Estuary Webs

National Estuaries Week

5th Grade

Themes: Food Webs, Ecosystems

Location:

Classroom and nearby water body, or closest estuary.

Remote learning modification: Students' local neighborhood, parks, lakes and rivers, beaches, etc. Adults should be mindful of park and public land closures and restrictions at this time. Don't forget to recreate responsibly.

Standards:

NGSS

5-LS2-1 Ecosystems: Interactions, Energy, and Dynamics

Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Materials:

Estuary elements: Gather as many of the following items as you can:

- Jar labeled salt water
- Jar labeled fresh water
- Jar of sand
- Rocks, grasses/cattails
- Pictures or figurines of fish, frogs, ducks, oysters, seaweed, herons, shrimp, crabs, and/or algae
- Pictures or labels for oxygen and sunlight

Activity materials: Glue, scissors, index cards, butcher paper, crayons/markers/colored pencils, map, Venn diagram, estuary cards (modified from Orange County Department of Education).

Objectives:

Students will…

1. Develop a model to describe a phenomenon that includes the movement of matter within and ecosystem. In the model, students identify the relevant components including matter, plants, animals, and decomposers in the environment.
2. Describe the relationships among components that are relevant for describing the phenomenon, including:
   i. The relationships in the system among organisms that consume other organisms.
   ii. The relationship between organisms and the exchange of matter in the environment.

Vocabulary:

Abiotic: Non-living elements of an environment such as sunlight, precipitation, wind, soil, and rocks.

Adaptation: A structure or behavior that helps an organism survive.

Bacteria: Microscopic (very small), single-celled organisms.

Biotic: Living things (also known as organisms) such as plants, animals, fungi, and bacteria in an environment.

Brackish water: A mix of salty ocean water and freshwater commonly found in estuaries. Contains sodium and chloride.

Consumer: Organisms that eat other organisms.

Decomposers: Organisms such as fungi, bacteria, and insects that get their energy from the remains of other organisms. Decomposers put nutrients back into the soil or water so that producers have nutrients to grow.

Ecosystem: All the living (biotic) and non-living (abiotic) things that interact with one another in an environment.

Energy: What is stored in matter that allows living things to grow.

Estuary: A body of water, partially enclosed by land, where salt water from the ocean and fresh water from the land can mix.

Food web: Multiple food chains in an ecosystem. Each food chain is one possible path of how energy and nutrients move throughout an ecosystem.

Freshwater: Water found in lakes, rivers, streams, and underground. Freshwater has very low concentrations of salts.

Pollution: Introduction of contaminants into the soil, water, air, or organisms that causes harm. Pollution can be chemical, noise, heat, or light.

Producers: Organisms such as plants and plankton that make their own energy from the sun or from other chemicals.

Saltwater: Water from the ocean, also called seawater. Saltwater contains high levels of sodium and chloride.

Shoreline: Where a body of water and land meet.

Watershed: An area of land where water collects and drains into a common area such as a river, lake, or estuary.

Procedure:

For teacher background on estuaries, read pages 7-9 in the Department of Ecology Estuary Guide, Estuary Habitat from NOAA Fisheries, and the Marine Shorelines webpage from Washington Department of Fish and Wildlife.

Part I

Arrange estuary elements on a table or on the floor where students can explore. Depending on your class size, you may want to have three or four different areas with the same materials so that students have enough space. Cover the elements for the first part of the lesson so that students cannot see them.

Inform students they will be learning about estuaries. Pass out or display the three photos, "Port Susan Bay", "Skokomish River Delta", and "Leque Estuary" and ask students to write down and describe what they think an estuary is based on the photos. Give them one minute. Then, ask students to pair with a partner and share their responses. Next, ask students to answer the following questions with their partner based on the three photos:

- What do the pictures have in common?
- What are differences among the pictures?
- What living things do you notice?
- What non-living things do you notice?
- Is there anything else that stands out about the pictures?
- Share student responses as a class.

After students have shared their paragraphs, watch the two-minute video, "Estuaries. More than Meets the Eye." After watching the video, ask students:

1. What is an estuary?
2. What elements of an estuary were highlighted in the video?
3. Why are estuaries important?
4. The video said, "we celebrate an ecosystem returned" What do you think an ecosystem is? Introduce the vocabulary definition for ecosystem here.
5. What's one thing that you would like to learn more about estuaries?

Ask students to analyze in their groups how estuaries differed from their original observations and how they were similar.

Next, partner students into groups of three-four and have them explore the laid-out estuary elements. Ask students to write down and discuss the following:

- List different ways you might group some of these elements together.
- How do these elements play a role in estuaries?
- How do these elements interact with another?

After students have completed both tasks, ask them to come up with a short paragraph as a team about how the elements (both living and non-living) of an estuary may or may not work together. Have each group share with the class. Write their main ideas on a whiteboard or virtual whiteboard.

