

Surveying the Shoreline

Time requirement: 30+ minutes of prep time, 45-60 minutes for classroom/field exercises.

Summary of Activity: Wrack, the debris cast ashore, wash up along many tidally influence shores in Oregon and are often a main nutrient source for communities living along a shoreline habitat. The source of the wrack varies depending on the location, but time and again evidence of the watershed to ocean connection is visible along the shore. This activity can be adapted for classroom use by collecting wrack and using it inside or for field use depending on location, time availability as well as the presence of wrack at the field site. This activity is appropriate for estuarine shorelines as well as beaches and shorelines along the open coast.

Concepts to Teach: Cycles, productivity, balance and interconnectedness.

Standards Addressed: 3.2L.1, 3.2E.1, 3.3S, 4.2L.1, 4.3S.2, 5.3S, 6.2E.1, 6.3S, 7.3S, 8.3S

Instructional Strategy: Experiential learning, field experience.

Goal: Students will learn about the watershed-estuary-ocean connection by exploring and identifying shoreline wrack and identifying the organisms that live and depend on it.

Specific Objectives:

- Students will be able to identify wrack and how explain how it occurs onshore
- Students will collect data on the contents of the wrack and make a graphical representation of their findings
- Students will analyze their data and provide an explanation for the results
- Students will be able to define at least 2 species in the community that depend on the presence of wrack

Vocabulary: (definitions in Additional Resources section)

Wrack or debris, origin, biotic, abiotic, anthropogenic, erosion, runoff, estuary, watershed

Required Materials:

For the field:

- An appropriate field site (stable estuary shoreline in a marsh or tideflat or a stable open coast shoreline) around low tide.
- Buckets or trays to collect items
- Camera (at least one for the classroom, if desired more for groups of students)
- Field notebooks or worksheets (available in the Resources section on website)
- Hand lenses
- Hand Sanitizer or a place to wash hands afterwards
- Transect line (optional)
- Quadrats (optional)
- Field guides (optional)

For the classroom:

- Computer and projector to view photos of wrack in the field
- A collection of wrack from one or more sites (Keep track of where you got it from so it can be returned to its proper place when finished. Please remember to not spread invasive species!)
- Low buckets & trays
- Small collection bottles
- Hand lenses
- Hand sanitizer or a sink to wash hands
- Field guides (optional)
- A copy of the Exploring the Shoreline Inside worksheet

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Background adapted from South Slough NERR's "Explore Your Estuary" Guide, October 2009

The shoreline of the estuary changes with tidal and seasonal influences. We can look for evidence of these daily and seasonal changes along the shore and record our observations to better understand the connection between the estuary and the watershed. Wrack and debris will tend to collect in estuarine waters flowing in from freshwater streams and flooding in with the incoming tide. The debris often floats and washes along the shore leaving wrack lines along tidal flats and estuarine marshes.

Daily tides rise and fall as the ocean floods into the bay and then ebbs. This takes about 12 hours for each cycle, so we have 2 high tides and 2 low tides along the Oregon coast each day. High tides flood the estuary with salt water bringing in wrack from the ocean and lower bay. As the tide goes out, marshes and tidal flats become exposed and the wrack gets left behind marking the high tide point.

As the seasons change, so does the amount of freshwater that floods the estuary and wetlands near the shore. As water flows downhill along a watershed it tends to collect debris and sediment as it flows down hillsides into streams and wetlands. Some of that debris (naturally occurring or anthropogenic) makes its way downstream into streams, rivers and often into an estuary or bay. This collection or runoff process is increased in the rainy season. This debris will collect with the wrack already in the estuary leaving behind evidence of the upper estuary and watershed along the shore.

By walking the shoreline or sorting through a collection of wrack from an estuary, a better understanding of the watershed to ocean connection is seen as debris and wrack from vastly different ecosystems collect in one location. The content and amount of debris can tell us more about the community and connection between the watershed, estuary and ocean. Along Oregon's estuaries a variety of materials may wash ashore including eelgrass, various kelps and algae, leafy debris, crab molts, and unwanted garbage. Although the wrack may seem lifeless, the piles make nice homes for a variety of organisms. Along an unstable sandy shore the decaying debris are a main source of

energy that wash ashore daily. The animals that inhabit wrack quickly feed on decaying materials to survive and in turn provide food for bigger creatures like shore birds. An entire food web can be discovered from a wrack line!

