

## Lesson Plan

# Game of Life

### FOCUS

Sustainable Seafood

### FOCUS QUESTIONS

What does overfishing mean?  
What are the effects of overfishing on fish stocks?

### LEARNING OBJECTIVE

By the end of the lesson, the students will be able to:

- explain why overfishing has occurred in our oceans.
- describe the effects of over-fishing on fish stocks.

### GRADE LEVEL

6-8 (Life Science/Earth Science)

### MATERIALS

- Recess-type ball, labeled "LIFE"
- Chart paper
- Markers
- Color-coded cards or sticker

### AUDIO VISUAL MATERIALS

None

### TEACHING TIME

One 50-minute class period

### SEATING ARRANGEMENT

Groups of 3-4; whole class

### MAXIMUM NUMBER OF STUDENTS

30

### KEY WORDS

Fish stocks  
Overfishing  
Population  
Biomass  
Sustainable, sustainability  
Bycatch  
Species

### BACKGROUND INFORMATION

Fish are an important component of the oceans' web of life. People often forget or do not know how important they are as wildlife in interdependent ecosystems. The prevailing view of fish in the past was that they were an unending supply of food. The ocean is so vast and unexplored. As technology has increased, so has the ability of the scientific community to better understand the roles fish play in the ocean and the effects people have on them and the ecosystems in which they live.

Making choices to sustain seafood populations starts with an understanding of the role each species plays in their ecosystem and the result of their removal from that ecosystem. Through the game in this lesson, students will understand the effects of overfishing on the sustainability of fish stocks and, thus, the ability to meet the human demand for seafood. By the end of the lesson, they should understand that the removal of many individuals from a fish stock makes it difficult to replenish



and sustain a population. Increased distances between individuals make it difficult to reproduce. Also, for some species, the separation from their stock makes it difficult to find protection (e.g. schooling fish), difficult for some species to find food, difficult for young to survive, etc.

### PREPARATION

Make cards or stickers for the game.  
Prepare recess ball.

### LEARNING PROCEDURE

#### *Introduction:*

Pose the following scenario to the class and give them approximately 10 minutes to complete:

*Imagine you live by yourself and are at least 100 miles away from any other human. This is also the case for every other human in the world. You have nothing but the clothes on your back. With a partner, brainstorm how you can benefit from the situation and what difficulties it creates for your survival. Record your answers in your journal and record the difficulties on the chart paper.*

Discuss the results of the pair activity and share the charts. Post the charts for the duration of the lesson for reference.

#### *Lesson:*

Game of Life: The goal of this game is to illustrate to the students what happens to a fish stock when large amounts of biomass are removed from a particular species.

1. Assign color cards or stickers to students as follows: for every 10 students, assign 1 red, 2 green, 3 blue, and 4 yellow. The number of colored cards will vary with class size, but try to approximate the above proportions as closely as possible.
2. Take the students to the gym or outside, if weather permits. The students need to spread out far enough to toss the recess ball to each other with slight difficulty, and all the colors need to be spread out evenly around the space.
3. Explain to the kids that the ball represents life. Have them toss around the ball for a minute. Discuss with the students how easy or hard this is. Explain that when a species has a sustainable population, life is easy. They are close enough to each other to interact (to mate, to be protected by their school, etc.). Then present a fishing scenario (step 4 below) and have students sit down according to how efficient the fishing practice is.
4. Over time, many species of marine animals and fish have been hunted on land or fished from the world's waters too much. Individual fisherman or those on small boats (artisanal fishermen) were the first to extract animals from the sea. Fish was only available to people who lived near the ocean and lakes. Two local fishermen in a small boat have entered the class waters to fish. They take just a few fish from the waters. Have the red cardholders sit down. Have the students toss the ball around and then ask how the loss of the red cardholders affects the



population. (Artisanal fishers have very little impact on a fish stock because they cannot extract a large amount of biomass using a hook and line or small net.)

5. A variety of factors influenced the increased demand for seafood in the 20<sup>th</sup> century. Refrigeration technology and trains made transport of fish to the interior of the United States easier. Also, scientists and doctors studied the diet of people living near the coasts of countries such as Japan. They found that eating fish contributed to a healthy diet and possible longer life. When these findings were published, people across the country began to get a taste for fish from the oceans. Seafood was no longer food for only coastal inhabitants.

As technology improved, larger fishing vessels sailed the seas with larger crews and could extract more biomass from the waters. Fish could also be kept fresh longer with new refrigeration technology. Tell the class a ship manned with 20 fishermen has entered their waters and are catching more fish than the artisanal fishermen ever could. Have all the students with blue cards sit down, while the rest continue tossing the ball. Discuss what is happening with the game (some students are farther away from other students than they previously were and it is hard to toss to them; more difficult to have interaction with member of their species).

