


## LESSON PLAN 1 : INTRODUCING THE PLASTIC PROBLEM

<b>Subject:</b> Science	<b>Grade:</b> 6-12	<b>Duration:</b> approx. 2 hours
<b>Lesson Overview</b>	To learn the impact plastic has on the environment and ecosystems and to begin to build engagement, interest and curiosity.	

<b>Curriculum Ties</b>	Core Competencies:	
		
	Grade	Subject
7	Science	<ul style="list-style-type: none"> <li>• First People’s knowledge of changes in biodiversity over time</li> <li>• Evidence of climate change over geological time and the recent impacts of humans <ul style="list-style-type: none"> <li>○ Change in climate affects: the interconnectedness of plants and animals and their environment.</li> <li>○ e.g., changes to harvesting dates, changes to schedules due to early/late ripening and runs, lowered water levels in creeks, rivers and lakes, change in humidity impacts the ability to preserve salmon, etc.</li> </ul> </li> </ul>
8	Science	<ul style="list-style-type: none"> <li>• The relationship of micro-organisms with living things.</li> <li>• Microorganisms are key to nutrient recycling in eco-systems as they act as.</li> </ul>

	9	Science	<ul style="list-style-type: none"> <li>• Matter cycles within biotic and abiotic components of ecosystems.</li> <li>• Human impacts on sources and sinks (e.g., climate change, deforestation, agriculture, etc.)</li> <li>• Bioaccumulation and biomagnification.</li> <li>• Sustainability of systems</li> <li>• A systems approach to sustainability sees all matter and energy as interconnected and existing in dynamic equilibrium.</li> </ul>
	11	Environmental Science	<ul style="list-style-type: none"> <li>• Human practices affect the sustainability ecosystems.</li> <li>• Humans can play a role in the stewardship and restoration of ecosystems.</li> </ul>
	12	Environmental Science	<ul style="list-style-type: none"> <li>• Human actions affect the quality of water and its ability to sustain life.</li> <li>• Human activities cause changes in the global climate system.</li> <li>• Living sustainably affects the well-being of self, community and Earth.</li> </ul>

<b>Content Objectives</b>	<ul style="list-style-type: none"> <li>• Students will begin to understand the impact of plastics in our marine environments.</li> <li>• They will gain a scientific knowledge of how it affects our local ecosystems.</li> </ul>
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<b>Materials and Equipment Needed for this Lesson</b>
<ul style="list-style-type: none"> <li>• A variety of plastic items with various resin codes (it is particularly impactful if they are recognisable items from day-to-day life. Examples:             <ul style="list-style-type: none"> <li>○ Plastic pop bottle</li> <li>○ Plastic cutlery</li> <li>○ Shampoo bottle</li> <li>○ Condiment bottle</li> </ul> </li> </ul>

- Plastic bag
- Coffee cup lid
- Large bucket full of water

Lesson Stages	Learning Activities												
Introduction	<ul style="list-style-type: none"> <li>● Begin to build connections with the local environment.               <ul style="list-style-type: none"> <li>○ “What do you enjoy about the beach / lake / river?”</li> <li>○ “What issues concern you the most about our environment?”</li> <li>○ “How do you think the things you enjoy doing can be impacted by these issues?”</li> </ul> </li> <li>● Introduce Surfrider &amp; the work we do               <ul style="list-style-type: none"> <li>○ Information about Surfrider Pacific Rim’s current campaigns and programs can be found on our website: <a href="http://www.pacificrim.surfrider.org">www.pacificrim.surfrider.org</a></li> <li>○ Do you have a local Surfrider chapter? What are they currently working on?</li> </ul> </li> </ul>												
Activity	<p><b>ACTIVITY #1: Plastic Science! Plastics in the Water Column</b></p> <p>What does plastic in the ocean do: float, hang or sink? Students make predictions and then test their theory, and see if there are similarities in types and numbers on plastics.</p> <p>1) Experiment with a variety of plastic objects in groups of 4 or 5</p> <p>a. Record the name of the item and its resin number in the chart below.            b. Predict whether it will sink, hang, or float and write in the chart below.            c. Now submerge the items in the water and record your results            d. Leave the last column until the final activity</p> <table border="1" data-bbox="402 1602 1563 1827"> <thead> <tr> <th data-bbox="402 1602 472 1766"></th> <th data-bbox="472 1602 695 1766">Plastic Item</th> <th data-bbox="695 1602 829 1766">Resin No</th> <th data-bbox="829 1602 1091 1766">Prediction: Do you think this plastic sinks or floats</th> <th data-bbox="1091 1602 1308 1766">Results: did it sink or float</th> <th data-bbox="1308 1602 1563 1766">Marine animals affected</th> </tr> </thead> <tbody> <tr> <td data-bbox="402 1766 472 1827">1</td> <td data-bbox="472 1766 695 1827"></td> <td data-bbox="695 1766 829 1827"></td> <td data-bbox="829 1766 1091 1827"></td> <td data-bbox="1091 1766 1308 1827"></td> <td data-bbox="1308 1766 1563 1827"></td> </tr> </tbody> </table>		Plastic Item	Resin No	Prediction: Do you think this plastic sinks or floats	Results: did it sink or float	Marine animals affected	1					
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1													

