

Survival of the...Luckiest?

(Adapted from: "The Great Anadromous Fish Game" from *Living in Water*, Kendall/Hunt Publishing Co)

Grade Level: Middle School

Subject Areas: Biology, Environmental Science, Math

Duration: 45 minutes

Maryland State Curriculum:

- Grade 6
 - Science
 - 1.B.1 - View data from a simple experiment, summarize the data, and construct a logical argument about the cause-and-effect relationships in the experiment.
 - 1.F.1.a - Explain that populations increase or decrease relative to the availability of resources and the conditions of the environment.
 - Math
 - 6.C.1.e - Determine a percent of a whole number
- Grade 7
 - Science
 - 1.B.1 - View data from a simple experiment, summarize the data, and construct a logical argument about the cause-and-effect relationships in the experiment.
 - 1.C.1.a - Organize and present data in tables and graphs and identify relationships they reveal.
 - 3.E.1.f - Provide evidence that supports the premise "In the flow of matter system the total amount of matter remains constant even though its form and location change."...food chains and food webs
 - Math
 - 6.C.3 - Analyze ratios, proportions, or percents
- Grade 8
 - Science
 - 1.B.1 - View data from a simple experiment, summarize the data, and construct a logical argument about the cause-and-effect relationships in the experiment.
 - 1.C.1.a - Organize and present data in tables and graphs and identify relationships they reveal.
 - Math
 - 6.C.3 - Analyze ratios, proportions, or percents

Environmental Literacy:

Grades 6-8

- 1.B.1 – Identify and describe that ecosystems can be impacted by human activities.
- 2.B.2; 4.D.1,2 – Analyze the value and limitations of different types of models in explaining real things and processes.
- 3.E.1 – Explain that the transfer of matter and energy links organisms to one another.

Objectives:

- Students will understand that very few bluegills survive to adulthood.
- Students will understand that the mortality rate depends on the life stage.
- Students will understand that bluegill mortality may be due to natural or man-made causes.

Materials:

- For each group of 2-3 students - game board, set of game cards, a penny, copy of “Life Stages of Fish”
- For each student - one game piece, worksheet, calculator (optional)

Teacher Preparation:

- Use a color copier to copy the game board.
- Copy the five kinds of hazard cards onto colored paper. This makes them easier to sort. It is easier if the cards match the colors on the game board.
 - Eggs in Nest – brown
 - Sac Fry in Nest – tan
 - Bluegill Larvae - light blue
 - Juvenile Bluegills – dark blue
 - Adult bluegills - green
- If you plan to use the game board and cards more than once, you might want to laminate them.

Activity:

- Introduction:
 - Ask students to think about the following scenario: Each spring, a female bluegill may lay up to 60,000 eggs. What would happen if all the eggs survived?
 - What do the students think happens to all those eggs? At what stage in a bluegill’s life is it most likely to die? Is the mortality from natural or human causes? *Accept any reasonable answers.*
 - Tell them that they are going to do an activity to find out.

- Activity:
 - Divide the students into groups of 2-3.
 - Give each group a copy of “Life Stages of Fish” so they know what each stage looks like and its characteristics.
 - Give each group a game board and a set of hazard cards.
 - Tell them not to look at the cards. Have them put the hazard cards facedown into five piles
 - The color of the cards matches the colors on the game board.
 - Give each group a penny; give each student a worksheet and have him/her find something to use as a game piece.
 - Explain that each student represents a bluegill nest. The average nest contains about 15,000 eggs.
 - Each student will start with 15,000 eggs.
 - The object of the activity is to see how many of those eggs survive to become mature and spawn successfully themselves.
 - Have each player flip the penny three times. The student with the most “heads” goes first, the one with the next highest goes second and so forth.
 - At each turn, the player will flip the penny. Heads = move one space; tails = move two spaces. .
 - If the player lands on a space that says “Take a hazard card”, the player is to draw a hazard card from the appropriate colored pile.
 - Remind the students that the color of the cards matches the color on the game board.
 - If the card says that a certain percentage of fish were lost, the student will have to calculate how many fish were lost and how many fish remain.
 - They are to calculate mortality every time they draw a hazard card. The use of a calculator is up to the teacher.
 - Any fraction is to be rounded up to the next whole number (After all, you cannot have half a fish!)
 - Give students time to play the game.

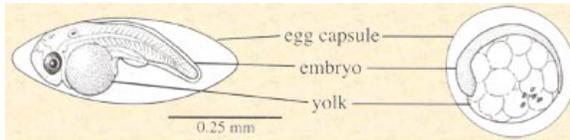
Discussion:

- Bring the students back together and take a class survey. Who had the highest number of survivors? The lowest? Did anyone lose all their fish?
- At what life stage did most of the mortality occur? *Most of the mortality usually occurs in the egg, sac fry or larval stage.*
- At each life stage was most of the mortality natural or man-made?
- How realistic do the students feel this activity is? If they were designing the activity, what changes would they make?



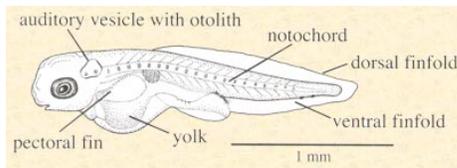
Life Stages of Fish

Egg



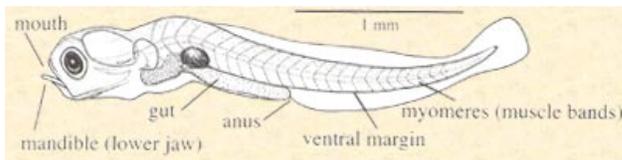
Bluegill eggs are tiny, only about 0.05 inch in diameter. They sink to the bottom of the nest where they stick to the gravel substrate. Depending on the temperature, they will hatch in 2 to 5 days. During this time, the male guards the nest from predators.

Sac Fry



Bluegill sac fry do not look anything like adult fish. They are slightly larger than the eggs, about 0.15 inch long, and they cannot swim or eat. Instead, they remain in the bottom of the nest and survive by absorbing the yolk sac. They will remain in the nest for another 5 to 10 days during which time, the male continues to guard them.

Larval Fish



Larval bluegills still do not look anything like the adult, but they can now swim and eat. At this point, they leave the nest and are on their own.

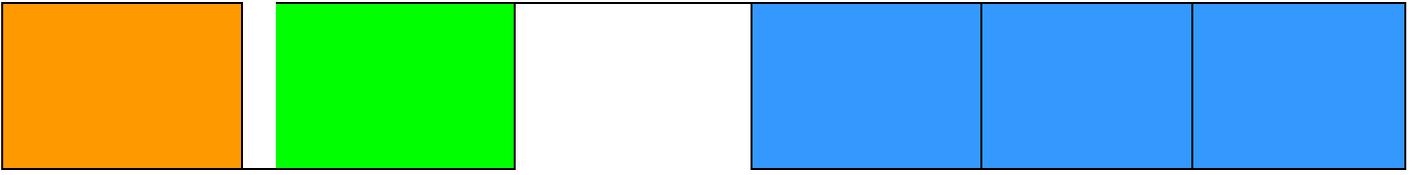
Juvenile Fish

Juvenile bluegills basically look like the adults – just smaller. Depending on the temperature, it may take several years before they become mature adults and able to spawn.

Illustrations from *Zooplankton of the Atlantic and Gulf Coasts (A Guide to Their Identification and Ecology)* by William S. Johnson and Dennis M. Allen.

<http://aqua-culture.blogspot.com/2007/03/stages-of-fish-development.html>

	Take a hazard card	Take a hazard card		Take a hazard card	Take a hazard card
Bluegill Larvae					Take a hazard card
Take a hazard card					
Take a hazard card	Take a hazard card		Take a hazard card		Juvenile Bluegills
					Take a hazard card
Take a hazard card			Take a hazard card		Take a hazard card
Take a hazard card					
Sac Fry in Nest	Take a hazard card		Adult Bluegills		
Take a hazard card					Take a hazard card
Take a hazard card			Take a hazard card		
Take a hazard card	Take a hazard card				Take a hazard card
Take a hazard card					
Take a hazard card					
Eggs in Nest	Successful Spawning				Take a hazard card
Start Here	End Here				



Survival of the...Luckiest? - Student Worksheet

Life Stage	Number Before Hazard Card	Percent and Number that Die	Number that Survive	Natural or Man-Made Hazard
Number of eggs to start	15,000			
Example	15,000	50 % (7,500)	15,000 – 7500 = 7500	Natural
Eggs in Nest				
Eggs in Nest				
Eggs in Nest				
Eggs in Nest				
Number of surviving eggs				
Sac Fry in Nest				
Sac Fry in Nest				
Sac Fry in Nest				
Sac Fry in Nest				
Number of surviving sac fry				
Bluegill Larvae				
Number of surviving larvae				

Life Stage	Number Before Hazard Card	Percent and Number that Die	Number that Survive	Natural or Man-Made Hazard
Juvenile Bluegills				
Number of surviving juvenile bluegills				
Adult Bluegills				
Number of Adult Fish that Survive to Spawn				