



## Predator Protector Game Lesson

In the Web-based game Predator Protector, students take on the role of an Ocean Adventures expedition volunteer member. In this role, students are charged with protecting three species of sharks from danger in order to defend the balance of nature in the ecosystem that these top predators help to maintain.

Use the tips and handouts below to turn the Predator Protector game into a structured learning activity for your students.

### SUBJECTS

Science

### GRADE LEVEL

Grades 6-10

### TIME

One to two class periods

### OBJECTIVES

Students will be able to

- describe the habitat, food web and ecosystem of three different shark species.
- identify threats to sharks.
- explain how top predators, such as sharks, help to maintain the balance of nature within ecosystems.

### MATERIALS

- Volunteers Wanted! (student handout #1)
- Location Data Sheet (student handout #2)
- Shark Species/Ecosystem Data Sheet (student handout #3)
- Shark Threat Data Sheet (student handout #4)
- Reporting Data (student handout #5)
- Game Background (teacher sheet #1)
- Answer Key (teacher sheet #2)
- Sharks at Risk Viewing Guide (optional; find at [pbs.org/oceanadventures/educators/sharks](http://pbs.org/oceanadventures/educators/sharks))
- Copy of Sharks at Risk episode of the *Jean-Michel Cousteau Ocean Adventures* series (optional)

### BACKGROUND

In the second episode of *Jean-Michel Cousteau Ocean Adventures, Sharks at Risk*, Jean-Michel Cousteau and his dive team travel to French Polynesia and South Africa to swim with sharks and to dispel the myth that sharks are senseless killers. Their expedition uncovers the threats sharks face from their human predators and explores the vital role these top predators play in supporting the intricate balance that makes up the ocean ecosystem.

Based on the experiences of the *Ocean Adventures* team, Predator Protector is a fast-paced interactive game in which students are the environmental heroes, protecting sharks from the numerous dangers that plague them in the ocean and thus helping to preserve the delicate balance of the ecosystem. Playing the part of an *Ocean Adventures* volunteer team member, students visit three separate locations to protect different species of sharks -- the shallow waters of California to swim with swell sharks, the mid-depth reef waters of French Polynesia to trail gray reef sharks and the cold, deep waters of Australia to protect the great white shark. Swimming behind one of the sharks, students are armed with repellent to deter the shark from life-threatening pressures. They accumulate points by keeping their shark alive long enough to find food and by ensuring their shark lives long enough to reproduce and keep the population stable. Students will need to monitor the level of shark health and time left on their mission. Upon completion of the game, students will analyze their data and compile a report describing what they have learned, then submit their report to the Volunteer Supervisor (the teacher).

#### WEB LINKS

Found at [pbs.org/oceanadventures/episodes/sharks](http://pbs.org/oceanadventures/episodes/sharks)

- Predator Protector Game
- Vanishing Sharks Interactive

Found at [pbs.org/oceanadventures/educators/sharks](http://pbs.org/oceanadventures/educators/sharks)

- Shark Encounter lesson plan
- Fish Are Animals Too lesson plan
- How to Catch a Fish lesson plan

#### STANDARDS

##### National Science

##### Education Standards Grades 5-8

<http://www.nap.edu/catalog/4962.html>

##### Science As Inquiry - Content Standard A

Abilities necessary to do scientific inquiry

##### Life Science - Content Standard C

Reproduction and heredity  
Regulation and behavior  
Populations and ecosystems  
Diversity and adaptations of organisms

##### Science in Personal and Social Perspectives - Content Standard F:

Populations, resources and environments

#### TEACHER PREPARATION

- Using blank student handouts, play Predator Protector yourself, paying particular attention to where you think your students will need extra guidance.
- Review the Game Background and Answer Key teacher sheets.
- Based on the availability of computers, decide the best way for students to play the game—individually, in pairs or in groups.
- Illuminate students with background information about sharks and spark their curiosity by using the Shark Encounter activity to introduce study of sharks.

