High School Environmental Science: Ocean Plastics

Standard

EV4. Obtain, evaluate, and communicate information to analyze human impact on natural resources.

4a. Construct and revise a claim based on evidence on the effects of human activities on natural resources.

Human Activities: Agriculture, Forestry, Ranching, Mining, Urbanization, Fishing, Water use, Pollution, Desalination, Wastewater treatment

Natural Resources: Land, Water, Air, Organisms

4b. Design, evaluate, and refine solutions to reduce human impact on the environment including, but not limited to, smog, ozone depletion, urbanization, and ocean acidification.

4c. Construct an argument to evaluate how human population growth affects food demand and food supply (GMOs, monocultures, desertification, Green Revolution).

Teaching Tips

Preparation Students will need internet connected devices. Request the free Ocean Debris Investigation Kit from Algalita (https://algalita.org/educators/) with Student Workbook (https://drive.google.com/file/d/1mx2KK9s3U9fqUuJptlLEAZ2cEHF9XZmA/view) or obtain materials for the alternative teacher-directed investigations below, including (for 1) small rubber ducks or paper images of rubber ducks, world map centered on the Pacific, (for 2) water sample with tiny bits of plastic debris, containers such as glass jars for float tests, array of plastic trash items to test, printed animal profile cards, (for 3) coffee filters, cleanser containing microplastics, jars or containers

Directions for this lesson are written for teachers. Provide students with the Investigation Lab Report from appendix.

Phenomenon: Present phenomenon in lesson without explanation before or after students view it. Keep sound off.

What Do you Notice? Engage students in writing an explanation (or labeled drawing) that tells who, what, why, how.

What Do you Wonder? Engage students in asking their own questions, which will form the basis for their research.

Student Research After each student writes a question, consider placing each question on a sticky note, grouping them in categories, and allowing students to learn more in small groups according to their interests. A curated collection of articles is provided for use in small groups, using the Jigsaw protocol. https://www.jigsaw.org/

Teacher-Directed Activity Engage students in rotating among these four investigation stations:

1. Students design an investigation to see what plastic items will Sink or Float . Address why it matters with this investigation:
    - Water Column Cross Section, Animal Profile Cards, Density Table , Monterrey Bay Water Column Investigation
2. Students design an investigation to track the path of floating debris, based on the Friendly Floaties or Rubber Duckie Lab
    - Analyze results of the investigation using this Map of ocean currents
3. Identify components of "plastic soup" from the "Great Pacific Garbage Patch" using this Guide to Recognizing Microplastics
    - Then design a protocol for Microplastic extraction based on this video and investigation

Zero Heroes Lesson Activity Students will design and carry out an environmental stewardship project to engage fellow students and school staff in making systemic or personal changes that reduce plastic waste or prevent plastic use

Revised Explanation Allow students to revise their initial explanations of the phenomenon, reflecting what they have learned and the effectiveness of their project(s). Identify how they would refine the project to improve effectiveness.

Teacher Resources Share any of the following for project inspiration:

GREAT Projects Ocean Planner *https://docs.google.com/document/d/1uvDCsMEJKMnP5WGodCsNMt5FeuWkEru5AT0Dzcasx4k/copy*

Plastic Prevention Projects: Plastic Pollution Coalition Guide https://www.plasticpollutioncoalition.org/get-involved#guides

Clean Up Projects Babylegs microplastics catcher, SeaBin project, Mr Trash Wheel, Boyan Slat's *Ocean Cleanup*

Environmental Science: Ocean Plastics Environmental Stewardship Project

Phenomenon	What Do You Notice? (tentative explanation)
 ***Credit: Chris Jordan – Midway: Message from the Gyre*** ***http://www.chrisjordan.com/gallery/midway-film/#trailer*** ***https://vimeo.com/218502282***	*Play video without sound to present the phenomenon. Engage students in writing (or creating a labeled diagram) about what they noticed while observing the phenomenon including who, what, why, where, and how they think it occurs. This will serve as a tentative explanation while they are doing research and conducting investigations to make sense of this.*

What do you Wonder? (student questions)

Engage students in asking their own questions about the unexplained phenomenon. These questions will form the basis for student research.

Curated Articles for Research Jigsaw www.jigsaaw.org/

Boyan Slat's Ocean CleanUp Project
https://theoceancleanup.com/oceans/
Ocean Debris from Land-based Sources infographic
https://www.ecowatch.com/80-of-ocean-plastic-comes-from-land-based-sources-new-report-finds-1891173457.html
What Happens to Marine Plastics infographic
https://green-alliance.org.uk/marine_plastics_graphics_references.php.php
Marine Debris
https://marinedebris.noaa.gov/images/plastics-ocean-infographic
Great Pacific Garbage Patch infographic
https://visual.ly/community/Infographics/environment/great-pacific-garbage-patch
Wandering Albatross - characteristics and behavior
https://oceanconservancy.org/wildlife-factsheet/laysan-albatross/
Tracking Recycling to Reveal Where it Really Goes
https://www.youtube.com/watch?v=hmGrI_BVInc

Findings from Plastic Pollution Investigations

Encourage students to summarize findings from their research and the teacher-directed investigations (see previous page), for incorporation into their revised explanations. Invite students to use River Runner and Ocean Plastic Tracker to identify the path of litter when rain washes it from the schoolyard to the nearest stream and then to the ocean.

Environmental Stewardship Project

Engage students in designing and carrying out a project involving fellow students to reduce the amount of plastic waste (especially single use plastics and packaging) or to limit or prevent plastic use.

Revised or Refined Explanation

Allow students to return to their original explanations and revise to reflect what they learned in this lesson, including who / when / how plastics end up in the ocean and what can be done about it. Prompt students to address the standard in the explanation, and to tell about their project's impact and how they could improve its effectiveness.