

The Effect of Algal Blooms on Marine Ecosystems

★ TASK ★ LADDER

by Mark C. Weese

https://s.ldc.org/u/2wv64kp482if9rsxgt8tf55lk

The goal of this module is for students to learn about the importance of population balance in marine ecosystems and how human activities (specifically fertilizer run-off from nearby farmlands into the Mississippi River) can impact energy webs by changing predator/prey relationships. A lab activity is included in this module during the Reading/Data Collection Process, enabling students to supplement the data collected from reading with their own lab results. Students are required to use scientific articles to research the cause and effect of algal blooms off the coast of the U.S. and write a letter to the Environmental Protection Agency to inform them of the problem as well as suggest possible solutions. I highly recommend having students complete the Dead in The Water lab to provide evidence in the classroom of the effects fertilizer has on pond ecosystems. Students should use their observations when constructing a strong letter to the EPA. This lab is provided in my resources. After sending in letters to the EPA, we did receive a letter in response from the agency. This letter can be found under my resources. This module was created by Mark Weese, a Life Science teacher from Effingham County. mweese@effingham.k12.ga.us This module can be adapted to emphasize any of the Life Science Georgia Performance Standards, and I was able to include concepts taken from each of the five Life Science standards. You can use the articles that I used in my module or find articles that work better for your discipline and regional concerns. I have uploaded additional articles (see digital articles) that include lexile levels for each resource.

GRADESDISCIPLINECOURSEPACING7**A** Science**B** Life
Science**O** N/A

This work is licensed under a Creative Commons-Attribution-NonCommercial-ShareAlike 4.0 International Public License (CC BY-NC-SA 4.0 Int).

Section 1: What Task?

Teaching Task

Task Template 25 - Informational or Explanatory

What effect do algal blooms have on marine environments off the coast of the UnitedStates? After reading scientific texts on fertilizer run-off and algal blooms, write a letter to the Environmental Protection Agency in which you examine the cause(s) of (he causes of algal blooms and explain the effect(s) fertilizer run-off has on the population of algae in marine ecosystems. Support your discussion with evidence from the text(s).

Standards

Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

CCR.R.1

Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.

CCR.R.2

Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.

CCR.R.4

Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.

CCR.R.6

Assess how point of view or purpose shapes the content and style of a text.

CCR.R.10

Read and comprehend complex literary and informational texts independently and proficiently.

CCR.W.2

Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

CCR.W.4

Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

CCR.W.5

Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.

CCR.W.9

Draw evidence from literary or informational texts to support analysis, reflection, and research.

CCR.W.10

Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

WHST.6-8.2

Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.

WHST.6-8.9

Draw evidence from informational texts to support analysis, reflection, and research.

Georgia Science Performance Standards

S7L4.c

Recognize that changes in environmental conditions can affect the survival of both individuals and entire species.

S7L4.b

Explain in a food web that sunlight is the source of energy and that this energy moves from organism to organism.

S7L4.d

Categorize relationships between organisms that are competitive or mutually beneficial.

S7L4.e

Describe the characteristics of Earth's major terrestrial biomes (i.e. tropical rain forest, savannah, temperate, desert, taiga, tundra, and mountain) and aquatic communities (i.e. freshwater, estuaries, and marine).

S7L4.a

Demonstrate in a food web that matter is transferred from one organism to another and can recycle between organisms and their environments.

Texts

DEAD IN THE WATER

Weir, Kirsten. Current Science, 3/4/2005, Vol. 90 Issue 12, p10-11, 2p

Red Tide's Weather Trail Cutlip, Kimbra. Weatherwise, Nov/Dec2001, Vol. 54 Issue 6, p10, 2p.

