

## Rocky Intertidal Ecology

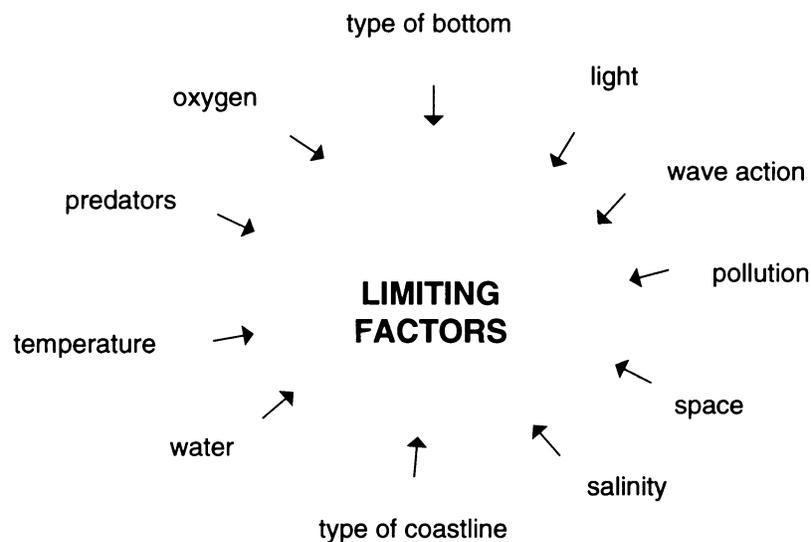
The Rocky Intertidal program at the Hatfield Marine Science Center is designed to be a 50-minute inquiry-based program that examines the dynamic environment of rocky shores and the interactions of the organisms found there. Students will learn about the complex communities in rocky intertidal areas and the ever-changing physical stresses these organisms are subjected to. During this program students will:

1. Identify rocky intertidal habitat and examine its typical inhabitants
2. Learn about environmental pressures and adaptations
3. Examine population interactions in the community

### Background Information

The Oregon Coast is often identified by its rugged rocky shores, with crashing waves and hardy creatures clinging to rocks. These areas are *intertidal* and are alternately inundated by seawater and exposed to air, wind, and dramatic changes in temperature. High tide floods these areas with cold, nutrient laden seawater, bringing food to organisms that live there in the form of *plankton* and *detritus*. Low tides often expose these organisms to the dangers of predation and *desiccation*. Because of these harsh conditions, organisms have developed special adaptations that not only help them to survive but thrive in these environments. An *adaptation* is a physical or behavioral trait that helps a plant or animal survive in a specific environment or *habitat*. *Ecology* is the study of the distribution and abundance of organisms and their interactions with their environment.

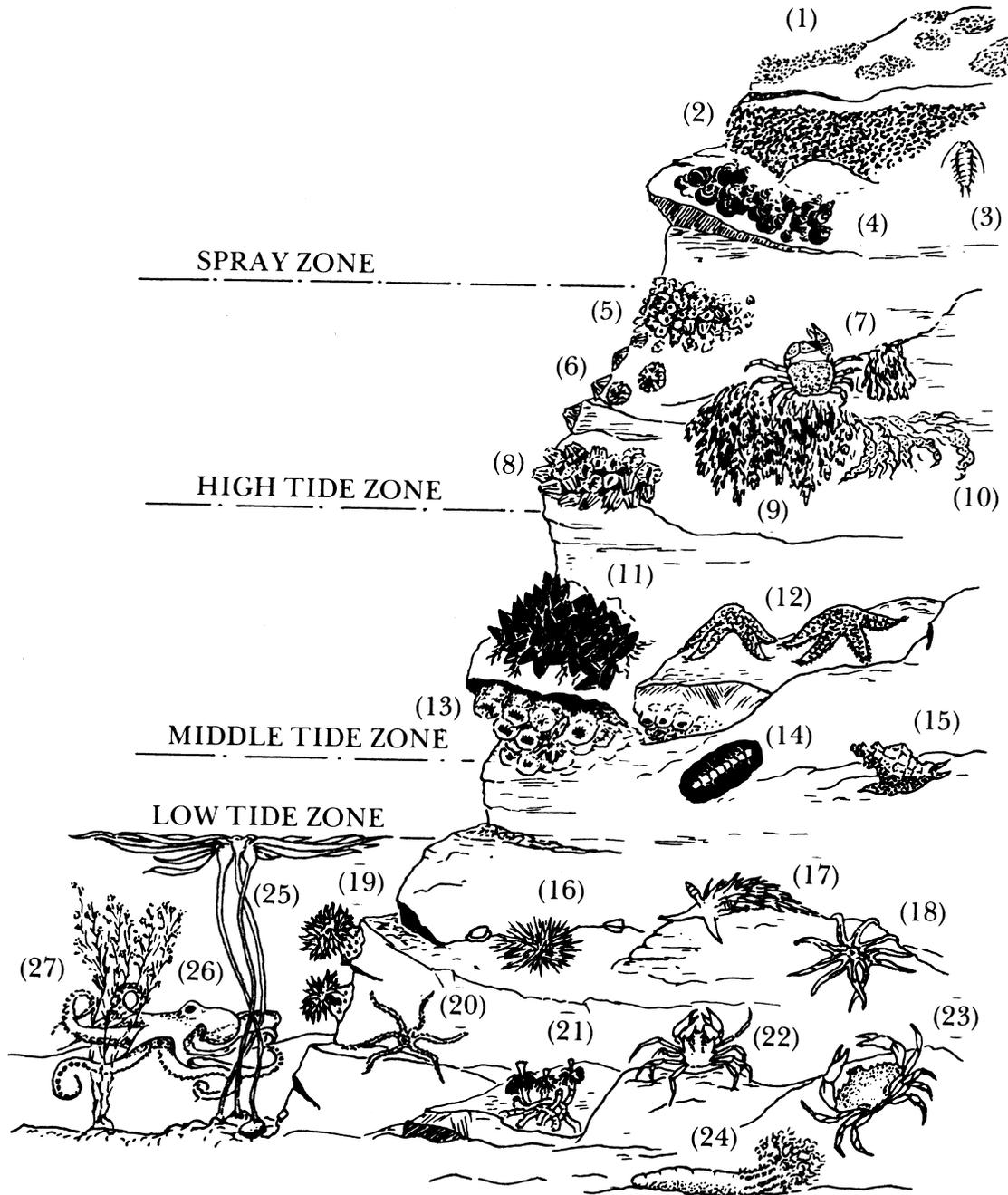
The rocky shore habitats are very diverse and can range from sheer vertical rock walls to sheltered tidepools. Rocky shores experience vertical zonation, which is the arrangement of plants and animals in distinct horizontal layers caused by *limiting factors* or a combination of what each organism can tolerate physically as well as interactions between organisms. Although some overlap does occur, plants and animals are adapted to live in certain zones on the shore and each zone contains its own unique complement of organisms.



*Examples of limiting factors that work together to determine where organisms are found in an environment.*

Rocky shores are generally broken into the following zones based on the amount and type of inundation: Spray Zone, High Tide Zone, Middle Tide Zone, and Low Tide Zone.

### Identifying Tidal Zones On A Beach



Cross-section showing vertical zonation on a rocky shore. (1) Lichens; (2) Blue-green Algae; (3) Rock Louse; (4) Periwinkles; (5) Small Acorn Barnacles; (6) Finger Limpets; (7) Rock Crab; (8) Common Acorn Barnacles; (9) Rockweed; (10) Sea Lettuce; (11) Blue Mussels; (12) Purple or Ochre Sea Stars; (13) Aggregate Anemones; (14) Black Chiton; (15) Wrinkled Whelk; (16) Red Sea Urchin; (17) Opalescent Nudibranch; (18) Sun Star; (19) Giant Green Sea Anemone; (20) Brittle Star; (21) Calcareous Tube Worm; (22) Kelp Crab; (23) Red Rock Crab; (24) Orange Sea Cucumber; (25) Bull Kelp; (26) Octopus; (27) Sargassum.



## Correlation to Oregon Science Education Standards

### **Kindergarten**

- K.1 Structure and Function: **The natural world includes living and non-living things.**
  - K.1P.1 Compare and contrast characteristics of living and non-living things.
  - K.1L.1 Compare and contrast characteristics of plants and animals.
- K.2 Interaction and Change: **Living and non-living things move.**
  - K.2P.1 Examine the different ways things move.
- K.3 Scientific Inquiry: **Science explores the natural world through observation.**
  - K.3S.1 Explore questions about living and non-living things and events in the natural world.
  - K.3S.2 Make observations about the natural world.

### **Grade 1**

- 1.1 Structure and Function: **Living and non-living things have characteristics and properties.**
  - 1.1L.1 Compare and contrast characteristics among individuals within one plant or animal group.
- 1.2 Interaction and Change: **Living and non-living things interact.**
  - 1.2L.1 Describe the basic needs of living things.
- 1.3 Scientific Inquiry: **Science explores the natural world using evidence from observations.**
  - 1.3S.1 Identify and use tools to make careful observations and answer questions about the natural world.
  - 1.3S.2 Record observations with pictures, numbers, or written statements.
  - 1.3S.3 Describe why recording accurate observations is important in science.
- 1.4 Engineering Design: **Engineering design is used to design and build things to meet a need.**
  - 1.4D.2 Demonstrate that designed structures have parts that work together to perform a function.
  - 1.4D.3 Show how tools are used to complete tasks every day.

### **Grade 2**

- 2.1 Structure and Function: **Living and non-living things vary throughout the natural world.**
  - 2.1L.1 Compare and contrast characteristics and behaviors of plants and animals and the environments where they live.
- 2.2 Interaction and Change: **Living and non-living things change.**
  - 2.2L.1 Describe life cycles of living things.
- 2.3 Scientific Inquiry: **Scientific inquiry is a process used to explore the natural world using evidence from observations.**
  - 2.3S.2 Make predictions about living and non-living things and events in the environment based on observed patterns.
  - 2.3S.3 Make, describe, and compare observations, and organize recorded data.
- 3.1 Structure and Function: **Living and non-living things vary in their characteristics and properties.**

### **Grade 3**

- 3.3 Scientific Inquiry: **Scientific inquiry is a process used to explore the natural world using evidence from observations and investigations.**
  - 3.3S.1 Plan a simple investigation based on a testable question, match measuring tools to their uses, and collect and record data from a scientific investigation.
  - 3.3S.2 Use the data collected from a scientific investigation to explain the results and draw conclusions.

## Grade 4

4.2 Interaction and Change: **Living and non-living things undergo changes that involve force and energy.**

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

4.3 Scientific Inquiry: **Scientific inquiry is a process of investigation through questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.**

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

4.4 Engineering Design: **Engineering design is a process of using science principles to solve problems generated by needs and aspirations.**

4.4D.3 Explain how the solution to one problem may create other problems.

## Grade 5

5.1 Structure and Function: **Living and non-living things are composed of related parts that function together to form systems.**

5.1L.1 Explain that organisms are composed of parts that function together to form a living system.

5.2 Interaction and Change: **Force, energy, matter, and organisms interact within living and non-living systems.**

5.2L.1 Explain the interdependence of plants, animals, and environment, and how adaptation influences survival.

5.3 Scientific Inquiry: **Scientific inquiry is a process of investigation based on science principles and questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.**

5.3S.3 Explain the reasons why similar investigations may have different results.

## Grade 6

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.

6.4 Engineering Design: **Engineering design is a process of identifying needs, defining problems, developing solutions, and evaluating proposed solutions.**

6.4D.3 Describe examples of how engineers have created inventions that address human needs and aspirations.

## Grade 7

7.2 Interaction and Change: **The components and processes within a system interact.**

7.2L.2 Explain the processes by which plants and animals obtain energy and materials for growth and metabolism.

7.2E.4 Explain how landforms change over time at various rates in terms of constructive and destructive forces.

7.3 Scientific Inquiry: **Scientific inquiry is the investigation of the natural world based on observations and science principles that includes proposing questions or hypotheses, designing procedures for questioning, collecting, analyzing, and interpreting multiple forms of accurate and relevant data to produce justifiable evidence-based explanations.**

7.3S.2 Organize, display, and analyze relevant data, construct an evidence-based explanation of the results of an investigation, and communicate the conclusions including possible sources of error.

7.3S.3 Evaluate the validity of scientific explanations and conclusions based on the amount and quality of the evidence cited.

## Grade 8

8.3 Scientific Inquiry: **Scientific inquiry is the investigation of the natural world based on observations and science principles that includes proposing questions or hypotheses and designing procedures for questioning, collecting, analyzing, and interpreting multiple forms of accurate and relevant data to produce justifiable evidence-based explanations and new explorations.**

8.3S.2 Organize, display, and analyze relevant data, construct an evidence-based explanation of the results of a scientific investigation, and communicate the conclusions including possible sources of error. Suggest new investigations based on analysis of results.

8.3S.3 Explain how scientific explanations and theories evolve as new information becomes available.

## High School

H.2 Interaction and Change: **The components in a system can interact in dynamic ways that may result in change. In systems, changes occur with a flow of energy and/or transfer of matter.**

H.2L.2 Explain how ecosystems change in response to disturbances and interactions. Analyze the relationships among biotic and abiotic factors in ecosystems.

H.2E.4 Evaluate the impact of human activities on environmental quality and the sustainability of Earth systems. Describe how environmental factors influence resource management.

H.3 Scientific Inquiry: **Scientific inquiry is the investigation of the natural world by a systematic process that includes proposing a testable question or hypothesis and developing procedures for questioning, collecting, analyzing, and interpreting multiple forms of accurate and relevant data to produce justifiable evidence-based explanations and new explorations.**

H.3S.1 Based on observations and science principles, formulate a question or hypothesis that can be investigated through the collection and analysis of relevant information.

H.3S.2 Design and conduct a controlled experiment, field study, or other investigation to make systematic observations about the natural world, including the collection of sufficient and appropriate data.

H.3S.3 Analyze data and identify uncertainties. Draw a valid conclusion, explain how it is supported by the evidence, and communicate the findings of a scientific investigation.