OIMB GK12 CURRICULUM

6th Grade **45-60 minutes**

ECOSYSTEM ENGINEERS

Oregon Science Content Standards:
6.2 Interaction and Change: The related parts within a system interact and change.
6.2L.2 Explain how individual organisms and populations in an ecosystem interact and how changes in populations are related to resources.
6.3S.2 Organize and display relevant data, construct an evidence-based explanation of the results of an investigation, and communicate the conclusions.

Ocean Literacy Principle:
5. The ocean supports a great diversity of life and ecosystems

Goals: Students will be able to:

- Define the term *ecosystem engineer*
- Explain how mussels growing on the docks, and coral, are ecosystem engineers
- Explain two factors that are used to measure biodiversity

Concepts:

- Ecosystem engineers are organisms such as corals, mussels, kelp or trees, which create habitat by providing structure where other organisms can live.
- Corals (and mussels) are important ecosystem engineers which create habitat allowing an increase of biodiversity where they are growing.
- Biodiversity is a measure of species richness and species abundance.

Materials:

- Clumps of mussels collected from the docks (preferably covered with a lot of fouling organisms), one per small group of students
- Transparent plastic containers to hold the mussel clumps for observation, one per small group of students
- Chilled seawater (can float sealed bags of ice in buckets of sea water) to refresh the mussels' water throughout the day
- Magnifying lenses, one or more per student group
- Tweezers (optional), one or more per student group
- Guide books on local marine invertebrates for reference (one-page guide included if books are not available)
- Collecting permit

Background:
An **ecosystem engineer** is an organism that creates or modifies habitats. As coral grows, it modifies its habitat and enables other organisms to live in an area where they would not normally

live. We don't have access to coral here, but mussels are an ecosystem engineer as well, so we can use them to see how a marine organism can alter its habitat by providing shelter and an increased surface area for the attachment of other organisms.

Biodiversity is a measure of the number of different species living in an area (species richness), and the number of individuals of each of those species that are living in the area (species abundance).

Lesson Plan:

1. Define ecosystem engineer. Have students think of examples of organisms that are ecosystem engineers (i.e. mangroves, beavers, kelp, coral, etc.)
2. Explain the importance of coral as an ecosystem engineer in the oceans.
3. Tell students that they are going to examine how an ecosystem engineer can affect the biodiversity where it is growing. Define biodiversity for the students, and explain that biodiversity is a measure of species richness (number of different kinds of species) and abundance (total number of individuals of each species). Explain to the students that, as there is not an abundance of shallow coral in the area, mussels will be examined, but the mussels act as ecosystem engineers in a way quite similar to coral.
4. Divide the students into small groups (3-4) and have them write a data chart as shown below on a sheet of paper.

Number of different species	Number of individuals

   The students will need to measure the biodiversity on their ecosystem engineers (mussel clumps) by counting the number of different species that are on the mussel clump, and the total number of living things that are on the clump. Do an example on the board for them, such as, "a mussel clump has 4 barnacles, 2 bryozoans, 1 sponge, 4 tunicates, and 2 worms on it. How many difference species are on the mussel?" (Students answer 5). How many different organisms are on the mussel? (Students answer 13).
5. Give each small group of students a mussel clump that was collected from the docks. Tell the students to count up the number of different species on the clump, and the number of individuals of each species that they find and write the counts on their data chart. After they are finished, they will need to add up the second column to find the number of living things on the clump. They will need a long time to look at the mussels

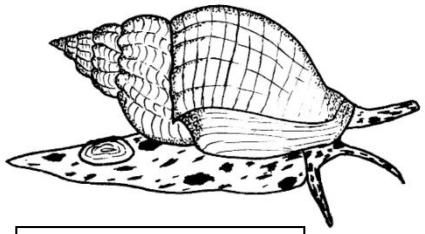
thoroughly; encourage them to pull off sponges and look in seaweed and worm tubes. Many organisms are not immediately obvious, but are found with careful observation. Often, the organisms may be small, or have burrowed into or underneath another organism. Encourage the students by writing on the board a running list of organisms found. As anyone finds an organism not already listed, they can add it to the list. Provide guide books to help with identification. Talk about the organisms as they are identified.

