Bluegills and the Top Predator

Grade Level: Middle school
Subject Areas: Biology, environmental science, math
Duration: Approximately a half hour

Next Generation Science Standards:

- MS-LS2-1 – Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem
- MS-LS2-4 - Construct an argument based on empirical evidence that changes to physical or biological components of an ecosystem affect populations
    - Practices of science
        - Developing and using models
        - Analyzing and interpreting data
        - Using mathematics and computational thinking
        - Constructing explanations
    - Cross cutting concepts
        - Patterns
        - Cause and effect

Common Core State Standards – ELA/Literacy

- SL.6-8.1 - Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade appropriate topics, texts, and issues, building on others' ideas and expressing their own clearly.

Environmental Literacy:

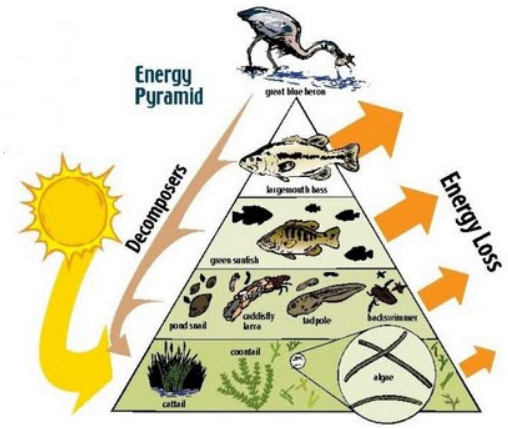
- 3.A.1 – Demonstrate that matter cycles through and between living systems and the physical environment, constantly being recombined in different ways
- 4.A.1 – Explain how organisms are linked by the transfer and transformation matter and energy at the ecosystem level.
- 4.B.1 – Analyze the growth or decline of populations and identify a variety of responsible factors.
- 2.B.2 – Use models and computer simulations to extend his/her understanding of scientific concepts

Objectives:

- Students will understand the predator/prey relationship between bluegills, largemouth bass, and humans
- Students will understand the importance of top predators in an ecosystem.

Teacher Background:

In a bluegill pond, a food pyramid might look something like this:



Bluegills are predators and feed primarily on herbivores, such as zooplankton, insects and insect larvae, small crustaceans, larval and smaller fish. In turn, they are preyed upon by top predators, usually larger fish like largemouth bass. But does anything feed on the bass? Blue herons and snapping turtles sometimes do, but we often forget about the top predator of all – humans.

Humans have an unfortunate tendency to remove top predators from ecosystems, often with unintended consequences. Sometimes, it is a matter of fear. For example, cougars, wolves and bears are frequently perceived as a threat not only to people, but also to domestic animals. The removal of these top predators has had a disastrous effect – deer populations have gotten out of control and damaged entire ecosystems, in many cases to the point that they cannot recover.

In the case of a bluegill pond, people again usually prefer to remove the top predator – the largest bass possible. The result often is that the number of bluegills increases so rapidly that they run out of food and the population crashes. The challenge of managing a bass/bluegill pond is knowing how many bass can be harvested without upsetting the population balance.

Materials:

- Cones to mark off playing field
- Tokens (poker chips, clothespins, etc) – ten for each "bluegill"
- Paper lunch bags – one for each student
- Bandanas or colored armbands – different colors for bass, bluegills, and anglers

Activity:

- Engage
  - Have students think about food webs in a pond containing bluegills. Have them think in terms of a food pyramid. You might want to have them draw this as it is being discussed.
    - What's at the bottom of the food web? *Plants, especially algae*

        - What eats the algae? *Herbivores, such as zooplankton, insects and insect larvae, tadpoles*
        - What eats the herbivores? *Fish like bluegills*
        - What eats the bluegills? *Larger fish like bass*
    - What impact might humans have on the food web in this pond? *Students will probably mention pollution, but eventually someone will mention fishing.*
        - Which level in the food web are humans most likely to fish for? *The top level – bass*
        - What impact do they think the removal of the bass would have on bluegill populations? Tell them that they are going to do an activity to find out.
- Explore
    - Mark off the playing field with the cones and scatter 10 food tokens for each bluegill. Designate one sideline as a hiding place; the other for "dead" fish.
    - Explain the rules:
        - Divide students into bass, bluegills, and humans. There should be approximately one bass for every four bluegills and two humans to start.
        - Each bluegill must collect 10 tokens to escape starvation. Each bass must collect 20 tokens in order to survive.
        - If a bass tags a bluegill, the bluegill must give the bass their tokens (they are "dead"). The bass must take the bluegill to the sidelines before it can continue hunting (after all, the bass must eat one fish before it goes after another).
        - **Emphasize to students that they must walk – not run!**
    - Round One:
        - In this round, the "humans" will watch.
        - Remind them that each bluegill must collect 10 tokens to survive; bass must collect 20 tokens.
        - When any animal has found enough to eat it can go to the designated "safe" sideline.
        - The round ends when everyone has either gotten enough to eat, has been eaten, or the food has run out.
            - How many bass and bluegills survived? How many were eaten and how many died of starvation?
            - Did a few fish at each level in the food pyramid survive to reproduce?
    - Round Two:
        - Scatter the tokens again. The same rules as in Round One apply.
        - Have the same number of bluegills and bass, but this time, add the humans. They may catch as many bass as they can, but they have to take the bass to the "dead" sideline each time.

        - Again, the round ends when everyone has either gotten enough to eat, has been eaten, or the food has run out.
            - How many bass and bluegills survived? How many were eaten and how many died of starvation?
            - Did a few fish at each level in the food pyramid survive to reproduce?
    - Round Three:
        - Scatter the tokens again. The same rules as in Round One apply.
        - This time, any dead bass becomes a bluegill. If all the bass were killed in Round Two, there's no reason for the humans to continue fishing, so they also become bluegills.
        - Again, the round ends when everyone has either gotten enough to eat, has been eaten, or the food has run out.
            - How many bass and bluegills survived? How many were eaten and how many died of starvation?
            - Did a few fish at each level in the food pyramid survive to reproduce?
- Explain
    - Have students graph the data
    - Using the graph, have students summarize in writing what happened. Did they see any pattern? *Usually once the top predators (bass) are eliminated, the bluegill population initially increases, but then they begin to run out of food*

Extend

- How realistic do they think the activity was? What changes would they make?

Bluegill and the Top Predator – Data Sheet

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	Round One				Round Two				Round Three			

Round One		Round Two		Round Three	