
# K-12 Partnership Lesson Plan

# *Sounds of Selection*

# *Exploring behavior and ecology of frogs*

## Overview

 This lesson will span both Middle and High School Michigan Standards making

connections to wetland ecosystems and natural selection. Students explore gray treefrog morphology and behavior, focusing on how these frogs are adapted to their environment. Students will be asked to describe their preconceptions of what makes a frog.  Students will engage in an activity demonstrating what a frog needs to survive in the wild.  Students will also examine several species of MI frogs taking notes of their similarities and differences and learning to identify the calls of MI frogs.  Finally, students will also play a card game simulating the pros and cons of different reproductive strategies.

**Objectives**

At the conclusion of the lesson, students will be able to:

* Identify food chains and food webs in a wetland incorporating the Michigan gray treefrogs
* Understand how the environment and human activity can influence populations.
* Understand that all plants and animals have a definite life cycle, and adaptations to accomplish specific life functions.
* Understand that inherited traits can be influenced by changes in the environment and by genetics
* Understand that characteristics of mature animals may be inherited or acquired and that only inherited traits are passed on to their young.
* Understand that there are different strategies that can be used to try to maximize reproduction

**Length of Lesson**

Our lesson can be divided into two forty-five minute sessions or all in ninety minutes

**Grade Levels**

 The focus of the lesson is for Michigan Middle and High School Standards

**Standards covered**

***Michigan Middle School***

**K-7 Standard L.HE:** Develop an understanding that all life forms must reproduce to survive. Understand that characteristics of mature plants and animals may be inherited or acquired and that only inherited traits are passed on to their young. Understand that inherited traits can be influenced by changes in the environment and by genetics.

**K-7 Standard L.OL:** Develop an understanding that plants and animals (including humans) have basic requirements for maintaining life which include the need for air, water, and a source of energy. Understand that all life forms can be classified as producers, consumers, or decomposers as they are all part of a global food chain where food/energy is supplied by plants which need light to produce food/energy. Develop an understanding that plants and animals can be classified by observable traits and physical characteristics. Understand that all living organisms are composed of cells and they exhibit cell growth and division. Understand that all plants and animals have a definite life cycle, body parts, and systems to perform specific life functions.

**6th Grade**

***L.OL.06.51*** *Classify producers, consumers, and decomposers*

*based on their source of food (the source of energy and building materials).*

***L.EC.06.11*** *Identify and describe examples of populations, communities, and ecosystems including the Great Lakes region. \**

***L.EC.06.23*** *Predict how changes in one population might affect other populations based upon their relationships in the food web.*

***L.EC.06.31*** *Identify the living (biotic) and nonliving (abiotic) components of an ecosystem.*

***L.EC.06.32*** *Identify the factors in an ecosystem that influence changes in population size.*

***L.EC.06.41*** *Describe how human beings are part of the ecosystem of the Earth and that human activity can purposefully, or accidentally, alter the balance in ecosystems.*

***7th grade***

***P.EN.M.3 Waves and Energy-Waves have energy and transfer energy when they interact with matter. Examples of waves include sound waves, seismic waves, waves on water, and light waves.***

***Michigan High School***

*B2.4C*

*Explain how different organisms accomplish the same result using different structural specializations (gills vs. lungs vs. membranes)..*

*B2.4B*

*Explain how major systems and processes work together in animals and*

*Plants ,including relationships between organelles, cells, tissues, organs,*

*organ systems, and organisms.*

***B5.1A***

*Summarize the major concepts of natural selection (differential survival and reproduction of chance inherited variants, depending on environmental conditions).*

***B5.1e***

*Explain how natural selection leads to organisms that are well suited for the environment (differential survival and reproduction of chance inherited variants, depending upon environmental conditions).*

*B5.2a*

*Describe species as reproductively distinct groups of organisms that can be classified based on morphological, behavioral, and molecular structures.*

*B5.3A*

*Explain how natural selection acts on individuals, but it is populations that evolve. Relate genetic mutations and genetic variety produced by sexual reproduction to diversity within a given population.*

**Materials**

See activity descriptions below and the resources page at the end of the lesson

**Background**

This lesson is centered around the biology of Michigan’s frogs and toads. Frogs are an important part of Michigan’s aquatic ecosystems where their physical characteristics and requirements for survival make them excellent indicator species of ecosystem health (see the frog survival activity below). Additionally, the breeding behavior of frogs and toads make them ideal subjects for studies on topics such as communication, sexual selection, and evolution.

