Activity 7:
Rockweed Harvesting Game

Learning Targets:

- Explore the concept of sustainability using a model of Maine's rocky shore.
- Investigate and explore a way to maintain a sustainable rockweed industry.

Length: 45 - 60 minutes

Essential Questions:

1. What characteristics do scientists use to identify seaweed species?
2. What do we mean by sustainable harvesting of seaweed?
3. What is carrying capacity?

Enduring Understandings:

1. Scientists use appearance, adaptations, and location to identify seaweed species.
2. In sustainable harvesting, seaweed is not completely used up and can reproduce over time.
3. Carrying capacity is the maximum population that can be supported in one area.

Background for Facilitator:

Seaweeds are an important marine resource that humans use for wrapping sushi, for thickening ice cream, and for adding to cosmetics, pharmaceuticals, and animal feed. Seaweed is also important to us because it serves as habitat for other sea life that we depend on. Even though most of the global seaweed production is farmed, there is still a large industry based on wild harvesting. In Maine, there is a large rockweed industry that supplies seaweed for fertilizer and livestock feed by harvesting it from the rocky shore. Since rockweeds are long-lived and provide such great habitat for over 100 other species, it is especially important that we don't harvest this species in greater amounts than it can repopulate. Sustainability refers to our ability to preserve the number of resources. We can use these resources, but we can't use them all up or destroy them. The sustainability of a fishery like this one depends both on the area being harvested, and on how much seaweed is being taken. In this game, youth will

have an opportunity to demonstrate their response as consumers of a resource (in this case, rockweed). The rocky shore represents the area of potential harvest, and the rockweed represents the resource the consumers want to use.

Vocabulary List:

Sustainable: able to be used without being completely used up or destroyed.

Fishery: the occupation or industry of taking fish or other animals (such as shellfish or seaweed) from the sea.

Carrying capacity: the maximum population that an area will support without deteriorating.

Key Concepts:

- Wild-caught seaweed (and other marine creatures, such as fish) populations have a carrying capacity. That means there are only so many that can live in one place. It is okay to harvest them if we do not go over that number and allow time for reproduction. If we harvest too many at one time, then we can harvest them to extinction.
- Aquaculture is one way to restore wild populations of organisms. Aquaculture is the rearing of aquatic plants or cultivation of plants for food and other uses.

Materials:

- 5 Pressed Rockweed Samples
- 5 Gulf of Maine Seaweed Guides (**Facilitator Note: find in Activity 1 bag**)
- 4 Rocky Coastlines (1 per group)
- 100 Rockweed images (16 per group, with some leftover)
- 5 Rockweed Data Sheet (1 per group)
- Clock or watch (**Facilitator Note: not included**)

Methods:

Engage

1. Divide the group into four cooperative learning groups.
2. Distribute one pressed Rockweed sample and one Gulf of Maine Seaweed Guide to each group.
3. Encourage youth to take another look at the rockweed species (Bladderwrack, *Fucus* sp.), which they may recall from the Maine Seaweed ID activity.
    a. Who remembers this seaweed, named "Rockweed" or "Bladder wrack", from the first activity?

b. How do you recognize it when you see it? How can you tell it apart from other seaweeds?

4. Prompt the youth to describe Rockweed on a sheet of paper.
    a. Using your observations of the rockweed sample in front of you, and the Seaweed Guide, come up with a way to describe this species to someone who hasn't seen it before but wants to collect some from the coast of Maine.
    b. What are the characteristics of this seaweed that they should know about?
    c. What other information, besides its looks, would be important for this person to know about?
    d. How will you prevent them from collecting another species by mistake?

    Answers: characteristics to distinguish from knotted Wrack/Rockweed: flattened blade with branching tips and air bladders.
    e. How many Rockweeds do you recommend this person take from the coastline?
    f. Record some notes.
5. Direct each group to present a way they would describe Rockweed to someone who has never seen it before.

