
Lophelia II:
Education and Outreach

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Lophelia II – Education & Outreach

The project has multiple strands of outreach:

- Curriculum/unit for high school
- NOAA OER website & workshops
- Deep wrecks and the past foundation efforts
- USGS DISCOVRE website
- Video production
- ✦ Scientist presentations in a variety of venues

In addition, the project has received a great deal of attention due to the *Deepwater Horizon* spill.

Lophelia II – Education

The Deep Coral Unit is a multi-lesson, high-school curriculum designed around a “real-life” scenario where students, acting as scientists, are challenged to help prioritize potential drill sites to minimize impacts on deep coral communities. To accomplish this task, they must learn a great deal about *Lophelia*.

Challenge Scenario – Problem-Based Learning

Justification: Problem-based learning (PBL) technique

PBL is a **curriculum** and a **process**.

The **curriculum** consists of carefully selected problems that demand from the learner acquisition of critical knowledge, and problem solving proficiency ...

The **process** replicates the commonly used approach to resolving problems or meeting challenges that are encountered in life and career.

- Barrows and Kelson 1993

➤ BOEMRE mission offers a perfect Challenge Scenario

Challenge Scenario – Pinnacle Petroleum Permit

The Challenge: What are the trade-offs when deciding how certain areas will be managed and developed?

MEMO

TO: Marine Research Science Group (MaRSciG)

FROM: Deep-water Resources Management Office

RE: Recommendations within area *Lophelia Gardens 100*

Pinnacle Petroleum has expressed interest in doing some exploratory drilling within the *Lophelia Gardens 100* area of Bluewater Gulf. We need to know which areas within the *Lophelia Gardens 100* section need to be off limits to any drilling activity and which areas could be opened to Pinnacle for drilling. You will need to prioritize areas within *Lophelia Gardens 100* as to risks to corals and coral habitat from drilling (High/Medium/Low) and support your claims with evidence. Indicate trade-offs that scientists, resource managers and representatives from Pinnacle Petroleum must consider when negotiating a permit.

We have attached the most recent maps and information on coral communities known in this area. There will not be time for additional observations of the sea floor before your report is due. You must work with the information currently available. We welcome any additional suggestions or ideas that might help us in developing a more comprehensive management plan for *Lophelia Gardens 100* and other deep-water communities in the future.



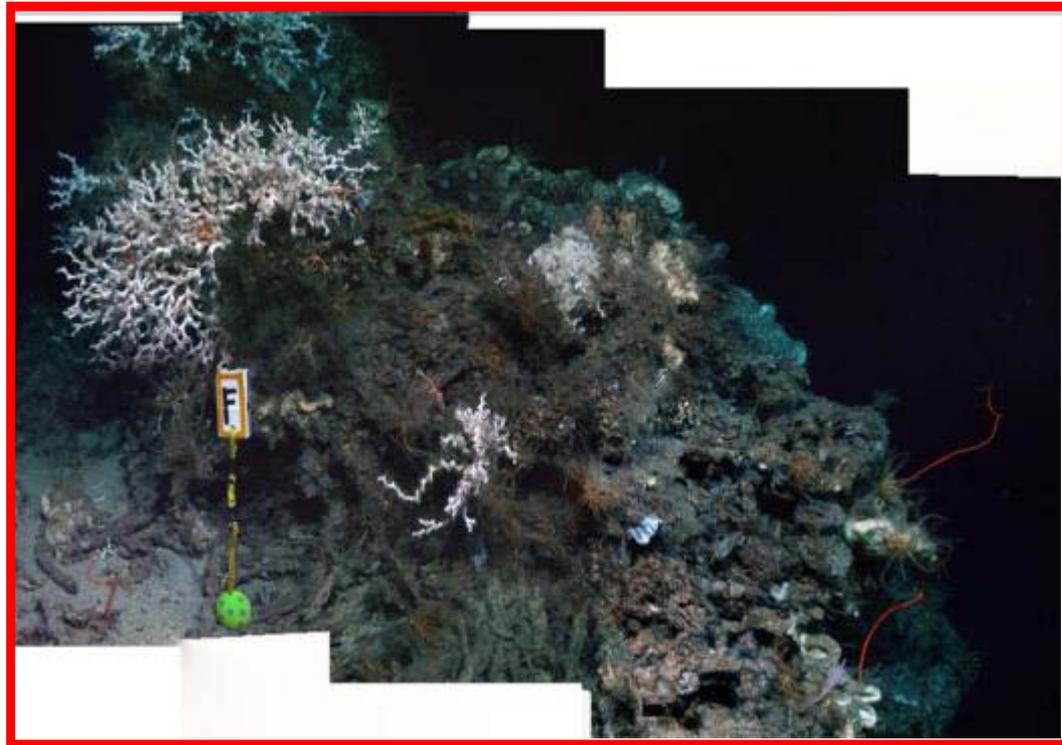
Students investigate a series of lessons designed to help them answer the challenge.

Lesson 1 – On the Bottom of the GOM

Focus Question: What are conditions like on the bottom of the Gulf of Mexico? What lives there?

The primary purpose of this lesson is to introduce students to the GOM seafloor environment and the coral ecosystem.

Students examine three coral photomosaics and use a dichotomous key to identify organisms living there.

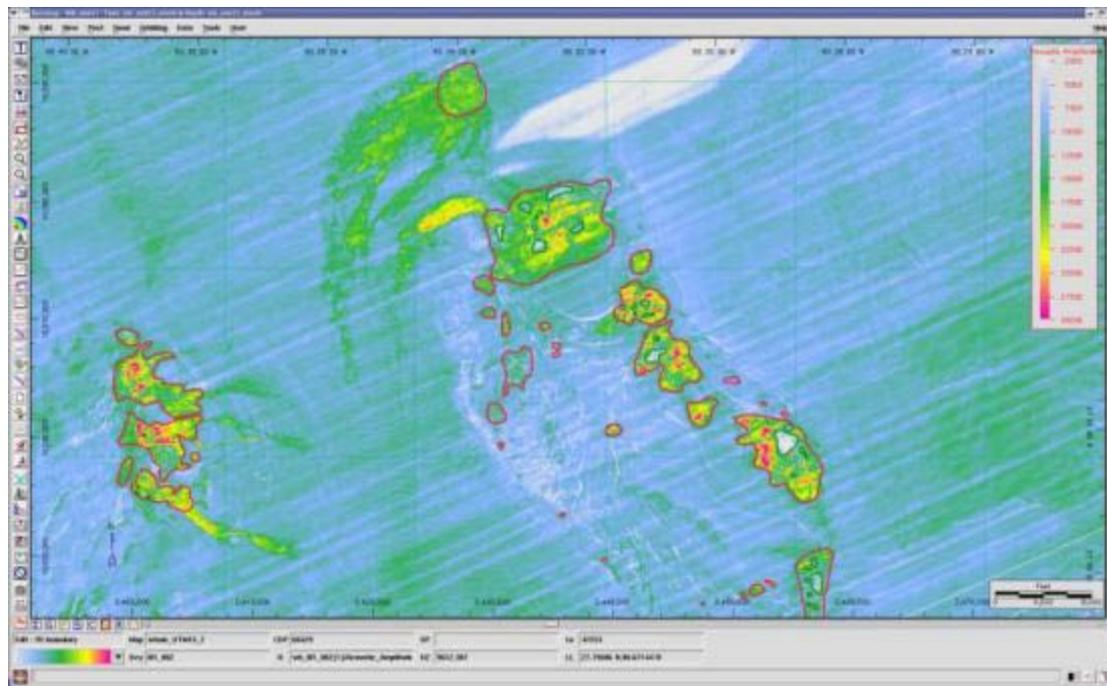


Lesson 2 – Where Are Corals Found?

Focus Question: Thinking like scientists, what questions do we have about *Lophelia* and other organisms observed in the photomosaics?

In this lesson, students are introduced to formation of hard-bottom and learn to interpret amplitude maps.

They also generate questions they have about coral communities in the deep-sea.



Lesson 3 – *Lophelia* Biology: Getting the Facts

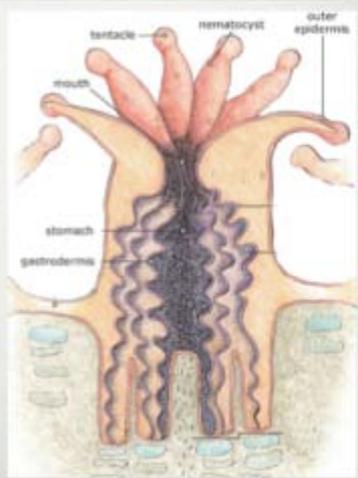
Focus Question: What do we know about *Lophelia* biology and what don't we know?

The focus of this lesson is on *Lophelia* biology.

Students review a presentation on *Lophelia* biology and examine what it needs to survive.

Lophelia Anatomy
Predict how a polyp meets each need.

- Exchange gases (O_2 & CO_2)
- eliminate waste
- obtain water
- grow
- Reproduce
- consume nutrients for energy
- respond to stimuli



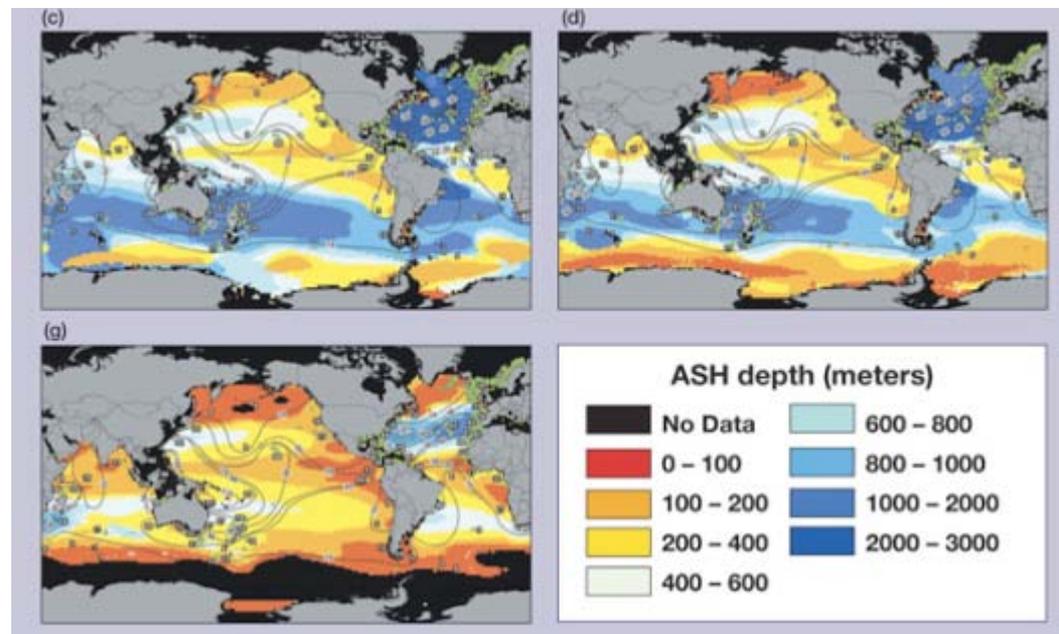
The diagram illustrates the anatomy of a *Lophelia* polyp. It shows a central gastrovascular cavity with a mouth at the top and a stomach below. The body is supported by a central axis. The outer layer is the outer epidermis, which contains nematocysts. Tentacles are located at the top. The inner layer is the gastrodermis. The diagram is labeled with 'tentacle', 'nematocyst', 'outer epidermis', 'mouth', 'stomach', and 'gastrodermis'.

Lesson 4 – Coral Skeletons and Climate Change

Focus Question: How does a coral with soft, delicate polyps build such a hard skeletal structure?

This lesson explores ocean chemistry, coral skeleton formation, and the challenges posed by climate change.

Students conduct in-class experiments and examine data to predict effects of increased CO₂ on corals.



In development ...

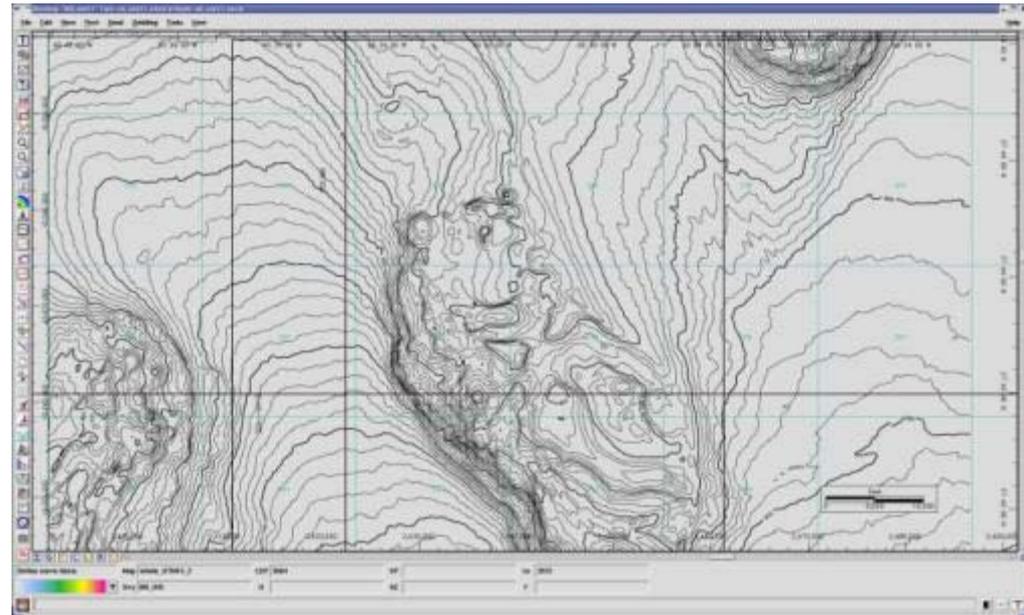
Lesson 5 – Movement and Currents in the GOM

Focus Question: How does *Lophelia* spread to so many places in the ocean?

This lesson emphasizes the importance of currents in movement of larvae, plankton and sediment.

Students model ocean currents in tanks, and explore the impact of currents on corals.

Students examine bathymetry maps to infer potential *Lophelia* sites.



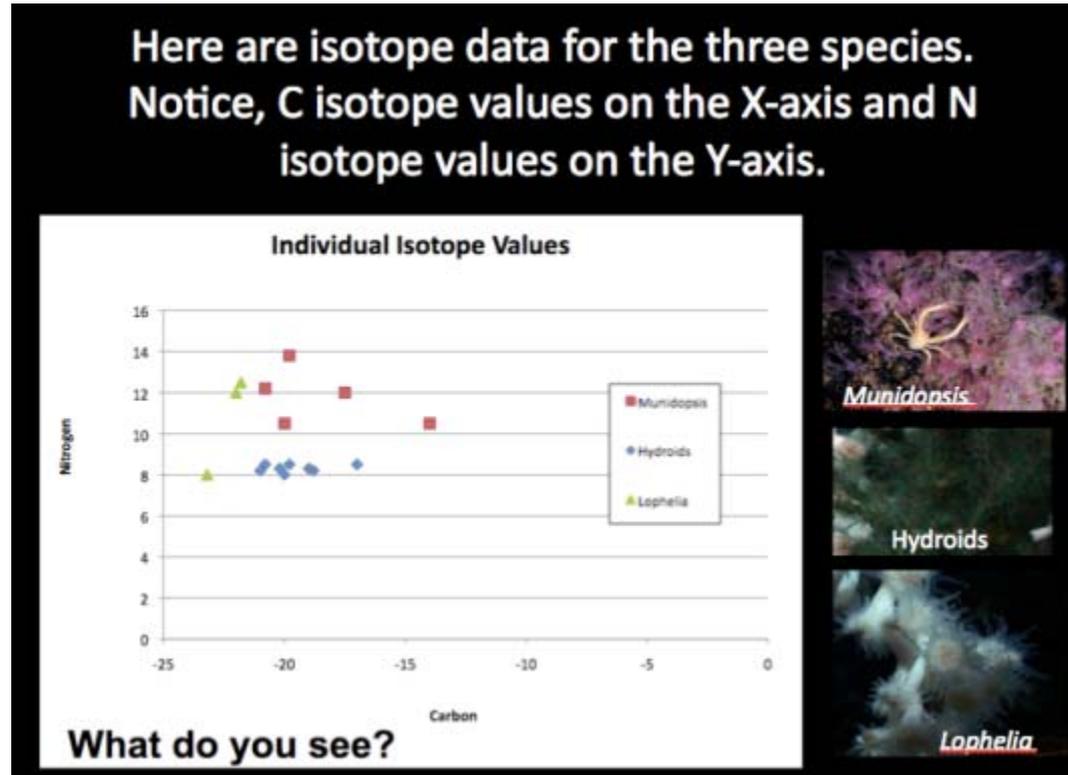
Lesson 6 – *Lophelia*'s Neighborhood

Focus Question: How does the community of organisms living near/within a *Lophelia* reef obtain energy?

In this lesson, students investigate a *Lophelia* community food web.

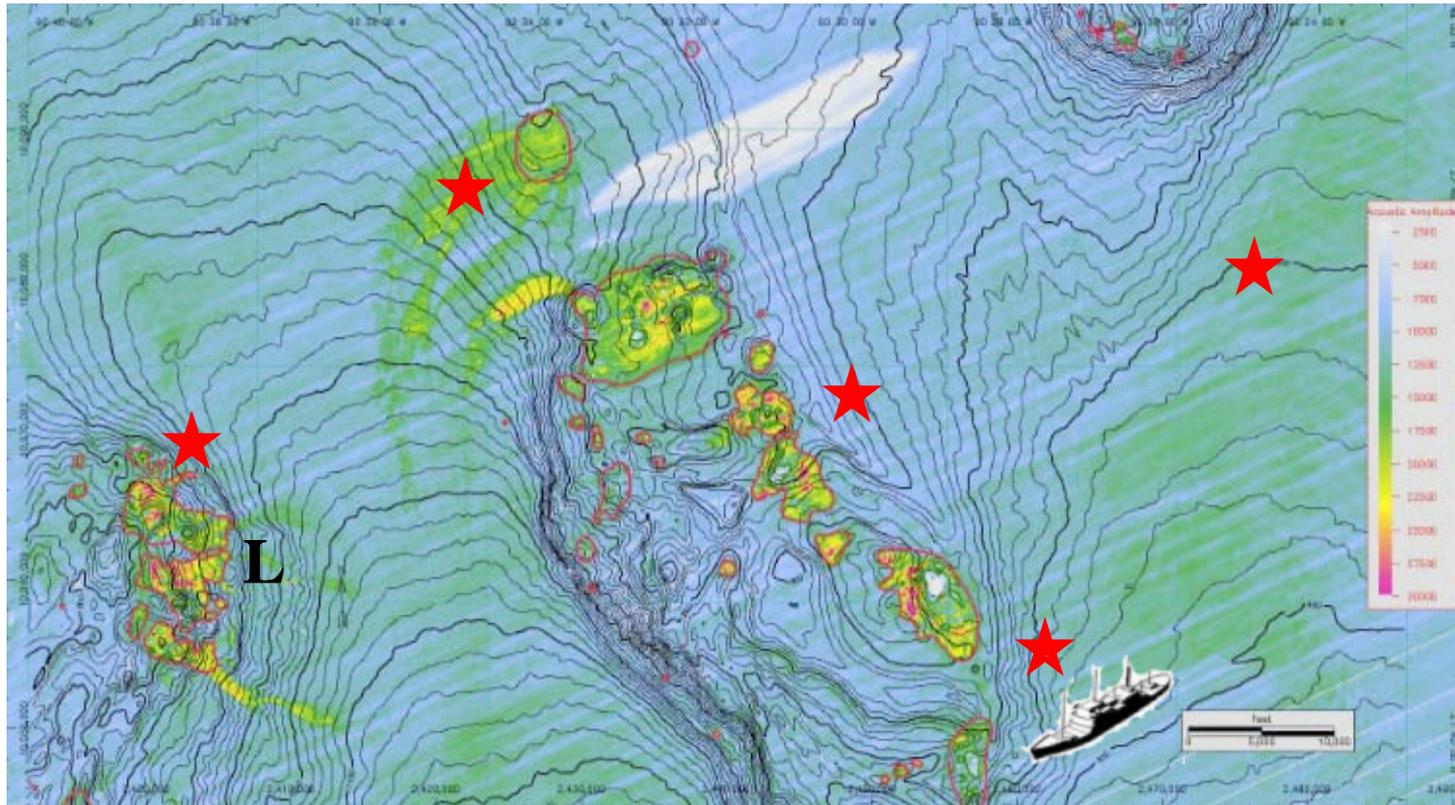
Students learn how isotope data may be used to infer trophic relationships.

Students understand the flow of energy in this deep-sea ecosystem.



Challenge Scenario – Pinnacle Petroleum Permit

Students apply what they learn about *Lophelia* to
1) identify other *Lophelia* sites and 2) prioritize
exploratory drilling sites to minimize impact.



- ★ Drill Site
- L *Lophelia* Site

Deep Coral Unit Status



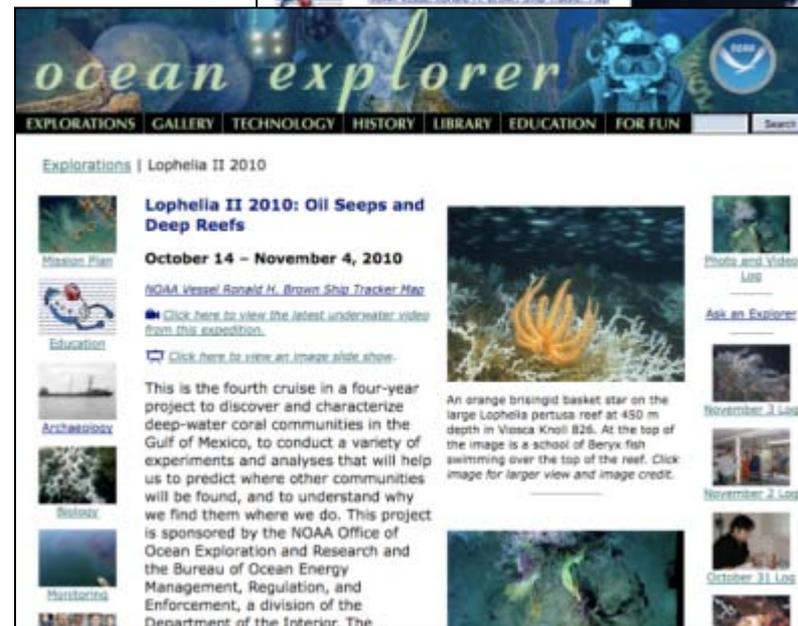
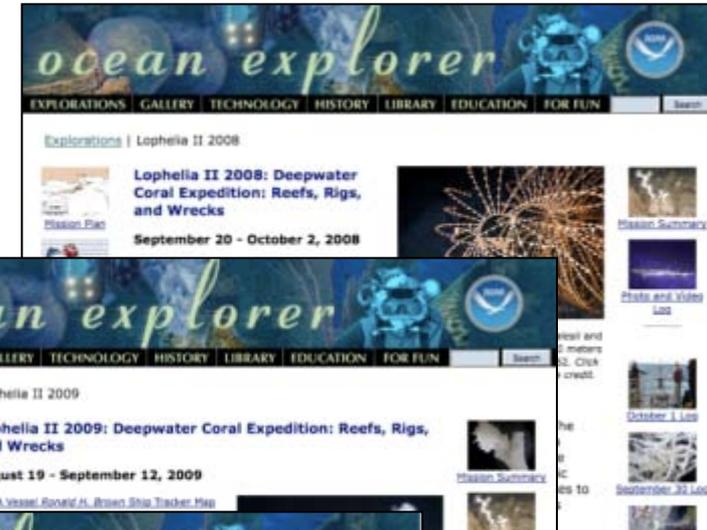
- Unit to be tested in May/June 2011
- Teacher training for beta teachers, April 11
- Obtain feedback and make modifications, Summer 2011.
- Complete lesson on ocean acidification, Summer 2011
- Originally designed to be used in GLOBE's Student Research Campaign, although currently not a viable option. Post materials on NOAA OER and BOEMRE sites.

Lophelia II – Outreach

NOAA Ocean Explorer

Three Signature Explorations:

- September 20 – October 8, 2008
- August 19 – September 12, 2009
- October 14 – November 4, 2010



Lophelia II : Teacher Workshops

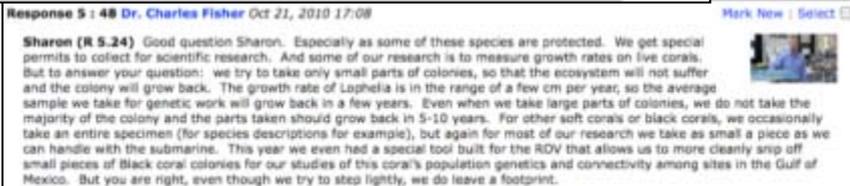
NOAA OER & College of Exploration:

Online teacher professional development, including keynote speakers, live discussion boards, classroom lessons, and resources library.

- “Why do we explore?”
June 24–25, 2010
- “Lessons from the Deep, Exploring the Gulf of Mexico’s Deep-Sea Ecosystems” – October 14 & 21, live from the cruise



The screenshot shows the NOAA Office of Ocean Exploration and Research Online Professional Development website. The page title is "2010 NOAA OER: Gulf of Mexico - Keynotes Item 5". The user is identified as Liz Goehring. The post is titled "Week Two: Dr. Charles Fisher - Cold Seeps" and "Item 5: Dr. William Bragg (TCOE) Oct 15, 2010 12:10". The post content includes a photo of Dr. Chuck Fisher and text introducing him as a professor at Pennsylvania State University who has been working on hydrothermal vents and cold seeps since 1967. It also mentions his recent expedition with the Lophelia II in 2009.



The screenshot shows a response to the discussion board post, dated October 21, 2010, at 17:08. The response is from Sharon (R 5.24) and discusses the challenges of collecting scientific research on Lophelia colonies, particularly regarding growth rates and the impact of sampling on the colonies.

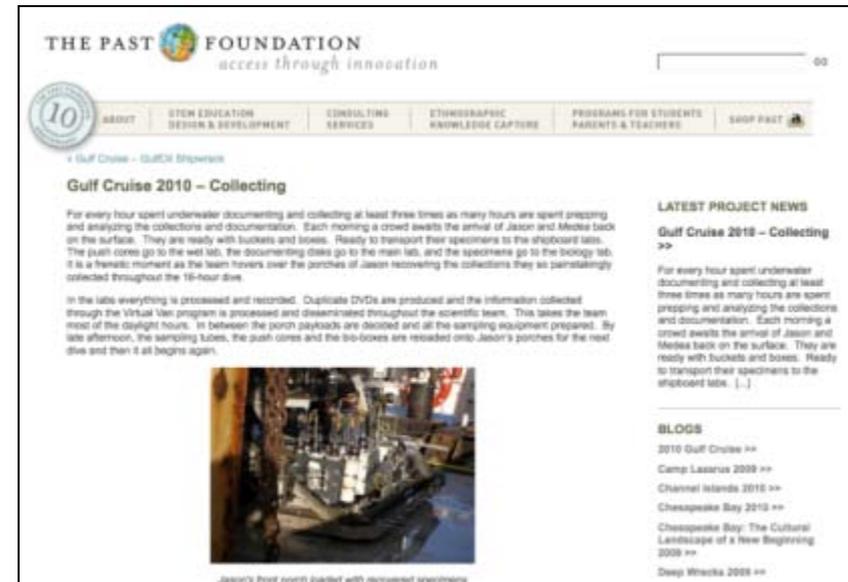
Lophelia II: Wrecks Outreach

PAST Foundation Outreach

Targeting teachers and students in Ohio, PAST provided Powerpoint presentations and related literature on:

- Shipwreck studies & history of wrecks
- ROV & AUV technologies
- *Lophelia* project
- Pressure studies & scrunch cups

Teachers and students followed cruises via PAST's blog on *Lophelia* II, and through the NOAA OE cruise site.



