OCEAN CLASSROOM

The Study of Corals

Threats to Coral Reefs

EDUCATOR GUIDE

THE
UNIVERSITY
OF RHODE ISLAND
GRADUATE SCHOOL
OF OCEANOGRAPHY

Guiding Question "What threats to coral exist today?"

Day 1

Time required: 45 minutes

Procedure:

Divide students into groups of 3 or 4.

Have them read the "Threats to Coral Reefs-Informational Essay" about "1. Local Threats" and highlight any important facts.

Then have the class click on this NOAA site for more facts about this poster: https://oceanservice.noaa.gov/facts/coral-pollution.html

Lastly, bring the students back to their seats and, as a class, watch as many videos as time allows. Here is your list:

Videos about the threats to corals

- https://www.youtube.com/watch?v=mQ10xBl8XMQ&ab_channel=NationalGeographic
- https://www.youtube.com/watch?v=14ot4DrXdds&ab_channel=AtlasPro
- https://www.wri.org/our-work/project/reefs-risk/interactive-map
- https://ejfoundation.org/reports/coral-reefs-in-crisis
- https://education.abc.net.au/home#!/media/524983/can-coral-reefs-survive

Day 2

Time required: 45 minutes

Procedure:

Have students get into their groups. They are to read the "Threats to Coral Reefs-Informational Essay" about "Global Threats" and highlight any important facts.

Then,have the class click on this NOAA site for more facts about this poster: https://www.iyor2018.org/wp-content/uploads/2018/06/coralbleac hing-large.jpg

Next, it's time to do an experiment about "Ocean Acidification." Students will see what happens to a coral's calcium carbonate, the material that makes up their skeletons.

See the sites below for background information and directions:
"Ocean Acidification in a Cup" (Grades 2 through 6) with video, questions and explanations:
https://www.exploratorium.edu/snacks/ocean-acidification-in-cup
with Extension (Grades 6 through 12)

Coral Bleaching Activity:

If you teach upper grades (7 through 12) you may want to try this

Video

https://mass.pbslearningmedia.org/resource/b6771c72-58ba-4140-8663-79a2775f40b2/coral-bleaching-hhmi-biointeractive/

Activity

https://mass.pbslearningmedia.org/resource/0d5be00d-db70-4b6a-ab25-f95175958c00/coral-bleaching-activity-hhmi-biointeractive/support-materials

Day 3

Time required: 45 minutes

Vocabulary Terms:

ANSWERS

Have the students make a word search or crossword at
http://puzzlemaker.discoveryeducation.com/
Or they can play a game at https://kahoot.com/
Another site to look up and use is quizlet.com

1. **Carbon Dioxide (CO^2)** —a colorless, odorless gas produced by burning carbon (present in fossil fuels) and organic compounds and by respiration. It is naturally present in air (about 0.03 percent) and is absorbed by plants in photosynthesis.
2. **Carbon Footprint** —the total amount of greenhouse gases (including carbon dioxide and methane) that are generated by our actions.
3. **Calcium Carbonate($CaCO^3$)** —Coral reefs are made of many layers of calcium carbonate. Stony corals secrete this chemical compound (also known as limestone) to create their skeletons. It is the main component of eggs, snail shells, seashells and pearls.
4. **Climate Change** —The large scale shift in weather patterns (like Global Warming) resulting from BOTH human activities and natural disasters that result in an increase in the emissions of greenhouse gases. Such shifting weather patterns threaten food production and cause rising sea levels that increase the risk of catastrophic flooding.
5. **Coral Bleaching** —an event that occurs when corals are stressed by changes in conditions (such as changes in temperature, light, or nutrients), they expel the symbiotic algae (zooxanthellae) living in their tissues causing the coral to turn completely white. The corals are still alive, and some survive this event, but their mortality rate rises.
6. **Conservation** —efforts/actions carried out to prevent the wasteful use of a resource and to preserve/protect that resource for future generations.
7. **Fluorinated Gasses (F-gasses)** —are man-made gases that can stay in the atmosphere for centuries and contribute to a global greenhouse effect. Unlike many other greenhouse gases, fluorinated gases have no natural sources and only come from human-related activities. F-gases are ozone-friendly, enable energy efficiency (as in refrigeration and air conditioners), and are relatively safe for use by the public due to their low levels of toxicity and flammability. However, most F-gases have a high global warming potential There are four types: hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF^6) and nitrogen trifluoride (NF^3)