% "The Gulf of Mexico Dead Zone and Red Tides" by Elizabeth Carlisle

Focus

Focus

Student Work Rubric - Informational or Explanatory Task - Grades 6-8

	Emerging	Approaches Expectations	Meets Expectations	Advanced
	1	2	3	4
Controlling Idea	Presents an unclear or unfocused controlling idea.	Presents a general controlling idea that addresses the prompt , with an uneven focus .	Presents and maintains a clear controlling idea that addresses all aspects of the prompt.	Presents and maintains a clear and specific controlling idea that addresses all aspects of the prompt and takes into account the complexity of the topic .
Selection & Citation of Evidence	Includes minimal details from sources. Sources are used without citation.	Includes details, examples, and/or quotations from sources that arerelevant to the controlling idea. Inconsistently cites sources.	Includes details, examples, and/or quotations from sources that are relevant to the controlling and supporting ideas . Consistently cites sources with minor formatting errors .	Includes well-chosen details, examples, and/or quotations from sources that support the controlling and supporting ideas. Consistently cites sources using appropriate format.
Development / Explanation of Sources	Explanation of ideas and source material is irrelevant, incomplete, or inaccurate.	Explanation of ideas and source material is minimal or contains minor errors .	Accurately explains ideas and source material and how they support the controlling idea.	Thoroughly and accurately explains ideas and source material, using reasoning to support and develop the controlling idea.
Organization	Lacks an evident structure. Makes unclear connections among ideas, concepts, and information.	Groups ideas and uses some transitions to connect ideas, with some lapses in coherence or organization.	Groups and sequences ideas to develop the controlling idea. Uses transitions to clarify the relationships among ideas, concepts, and information.	Groups and sequences ideas logically to develop the controlling idea and create cohesion. Uses varied transitions to clarify the relationships among ideas, concepts, and information.
Conventions	Major errors in standard English conventions interfere with the clarity of the writing. Language or tone is inappropriate.	Errors in standard English conventions sometimes interfere with the clarity of the writing. Uses language and tone that are sometimes inappropriate to the audience and purpose.	Consistently applies standard English conventions; minor errors, while noticeable, do not interfere with the clarity of the writing. Uses language and tone appropriate to the audience and purpose.	Consistently applies standard English conventions, with few errors. Demonstrates varied syntax and precise word choice. Consistently uses language and tone appropriate to the audience and purpose.
Content Understanding (Generic)	Attempts to include disciplinary content in explanation or argument but understanding of content is weak; content is irrelevant, inappropriate, or inaccurate.	Briefly notes disciplinary content relevant to the prompt; shows basic or uneven understanding of content; minor errors in explanation.	Accurately presents disciplinary content relevant to the prompt with sufficient explanations that demonstrate understanding.	Integrates relevant and accurate disciplinary content with thorough explanations that demonstrate in-depth understanding.

Background for Students

The Environmental Protection Agency is composed of ecologist that engage in decision making at various levels of government. They work with federal agencies to create environmental laws that ensure preserving, utilizing, and sustaining the American ecosystems. This organization works to communicate with the public, the importance of maintaining balanced ecosystems. Write a letter that addresses how the agricultural industries are contributing to the occurrance of algal blooms off the coast of the United States and the effect it has had on marine life. In your disscussion, include several ideas that may resolve efforts for a ecological balance. In efforts to have a larger voice, informing this organization of the problem will help in efforts to address the situation as well as expedite a solution.

Extension

Dead in the Water Lab: This lab simulates the creation of a dead zone similar to the one in the Gulf of Mexico due to huge expanses of algal growth.

Section 2: What Skills?

Preparing for the Task

BRIDGING CONVERSATION > **TASK ENGAGEMENT**: Ability to connect the task and new content to existing knowledge, skills, experiences, interests, and concerns.

TASK AND RUBRIC ANALYSIS > TASK ANALYSIS: Ability to understand and explain the task's prompt and rubric.

Reading Process

NOTE TAKING: Ability to read purposefully and select relevant information; to summarize and/or paraphrase. Ability to select important facts and passages for use in one's own writing.

ESSENTIAL VOCABULARY: Ability to apply strategies for developing an understanding of text(s) by locating words and phrases that identify key concepts and facts, or information.

MAKING INFERENCES: Ability to make observations and relate these observations to key concepts and essential vocabulary learned.

SCIENTIFIC INQUIRY: Ability to use scientific concepts and apply them to develop or simulate experimental designs.

ACTIVE READING: Ability to identify the central point and main supporting elements of a text.

Transition to Writing

BRIDGING CONVERSATION > PREPARING FOR WRITING: Ability to begin linking reading results to writing task.

ACADEMIC INTEGRITY: Ability to use and credit sources appropriately.

Writing Process

INITIATION OF TASK > **ESTABLISHING THE CONTROLLING IDEA**: Ability to establish a claim and consolidate information relevant to task.

PLANNING > PLANNING THE WRITING: Ability to develop a line of thought and text structure appropriate to an argumentation task.

DEVELOPMENT: Ability to construct an initial draft with an emerging line of thought and structure.

REVISION: Ability to refine text, including line of thought, language usage, and tone as appropriate to audience and purpose.

EDITING: Ability to proofread and format a piece to make it more effective

COMPLETION: Ability to submit final piece that meets expectations

Section 3: What Instruction?

