Life in Intertidal Zones

Unit Description	• Appropriate for students at 4th-6th grade • Supplement for the following FOSS Kits: Environments, Landforms, Structures of Life • Takes 3-5 class periods (35-45 minutes each) • Uses science notebooks http://www.sciencenotebooks.org
Big Ideas	• Environments affect living things. • Living things need to adapt to environmental conditions. • Tidal water movements affect the life forms in an estuary.
Essential Questions	• How do tides push the water in and out of an estuary? • How does exposure to tides affect living things in intertidal habitats? • How do plants and animals adapt to living in intertidal habitats?
GLE Ties	**1.2.4 Components and Patterns of Earth Systems** **Understand that Earth's system includes a mostly solid interior, landforms, bodies of water, and an atmosphere. *W*** Construct a model that demonstrates understanding of Earth's structure as a system made of parts (e.g., solid surface, water, and atmosphere) **1.3.9 Biological Evolution** **Understand that plant and animal species change over time. *W*** Know that some kinds of plants and animals survive well, some survive less well, and some cannot survive at all in particular environments **1.3.10 Interdependence of Life** **Understand that an organism's ability to survive is influenced by the organism's behavior and the ecosystem in which it lives. *W*** Describe how an organism's ability to survive is affected by a change in an ecosystem.
Vocabulary	

Low tide zone	Splash Zone	Tide
Middle tide zone	Sub-tidal zone	Spring tide
High tide zone	Adapt **W**	Neap tide
Habitat **W**	Intertidal	Environment **W**
Consumer **W**	Producer **W**	

Glossary

W- WASL terms

Possible Misconceptions	• Students may not understand that the ebb and flow of tides cause stress on organisms that live in the intertidal zone and that these stresses are particular to specific elevations. • Students may not understand that adaptation to these environmental stresses is needed for survival. • Students may not understand that some organisms have adapted to thrive at particular elevations and can't survive at other elevations in intertidal habitats.
Instructional Strategies	• This unit can stand-alone or be used in conjunction with the Foss Landforms Kit after the erosion investigations using the landforms trays or at the end of the Environments or Structures of life kits to share more on organism and plant tolerance and structure. • It is assumed that students have been using science notebooks: http://www.sciencenotebooks.org/ If not, this will need to be taught during this lesson. • Use science notebooks for student responses to the essential questions and use their responses to identify level of understanding and gaps in knowledge. • Students will also record observations and results of research in their notebooks. • Demonstrate how scientists use models to study ecosystems in the laboratory. Students will create a tidal zone model using a tray and water. • Use the Internet to research life forms in intertidal habitats. • Students will write up a lab report on their tide simulation tray. • Students will produce written or oral reports about life in intertidal habitats.
Assessments	• Student written and oral reports. • Science notebooks
System Description	This lesson focuses on the Intertidal zone system <u>Important structures in the system:</u> • Estuary organisms (producers such as eel grass, phytoplankton, algae and consumers including mollusks, worms, fish, zooplankton and arthropods). • Tide

System Description	• Weather Energy and Matter Transfers: • Producers convert Sunlight to chemical energy • Sunlight heats water, mud, sand and rocks • Consumers transfer energy and matter from producers through the food chain • Wind and waves act on organisms in intertidal zones. In some exposed locations, these forces exert very extreme stresses on organisms. They may be pounded directly or hit by moving rocks and logs Forces acting on the system: • Gravity and centrifugal forces create tides • Waves move material including plants and animals
Lesson Description	**Lesson 1. Modeling Tidal Action** Introduction: • Students write the following question and responses in their notebooks. *Think about the tide coming in and going out. How might this change affect plants and animals that live at the beach?* • Students share what they have written. Students create tide simulations Materials needed: • Seattle Times article *Wave Action*: http://www.padillabay.gov/lessons/waveaction.pdf • Trays with 2-3 inch high sides either from the landforms kit, paint roller trays or wallpaper trays work well. • Water • Tubes or hoses for siphons • Paper towels and sponges for cleanup • Books or websites on near shore habitats from the library (see

Lesson Description	resources listed at the end of this packet) • Connection to the Internet is optional. Read the beginning of the article *Wave Action*. <u>Procedure:</u> 1. Explain that the tide is actually a long wave that crosses the ocean on its way around the globe. If we were in a boat on the ocean, our boat would rise and fall just a few feet once in 12 hours as the wave passed us by. When the wave reaches land, the water gets deeper and moves further up on the land. As it gets shallower, the waterline will move out from the land. 2. Draw on the board or make an overhead of the illustration of tidal ebb and flow: http://www.padillabay.gov/lessons/waterline.pdf 3. Students form groups of four to six and plan how to create a simulation of water slowly getting deeper and moving up a sloping beach, then slowly getting shallower and moving down a sloping beach using the materials provided. Each group must: 1. Agree on a detailed procedure. 2. Write the procedure in their notebooks. 3. Share their procedure with the teacher for approval before testing 4. Test the procedure using the materials provided. 5. Fill out the Laboratory Report: http://www.padillabay.gov/lessons/labform.pdf Students discuss in groups and write responses in notebooks: 1. Make an illustration of your tide simulation. 2. Label the beach just above the highest high tide, "Splash Zone." 3. Label the beach just below the lowest low tide, "Sub-tidal zone." 4. Label the area in between, "Intertidal." 5. Label the part of the Intertidal that will be exposed to the air the most, "High Tide Zone." 6. Label the part of the Intertidal that is in the middle, "Middle Tide Zone." 7. Label the "Low Tide Zone." 8. In some places in Puget Sound, the distance from the high tide line to the low tide line is only a few dozen feet. In other

Lesson Description	places, it can be over a mile. If the size of the tidal wave is constant (it can only go up and down the same distance) how could you change your simulation so that the intertidal zone is longer or shorter? (Answer: Change the slope of the beach. As the slope becomes closer to horizontal, the length of the intertidal zone increases.) 9. How would you change your simulation to illustrate spring and neap tides? (spring tides are especially strong and neap tides are especially weak) **Lesson 2. Intertidal Organisms** Start by revisiting the big questions and what they observed and concluded in their investigation. Students write in their notebooks any new ideas they have for the question they addressed at the beginning of Lesson 1. Show the PowerPoint of the 5 tidal zones: http://www.padillabay.gov/lessons/zones.ppt (12.3 MB) In large group discussion while students take notes: 1. Make a list of intertidal organisms (Plants and animals that live in intertidal habitats). 2. Make a list of stresses that intertidal organisms must be adapted to. (Hint: All plants and animals need air, water, food, protection from predators and harsh weather and a means of reproduction. Anything that the tide does to make these things difficult is a stress. Examples include being underwater and exposed to the air two times each day. It's a stress for underwater animals that breathe with gills to have the water go away. Exposure to the heat of the sun is a stress for water animals because warm water has little oxygen. Waves and currents can carry animals and plants away from their favored habitat so they usually favor a specific range of wave energy. Some beaches have much stronger waves and currents than others.) 3. Why would the prey of sea stars be more abundant in the high tide zone? (Answer: Sea stars are mostly found in the low tide zone because they can only move when under water. When exposed,