6. After students have completed their observations, discuss with them that this counting is a *measure* of biodiversity. Again define biodiversity. Then compare the biodiversity found on each of the *ecosystem engineers*, or mussel clumps, in the class. Write all of the students' numbers on the board. Discuss with the students the organisms they found and the comparative numbers of each. Finally, ask them how mussels (and coral) are ecosystem engineers on the docks (provide structure with nooks and crannies for attachment, change water flow, etc.). What benefits exist for the animals that are living on the mussels? Why would these animals be less prevalent if they were growing on the flat (exposed) surface of the dock? What benefit to the habitat is provided by the mussels? Etc. Have the students write their conclusions and reflections under their data chart.

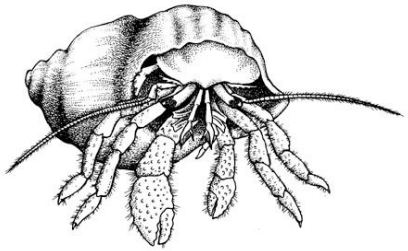
Assessment: Students' conclusions and reflections on their papers.

GK12 Fellow: Annie Pollard

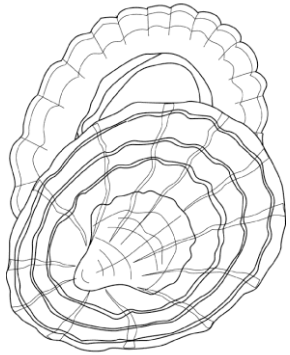
NAME_____



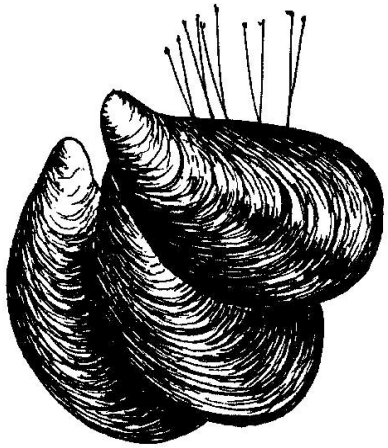
Dog Whelk



Hermit Crab

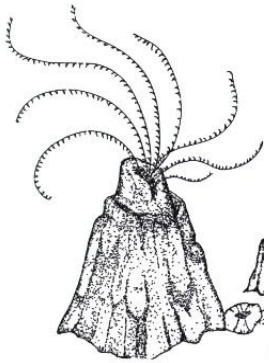


Limpet



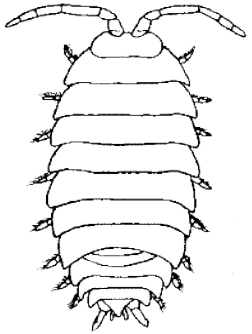
Mussel

Goose Barnacle

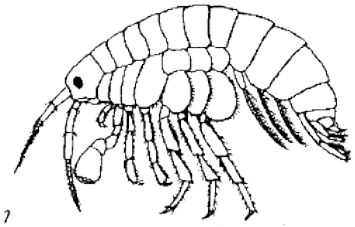


Acorn Barnacle

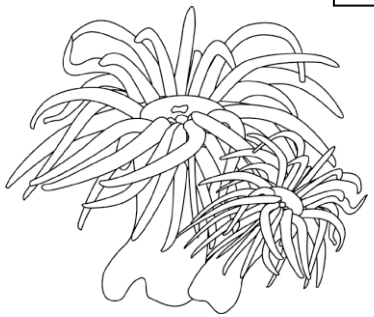
Sea Star



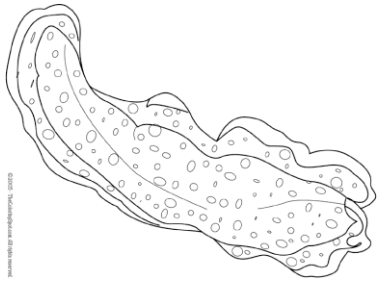
Isopod



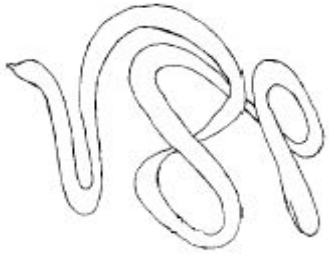
Amphipod



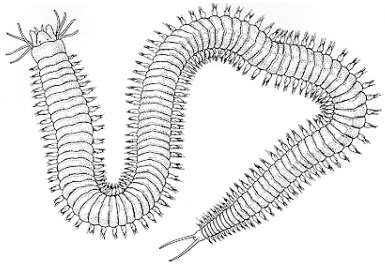
Sea Anemone



Flatworm



Ribbon Worm



Mussel Worm