2					
3					
4					
5					
<p><i>*See workbook for full copies of these tables</i></p> <p>2) Have a discussion:</p> <ul style="list-style-type: none"> <li>• Are there similarities with the buoyancy of the plastics?</li> <li>• What is the resin code number? Refer to the Resin Code Key for help!</li> <li>• What would you normally use these plastic objects for? Are there alternative materials this object could be made with?</li> <li>• What would happen if the plastics from your experiment made it into the ocean? (photodegradation, break down into tiny pieces and impact sea life at all levels of the food chain; soak up toxins like PCBs and POPs; sink to the sea floor; float and end up on beaches)</li> </ul>					
#	Name of Plastic	Uses	Where in Water Column		
1	PETE Polyethylene terephthalate	Soft drink and water bottle, peanut butter containers, salad dressing and vegetable oil containers	Sinks		
2	HDPE High-density polyethylene	Milk jugs, detergents, household cleaners, motor oil containers, some garbage bags, butter and yogurt tubs	Floats		
3	PVC Polyvinyl chloride	Clear food packaging, medical equipment, siding, piping, windows, shampoo bottles	Sinks		
4	LDPE Low-density polyethylene	Squeezable bottles, various bags (for bread, frozen food, shopping and dry cleaning), clothing and furniture	Floats		
5	PP Polypropylene	Syrup bottles, ketchup bottles, caps, straws, medicine bottles	Floats		

6	PS Polystyrene	CD cases, takeout containers, food packaging	Sinks
6	EPS Expanded Polystyrene	Meat trays, egg cartons, disposable plates and cups, dock floatation	Floats
7	Other	DVD cases, iPod packaging, signs and displays, nylons	Varies

### ACTIVITY #2: Impact on eco-systems

For younger grades: Cut out the animals and stick onto the zone of the ocean they feed in. What marine animals might be affected by your plastics in the experiment? Write the answers in the last column of the table above. *How does that make you feel?*

*Surface: Bald Eagle, Albatross, Grey Whale, Right Whale*

*Pelagic: Orca, Tufted Puffin, Leatherback Turtle, Humpback Whale, Coho Salmon*

*Benthic: Giant Pacific Octopus, Grey Whale, Sea Otter*

For older grades: research exactly where and what these animals are feeding on, and what role they play in the ecosystem.

Discuss: How does this information make you feel? How do you think this is also affecting humans? This discussion can then lead into the bio accumulation discussion.

### ACTIVITY #3: Bioaccumulation

How plastic ends up in the food chain

1. Pollutants are absorbed by microplastics, and mix with plankton
2. This toxic soup is ingested by filter feeders
3. These pollutants bioaccumulate and biomagnify up the food chain

#### Class demonstration:

- In a class of 20, designate 8 students to be Plankton, give them each a handful of rice / pasta / poker chips / or some other token. Then they wander around the room.
- Next, designate 5 different students as Herring. The Herring run around and 'eat' and as many plankton as they can (the plankton pass over their tokens to their Herring captors) Now the herring wander around with their groups of Plankton.
- Designate 4 different students as Salmon. The Salmon run around and 'eat' as many Herring as they can (collecting their tokens as they go). Now the Salmon swim around with their groups of herring and Plankton.

	<ul style="list-style-type: none"> <li>- Designate 2 more students to be <u>Sea Lions</u>. The Sea Lions ‘eat’ as many salmon as they can (collecting their tokens), and they wander around in their groups of Sea lions, Salmon, Herring and Plankton.</li> <li>- The final student is a <u>Transient Orca</u>. They eat both Sea Lions (collecting all the tokens).</li> <li>-</li> </ul> <p>Explain that these animals are absorbing the chemicals and toxins from plastic into themselves as they feed (bioaccumulation), and that animals higher up the food chain consume a heavier load of these toxins as they inherit the load that their prey has already accumulated (biomagnification). Whilst the plankton only has a handful of tokens, a transient orca has a whole bag.</p>
<b>Closure</b>	<ul style="list-style-type: none"> <li>● Have a final discussion on the impacts</li> <li>● <i>Consider this: it isn’t only marine creatures that eat seafood. Research has shown that not only are we consuming microplastic with our food, but even inhaling it in the air we breathe! Microplastics are literally everywhere, from the deepest ocean trenches to uninhabited arctic shores.</i></li> </ul>

<b>Modifications / Extensions</b>	<ul style="list-style-type: none"> <li>● Adjust the level of depth depending on the grade. The goal is to begin to build an interest, engagement and curiosity.</li> <li>● For non-coastal groups, discuss how rivers transport plastic to the ocean</li> <li>● Make sure to discuss more specific the topic for each grade. <ul style="list-style-type: none"> <li>○ Science 2: Water Sources</li> <li>○ Science 3: Local eco-systems</li> <li>○ Science 4: Biomes</li> <li>○ Science 5: Nature of sustainable practices</li> </ul> </li> </ul>
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<b>Additional Teacher Info</b>	<p><b>Additional Student Resources for Research:</b></p> <p><b>Plastic 101 video:</b>  <a href="https://education.nationalgeographic.org/resource/science-101-plastics/">https://education.nationalgeographic.org/resource/science-101-plastics/</a></p> <p><a href="https://5gyres.org">https://5gyres.org</a>  <a href="https://oceanlegacy.ca/">https://oceanlegacy.ca/</a>  <a href="https://marinedebris.noaa.gov/">https://marinedebris.noaa.gov/</a>  <a href="http://www.plasticpollutioncoalition.org">www.plasticpollutioncoalition.org</a>  <a href="https://www.plasticoceans.org/">https://www.plasticoceans.org/</a></p>
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