Prerequisites

Students should be familiar with tidal cycles of Oregon's shores as well as being able to identify that an estuary is a place where fresh water from a watershed and sea water meet and mix in a partly enclosed bay. Introduction activities in the OCEP modules provide activities that will introduce these topics to students.

Preparation

If a field experience is not feasible for this activity you may collect small amounts of beach drift for the classroom. Check with local regulations at your collection site. Nothing can be taken from a reserve, preserve or National Seashore, not even drift or sand. Please be mindful that the drift is food for many creatures living along the shoreline. For beach drift/wrack take only what you need for the activity and collect as much marine debris (trash) as you can find. For the classroom exercise you may consider collecting as much as would fit in a quadrat or sample size for the whole group. This way quantifying data about wrack can still be accurate with minimal habitat disruption. Students will only need enough wrack to fill a small shallow tray per group. We do not encourage purchase of shells or other dead animals, as they are often collected in an unsustainable manner. Consider taking photos to share with the class while they explore the wrack. Separate out even amounts of wrack and debris into trays for groups of 2 to 4 students to sort through. Change the red wording on the worksheet to reflect the location of the wrack. When the activity is done, return the wrack to the beach it was collected from.

For field trip preparation, consider visiting the site ahead of time. The presence of drift is not always consistent due to storms, weather, high tides and other impacts. Fall is usually a good time for this activity or after a storm as the strong currents will pick up items and rainwater will wash varying items downstream. This activity would work well as a part of a longer field trip to an estuary or beach with additional planned field activities.

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Activity Description

Introduction:

Introduce this activity using a map of the estuary the class is studying. Review the definition of an estuary and its defining features with students using the map as a visual. Tell students you will be visiting the shoreline of an estuary.

If you choose to stay in the classroom it is a good idea to show on the map where they are "visiting" and describe what the shoreline is like using photos and information on tides, the current weather. It is important to note where the wrack was collected as well. Wrack from a salt marsh could be quite different than that of a sandy beach near

the mouth of the bay. Likewise, wrack from the upper part of the shore can be different from a lower wrack line.

If this activity is part of a field experience be sure to give information to students about what they are doing on the trip, where they will be and what they will need to bring with them. It is a good idea to introduce the worksheet ahead of time or have students create a field notebook for collecting data and notes. Before leaving the classroom and upon arrival at the field site remind students of safety protocols and precautions.

Main Activity:

In the classroom

1. Tell students that a little bit of the _____ estuary has come to the classroom! After handing out the trays of wrack to look at (no hands yet!) have a discussion about what questions can be asked about the wrack. List these questions on the board.
2. This activity is designed to have students sort and categorize wrack that has washed ashore. Discuss the types of categories or groups the wrack could be sorted in to and list these on the board. The worksheet is organized by the **origin** of the wrack as the watershed-estuary-ocean connection is emphasized in this lesson. Students may come up with categories like, living (biotic), non-living (abiotic), human derived, plants & algae, animals, etc.
3. Hand out the worksheet and define the categories listed as a class. **Watershed** will encompass anything that came naturally from land or freshwater systems (forests, wetlands, rivers, etc.), **estuary** will be anything from an estuarine habitat (tidal marshes, open water channel, tide flats), **ocean** will be anything that came from the ocean (kelp, fish bones, etc.) and last **mystery** will be for anything that didn't come naturally from the system (plastic, chicken bones, cans, etc.) or for items that have an undecided origin.
NOTE: Before handing out the trays of beach wrack check for any unsafe items that students should not be handling (broken glass, sharp objects, etc.). Students should wash their hands when done with the activity as well.
4. Students should start to sort through and identify the items in their tray. Decide ahead of time as a class if they are keeping track of a list of what they find or if they will tally how many times they find that particular item.
5. After the group has sorted through their sample have them finish the front of the worksheet.

In the field

The procedure is similar to that used in the classroom. You may choose to use quadrats and transect lines to focus student attention on a small sample of wrack or allow them to travel the wrack line collecting data more freely if more time is available. Students should still be collecting data on either the worksheet or a similarly designed field notebook. The data will be graphed and discussed further later in the classroom.