PACING	SKILL AND DEFINITION	PRODUCT AND PROMPT	SCORING GUIDE	INSTRUCTIONAL STRATEGIES	
Preparing for the Task					
15 mins	BRIDGING CONVERSATION > TASK ENGAGEMENT: Ability to connect the task and new content to existing knowledge, skills, experiences, interests, and concerns.	SHORT CONSTRUCTED RESPONSE In a quick write, write your first reaction to the task prompt. Add some notes of things you know about balanced ecosystems as well as how this consideration of the topic might require more information than what you already have. • Link this task to earlier class content. • Discuss student responses. • Clarify timetable and support plans for the task	None	• Link this task to earlier class content. • Discuss student responses. • Clarify timetable and support plans for the task	
20 mins	TASK AND RUBRIC ANALYSIS > TASK ANALYSIS: Ability to understand and explain the task's prompt and rubric.	SHORT CONSTRUCTED RESPONSE In your own words, what are the important features of a good response to this prompt? Discuss why this task is important to us and how it relates to people in our region (local and national). Share examples of types of text students will produce (use student samples or samples from professional writers). Discuss the importance of writing letters to public figures and ways to get information out to the general public.	None	Discuss why this task is important to us and how it relates to people in our region (local and national). Share examples of types of text students will produce (use student samples or samples from professional writers). Discuss the importance of writing letters to public figures and ways to get information out to the general public.	
Reading Process					
40 mins	NOTE TAKING : Ability to read purposefully and select relevant information; to summarize and/or paraphrase. Ability to select important facts and passages for use in one's own writing.	NOTES During the presentation, list key essential concepts that define the Protist Kingdom and differentiates this kingdom from other kingdoms of organisms.	Work meets expectations if the student participates in discussion and provides credible responses to verbal questioning.	• Present characteristics of the Protist Kingdom and how they are classified scientifically (see PowerPoint in resources below). • Compare and contrast these characteristics to the Prokaryotic Kingdoms. • Share the important roles of algae and relate their usefulness and place in our lives.	
20 mins	ESSENTIAL	LIST	Work meets	Discuss essential vocabulary such as photosynthesis,	

The Effect of Algal Blooms on Marine Ecosystems

	VOCABULARY: Ability to apply strategies for developing an understanding of text(s) by locating words and phrases that identify key concepts and facts, or information. Additional Attachments:	In your notebook, list words and phrases essential to the texts. Add definitions, and (if appropriate) notes on connotation in this context.	expectations if student • Lists appropriate phrases. • Provides accurate definitions.	chloroplast, algae, and algal blooms	
	 Science Cell Structure and Protists The Protist Kingdom.ppt Life Science Cell Structure and Protists Protists Notes Fill In.doc 				
30 mins	ESSENTIAL VOCABULARY: Ability to apply strategies for developing an understanding of text(s) by locating words and phrases that identify key concepts and facts, or information.	OUTLINE: CONCEPT MAP Represent the relationship between photosynthesis and cellular respiration by designing a diagram of the chloroplast and the mitochondria; include products and reactants of each cellular process.	Work meets expectations if student • Designs an appropriate model that represents how the two processes work together to present a cycle within the eukaryotic plant cell.	• Present the concepts of photosynthesis and cellular respiration and how these two organelles work together to provide energy for producers such as algae. • Discuss reactants, products of each process, and how each depends on one another. • Relate these processes to what is occurring in pond water algae.	
	Additional Attachments:				
	% E:Life ScienceFungiCellular Energy Activity Diagram.doc				
1 hr	MAKING INFERENCES: Ability to make observations and relate these observations to key concepts and essential vocabulary learned.	SHORT CONSTRUCTED RESPONSE How are protists classified? What characteristics define this kingdom of organisms? Draw and describe several of the organisms that you found in the pond water. Using the dichotomous key, try to identify the organisms you observed.	Work meets expectations if student records appropriate observations using appropriate descriptive terms that relate to key concepts.	Pass out and explain "Life in a Drop of Water" pond water lab: Using microscopes, students observe life in pond water. Students identify key characteristics learned in previous lessons and record observations. Using identification key or dichotomous key, students identify protists found in the water.	
	Additional Attachments:				
	% Dead in The Water Task Dead in the Water Prelab.doc				
1 hr and 30 mins	SCIENTIFIC INQUIRY: Ability to use scientific concepts and apply them to develop or simulate experimental designs.	SHORT CONSTRUCTED RESPONSE Scientific Method: Design a controlled experiment that answers the problem, "How does fertilizer run-off impact pond water ecosystems?" Come up with a hypothesis that	Work meets expectations if: • Lab sheets, data analysis, observations, and data recording reflect the experimental procedure was	Teaching Strategies: • Provide students with the Dead in the Water Lab sheets and discuss procedures and pre-lab research questions. • Set up classroom simulation of the dead zone occurring in the Gulf of Mexico by setting up a controlled experiment including three containers of pond water with different amounts of fertilizer added. (See Dead in the Water Lab in resources below). • Additional fertilizer will be added weekly to two groups as noted in lab instructions. (See	