THE PAST FOUNDATION
access through innovation

10 ABOUT STEM EDUCATION DESIGN & DEVELOPMENT CONSULTING SERVICES ETHNOGRAPHIC KNOWLEDGE CAPTURE PROGRAMS FOR STUDENTS PARENTS & TEACHERS SAOP PAST

1 Gulf Cruise - GulfOf Mexico

Gulf Cruise 2010 - Collecting

For every hour spent underwater documenting and collecting at least three times as many hours are spent prepping and analyzing the collections and documentation. Each morning a crowd awaits the arrival of Jason and Moses back on the surface. They are ready with buckets and boxes. Ready to transport their specimens to the shipboard lab. The push comes go to the wet lab, the documenting data go to the main lab, and the specimens go to the biology lab. It is a frantic moment as the team tows over the porches of Jason recovering the collections they so painstakingly collected throughout the 16-hour dive.

In the labs everything is processed and recorded. Duplicate DVDs are produced and the information collected through the Virtual View program is processed and disseminated throughout the scientific team. This takes the team most of the daylight hours. In between the porch payloads are decided and all the sampling equipment prepared. By late afternoon, the sampling tows, the push cones and the bio-tows are reloaded onto Jason's porches for the next dive and then it all begins again.



Jason's front porch loader with recovered specimens

LATEST PROJECT NEWS

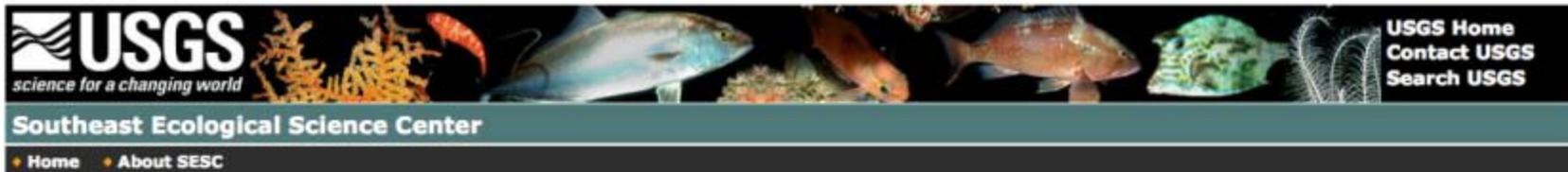
Gulf Cruise 2010 - Collecting >>

For every hour spent underwater documenting and collecting at least three times as many hours are spent prepping and analyzing the collections and documentation. Each morning a crowd awaits the arrival of Jason and Moses back on the surface. They are ready with buckets and boxes. Ready to transport their specimens to the shipboard lab. [...]

BLOGS

- 2010 Gulf Cruise >>
- Camp Lazarus 2009 >>
- Channel Islands 2010 >>
- Chesapeake Bay 2010 >>
- Chesapeake Bay: The Cultural Landscape of a New Beginning 2009 >>
- Deep Wrecks 2008 >>

Lophelia II – USGS DISCOVRE



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USGS DISCOVRE EXPEDITION

Diversity, Systematics, and Connectivity of Vulnerable Reef Ecosystems

The 4-year multidisciplinary research program will focus on understanding the physical oceanography, biology, ecology, genetic connectivity, and trophodynamics of deep coral environments in the Gulf of Mexico (300-1000 m depths), both within natural and artificial (shipwreck) sites. The program has integrated a diverse group of collaborators, including scientists from the U.S. Geological Survey (USGS), University of North Carolina Wilmington (UNC-W), UNC Chapel Hill, National Oceanic and Atmospheric Administration (NOAA), the Royal Netherlands Institute for Sea Research (NIOZ), and the Scottish Association for Marine Science (SAMS). It is part of a larger effort involving the Minerals Management Service (MMS), NOAA Ocean Explorer, and TDI Brooks. We will use a combination of traditional techniques (for example, photography, quantitative sample collections) and several advanced tools (including remotely operated vehicles, multibeam sonar, benthic landers, and genetic analysis) in order to better understand these critical, poorly studied deep-sea habitats.



- ← [Dive and Discover - Expedition 13: Gulf of Mexico](#) (You are leaving this site)
- ← [DISCOVRE Involvement in Deep Gulf of Mexico Research since the Deepwater Horizon Event](#)
- ← [Deep-sea Cruises 2010 - Cruise 2](#) (You are leaving this site)
- ← [Deep-sea Cruises 2010 - Cruise 1](#)



Cold-water Coral Ecosystem Studies - U.S. Gulf of Mexico

Download:
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- [Adobe PDF Print Version](#)

<http://fl.biology.usgs.gov/DISCOVRE/>

Lophelia II – Video

Video Documentary:

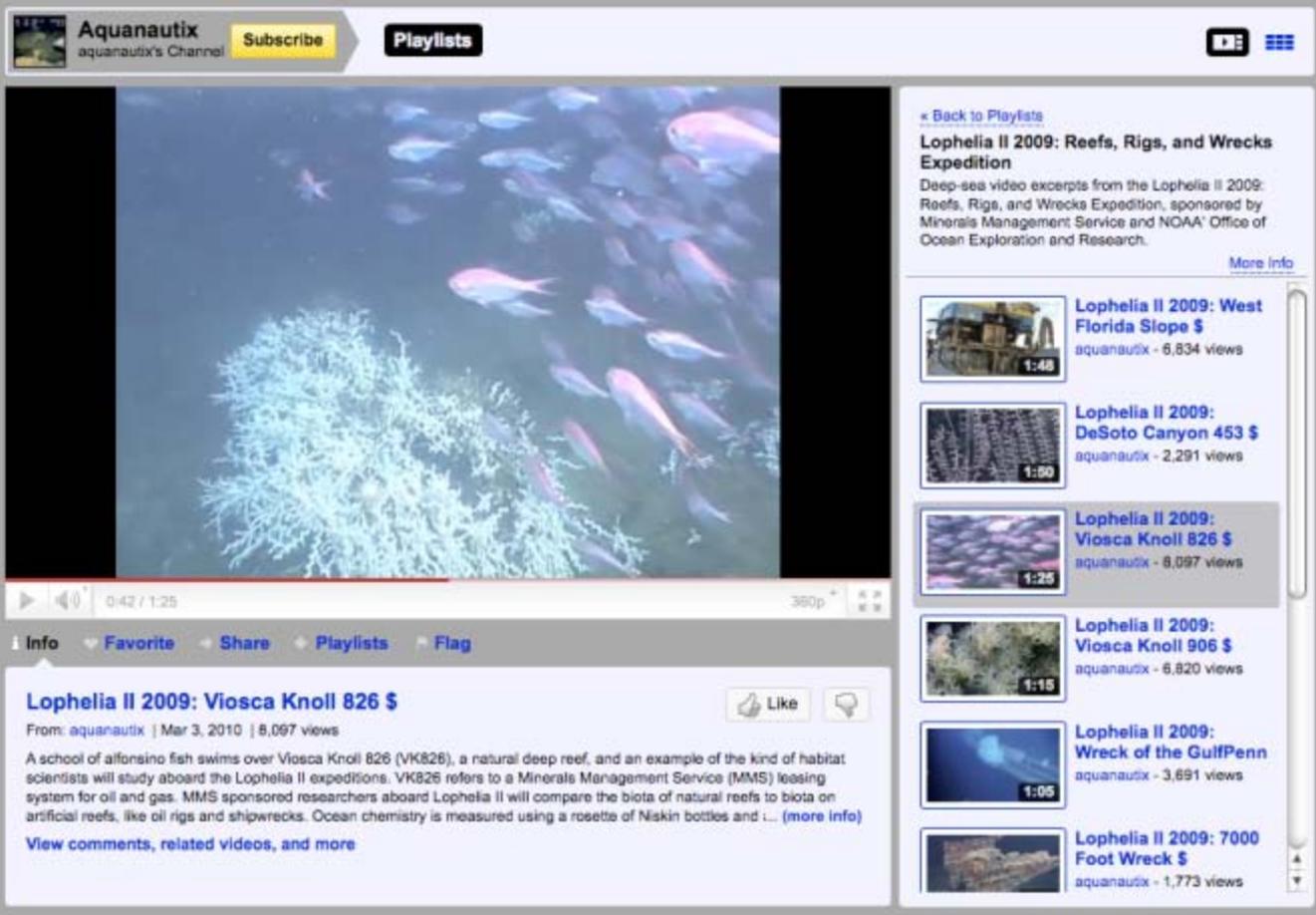
A 20-minute documentary to share research and summary of findings with public. Format to include *in situ* seafloor footage, seafloor visualizations, and scientist interviews.

- >100 hours of seafloor video collected, so plenty of material
- First draft (8.5 minute) project-in-progress featuring PSU Fisher interview, available during break
- Assessing best online distribution channel (e.g., NOAA Ocean Explorer Channel, GoogleOcean Tour, Ocean's Kiosk)

Lophelia II – Video

YouTube:

10 videos from the *Lophelia* II project are currently posted on YouTube, with over 42,000 views.



The screenshot shows a YouTube video player interface. At the top, the channel name 'Aquanautix' and 'aquanautix's Channel' are visible, along with a 'Subscribe' button and a 'Playlists' button. The video player itself shows a school of fish swimming over a coral reef. Below the video player, there are controls for play, volume, and a progress bar showing 0:42 / 1:25. The video title is 'Lophelia II 2009: Viosca Knoll 826 \$' and it has 8,097 views. The description mentions that the video shows a school of alfonso fish swimming over the Viosca Knoll 826 (VK826), a natural deep reef. The video is part of a series of 10 videos from the Lophelia II project.

Lophelia II 2009: Viosca Knoll 826 \$
From: aquanautix | Mar 3, 2010 | 8,097 views

A school of alfonso fish swims over Viosca Knoll 826 (VK826), a natural deep reef, and an example of the kind of habitat scientists will study aboard the Lophelia II expeditions. VK826 refers to a Minerals Management Service (MMS) leasing system for oil and gas. MMS sponsored researchers aboard Lophelia II will compare the biota of natural reefs to biota on artificial reefs, like oil rigs and shipwrecks. Ocean chemistry is measured using a rosette of Niskin bottles and ... [\(more info\)](#)

[View comments, related videos, and more](#)

Back to Playlists

Lophelia II 2009: Reefs, Rigs, and Wrecks Expedition
Deep-sea video excerpts from the Lophelia II 2009: Reefs, Rigs, and Wrecks Expedition, sponsored by Minerals Management Service and NOAA's Office of Ocean Exploration and Research. [More Info](#)

- Lophelia II 2009: West Florida Slope \$**
aquanautix - 6,834 views
- Lophelia II 2009: DeSoto Canyon 453 \$**
aquanautix - 2,291 views
- Lophelia II 2009: Viosca Knoll 826 \$**
aquanautix - 8,097 views
- Lophelia II 2009: Viosca Knoll 906 \$**
aquanautix - 6,820 views
- Lophelia II 2009: Wreck of the GulfPenn**
aquanautix - 3,691 views
- Lophelia II 2009: 7000 Foot Wreck \$**
aquanautix - 1,773 views

Deepwater Horizon Spill Outreach

- Extensive Media Coverage (newspaper, TV, radio, Internet)
- College of Exploration/NOAA OER online Teacher Professional Development connected to the October/November 2010 cruise *live*.
- GLOBE/FLEXE students in Mississippi share their thoughts with other students, shortly after the spill
- Rapid Response December cruise was featured on Dive and Discover website

Deepwater Horizon Spill Outreach

GLOBE/FLEXE students react to the spill

Our thoughts on the oil spill...

The waters are calm; the fish are filled with might,
The skies are beautiful; the sun shines bright,
The marine life is strong; there's not a problem in sight,
Though at the same time in the deep seas below,
A dangerous explosion fills the ocean with a terrible glow,
Sea critters of the Gulf Coast know not their fate,
Yet they have unknowingly been setup on a treacherous date,
Help is needed from all the eight seas of the world,
Save the marine life of the Coast please boys and girls.

