

## Biology Lesson: Plastics and Ocean Life

Created By	Grades	Subjects	Duration
Melissa Luetje	9th, 10th, 11th, 12th	Science and Engineering	255 minutes (multi-day)

### Lesson Overview


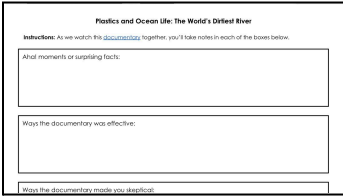
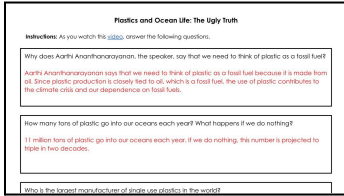
<b>Essential Questions</b>	<ul style="list-style-type: none"> <li>How do plastics impact quality of life?</li> <li>How does matter move through Earth's systems?</li> </ul>
<b>Learning Outcomes</b>	<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>Describe ways that plastics impact quality of life.</li> <li>Explain the relationship between climate change and plastic.</li> <li>Categorize campus waste and advocate for ways to reduce waste.</li> </ul>
<b>Summary</b>	<p>Students learn about the effects of plastic pollution in the ocean and lead a clean-up of their campus.</p> <p><b>Inquire:</b> Students watch a documentary about how pollution of water sources affects human life.</p> <p><b>Investigate:</b> Students learn about the relationship between climate change and plastics and the effects plastic in the ocean has on the Gulf of Maine.</p> <p><b>Inspire:</b> Students clean up their school and share their findings with the community.</p>

### Instructions

<b>Inquire</b> ≈ 15 minutes	<ul style="list-style-type: none"> <li>Students turn and talk to answer the following question: How do plastics impact quality of life?</li> <li>Students watch the beginning of a <a href="#">documentary</a> (3 minutes, 35 seconds). While they watch, students take notes on the scaffolding provided in the <a href="#">Student Document</a>.</li> <li>Students share their key takeaways and feelings from the documentary, and any questions the documentary raised for them.</li> </ul>
<b>Investigate</b> ≈ 120 minutes	<ul style="list-style-type: none"> <li>Students watch a <a href="#">video</a> (16 minutes, 56 seconds) connecting plastics to climate change. As they watch, students answer the questions in the Student Document.</li> <li>Students discuss their answers and responses to the video as a class.</li> <li>Students examine two <a href="#">graphs</a> of plastic production and greenhouse gas emissions due to plastics over time. Using the prompts in the Student Document, students analyze the graphs to make a prediction about plastic production and the resulting greenhouse emissions in the year 2040.</li> <li>Students view a map of the world in order to ascertain which countries emit the most plastic waste into the ocean.</li> <li>Students view a diagram explaining different ways plastic enters the oceans and consider the questions in the Student Document.</li> </ul>

	<ul style="list-style-type: none"> <li>Students discuss the impact that plastic in the ocean has on ecosystems. <ul style="list-style-type: none"> <li>Students begin with a general discussion of ecosystem services.</li> <li>Students then discuss marine ecosystem services.</li> <li>Students brainstorm a list of ecosystem services specific to the Gulf of Maine.</li> </ul> </li> <li>Students investigate the impacts plastic is having on the Gulf of Maine by reading an <a href="#">article</a> about the lobster population and answering the questions in the Student Document.</li> <li>Students investigate Wabanaki Traditional Ecological Knowledge by Jigsawing the following resources and answering the questions in the Student Document. <ul style="list-style-type: none"> <li><a href="#">Poster</a> about Indigenous land use in Casco Bay over time</li> <li><a href="#">Article</a> about climate change and Wabanaki culture</li> <li><a href="#">Article</a> about the Wabanaki people</li> </ul> </li> <li>Students discuss what they have learned in the Investigate section using the prompts in the Teacher Slideshow. Note: These discussion questions could also be used as a formative assessment.</li> <li>Students reflect using the prompts in the Teacher Slideshow.</li> </ul>
<p><b>Inspire</b></p> <p>≈ 120 minutes</p>	<ul style="list-style-type: none"> <li>Using the <a href="#">Teacher Slideshow</a>, students discuss the importance of removing plastic from their campus.</li> <li>Students conduct a clean up of their campus using the <a href="#">data card</a>.</li> <li>Students analyze their data by following the prompts in the Teacher Slideshow, adapted from this <a href="#">resource</a>.</li> <li>Using the Teacher Slideshow, students reflect on their data. Note: These can be used as an exit ticket or assessment.</li> <li>Students share their findings with the school community.</li> </ul>