Part II

Ask students why they think estuary habitats are unique compared to other sea or land habitats. Write student answers on the board and then have them watch this video, "What is an estuary?" until 1:11.

Afterward, Ask students to raise their hands and list one reason why estuaries are important. Then explain that because estuaries are a mix of fresh and salt water, this forms brackish water. In estuaries, the salt (or salinity) level of the ecosystem is always changing as the and thus the organisms who live there are uniquely adapted to both salt and fresh water. Many of the plants in estuaries filter pollutants from water to keep the ecosystem healthy.

Next, return to your table of estuary elements and model the components of an ecosystem with your laid-out estuary elements. First, group your elements into two parts:

1. Air, sunlight, soil, rocks, water, wind, and temperature
2. Plants, animals, bacteria, fungi, plankton, and algae

Ask students the differences between these two groups of elements. They should say something like, "non-living" vs. "living". Introduce the terms "abiotic" and "biotic" and reiterate that an ecosystem includes all the living (biotic) and non-living (abiotic) things that interact with another in an environment.

Ask students to think-pair-share if they think an estuary is an ecosystem, and why or why not. Discuss answers as a class. Distribute the estuary Venn diagram to students. Have students complete a comparison of saltwater and freshwater ecosystems. You can send this home for homework or have students work with a partner as an in-class assignment. Students can name biotic or abiotic features of each ecosystem type. Draw your own Venn diagram on the board and write student answers.

Part III

For the final assignment, cut out the estuary cards and place them in a bag to be used later. Have students randomly select two cards from the bag. Explain that students will be creating an estuary model in small groups (3).

After students chose their cards, ask them to remind you of what estuary ecosystems are and what makes them unique. Ask them to give you an example of how energy is transferred in an ecosystem (i.e., through producers, consumers, and decomposers). Write answers on a board so they have a visual. Next, tell students to find two other partners whose cards will tell the story of energy transfer in ecosystems. If students don't know what their species is, allow them time to research online.

Next, have student groups chose an estuary in Washington using this map. To find the estuary locations on the map, click "contents" and then under "shorelines" and "hydrogeography" you will see a button for "estuaries". They will then draw a map of their chosen estuary on butcher paper (students can also model using clay, plaster, Legos, or whatever medium they choose and have access to). Students must include the six organisms they chose out of the bag (they can add more if they like, but no less than six).

Students will label the freshwater system, the name of the saltwater area (or estuary) and nearby landforms or human-made structures. Students can use Google Earth to get a better idea of the area, if they choose.

Next, students will incorporate their estuary organisms on their map. Have students work in groups to place their estuary

pieces on the butcher paper. Each student should be able to offer an explanation as to why they place the item in a particular place (i.e., is it close to a food or water source?). Students should show relationships between organisms on the map and explain how abiotic elements play a role in the transfer of energy among the ecosystem as well. After students complete their map, have them write a short essay (one-two pages) about the estuary. They may need to do some follow-up research to complete their essay. Their essay should include:

- The name of the estuary they chose.
- A brief life description of the organisms that live in their estuary.
- How energy transfers between biotic and abiotic elements in an ecosystem.
- How the organisms in their estuary transfer energy among another.
- If there are any threats to the estuary and if so, what can people do to help?
- If there is anything unique about their estuary (i.e., does it have any rare plants or animals?)

After students finish their models, (they may need a couple of class periods) invite students to display their work in an art-walk setting. After students peruse other models, discuss the project. Questions could include:

- What is an ecosystem and how do organisms interact within ecosystems?
- How do ecosystems change?
- What if we removed an item from our estuary? (Choose at least one non-living and one living item to remove.) How would this affect the ecosystem?
- How do humans play a role in estuary ecosystems?
- How do humans benefit from estuary ecosystems?
- What's one thing you or your family could do to support healthy estuary ecosystems?

Optional extension: Have students research people's impact on estuaries. Possible research topics include:
- How has pollution, climate change, and over-fishing affected estuarine food webs?
- Research an estuarine species that has gone extinct or is endangered. How has the absence of the species affected the food web?
- Find out information about estuary restoration projects. What were the restoration goals, and what were the results of the project?

Field Trip Extension: Organize a field trip to an estuary. Have students try and identify as many species using guidebooks or mobile applications like iNaturalist. Make sure students note where they found the organism or element and what it was doing. For example, if they find pickleweed, was it in mudflats or on dry land? Were there any insects on it? Have students document their observations in a notebook or with drawings or photos. Students can make their own food webs based on their observations in the estuary.

Idea: Show off your students' work! Share student projects from this lesson with WDFW.
Facebook:@WashingtonFishWildlife
Instagram:@TheWDFW
Twitter:@WDFW
#WildWashington #WildWa

Did you teach this lesson? Give us your feedback.