Who Bleached My Coral?

Photosynthesis and Coral Reef Health

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Grade Level	6th – 8th Grade	**Time Frame**	160 minutes
Subject	Science	**Duration**	3-4 class periods

Essential Question

How do photosynthesis and the relationship between coral and their symbiotic algae explain coral bleaching?

Summary

This lesson examines the phenomenon of coral bleaching as a context for learning about photosynthesis. Students investigate photosynthesis' inputs and outputs using an online simulation activity and connect these elements to the relationship between coral and their symbiotic algae. Student will also gather information about environmental factors that disturb coral and photosynthesis in coral reefs. Then, they will write an evidence-based explanation for a bleaching event that occurred at the Flower Garden Banks National Marine Sanctuary.

Snapshot

Engage

Students look at pictures to compare healthy and bleached coral. Then, students discuss possible causes of such changes to the coral reef ecosystem.

Explore

Students investigate the inputs and outputs of photosynthesis through a simulation activity.

Explain

Students make connections between photosynthesis and coral survival and create a list of environmental factors that would disturb coral and/or photosynthesis.

Extend

Students research several causes of coral bleaching that also impact photosynthesis.

Evaluate

Students write an evidence-based explanation for a coral bleaching event in the Flower Garden Banks National Marine Sanctuary and complete a self-reflection on their learning.

Standards

Next Generation Science Standards (Grades 6, 7, 8)

MS-LS1-6: Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.

Oklahoma Academic Standards (7th Grade)

7.LS1.6 : Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.

Attachments

- Claim Evidence Reasoning—Who Bleached My Coral - Spanish.docx
- Claim Evidence Reasoning—Who Bleached My Coral - Spanish.pdf
- Claim Evidence Reasoning—Who Bleached My Coral.docx
- Claim Evidence Reasoning—Who Bleached My Coral.pdf
- Coral Bleaching Graphic Organizer—Who Bleached My Coral - Spanish.docx
- Coral Bleaching Graphic Organizer—Who Bleached My Coral - Spanish.pdf
- Coral Bleaching Graphic Organizer—Who Bleached My Coral.docx
- Coral Bleaching Graphic Organizer—Who Bleached My Coral.pdf
- Extend Station Cards—Who Bleached My Coral - Spanish.docx
- Extend Station Cards—Who Bleached My Coral - Spanish.pdf
- Extend Station Cards—Who Bleached My Coral.docx
- Extend Station Cards—Who Bleached My Coral.pdf
- Lesson Slides—Who Bleached My Coral.pptx
- The Mystery of the Texas Flower Gardens Bleaching—Who Bleached My Coral - Spanish.docx
- The Mystery of the Texas Flower Gardens Bleaching—Who Bleached My Coral - Spanish.pdf
- The Mystery of the Texas Flower Gardens Bleaching—Who Bleached My Coral.docx
- The Mystery of the Texas Flower Gardens Bleaching—Who Bleached My Coral.pdf

Materials

- Lesson Slides (attached)
- Coral Bleaching Station cards (attached; one set)
- Coral Bleaching Graphic Organizer handout (attached; one per student)
- Flower Gardens Bleaching handout (attached; one per student)
- Claim Evidence Reasoning (CER) handout (attached; one per student)
- Student devices with internet access
- Notebook paper
- Pen/pencil

Engage

Teacher's Note: Lesson Preparation

Prior to teaching the lesson, download the attached **Lesson Slides** and insert images of bleached coral onto **slide 4**. The "Coral Bleaching" article from the Flower Garden Banks Marine Sanctuary has many pictures of bleached coral. An image search online for "bleached coral reef" provides more examples, including a variety of before and after bleaching shots.

Use the attached **Lesson Slides** to guide the lesson. Begin the class by displaying **slide 3**. Show students the embedded BBC Earth's coral reef video. Don't be intimidated by the 10-hour video loop! Show only the first 3–5 minutes to give students an idea of what a healthy reef looks like.

Embedded video
https://youtube.com/watch?v=nMAzchVWTis

Before continuing the lesson, facilitate a brief discussion to help students orient their thinking to why having algae would help feed corals.

Guiding Questions

Some questions to help guide the discussion might include:

- How would algae help feed coral?
- How do plants and animals obtain food and energy?
- Who are the producers and consumers in a coral reef?

Depending on students' prior knowledge, the discussion may only result in students identifying that algae are producers, but they *should* be able to identify that plants use photosynthesis to make food.

Move through **slides 6–7** to review the essential question and lesson objective with students.

Explore

Move to **slide 8** and have students navigate to the Concord Consortium Leaf Photosynthesis Activity homepage. Guide students as they complete the activity.

