



Light Waves and Intertidal Zone Lesson Plan

Grade Span	6-8th Grade
Time Span	3-4 (70 minute) days
Standards	<p>MS-PS4-2 Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.</p> <p>MS-LS 2-1 Analyze and interpret data to provide evidence for the effects of resource availability of organisms and populations of organisms in an ecosystem.</p> <p>MS-LS 2-2 Construct and explanation that predicts patterns of interactions of organisms across multiple ecosystems.</p> <p>MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.</p> <p>MS-LS2-4 Construct and argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.</p> <p>Practice Standards: Analyzing and Interpreting Data Constructing Explanations and Designing Solutions Developing a Model Engaging in Argument from Evidence Obtaining, Evaluating, Communicating Information Using Mathematics and Computational Thinking</p>
Focus Question	How does light wavelengths affect what grows where in the intertidal zone?
Overview	Students will take their knowledge of light waves, and organisms in the intertidal zone, and learn how the light affects that ecosystem.
Objectives	<p>Students will be able to:</p> <ul style="list-style-type: none"> • Explain how differences in light interactions affect the organisms survival in the intertidal zone. • Explain how these impacts affect food webs especially in the intertidal zones.

Outdoor Classroom Lesson Plan

National Park Service
U.S. Department of the Interior
Acadia National Park, Maine



Materials Needed	<p>Transect rope Quadrats or sorting circles Clipboards Pencils Magnifying glasses Set of pictures of things in the intertidal zone Articles from Chris Harley</p>
Video Material	<ul style="list-style-type: none"> • ExplorOcean video about Tide Pools in California: https://www.youtube.com/watch?v=ZkULAD8gJT0 • Intertidal Zone at Cape Cod presented by a Park Ranger: https://www.youtube.com/watch?v=9omy60mO4_E • Video on Intertidal Biomes: https://www.youtube.com/watch?v=u64ppKBY3cM
Vocabulary	<p>Wave, Medium, Amplitude, Wavelength, Mechanical Wave, Matter, Energy, Crest, Trough, Transverse, Compression, Compressional Wave, Volume, Frequency, Vibrations, Conductor, Transmission, Sound, Medium, Pitch, Air, Water, Solid, Amplitude, Reflection, Amplitude, Refraction, Diffraction, Absorption, Convex, Concave, Transparent, Electric field, Visible light, Magnetic field, Electromagnetic wave,</p>
Teacher Prep	<p>If you're planning a trip to the ocean, watch the tide charts for days to go.</p> <p>Familiarize yourself with light waves and the intertidal zone:</p> <ul style="list-style-type: none"> • The Physics Classroom What is a Wave: https://www.physicsclassroom.com/Class/waves/U10L1b.cfm • The Physics Classroom: Anatomy of a Wave: https://www.physicsclassroom.com/Class/waves/u10l2a.cfm • NOAA Life in the Intertidal Zone: https://oceanexplorer.noaa.gov/edu/learning/10_tides/activities/intertidal.html (interactive)
Background	<p>Under the right conditions algae can be your friend or your enemy. Algae can be used as an alternative energy source like biofuels and can also “bloom” causing “Red Tide”, which can harm the shellfish industry and other living organisms in water ecosystems including the tidal habitat.</p> <p>The following: Waves and Wave like Motion has background information and thinking points about waves.</p> <p>The following is a teacher guide to a few organisms in the Gulf of Maine: https://www.maine.gov/dmr/education/aquarium/documents/Teachers_Guide.pdf</p> <p>Intertidal Zone Information and pictures: https://untamedscience.com/biology/biomes/intertidal-zone-aquatic-biome/</p>



Procedure

Engage:

1. Break students up into smaller groups.
2. Hand each group a set of pictures with living and nonliving things from the intertidal zone.
3. Have students look at what they see and what they DON'T see. (Students could fill in a KWL chart or make a list of DOs and DON'Ts.)
4. Come back together as a class and discuss.

Commented [1]: Need to find some pictures to link here.

Explore:

1. Intertidal Zones
 - a. Video on Intertidal Biomes:
<https://www.youtube.com/watch?v=u64ppKBY3cM>
 - b. Learn about the different layers of the intertidal zone. Great information from this site: https://archive.bigelow.org/mitzi/site_map.html
2. Take a trip to the intertidal zone and gather data along a transect line using quadrats. Activity CSI: Coastal Shore Investigation taken from:
 - i. <http://blog1.miami.edu/sharklab/wp-content/uploads/sites/28/2018/07/MODULE-1-Ocean-and-Coastal-Habitat-SECTION-4-Intertidal-Zones.pdf>
3. Make sure students are looking at the "layers" of the intertidal zone. Observe the algae as the tide comes back in.
 - a. Think about that light shining through the water. Relate back to the [light lesson](#)
 - i. How much is reflected? Absorbed?
 - ii. What organisms live where there is more light? Less light?
 - iii. Does light matter?
4. When you get back into the classroom take a look at how deep the light from the sun goes in the ocean?
 - a. How Far Does Light Travel Information:
https://oceanservice.noaa.gov/facts/light_travel.html
 - b. Ocean Zones:
<https://www.ck12.org/earth-science/Ocean-Zones/lesson/Ocean-Zones-HS-ES>

Explanation:

1. After the trip to the intertidal zone students make a drawing of the biotic and abiotic factors in the intertidal zone. Students should include the sun being absorbed and reflected.
2. Read an article about climate change and the intertidal zones from Dr. Chris Harley

All this is taken from: <http://blog1.miami.edu/sharklab/wp-content/uploads/sites/28/2018/07/MODULE-1-Ocean-and-Coastal-Habitat-SECTION-4-Intertidal-Zones.pdf>



3. Once students have read the article about climate change and the intertidal zones, have students come up with an experiment that they could, but don't have to, carry out. Their challenge should be "to come up with an experimental design that would allow Dr. Harley and his students to test how rising temperatures and decreasing pH will affect intertidal organisms that can be carried out on the shore."

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4. Make sure students look at and think about how light plays a role in climate change.
 - a. Increased light from our sun means:
 - i. Warmer ocean
 - ii. Algal blooms
 - iii. Organisms unable to survive in warmer temps
 - iv. Movement of fish, warmer temp fish showing up along the Maine coast.

Extension:

2. Food Webs
 - a. Great activities taken from this website on how to have students choose an organism, sketch it, play a sound game. You could then take the sketches and put them up on a poster wall.
https://archive.bigelow.org/mitzi/food_web.html
 - b. Information that talks about the different ocean zones and what organisms live in those zones (helpful with food web thinking..)
<https://www.enchantedlearning.com/biomes/ocean/sunlit/>

Evaluate:

Formative Assessment:

The drawings and sketches students make will be used for understanding.
Student conversations for check in's.
Food web

Summative Assessment:

Students Choose a tidal zone and design a creature to live there taking into account the amount of light waves. Students must include: food it eats, way to attach (or survive the tides), protection from predators, how does light waves affect the organism?