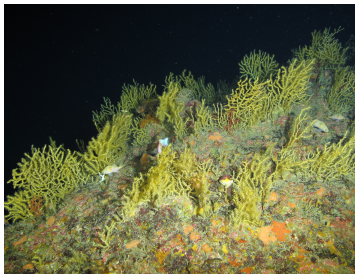
Island STYLE

Deepwater Soft Corals and Oil Spills



SUBJECT:

Science

GRADE LEVEL:

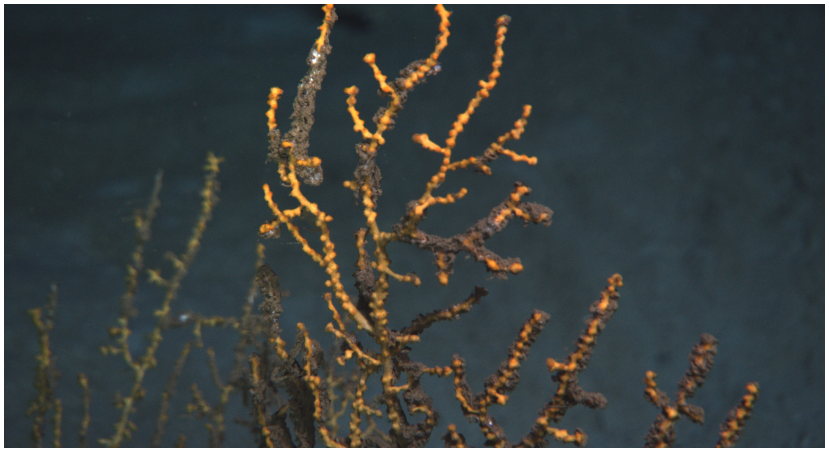
6th

TIMEFRAME:

45 minutes

MATERIALS:

- Demonstration soft coral
  - Sea Fan
  - Sea Pen
  - Black coral
- Demonstration stony coral
  - Brain
  - Elkhorn
  - Staghorn
- Reference images of stony coral species
- Oil Spill Simulation
  - Pipe cleaners (coral sculpture)
  - 3D Printed coral
  - Coral reference images
  - Glass beaker
  - Glass pan
  - Saran wrap
  - Water
  - Vegetable oil
  - Food coloring
  - Cajun Injector
  - Spoon
  - Paper towels
  - Cotton balls
  - Cup of loose dirt



ACTIVITY SUMMARY:

Students will learn about the physical makeup of soft corals, what type of environment soft corals need to thrive, learn about the historic *Deepwater Horizon* Oil Spill, the devastating impact it had on the mesophotic and deep benthic coral communities, and how scientists are helping these communities bounce back.

LEARNING OBJECTIVES:

- Soft coral species structure, identification, and function
- Ecosystem requirements for soft corals
- Differentiate stony/soft coral characteristics
- Understand threats to soft coral ecosystems
- Recognize impact of Deepwater Horizon Oil Spill

ALIGNMENT:

TEKS:

6.6(A) - Compare metals, nonmetals, and metalloids using physical properties such as luster, conductivity, or malleability
6.11(B) - Understand that gravity is the force that governs the motion of our solar system
6.12 (E) - Describe biotic and abiotic parts of an ecosystem in which organisms interact

Ocean Literacy Principles:

5 The ocean makes Earth habitable
7 The ocean and humans are inextricably interconnected
8 The ocean is largely unexplored

VOCABULARY:

- **Buoyancy** - the ability or tendency to float in water or air or some other fluid
- **Deep benthic** - Areas on the seafloor where sunlight is not present; for Gulf restoration, this deeper than 980 feet
- **Density** - the degree of compactness of a substance
- **Mesophotic benthic** - Areas on the seafloor where sunlight levels are low; for Gulf restoration, this is ~160 feet to ~980 feet
- **Oil** - a viscous liquid derived from petroleum, especially for use as a fuel or lubricant
- **Oil Rig** - a structure with equipment for drilling and servicing an oil well
- **Oil Well** - a well or shaft drilled through rock, from which petroleum is drawn
- **Pollution** - the presence in or introduction into the environment of a substance or thing that has harmful or poisonous effects
- **Restoration** – Repairing and supporting recovery of injured or degrading habitats, populations, or ecosystems
- **Soft Corals** - Soft corals are soft and bendable and often resemble plants or trees. These corals do not have stony skeletons and are non-reef-building corals—instead, they grow wood-like cores and fleshy rinds for protection

BACKGROUND INFORMATION:

CORALS:

In the previous science lesson, students have learned about the physical makeup of stony corals, what type of environment stony corals need to thrive, and aimed to understand some of the challenges coral colonies face for survival. This lesson will introduce soft corals.

