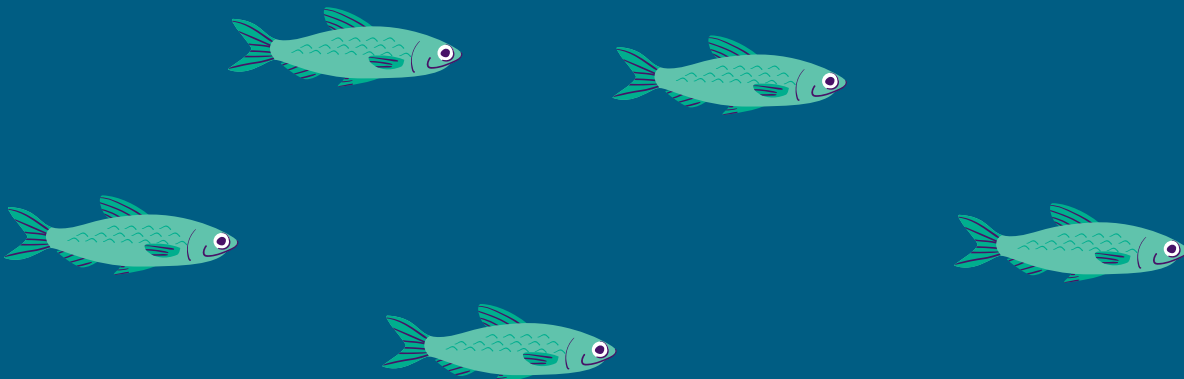




District of Columbia
Office of the State Superintendent of Education

CONTAMINATION OF FISH IN THE ANACOSTIA RIVER

High School Environmental Science
Instructional Sequence

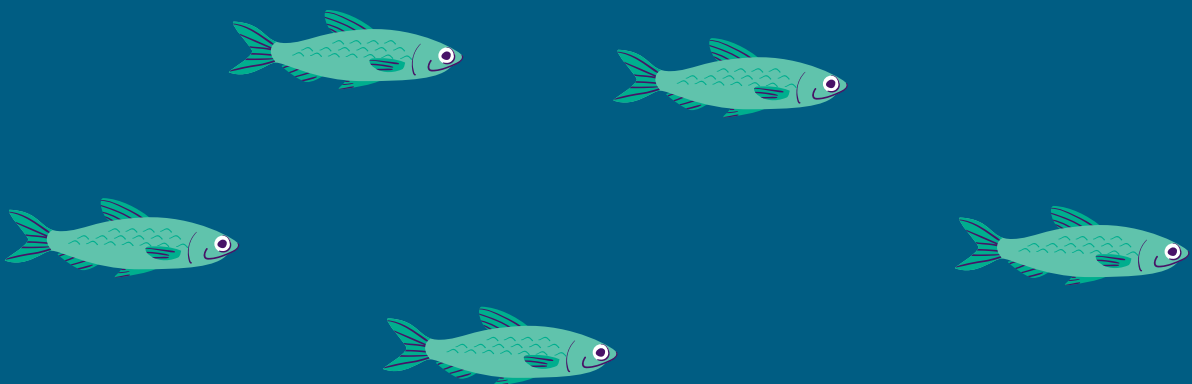


This high school environmental science instructional sequence was created to support teaching the Next Generation Science Standards through the Biological Sciences Curriculum Study (BSCS) 5E instructional model. Developed by District of Columbia teachers, these lessons include real-world contexts for learning about environmental science through a lens that encourages student investigation of local issues.

The lessons also support Scope and Sequence documents used by District local education agencies:
Unit 1: Ecosystems: Interactions, Energy, and Dynamics
Advisory 1

Acknowledgements:
Molly Mus, Anacostia High School

This curriculum resource can be downloaded online:
<https://osse.dc.gov/service/environmental-literacy-program-elp>



Overview and Goal of the Lesson:

Students will identify various consequences associated with the contaminants found in the Anacostia River sediment, namely, the effect that contaminated fish has on the Anacostia neighborhood. Students will collect and analyze data in order to understand the reasons why individuals consume fish and how it impacts their health. Students will then develop a plan for how to educate community residents about the risks associated with eating contaminated fish, with the ultimate goal of lowering contaminated fish consumption. They will then implement the most viable campaign to a pilot community (their school, as one example) and determine the effectiveness of their campaign.

Essential Question(s):

- What are the effects of the Anacostia River’s contamination on the neighboring Anacostia neighborhood?
- How can we reduce the consumption of contaminated fish from the Anacostia River? Identify, execute, and determine an effective campaign that addresses previous pitfalls and includes data.

