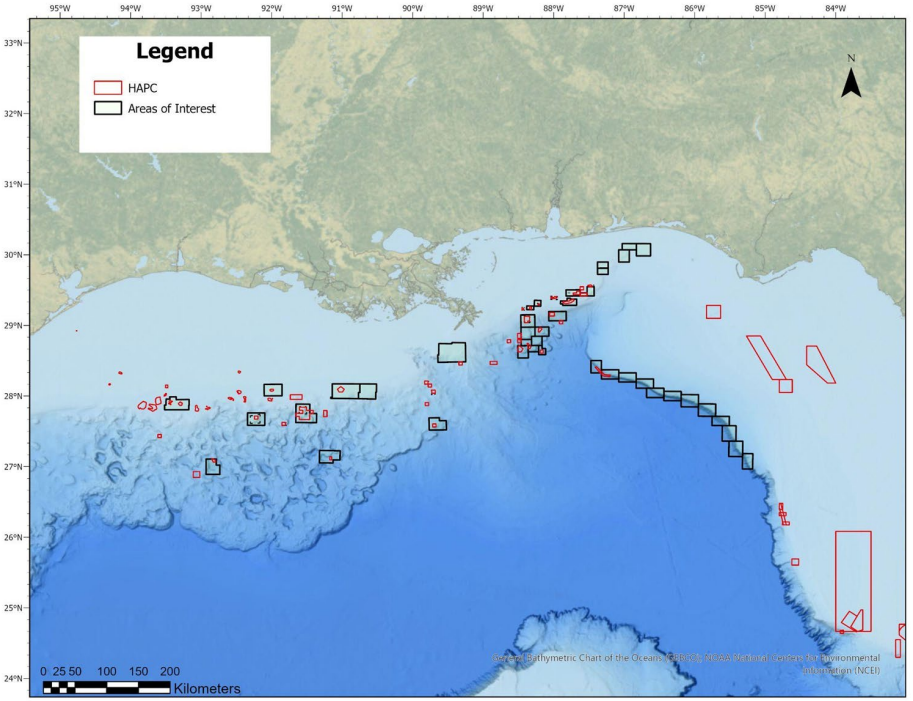


Credit: NOAA

2025 Field Activities Overview

Habitat Assessment and Evaluation:

- ROV transects
- Conductivity, temperature, depth (CTD) casts, & collect water samples
- Deploy and recover landers and ARMS
- Collect biological samples
- Collect sediment samples
- Survey DWH wreck and collect images of marked coral colonies

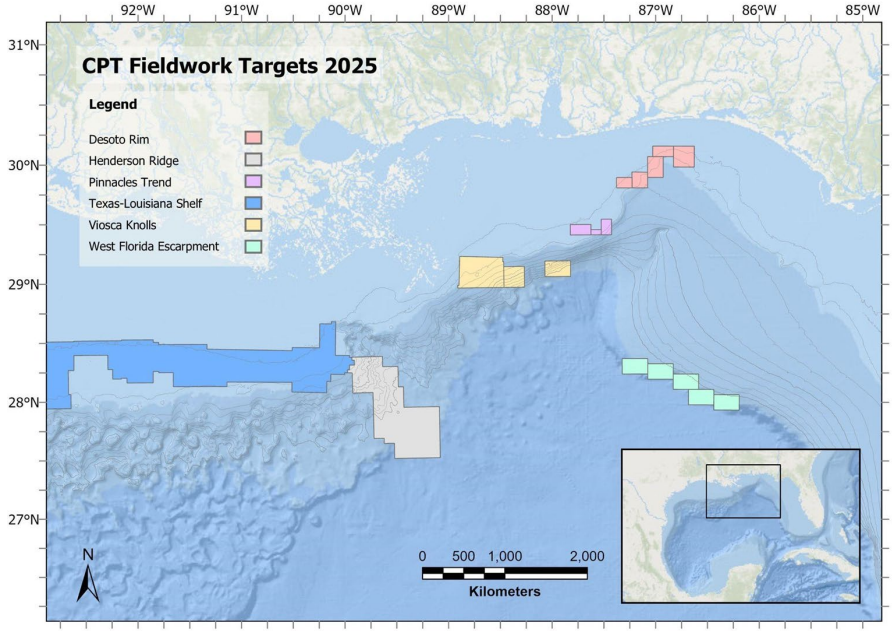


Credit: NOAA

2025 Field Activities Overview

Coral Propagation Technique Development:

- Monitor health of propagated corals
- Monitor settlement to artificial substrates
- Collect new coral samples for labs and for further analyses
- Conduct additional propagation tests via
  - fragmentation
  - deployment of artificial substrates



Credit: NOAA

2025 Field Activities Overview

Active Management and Protection:

- Support Flower Garden Banks National Marine Sanctuary marine debris removal mission
- Support remote monitoring and enforcement technology demonstration mission
- Monitor threat reduction objectives from 2024
- Coordination on education, outreach, and livestream programs

