

An aerial photograph of a rugged coastline. The top half of the image shows a vast expanse of deep blue water. The bottom half shows a rocky shore with various shades of green vegetation, including mosses and small trees, growing on the rocks. The text is centered in a dark grey horizontal band across the middle of the image.

8TH GRADE
STEAM LESSON



REEF-LIEF

▶ **Driving Question:**

How can humans help reverse the damage and ecosystem loss caused by the destruction of coral reefs?

Materials Needed:

Before and after images of coral reef systems, science notebook, sketchbook, prototype materials such as a 3D printer (ProtoCycler), clay or model supplies

In this lesson, students will:

- recognize the damage done to coral reefs resulting from human activities and climate change, and develop a plan to rehabilitate or recreate the ecosystem.

National Learning Standards:

Science: MS-LS2-4; MS-LS2-5;
MS-ETS1-1; MS-ETS1-2
Art: Cr2.3.8a; Pr5.1.8a



SPINNING THE COCOON

Begin by showing students before and after pictures of the Great Barrier Reef such as the ones in this [article](#), and ask students what impact such changes could have. Discuss how the coral reef not only serves as a hotspot for oceanic biodiversity, but also acts as a barrier for coastlines to prevent damaging erosion. It is also vital to nutrient cycling, and provides economic benefits such as fishing and tourism to local areas. Coral reefs may have additional benefits such as housing organisms used in medications for humans or other products.

Tell students that most coral reefs are near the equator, just like rainforests. Their consistent temperature is what encourages their biodiversity. Based on this information, what can students deduce is occurring in reef systems such as the Great Barrier Reef to cause die-offs and bleaching? Explain that at least two global bleaching events have been associated with El Niño weather patterns, but that ocean temperatures are expected to continue to change, leaving reefs vulnerable. One way to help maintain oceanic biodiversity as well as the other benefits of the reef are to install artificial reefs. Thus far, artificial reefs have primarily been made by sinking old military equipment and similar vehicles as explained in this [article](#). These artificial reefs help to protect coastlines and provide habitat for various aquatic organisms, just like natural reefs. Installing a natural substrate to encourage reef restoration and coral growth in various areas can also prevent changing ocean temperatures from causing further damage to existing reefs.

KERNEL OF KNOWLEDGE

The Great Barrier Reef generates more than \$1.5 billion each year from fishing and tourism for the Australian economy.



METAMORPHOSIS

Have student groups brainstorm materials and a design for creating an artificial reef. They can use existing materials, or create and design their own, similar to the underwater sculptures. Students should study current natural reef systems for information on how reefs grow and what the organisms they require for life. Studying natural reefs might also give students ideas for design. After the design phase, students will select materials to create a prototype for their reef design. Students should analyze their prototype and consider factors such as how likely it would be to move with ocean currents and the durability of materials. Students will research options for where to place their artificial reef in the ocean and provide the reasoning for their choices.

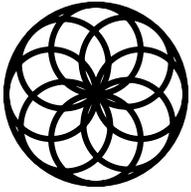


THROUGH THE LENS

Instruct students to document the process of creating their coral reef dioramas. In their documentary, they should discuss why it is important to bring awareness to the dying off of the coral reefs, as well as steps that can help prevent further deterioration. For inspiration, have them watch [*Chasing Coral*](#). (Netflix account required to stream the film.)

UPCYCLE

Oceanic plastic is a hot topic right now. The ProtoCycler is a 3D printer that uses plastic such as water bottles to create 3D models without the use of virgin materials. Students should design an artificial reef prototype and then print it using the ProtoCycler. They will then use ratios to determine how much recycled plastic they could convert into a usable, artificial reef if the technology were available at scale.



KALEIDOSCOPE

Explain to students that Americans are constantly redefining our national identity. Ask students to give examples of current social movements. Tell them that these movements each help to define America. Ask, “How does Americans’ commitment to the environment help define our national identity?” Have students create a foldable or poster that explains the environmental movement, including a brief history. Have them explain how the movement connects to the coral reef project above, and the message it sends to the rest of the world.



eARTh

Equipped with their new knowledge of coral reefs, have students create a diorama of a reef. The diorama should include different coral of various colors and textures, organisms that rely on the coral for life, and animals that rely on it for protection or food. Dioramas include both 3D and 2D elements, so allow the students to decide which ones they will create in 2D or 3D. If possible, have the students sculpt some of the forms from clay and paint and fire them. If not, they can use cardboard, paper, found objects or any other 3D material for the solid forms.

The students will need to research each element that would be present to create a complete environment. These can be as large or as small as you require. In addition to the diorama, the students should write at least one statistic regarding the dangers that coral reefs face on or near their artwork. Have them present their work to the class and, if possible, create an exhibit with the pieces for the public to view.

Community Garden

- Study the impact of litter on marine plant and animal habitats. Invite other clubs or school organizations to participate in a nearby beach cleanup.
- If there are no oceans near you, no problem! Nearby lakes and streams are just as important and require litter-free environments to thrive. Sort and quantify the litter retrieved, and present the findings at your school to encourage others not to litter local beaches, lakes and streams.



CAREER CONNECTION

Marine Biologist - Marine biologists specialize in species and ecosystem interactions in our oceans. Their examinations of both biotic and abiotic features are vital to the health of our oceans and seas. Marine biologists hold a minimum of a bachelor's degree, and most have a master's or doctorate degree.

Chemical Engineer - Chemical engineers develop compounds found in food, medications and other products. They are responsible for the creation of products such as new sunblock formulas that won't harm coral reefs. Chemical engineering requires a bachelor's degree as well as an internship.



CAREER HIGHLIGHT

Dr. Ruth Gates is best known as president of the International Society of Reef Studies and a contributor to the film *Chasing Coral*. Currently, she is the director of the Hawaii Institute of Marine Biology (HIMB) at the University of Hawaii at Manoa where she leads a team dedicated to the research and preservation of coral reefs.