Lesson Description	they can be eaten by gulls. When the high tide zone is underwater, sea stars can't move fast enough to get up into the high tide zone and back down before the next low tide. Sea star prey will thrive in the high tide zone because their predators, sea stars, are absent.) 4. Other adaptation examples: Barnacles- prefer middle to upper intertidal zones where they are out of reach of the Nucella snail, but have adapted to be able to live in all tidal zones. When living in the spray zone, they can close up their impenetrable, plate-like doors to conserve water and energy and protect themselves from predators. Aggregate Anemone- adapted to survive in the intertidal zones on rocky beaches by attaching themselves to the sheltered side of rocks to protect them from the beating waves. Amphipods- are specially adapted to the spray zone, scavenging detritus and burying themselves in the sand or washed up eelgrass to stay moist when the tide is out. They feed at night, following the water line and then, using cues from the moon, return to their sandy burrows at dawn. They "hop" when on land, and swim on their side when submersed in water. Each student picks one plant or animal that lives in estuaries in this region. Some teachers might want to ensure there are representatives for each of the five tide zones and include both plants and animals. Don't forget plankton. Each student creates a report covering the topics below. Encourage students to add things beyond this list as well: 1. What is the name of your organism, both common name(s) and Latin name? 2. Specify which tide zone(s) this organism lives in. 3. Why is this organism limited to living in this tide zone? Students may have trouble finding the answer to this and may have to speculate, but students should use data/observation of the organism to come up with answers. 4. Include some interesting facts about your animal. <u>EXTENSION:</u> Some classes might make a mural or poster showing all their organisms in appropriate tide zones as a culminating project. Identification cards

	should be added to the mural to share information on the organism and plants in the display.
Resources	**Books**: Coulombe, Deborah A. 1984. *The Seaside Naturalist: A Guide to Study at the Seashore.* New York, N.Y.: University of New Hampshire MacGowen, Craig. 1997. *Mac's Field Guide to Northwest Coastal Invertebrates.* Seattle, W.A.: The Mountaineers Sheldon, Ian. 1998. *Seashore of the Pacific Northwest*. Vancouver, B.C.: Lone Pine Publishing Sept, J. Duane. 2004. *The Beachcombers Guide to Seashore Life in the Pacific Northwest*. Madeira Park, B.C.: Harbour Publishing. Snively, Gloria. 1978. *Exploring the Seashore in British Columbia, Washington and Oregon: A Guide to Shorebirds and Intertidal Plants and Animals.* Vancouver, B.C.: Gordon Soules Book Publishers LTD **Video:** Sefton, Nancy. *The World Between the Tides*. 1999. Produced by Nancy Sefton. 22 min. Video Presentations Inc. **Internet**: Tides: This site from NOAA explains tides. http://www.nos.noaa.gov/education/kits/tides/tides02_cause.html Tides: A short explanation of tides with a nice animation you can use with students. http://www.ocenservice.noaa.gov/education/kits/tides/media/supp_tide06a.html Tides: Another animation with a good explanation of tides from the Fitzgerald Marine Reserve. http://www.sfgate.com/getoutside/1996/jun/tides.html This is from Oceans Alive and shows the topography of the ocean floor. http://www.mos.org/oceans/planet/features.html

Resources	Tidal Zones: This site from southern Arkansas University is from an ecology course and describes the different tidal zones in the Pacific Northwest. There are pictures and simple descriptions. http://www.scsc.k12.ar.us/2001Outwest/PacificEcology/Projects/ThrowerE/Tidalzones.htm Enchanted Learning: A great web site for science. This page has a great graphic of the life in the tidal zones and good text for students. http://www.enchantedlearning.com/subjects/ocean/Intertidal.shtml Virtual Tide Pool: A nice interactive site with clickable creatures the provide information about each animal in the tide pool. http://bonita.mbnms.nos.noaa.gov/Visitor/TidePool/ Tide Pools and the Tidal Zones: This is a great site from the University of Oregon with beautiful photographs of the zones and the life found in each. http://www.uoregon.edu/~dwaiss/tidepools/tides.htm Tide Pool page: This site for the University of Oregon is an interactive site and provides a lot of information including links to explain tides. http://hmsc.oregonstate.edu/projects/rocky/intro.html Secrets of the Tide Pool: Another wonderful site from Think Quest that even includes puzzles and a challenge. http://library.thinkquest.org/J002608/Tidepool_home_page.html Ocean world is a site full of great information from Texas A&M. http://oceanworld.tamu.edu/index.html