NGSS Emphasized and Addressed in this Lesson Sequence:

PERFORMANCE EXPECTATIONS	SCIENCE AND ENGINEERING PRACTICES	DISCIPLINARY CORE IDEAS	CROSSCUTTING CONCEPTS
<p>HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.</p> <p>[Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.]</p>	<p>Constructing Explanations and Designing Solutions</p> <p>Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-LS2-7)</p>	<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience</p> <p>A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (HS-LS2-2, HS-LS2-6)</p> <p>Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. (HS-LS2-7)</p>	<p>Stability and Change</p> <p>Much of science deals with constructing explanations of how things change and how they remain stable. (HS-LS2-6, HS-LS2-7)</p>

Materials

ITEM	QUANTITY	PURPOSE
Poster board	dependent on class size and need	student campaign supplies
Camera/smartphone	dependent on class size and need	student campaign supplies
Markers	dependent on class size and need	student campaign supplies
Scissors	dependent on class size and need	student campaign supplies
Glue sticks	dependent on class size and need	student campaign supplies
<i>What's Wrong with the Anacostia River?</i>	one per student	graphic organizer for close reading

5E Lesson Sequence

TOTAL DURATION: 210 MINUTES				
5E Model Stage	Duration	Teacher and Student Actions		Notes
Engage	15-20 minutes	What Teacher Does	<ol style="list-style-type: none"> 1. Teacher shows students two different water samples (images or actual) and ask which one is healthier for people to drink. How do we know? Allow students to share their reasoning. 2. Teacher shows students the images of fish consumption warnings and ask them if it would deter them from consuming fish caught in the Anacostia River. 3. Teacher asks students to discuss why it might not be safe to eat the fish caught in the Anacostia River. What might be impacting the health of the fish? How would contamination in fish impact humans? 	See Supporting Document 1 for images. This video discusses what contaminants exist in tap water. ¹ Helpful background information can be found by reading the Anacostia Watershed Society report: ADDRESSING THE RISK Understanding and Changing Anglers' Attitudes about the Dangers of Consuming Anacostia River Fish ²
		What Students Do	<ol style="list-style-type: none"> 1. Students observe and discuss the photos shown by the teacher. Students to discuss their reactions to the fish photos and share their reasoning. 	
5E Model Stage	Duration	Teacher and Student Actions		Notes
Explore	40 minutes	What Teacher Does	<ol style="list-style-type: none"> 1. Teacher informs the students that they will be conducting research to better understand the issue of contamination of fish in the Anacostia River. Teacher will split students into groups of four or five students. Each group will read a different article related to contamination of fish in the Anacostia River. 	The following articles can be distributed to students to help better inform their understanding of what has caused contamination of fish in the Anacostia River. <ul style="list-style-type: none"> • Anacostia RiverKeeper's Pollution Map³ • Study Reveals D.C. Community near Anacostia River Are Eating and Sharing Contaminated Fish⁴ • Toxic chemicals moving up food chain in Anacostia⁵ • Recreational Fishing in the Anacostia Watershed⁶ • Fishing in the District⁷ • Fishing the Forgotten River in the Nation's Capital⁸
		What Students Do	<ol style="list-style-type: none"> 1. Students will work in small groups to read a variety of articles/reports related to fish contamination in the Anacostia River. 2. Students will attempt to gain a greater understanding of what has caused contamination of fish in the Anacostia. What processes have led to contamination? 	

