The Secret Life of Coral Reefs: A Dominican Republic Adventure

TEACHER'S GUIDE

Grades: All **Subjects**: Science and Geography

Live event date: May 10th, 2019 at 1:00 PM ET

Purpose: This guide contains a set of discussion questions and answers for any grade level, which can be used after the virtual field trip. It also contains links to Nature Works Everywhere resources and other resources ranging from lessons, activities, videos, demonstrations, experiments, real-time data, and multimedia presentations.

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Event Description:
Is it a rock? Is it a plant? Or is it something else entirely?

Discover the amazing world of coral reefs with coral scientist Joe Pollock, as he takes us on a virtual field trip to the beautiful coastline of the Dominican Republic. We'll dive into the waters of the Caribbean to see how corals form, the way they grow into reefs, and how they support an incredible array of plants and animals.

Covering less than 1% of the ocean floor, coral reefs are home to an estimated 25% of all marine species. That's why they're often called the rainforests of the sea! Explore this amazing ecosystem and learn how the reefs are more than just a pretty place—they provide habitat for the fish we eat, compounds for the medicines we take, and even coastal protection during severe weather.

Learn how these fragile reefs are being damaged by human activity and climate change, and how scientists from The Nature Conservancy and local organizations are developing ways to restore corals in the areas where they need the most help.

So, come aboard the boat with Joe and our team of experts as we explore one of the most breathtaking, and important, places in the ocean, and learn about the science that's helping bring nature back to life, and how you can help!

Standards:

Next Generation Science Standards Disciplinary Core Ideas

- ESS2.A Earth Materials and Systems
- ESS2.E Biogeology
- ESS3.A Natural Resources
- ESS3.B Natural Hazards
- ESS3.C Human Impacts on Earth Systems
- LS1.C Organization for Matter and Energy Flow in Organisms
- LS2.A Interdependent Relationships in Ecosystems
- LS2.B Cycle of Matter and Energy Transfer in Ecosystems
- LS2.C Ecosystem Dynamics, Functioning, and Resilience
- LS4.C Adaptation
- LS4.D Biodiversity and Humans

National Geography Standards

- 4 - The physical and human characteristics of places
- 8 - The characteristics and spatial distribution of ecosystems and biomes on Earth's surface
- 11 - The patterns and networks of economic interdependence on Earth's surface
- 14 - How human actions modify the physical environment
- 15 - How physical systems affect human systems

Discussion Questions: You can use or adapt these questions for a follow-up discussion with your students after viewing the virtual field trip.

1. Where can you find coral reefs around the world?
   Answer: Coral reefs form in warmer waters near the equator and between the Tropic of Cancer and the Tropic of Capricorn.

2. What is coral?
   Answer: Coral is an animal that has a hard skeleton filled with soft, fleshy parts called polyps. The polyps are like mini jellyfish that live together in a colony.

3. What does symbiosis mean?
   Answer: Symbiosis is when two different organisms live close together and interact in some way. This interaction can be positive or negative. A positive interaction is called "mutualism" because both organisms benefit.

4. Give an example of mutualism in a coral ecosystem and explain how the symbiotic relationship works.
   Answer:
   a. *Zooxanthellae (microalgae) and Corals: Zooxanthellae help corals by providing food for the corals and corals help zooxanthellae by giving them a place to live. Corals also provide zooxanthellae with carbon dioxide that they can use during photosynthesis.*
   b. *Herbivores and Corals: Some fish that are herbivores eat macroalgae that is growing in competition with the coral. Parrot fish are a great example of a fish that helps corals in this way.*

5. List and describe some of the things that coral reefs do for people.
   Answer:
   a. *Coastal Protection: Reefs act as a barrier and help to calm or buffer waves that could be destructive to property on the coasts. They help prevent the coastline from eroding and keep waves from surging onto land and flooding property.*
   b. *Habitat for Fish: Reefs provide a home for a wide variety of organisms, including fish that people eat and sell to make a living.*
   c. *Tourism: Reefs provide natural beauty to support a tourist-based economy that benefits when people come to dive and snorkel.*

6. In what ways are coral reefs sensitive?
   Answer: Coral reefs are sensitive to temperature change. Reef-forming corals live in waters that are not too hot and not too cold. Slight increases in temperature can cause the corals to expel their zooxanthellae. This is called coral bleaching because the zooxanthellae give corals their color. When the zooxanthellae leave, the corals appear white or bleached. If the water temperature cools, the zooxanthellae will come back, however, if the zooxanthellae leave for too long, the corals can die. Corals are also sensitive to pollution and overfishing. Lastly, ocean acidification, caused by the increased uptake of carbon dioxide in the ocean, can greatly diminish the ability of corals to build new structures and can even cause coral skeletons to weaken or dissolve.

