

Australian
Sea Lion

Jellyfish

Welcome To Our World. It's Your World, Too.

Diagonal-Banded
Sweetlips

Cuttlefish

Coral

Leafy Sea Dragon

Lionfish

Spine-checked Anemonefish

Chambered
Nautilus

Sea Anemone

Crocodilefish

IMAX UNDER THE SEA

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IMAX UNDER THE SEA

Educator's Resource Guide

GRADES 6–8



Dear Teachers: Welcome to dynamic science activities inspired by the IMAX film *Under the Sea*. These materials, created by Scholastic Inc., IMAX Corporation, and Warner Bros. Pictures, can build student skills through engaging **critical-thinking activities** and **hands-on experiments**. You can also further students' learning experience with a film field trip (see below), allowing students to experience face-to-face encounters with some of the underwater world's most mysterious and unusual creatures. We hope you enjoy *Under the Sea*!

Worksheet Guide: For additional educational worksheets, visit WWW.IMAX.COM/UNDERTHESEA.

Worksheet 1: Coral Crisis	Worksheet 2: Creatures of the Deep	Worksheet 3: Oceans	Worksheet 4: Hot Spot	Worksheet 5: Food Web
Summary: Students will hone graph-reading skills as they learn how many of the world's coral reefs are at risk.	Summary: Students will learn the characteristics of the group of invertebrates called cephalopods .	Summary: Students will learn how carbon dioxide affects the oceans and calculate how daily activities release carbon dioxide.	Summary: Students will learn about the Coral Triangle —the region of the world with the highest diversity of coral.	Summary: Students will learn about the coral reef ecosystem . They will create a food web for organisms in the ecosystem.
Skills/Curriculum: <ul style="list-style-type: none"> Graph-reading skills Critical thinking Coral reefs Pollution 	Skills/Curriculum: <ul style="list-style-type: none"> Reading comprehension Invertebrates Cephalopods 	Skills/Curriculum: <ul style="list-style-type: none"> Math skills Fossil fuels Carbon dioxide Acids Coral reefs 	Skills/Curriculum: <ul style="list-style-type: none"> Map-reading skills Geography Ecosystems Biodiversity Coral reefs 	Skills/Curriculum: <ul style="list-style-type: none"> Diagram-reading skills Ecosystems Food webs
NSES Standards: <ul style="list-style-type: none"> Populations, resources, and environments Science and technology in society 	NSES Standards: <ul style="list-style-type: none"> Diversity and adaptations of organisms Form and function 	NSES Standards: <ul style="list-style-type: none"> Properties and changes of properties in matter Understanding about science and technology 	NSES Standards: <ul style="list-style-type: none"> Populations and ecosystems Structure of the earth system 	NSES Standards: <ul style="list-style-type: none"> Structure and function in living systems Regulation and behavior
Lesson Ideas: Start a discussion about human-caused pollution. Ask students how pollution created on land can affect organisms that live in the ocean.	Lesson Ideas: Extend the lesson by having students research the most mysterious cephalopod: the giant squid. Find out why this creature is so hard for scientists to study.	Lesson Ideas: Extend the lesson by having students calculate their total "carbon footprint" at www.zerofootprintkids.com . Have them track their footprint over time.	Lesson Ideas: Start a class discussion about biodiversity by having students compare the life seen around their school with that found in a rain forest. Why might it be important to protect areas with a lot of diversity of life?	Lesson Ideas: Start a discussion about the interdependence of animals by thinking about the organisms they need in order to survive. For instance, they need plants and animals for food. They need trees to build homes.

WORKSHEET ANSWERS: **Worksheet 1:** 1. 58%; 2. 42%; 3. Southeast Asia; 4. 25,000 square kilometers; 5. Yes, the Coral Triangle is in an area that is at high risk; 6. It should be protected because it has a high diversity of organisms and reefs in that area are at high risk. **Worksheet 2:** 1. They are carnivores, invertebrates, live in the ocean, and have arms called tentacles; 2. It has an outer shell; 3. The octopus has the largest brain relative to body size of all invertebrates; 4. By having them navigate mazes, complete memory tasks; 5. No one had ever seen a live giant squid until recently. **Worksheet 3:** "Transportation" ways to reduce: Ride your bike or walk instead of getting a ride in a car. Drive smaller cars. "Electricity" ways to reduce: Turn off lights when you leave a room. Watch less television. Turn off computers when not using them. **Worksheet 4:** 1. Southern; 2. Australia; 3. It causes water to warm and causes the water to become acidic; 4. Fish and sea turtles would die off; 5. Local people need the coral reefs for food and jobs. **Worksheet 5:** If plankton disappeared the whole food web could disappear.

