



Teacher Resource Kit - Experiment Lesson Plan

Coral Bleaching

Experiment Summary

This experiment introduces coral bleaching and how it can have a negative impact on coral reef ecosystems. Using CCMI's training video and resource kits, teachers will be guided through how to undertake a simple coral bleaching experiment with their students by a CCMI educator. Background information on coral bleaching and its causes will also be provided in the training video. Teachers undertaking this experiment are encouraged to follow up with a class discussion focusing on how other environments are changing and what impact this has on the organisms that live there.

Curriculum Aim - Key Stage 2 (Year 4, 5 and 6)

Reefs Go Live corresponding broadcasts:

- Underwater Symbiosis (https://youtu.be/bo3fz_pAMRQ)
- Mini-module Reefs Go Live: Symbiotic Relationships Explained - Mutualism (<https://youtu.be/qxAd4J48Muc>)

Learning objectives

- Describe global warming and its causes
- Define the mutualistic symbiotic relationship between corals and zooxanthellae
- Explain coral bleaching
- Observe a scientific experiment and make predictions
- Recognise how to prevent coral bleaching by reducing carbon emissions

The Cayman Islands - Science National Curriculum Alignment

- Recognise that environments can change and that this can sometimes pose dangers to living things (Year 4)
- Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate (Year 5 and 6)
- Using test results to make predictions to set up further comparative and fair tests (Year 5 and 6)

Ocean Literacy Principles

- #5 - The ocean supports a great diversity of life and ecosystems.
- #6 - The ocean and humans are inextricably interconnected.



Materials

Teacher training video

- Internet connection
- YouTube.com classroom account
- computer
- note paper
- pencil or pen

Experiment

- thermochromic pigment
- latex paint
- two small rocks
- paintbrush
- paint mixing dish
- two clear containers
- hot and cold water

Useful resources

- www.reefresearch.org/reefs-go-live
- www.projectaware.org
- www.doe.ky
- www.education.gov.ky/education/curriculum
- www.oceanservice.noaa.gov/kids/

Experiment Instructions

Coral Bleaching

1. Prior to this experiment, prep your coral/rock. In a small container, mix the thermochromic pigment and latex paint until a coloured paint has been formed. Paint your coral/rock with this paint and leave to dry for at least 24 hours.
2. Begin your class by introducing global warming and its causes to students. Explain that most of this excess heat is absorbed by the ocean, which results in increased ocean temperatures.
3. Explain the basic biology of a coral, and define the symbiotic relationship between corals and zooxanthellae. Highlight how corals receive 90% of their food from the photosynthetic zooxanthellae on average and that zooxanthellae provide corals with their colour.
4. Describe the process of coral bleaching and the environmental conditions that cause it, including increased ocean temperatures. Explain that corals can recover from coral bleaching if the stressful environmental condition is removed; however, sometimes corals can die as a result of bleaching events.
5. Fill two small containers with water, one with cold water and one with warm water (above 31°C/88°F). Place the prepared rock/coral in the cold water. Ask students to predict what will happen when the coral/rock is moved to the container filled with warm water. Will the coral remain the same colour or will the colour change?



6. Move the coral/rock to the container filled with warm water. The coral should turn white. Now ask students to predict what will happen when the coral/rock is moved back to the container filled with cold water. Will the colour remain the same or will the colour change? Move the coral/rock to the container filled with cold water; have students observe the coral/rock returning to its original colour.
7. Explain that this experiment mimics coral bleaching. When water temperatures are too high, zooxanthellae leave the coral, which is simulated by the coral/rock turning white when placed in the warm water. If conditions change back (water cooling down), the zooxanthellae may return to the coral, and the coral can survive. This is simulated when the coral/rock is placed back in the cool water and the colour returns.
8. Discuss how reducing carbon emissions can help to keep the water temperature from rising, which in turn reduces the chance that coral bleaching will occur. Have students list some ways they think people can reduce carbon emissions. Continue discussion by asking and teaching students about other environments that are changing, and what effects those changes have on the organisms that live there.

Experiment Glossary

Coral Bleaching

Carbon footprint - the amount of greenhouse gases, especially carbon dioxide, produced by an individual, event, organization, or product, that results from the burning of fossil fuels

Coral bleaching - process of corals appearing white, due to the loss of the algae living inside of them

Fossil fuel - a natural fuel such as coal or gas, formed from the remains of living organisms

Global warming - significant increase in the “normal” temperature of Earth over the last century

Greenhouse effect - the process that occurs when the gases in the earth’s atmosphere traps the sun’s heat around the earth

Greenhouse gas - a gas that absorbs heat from the sun and contributes to the greenhouse effect; e.g. carbon dioxide and methane

Hermatypic coral - stony coral, corals that help build the reef and become limestone over time

Mutualism - relationship between two species of organisms where both benefit

Symbiotic relationship - interaction between two organisms where at least one of the organisms benefit; however, the other may be harmed, be unaffected, or benefit as well

Zooxanthellae - symbiotic algae that live in the tissues of coral polyps (and several other marine animals) and provide the coral animals with 90% of their needed energy and nutrients



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Student Vocabulary Assessment Coral Bleaching

Below is a list of 10 vocabulary terms used during your Reefs Go Live Coral Bleaching experiment. Show the CCMI Educator that you understand coral bleaching and can match the definition on the right with the correct term on the left. Thanks for your help and good luck!

1. Carbon footprint: _____
 2. Coral bleaching: _____
 3. Fossil fuel: _____
 4. Global warming: _____
 5. Greenhouse effect: _____
 6. Greenhouse gas: _____
 7. Hermatypic coral: _____
 8. Mutualism: _____
 9. Symbiotic relationship: _____
 10. Zooxanthellae: _____
- a) A gas that absorbs heat from the sun and contributes to the greenhouse effect; e.g. carbon dioxide and methane
 - b) Stony coral, corals that help build the reef and become limestone over time
 - c) Significant increase in the “normal” temperature of Earth over the last century
 - d) the amount of greenhouse gases, especially carbon dioxide, produced by an individual, event, organization, or product, that results from the burning of fossil fuels
 - e) Relationship between two species of organisms where both benefit
 - f) process of corals appearing white, due to the loss of the algae living inside of them
 - g) A natural fuel such as coal or gas, formed from the remains of living organisms
 - h) Symbiotic algae that live in the tissues of coral polyps (and several other marine animals) and provide the coral animals with 90% of their needed energy and nutrients
 - i) The process that occurs when the gases in the earth’s atmosphere traps the sun’s heat around the earth
 - j) Interaction between two organisms where at least one of the organisms benefit; however, the other may be harmed, be unaffected, or benefit as well