The majority of this lesson plan will focus specifically on one of Michigan’s common frog species; the gray treefrog (*Hyla versicolor*). The gray treefrog is a small arboreal frog that inhabits much of the eastern United States. Individuals are generally between 1.5 to 2 inches long and vary in color depending on what substrate they are sitting on (their color ranges from gray to brown to bright green). Treefrogs live at a variety of different elevations in trees and other vegetation near water bodies. They use sticky toepads and mucus secretions to cling to tree bark and other vertical surfaces.

Gray treefrogs feed primarily on various species of insects and arachnids, however they will opportunistically eat other animals small enough to fit in their mouths including other frogs. In turn, these frogs are eaten by numerous predators including snakes, larger frogs, certain birds, and mammals such as raccoons.

During the summer months males congregate in large groups in swamps and ponds to call to attract females. These large groups are known as choruses and may contain hundreds of individuals of several species. Females enter these choruses and select a male with which to mate (often basing her decision on the specific call properties of males). Once a mate has been chosen the pair will enter amplexus (the mating position). While in amplexus the male grasps the female’s back and may remain on top of her for several hours until the female deposits her eggs. After deposition the male fertilizes the eggs. A single mating can result in well over 1000 tadpoles which will develop into frogs in 6-8 weeks.

### Activities of the session

5 Min. Pretest

15 Min. Have them draw a frog and label size, shape, and other unique characteristics. Hypothesize about lifecycle and how they communicate. Compare your drawing to the live frogs in the room. Compare and contrast the different species present. Middle School Survival Activity From Mich Tech (see details below)

15 Min. Introduction to biology of gray treefrog (characteristics, adaptations, current research)

15 Min. Communication: How does it sound around the water? Identification of # of frogs. How do frogs communicate and why? Linking into the life history gambling game.

High School Activity (Life history gambling. See below)

5 Min. Rules and background info and recording data

15-20 Min. Playing and recording

10 Min. Wrap it up and compare gaming groups.

5 Min. Post Test

\*The following activity was developed by Michigan Technological University

**FROG SURVIVAL GAME or Disappearing Frog Game**

Players in this activity take on the role of frogs trying to survive. In order to survive frogs need:

**Food:** How do frogs get their food? They use their tongue to catch mosquitoes, flies, fish, birds, water insects (algae and aquatic plants at tadpole stage)

**Water:** Clean water for breeding, keeping skin moist, wintering over.

**Shelter:** Places to hide from predators, i.e. burrow into mud, lily pads, grasses)

**Space:** Only a certain density of frogs per pond, need travel corridors between breeding sites and living areas in the forest).

Throughout the game players will try to collect these important aspects of frog lives in order to survive and thrive.

**Materials Needed:**

· Cut 8 1/2 sheets of paper of different color, cut into approx. 3”x3” squares. Plan on 6 squares of each color per participant. Mark specific colors with “D,” “P,” “T,” or “X.”

orange cards (mark ½ with “D”)

blue cards (mark ½ with “P”)

yellow cards (mark ½ with “T”)

green cards (mark ½ with “X”)

Lollipops/suckers with an adhesive pad attached to the wrapper. You can use double sided tape or you can attach Velcro patches to the lollipops and cards. These will serve as a frog’s sticky tongue.

**Directions:**

1) Give each student a lollipop with an adhesive pad.

2) Spread out colored cards on blanket or table top (if using Velcro make sure the cards are laying Velcro side up).

3) Tell the students, “Each of you is a frog. Frogs don’t us their legs to capture food, so you cannot use your hands. Grip the lollipop in your teeth by the stick, and use it to pick up as many paper squares as you can”

4) Allow one or two minutes (depending on class size) for the students to collect the paper cards.