The activity includes three simulations that illustrate the inputs and outputs of photosynthesis as they are processed in the chloroplasts of a leaf. Students can adjust sun brightness, amount of CO2, and water flow and observe how each adjustment changes the process. The analysis questions at the end of the activity focus on photosynthesis inputs and outputs and how people depend upon photosynthesis. There are also a few brief career-related questions at the end of the analysis that you may find valuable.

During the Leaf Photosynthesis Activity, circulate the room and provide feedback as students work. Consider using the answers in the activities as an additional formative assessment.

Teacher's Note: Concord Consortium

There are two ways for students to use this activity.

The preferred way is to create a Concord Consortium account and register your students individually or have them register themselves. Instructions for signing up and managing classes can be found on the downloadable user guide pdf on the site's Help Page. This method allows students to save their progress and return later, and for you to view their responses on the site.

The second option is to use the simulation without registration. This option will require students to finish the activity in one sitting as it does not save progress. If you choose this option, replace the link on **slide 8** to send students directly to the simulation page (link: https://authoring.concord.org/activities/1008). Students can use the buttons at the top of the screen to "Print" the page directly (to a printer or pdf) or create a summary of their responses by clicking the "Report". The report is a condensed version of student responses without any graphics, but they will still need to screenshot or print that page. For this option, it is recommended that you review the site features ahead of time so you can provide students with clear directions.

Explain

Have students take notes as you review the results of the simulation with students. This will be most effective if students draw a model or diagram that illustrates photosynthesis inputs and outputs as the class discusses the simulation. Be sure to illustrate this on the board or somewhere else visible to students.

Teacher's Note

Middle school students only need to know what the inputs and outputs of photosynthesis are, and that it takes place within chloroplasts. If students are already familiar with chemical equations, you can give them the photosynthesis equation *after* they have discussed the inputs and outputs. However, this is optional as **middle school students do not need to memorize the equation** or go into further cellular-level details.

Using the I Think / We Think strategy, develop a list of environmental conditions that might (1) stress coral enough to evict their algae, and (2) affect photosynthesis, either negatively or positively. Have students draw a t-chart on a piece of notebook paper and label the columns with “I Think” and “We Think”.

Display **slide 9** and have students record their own ideas in the "I Think" column. After students record their thoughts, ask for some volunteers to share their ideas. As the volunteers share their ideas, have the other students fill in the “We Think” column with ideas they didn’t think of themselves. To scaffold this, consider having students think through each question individually rather than all at the same time.

Extend

Teacher's Note: Chat Station Cards

Prior to teaching the lesson, print the attached **Coral Bleaching Station Cards** and place them at stations around the room. There are one to two cards for students to read at each of the five stations. The cards have a recommended card arrangement for each station, but these can be adjusted based on time and the number of students in your class. To reduce group sizes, make extra copies and have students divide into pairs or trios at each station. Alternatively, set up duplicate stations to reduce the number of students at each station.

The station cards could also be used with other strategies that allow students to collaborate with one another (e.g., Jigsaw and Three Stray, One Stay).

Among other threats to coral, students will focus on a few that have direct impacts on both photosynthesis and coral survival (such as changes in light, heat stress, and oxygen depletion).

Move to **slide 10** and pass the attached **Coral Bleaching Graphic Organizer** to each student. Using the Chat Stations strategy, number students into groups of two to four. Point out the posted chat stations around the room and tell students to visit each station as a group. At each station, they should discuss the material provided on the cards to determine the most important idea(s) for how the conditions lead to coral bleaching or affect photosynthesis. They should record this information in their graphic organizer.

Evaluate

Have students return to their seats. Pass out the attached **Flower Gardens Bleaching** handout and the attached **CER** handout to each student. Display **slide 11** and provide time for students to read the Flower Gardens Bleaching handout. Then, have students use the Claim, Evidence, and Reasoning (CER) strategy by writing a claim, evidence, and reasoning to the question on the slide: "What caused the bleaching of Flower Gardens Banks National Marine Sanctuary?" In their response, students should include evidence from the photosynthesis activity, class notes, and/or chat station notes. The CER handout guides students as they write their claim, evidence, and reasoning items.

Teacher's Note: Claim, Evidence, Reasoning Scaffolding

If students are not familiar with CER or need a refresher, show the Claim, Evidence, and Reasoning video which explains how to write a CER.

Embedded video

https://youtube.com/watch?v=JGOxVIgmGWE

Display **slide 12** and conclude the lesson by having students reflect on what they have learned using the 3-2-1 strategy. Ask students to write their reflections on the back of their CER handouts. Collect students' CER handouts and review both their CER and 3-2-1 responses to assess student understanding of the lesson content.

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Resources

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