It is important to remind students to put all wrack back where they found it. Animals depend on the moist wrack to keep them wet and safe from predators while the tide is out. If desired you may give students direction on collecting marine debris while they are exploring. Take only photos and marine debris (trash); all animals, wrack, shells, etc. should remain at the field site.

Conclusion:

1. Go around the room and have groups share 1 thing from their wrack sample until each group has shared 1 different item they found. Go back through until all items identified are on the class list. This is a great time to discuss what they found as a group, tally each category, identify as a class where most of the items came from and demonstrate how to make a graph.
2. Have students graph their group's data on the back of the worksheet. A bar graph or pie chart works well to display how many different items they found in each category. In addition, students may have kept track of how many times they found each item e.g., 6 blades of eelgrass, 3 cockle shells, 1 Dungeness shore crab molt. Students can display this data as well in their graph or as separate diagrams.
3. After students have finished graphing their data have them share their group results. The class may decide if group data reflects the whole class and hypothesize why or why not.
4. During this activity students may find many things they have not seen before and are curious about. Students and instructors can use field guides, the Internet and personal experience to engage in discussion and research on beach wrack and shoreline habitats and communities. Results will vary widely depending on a number of factors including the type of habitat the wrack was collected from (sandy beach, tide flat, salt marsh, etc.) what lives there, what type of weather, how much freshwater is coming into the estuary, the tidal range. Students may find that having knowledge of the tides and watersheds will help with their discussion. Refer back to the list of initial questions to see if the data collection helped to answer any of the initial questions. Ask students what kind of studies they could do to answer those questions now?

While having plastic and garbage in wrack (known as marine debris) is a negative thing for the system, it is a very good visual for the distance items travel by way of water movement. Know your audience and engage students in appropriate discussion for these types of impacts. This is a good opportunity to encourage students to dispose of their waste properly by recycling and putting garbage in a waste receptacle.

Assessment

- Grade the worksheets for completeness, quality of graphs and level of inquiry and responses.

Adaptations & Extensions

- Use this activity as an introduction to food webs. Create a food web or web of life of the things found in the wrack sample. If the sample was collected on a sandy beach there is a good chance some students found amphipods or beach hoppers. This animal depends almost entirely on beach wrack for food. Because of this they are responsible for “cleaning” up the beach and cycling nutrients back into the system. Shore birds often search the wrack line for small amphipods.
- Explore wrack from multiple locations. Have students collect data on multiple samples and have a discussion about why they might be different. If it is collected further up the estuary near a fresh water source the items will probably look very different from that collected near the mouth of the estuary or on the open coast.
- Conduct a research project on marine debris. People are surprised to find items from as far away as Japan landing on Oregon’s shores. Marine debris and marine wrack travel on a large ocean conveyor belt system made up of expansive marine currents studied in oceanography.
- **For older students**, have them formulate an investigation and data collection to analyze the sample. In this case the worksheet may be modified or discarded for the main part of the activity.

Additional Resources:Vocabulary

Abiotic- non-living things

Anthropogenic- related to the influence of human beings on natural objects

Biotic- living things

Erosion- the washing away of soil, rocks, etc. by water and wind

Estuary- a place where fresh water and salt water meet and mix in an enclosed bay or inlet

Origin- the place where something begins

Runoff- describes water moving through the watershed to a common drainage point

Watershed- the area of land where all the water that is under it or drains off of it goes into the same place; boundaries are defined by high ridges of land

Wrack or debris- decaying or decomposing materials (algae, sea grasses, leaf litter, decaying animals, etc.) that washes ashore in an estuary, bay or beach

Standards addressed*Elementary School-*

3.2L.1- Compare and contrast the life cycles of plants and animals

3.2E.1- Identify Earth as a planet and describe its seasonal weather patterns of precipitation and temperature.

3.3S- Scientific Inquiry

4.2L.1- Describe the interactions of organisms and the environment where they live.

4.3S.2- Summarize the results from a scientific investigation and use the results to respond to the question being tested.

5.3S- Scientific Inquiry

Middle School-

6.2E.1-Explain the water cycle and the relationship to landforms and weather.

6.3S – Scientific Inquiry

7.3S – Scientific Inquiry

8.3S – Scientific Inquiry