SeaKeepers Documentary Series

Lesson 1: Marine Food Webs

Grade Level: 4-6 **Estimated Time: 60 min**

Lesson Overview:

Our oceans face many threats today, including climate change and pollution. In order to protect and preserve our oceans, we need to understand these threats and how the oceans respond to them. The International SeaKeepers Society supports marine research and education by connecting scientists with yacht owners, creating research opportunities for scientists to better understand our oceans - and to create plans to protect them.

You don't need to be a scientist to help save the oceans! Understanding marine ecosystems and how we affect them is just as important. This lesson explains why each level of a food web is important in an ecosystem, and introduces **trophic levels** and **trophic cascades**. The goal of this lesson is to open a conversation about human impacts on ecosystems, and how we can minimize those impacts to protect oceans better.

Lesson Breakdown:

- SeaKeepers Documentary Series: Episode 1 (6 min)
- Presentation about food webs and trophic cascades (10 - 15 min)
- Activity: Card game & Worksheet (30 min)
- Assessment: Discussion (15 min)

Florida Educational Standards Addressed:

- SC.4.L.17.4: Recognize ways plants and animals, including humans, can impact the environment.
- SC.4.L.17.3: Trace the flow of energy from the Sun as it is transferred along the food chain through the producers to the consumers.

Preparation & Materials

Students will need background information on food webs, trophic levels, and trophic cascades for this activity. A powerpoint presentation is included for the lesson, but feel free to use whatever materials you prefer to explain these concepts.

For the activity, students will need:

- A set of trophic cards, attached after page 8 (1 set per group of 2 students - they can cut them out themselves)
- Food Webs Instructions & Worksheet, pages 3 - 8 (1 per 2 students)
- Table space to lay out cards

Tips:

This lesson is part of a 3-part documentary series by The International SeaKeepers Society. This lesson would fit best surrounded by lessons of similar themes (ocean conservation), including other lessons from this series as well as lessons from other ocean conservational organizations.

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Grade Level: 4-6 **Estimated Time: 60 min**

Anticipated learning objectives:

- Understand energy flow from primary producers to apex predators
- Be able to define and describe a trophic cascade
- List and describe ways that humans disrupt ecosystems
- List specific things we can do to prevent ecosystem disruptions

Activity instructions for teachers:

1. Divide students into pairs, and give each group a set of 22 cards to cut out and a worksheet.
2. Students will first need to arrange their cards into a food web. Each group should have the following cards:
   - 1 shark card (apex predator)
   - 3 large fish cards (tertiary consumers)
   - 4 medium fish cards (2 fish/card; secondary consumers)
   - 6 small fish cards (3 fish/card; primary consumers)
   - 8 seagrass cards (4 plants/card; primary producers)
3. Make sure each group understands the food web aspect and the different trophic levels. Once everyone understands, you can move onto the first ecosystem simulation.
4. Inform students that words in **bold** are described in their vocabulary list.
5. For the "healthy ecosystem" simulation, each student will need to follow the "who-eats-who" rules outlined in their worksheet. Some students may have trouble with the math, so make sure they all reach the same result. Following the rules, each group should end up with: 1 shark, 2 large fish, 4 medium fish, 6 small fish, 8 seagrass plants. (I recommend trying the game yourself first!)
6. At this point, the students will answer a few questions on their worksheet about their ecosystem. You can stop and have a mini discussion here, or wait until the end of the activity.
7. The students will then reset their ecosystems (put all cards back to where they started), and will work through the system again without the apex predator. This time, the remaining cards should be: 0 sharks, 3 large fish, 2 medium fish, 12 small fish, 0 seagrass plants. **Be aware here, the 12 small fish left would need to eat 48 seagrass plants, and we only started with 32. There isn't enough food to eat - this is the point, but it may confuse some students! The students should just take all the plants off the table and record the number left as 0.
8. Students will then complete the rest of the questions on the worksheet. When everyone has finished, bring the class together and discuss the questions from the worksheet.
9. An important point to bring up at the end, if it has not yet been discussed, is what happens to the ecosystem level-by-level if there are no more primary producers. Without any food, the ecosystem completely collapse.

If you'd like to provide feedback on this lesson plan, click here! We'll use your comments to improve existing and future SeaKeepers lessons.