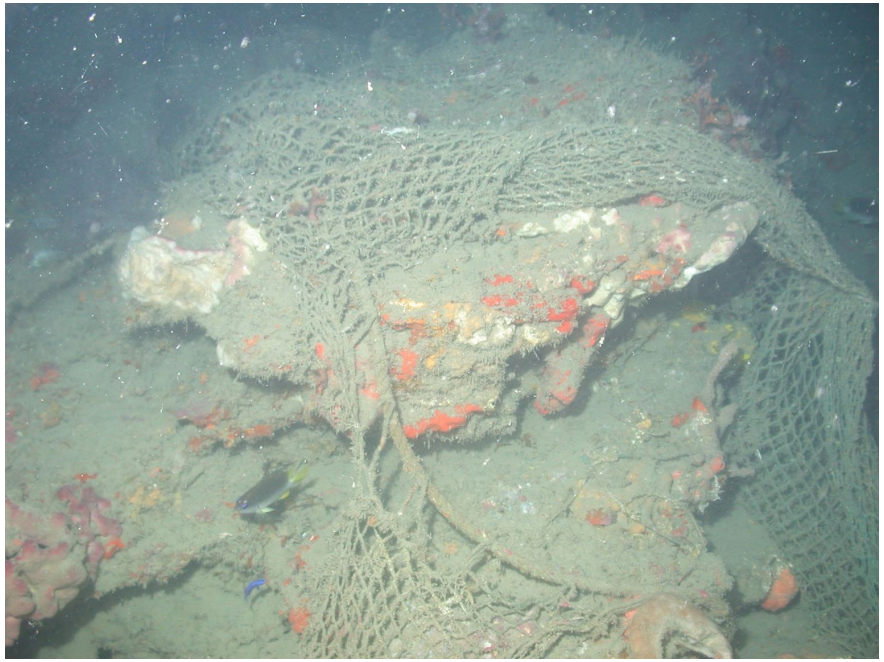


Photo: NOAA

Webinar Participation

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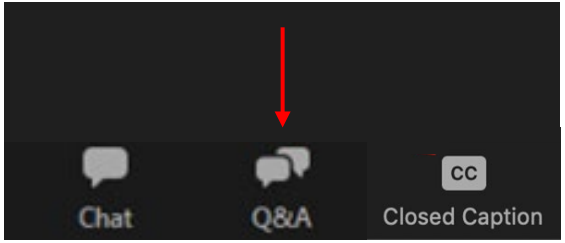
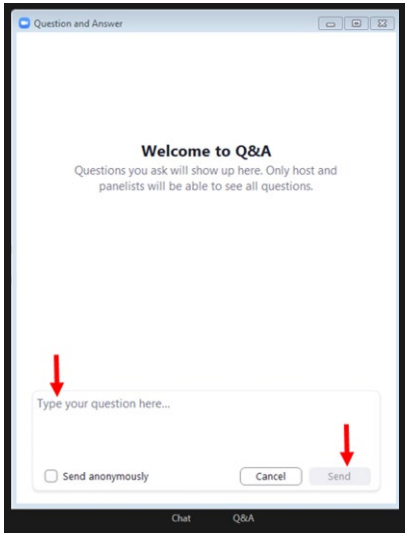
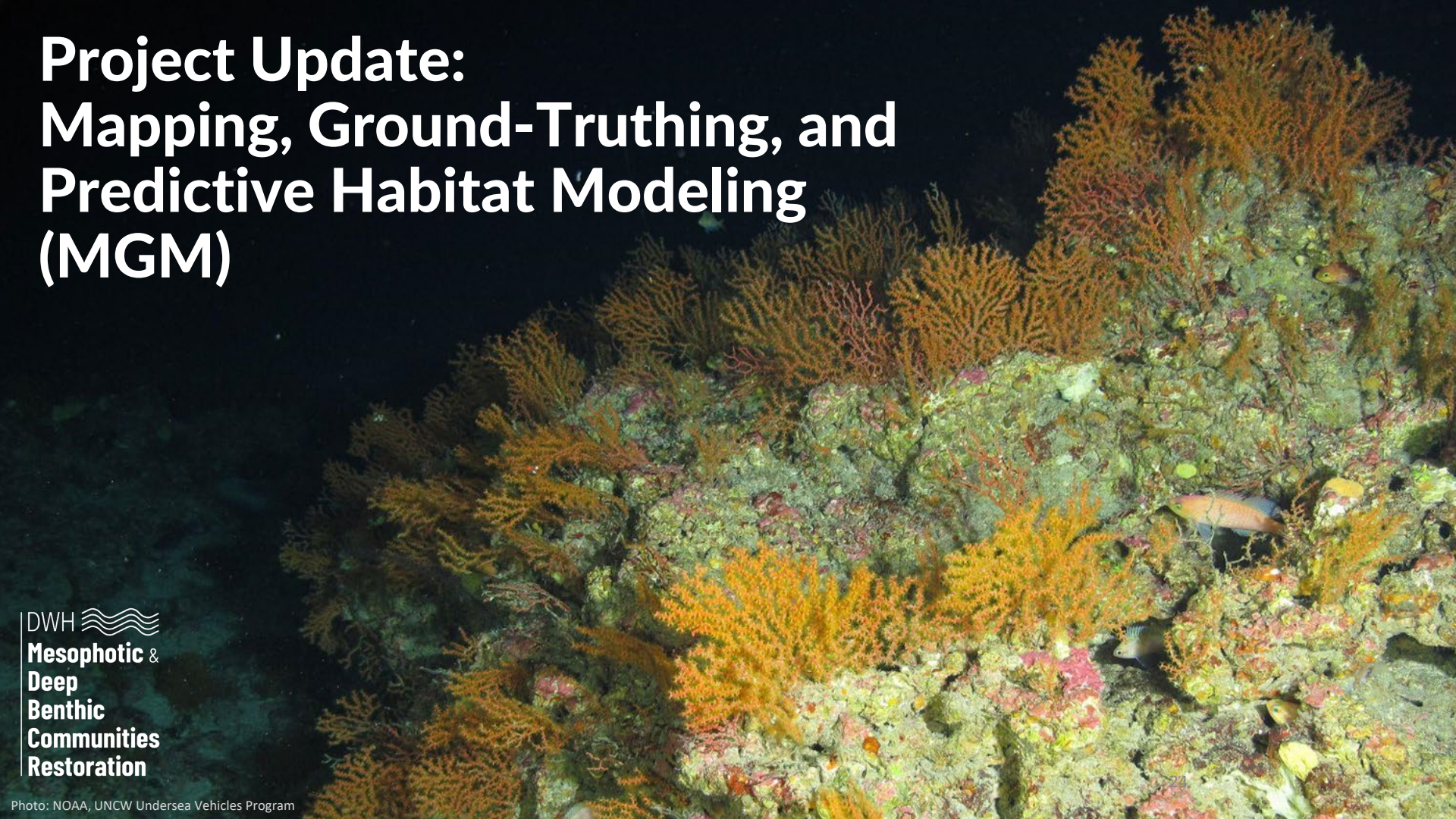


- We’ll get to as many questions as we can!



Project Update: Mapping, Ground-Truthing, and Predictive Habitat Modeling (MGM)

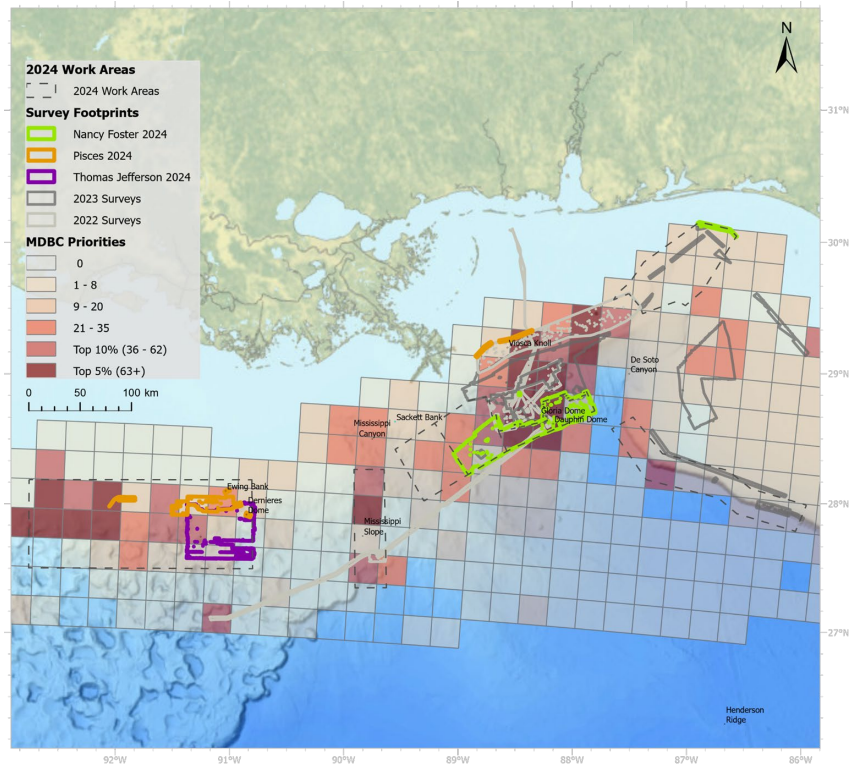


DWH Mesophotic & Deep Benthic Communities Restoration

Photo: NOAA, UNCW Undersea Vehicles Program

Project Update - MGM

- Over 7,500 square miles of the seafloor mapped to date, continue to align with stakeholder prioritization completed in 2021
- Predictive habitat modeling (PHM)
  - Inventory of existing PHM studies
  - Publication of sampling design simulation study technical report
  - Exploring application of synthetic aperture sonar data for PHM