5) EACH FROG MUST HAVE AT LEAST 5 CARDS AND AT LEAST ONE OF EACH COLOR TO SURVIVE!! **(If not, have the player step to the side of the classroom and sit down).**

6)**Turn Orange Food cards over.** Orange cards represent food. If you have an orange card marked with a **D** you’ve just become someone else’s dinner! What eats frogs? (muskrat, heron, snake, fish, turtles, humans, hawks, minks, and otters.) **(Have them step to the side of the classroom and sit down).**

**Turn Green Space Cards over**. Green represents the space you need to survive. If you have a green card marked with a **X** , your puddle was filled in by someone wanting to build a house or shopping center there. **(Have them step to the side of the classroom and sit down).**

**Turn Blue Water Cards over**. Blue represents the water that frogs need. If you have a blue card marked with a **P** your water has become polluted—what pollutants might affect frogs? Fertilizers, pesticides (to kill insects), toxic chemicals, acid rain.... **(Have them step to the side of the classroom and sit down).**

**Turn Yellow Shelter Cards over**. Yellow represents the shelter that frogs need. If you have a yellow card marked with a **T** that means that the tree or bush shading your pond was cut down and all of the water dried up before you could go from the tadpole stage to the adult frog stage..... **(Have them step to the side of the classroom and sit down).**

7) Ask the remaining students which students got at least one card of each color— orange, green, yellow, blue, AND at least five cards with insects? Tell students, “If you are missing any one of these colors, you’ve croaked. You just disappeared.” Have them step to the side and sit down. The remaining frogs SURVIVED!! “How many of you got lucky and survived?” Ask them again what frogs need to survive—food, water, shelter, and space in a certain arrangement

**SUMMARIZE—WHY DID SOME FROGS DIE?**

• Habitat loss due to new house or shopping center in their home pond.

• Poisons/pollution in the environment got into their pond water.

• Got eaten by other animals (predators).

• Shade trees and bushes next to pond were cut down.

**SUMMARIZE—WHY ARE FROGS IMPORTANT?**

**1. Frogs are part of the food chain.**

**2. Frogs are natural insecticide—** without frogs the insect population would be much greater.

(1 cricket frog = 4800 bugs/year). How many bugs could 100 frogs eat?

**3. Frogs are sensitive to pollution (bioindicators) —** their thin permeable skin is sensitive to poor water and air quality that would also affect humans— may be first warning sign for humans.

**Life History Gambling**

**Number of Players:** 4

**Materials:** The game is played with standard playing cards. The game deck consists of 40 cards: 8 face cards and 32 number cards.

Face card = predator (the player is eaten and out of the game)

Number card = tadpoles (the player has successfully reproduced)

**Background/Objective:** The purpose of this game is to demonstrate the pros and cons of different reproductive strategies. The players of the game take on the role of a young male gray treefrog. The game spans a maximum of 4 “years” covering the frog’s entire life. Each year during the breeding season males gather in large numbers at ponds and lakes to call to attract females. These large groups are known as choruses and may contain hundreds of frogs from several different species. Female frogs enter these choruses and select a male with which to mate. After finding a mate the female can lay over 1000 eggs which are then fertilized externally by the male. Each male can potentially mate with several females during a single breeding season. Males can attract additional females by calling at fast rates and producing long calls. As a young male frog, it is up to the player to decide how much time and energy to invest each year in breeding. Investing heavily means increasing calling effort which is effective at attracting females; however, this can also result in an increased risk of being eaten by a predator.

The overall objective of this game is to be the frog that sires the most offspring throughout its entire life.

**Rules:** The game consists of four rounds, each round simulating one year and breeding season. At the start of each round the 40 card deck is thoroughly shuffled and the cards are spread out face down in front of the players. Each player draws a card from the deck, keeping the card face down (players are not allowed to look at their cards until the end of the round). For the remainder of the round players take turns drawing additional cards from the deck. A player can draw as many cards as he/she wants up to a maximum of 5 cards per round. Once all players have drawn their desired number of cards for the round the cards are flipped over and the scores for the round are tabulated. Each number card is worth 1 point (simulating a successful mating with 1 female resulting in many tadpoles). A face card simulates a predator; if a player draws a face card that player has been eaten and is out of the game. Any number cards drawn along with the face card are counted towards the player’s final score, but he/she cannot participate in any further rounds. Players record the number of cards drawn and the number of points received by each player on their scorecard. The cards are reshuffled and the next round begins with the surviving players. The game continues until the end of the fourth round or until all players are eaten by predators. At the end of the game, tally the total number of points for each player. The player with the most points has sired the most offspring and thus wins the game.