7. What are some ways that people in the Dominican Republic have worked to save their reefs and protect ocean habitats?
   Answer: Fishing for Parrot Fish has been banned so that these fish can continue helping coral by eating the macroalgae that competes with the corals. Fragmentation and microfragmentation techniques are helping to increase and strengthen coral populations in vulnerable or degraded areas.

8. What are some things that you can do to help coral reefs stay healthy and strong?
   Answer: You can be mindful of the fish that you eat and make sure to eat fish that are sustainably harvested by using websites like NOAA's Fishwatch (www.fishwatch.gov) to learn which species are okay to eat. Don't purchase jewelry made with coral pieces. If you go snorkeling or diving near reefs, don't touch the corals and be careful not to step on them or hit them with your feet. Don't litter – it might eventually end up in our oceans. Conserve water – the less wastewater you generate, the less likely that wastewater will end up in the ocean. Teach other people what you have learned about corals.

Related Nature Works Everywhere Resources: The following lesson plans and videos can be used to supplement the virtual field trip.

The Need is Mutual: The Importance of Biological Interactions

Grade Levels: 6-8

https://www.natureworkseverywhere.org/resources/importance-biological-interactions/

Organisms have a variety of relationships. In this lesson, students learn to categorize relationships, like symbiosis, between organisms. To reinforce the lesson, examples from coral reefs are presented. There are several extensions for this lesson plan.

The Coral Reefs of Palau: Nature's Amazing Underwater Cities

Grade Levels: 3-8

https://www.natureworkseverywhere.org/resources/coral-reefs-palau/

Join scientist Stephanie Wear on a virtual field trip to the coral reefs of Palau where you'll explore amazing underwater cities found near a remote network of islands in the Pacific Ocean. Our journey to the coral reefs will open your eyes to an amazing, interconnected ecosystem built on symbiosis, where diverse organisms are designed to protect, clean, nourish, and even camouflage one another. In this natural factory, the coral supports its many "workers" and they, in turn, keep the coral healthy.

Other Related Resources

Classroom Resources (All Grades)

- Students Rebuild Ocean Challenge – Create ocean-related artwork and support ocean conservation and coral restoration
  https://www.studentsrebuild.org/challenges/ocean
- NOAA Education Coral Ecosystems Collection – Background information, lessons and activities, multimedia
  https://www.noaa.gov/education/resource-collections/marine-life-education-resources/coral-reef-ecosystems
- NOAA Education Ocean Acidification Collection – Background information, lessons and activities, multimedia
  https://www.noaa.gov/education/resource-collections/ocean-coasts-education-resources/ocean-acidification
- NOAA Coral Reef – 3D Printed Coral Polyp Model
  https://coralreef.noaa.gov/education/polypmodel.html
- Google Earth Great Barrier Reef Street View – Explore coral reefs using Google
  https://www.google.com/maps/about/behind-the-scenes/streetview/treks/oceans/
- Google Earth Underwater Street View for World Oceans Day 2015
  http://google-latlong.blogspot.com/2015/06/explore-life-beneath-waves-in-honor-of.html

Videos (Middle School to High School Level)

- Science Bulletins – Coral Reefs in Hot Water
  https://www.youtube.com/watch?v=RTcBFME4_bU&list=PL03468DEB0456E448&index=21
- NOAA's Ocean Today Every Full Moon Coral Under Threat Video Series
  https://oceantoday.noaa.gov/fullmoon-coralsunderthreat/

Real-time Data (Middle School to High School Level)

- Data in the Classroom – Ocean Acidification and Coral Bleaching Modules
  http://dataintheclassroom.noaa.gov/
- NOAA View Data Exploration Tool – Find data sets on ocean temperature, coral locations, coral bleaching
  https://www.nnvl.noaa.gov/view/globaldata.html

Ocean Acidification Activities and Experiments

Below is a summary of a few demonstrations or simple experiments you can do with students. The URLs provided come from lesson plans with more detailed information.

- Use beakers with differing concentrations of acid (in this case – vinegar). Put calcium tablets, old-style chalk, egg shells, etc. in the beakers and watch the change over time. The pH of the solution can be measured, and the items can be weighed as time passes. This demonstrates how organisms with calcium carbonate shells can dissolve in the presence of increased acidity.
  - http://www.cisanctuary.org/ocean-acidification/PDFs-WorkshopPage/Hands_on_acivities/Marine_Osteoporosis/marineos.pdf
  - http://www.cisanctuary.org/ocean-acidification/PDFs-WorkshopPage/Hands_on_acivities/OA_Shells.pdf

- Put red cabbage juice or bromothymol blue indicators in a beaker and blow into them with straw (adding CO_2). The indicator will change color as CO_2 increases. This demonstrates how the ocean takes up carbon dioxide.
  - http://monitor.noaa.gov/education/pdfs/rov_ocean_acidification.pdf

- Put dry ice in a beaker with bromothymol blue. As the dry ice sublimates, the carbon dioxide gas will change the color of the indicator from blue to green to yellow. This illustrates how carbon dioxide can be taken up by seawater.