Course Title: *Wildlife and Natural Resources* **Unit Title:** *Aquatics*

Lesson Title: *What are Animal Adaptations?*

Instructional Time: *80 minutes – 2 days*

Lesson Type: *Managerial*

PA Academic Standards:

Environment and Ecology

- **BIO.B.4.2.2:** Describe biotic interactions in an ecosystem (e.g., competition, predation, symbiosis).
- **BIO.B.4.2.4:** Describe how ecosystems change in response to natural and human disturbances (e.g., climate changes, introduction of nonnative species, pollution, fires).
- **BIO.B.4.2.5:** Describe the effects of limiting factors on population dynamics and potential species extinction
- **BIO.B.4.1.2:** Describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems.

Science

- 3.1.12.C2 – Analyze how genotypic and phenotypic variation can result in adaptations that influence an organism's success in an environment.
  - Standard - 3.1.B.B4Explain how genetic technologies have impacted the fields of medicine, forensics, and agriculture

Agriculture Benchmark:

Natural Resources

- 6.6.2 – Identify fish and wildlife found in Pennsylvania.
- 6.6.3 – Explain and identify fish and wildlife management techniques.

Objectives: ***Upon completion of class instruction, students will be able to:***

1. Define succession and adaption with 100% accuracy.
2. List three adaptations of specific aquatic organisms with 100% accuracy.
3. Identify the advantages of adaptations with 100% accuracy.

Key Agriscience Terms (Essential Vocabulary):

Succession, adaptation, pH, Daphnia, Artemia

Modalities Addressed: Visual, Auditory, and Kinesthetic

Need/Situation:

This lesson is designed for a high school wildlife class who will study a unit on aquatics and water quality. In this unit students will be learning about the various parts of the aquatic ecosystem including identifying aquatic organisms, managing watershed and determining non-point source pollution through multiple activities and hands- on methods. This lesson is designed for 20 students.

Resources:

Project WILD Aquatic. (2009). *Eat and glow*. (pp. 69-74).

Project WILD Aquatic. (2009). *Pond succession*. (pp. 66-68).

Realia:

- Plain paper
- Colored pencils
- 10 long pieces of white paper
- Art supplies
- 20 copies of Adaptations Worksheet
- 400 Daphnia
- 300 Artemia(Brine Shrimp)
- 1 gram sugar-dye compound (4-methylumbelliferyl-beta-d-galactose)
- 3 mL vinegar
- Water from a natural source such a lake, pond or stream
- Ultraviolet light source (ie black light)
- Viewing box for black light
- 60 30-mL beakers or baby food jars

- 10 droppers or pipettes with wide openings
- 10 - 100 mL graduated cylinder
- 10- 50 mL graduated cylinder
- 10- 5 mL graduated cylinder
- 1, 1-Liter bottle
- 10 Styrofoam trays or other soft carving material
- 10 scalpels
- 20 copies of Eat and Glow packet
- Computers or computer lab

Pre-Class Set-Up

- Make photocopies or upload to Google Classroom
- Get out art supplies
- Prepare sugar dye solution – mix 500 mL water from a natural source to 1 g of sugar compound in plastic 1-Liter bottle. Shake well and label and store in refrigerator
- Mix vinegar solution – 2 mL of vinegar with enough natural water to make a 600 mL solution
- Ensure working computers
- Make Daphnia Recovery Tank
- Make Brine Shrimp Recovery Tank

Interest Approach: Pick your favorite animal. If you could change that animal in any way how would you change it? Take a minute to draw out what that animal would look like. Do you think living here in PA would fit your animal's needs for survival? Would they have to adapt to live here or would they die off? Ultimately what I want to know is could they survive in this environment? What about in an underwater environment?

Bellwork: Have you ever had to adapt to a situation? Was it easy or hard?

Summary of Content and Teaching Strategies

Pass out paper and colored pencils- Interest Approach

Review the vocabulary word succession

Today we are going to really focus on our artistic side. As you all know and understand from our super student activity, life forms are affected by changes in their habitats. They make adjustments or changes to adapt to their habitat. However, these adaptations don't occur overnight. Some take 100's of 1000's of years to occur. Changes to one's habitat can either happen naturally or can be human-related. Who knows what I mean by the term succession? Succession is used to describe the changing environment and the gradual process by which one habitat is replaced by another. For example a shallow pond may change into a marsh then into a forested area in about a thousand years. Succession is generally thought of an as orderly process in which plant communities change over time. The first plants that change the environment by adding nutrients to the soil allow other plants to then grow in this new area. What questions are there? Succession not only affects the plant life but also the types of wildlife that can live in that area.