**BOOK AN IMAX®
FIELD TRIP**

Engage your students with an unforgettable learning experience.

Each of the activities inside provides eye-opening extensions connected to viewing *Under the Sea*. **IMAX films are ideal teaching tools that:**

- Present new knowledge in a powerful, popular medium
- Inspire thoughtful and lively classroom discussion
- Motivate students for extended learning

Field trips are economical and easily arranged. To book a field trip, contact your local IMAX theatre today! For locations near you, visit www.IMAX.com.



Worksheet #1

Name: _____ Grade: _____

CORAL Crisis

More than 1 million plants and animals live in the world's coral reefs. Coral reefs protect coastlines from storm damage, and organisms that live in them have been used to develop drugs to treat diseases.

Many of the world's coral reefs are at risk. The threats include destructive fishing practices and pollution. Global warming is also threatening reefs. Scientists have found that warming ocean waters are killing off many coral plants. Use the graphs to answer questions about the threats to coral reefs.

PERCENTAGE OF THE WORLD'S REEFS THAT ARE AT RISK OF DISAPPEARING

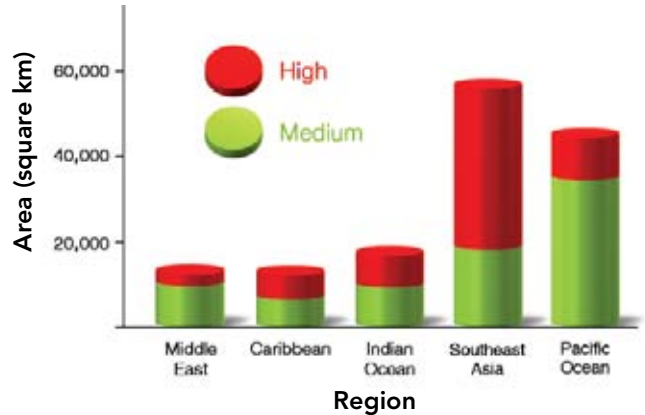
High
27%



Low
42%

Medium
31%

TOTAL AREA OF CORAL REEFS THAT ARE AT MEDIUM TO HIGH RISK OF DISAPPEARING



1. According to the pie chart, what percentage of the world's reefs are at high or medium risk of disappearing?

2. There are approximately 255,000 square kilometers of coral reefs in the world. Look at the pie chart. Roughly what area of coral reef is at low risk?

3. In which region of the world is the largest area of coral reef at risk?

4. Approximately what area of coral reef in the Caribbean and the Indian Ocean is at risk?

5. The Coral Triangle in Southeast Asia holds the greatest diversity of coral in the world. Based on the bar graph, are the reefs in the Coral Triangle at risk?

6. Do you think the reefs in the Coral Triangle and other places should be protected? Why or why not?

BONUS ACTIVITY

Under the Sea

Under the Sea highlights some of the threats facing the coral reefs in the Indian and Pacific Oceans. Write a paragraph describing some of these threats and the damage they inflict on coral reefs.

Coral plants in the waters off Papua New Guinea provide an important habitat for fish and other organisms.



CREATURES of the DEEP Meet the world's most unusual invertebrates, or creatures without a backbone. Cephalopods such as octopus and cuttlefish are ocean-dwelling creatures that have arms called tentacles, which surround the animal's mouth. Check out some cephalopods that inhabit the oceans in the Coral Triangle, a region off the coasts of Australia and Southeast Asia.



CUTTLEFISH

Cuttlefish have a long, flat shell inside their body. They have eight short arms and two longer tentacles that are covered in suckers to grasp prey. Cuttlefish can camouflage themselves by changing color to match their surroundings. They also flash colors to communicate with other cuttlefish.