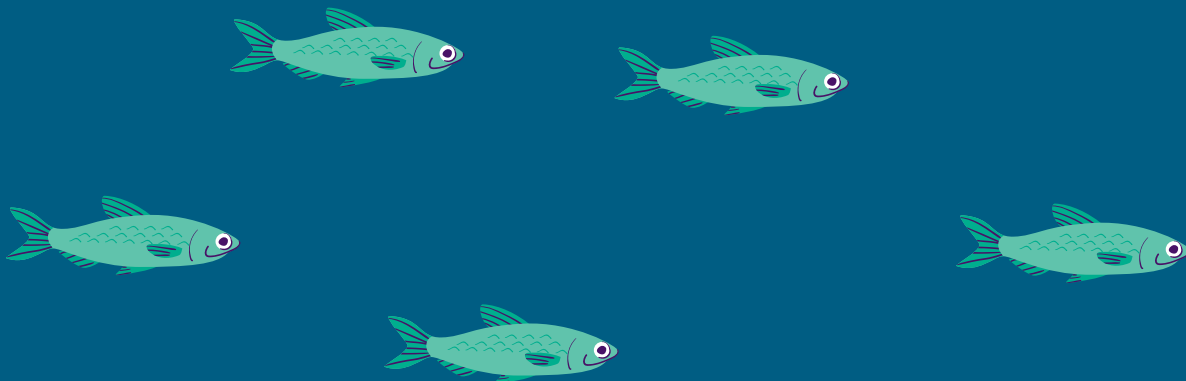
5E Model Stage	Duration	Teacher and Student Actions		Notes
Explain	45 minutes	What Teacher Does	1. Teacher passes out <i>What's Wrong with the Anacostia Graphic Organizer</i> and instructs students to summarize the key facts from their article to share with the other students.	Distribute <i>What's Wrong with the Anacostia? Graphic Organizer</i> to guide student reflection on the articles/ reports (Supporting Document 2).
		What Students Do	1. The group will have read their article/ report individually but will work as a group to fill out the graphic organizer. 2. Then students explain their article with three key facts to others and fill out the backside of the graphic organizer	
5E Model Stage	Duration	Teacher and Student Actions		Notes
Elaborate	45 minutes	What Teacher Does	1. Teacher leads the class in a discussion about what they have learned so far: Fish contamination is an issue in the Anacostia River and many people are eating the contaminated fish. 2. Teacher leads a discussion, having students brainstorm potential solutions. 3. Teacher then splits students into groups where they will work on developing a potential solution.	In this section of the lesson sequence students will brainstorm potential solutions to the problem of fish contamination in the Anacostia River. While this is ongoing, provide students with preliminary findings from the TetraTech study of the Anacostia River sediments. ⁹ **Once the study is completed, it can be included as a document to be reviewed by one of the groups. The students can assess the recommendations from the report. Teacher can also provide students with the Anacostia Watershed Society report: ADDRESSING THE RISK Understanding and Changing Anglers' Attitudes about the Dangers of Consuming Anacostia River Fish ¹⁰
		What Students Do	1. Students design a plan for how to either (1) reduce the amount of contamination that fish are exposed to and/or (2) reduce the amount of contaminated fish being consumed by individuals in the Anacostia neighborhood. 2. What can be done to mitigate the contamination in the Anacostia River and therefore in the fish? What can be done to reduce the damage to humans?	

5E Model Stage	Duration	Teacher and Student Actions		Notes
Evaluate	60 minutes	What Teacher Does	<ol style="list-style-type: none"> 1. Teacher informs the students that each group will be sharing their ideas regarding the questions of: What can be done to mitigate the contamination in the Anacostia River and therefore in the fish? What can be done to reduce the damage to humans? 2. Teacher reminds students that they are to consider each idea and evaluate the idea based a number of factors including cost, target audience, potential pitfalls, etc. 3. Teacher informs students to think critically about each idea, provide constructive feedback, and vote for the project they believe will be the most successful in mitigating the exposure of humans to contaminated fish from the Anacostia River. 	<p>Potential ideas for how to address the problem of fish contamination:</p> <ul style="list-style-type: none"> • Protein exchange • Educating younger students • Educating the community
		What Students Do	<ol style="list-style-type: none"> 1. Each small group will present its idea to the rest of the class. The groups must explain how they came up with their idea, potential shortfalls of their plan and how they would address them. 2. Other groups will provide feedback for each group and ultimately vote on what they believe to be the most successful plan. <ul style="list-style-type: none"> • <i>Have students share a reason that they think a certain campaign is the most effective</i> • <i>Ask students why a project earned the most votes</i> <ul style="list-style-type: none"> ○ <i>Only after a discussion should the teacher reveal voters' reasons for choosing a campaign</i> 	

Footnotes

- 1 www.cbsnews.com/videos/database-shows-what-contaminants-are-in-tap-water/
- 2 www.anacostiaws.org/fishing
- 3 www.anacostiariverkeeper.org/map/pollution-map
- 4 www.response.restoration.noaa.gov/about/media/study-reveals-dc-community-near-anacostia-river-are-eating-and-sharing-contaminated-fish
- 5 www.bayjournal.com/article/toxic_chemicals_moving_up_food_chain_in_anacostia
- 6 www.anacostiaws.org/get-involved/recreation/fishing
- 7 www.doe.dc.gov/node/9582
- 8 www.news.nationalgeographic.com/news/2012/07/120723-fishing-anacostia-river-washington-dc/#close
- 9 www.tetrattech.com/en/projects/anacostia-river-sediments-remedial-investigation
- 10 www.anacostiaws.org/fishing

Supporting Documents



Supporting Document 1: Images for Engage Lesson

Photo of different water samples:



Sample fish consumption warning images:



Supporting Document 2: What's Wrong with the Anacostia River?