Explore

6. After the presentations, tell them that Rockweed is a very important natural resource to Mainers.
    a. Rockweed is a long-lived species that provides important habitat for over 100 other species such as fish, crabs, shellfish, and other sea creatures.
    b. Rockweed is harvested from Maine's rocky shores and used in fertilizers and animal feed.
7. Engage youth in a discussion of sustainable harvesting:
    a. Does anyone remember what rockweeds have that help them attach to a rock? **Answer: Holdfasts**
    b. What do you think would happen if we took all of the Rockweed from the rocky shore?
    c. What would happen to the sea animals that depend on the Rockweed?
    d. What would happen if we ran out of Rockweed to use for fertilizer and animal feed?
8. Introduce the idea of carrying capacity.

a. A rock can only support a certain number of seaweeds given the space available for each holdfast.
b. The maximum number of individual seaweeds that can live in one place is called the **carrying capacity**.
c. Today, we will be playing a game all about the carrying capacity of Rockweed!

Explain

9. Distribute one Rocky Coastline with 16 Rockweed images attached to it and one Rockweed Datasheet to each group.
10. Introduce the game with a discussion of the ground rules, supplying only the information needed to get the participants started. A discussion of problems and strategies will surface as the youth play the game.

Ground Rules

a. The object of this game is to harvest as much Rockweed as possible from the coastline over the course of **four rounds**.
b. Count how many Rockweeds are on your group's rock. Give them a few moments to do this. Each group should have 16.
c. This is the rock's carrying capacity, or the maximum number of seaweeds that can live on this rock. At carrying capacity, there are 16 Rockweeds on each rock.
d. Write this number down on your Rockweed Data sheet under "Carrying Capacity".
e. Each group represents a team of fisher-people.
f. Your team will have four 20-second trials in which to harvest rockweed. We will tell you when each trial starts and stops.
g. For each round, your team can either harvest all of the rockweed, some of the rockweed, or none of the rockweed.
h. Every Rockweed that remains on the rock after each trial will reproduce, so a new Rockweed will be added. Each round, the number of Rockweeds on your group's rock will double. However, the total number of Rockweeds on the coastline cannot be more than the rock's carrying capacity of 16.
i. Use the Rockweed Datasheet to keep track of how many Rockweeds your team harvests.
j. Each fisher-person may only use one hand when harvesting Rockweed! Remember, you are a team. You must work together to harvest as much as possible over the four trials.

11. Play all four rounds of the game one time. *Note: if one team chooses to harvest all of the rockweed during the first round, they will not be able to

harvest rockweed for the other three rounds. They must wait until the game is over for a chance to play again.

12. Distribute extra Rockweeds for the groups who leave some on the rock to reproduce.
13. Ensure that the youth are filling out the Rockweed Datasheet in its entirety.
14. After four rounds, facilitate a quick debrief of the game:
    a. How many Rockweeds did each group harvest?
    b. Why were Rockweeds only replaced if some remained on the coast?

Elaborate

15. Explain that each team will be given a chance to play again.
16. Encourage each team to improve their strategy.
    a. Take a few minutes to discuss and improve your harvesting strategy within your groups.
    b. What will you do differently this time? What will you do the same?
17. Play the game as many times as you have time for, making sure the youth use the Rockweed Datasheet to keep track of their harvest.

Evaluate

18. Engage the youth in a discussion of their experience. Then have them record answers to the questions below.
    a. What were some ways that you improved your strategy?
    b. What strategies worked in this game? What didn't work?
    c. Is it possible to keep harvesting Rockweed forever?
    d. How can we make sure humans don't over-harvest a species to extinction?
    e. How do you think aquaculture can help in areas where a species has been overharvested?

Extension Ideas:

- Repeat the demonstration with six participants in each group to simulate population growth. Keep all other factors constant.
- Add other species, such as crabs or fish, to the rocky coastline that will be positively or negatively affected by the rockweed population.
- Add competitors, such as other seaweed species of no commercial value, that may take up space on the rocky coastline and prevent rockweed from reproducing.

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