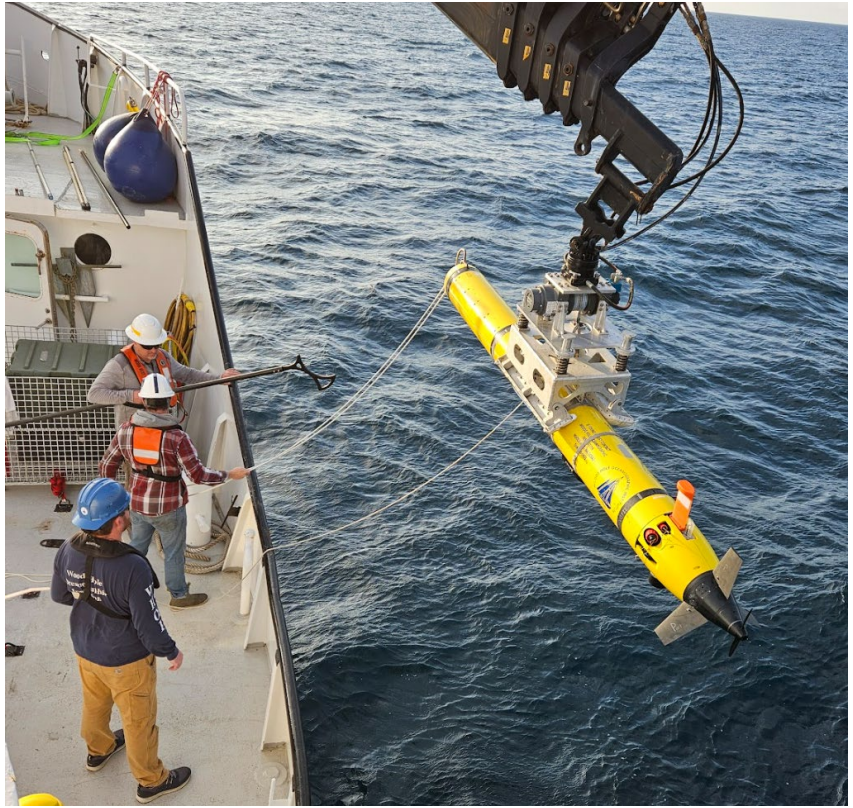


Credit: NOAA

Project Update - MGM

DWH Mesophotic & Deep Benthic Communities Restoration

- Heavy investment in deploying new Remus 620s in partnership with Navy
- Filling broad gaps in ground-truthing in mesophotic and depths to 600m
- Synthetic aperture sonar revealing new details on seafloor substrates
- New imaging and laser profiling providing unprecedented views of MDBC
- Providing very high resolution seafloor maps to guide restoration activities



Credit: Erik Ebert/NOAA

Project Update - MGM

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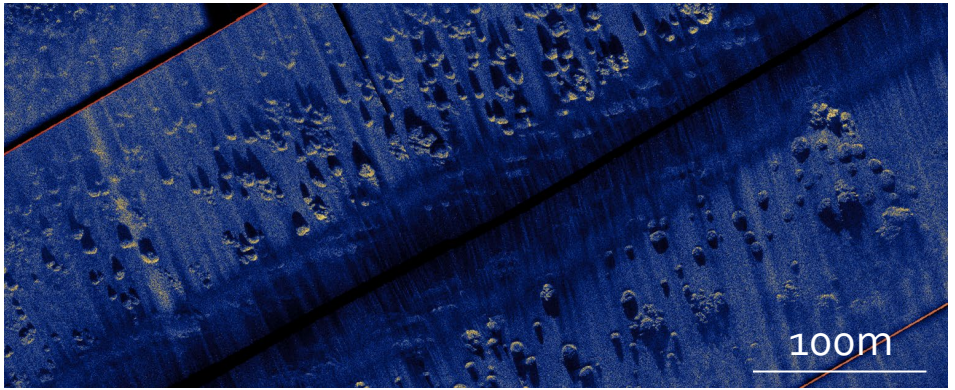
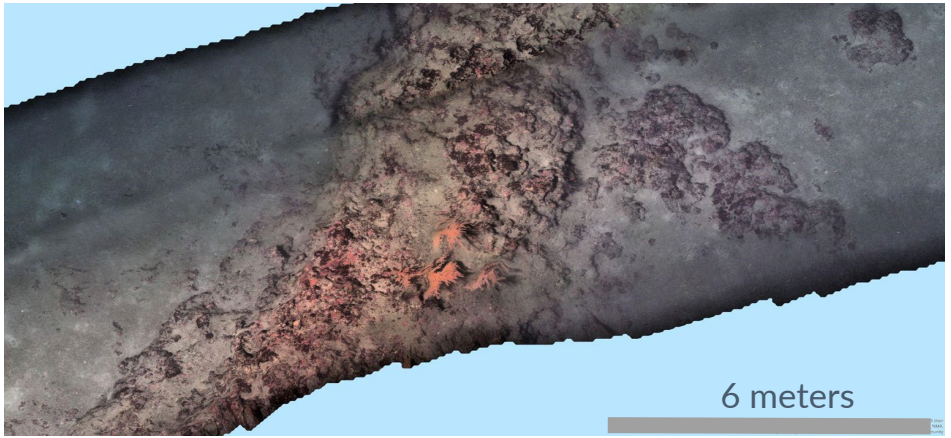
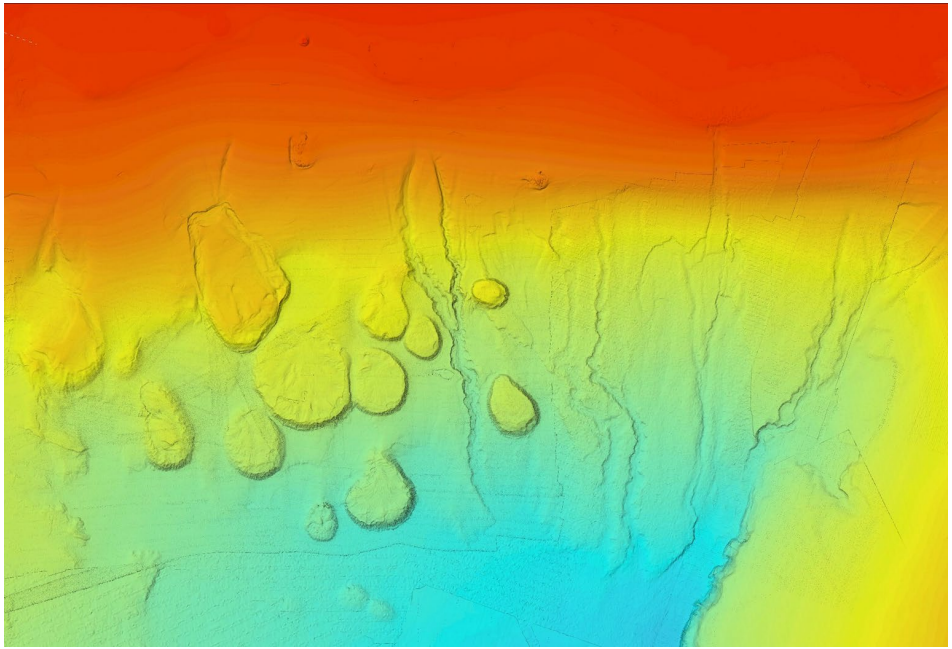




Project Update - MGM

Synthesis products to be developed by the end of the project:

- Regional and local mapping surfaces
- Annotated seafloor image library
- High resolution habitat characterizations
- Regional and local predictive coral species models