- Aaron & Isiah

FLEXE : From Local to Extreme Environments

Gulf of Mexico Oil Spill

Since February 2010, GLOBE students in the US, Thailand, England and Costa Rica have been studying the ecology of deep water ecosystems, including the cold seep communities on the seafloor in the Gulf of Mexico, as part of the FLEXE project. Needless to say, news of the disastrous explosion of the Deepwater Horizon drilling platform and subsequent oil spill has many of these students wondering how the oil spill will affect the seafloor communities. FLEXE students in Ms. Leslie Salter's Marine Biology class from Vancleave High School in southern Mississippi are witnessing first hand the effects of this spill and are also wondering what will happen to their coastal communities. On May 7th, these students took a field trip to Ship Island, part of the Gulf Island National Seashore, to look for signs of the spill. They offer the following report as well as their thoughts on the spill.



Vancleave students seise the water around Ship Island

Monday, 10 May 2010

As of right now, there is no oil in MS. It has skipped us and hit LA and AL, mostly because of the direction of the wind. It is now blowing in our direction, so we will be seeing it soon...unfortunately. Although we have signed up to volunteer, they aren't doing much here yet...nothing really to do at this point. We have all just registered and are waiting to hear what to do. We can't clean up any oil related stuff unless we have Hazmat training....40 hours of it. So, we will likely be doing paperwork things, unless they give us a crash course. We have had no birds wash up, and this past Friday we were at Ship Island and saw no signs of problems...but, there were oil booms everywhere. I did some tests on the water, and it was pretty basic....B.S tested twice, on both sides of the island. I wonder if the water has some cleaning product in it...but, again, no signs of animal issues.

Students in Vancleave High School Marine Biology class share some of their thoughts. Click on a name to read what they've written.

- [Aaron - Isiah](#)
- [Alison - Haley](#)
- [Brittany - Latenia](#)
- [Brittany - Richard](#)
- [Hanna - Kayla - Lauren](#)
- [Hunter - Ginger](#)
- [Jessica - Connor - Seth](#)
- [Jherica - Savana](#)
- [Melodye](#)
- [Nathan - Brandon](#)
- [Preston](#)
- [Tim - Chris](#)



Vancleave students search for signs of the oil spill

Other Resources

- [Gulf Oil Spill Tracker](#)
- [National Park Service \(NPS\) Gulf Island National Seashore](#)
- [Audubon: Most recent oil spill info/volunteer info - best source of info for wildlife](#)
- [Local paper \(Gulf Live\) covers story of students' visit to Ship Island](#)
- [Vancleave High School](#)

Deepwater Horizon Spill Outreach

Dive and Discover

Rapid Response Cruise: December 6–15, 2010

- Established WHOI educational site
- InfoMods and HotTopics for more in depth coverage
- Extensive graphics, videos, slideshows and visualizations



The screenshot shows the 'Dive and Discover' website interface. At the top, there is a navigation bar with links for 'Home', 'Choose an Expedition', 'Dive into Deeper Discovery', and 'For Teachers', along with a search box. The main header features the title 'Dive and Discover' in large yellow letters over a background image of an underwater scene with a submersible and a yellow ROV. Below the header, the page is divided into sections. On the left, there is a sidebar with the title 'Expedition 13: Gulf of Mexico' and the dates 'December 6-15, 2010'. Underneath, there is a 'Mission' section and a list of links: 'Daily Updates', 'Mail Buoy', 'Scientists & Crew', 'Interviews', 'Hot Topics', 'Slideshows', 'Videos', and 'Glossary'. The main content area has the title 'Our Mission: December 6-14, 2010' and contains two paragraphs of text. The first paragraph describes the Deepwater Horizon oil spill. The second paragraph describes the mission's goals. To the right of the text is a map of the Gulf of Mexico with a legend and a 'Click to enlarge' link. At the top right of the main content area, there are links for 'Print page' and 'Email to friend'.

Home | Choose an Expedition | Dive into Deeper Discovery | For Teachers | Search

Dive and Discover™

Expedition 13:
Gulf of Mexico
December 6-15, 2010

Mission

Daily Updates
Mail Buoy
Scientists & Crew
Interviews
Hot Topics
Slideshows
Videos
Glossary

Our Mission: December 6-14, 2010

On April 20, 2010, the oil-drilling rig *Deepwater Horizon* exploded and sank in the Gulf of Mexico. The well it was drilling continued to gush oil for nearly three months, eventually causing one of the worst oil spills in history. When it was finally stopped, the well had poured millions of gallons of oil into the water.

Dive and Discover's Expedition 13 will take you beneath the surface of the Gulf to investigate life on the bottom of the ocean and to look for signs of impact by the oil on deep-sea ecosystems. In addition to fouling beaches, threatening wildlife, and shutting down fisheries, scientists are concerned that there could also be damage to the little-known animals and the communities in the deep ocean.

The expedition will feature six dives by the submersible *Alvin* to carefully document the bottom and to collect samples of animals and sediment. Scientists will also send the autonomous underwater vehicle (AUV) *Sentry* out on overnight missions to map and photograph the bottom. This expedition follows a cruise with the remotely operated vehicle (ROV) *Jason* in October, during which many of the same scientists on Expedition 13 discovered dozens of dead and dying corals just seven miles from the *Deepwater Horizon* well. With *Alvin* and *Sentry* working in tandem, this team will revisit that site as well as seek out unexplored places on the ocean floor to learn whether the oil spill did, in fact, affect animals in the deep.

Print page | Email to friend

Click to enlarge

Reference

Barrow, H.S. and A. Kelson. 1993. Problem-based learning in secondary education and the Problem-based Learning Institute (monograph). Springfield: Southern Illinois University School of Medicine.

Lophelia II – Education & Outreach

Thank you, *Lophelia* team!

For all that you do telling the story of your
important work to other audiences.