



Science Assessment System Through Course Task

Coral Bleaching

Grade Level:

9, 10, 11, 12

Phenomena:

Coral Bleaching

Science & Engineering Practices:

Analyzing and interpreting Data
Engaging in Argument from Evidence

Crosscutting Concepts:

Cause and Effect

Designed and revised by Kentucky Department of Education staff
in collaboration with teachers from Kentucky schools and districts.



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Preparing to implement Through Course Tasks in the Classroom

What is a TCT?

- TCTs are 3-dimensional tasks specifically designed to get evidence of student competency in two dimensions, Science and Engineering Processes (SEPs) and Crosscutting Concepts (CCC), untethered from Performance Expectations (PEs)/standards. Tasks are sense-making experiences.
- Tasks are to be used formatively. The goal is for both students and teachers to understand areas of strength and improvement for the SEP(s) and CCC assessed within the task.

How do I facilitate a Through Course Task (TCT)?

- TCT facilitation is a collaborative process in which teacher teams calibrate understanding of the expectations of the task and refine strategies to be used during task facilitation.

Before the task:

1. Complete the TCT as a learner – compare understanding of task through the lens of success criteria (identified in the task) in order to understand expectations.
Success criteria include:
 - What is this task designed to get evidence of?
 - What is the task asking the students to do?
 - What might a student response look like?
2. Identify the phenomenon within the task. Consult resources to assure teacher teams have a deep understanding of associated science concepts.
3. Collaborate to generate, review and refine feedback questions during facilitation.
4. Identify potential “trouble spots” and plan for possible misconceptions.

During the task:

5. Collect defensible evidence of each student’s competencies in 3-dimensional sense-making for the task.
6. Ask appropriate feedback questions to support student access and engagement with the task in order to elicit accurate evidence of student capacities.

After the task:

7. Reflect on the task as a collaborative team.
8. Review student work samples to identify areas of strength and areas of need.
9. Determine/plan next steps to move 3-D sense making forward through the strengthening of the use of SEPs and CCCs.

Using the materials included in this packet:

- **Task Annotation:**
 - The task annotation is a teacher guide for using the task in the classroom. Additionally, the annotation gives insight into the thinking of developers and the task overall.

- Each task has science and engineering practices, disciplinary core ideas, and crosscutting concepts designated with both color and text style:
 - **Science and Engineering Practices**
 - *Disciplinary Core Ideas*
 - Crosscutting Concepts
- **Student Task:** The materials to be used by students to complete the TCT.

Coral Bleaching Task Annotation

After **analyzing and interpreting data** about *the coral bleaching and factors that may affect coral bleaching*, **develop an argument for which of two opposing arguments most accurately reflects the cause for the coral bleaching for the data provided.**

Overall intent

The overall intention of this task was to evaluate students' ability to engage in argument from evidence about the cause of coral bleaching based on the evidence given and their background knowledge. The intended grade level for this task is 9th or 10th grade Earth Science or Life Science.

Phenomenon within the task

Coral bleaching is a phenomenon affecting coral reefs by which they lose their natural color as a result of high water temperatures or other environmental stressors such as pollutants. A common issue where students may struggle is that they do not know what the term 'bleaching' means. They may relate it to a cleaning product (bleach).

Ideas for setting up the task with students

Share ideas for setting up a positive learning climate in order to get best evidence of what the task is designed to measure. Because the task is designed to get evidence of a student's ability to critique scientific arguments, it is important that students have had experience with the practice of argumentation. In addition, you may want to allow students' access to a standard Webster's dictionary as well as a Claim-Evidence-Reasoning template. The task provides two different student response formats.

Students would benefit by doing a lab on modeling ocean acidification prior to the completing the Coral Bleaching TCT. Students would also benefit by viewing a video on coral reef ecosystems. Teacher could also facilitate a class to identify strong (descriptive) evidence versus weak (general) evidence. The teacher could facilitate a class to provide students an opportunity to practice expressing reasoning skills using data and evidence to support a claim.

Intent of the Task for Assessment

The intent of this task is to provide evidence of a student's ability to engage in argument from evidence while evaluating the possible cause of coral bleaching based on the data provided. In the task, students will evaluate two competing arguments from a fictional debate in a high school level course. Both students use data provided to support their claim, but one student supports the evidence with more accurate reasoning.