#### PROCEDURE

- 1. Review Background Information:** It will be helpful if your students have a general understanding of ecological relationships before beginning the interactive—review terms such as “predator,” “prey,” “producer,” “consumer” and “decomposer.” Also introduce students to the game’s three shark species (swell shark, gray reef shark, great white shark) and the location of and facts about their habitats and ecosystems. Use the Vanishing Sharks interactive and essays located on the *Sharks at Risk* Web site for assistance.
- 2. Introducing top predators:** Use ideas from the *Sharks at Risk* Viewing Guide to set the scene. Pay particular attention to the Segment Suggestions for the ecosystem balance/food web and longline fishing/other human factors themes. If you do not have access to the *Sharks at Risk* episode, use the *Ocean Adventures* Web site to find pictures of the sharks to show to students, then lead a class discussion about the dangers facing shark populations and the importance of sharks to ecosystem stability.
- 3. Game Setup:** Pass out the Volunteers Wanted! student handout, a fictional posting for a volunteer position introducing volunteers (the students) to their shark protection mission. Explain to students that as part of the *Ocean Adventures* team, they are a part of this volunteer mission. Give students an overview of how to play Predator Protector, hand out the Location Data Sheet, the Shark Species Data Sheet and the Shark Threat Data Sheet and explain that they will be collecting information on these organizers for later use. Have students record their hypotheses on their Location Data Sheet before game play begins.
- 4. Game Play:** Allow students sufficient time to play the game and collect data.

**Ocean Literacy:  
Essential Principles and  
Fundamental Concepts**  
[http://coexploration.org/  
oceanliteracy/](http://coexploration.org/oceanliteracy/)

**Essential Principle #1:  
Earth has one big ocean  
with many features.**

- a. The ocean is the dominant physical feature on our planet Earth, covering approximately 70 percent of the planet's surface. There is one ocean with many ocean basins, such as the North Pacific, South Pacific, North Atlantic, South Atlantic, Indian and Arctic.
- h. Although the ocean is large, it is finite and its resources are limited.

**Essential Principle #5:  
The ocean supports a great  
diversity of life and ecosystems.**

- d. Ocean biology provides many unique examples of life cycles, adaptations and important relationships among organisms (symbiosis, predator-prey dynamics and energy transfer) that do not occur on land.
- e. The ocean is three-dimensional, offering vast living space and diverse habitats from the surface through the water column to the seafloor. Most of the living space on Earth is in the ocean.

5. **Data Sharing:** Set aside time for students to gather in small groups to review data after game play has ended to ensure all students have understood the game.
6. **Reporting Information:** Pass out the Reporting Data handout and explain the directions. Students will submit this "report" to you, their Volunteer Supervisor.

### TEACHER NOTES

- Depending on the number of computers available, you might want to make adjustments, such as having students play the game on alternate days.

### EXTENSIONS

- Lead students in the How to Catch a Fish lesson to explore the dangers of bycatch.
- Use the Fish Are Animals Too lesson to further illustrate the importance of sharks in ocean ecosystems.
- Have students experiment with the Vanishing Sharks interactive, through which they can learn about the causes of actual population drops in a number of shark species over time.
- Introduce students to the *Ocean Adventures* expedition team and their diverse careers using the Ocean Careers Exploration lesson.

These and additional educator resources for ***Jean-Michel Cousteau Ocean Adventures*** can be found at [pbs.org/oceanadventures/educators](http://pbs.org/oceanadventures/educators).

**Essential Principle #6:**

**The ocean and humans are inextricably interconnected.**

- b. From the ocean we get foods, medicines, and mineral and energy resources. In addition, it provides jobs, supports our nation's economy, serves as a highway for transportation of goods and people, and plays a role in national security.
- e. Humans affect the ocean in a variety of ways. Laws, regulations and resource management affect what is taken out and put into the ocean. Human development and activity leads to pollution (point source, nonpoint source and noise pollution) and physical modifications (changes to beaches, shores and rivers). In addition, humans have removed most of the large vertebrates from the ocean.
- f. Everyone is responsible for caring for the ocean. The ocean sustains life on Earth, and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all.

**Essential Principle #7:**

**The ocean is largely unexplored.**

- c. Over the last 40 years, use of ocean resources has increased significantly; therefore the future sustainability of ocean resources depends on our understanding of those resources and their potential and limitations.

**AUTHOR**

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**CREDITS**

*Jean-Michel Cousteau Ocean Adventures* is produced by KQED Public Broadcasting and the Ocean Futures Society.