6. The demand for fish increases as the population of the U.S. and the world

increase. People in the U.S. continue try to live more healthy lives. This, coupled with the improvements in fishing technology enables fishermen to become much more efficient. Fishing vessels can hold tons of fish, can stay out at sea longer, and can catch and store thousands of fish during one fishing trip. These vessels usually target one species of fish during a certain time of year and extract tons during the fishing season. Also, no matter when they fish, the vessels have bycatch (animals that are not the target of the fishing operations) in the nets or on the fishing lines. Not only are the populations of the target species quickly declining, other species are negatively affected as well. Have all the students with the yellow cards sit down.

7. Have the remaining green card students briefly toss around the ball. Discuss what happens to the game when so many people can no longer participate in the game.

#### *Closure:*

Use the game to discuss the effects of overfishing with the class. Possible questions to start the spur the discussion are:

- What problems could occur for the remaining fish (green card students) that are spread apart? See paragraph below.
- What happens if disease breaks out among the population?
- What happens if an oil spill or other toxic event occurs?
- What happens if man keeps fishing this way?



When a large percentage of a species is removed from the environment, it can have a negative effect on the fish primarily because they cannot reproduce. They are too far from each other to mate and raise young. In addition, many fish, such as the Patagonian toothfish (popularly known as Chilean sea bass), cannot reproduce until they are many years old; 10-12 years for the toothfish. The increase in the number of fish taken from the sea increases the likelihood that fish will not reach maturity and be able to replenish their species.

You can also relate this back to the food web and ecosystems lessons. The primary organism affecting the life of the fish (the students), or the top predator, in the game is man. We have no natural predators above us on the food chain. The three events that cause students to sit down are also three of the primary causes of population decline in marine species. They are the result of man's activities. Other factors have threatened species in the past, but now man is exerting the primary influence of the marine environment.

#### THE BRIDGE CONNECTION

<http://vims.edu/bridge/>--Click on "Ocean Science Topics" in the navigation menu to the left, then navigate to (1) "Human activities," then "Environmental Issues," then "Sustainability"; (2) "Biology," then "Biodiversity" or "Endangered" or "General Marine Life."

#### THE "ME" CONNECTION

Have students compose a speech

discussing their place in the food web and how they affect the web of life in the ocean. This assignment will prepare the students for the following lesson.

#### CONNECTIONS TO OTHER SUBJECTS

English/Language Arts

#### EVALUATION

1. Using the class chart, have each student summarize key learnings in individual science journals.
2. Using the information gained in the lesson, have students create a poster about the overfishing of their class (e.g. The Overfishing of the Seventh Grade Sea). They should mention the history of fishing and how current fishing practices (from the game) affect the chance of survival of their species (the class). They may need to do additional research. Display the posters around the school as appropriate and have the administrators "judge" them (not on artistic skill) or complement each one.

#### EXTENSIONS

Visit <http://marinelife.noaa.gov> to learn about the top one hundred species in each national marine sanctuary in the U.S.

Visit the Seafood Watch Program <http://mbayaq.org/cr/seafoodwatch.asp> to learn more about overfishing and how to make sustainable seafood choices.

Visit the NOAA Fishwatch Program <http://www.fishwatch.gov/> for the most up-to-date information on popular seafood harvested - or farmed - in the United States.



## RESOURCES

<http://sanctuaries.noaa.gov> - Website of the NOAA Office of National Marine Sanctuaries

<http://sanctuaries.noaa.gov/education> - NOAA Office of National Marine Sanctuaries Education Program website with sections specifically designed “For Students” and “For Teachers.”

<http://oceanworld.tamu.edu/students/fisheries/fisheries6.htm> – Texas A&M University website with resources for students about fisheries and overfishing.

## NATIONAL SCIENCE EDUCATION STANDARDS

Content Standard C: Life Science

- Regulation and Behavior
- Populations and Ecosystems
- Diversity and Adaptations of Organisms

Content Standard F: Science in Personal and Social Perspectives

- Populations, Resources, and Environments
- Natural and Human-induced Hazards

## NATIONAL GEOGRAPHY STANDARDS

Essential Element 5: Environment and Society

- Human influences on the oceans

- Ocean influences on humans
- Ocean resources

## FOR MORE INFORMATION

National Education Coordinator  
NOAA Office of National Marine Sanctuaries  
1305 East-West Highway, N/ORM63  
Silver Spring, Maryland 20910  
301-713-3125 • 301-713-0404 (fax)  
[sanctuary.education@noaa.gov](mailto:sanctuary.education@noaa.gov)

## ACKNOWLEDGEMENT

This lesson was developed for the NOAA Office of National Marine Sanctuaries by Molly Harrison, Education and Outreach Coordinator for NOAA National Marine Fisheries Service Office of Protected Resources, and edited by Michiko Martin, Outreach and Education Division Chief for the NOAA Office of National Marine Sanctuaries.

## CREDIT

Permission is hereby granted for the reproduction, without alteration, of this lesson plan on the condition its source is acknowledged. When reproducing this lesson, please cite the NOAA Office of National Marine Sanctuaries as the source, and provide the following URL for further information:

<http://sanctuaries.noaa.gov/education>.