Students will use background knowledge, as well as skills, to complete this task. Students must compare two seemingly reasonable arguments and deduce which student is supported by the evidence given. Students have to accurately weigh background knowledge with new data presented in this task.

Success Criteria

Evidence of Learning Desired based on Progression from Appendices

Analyze & Interpret Data

- Analyze data in order to make valid and reliable scientific claims.

Argumentation

- Compare and evaluate competing arguments in light of currently accepted explanations, new evidence, limitations, constraints and ethical issues. (Appendix F)
- Construct a written argument or counter-arguments based on data and evidence. (Appendix F)

Cause and Effect

- Changes in systems may have various causes that may not have equal effects. (Appendix G)

Success Criteria

1. A claim that states one of the two students is the most supported debater.
2. Students must explicitly reference multiple sources of evidence within the data that support the student's argument.
3. Students must supply sound reasoning about why they chose that student. It should include any of the following reasons:
 - The student had more evidence in the given data to support her claim.
 - The student had more concrete mathematical/quantitative evidence to support her claim.

- The student had the most support from background information.
- Student reasoning demonstrates understanding of cause and effect relationships

Possible Student Responses

“Nicola is the most correct based on the evidence. According to the data, pollution can be the cause of coral bleaching. In addition, the data states that human activities are the majority of the pollution in the Florida Keys. There is no given data to suggest that water temperatures in the Florida Keys are rising. Nicola has more evidence to support her claim than Ramon. She does not base her argument solely on background knowledge but backs it up with mathematical evidence. “

“Ramon is the most correct based on the evidence. According to the data, coral bleaching can be caused by the rise and fall of water temperatures. According to the graph, the live coral have been reduced by ~ 50% in 35 years. In addition, the pollution from runoff, oil spills, etc. has been detected as a factor that contributes to global warming. Global warming is caused by the greenhouse effect where outgoing heat is re-emitted warming the planet including the ocean temperatures. Ramon is most correct because his claim is based in the data and current scientific research. “

Through Course Task – Coral Bleaching

CORAL BLEACHING

HEALTHY

Coral and algae depend on each other to survive

STRESSED

If stressed, algae leaves the coral

BLEACHED

Coral is left bleached and vulnerable



Increased greenhouse gases from human activities result in increased global temperatures, climate change and ocean acidification. Contributing factors that increase greenhouse gases in the atmosphere include burning fossil fuels for heat and energy, producing some industrial products, raising livestock, fertilizing crops, and deforestation.

WHAT CAUSES CORAL BLEACHING?

Changes in ocean temperature: increased ocean temperature caused by climate change is the leading cause of coral bleaching

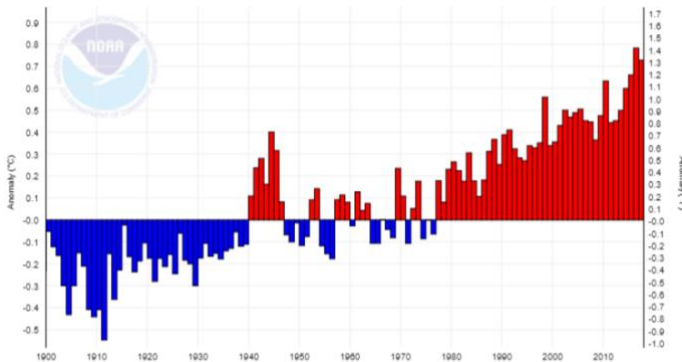
Runoff and pollution: Storm generated precipitation can rapidly dilute ocean water and runoff can carry pollutants, bleaching near-shore corals

Overexposure to sunlight: When temperatures are high, high solar irradiance contributes to bleaching in shallow-water corals

Extreme low tides: Exposure to the air during extreme low tides can cause bleaching in shallow corals

—National Oceanic and Atmospheric Association (NOAA)