OCTOPUS

The largest octopuses can grow up to 16 feet long or more. Each of the octopus's eight arms has two rows of suckers. Octopuses have the largest brain relative to body size of all invertebrates. Like all cephalopods, octopuses are carnivores; they eat other animals. Many octopuses are also cannibals—they sometimes eat other octopuses.



NAUTILUS

The nautilus is the only living cephalopod with an outer shell. The nautilus lives in the final chamber of its coil-shaped shell. When threatened, a nautilus shuts its body in its shell with a leathery hood. The nautilus has more than 80 arms, which guide prey into its mouth.

1. Describe four characteristics shared by all cephalopods.

2. What characteristic distinguishes the nautilus from other cephalopods?

3. Scientists believe that cephalopods are some of the most intelligent creatures in the oceans. What characteristic described above might support that claim?

4. What are some ways in which you think scientists test an animal's intelligence?

5. One of the most mysterious cephalopods is the giant squid. Research the animal and then write a paragraph on a separate piece of paper explaining why so little is known about this creature.

BONUS ACTIVITY

Under the Sea

The oceans' cuttlefish exhibit many unusual behaviors—from amazing camouflage to extremely aggressive hunting. The flamboyant cuttlefish is one of the cephalopods seen in *Under the Sea*. Write a paragraph about this creature, including information about how it hunts and finds a mate.



Worksheet #3

Name: _____ Grade: _____

PROTECTING the Oceans

The rising level of **carbon dioxide** in the atmosphere is one of the biggest threats to the world's oceans. Millions of tons of carbon dioxide are released into the atmosphere every year from burning fossil fuels, such as oil and gas. Carbon dioxide causes the atmosphere to warm—a process called **global warming**. This heats the world's oceans. Many sea organisms can't adapt to the changing temperatures and may die out.



Carbon dioxide also dissolves into the oceans, causing the water to become acidic. The acidic water dissolves the shells many ocean creatures rely on to survive.

Complete the questions in the two charts below to become aware of how some activities—involving transportation and electricity—contribute to the world's level of carbon dioxide. Then answer the questions that follow to come up with some ways that you can help to reduce these levels.

Transportation Every time you take a car ride, the car releases carbon dioxide by burning gasoline. Use the chart below to see how much carbon dioxide is released when you ride in a car.



1. Estimate the number of miles you ride in a car per month:

2. Determine how much gasoline is used for the number of miles you ride in a month. Divide your total monthly miles by gas mileage. For a small- to medium-size car, divide your monthly total by 28 miles per gallon. For a large car, divide your monthly total by 21 miles per gallon. Write your answer below:

3. Multiply the number of gallons of gas used by 19.5 to estimate the number of pounds of carbon dioxide released per month:

What are some ways you could reduce the amount of carbon dioxide you release using transportation?

Electricity Every time you turn on a light or the television, fossil fuels are burned to create electricity. Use the chart below to see how much carbon dioxide is released when you use electricity.



1. Determine your total household use by studying your family's energy bill. Look at your electricity bill to see how many kilowatt-hours of electricity you use in one month:

2. Calculate the number of pounds of carbon dioxide released by multiplying the kilowatt-hours used by 1.34:

What are some ways you and your family could reduce the amount of carbon dioxide you release each month from your electricity use?

**BONUS
ACTIVITY**

Under the Sea

Under the Sea highlights some of the effects of carbon dioxide on the oceans. Create a poster that explains how daily activities such as driving a car and using electricity can affect ocean life. Include tips on how people can reduce their carbon dioxide contribution.

HOT SPOT

The Coral Triangle is an area of the oceans between Southeast Asia and the northern tip of Australia containing 53% of the world's coral reefs. Read below and study the map to discover more about this important ocean region. Then answer the questions that follow on a separate sheet of paper.



More than 75 percent of the world's species of coral are found in the Coral Triangle.



The region is home to more than 3,000 species of fish and acts as a breeding ground for many sea organisms.



Its beaches serve as nesting grounds for five of the world's seven species of sea turtles.



The reefs in the Coral Triangle are being threatened by human activities. Destructive fishing methods, such as the use of explosives, can destroy reefs.



More than 150 million people call the Coral Triangle home. Many of these people rely on the coral reefs for food and jobs.



Rising levels of carbon dioxide are harming the coral. Carbon dioxide causes Earth's temperatures to rise, warming the oceans and harming some ocean life.