OIL SPILLS:

***Deepwater Horizon* oil spill**, also called **Gulf of Mexico oil spill**, the largest marine oil spill in history, caused by an April 20, 2010, explosion on the Deepwater Horizon oil rig—located in the Gulf of Mexico, approximately 41 miles off the coast of Louisiana—and its subsequent sinking on April 22:

The April 20, 2010, the explosion, subsequent fire, and sinking of the *Deepwater Horizon* mobile drilling unit triggered a massive release of oil and other substances from BP's Macondo well. Initial efforts to cap the well following the explosion were unsuccessful and, for 87 days after the explosion, the well blasted oil and natural gas continuously and uncontrollably into the northern Gulf of Mexico. Oil under pressure gushed into the deep ocean from the BP's Macondo well, located about 1 mile below the ocean surface and about 50 miles offshore. Subsea videos captured dramatic images of oil spewing unchecked from the well's broken riser pipe into the deep ocean. Oil moved with deep-sea currents, creating a plume of oil within the deep sea; oil and associated "marine oil snow" also settled on the sea floor. More buoyant oil traveled up through about a mile of water column and formed large surface slicks; at its maximum extent on June 19, 2010, oil covered over 15,300 square miles of the ocean, an area about 10 times the size of Rhode Island. Cumulatively over the course of the spill, oil was detected on over 43,300 square miles of the ocean, an area about the size of Virginia.

In total, the *Deepwater Horizon* oil spill released 134 million gallons of oil into the Gulf of Mexico. To clean oil from the open water, 1.8 million gallons of dispersants —substances that emulsified the oil, allowing for easier metabolism by bacteria—were pumped directly into the leak and applied to the slick from above using airplanes. Booms to corral portions of the slick were deployed, and the contained oil was then siphoned off or burned. As oil began to contaminate Louisiana beaches in May, it was manually removed; more difficult to clean were the state's marshes and estuaries, which are knit together by delicate plant life, and underwater habitats. By June, oil and tar balls had made landfall on the beaches of Mississippi, Alabama, and Florida. In all, an estimated 1,100 miles of shoreline were polluted. The oil came into contact with and injured deep-sea coral, fish and shellfish, birds, sea turtles, and marine mammals. Additionally, the oil spill prevented people from fishing, going to the beach, and enjoying recreational activities along the Gulf of Mexico.

Under the Oil Pollution Act (OPA), a council of federal and state "trustees" was created soon after the spill to assess the natural resource injuries resulting from it, develop a restoration plan to address those injuries, and acquire funding to make restoration possible. One of the 13 restoration areas in need identified during this plan are mesophotic and deep benthic communities in the Gulf, which consist of soft corals, sponges, fish, and invertebrates and are important habitats in the food web of larger Gulf species.

More than 770 square miles of deep-sea habitat and 4 square miles of mesophotic habitat were injured by the *Deepwater Horizon* oil spill. Humans have a limited understanding of mesophotic and deep benthic communities, including the species found in these ecosystems and how they interact, how long they live, how they reproduce, and how they can be effectively conserved or restored. Restoring mesophotic and deep-sea habitats is a challenging task due to the limited knowledge of these ecosystems and the fact that restoration at these depths has rarely been done so far. To ensure these habitats are restored as effectively as possible, 4 projects were created for the National Oceanic and Atmospheric Administration (NOAA) to work together with partners on this effort.

These projects will:

- Improve understanding of mesophotic and deep-sea communities to inform better management and ensure resiliency
- Restore mesophotic and deep benthic invertebrate and fish abundance for injured species, focusing on high-density mesophotic and deepwater coral sites and other priority hard-ground areas to provide healthy habitats from the coast to offshore
- Actively manage valuable mesophotic and deep-sea communities to protect against multiple threats and provide a framework for monitoring, education, and outreach.

PREPARATION:

Gather all necessary materials listed above. Set up small group stations for each group to conduct their own oil spill activity.