OCEAN TEMPERATURE ANOMALIES



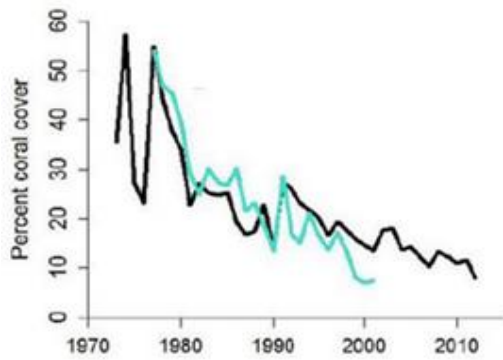
CARBON EMISSIONS FROM FOSSIL FUELS



Source: Boden, T.A., Marland, G., and Andres, R.J. (2017). Global, Regional, and National Fossil-Fuel CO₂ Emissions. Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A. doi 10.3334 <https://www.epa.gov/ghgemissions/global-greenhouse-gas-emissions-data>

DECLINE OF CARIBBEAN REEF SURFACE

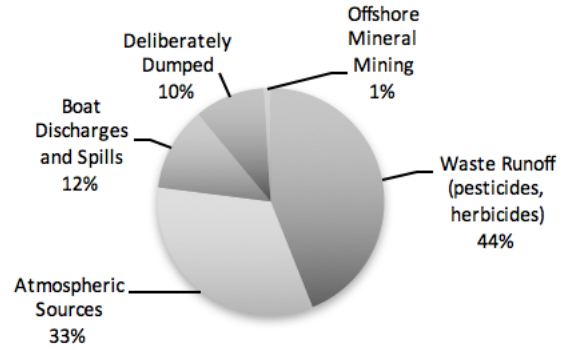
COVERED BY LIVE CORAL



[Source: Status and Trends of Caribbean Coral Reefs: 1970-2012. Report prepared for the 21st Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change, Paris, December 2015]

SOURCES OF MARINE POLLUTION

Source: Joint Group of Experts on Scientific Aspects of Marine Environmental Protection (GESAMP)



WHY SHOULD WE CARE ABOUT CORAL BLEACHING? Hidden beneath the ocean waters, coral reefs teem with life. Coral reefs support more species than any other marine environment and rival rainforests in their biodiversity. Countless numbers of creatures rely on coral reefs for their survival. These important habitats are threatened by a range of human activities. However, we can still protect and preserve our remaining reefs if we act now. – *National Oceanic and Atmospheric Administration (NOAA)*

WHICH STUDENT IS RIGHT?

Clarence and Alexis debated the issue of coral bleaching after viewing the given data. Evaluate their arguments and **explain which student is right**.

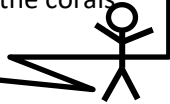
- ✓ Construct a **claim** about which student is most correct based on the evidence given
- ✓ Use data as **evidence** to support your claim
- ✓ Explain your **reasoning** on why/how that student is correct

Humans are the main cause of coral bleaching, but it is not too late to preserve the reefs that remain. The data shows that as carbon emissions from fossil fuels increase, ocean temperatures increase. The NOAA stated that "Increased ocean temperature caused by climate change is the leading cause of coral bleaching." Humans burn fossil fuels for energy, which causes global warming and climate change. Reducing our fossil fuel use may prevent future coral bleaching events. Additionally, pollution bleaches corals near the coasts. Reducing pollution would save future corals from bleaching. Our actions today could save coral reefs and the species that depend on them.



CLARENCE

Humans are not causing coral bleaching, and there is nothing we can do to protect coral reefs. The NOAA said that the main cause of coral bleaching is increased global temperatures. The data shows an overall trend of rising temperatures. Carbon emissions are increasing, but the data shows that only 33% of pollution is from the atmosphere. Humans burn fossil fuels, but this is not what is causing coral bleaching. We can stop burning fossil fuels to decrease global warming, but we can't control the temperatures of the water. The NOAA says that "Countless numbers of creatures rely on coral reefs for their survival." Sadly, we cannot do anything to save the corals.



ALEXIS

CLAIM Write a statement that responds to the question	EVIDENCE Use scientific data to support your claim. Your evidence should be relevant and sufficient (enough to convince someone that your claim is correct)	REASONING Use scientific principles and knowledge to explain why your evidence (data) supports your claim