Marine Food Webs

STUDENT INTRODUCTION

In this activity, you will be building your own marine **ecosystem** made up of **producers** and **consumers**. Marine ecosystems and **terrestrial** (land-based) ecosystems have the same basic food web structure: they are made up of primary producers, primary consumers, secondary consumers, tertiary consumers, and apex predators. In the marine ecosystem, primary producers are usually algae, grasses and plants, and other **photosynthetic organisms** that get all their energy from the sun. They are the smallest organisms, and make up the bottom of the food web. Primary consumers are the next level of the food chain, eating the primary producers. **Herbivorous** animals that only eat plants, like small crabs and some young fish, fall into this category. Secondary consumers then eat the primary consumers, and tertiary (or third-level) consumers eat the secondary consumers. Finally, at the very top of the food web, apex predators eat the tertiary consumers, and almost nothing eats the apex predator.

These levels of the food web are also called trophic levels. Many different animals can fit into each category, and some fish move into different levels as they grow up and get bigger. However, all the levels must be present in an ecosystem in order for the ecosystem to function properly. In this exercise, we are going to see what happens to an ecosystem when a single level - the apex predators - are removed.

PART 1: Build your ecosystem

Start by arranging your cards into a food chain. The predator (shark) should be at the top, and your primary producers should be at the bottom. This is your ecosystem!

Once your ecosystem is laid out, record how many fish or plants make up each level. For example, if you have three “small fish” cards that each have four fish on them, write down twelve small fish.

STARTING ECOSYSTEM

Sharks	Large fish	Medium fish	Small fish	Seagrass

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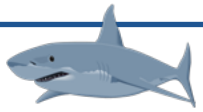
PART 2: Balance your food web

In a healthy ecosystem, fish are eating other fish. This gets more complicated in real-life ecosystems, but for this game we are going to use these rules:

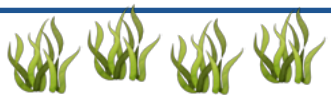
- **A shark eats 1 large fish**
- **A large fish eats 2 medium fish**
- **A medium fish eats 3 small fish**
- **A small fish eats 4 pieces of seagrass**

Using these rules, you are going to remove all plants and fish that are eaten, starting with your apex predator. To remove a fish or plant, take the card off the table and set it aside. For example, you start with 3 large fish in your ecosystem, but the 1 shark eats 1 large fish. You'll remove that 1 large fish and put it aside, leaving 2 large fish in the ecosystem. Now only those 2 large fish need to eat.

Example:

PREDATOR:	EACH FISH NEEDS TO EAT:	STARTING - EATEN = HOW MANY LEFT?
1 shark 	**1 large fish** 	**3 large fish - 1 large fish = 2 large fish left**

Keep in mind, for cards with multiple fish, EACH fish needs to eat!

PREDATOR:	EACH FISH NEEDS TO EAT:	STARTING - EATEN = HOW MANY LEFT?
		_____ - _____ = _____
3 small fish	**4 pieces of seagrass**	

Work through the rest of your ecosystem this way, removing every fish and plant that gets eaten. What is left in your ecosystem? Record the numbers of each group below:

HEALTHY ECOSYSTEM

Sharks	Large fish	Medium fish	Small fish	Seagrass

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Looking at your healthy ecosystem, discuss with your partner and answer the following questions together.

1. Why do you think there are more small and medium sized fish in this ecosystem than there are large fish and apex predators?

2. What do you think would happen if one of the trophic levels was removed?

3. What do you think would happen if the apex predator (in this case, a shark) was removed from your ecosystem? Make a prediction, we are going to test this next!

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PART 3: Remove the apex predator

Time to test your prediction!

Go ahead and put all your original fish and seagrass back into your ecosystem, leaving out only the apex predator. Using the same "who-eats-who" rules as you did for your healthy ecosystem, you are going work through each level again, removing fish and plants that are eaten. You will need to do some math here!

Record who is left at the end:

ECOSYSTEM WITHOUT APEX PREDATOR

Sharks	Large fish	Medium fish	Small fish	Seagrass

Answer the following questions with your partner:

1. When an apex predator is removed from an ecosystem, what happens is called a **trophic cascade**. What happened to each level of your ecosystem? Did it behave as you expected?

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2. In real life, what would happen to other trophic levels if there were no more primary producers? Take a guess!

3. Sharks can be apex predators, but the majority are small (less than 3 ft!). Being specific and considering your starting ecosystem, how would a food web be affected if the secondary consumers (the medium sized fish) were completely removed?

4. Consider the video you watched. What things do humans do to disrupt healthy ecosystems? What things can we do to keep ecosystems healthy?

Marine Food Webs

VOCABULARY

Ecosystem: An entire community of living things, including all plants, animals, and insects in that area.

Producer: Takes up energy from the sun, is the bottom level of the food chain.

Consumer: Consumes other living things instead of getting energy from the sun.

Terrestrial: Lives on land.