Credit: NOAA

Project Update: Habitat Assessment and Evaluation (HAE)

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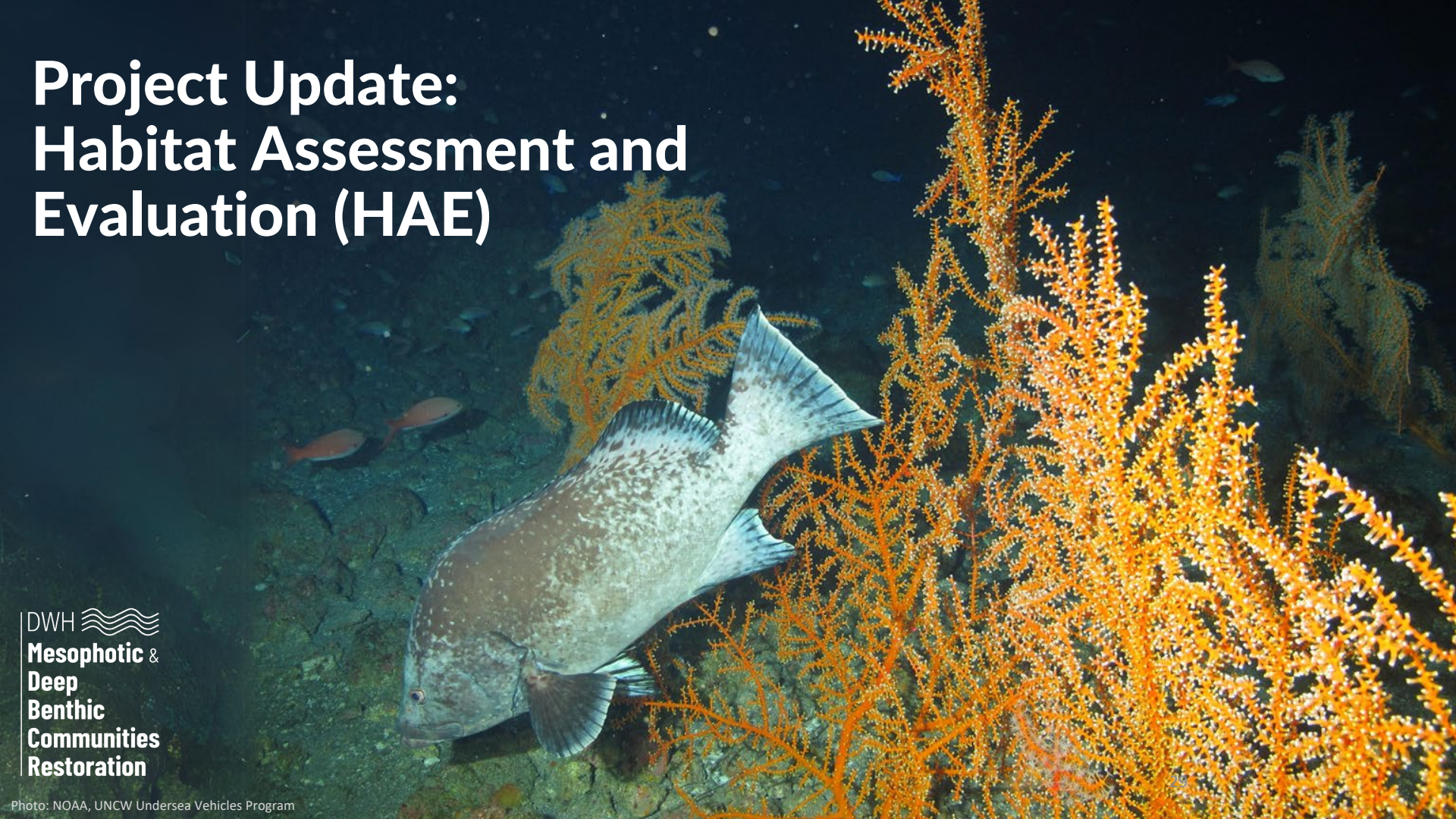
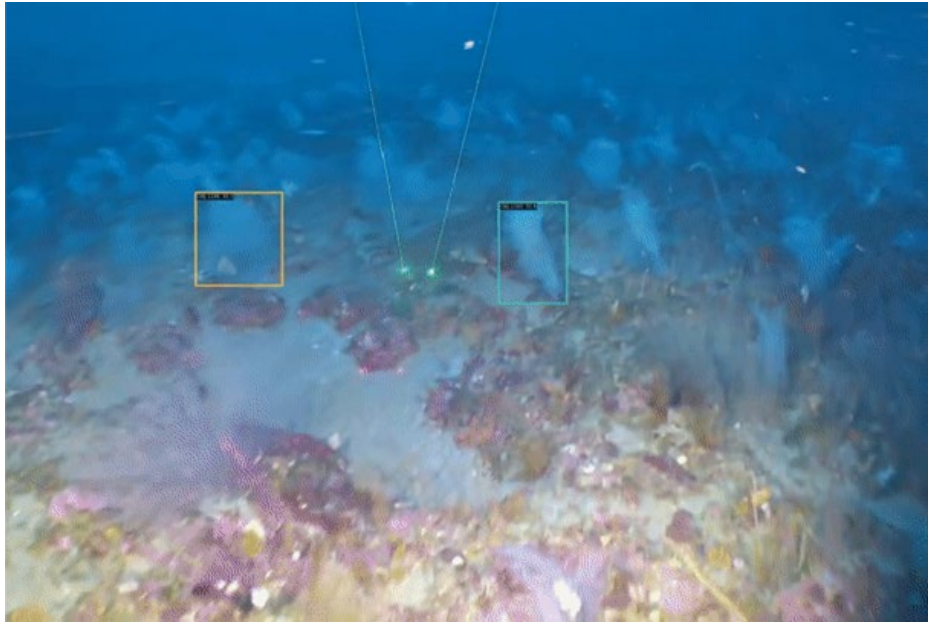


Photo: NOAA, UNCW Undersea Vehicles Program

Project Update - HAE

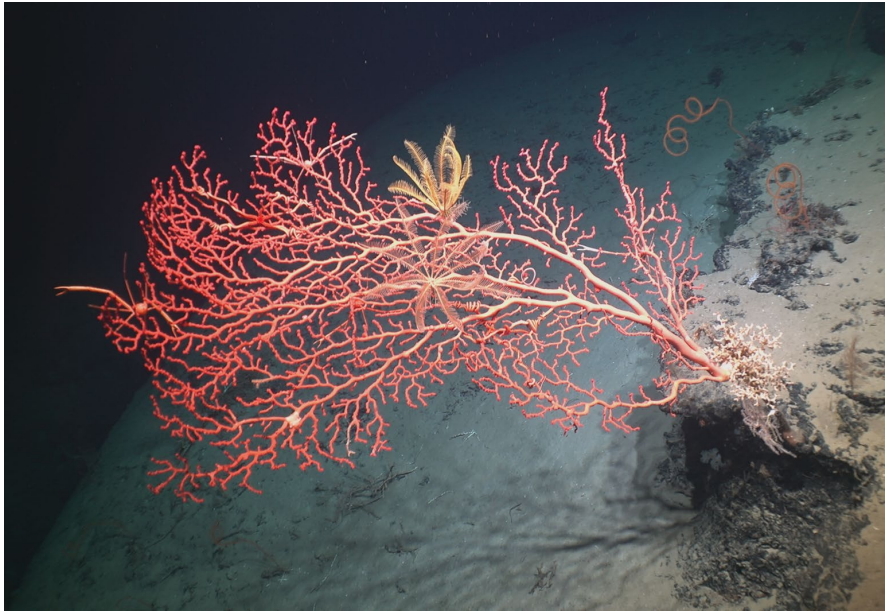
- Imagery annotation from 2022, 2023, and 2024 field seasons
- “Click-a-Coral” citizen science project to support the development of an AI model that can identify coral species
- Want to get involved? Scan the QR code:



Credit: NOAA

Project Update - HAE

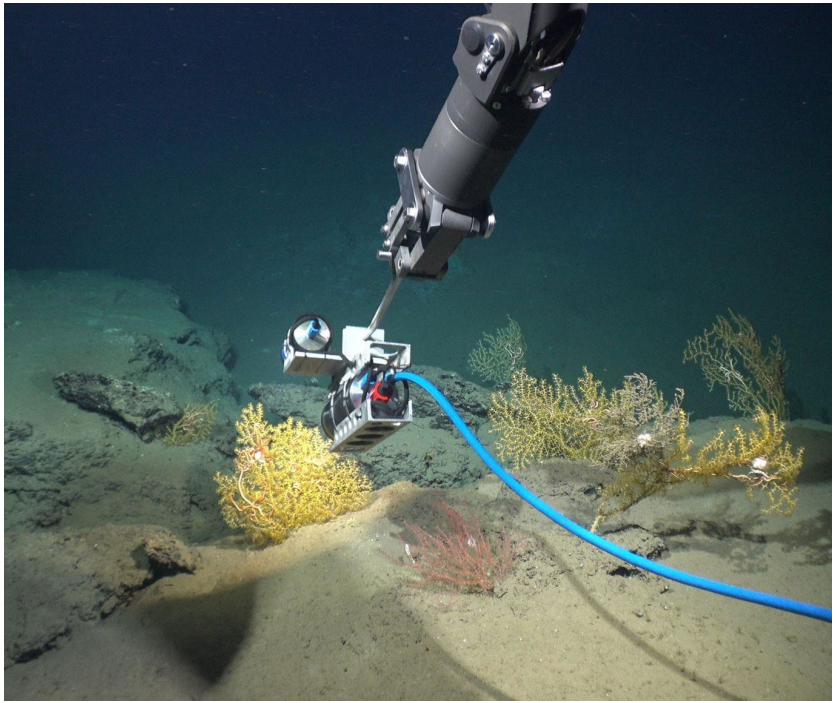
- Extensive, multi-partner effort to analyze data
  - Population genetics and connectivity
  - Environmental baselines and changes
  - Food availability and density of organisms
  - Microbiome characterization
  - Comparison of sediment communities
  - Physical oceanographic modeling
  - … and much more!
- Collaboration with other DWH restoration projects to describe connections between deep-sea communities and marine mammals, fish, etc.



Credit: NOAA, Pelagic Research Services, Florida Institute of Oceanography

Project Update - HAE

- Gap analysis and partner input to inform field work
- Published or forthcoming results of data analysis
    - Long-term time series of environmental data from landers
    - Characterizing reproductive potential of sites based on coral size
    - Longest existing time series of images to monitor coral health
    - Identification of 30+ new species
    - …and more to come



Credit: NOAA, Pelagic Research Services

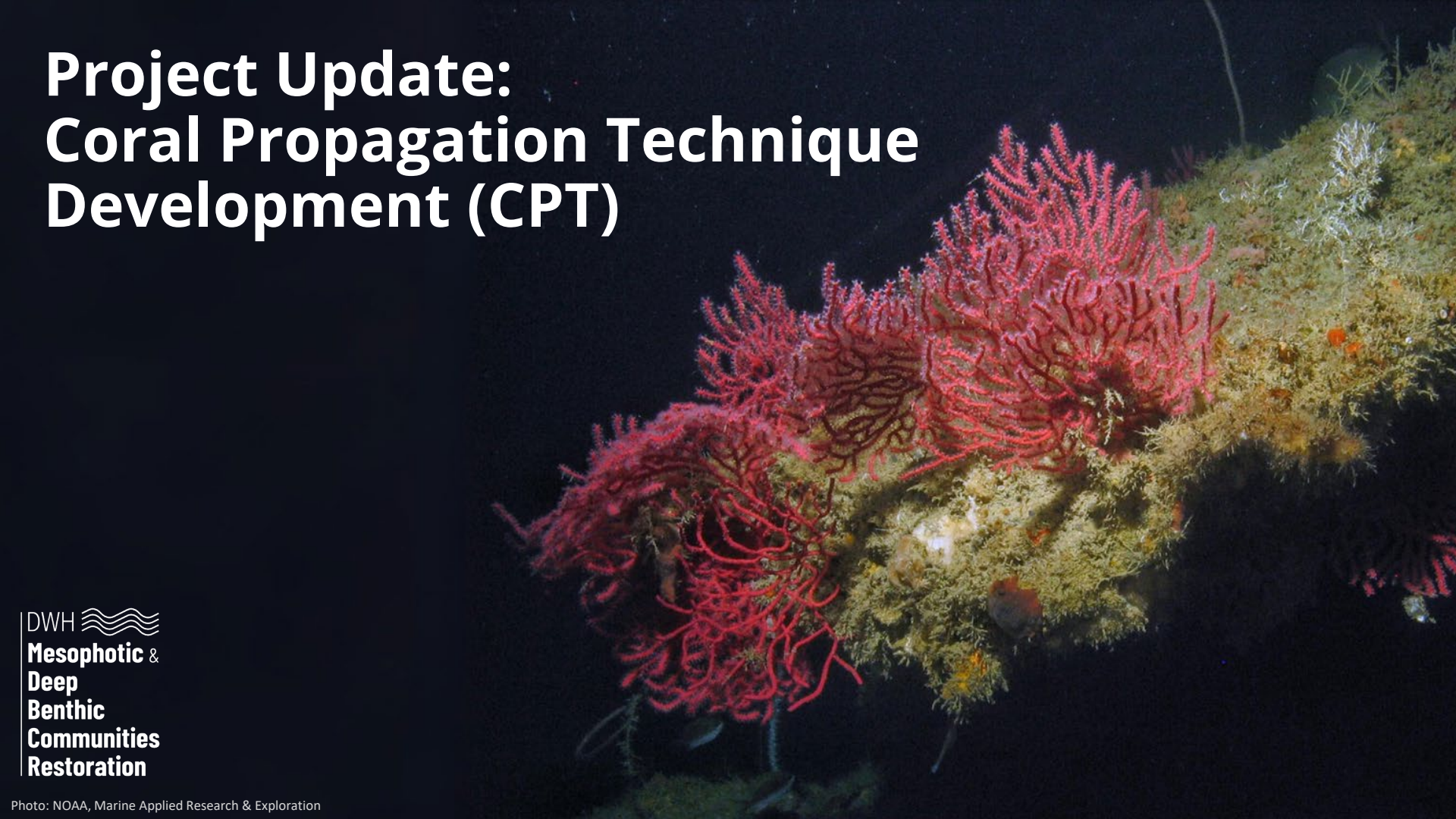
Project Update - HAE

DWH Mesophotic & Deep Benthic Communities Restoration

- Synthesis products to be developed by the end of the project:
  - Synthesis of all data based on core subject areas identified in the project planning phase
  - Spatial structure to synthesis - overlaying habitat and environmental data with mapping and models data provided by mapping team
  - Priority site characterizations and long-term monitoring plan