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Day 3

Vocabulary Terms, ANSWERS *(Continued from previous page.)*

8. **Fossil Fuels** —Energy sources from nature, including oil, coal and natural gas, are non-renewable resources that formed when prehistoric plants and animals died and this organic matter was gradually buried by layers of rock for millions of years.The burning of fossil fuels emit greenhouse gases that greatly contribute to climate change and global warming.
9. **Greenhouse Effect** —is a natural process that warms the Earth's surface. When the Sun's energy reaches the Earth's atmosphere, some of it is reflected back to space and the rest is absorbed and re-radiated by the greenhouse gases that surround the Earth. The extra absorbed energy, or extra heat, warms the atmosphere and the surface of the Earth. This process causes global warming. Greenhouse gases absorb heat and deplete our protective ozone layer. They include water vapour(H^2O), carbon dioxide (CO^2), methane (CH^4), nitrous oxide(N^2O), ozone(O^3) and some artificial chemicals such as chlorofluorocarbons (CFCs).
10. **Global Warming** —the increase in our average global temperature caused by the long-term heating of Earth. Global warming is the result of the Greenhouse Effect.
11. **Methane (CH^4)** —a colorless, odorless gas that occurs abundantly in nature and as a product of certain human activities. Methane is the simplest member of the greenhouse gases. Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and by the decay of organic waste.
12. **Nitrous Oxide (N^2O)** —a colorless odorless gas that is emitted from wastewater that contains nitrogen-based organic materials, such as those found in human or animal waste. It is also the result of agricultural activities that use lots of nitrogen based fertilizer.
13. **Ocean Acidification** —a reduction in the pH of the ocean over an extended period of time, causing the ocean to become more acidic. This event is caused primarily by an increase in carbon dioxide (CO^2) from the atmosphere. When CO^2 is absorbed by seawater, a series of chemical reactions occur resulting in an increase in hydrogen ions and a decrease in carbonate (needed for building shells and skeletons).
14. **Pathogens** —any organism/microbe that causes disease to its host; they get into our water from treated sewage, stormwater, and runoff from livestock pens.

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Day 3

Vocabulary Terms, ANSWERS *(Continued from previous page.)*

15. **Restoration** —coral restoration refers to projects whereby time, energy, and resources are devoted to directly increasing the coral reef health, abundance, or biodiversity.
16. **Sedimentation** —an overabundance of particles that block light and smother coral reefs; it gets into our waters from coastal development, urban stormwater runoff, forestry, and agriculture. Sedimentation has been identified as a primary stressor of corals.

Procedure: Today the students are going to discuss and learn about the "Greenhouse Effect." Students can be in groups, or you can teach them as a whole class.

1. Put this question on the board: "What is the Greenhouse Effect?" Tell the class to write it in their science notebooks. See if the class can tell you some facts. Have students click on NASA s site about Climate Change: https://climatekids.nasa.gov/greenhouse-effect/ There is a short video to watch and an article with pictures. Come up with a class definition of the "Greenhouse Effect" and have them write it in their science notebooks.
2. Next, put this question on the board: "What are the Greenhouse Gasses?" Tell the class to write it in their science notebook. Students should click on: https://climatekids.nasa.gov/greenhouse-cards/ and as a class make a list of the greenhouse gasses. Have students write the list in their science notebooks.
3. Then, have students go to this site to experience an interactive time machine showing the earth as it warms up: https://climatekids.nasa.gov/time-machine/
4. If time allows, students can play the games about climate change on this site: https://climatekids.nasa.gov/menu/play/

Day 4

Time required: 45 minutes

Procedure: Students meet in their groups to complete the two parts of the "Displaying Data Activity." The sites given to them are from the EPA site on pollution. When everyone has finished the activity, display the answers on the front board, and it's a good idea to give each child a copy of the charts to glue in their science notebooks. See answers below:

Global Activities Causing Greenhouse Gases

https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data#Sector

Greenhouse Gases Being Released Globally

https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data#Gas

Textbook Activity

The last activity about reading graphs and charts is called "Textbook Activity." This can be a classwork or homework assignment.Students are given a graph from the EPA (Environmental Protection Agency) site: https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data

Students have to come up with five questions that relate to the chart about Global Carbon Emissions of Fossil Fuels. When they are done, ask students to share some of their questions with the class.