Title:	
Author:	
Year:	
Problem: What is the main problem that you uncovered during your close read? This should be a problem that affects the Anacostia neighborhood directly.	
Key Fact #1: What is one fact from the close read that could help neighbors understand the importance of your campaign?	
Key Fact #2: What is one fact from the close read that could help neighbors understand the importance of your campaign?	
Key Fact #3: What is one fact from the close read that could help neighbors understand the importance of your campaign?	
Possible Solution: How would YOU solve this problem? Draft an idea for a campaign that would resonate with the neighborhood:	

What's Wrong with the Anacostia River?

On this side of your worksheet, write down five key facts from sources that your classmates have read:

Title:

Key Fact #1:

Author:

Title:

Key Fact #1:

Author:

Title:

Key Fact #1:

Author:

Title:

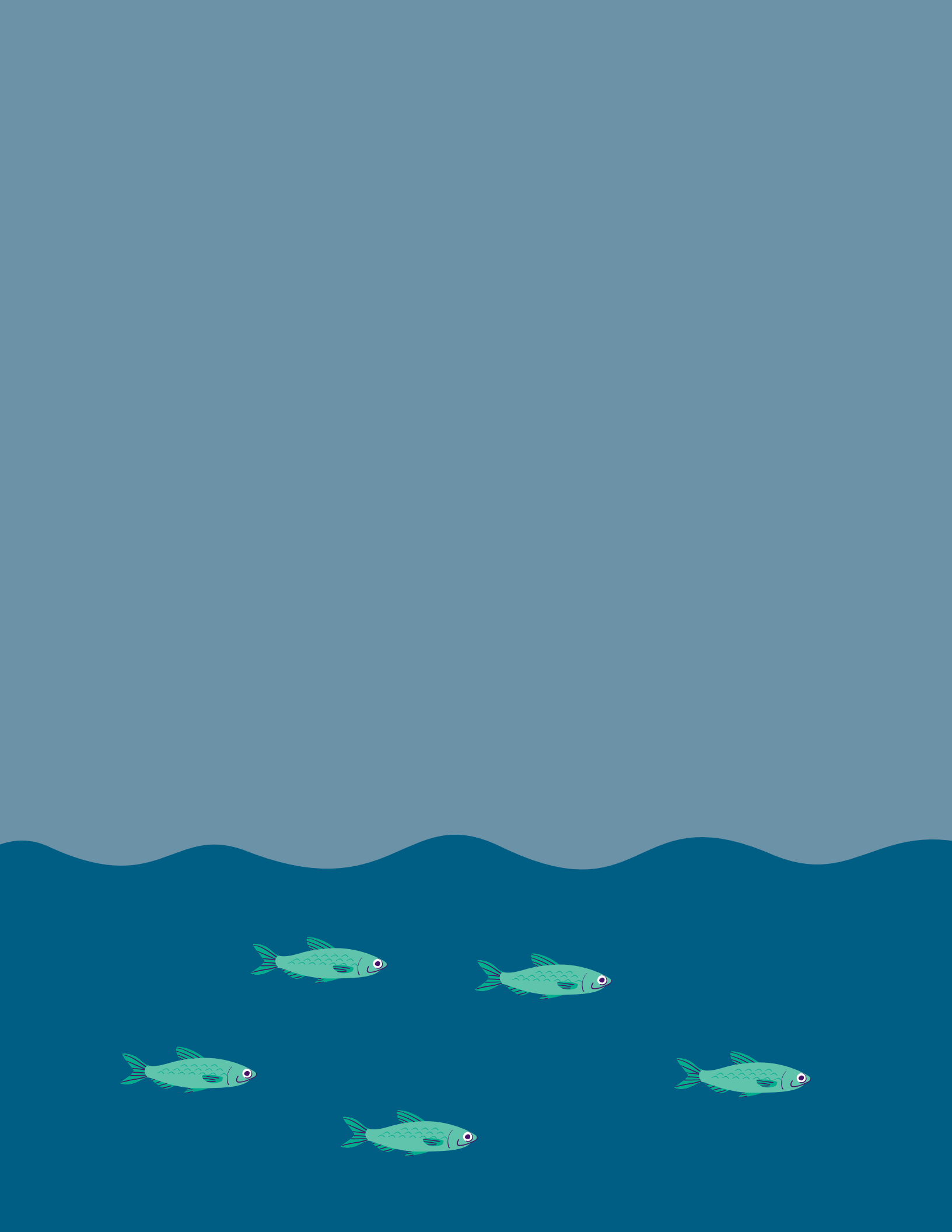
Key Fact #1:

Author:

Title:

Key Fact #1:

Author:






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