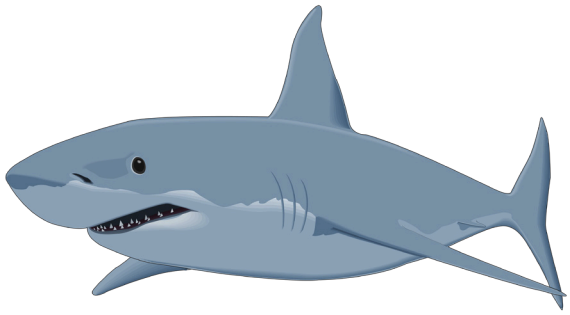
Photosynthetic: A descriptive form of the word photosynthesis, which plants use to convert energy from the sun into chemical energy that can be eaten by primary consumers.

Organisms: All living things.

Herbivorous: Something that only eats plants.

Large shark (1)

Eats 1 large fish



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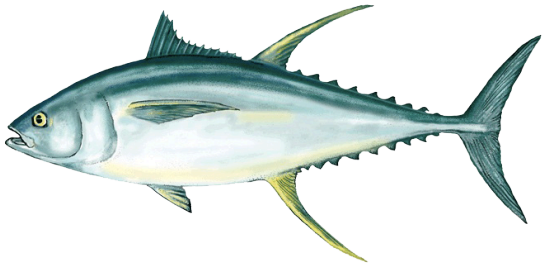
THE INTERNATIONAL SEAKEEPERS SOCIETY

Large fish (1)

Eats 2 medium fish



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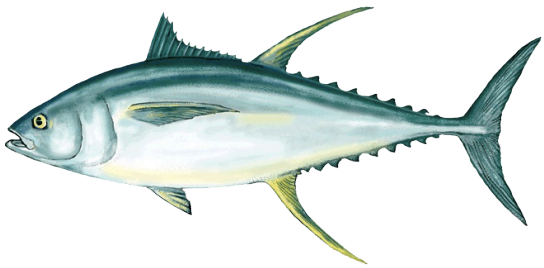
Large fish (1)

Eats 2 medium fish



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Medium fish (2)

Each fish eats 3 small fish

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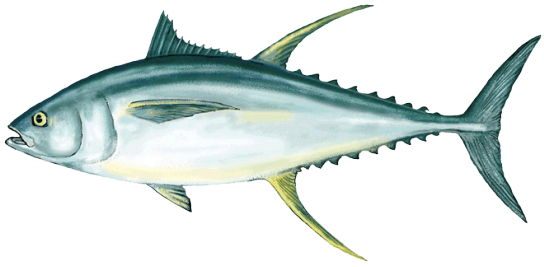
Large fish (1)

Eats 2 medium fish



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Medium fish (2)

Each fish eats 3 small fish

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Medium fish (2)
Each fish eats 3 small fish

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Medium fish (2)
Each fish eats 3 small fish

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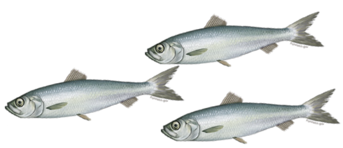
Small fish (3)
Each fish eats 4 pieces of seagrass



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Small fish (3)
Each fish eats 4 pieces of seagrass

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Small fish (3)
Each fish eats 4 pieces of seagrass

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Small fish (3)
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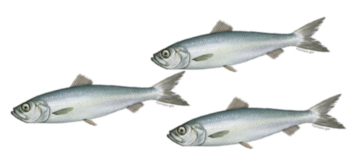

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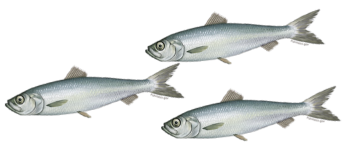
Small fish (3)

Each fish eats 4 pieces of seagrass



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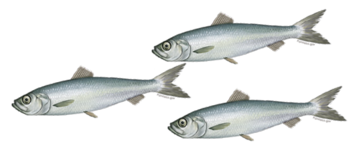
Small fish (3)

Each fish eats 4 pieces of seagrass



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Seagrass (4 pieces)

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Seagrass (4 pieces)

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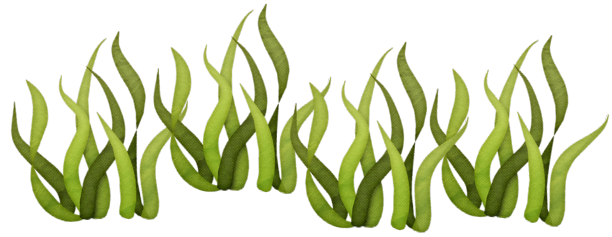
Seagrass (4 pieces)



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Seagrass (4 pieces)

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Seagrass (4 pieces)

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