

CONNECTED ECOSYSTEM

INTRODUCTION

Students will play a game as a class to learn about living and non-living components of an ecosystem and natural cycles. By exploring the relationship between a coral reef seastar and the resources in its environment, students will begin to understand an animal's reliance on its ecosystem and all its parts.

A follow-up PowerPoint lesson is available on the MCR LTER education website to emphasize the concepts introduced in this lesson in a more formal format and bring in more *Ecosystem* state standards.

OBJECTIVES

Students know:

- Ecosystems are made of animals and plants (biotic) working together with the abiotic (non-living) components of their habitat, such as light, temperature, food, and shelter.
- Interactions with both the living and non-living components of an organism's ecosystem are essential for an organism's survival.
- Natural ecosystems go through cycles, which can be altered by natural and human-induced disturbance.

CALIFORNIA STATE SCIENCE STANDARDS / EDUCATION AND THE ENVIRONMENT INITIATIVE

4 th Grade Life Science	EEI Learning Objectives
3a. Students know ecosystems can be characterized by their living and non-living components.	Students will: <ul style="list-style-type: none">• Recognize that the living and non-living components of an ecosystem and the interactions among them produce the resources that are required for the survival of the living components of the ecosystem.

BACKGROUND

Ecosystems are made of living organisms working together with the non-living components of their environment, such as soil, atmosphere, water, and heat and light from the sun. The living parts of an environment are termed *biotic*, while the non-living components are called *abiotic*. On land, humans depend on the atmosphere for oxygen to breathe and carbon dioxide to help the plants they eat grow. In the ocean, plants and animals rely on oxygen and carbon dioxide dissolved in the water. They also depend on plants near the surface receiving sunlight, and are adapted to certain temperatures. Just like on land, some animals survive in certain ecosystems better than others. Few plants and animals can survive in the cold near the poles, but others can survive in the warm clear water surrounding coral reefs. Organisms adapted to certain environments must meet their needs using the resources around them for survival.

Crown of Thorns Seastars, *Acanthaster planci*, are voracious coral predators. They require oxygen to survive, and prefer calm reefs with shelter from strong currents and large territories with lots of food. Recent years have seen "outbreaks" of Crown of Thorns Seastars, which have been known to wipe out coral populations. Scientists are researching whether these outbreaks are occurring as a part of a natural cycle or if the natural cycle has been altered by human activity.

MATERIALS

- A large open area, possibly the school yard
- Sidewalk chalk, tape, or an area already marked with two parallel lines ~30 to 50 feet apart
- 30 Connected Ecosystem Worksheets (optional)

PREPARATION

- Secure a large area where your class can play the game.
- Draw two lines about 30 to 50 feet apart, if lines are not already present.

ACTIVITY (40 minutes)

- Lead a discussion with your students about ecosystems.
 - *Remember the food chain hide and seek game? What kinds of interactions were your animals experiencing?*
 - Competition, predation.
 - *These types of interactions are with other living things in an ecosystem, can you think of any interactions with non-living things?*
 - Looking for shelter, adaptation to light, having enough space, proper salinity, breathing oxygen from the water, wave action/currents.
 - Discuss how the interactions described here, with both living and non-living things, determines an animal's (or plant's) survival.
- Have students count off in threes, dividing the class into three groups. Have all the "ones" stand behind one line, and all the "two" and "threes" stand behind the other line. The "ones" will become Crown of Thorns Seastars and the other students will become the ecosystem components: food, shelter, space, and oxygen.
- At the beginning of each round, seastars must choose which resource to look for during that round. They cannot change this resource once a round begins, but may switch before the next round if they survive.
 - When a seastar is looking for food, it should hold its hands over its stomach.
 - When a seastar is looking for shelter, it should hold its arms over its head, like a tent.
 - When a seastar is looking for space, it should hold its arms out to the side.
 - When a seastar is looking for oxygen, it should make a sweeping motion towards its mouth, like bringing in air to breathe.
- The students who are acting as the components of the seastar's ecosystem will choose which resource they will be at the beginning of each round, and depict this with the same gesture the seastars use.
- Begin the game with all players lined up on their respective lines, with their backs to the players on the opposite line. Count the number of seastars.
 - Ask all students to choose their sign. When all students are displaying their signs, count to three and have the lines turn and face each other.
 - Seastars will run to the ecosystem line, grab a student displaying the ecosystem sign they were looking for, and bring that student back to the seastar line. The ecosystem component they bring back should remain on the seastar line for the next round (representing a seastar that has been able to meet its needs and reproduce).
 - Any seastars who fail to find the resource they were looking for will "die" and become a part of the ecosystem. They should join the students on the ecosystem line for the next round.