INTRODUCTION:

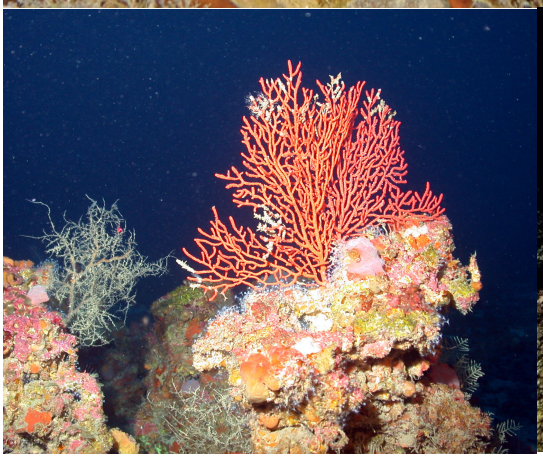
What is the difference between Coral Specimen #1 and Coral Specimen #2?

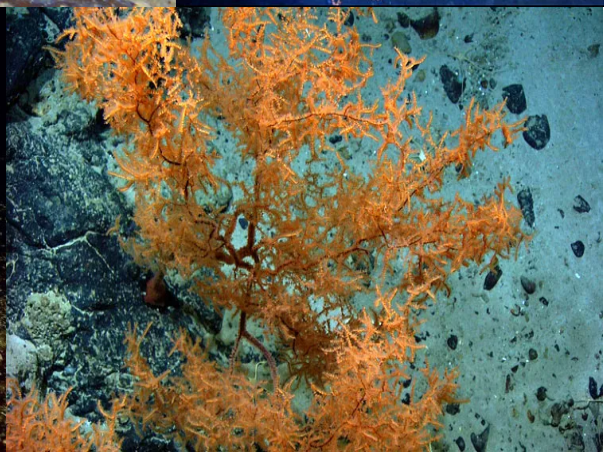
Allow for students to touch both **stony** and **soft coral** specimens. Make a list of similarities and differences.

Soft corals can survive in much deeper, colder waters than the stony corals!

Soft corals can be distinguished from hard corals by their appearance and by their movement in the water. They are also found in a huge range of forms and shapes, from doughy/fleshy shapes to delicate fans and whips.

Some species are much **more depth tolerant** than their harder cousins; **Their large, eight-tentacled polyps** feed voraciously in deep water currents. Soft corals are present in larger numbers **in temperate or even polar waters** because they are **not as dependent on algae** to produce the bulk of their food.





Sea Fan **Sea Pen** **Black Corals**

GUIDED PRACTICE:

Introduction to Oil Spills

- What is oil?
  - Crude oil, the liquid remains of ancient plants and animals, is a fossil fuel that is used to make a wide range of fuels and products. Oil is found below ground or below the ocean floor in reservoirs, where oil droplets reside in "pores" or holes in the rock. After drilling down and pumping out the crude oil, oil companies transport it by pipes, ships, trucks, or trains to processing plants called refineries. There it is refined so it can be made into different petroleum products, including gasoline and other fuels as well as products like asphalt, plastics, soaps, and paints.
- What is an oil spill?
  - An oil spill is a form of pollution generally found in a marine ecosystem. However, oil spills can happen on land too. An oil spill occurs when oil leaks or spills into the water. Oil spills can also happen in rivers or lakes!
- What causes an oil spill?
  - Oil spills are often caused by accidents, but they can also be caused by human error or carelessness. These accidents involve tankers, barges, oil drill rigs, and other places or methods of transportation that store or hold large amounts of oil.
- Why are oil spills harmful?
  - Oil spills are harmful to marine birds and mammals as well as fish and shellfish. Oil coats the feathers and fur of marine life, leaving them susceptible to hypothermia (being too cold) because their fur or feathers cannot protect them from the weather.
  - Additionally, an oil spill can contaminate the food supply or food chain. Marine mammals that eat fish or other food exposed to an oil spill may be poisoned by oil.