		answers this scientific problem (See Dead in the Water Lab in resources below).	accurately carried out and recorded.	Dead in the Water Lab in resources) • Make initial readings of turbidity, dissolved oxygen, and PH levels. Continue measuring and recording data on these features weekly to observe changes. Notes: This is a description of the experiment my students designed in response to the prompt. Any feasible and practical experiment students recommend could be used for this part of the module. This took 2 days.	
	Additional Attachments: So Dead in The Water Task Cause and Effect				
40 mins	ACTIVE READING: Ability to identify the central point and main supporting elements of a text.	SHORT CONSTRUCTED RESPONSE Research Questions to guide reading: How does fertilizer get into the Mississippi River? What is the active ingredient in the fertilizer? How does fertilizer run-off promote a "dead zone" in the Gulf of Mexico"? How have algal blooms impacted marine life in the Gulf of Mexico? How do scientists hope to decrease the size of the "dead zone"?	Work meets expectations if student: • Appropriately explains how algal blooms have formed in the Gulf of Mexico and affected marine life. • Answers questions with credible response.	• Provide Kirsten Weir's, "Dead in the Water" article and discuss the value of the content as it relates to the everyday life of citizens in the United States. • Discuss the causes and effects of algal blooms and how they affect marine ecosystems. • Ask students to describe the process of algal bloom formations and the role bacteria play in the production of "hypoxic waters"; using student descriptions, draw a representation of the process on the board.	
	Additional Attachments: % E:Life ScienceCell Structure and ProtistsDead in the Water Guided reading.doc				
40 mins	ACTIVE READING: Ability to identify the central point and main supporting elements of a text.	SHORT CONSTRUCTED RESPONSE Guided Reading: Nitrogen and phosphorous create favorable conditions for which organisms? What are the toxins produced by these algae? What specific health problems occur from these toxins? Explain how these toxins affect organisms found higher in the food chain?	Work meets expectations if: • Answers questions with credible response.	• Provide students with the excerpt from Elizabeth Carlisle's The Gulf of Mexico Module3573.pdf Page 13 of 28Pacing: 2 days Pacing: 40 minutes Dead Zone and Red Tides. • Discuss the cause of red tides and how this relates to typical algal blooms. • Discuss the effects red tides have on marine life, human health, tourism, fishing industries, and economical decline.	
40 mins	ACTIVE READING: Ability to identify the central point and main supporting elements of a text.	SHORT CONSTRUCTED RESPONSE SHORT CONSTRUCTED RESPONSE Research Questions to guide reading: • What is being carried in dust clouds across the Atlantic Ocean from Africa, causing an increase in bacteria in	Work meets expectations if: • Answers questions with credible responses and evidence from text.	• Provide Students with Kimbra Cutlip's "Red Tide's Weather Trail." • Discuss favorable conditions for the formation of Red Tides. • Discuss the effects of red tides on marine life, human health, tourism, fishing industries, and local economies.	

		surface water? • What is the name of the bacteria causing algal blooms? • Explain how these bacteria increase the amount of algae in the water. • What is the impact of red tides on the region's economy? Cite evidence. • How can red tides be predicted?				
	Additional Attachments:	ater TaskArticlesAn exert fr	om Carlisle's Red Tid	de with questions.doc		
Transitio	on to Writing					
50 mins	BRIDGING CONVERSATION > PREPARING FOR WRITING: Ability to begin linking reading results to writing task.	OUTLINE Cause and Effect Concept Map To organize the information from your experiment and from your reading, design a cause and effect map using the following main ideas: •Farm Lands and fertilizer use •Mississippi River traveling into the Gulf of Mexico •Formation of Algal Blooms •Red Tides •Disruptive Ecosystem •Economic Decline	Work meets expectations if: • Check concept maps and provide appropriate feedback.	Teaching Strategies: • Using the article read in class, students should be prompted to organize their ideas on the causes and effects associated with algal blooms and red tides. (See Cause Module3573.pdf Page 15 of 28Pacing: 25 minutes Pacing: 20 minutes and Effect in resources) • Discuss that designing concept maps is an essential step in the pre-writing process.		
	Additional Attachments: % Dead in The Water Ta	askCause and Effect.doc				
20 mins	ACADEMIC INTEGRITY: Ability to use and credit sources appropriately.	LIST CITATIONS Practice ways to include citations in a paper to support ideas and properly provide credit to authors.	Work meets expectations if: Work meets expectations if citations are appropriately included on the concept map	• After students complete the Cause and Effect concept map, have students list quotes from the readings that support the ideas they listed. • Have students practice various ways to properly incorporate these quotes and evidence into their paper using correct methods of crediting the author.		
Writing	Iriting Process					
50 mins	INITIATION OF TASK > ESTABLISHING THE CONTROLLING IDEA: Ability to establish a claim and consolidate information relevant to task.	SHORT CONSTRUCTED RESPONSE Write an opening paragraph that includes a controlling idea and sequences the key points you plan to make in your composition. • Students can be prompted to write the opening paragraph of	Work meets expectations if: • Writes a concise summary statement or draft opening. • Provides direct answer to main prompt requirements. • Establishes a	• Students can be prompted to write the opening paragraph of their letter with the following questions: -"Whom are they addressing in their letter?" -"Why is this an important issue?" -"What makes the information they will discuss credible?"		