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## Volunteers Wanted

Join in the effort to protect the delicate balance of ocean ecosystems by swimming with and protecting sharks!

**Position**

Predator Protector volunteer

**Location**

French Polynesia, California, Australia

**Start Date**

Accepting volunteers year-round

**End Date**

N/A

**Partners**

Jean Michel Cousteau's Ocean Adventures team

**Contact**

Volunteer Supervisor

**Activities**

- Swim with and closely trail three species of sharks
- Operate shark-repelling bubble gun
- Monitor levels of shark health
- Collect data on shark species and the ecosystems in which they live
- Complete Reporting Data form and submit to the Volunteer Supervisor

**Details**

Seeking persons with quick reflexes to protect sharks from numerous threats; must have note-taking skills and be detail-oriented

**Suitability**

Teens and adults

**Difficulty**

Average (though difficulty will increase with success and graduation to different species)

## Location Data Sheet

**Directions:** Please fill out the following information for the location at which you are volunteering. This information will be used later when completing the report to submit your Volunteer Supervisor.

**Volunteer Position:** Predator Protector volunteer

**Before you begin your volunteer job, please make a hypothesis:** What types of threats do you think your sharks will encounter?

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Sharks are known as “top predators.” How do you think ocean ecosystems are affected when large numbers of sharks are missing from the food web?

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### Destination Information

SHARK	NEAREST COUNTRY	SURROUNDING OCEAN BASIN
Swell shark		
Gray reef shark		
Great white shark		

**Problem you are helping with** \_\_\_\_\_

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## Shark Species/ Ecosystem Data Sheet

SHARK SPECIES	HABITAT	WHAT DOES IT EAT?	WHAT EATS IT?
Swell shark			
Gray reef shark			
Great white shark			

## Shark Threat Data Sheet

THREAT	HOW IS THIS A THREAT TO SHARKS?	THINK OF SOME POSSIBLE SOLUTIONS
Predators and larger animals		
Crab and lobster traps		
Trawls and gillnets		
Longlines		
Finning		
Sport fisherman		
Boat engines		

## Reporting Data

**Directions:** Once you have fulfilled your volunteer duties and collected the proper data, please answer the following questions on a separate sheet of paper and submit with all of your data sheets to your Volunteer Supervisor.

1. What threats do sharks encounter in the ocean?
2. What happens in the game when a shark dies? How do you think this compares with real life?
3. Which threat do you think is the most dangerous to shark populations? Why?
4. Draw a possible food chain or web for each shark species you have studied.
5. If large numbers of sharks die because of human activities, what will happen to the ecosystem that the sharks are a part of? Please explain for each shark species you have studied.
6. (Option 1) Use your game experience to help you write about "a day in the life of a shark." Pretend to be the shark: What type of shark are you? Where do you live? What situations do you encounter in your day? What types of food are you looking for? Present your story to the class (read it, act it out or draw a poster/illustration).
6. (Option 2) Design an advertising campaign to educate the public on the importance of sharks to the balance of nature in the sea. You may choose to target commercial fishers that use harmful fishing methods, sport fishers who see the great white as a trophy or other students who think sharks are just scary and dangerous. Be creative with your ads - they can be designed for a newspaper, magazine, billboard or Web site or you may want to create and film your own public service announcement.

## Game Background

On the introductory screen, players can choose to read more about each shark species in the game (swell shark, gray reef shark and great white shark), read instructions on how to play the game or simply start game play.

Players take the role of a diver “trailing” three species of sharks, using a repellent—bubbles. The mouse cursor will be crosshairs to indicate the aim of the repellent.

Players get three “lives” as well as the opportunity to gain new lives when they reach increments of 10,000 points. Each time a player loses one of their lives, the balance of the ocean is affected—the decline in predators results in an increase in other creatures within this virtual ocean environment. Having more creatures swimming past makes the game somewhat harder by camouflaging where hazards may be. With each life, the player also sees a health meter for the specific shark life currently in play. This life meter gradually declines unless the shark finds a food source. Each food item completely replenishes the shark’s health. If the shark does not find food within 30 seconds, it runs out of health and the player loses one life.

This means that each shark life may be lost either (a) by encountering a threat or (b) by running out of health due to lack of food.

At the end of each level, graphics will show the risks the player has avoided. Clicking any item brings up information about why it is a danger to sharks. In addition, clicking an item adds 50 points to the player’s score, but only once per item per game, regardless of level. (For example, clicking the same item twice does not result in 100 points.)

### LEVEL 1

**Swell sharks:** Player trails a swell shark swimming in shallow waters. Food sources are fairly plentiful in this level, but the swell shark’s size creates a challenge in covering the space to get to food.

**Habitat:** The preferred habitat of the swell shark is rocky, algal covered bottoms. During the day, this small sluggish shark hides in caves and rocky crevices, camouflaged with its surroundings. As night approaches, the swell shark moves out to adjacent sandy bottoms in search of food. It ambushes prey items or rests quietly on the bottom with its mouth wide open, waiting for an unsuspecting victim. Although the swell shark is primarily a solitary species, it sometimes forms aggregations while resting, with individuals sometimes piled on top of each other.

**Avoid**

- **Predators:** Swell sharks' predators are marine mammals, including sea lions, seals and larger sharks, such as hammerhead sharks and leopard sharks.
- **Traps:** set by crab and lobster fishermen.
- **Trawls and gillnets:** set by sport fishermen.

**Seek**

- **Food sources:** sea urchins, crabs, squid, mollusks, aquatic crustaceans, fish, carrion (dead animal matter)
- Ideal location for laying eggs

**LEVEL 2**

**Gray reef shark:** Player trails a reef shark swimming in mid-depth reef waters. Food sources are less plentiful in this level.

Gray reef sharks appear grayish-brown, with white undersides and a black margin on their tail fin. They have a broadly rounded snout and very large eyes. They can grow to between six and eight feet and are sometimes territorial if other sharks are near. Females give live birth to a litter of one to six pups, which are usually from 15 inches to 22 inches long. Gray reef sharks school during the day and are more active nocturnally.

**Habitat:** Primarily distributed in shallow tropical and subtropical waters, the grey reef shark is often found near coral atolls and lagoons adjacent to reef habitats. It is often observed swimming along the outer edges of coral reefs. Its depth ranges from the surface to 920 feet (280 m). Active during the night, grey reef sharks sometimes form schools during the day. These schools swim close to the bottom, over flat habitats. Grey reef sharks also form loose aggregations that lurk close to reef drop-offs. Lone individuals may be seen over shallow reefs either lying motionless on the bottom of the sea floor for long periods of time or swimming. Tagging studies show that sharks living near ocean reefs are nomadic and travel long distances along the reef habitat each day. Sharks residing in lagoon areas tend to return day after day to the same site.

#### Avoid

- **Fisheries:** gillnets and longlines (baited) set relatively close to outer reefs.
- **Finning:** represented by particular boats as seen from below.
- **Predators:** Big sharks—specifically, white-tipped reef sharks, tiger, hammerhead sharks—eat little sharks of all species, even their own babies.

#### Seek

- **Find a mate:** Move toward mature females and away from obviously pregnant females.
- **Feed:** Search for boney reef fish about a foot long, lobsters, squids, crabs and octopuses.

### LEVEL 3

**Great white shark:** Player trails a great white shark swimming in deep waters. Food sources occur only occasionally so it is very important to get almost every one.

**Habitat:** Great white sharks, normally 12 to 16 feet long (3.5 to 5 m), are one of the ocean's most feared predators. Off the California coast, they are responsible for more attacks on humans than any other shark, but they usually do not kill their victims. Great whites swim just beyond the surf, near coastal archipelagos or in deep water. Recent research using tags that record and transmit information about white shark behavior has led to the discovery that this species spends more time in deep water than previously believed.

#### Avoid

- Commercial longlines and gillnets and big game sport fishermen; protected in California
- Finning (same as Level 2)
- Boat engines (mistaken for food and can instead wound).
- Certain types of prey: As an apex predator feeding on prey often larger than themselves (e.g., sea lions), you must exercise caution when choosing a prey item and an attack strategy because the prey could inflict a potentially fatal wound (even if just due to infection).
- Larger great white sharks that may feed on smaller ones.
- Potentially fatal altercations with larger or more aggressive individuals of your own species while you are all feeding on the same food source, like a whale carcass.