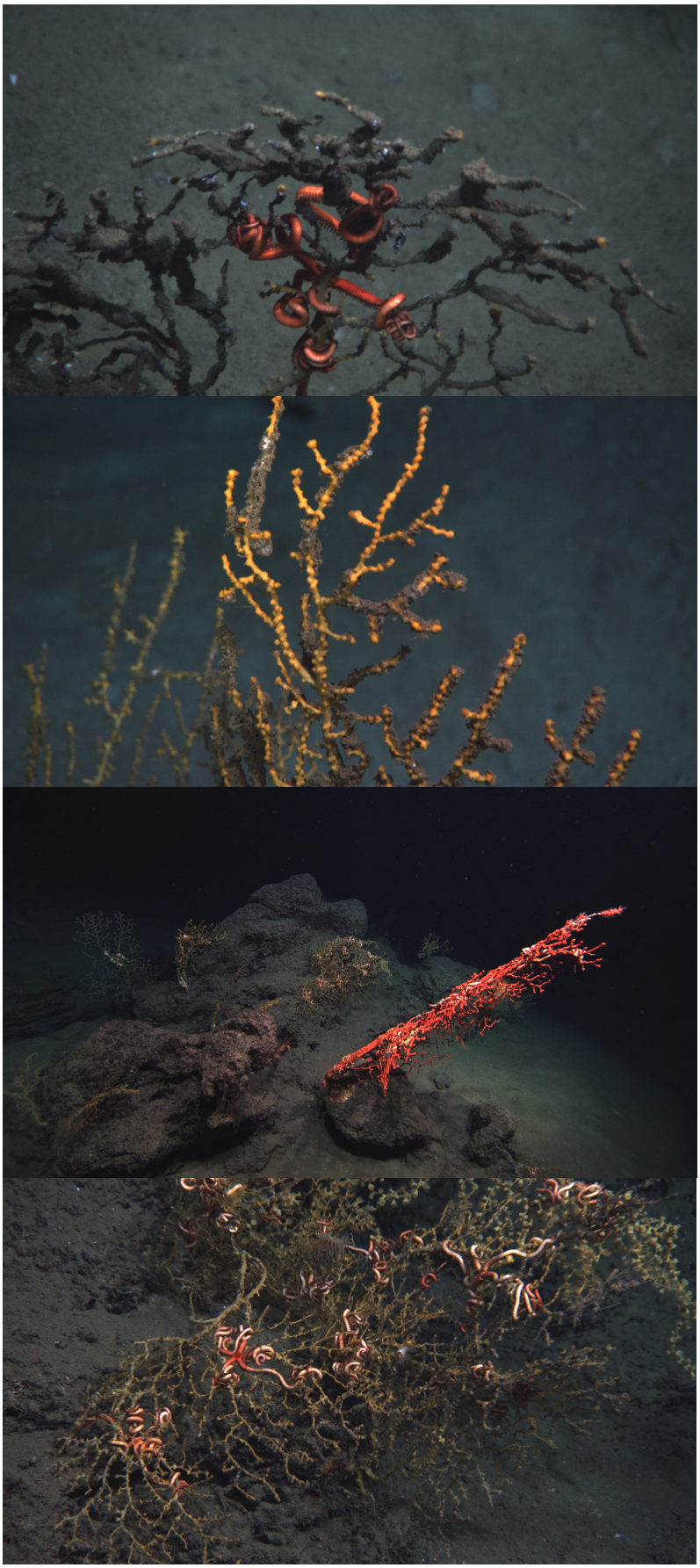
The Deepwater Horizon Oil Spill

- Largest marine oil spill in history, caused by an April 20, 2010, explosion on the Deepwater Horizon oil rig—located in the Gulf of Mexico, approximately 41 miles off the coast of Louisiana—and its subsequent sinking on April 22. The spill dumped 3.19 million barrels of oil into the Gulf of Mexico.