- Continue to play 10 to 15 rounds. Keep track of the number of seastars at the beginning of each round.
- At the end of the activity, gather students to talk about their experience. *What did they notice?*
 - *Did some students do better than others at finding the resources they needed? How?*
 - Make a list of the number of seastars at the beginning of each round and have students help construct a graph on the board. *Is there a pattern? In nature, what might cause these patterns?*
 - The seastar group should grow initially, but decrease as the ecosystem becomes depleted before increasing again in a time of excess resources. You should observe a couple of these natural cycles throughout the game, and discuss this interesting pattern with your students.
 - *How might these natural cycles be altered?*
 - Loss of predators, loss of competitors, storms, pollution, overfishing...
 - *What are some other non-living components of an ecosystem that are important to us or other animals?*
 - You may choose to discuss these questions as a group and then assess student comprehension by having them complete the Connected Ecosystem Worksheet.
- Have students keep these concepts in mind as you continue to talk about ecosystems in the coming weeks.

EXTENSIONS

- Follow-up this lesson with the PowerPoint offered on the Moorea Coral Reef LTER education page to emphasize terms and delve deeper into the topic.
- Repeat the game introducing limiting factors. If the water is polluted, have the ecosystem students secretly decide that no one can provide coral food for the crown of thorns seastars to eat. If there is a storm, perhaps there is no shelter for the seastars. Draw a new graph and see how disturbances alter natural cycles.

This lesson also fulfils:

OCEAN LITERACY: ESSENTIAL PRINCIPLES AND FUNDAMENTAL CONCEPTS

1. The Earth has one big ocean with many features.

REFERENCES

The Educator's Reference Desk. Oh Dear!

<http://ericir.syr.edu/cgi-bin/lessons.cgi/Science/Ecology>

Unique Australian Animals. Crown of Thorns on the Great Barrier Reef Australia.

<http://home.iprimus.com.au/readman/crown.htm>

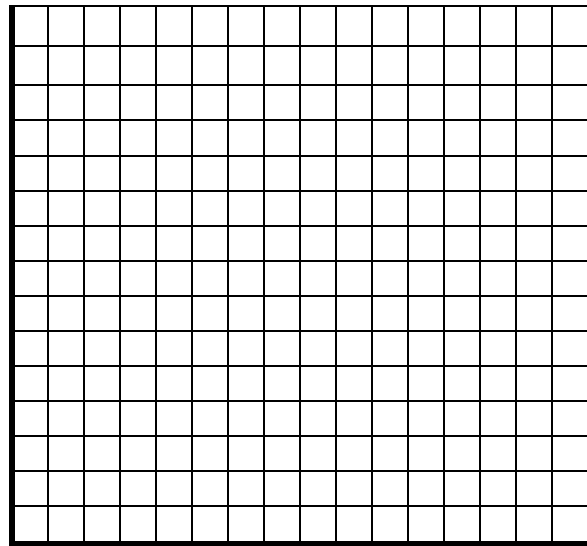
Connected Ecosystem Worksheet

1. Did you notice anything interesting during this game? Did some students do better than others at finding the resources they needed?

2. Make a list of the number of seastars at the beginning of each round. Graph your results. Do you notice a pattern?

Round	# of Seastars
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

of Seastars



Round

3. In nature, what might cause these patterns?

4. In nature, what could alter these natural cycles?

5. What are some other non-living components of an ecosystem that are important to us or other animals?