

Fighting for Life in French Creek

Created By: An original Creek Connections activity created by David Hall, Creek Connections staff. Creek Connections, Box 10, Allegheny College, Meadville, Pennsylvania, 16335

Grade Level: Basic to Intermediate

Duration: One class period, 30-40 minutes

Setting: open space, outdoors, or in a gymnasium

Summary: Students take part in a physical activity to simulate the hazards faced by a fish in a typical creek, including predation, toxins, and oxygen depletion.

Objectives: Students will become more aware of how difficult life is for a fish in a typical creek. They will learn how, predation, toxins, and oxygen depletion affect fish.

Vocabulary: eutrophication, bioaccumulation

Related Module Resources:

- Fishes of French Creek Watershed Booklets (orange)
- Fish Field Guides (green)

Materials (Included in Module):

- 210 Poker chips (clear box)
- Whistle (clear box)
- Cones (red and yellow bowls)
- Fish and Predator cards
- Oxygen chips

ACADEMIC STANDARDS: ENVIRONMENT AND ECOLOGY

7th Grade

- 4.1.7.C Explain the effects of water on the life of organisms in a watershed
- Describe the life cycle of organisms that depend on water
- 4.1.7.E Describe the impact of watersheds and wetlands on people.
- Explain the impact of watersheds and wetlands in...wildlife habitats and pollution abatement
- 4.7.7.B Explain how species of living organisms adapt to their environment.
- Explain how living things respond to changes in their environment
 - Explain how one species may survive an environmental change while another may not

10th Grade

- 4.1.10.C Describe the physical characteristics of a stream and determine the types of organisms found in aquatic environments.
- describe and explain the physical factors that affect a stream and the organisms living there
 - explain the habitat needs of specific aquatic organisms
- 4.7.10.C Identify and explain why adaptations can lead to specialization
- explain factors that could lead to a species' increase or decrease
 - explain how management practices may influence the success of specific species

12th Grade

- 4.1.12.E Evaluate the trade-offs, costs and benefits of conserving watersheds and wetlands.
- evaluate the effects of human activities on watersheds and wetlands
- 4.6.12.C Analyze how human action and natural changes affect the balance within an ecosystem.

BACKGROUND:

French Creek supports a vast variety of life within its water column. Among this life are 84 species of fish, including 12 threatened or endangered species. Although French Creek has excellent water quality and provides good habitat, life for a fish in French Creek is not free from challenges. Some of these challenges are natural and others are the result of human actions.

Among the natural challenges faced by the fish is that of being preyed upon by many species of animals. Small fish are in constant danger of being fed on by larger fish. Small and medium sized fish are also prey for raccoons and birds like the Great Blue Heron. And even the largest fish are at risk from the occasional bald eagle or the ultimate predator in the watershed, humans. Being eaten by a predator is only one of the many challenges in the life of fish.

A fish must find food if it is going to survive and reproduce. Searching for food often makes a fish more vulnerable to predators while they are moving about feeding. Toxins are also a risk that fish face. Toxin

levels can get so high that they disrupt biological processes or even cause death. French Creek is a high quality stream, but it is not completely free from toxins. Heavy metals and other poisons leak into the water from faulty storage tanks or discharged in wastewater from industrial plants. As a fish feeds, **bioaccumulation** occurs, meaning that toxic levels build up and are passed on through the food chain in waterways.

Low oxygen levels are another challenge faced by fish. Dissolved oxygen naturally decreases as the water temperature rises in the summer. Human actions can cause further increases in water temperature, which make life increasingly difficult for fish. Human activities such as riparian buffer removal, paving parking lots, industrial cooling water discharge, and damming all raise water temperatures. A process called **eutrophication** also decreases oxygen levels. This occurs when excess nutrients are introduced into the system by pollution. These pollutants come from sewage, detergents, and farm runoff. These nutrients, mostly phosphates and nitrates cause excessive plant growth to occur. When these plants die, the decomposition removes huge amounts of oxygen from the water. Once dissolved oxygen is removed from the water, the fish suffocate.

Despite the many challenges to life in the creek, fish are very resilient and have developed mechanisms to defend themselves against natural risks like predation. Challenges caused by human activities, however, are more problematic because they have arose rapidly in recent years. Fish have not had time to evolve and develop defense mechanisms against manmade toxins, or eutrophication from human pollution.

OVERVIEW:

Students will play an active game that simulates the dangers faced by a fish in French Creek. These include simulated predation, toxic poisoning, and oxygen depletion.

PROCEDURE:

Teacher Preparation:

1. Prior to starting the activity the playing field must be set up. (See the attached diagram)
2. Use cones to mark off a starting pool and feeding area.
3. Place cones in between the starting and feeding area to simulate the winding stream channel.
4. Spread out poker chips in the feeding area. Use three colors about 70 of each color. (Pick one color that will be the toxins, but do not let the students know which one it is.)
5. On the other side of the field spread 150 oxygen squares out evenly. These will represent dissolved oxygen in the water. Spread them well apart or only a few fish will die from oxygen depletion.
6. Make copies of the data sheet for students to keep track of the dangers they face as fish and to use for comparison and discussion after the game is finished.