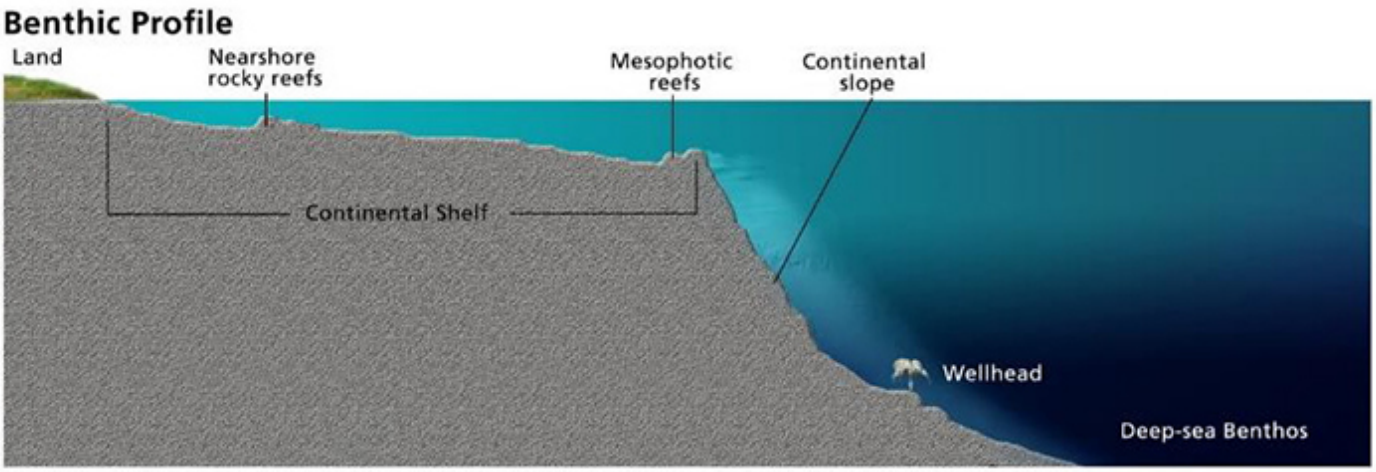
Impact on Deep Coral Communities

- Oil, gas, and dispersant spilled out from the site of the leak about 5,000 feet below the sea surface. A mixture of oil, dispersant, microbes, and mucus clumped together and rained down on the seafloor.
- More than 770 square miles of deep-sea habitat and 4 square miles of mesophotic habitat were injured by the *Deepwater Horizon* oil spill. Restoring mesophotic and deep-sea habitats is a challenging task due to the limited knowledge of these ecosystems and the fact that restoration at these depths has rarely been done so far.
- Coral colonies presented signs of stress - tissue loss, sclerite enlargement, excess mucous production, bleached commensal ophiuroids, and being covered in brown flocculent material (floc).

VIDEO - Deepwater Corals: Where Did the Gulf Oil Go?



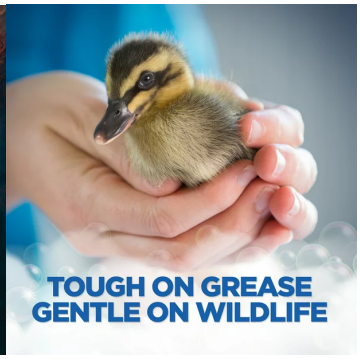
INDEPENDENT / GROUP PRACTICE:



A profile of the Gulf of Mexico seafloor habitats extending from the shore to depths around the Macondo wellhead. The mesophotic coral reefs in this study were located at the edge of the continental shelf. (NOAA/Kate Sweeney)

OIL SPILL SIMULATION ACTIVITY:

- Create oil well:
  - Fill condiment cup with oil (weigh down if possible), place lid on top
- Create ocean scene:
  - Carefully fill clear glass pan half full with cold water, add blue food coloring
- Add biodiversity:
  - Place coral sculptures (make from pipecleaners) and marine toys in the bottom of the pan, weigh down if possible
- Simulate an oil spill:
  - Carefully take Cajun Injector and puncture hole through the plastic lid of condiment cup extract oil into syringe
  - Remove the Cajun Injector entirely
- Observe the oil spill:
  - Where does it go? Does it sink, float, attach to marine life?
- Add in marine snow:
  - Sprinkle in cup of dirt
  - Observe how it attaches to the oil. Where does it go? Does it stick to the coral?
- Attempt to clean the oil spill! Which is most effective? Which tool best helps you clean the oil off of the coral?
  - Q-tips
  - Cotton balls
  - Paper towels
  - Sponges
  - Spoon
  - Dawn dish soap



ASSESSMENT OF LEARNING:

- What are some of the key differences between stony and soft corals?
- Describe the properties of oil and how it behaved when it was added to the water
- Describe the difficulty level of removing the oil from the water completely
- Discuss the different ways that scientists clean up oil spills
- Discuss the ripple effect impact that oil spills have on the marine environment

CLOSING:

As you teach lessons linked to our Galveston Bay watershed and the Gulf of Mexico you can use the "I Wonder" board as a closure assignment. You might ask what else the students want to learn about corals. Students may ask about photosynthesis, or depth of water or who eats them or how boats anchor in areas with coral. All their questions (even the ones asked multiple times) would go on the I Wonder board. If a question was answered in the lesson, it still goes on the board.

Students may even have questions days later that could be added. The goal is to have a place for all questions about Galveston Bay and Gulf of Mexico to be housed.

EXTENSION:

Students may have more questions about the mesophotic and deep benthic communities or drilling in general. There are many resources put out by NOAA that can assist their discovery. https://www.fisheries.noaa.gov/southeast/habitat-conservation/mesophotic-and-deep-benthic-communities-restoration

NOTES: