

On the Hunt for Eco-Relationships



Developed by: Megan Copley

Safety Procedures Adapted from:

- Oregon State Parks. Oregon State Parks Beach Safety Tips for KIDS. Salem, OR: OPRD, 2003.

Time:

- Preparation: 30 min
- Activity: 1hr 10 min

Level: Grades 3-5

Overview

Ecological relationships are important determinants in community structure. In this field-based activity students will be introduced to the concepts of predation, competition, and mutualism in a rocky intertidal habitat while acting as investigators in an ecological-relationship-scavenger-hunt. They will also learn how to safely and courteously explore tidepool areas.

Benchmarks Addressed

Life Sciences (3rd Grade):

- CCG: SC.03.LS.04 Describe a habitat and the organisms that live there. *In this activity students will be able to look at a rocky shore habitat and observe and recognize the organisms that live there.*
- CCG: SC.03.LS.05 Identify how some animals gather and store food, defend themselves, and find shelter. *Through inquiry, students will be able to recognize how rocky shore organisms act as predators and what eats whom. They will see how adaptations (i.e. shells, spines, etc.) and placements in the rocky shore work as shelter and defense against predators.*

Life Sciences (5th Grade):

- SC.05.LS.05.04 Explain the relationship between animal behavior and species survival. *Students will recognize predator-prey relationships in the rocky intertidal and see what organisms do in order to survive.*
- SC.08.LS.04.03 Differentiate between relationships among organisms including predator-prey, producer-consumer, and parasite-host. *Students will identify and discuss predator-prey relationships in the rocky intertidal as well as mutualism and competition.*

With food web post-activity:

- SC.05.LS.05.01 Use drawings or models to represent a series of food chains for specific habitats. *Students can use relationships discussed in this activity to put together a food web when they return to class.*

Learning Objectives

By the end of this activity, participants will be able to:

1. Practice safe tide pool behavior.
2. Record the different tide pool relationships they see.
2. Understand and give examples of different tide pool ecological relationships including predator-prey, competition, and mutualism.

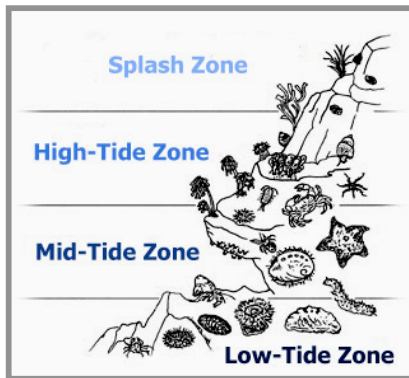
Materials Needed

- 1 journal and pencil per student.
- 1 hand-lens per student. Attach to yarn for hanging around neck.
- 1 set of laminated scavenger hunt activity cards per 4 students (Fig 1.0 & 1.1). Attach to yarn for hanging around neck.
- 1 record-keeping sheet (Fig 2.0).
- 1 laminated chart or small field guide of tide pool organisms.

Background Material

Environmental Conditions and Zones of the Rocky Intertidal

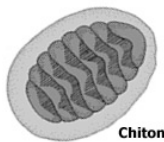
The *rocky intertidal* region (the area between the lowest and highest tide marks) is a harsh place. Environmental conditions such as incoming and outgoing *tides*, *wave force*, and *air exposure* change daily, requiring strong adaptations of rocky intertidal organisms. As the tide comes in-and-out, the intertidal region becomes divided into what is called bands or zones. The *splash zone* and *high-tide zone* are more land than sea. In these zones animals such as barnacles and limpets are highly prevalent. Both barnacles and limpets have adapted to being able to survive with high desiccation and little water. The *mid-tide zone* houses many seaweeds, mussels, and sea stars. In this zone organisms must find ways to stay moist when the tide is out and avoid predation and competition for space when the tide comes in.



The *low-tide zone* (that furthest from land) is exposed to air only when the lowest low tides occur (a few hours every month). In this zone, top predators like sea stars and fish are more abundant than in any other zone.

Organismal Adaptations to Environmental Stresses in the Rocky Intertidal

For protection from strong waves, organisms such as snails, chitons, and sea stars use large surface areas of strong muscular tube feet for holding on to rocks. Mussels secrete glue-like threads that allow them to adequately stay in one place. Structure of organisms can also be used for their protection in the intertidal.



Chiton

Flat shapes (i.e. chitons, limpets, barnacles, and crabs), strong shells (i.e. snails, crabs, barnacles, and mussels), and flexibility (i.e. anemones and seaweeds) are a few of the adaptations for protection in changing sea conditions. For battling air exposure



Anemone

many organisms seal themselves (i.e. limpets and snails) or layer (i.e. seaweed) in order to keep water inside and have less surface area exposed to the air.

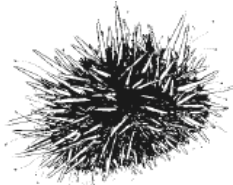
Diversity in the Rocky Intertidal

A rocky intertidal community houses a large surface area of rocks, cobbles, and seaweeds within a very small geographic area. These surfaces create a diversity of *refugia* for marine organisms. Organisms use all sides of a rock (including the underside) and you will notice when exploring the tide pools that most every crevice of the intertidal region is housing marine organisms of all types and shapes. Some are even microscopic!

Ecological Relationships and Community Structure in the Rocky Intertidal

With so much diversity intricately packed into a small area, ecological interactions will occur. There are three main types of relationships in the rocky intertidal: *predator-prey*, *competition*, and *mutualism*.

Predation is the consumption of one organism (the *prey*) by another organisms (the *predator*) in which the prey is alive when the predator first attacks it. Predation can come in the form of *herbivory* (where predators eat plants), *carnivory* (where predators eat other animals), *omnivory* (where predators eat from different trophic levels i.e. plants and animals), and *parasitism*. As a prey in the rocky intertidal, protection from predators comes from shells or spines (i.e. snails, limpets, urchins, etc.), crevices, rocks, pits (i.e. urchins) or camouflage.



Purple sea urchin

Competition can be between the same species (*intraspecific*) or between two different species (*interspecific*). The *competition for space* is most easily seen in the rocky intertidal (i.e. barnacles and limpets).

Mutualism occurs when two organisms work together to benefit each other. The best example in Oregon's rocky intertidal is between algae and sea anemones in which each one provides essential nutrients and energy for the other. Without this relationship neither would survive.

All three of these ecological interactions affect the assemblage of the rocky intertidal community. The combination of environmental conditions, individual biological factors, and ecological interactions all determine the numbers, types, and distribution of organisms in any community.

Activity Description:

Step 1. Discussion of Tide-pool Safety and Etiquette (5 min):

1. Reiterate the following **safety rules**:
 - Explain that **the ocean is not a swimming pool**. There are lots of dangers such as strong waves, drift logs, wobbly rocks, and cliffs that could hurt someone badly if not careful.
 - **Don't turn your back on the ocean**: large sneaker waves could knock you over and pull you down.

- ❑ **Keep an eye on the tide level:** the last thing you want is to get stranded in a tide pool area; swimming back in the ocean is not a good idea.
 - ❑ **Do not step on drift logs:** a drift log is strong enough to pull you over.
 - ❑ **Watch your step:** the intertidal is full of loose rocks and slippery seaweed. Make sure to step carefully and slowly. No running!
2. Reiterate the following **tide pool etiquette:**
- ❑ Explain that the **tide pools are home to many organisms**. Therefore we must **not take anything out of the tide pools**. If you pick up an organism, make sure to put it back exactly where you found it. How would you like it if someone took you away from your home and didn't put you back?
 - ❑ **Put rocks back if you flip them over.** By not doing so, you could hurt an animal that uses that rock for shelter by removing them from water or exposing them to predators.
 - ❑ **Watch your step.** There are lots of animals living on the rocks and we don't want to hurt them by stepping on them.

Step 2. Discussion of Predation and Competition (10 min)

1. Use the questions below to get a discussion going on tide pool relationships, including predation and competition.

Q: What did you have for breakfast this morning?

A: If they say cereal, ask them where cereal comes from? They should catch on to the fact that it comes from grain and that grain is a plant. Tell them that animals that eat plants are called *herbivores*. If they say eggs or ham, ask them where these come from? They should understand that these two products are animals. Tell them that organisms that eat only other animals are called *carnivores*.

Q: Are humans *herbivores* or *carnivores*?

A: They should be able to see that humans eat both plants and animals. Explain that organisms that eat both plants and animals are called *omnivores*, thus humans are omnivores.

Q: What it is called when one organism eats another live organism?

A: Predation.

Q: What is the term given to the organism that is eaten?

A: *Prey*, which is eaten by a *predator*. Explain that just as humans need to eat in order to get energy, so do organisms in the tide pools. In fact, tide pools are full of predator-prey relationships with both animals and plants.

Q: Do any of you have brothers or sisters?

Q: For those of you with siblings, do you ever argue with them?

Q: What kinds of things do you argue with them about?

A: This could be anything. Just make sure that it is of a competitive nature, like fighting over the front seat in the car or who gets to play with a certain toy next.

Q: Would you say that these arguments are of a competitive nature?

A: Explain that in the tide pools there is *competition* between organisms too. These competitions are not necessarily over the same things as those you have with your siblings, but many times organisms in the tide pools compete for space or food.

Step 3. Eco-Relationship Scavenger Hunt (35 min)

1. Introduction and Instructions to the Scavenger Hunt (5 min)

- Tell students that today they get to be investigators in the tide pools! Tell them that you are going to send them on a scavenger hunt where they will have to find evidence of predation and competition. But before they can go on the scavenger hunt, they must listen to the instructions. They must also promise that they will practice the safety rules and tide pool etiquette that was discussed earlier.
- Divide the class into groups of 2-4.
- Tell them that they must stay with their group at all times while out in the tide pools and define the boundaries of the scavenger hunt.
- Explain that each group is going to get a 'clue card' with one item that their group is in charge of finding in the tide pools.
- Hand out clue card #1 to each group (fig 1.0-1.1). Tell the group to turn the card over in order to read the instructions with the facilitator (yourself).
- Explain that when the group finds the item in the tide pools that best fits their clue card, each person in the group will follow the instructions on the back of their card. Read the following instructions with them:

- 1) Draw a picture of what you see.
 - 2) Write a short description of what you see.
 - 3) Answer the following questions:
 - Is this an example of predation or competition?
 - If predation, label the predator and prey.
 - If competition, what is being competed for?

- Explain that when the group has completed these instructions they may come to you to get a new clue card.
- Ask them if they have any questions about the instructions.
- Pass out hand lenses to each individual in a group. Explain that they can use these to look at close-up details of the organisms they see, like the suction feet of a sea star. Tell them that each group is

in charge of keeping track of their clue card as well as their hand lenses.

- Let them begin.

2. Activity (30 min):

- Check in on groups periodically. Make sure they understand the rules and help identify organisms. If helpful, carry a field guide or laminated key chart with you (see 'Recommended Reading' and 'Additional Resources').
- Make sure they are following the safety rules and etiquette. Remind them that in order to do the scavenger hunt, they must be safe and kind in the tide pools.
- Hand out another clue card when a group has completed the instructions on their first clue card. Check that each participant did all the directions on the back of the clue card.

Note: there are 3 clue cards that look for predation (#1-3) and 3 clue cards that look for competition (#4-6). If time is running out, make sure that each group gets to try at least one predation and one competition card.

- Round up participants on the beach when 5 minutes left.

Step 4. Gauging Understanding- Discussing Observations (15 min)

1. Use the following questions to discuss and elaborate examples of predation and predator-prey relationships that groups found:

Q: May I have a volunteer raise their hand and share their picture and description for Clue Card #1?

Q: Was this an example of predation or competition? Who was the predator and who was the prey?

A: *Predation.* Possible answers could be: a sea star (*predator*) eating a mussel, limpet, or periwinkle (*prey*); a sculpin (*predator*) eating a bug or zooplankton (*prey*); or a whelk (*predator*) eating a limpet (sometimes signified by a hole in the limpets shell - *prey*).

- Repeat questions for Clue Cards #2 & #3, which target predator-prey relationships too.
 - Possible answers for #2: snail (*predator*) on seaweed (*prey*) or seaweed (*prey*) and urchin (*predator*).
 - Possible answers for #3: urchins in pits, sea anemone's in crevices, or crabs under rocks. Use this to discuss how as prey, organisms will find ways to hide or reduce the probability of getting eaten by a predator such as a bird, sea star, or crab.

3. Use the following questions to discuss and elaborate examples of competition and what gets competed for in the tide pools:

Q: May I have a volunteer raise their hand and share their picture and description for Clue Card #4?

Q: Was this an example of predation or competition? What was being competed for?

A: Competition. Space. Possible examples could be a limpet and barnacle next to each other or different animals in a specific tide pool.

- Repeat this set of questions for Clue Cards #5 & #6, which both target competitive relationships.
- Possible answers for #5: 2 different plants next to each other.
- Possible answers for #6: sea anemones and urchins. Suggest that when food is limited there could be increased competition between two organisms in order to get enough food to survive.

4. Use the following question to define another type of relationship - mutualism:

Q: Are competition and predator-prey relationships the only interactions in the tide pools?

Q: What could be some other ways in which organisms interact? What if both worked together? What could this be called?

A: Mutualism/symbiosis. In this relationship both organisms benefit by working together. Some examples include algae that grow on sea anemones. The algae give the sea anemones their green color and depend on the sea anemone for nutrients, while the sea anemone depends on the algae for large inputs of energy. Without this relationship both would probably die because they wouldn't be getting essential nutrients and energy.

Q: Has anyone ever seen Finding Nemo? What kind of fish is Nemo? Can anyone tell me what kind of animal Nemo lives in?

A: Nemo is a clown fish living in an anemone.

Q: What does Nemo provide for the anemone if this relationship is mutualistic?

A: Clown fish aerate the anemone as well as shake off parasites that try to live on the anemone.

Step 6. Wrap Up (5 minutes)

1. Use the following questions to debrief and evaluate understanding of concepts:

Q: How do we define predation?

Q: What are 3 examples, here in the tide pools, of a predator and its prey?

Q: How do we define competition?

Q: What are two examples of competition in the tide pools?

Q: What is the last relationship we talked about?

Q: What is an example of a mutualistic relationship?

- Reiterate that all these relationships determine where organisms live and how they live. These relationships are part of what determine the rocky intertidal structure we have observed today.

Additional Reading/Resources

Armstrong, P., Conner, J., Parsons, C., Rand, J., and J. Vuturo-Brady. 1996. *Sea Searcher's Handbook: Activities from the Monterey Bay Aquarium*. Monterey, CA: Roberts Rinehart Publishers. This book provides supplemental activities for before/after field trips or any time in the tide pools. Activities are geared towards exploration of ocean ecosystems including the rocky shore.

BBC Video. 2001. *The Blue Planet Seas of Life: Collector's Set 4 Disc*. Produced by Alastair Fothergill and Narrated By David Attenborough. All four discs use beautiful graphics of mega fauna to target predator-prey relationships of different organisms in the sea. Disc 4 particularly focuses on the rocky intertidal.

Harbo, R.M. 2004. *Whelks to Whales: Coastal Marine Life of Oregon, Washington, British Columbia and Alaska*. Madeira Park, BC Canada: Harbour Publishing. A useful field guide for out in the rocky intertidal. Full of colored pictures that accurately help you find things in the tide pools.

Niesen, T.M. 1982. *The Marine Biology Coloring Book*. New York, NY: HarperCollins Publishers, Inc. This book has 200 pages of interactive scientific drawings of ecological and biological concepts in marine biology. Each coloring page is accompanied by background information for a great introduction and expansion on key concepts.

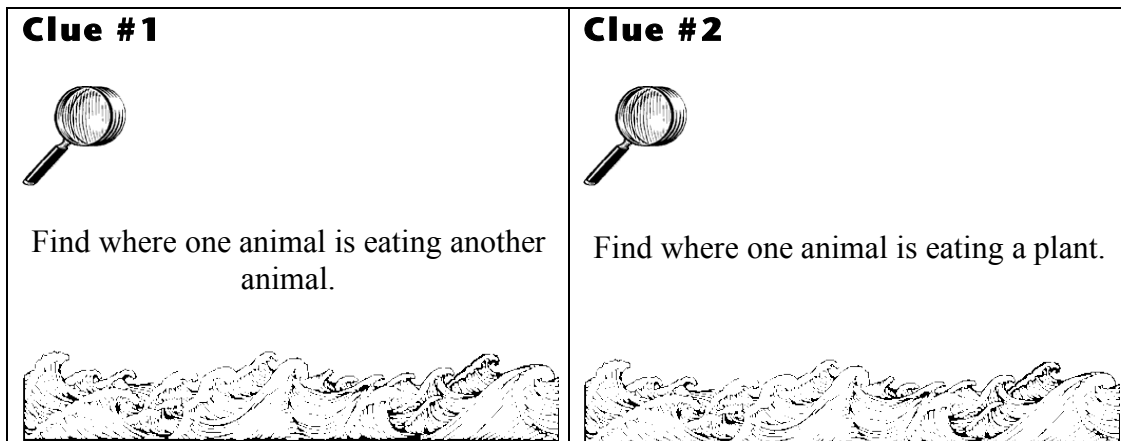
Frances, P., Guerrero, A.G. and F. Cousteau 2006. *OCEAN: The World's Last Wilderness Revealed*. American Museum of Natural History and DK Publishing. New York, NY. A breathtaking photographic journey through the ocean sciences and the organisms that live there. Useful in expanding ocean studies past rocky intertidal or bringing in a multicultural perspective to rocky intertidal life.









Russo, R., P. Olhausen 1981. *Pacific Intertidal Life*. Nature Study Guild Publishers. Rochester, NY. If size is an issue, but you still want to have a field

guid in the tide pools, this one is small and detailed enough to help you identify intertidal organisms.

Supplemental Worksheets:

➤ Fig 1.0: Eco-relationship scavenger hunt activity clue cards (front side)



<p>Clue #3</p>  <p>Find an animal that is trying to avoid being eaten.</p> 	<p>Clue #4</p>  <p>Find where 2 animals are trying to share the same space.</p> 
<p>Clue #5</p>  <p>Find where 2 plants are trying to share the same space.</p> 	<p>Clue #6</p>  <p>Find 2 animals that could eat the same food.</p> 

➤ Fig 1.1: Eco-Relationship Scavenger Hunt Activity Clue Cards (Backside) - Instructions

<p>Clue #2 - Instructions</p> <ol style="list-style-type: none"> 1. Draw a picture of what you see. 2. Write a short description of what you see. 3. Is this an example of predation or competition? <ul style="list-style-type: none"> • If predation, label the predator and prey. • If competition, what is being competed for? 	<p>Clue #1 - Instructions</p> <ol style="list-style-type: none"> 1. Draw a picture of what you see. 2. Write a short description of what you see. 3. Is this an example of predation or competition? <ul style="list-style-type: none"> • If predation, label the predator and prey. • If competition, what is being competed for?
<p>Clue #4 - Instructions</p> <ol style="list-style-type: none"> 1. Draw a picture of what you see. 2. Write a short description of what you see. 3. Is this an example of predation or competition? <ul style="list-style-type: none"> • If predation, label the predator and prey. • If competition, what is being competed for? 	<p>Clue #3 - Instructions</p> <ol style="list-style-type: none"> 1. Draw a picture of what you see. 2. Write a short description of what you see. 3. Is this an example of predation or competition? <ul style="list-style-type: none"> • If predation, label the predator and prey. • If competition, what is being competed for?
<p>Clue #6 - Instructions</p> <ol style="list-style-type: none"> 1. Draw a picture of what you see. 2. Write a short description of what you see. 3. Is this an example of predation or competition? <ul style="list-style-type: none"> • If predation, label the predator and prey. • If competition, what is being competed for? 	<p>Clue #5 - Instructions</p> <ol style="list-style-type: none"> 1. Draw a picture of what you see. 2. Write a short description of what you see. 3. Is this an example of predation or competition? <ul style="list-style-type: none"> • If predation, label the predator and prey. • If competition, what is being competed for?