#### Seek

- **Find a mate:** a challenging task since they are an apex predator and are few and far between.
- **Feed:** seals, sea lions, dolphins, sea turtles, skates, stingrays

## Answer Key

### LOCATION DATA SHEET ANSWERS

SHARK	NEAREST COUNTRY	SURROUNDING OCEAN BASIN
Swell shark	United States (California coast)	Pacific ocean basin
Gray reef shark	French Polynesia	Pacific ocean basin
Great white shark	Australia	Indian ocean basin

### SHARK SPECIES/ECOSYSTEM DATA SHEET ANSWERS

SHARK SPECIES	HABITAT	WHAT DOES IT EAT?	WHAT EATS IT?
Swell shark	Bottom of the ocean to depths of 120 feet	Fish, mollusks, crustaceans	Crabs, octopuses, sea lions, seals, other larger marine creatures
Gray reef shark	Ocean floor and open ocean	Cowfish, surgeonfish, butterfly fish, squid, octopus, shrimp, lobster	Silvertip sharks, fishermen, hammerhead sharks
Great white shark	Open ocean	Seals, sea lions, dolphins, sea turtles, skates, stingrays	Killer whales, humans, larger great white sharks

## Shark Threat Data Sheet Answers

THREAT	HOW IS THIS A THREAT TO SHARKS?	THINK OF SOME POSSIBLE SOLUTIONS
Predators and larger animals	The shark is not always the largest animal in the sea, and many are prey for larger sharks and mammals. Even great whites need to be careful of whom they attack because larger prey may fight back.	<ul style="list-style-type: none"> <li>• Swell sharks – camouflage, wedge into tight spaces, create an awkward circle with their bodies</li> <li>• Gray reef sharks – swim erratically, attack, flee</li> <li>• Great white sharks – avoid too large or dangerous prey</li> </ul>
Crab and lobster traps	Looking for food, swell sharks may poke their heads into the traps and become trapped themselves.	Answers will vary; some may include ideas regarding limiting the use of these fishing methods as well as frequent checking for and release of trapped sharks.
Trawls and gillnets	Swell sharks can be caught in trawls because they are bottom dwellers and slow swimmers. Some sharks may become entangled in gillnets as they twist and turn in an attempt to free themselves.	Answers will vary; some may include ideas regarding limiting the use of these fishing methods as well as frequent checking for and release of trapped sharks.
Longlines	Sharks may be attracted to fish already caught on the many hooks of a longline, then be snagged themselves.	Answers will vary; some may include ideas regarding limiting the use of these fishing methods as well as frequent checking for and release of trapped sharks.
Finning	Sharks are caught by fishermen whose only intent is to slice off their fins—discarding the shark body—for use in shark fin soup, a delicacy in Asian countries.	Answers will vary; some may include ideas regarding banning the use of sharks for food or setting limits on how many sharks can be caught each year.
Sport fisherman	Individuals seek out great whites to catch as trophies.	Answers will vary; as this is already illegal in many countries, ideas may reflect better enforcement of the regulations as well as better education of the public about the importance of maintaining this species in the wild.
Boat engines	Sharks don't have the use of hands to investigate their surroundings and generally use their mouths; coming too close to an interesting boat may hurt a shark because propellers can gash the body or slice off a fin.	Answers will vary; ideas may include limiting the number of boats allowed in some shark habitats or creating new boat designs that are less dangerous to sharks.

## Reporting Data Answers

1. **Threats:** larger sharks, fish, mammals, crab and lobster traps, trawls and gillnets, longlines, finning practices, sport fishermen, and boat engines.
2. An increase in the shark's prey species and an imbalance of the ecosystem. Answers will vary to second part.
3. Answers will vary.
4. **Sample food chains:**
  - Fish/mollusks/crustaceans → **swell shark** → crabs/octopuses/sea lions/seals/larger
  - cowfish/surgeonfish/butterfly fish/squids/octopuses/shrimps/lobsters → **gray reef sharks** → silvertip sharks/fishermen/hammerhead sharks
  - seals/sea lions/dolphins/sea turtles/skates/stingrays → **great white shark** → killer whales/humans/larger great white sharks
5. Answers should reflect an imbalance of the respective ecosystem and an increase in the number of the prey species.
6. Answers will vary.