Habitat Characterization
• Sediment Community Composition and Associated Environmental Geochemistry
• Demersal Fish, Corals, and Macroinvertebrate Community Composition
• Coral Health and Condition
• Water Column Fish and Macroinvertebrate Characterization
• Environmental and Oceanographic Characterization
• Sentinel Sites (e.g. Priority Long-Term Monitoring Sites)
Biodiversity
• Genetics and Taxonomy
• Coral Age and Growth
Connectivity
• Coral, Fish, and Other Invertebrate Trophic Ecology
• Coral Genetic Connectivity and Larval Dispersal Models

Project Update: Coral Propagation Technique Development (CPT)



DWH Mesophotic & Deep Benthic Communities Restoration

Photo: NOAA, Marine Applied Research & Exploration

Project Update - CPT

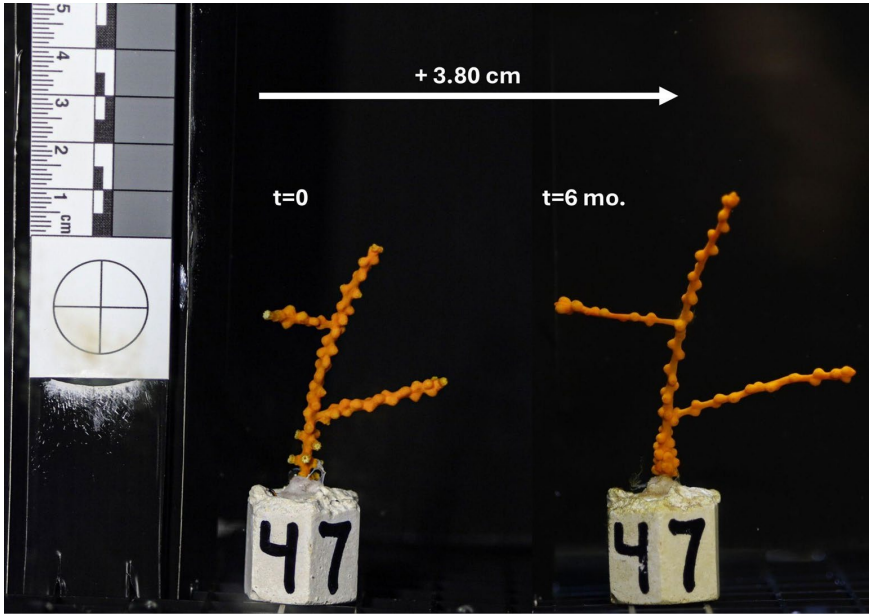
- Continued coordination across federal and partner labs
- Ongoing studies of coral biology and physiology, resulting in peer-reviewed publications
- Spawning success in lab settings
- Building capacity and best-practices for deep corals
- Analysis of monitoring data from coral fragment racks

Photos: Ben Higgins/NOAA

Project Update - CPT

DWH Mesophotic & Deep Benthic Communities Restoration

- Optimization of mesophotic octocoral husbandry techniques through various lab-based studies:
  - Cross institutional comparison of husbandry practices
  - Coral diet studies
  - Assessing the importance live rock
  - Evaluating artificial vs. natural water sources
- Planning for coral outplanting



Credit: Kassidy Lange & Matthew Rojano, NOAA

Project Update - CPT

- Synthesis products to be developed by the end of the project:
  - Publications contributing to increased baseline knowledge of deep-sea coral biology
  - Best-practices for deep-sea coral husbandry
  - Annotations of corals across MDBC cruises
  - Data and publications to support selection of successful propagation methods

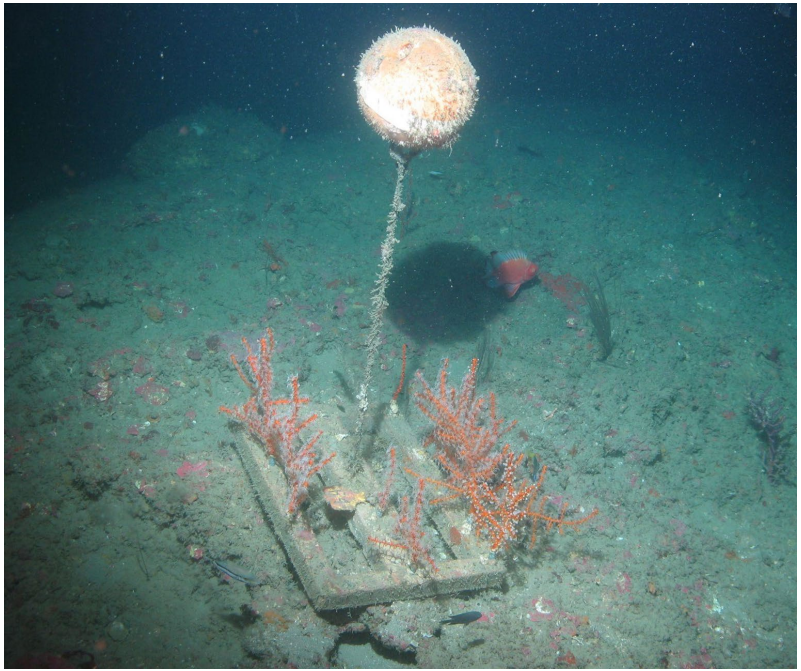
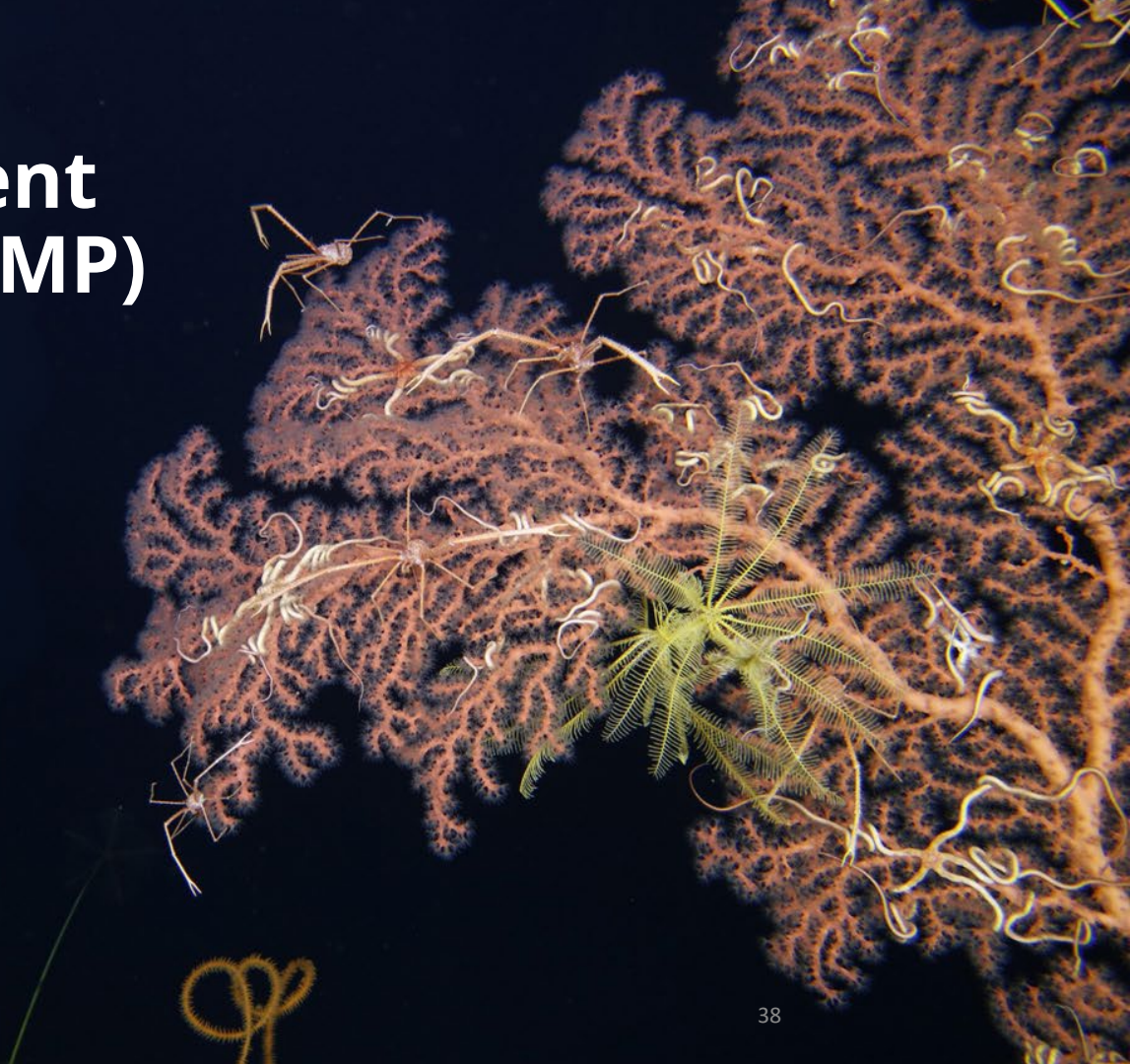