Student Experiment or Activity:

PART I

1. Select 2 or 3 students to be predators, give them predator cards and have them stand outside of the stream channel area. Give the rest of the students fish cards and have them stand in the starting pool. Mix the cards up so that you have about equal numbers of each fish type represented in your group.
2. Explain the layout of the field to the students and make sure that they know what they are supposed to be doing. The students will have to run through the cones to the feeding area, without being caught by the predators. During this time, the predators may enter the stream channel taking one fish (student) at a time by the arm and escorting them out of the playing area. Then, the predator can return for another fish (student).
3. Have the students read their fish card, to determine how many food chips they are going to have to collect in the feeding area.
4. Start the game with a whistle blow.
5. Once the students reach the feeding area they must pick up the number of poker chips indicated on their fish card as food required. Then they must move out of the feeding area to the end of the playing field. While the students are in the feeding area, the predators may still catch and remove fish (students) from the game. However, once the students have collected their required number of food chips without being caught, they have successfully completed part I of the activity. They should wait in the ending safe area for the rest of the students to collect their food chips or to be eaten.
6. While students are in the feeding area the predators may still catch and remove fish (students) from the game.
7. Once every student has been through the feeding area or has been caught by a predator stop the game with a whistle blow.
8. Now tell the students which color of chip was the toxin. If anyone picked up more toxin chips than allowed on their card, then they die and must leave the game. Record how many fish were caught by predators and how many were killed by toxins on the data sheet.

PART II

1. For this part of the game the predators will now be judges to make sure that no one cheats by taking more steps than they are allowed. Fish who died in Part I may play in Part II.

2. The students will attempt to move from the starting area to the ending area without running out of oxygen. A student may only take the number of steps indicated on their card before they must pick up another oxygen square.
3. If no square is within reach, then the fish runs out of oxygen and dies.
4. To survive, the fish must make it to the end pool without running out of oxygen.
5. Record on the data sheet how many fish died from oxygen depletion.

DISCUSSION:

What effect did predators have on the population of fish? *Actual results will vary but they should have reduced the fish populations.*

What can fish do to avoid predators? *Fish can zigzag and dodge predators. A real fish is often camouflaged to avoid detection by predators. Fish may also move together in schools so that some are sure to escape when a predator attacks.*

How did the toxins affect the fish populations? *The toxins should have reduced the fish population.*

Were some fish affected more than others were? Why? *The trout population should have been reduced more than the bass, blue gill, and bullhead populations were. Some species of fish are more tolerant of pollution than others are due to differences in their biological systems and evolutionary history.*

How did the lack of oxygen impact the fish population? Why? *It should have killed off the ones with higher oxygen demand. Without sufficient oxygen levels, fish suffocate and die.*

Where might the toxins in the creek have come from? *See the background section.*

If the game was extended as suggested in the modifications, how did the toxins and oxygen impact the populations this time? *The number of fish that perish in the second round should be higher than the number that died in the first due to toxic build up and less dissolved oxygen.*

What can humans do to reduce the threats to fish? *Replanting riparian cover, preventing warm water discharge into streams, and stopping excessive nutrient inputs are all things that humans can do to help fish survive. Humans can also prevent pollution and litter from entering streams.*

EVALUATION:

- The discussion questions above can be used as a quiz to evaluate what the students learned

- For more advanced classes the students can write a one page explanation of the results that were recorded in the data table, and about the threats to fish that exist in our area.

EXTENSIONS AND MODIFICATIONS:

- If time permits you may have the students run through the activity a second time. Pick a new color in the second round to be the toxin, and have them add the amount of toxin they get in this round to the amount that they picked up in the first round. This will represent the bioaccumulation that takes place in nature. Do not put back additional oxygen squares so they can see how with time the oxygen levels get lower and impact fish more.
- You can conduct an additional class discussion about how the risks to fish can be lowered. What other factors might make life for a fish difficult?
- Have the class select fish species and do research on what the major threats to them are in our waterways.
- Review current events related to threats to waterways that have been in the news and talk about solutions
- Talk about things the students use that may end up being toxic to fish in waterways.
- Talk about ways to increase DO levels in a river or stream.

NOTES (PLEASE WRITE ANY SUGGESTIONS YOU HAVE FOR TEACHERS USING THIS ACTIVITY IN THE FUTURE)



DATA SHEET : FIGHTING FOR LIFE IN FRENCH CREEK

Name _____ Date _____

	Round #1			Round #2		
	Predator Kills	Toxin Kills	O ₂ lack Kills	Predator Kills	Toxin Kills	O ₂ lack Kills
Trout						
Bluegills						
Bass						
Bullheads						

	Round #1			Round #2		
	Predator Kills	Toxin Kills	O ₂ lack Kills	Predator Kills	Toxin Kills	O ₂ lack Kills
Trout						
Bluegills						
Bass						
Bullheads						

<p style="text-align: center;">Bluegill</p> <p># food chips = 3 # toxins allowed = 2 # step/O₂ chip = 3</p>	<p style="text-align: center;">Trout</p> <p># food chips = 4 # toxins allowed = 1 # steps/O₂ chip = 2</p>
<p style="text-align: center;">Bass</p> <p># food chips = 4 # toxins allowed = 2 # steps/O₂ chip = 3</p>	<p style="text-align: center;">Bullhead</p> <p># food chips = 5 # toxins allowed = 3 # steps/O₂ chip = 4</p>

OXYGEN SQUARES

O ₂	O ₂	O ₂	O ₂	O ₂	O ₂	O ₂
O ₂	O ₂	O ₂	O ₂	O ₂	O ₂	O ₂
O ₂	O ₂	O ₂	O ₂	O ₂	O ₂	O ₂
O ₂	O ₂	O ₂	O ₂	O ₂	O ₂	O ₂
O ₂	O ₂	O ₂	O ₂	O ₂	O ₂	O ₂
O ₂	O ₂	O ₂	O ₂	O ₂	O ₂	O ₂
O ₂	O ₂	O ₂	O ₂	O ₂	O ₂	O ₂
O ₂	O ₂	O ₂	O ₂	O ₂	O ₂	O ₂
O ₂	O ₂	O ₂	O ₂	O ₂	O ₂	O ₂

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Playing Field