**Playing tip:** Play through the game several times to come up with the best “reproductive strategy”

Life History Gambling Score Sheet

For each round record the number of cards drawn by each player and the number of points received.

Game 1:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Round/ “Year”** | **Player 1 name:** | **Player 2 name:** | **Player 3 name:** | **Player 4 name:** |
| **1** |  |  |  |  |
| **2** |  |  |  |  |
| **3** |  |  |  |  |
| **4** |  |  |  |  |

How effective was your strategy? What are your plans for the next game?

Game 2:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Round/ “Year”** | **Player 1 name:** | **Player 2 name:** | **Player 3 name:** | **Player 4 name:** |
| **1** |  |  |  |  |
| **2** |  |  |  |  |
| **3** |  |  |  |  |
| **4** |  |  |  |  |

Plans for next game?

Game 3:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Round/ “Year”** | **Player 1 name:** | **Player 2 name:** | **Player 3 name:** | **Player 4 name:** |
| **1** |  |  |  |  |
| **2** |  |  |  |  |
| **3** |  |  |  |  |
| **4** |  |  |  |  |

What strategy worked the best? How does this simulation relate to natural selection?

Pretest and Posttest

1. Please draw and label any unique features that frogs need to survive in a wetland ecosystem.
2. Why are frog populations such a good indicator for the healthy of a wetland ecosystem?

 3. What sort of characteristics would you use to group different species of frogs?

4. Explain how the sounds for selection relate to the health and longevity of the Gray Tree Frogs.

5. A new mutation has arisen in a small number of individual frogs in a large population that allows them to increase their reproductive rate. Describe what you think will happen to the new mutation over time.

**Resources**

[http://www.michigannature.org/home/education/lessonplans/Wonderful%20Wetlands%20(6-8).pdf](http://www.michigannature.org/home/education/lessonplans/Wonderful%20Wetlands%20%286-8%29.pdf)

Great lesson for MS to start with in there study of wetlands in Michigan.

[http://www.michigan.gov/dnr/0,1607,7-153-10370\_12143\_12194-35089--,00.html](http://www.michigan.gov/dnr/0%2C1607%2C7-153-10370_12143_12194-35089--%2C00.html)

Michigan Frog and Toad information from the DNR

<http://wupcenter.mtu.edu/education/frgwatch.pdf>

Cool Frog game to see impact on species and game that can be played

<http://www.projectfishnet.org/pdf/FLOW-Unit-1_Food%20Web.pdf>

Great large lesson resource

<http://www.watershedcouncil.org/resources%20and%20publications/files/Living%20With%20MI%20Wetlands.pdf>

Great reading resource book for teachers and advanced students

<http://www.remc11.k12.mi.us/bstpract/bpIII/070/070.PDF>

Good large lesson with a lot of resources 6th grade

<http://www.glwi.uwm.edu/ourwaters/documents/FoodWebWeb.pdf>

<http://www.glerl.noaa.gov/pubs/brochures/foodweb/LMfoodweb.pdf>

Great Lake Michigan Food Web

<http://news.change.org/stories/frog-songs-silenced-in-wake-of-michigan-spill-chorus-for-change-amps-up>

High School reading article tangled in the toads and frogs with oil spill

<http://www.enature.com/fieldguides/detail.asp?recNum=AR0020>

<http://animaldiversity.ummz.umich.edu/site/accounts/information/Hyla_versicolor.html>

<http://www.nhptv.org/natureworks/graytreefrog.htm>

<http://www.youtube.com/watch?v=Fjr3A_kfspM>
Frog Video Freezing

<http://videos.howstuffworks.com/tlc/28588-understanding-frozen-wood-frogs-video.htm>
Interesting

<http://sites.hamline.edu/cgee/frogs/science/faq1.html>
Cool site with questions

<http://www.lifeslittlemysteries.com/can-frogs-survive-being-frozen-0326/>