Photo: NOAA, Marine Applied Research & Exploration

Project Update: Active Management and Protection (AMP)



DWH Mesophotic & Deep Benthic Communities Restoration

Photo: NOAA, Oceaneering International, Inc.

Project Update - AMP

- Exhibit openings at:
  - Audubon Aquarium (New Orleans, LA)
  - Mississippi Aquarium (Gulfport, MS)
  - Man in the Sea Dive Museum (Panama City Beach, FL)
- Traveling art exhibit featuring 370 Gulf species: April 12 - July 6th (Galveston, TX)
- Free educational resources available online
- More than 60 articles and web stories published in 2024
- Continued efforts to compile data related to MDBC threats, inform future field work

Photo: Sasha Francis/National Marine Sanctuary Foundation

Project Update - AMP

- Additional educational resources coming in 2025
- Distribution of resources at teacher conferences, outreach events, public venues, etc.
- Two more exhibits coming in 2025:
  - Frost Science Museum (Miami, FL)
  - Moody Gardens Aquarium (Galveston, TX)
- Collecting evaluation data on education and outreach efforts
- Threat reduction prioritization workshop

Credit: Gulf Reach Institute, Grayling Education LLC.

Project Update - AMP

- Synthesis products to be developed by the end of the project:
  - Education and outreach evaluation data compilation
  - Threats database & monitoring data
- Support the dissemination of other team's synthesis products to the public and natural resource managers
- Coordinate with natural resources managers to assess utility of portfolio products for decision-making

Credit: National Marine Sanctuary Foundation

MDBC Portfolio Products & Resources

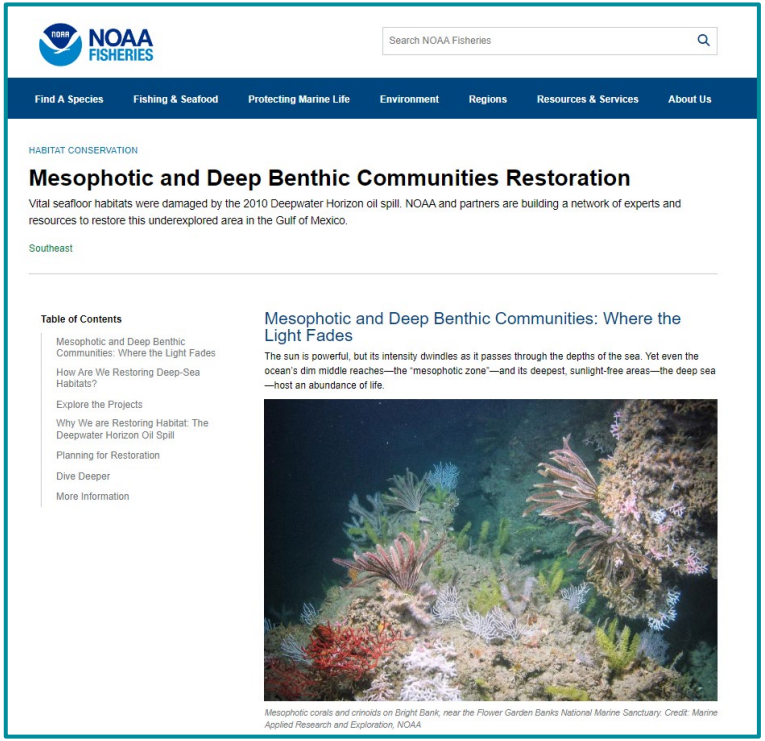
DWH Mesophotic & Deep Benthic Communities Restoration

Photo: NOAA, Marine Applied Research & Exploration

MDBC Webpages

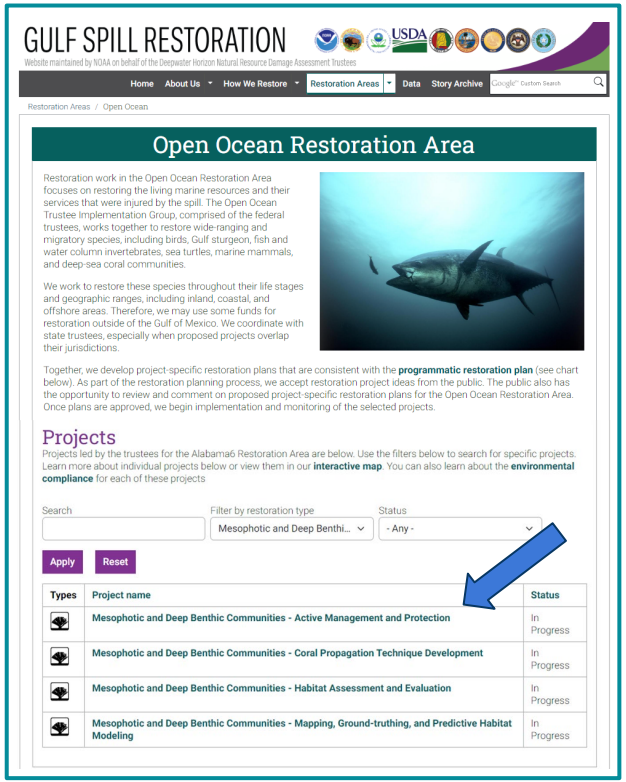
DWH Mesophotic & Deep Benthic Communities Restoration