## Accompanying Materials

<p><a href="#">Teacher Slideshow</a></p> 	<p><a href="#">Student Document</a></p> 	<p><a href="#">Teacher Answer Key</a></p> 
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## Teaching Tips

<p><b>Suggestions</b></p>	<ul style="list-style-type: none"> <li>This lesson could be used as part of a unit on ecology in a biology class.</li> <li>This lesson focuses on the Gulf of Maine, allowing local students to make connections.</li> <li>This lesson includes discussions about the Wakanabi people and traditional ecological knowledge.</li> <li>This lesson emphasizes data analysis and using spreadsheets which can build the necessary skills for science classes.</li> <li>For teaching this lesson over multiple days, the following pacing is recommended:</li> </ul>
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	<ul style="list-style-type: none"> <li>○ Day 1: Inquire Section and begin the Investigate Section, ending with the graphical analysis.</li> <li>○ Day 2: Continue the Investigate Section, picking it up with the discussion of ecosystems and ending with the Jigsaw.</li> <li>○ Day 3: Wrap up the Investigate Section with the connect and reflect prompts, then begin the Inspire Section.</li> <li>○ Day 4: Inspire Section - campus clean-up.</li> <li>○ Day 5: Complete the Inspire Section, starting with the data analysis.</li> </ul>
<b>Prerequisites</b>	<ul style="list-style-type: none"> <li>● The video in the Inspire Section could be watched in its entirety as homework before the first class.</li> <li>● Students should already have a basic understanding of what an ecosystem is.</li> <li>● For the campus clean-up, the following supplies will be needed: <ul style="list-style-type: none"> <li>○ Enough trash bags for groups of 2-4</li> <li>○ Sterile gloves, at least 1 for each student, plus extra</li> <li>○ <a href="#">Data card</a> - for each group</li> <li>○ Pencil - 1 per group</li> <li>○ Clipboard - 1 per group</li> <li>○ Smartphone - 1 to 2 per group (optional)</li> <li>○ A container for sharp or hazardous materials</li> <li>○ Bathroom scale</li> <li>○ Old newspapers (for sorting and tallying trash back in the classroom)</li> </ul> </li> <li>● Students will ideally use computers with access to Excel or Google Sheets for the data analysis section.</li> </ul>
<b>Differentiation</b>	<ul style="list-style-type: none"> <li>● The campus clean-up could be expanded to a local river or beach, if possible.</li> <li>● For the graphical analysis, this activity could include mathematical modeling of exponential growth, or students could discuss their predictions more qualitatively. This will depend on what level of math the students have obtained, as well as what the teacher would like to be the focus of the activity.</li> <li>● For the Jigsaw activity, consider grouping students according to the type of resources they will use. <ul style="list-style-type: none"> <li>○ Group A - This is an infographic that can be assigned to students who may struggle to read a longer passage in English.</li> <li>○ Group B - This article contains key points about TEK and could be assigned to the strongest readers.</li> <li>○ Group C - This article is more general about the Wakanabi people and could be divided further to shorten the amount of reading students need to do.</li> </ul> </li> <li>● For extension after the clean-up, students can investigate the following resources: <ul style="list-style-type: none"> <li>○ <a href="#">Gulf of Maine Found Objects Ideas</a></li> <li>○ <a href="#">Build a Monofilament Recycle Bin</a></li> </ul> </li> </ul>

## Learning Standards

Primary Standards
Science and Engineering
HS-LS2-4 Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
Supporting Standards
Mathematics
HSF.LE.A.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
Science and Engineering
HS-CCC-Energy and Matter.2: Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.
HS-CCC-Systems and System Models.2: When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models.