		their letter with the following questions: -"Whom are they addressing in their letter?" -"Why is this an important issue?" -"What makes the information they will discuss credible?"	controlling idea. • Identifies key points that support development of argument.	
	Additional Attachments:	ask Informative Letter Prom	pt.doc	
50 mins	PLANNING > PLANNING THE WRITING: Ability to develop a line of thought and text structure appropriate to an argumentation task.	OUTLINE Create an outline based on your notes and reading in which you state your claim, sequence your points, and note your supporting evidence.	Work meets expectations if: • Creates an outline or organizer. • Supports controlling idea. Uses evidence from texts read and experiment conducted.	• Have students come up with their own outline for their letter using a sequencing map that includes major concepts they plan to discuss in each paragraph such as: - Define algae and explain their important ecological niche How algal blooms develop - How fertilizer enhances growth of algae - The ecological effects of algal blooms - The economical effects of algal blooms - Evidence from their experiments that supports the effects algal blooms have on marine life.(Students will have completed all data collection from "Dead in the Water Lab" and formed a conclusion from evidence.) - Brainstorm and discuss possible solutions to decrease the effects of algal blooms. Struggling students may need a sequencing map such as the one above that is already completed for them. Students should refer to the cause-and-effect concept map for quotations and details to incorporate into the outline.
	Additional Attachments:			
	% F:LDCDead in The W % Letter from the EPA.	/ater TaskMap out Your Lett pdf	er.doc	
1 hr	DEVELOPMENT: Ability to construct an initial draft with an emerging line of thought and structure.	LONG CONSTRUCTED RESPONSE LONG CONSTRUCTED RESPONSE Using your sequencing outline, write an initial draft complete with opening (already written), development, and closing; insert and cite textual evidence from your cause and effect map.	Work meets expectations if: • Provides complete draft with all parts. • Supports the opening in the later sections with evidence and citations.	Teaching Strategies: their letter to make sure they are supporting the main ideas of the letter. • Have students use their sequencing maps as well as the cause and effect maps to organize and develop their letters. • Encourage students to use appropriate transition words to link ideas
1 hr	REVISION: Ability to refine text, including line of thought, language usage, and tone as appropriate to audience and purpose.	LONG CONSTRUCTED RESPONSE Refine composition's analysis, logic, and organization of ideas/points. Use textual evidence carefully, with accurate citations. Decide what to include and what not to include.	Work meets expectations if: • Provides complete draft with all parts. • Supports the opening in the later sections with evidence and citations. • Improves earlier edition.	• Provide useful feedback that balances support for strengths and clarity about weaknesses. • Provide students with a checklist of components (claim, evidence, warrant) that will strengthen their paper, and have the students highlight these features in their paper in order to prove they have incorporated them in their writing.

50 mins	EDITING: Ability to proofread and format a piece to make it more effective	LONG CONSTRUCTED RESPONSE Revise draft to have sound spelling, capitalization, punctuation and grammar. Adjust formatting as needed to provide clear, appealing text.	Work meets expectations if: • Provides draft free from distracting surface errors. • Uses format that supports purpose.	• Teach a short list of proofreading marks. • Assign students to proofread each other's letters and add feedback.
Not provided	COMPLETION : Ability to submit final piece that meets expectations	LONG CONSTRUCTED RESPONSE Turn in your complete set of drafts, plus the final version of your piece.	Work meets expectations if: • Fits the "Meets Expectations" category in the rubric for the teaching task.	Teacher and peers provide meaningful feedback.

Instructional Resources

No resources specified

Section 4: What Results?

Student Work Samples

Advanced

% Advanced 1

% Advanced 2

Approaches Expectations

% Approaches 1

% Approaches 2

Teacher Reflection

Not provided