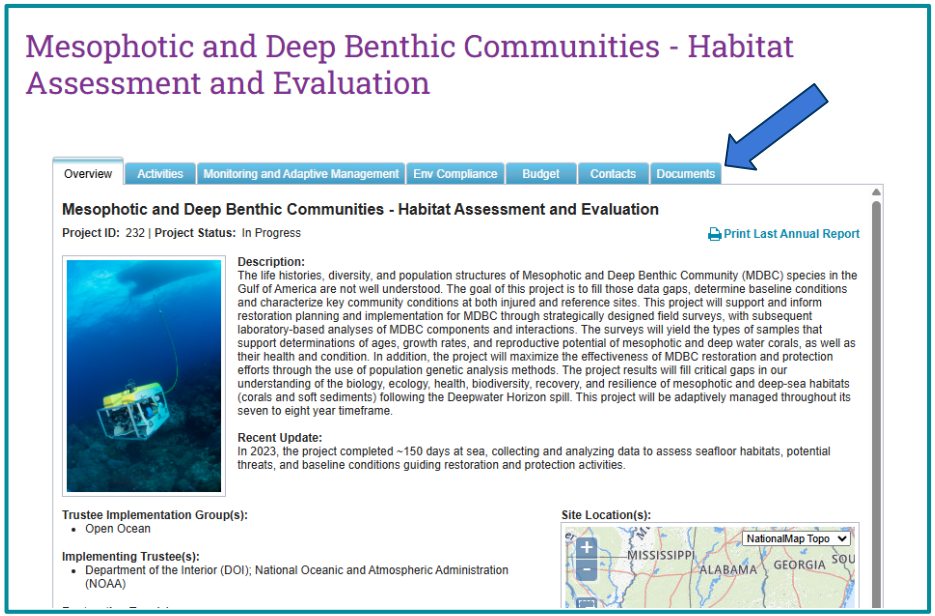
- Gulf Spill Restoration
- NOAA Fisheries Office of Habitat Conservation - MDBC Webpage
- NOAA National Centers for Coastal Ocean Science - MDBC Webpage



MDBC Data & Publications

DWH Mesophotic & Deep Benthic Communities Restoration



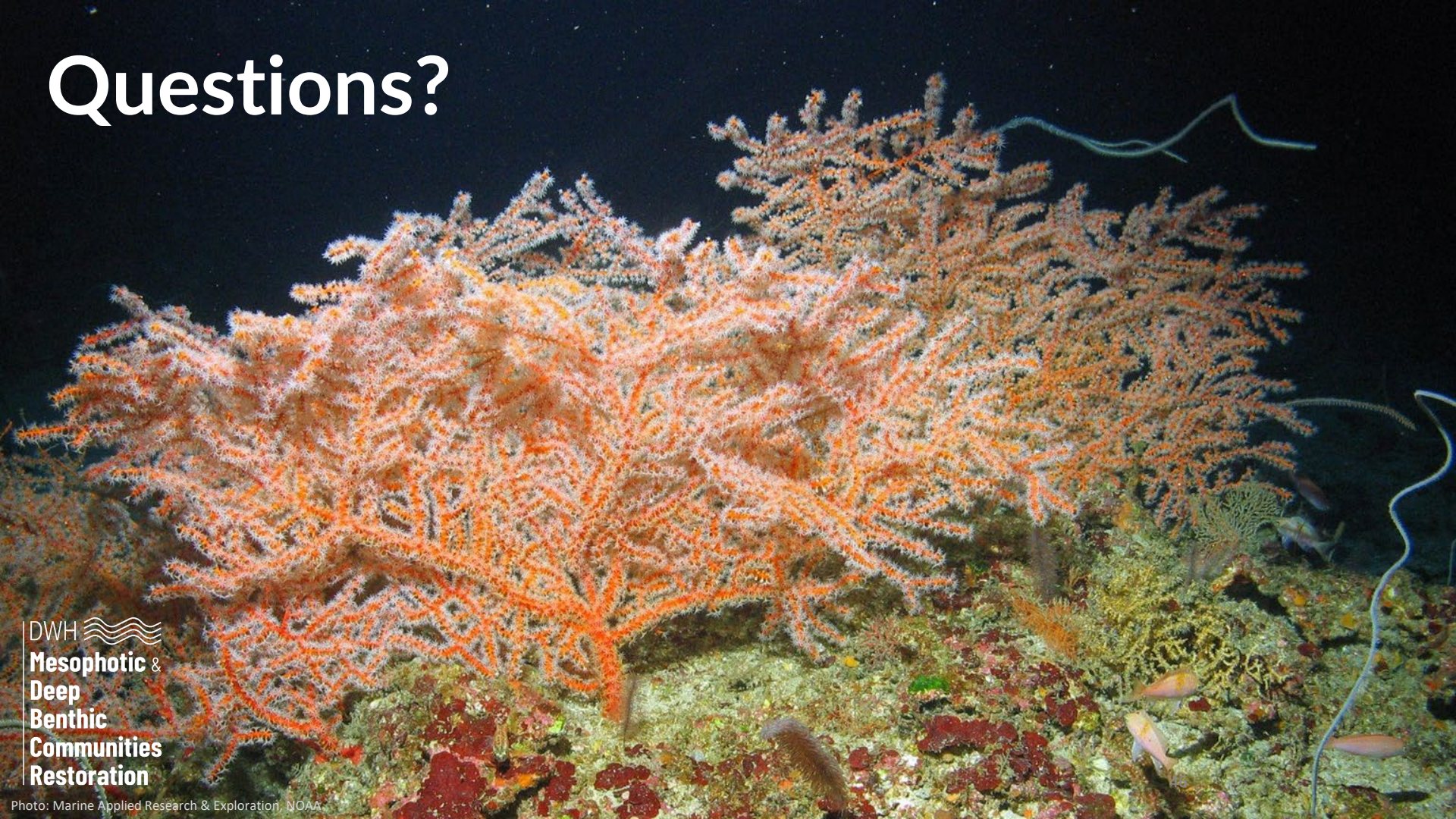


MDBC Data & Publications

"MDBC Data Accessions and Publications"

Annual Project Report

Questions?

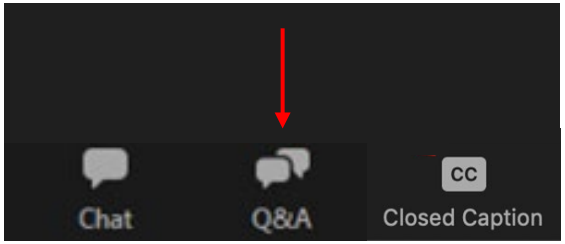


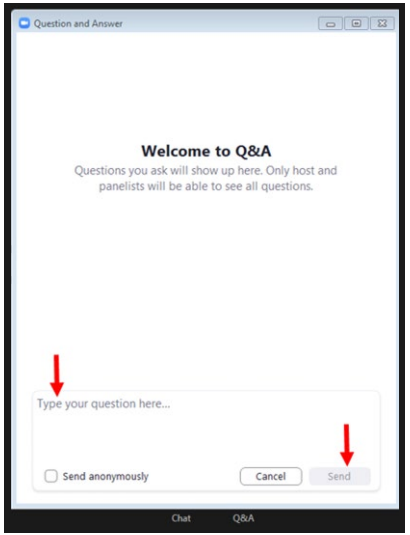
DWH Mesophotic & Deep Benthic Communities Restoration

Photo: Marine Applied Research & Exploration, NOAA

Webinar Participation

- Please use the “Q&A” box to type questions for the Q&A session at the end
- We’ll get to as many questions as we can!
- Keep your eye on the chat, we may answer some questions there.





Thank you for tuning in!

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DWH Mesophotic & Deep Benthic Communities Restoration

Photo: NOAA, Oceaneering International, Inc.