1. In which hemisphere is most of the Coral Triangle located: Northern or Southern?
2. Which of the following countries do not border or are not within the Coral Triangle: Australia, Philippines, Indonesia, Malaysia?
3. How does an increasing amount of carbon dioxide in the air affect coral reefs in the Coral Triangle?
4. What do you think would happen to the populations of fish and animals like sea turtles if the reefs in the Coral Triangle disappeared?
5. Conservation organizations are working with people who live in the region to try to protect the Coral Triangle. Why might it be beneficial for local people to protect the reefs?

BONUS ACTIVITY

Under the Sea

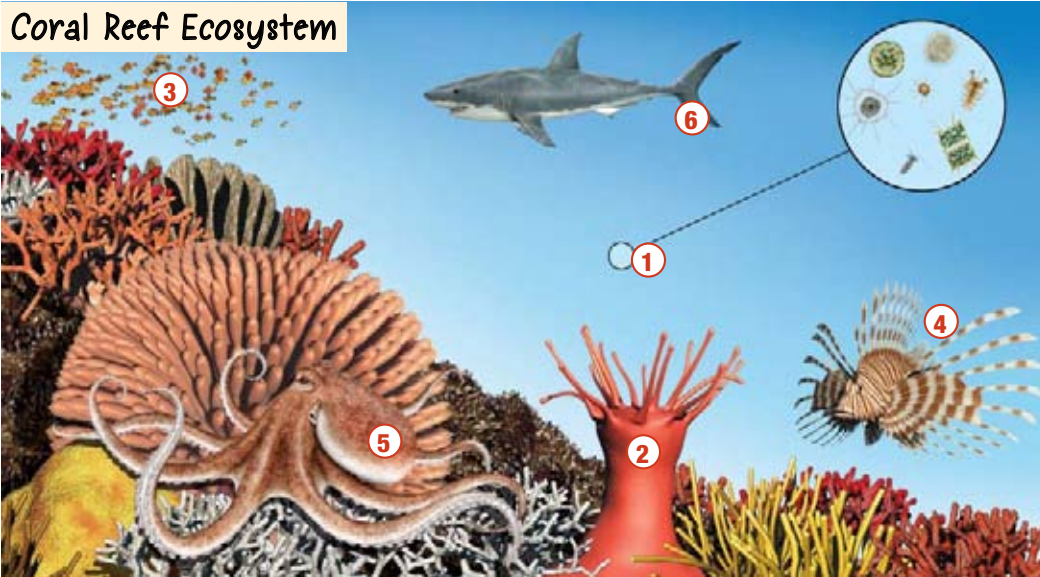
Under the Sea highlights the heart of the Coral Triangle, where animals like the warty frogfish live. Write a description of this region for a scuba-diving guidebook. Your guidebook entry should include descriptions of the organisms a diver might see, and explain why this region is a unique place to dive.



FOOD WEB

The reefs created by corals are the basis for a rich oceanic ecosystem. The corals are part of a complex food web, or interconnected system, in which animals eat other animals to survive. If one organism in a food web were to disappear, it could disrupt the entire system. To learn more, study the coral reef ecosystem in the illustration below, and then do the activity that follows.

Coral Reef Ecosystem



Ecosystem Key:

1. Ocean currents bring a constant supply of drifting plankton into a coral reef.
2. Corals are made up of tiny animals called polyps. Polyps eat plankton.
3. Small fish like fairy basslets feed mainly on plankton floating in the ocean water.
4. Lionfish hunt for small fish and crustaceans, mostly during the night.
5. Octopuses hunt the seafloor for crabs and fish.
6. Shark feed on larger fish and invertebrates, such as octopuses.

Activity On a separate piece of paper draw a food web of this coral reef ecosystem. Your food web should show how each organism in the ecosystem relates to the other organisms according to what they eat. Each organism should have arrows going from it to organisms that rely upon it for food.

Question When you have completed your food web, answer the following: What would happen to your food web if plankton were to disappear?

BONUS ACTIVITY

Under the Sea

After watching *Under the Sea*, add three new creatures to the above diagram of the coral reef ecosystem. Then, research the diets of those creatures and add them to your food web.

Anemonefish eat mostly plankton floating in the water. They hide from bigger fish in the stinging tentacles of sea anemone.