Review the vocabulary word adaptation

This is when adaptations come into play. Who can tell me what adaptions are?
Adaptations are an alterations or adjustment in structure or habits by which a species or individual improves its conditions in relationship to its environment. Wildlife species differ in their ability to adapt to changes. Some can withstand substantial changes, while others are very sensitive and will die with the slightest change. Aquatic organisms are the most fragile because aquatic environments tend to be more constant than a terrestrial environment. What questions are there? An example of this is trout. The slightest change in temperature may limit the life span of young trout. If a stream continues to stay warm, then the trout may die off and another species may increase in abundance and move into the trout's habitat.

Succession Drawing Activity

You are going to divide your paper into 3 sections. The left side will show the pond as it is today, the middle will how it might look 500 years from now after natural changes and the right side will show how the pond could look in 800 years.
Let's start with our first section, the left side. Think about a pond that you have seen recently. What kinds of plants

and animals live in the water, along the shoreline and in the surrounding area? What kinds of things is the pond surrounded by? I want you and your partner to draw this pond in the left section now. What questions are there? Now let's fast-forward 500 years. Consider the following: What changes have taken place in the environment? How will the pond look now? Is it bigger, smaller, shallower, deeper, marshy, etc.? What lives and grows in the water, on the shoreline and in the surrounding area? I want you and your partner to draw this pond in the middle section now. What questions are there?

Finally the third section, 800 years later. Consider the following: What changes have taken place in the environment? How will the pond look now? Is it bigger, smaller, shallower, deeper, marshy, forested, etc.? What lives and grows in the water, on the shoreline and in the surrounding area? What effects has the pond succession had on the surrounding area? I want you and your partner to draw this pond in the final section now. What questions are there?

Hang all of the posters up on the chalkboard- Gallery Walk in groups of 4 (Leave notes- 2 positives per drawing)

Debrief poster activity. Just as these changes to the pond did not occur overnight, some animal adaptations do not happen in a short period of time. Let's take a closer look at adaptations to see how aquatic animals have adapted.

Aquatic Life Adaptation Worksheet

I want you to work with a different partner to complete the worksheet researching different animal adaptations. You each should research two aquatic animal adaptations and capture what their adaptation is and how it has been an advantage to that animal. When you are finished I want you and your partner to pick your favorite 2 and share them on our Google Classroom feed.

Day 2

Today we are going to do a science experiment to test the sensitivity of aquatic organisms to changes in their environment.

Bellwork- What is an adaptation?

(Find your lab partner- use color chips)

You are going to work in pairs on this science project. Make sure that when you get your packet you begin activity #1 and 2 quickly because the experiment must sit for 25 minutes. What questions are there? Remember even though you are working in groups, each person must complete a lab packet. Okay, get to work! 1/3 of you will begin with activity #1, 1/3 of you will begin with activity #2 and the rest of you will begin with activity #3 and then I will rotate you around to the different stations. What questions are there?

(rotate after 30 minutes)

Students should be able to complete all 3 groups. If students need more time it can be given during homeroom the next day.

Have students review the lab packet tomorrow with another team to compare answers.

Review Daily Objectives:

1. Define succession and adaption with 100% accuracy.
2. List three adaptations of specific aquatic organisms with 100% accuracy.
3. Identify the advantages of adaptations with 100% accuracy.

Cognitive Connect:

Yesterday: Invasive Species

Today: Adaptions and Succession

Tomorrow: Food Chains

FFA: Students could join a team with the Natural Resources CDE or an Envirothon team to learn more about aquatic species.

SAE:

1. Set up an experiment to see if Daphnia will adjust to a higher-level acidic environment over time.

Extended Classroom Activity: Students can further identify animal adaptations.

Adaptations & Accommodations: During kinesthetic activities, students with special needs will be partnered with advanced students to complete the task.

Reflections:

1. My flex item is reviewing the lab. If the lab goes quickly students will have plenty of time to review the lab in groups. If we run out time we will review the lab on day 3.
2. During the activities targeting the kinesthetic modalities, I could partner students with special needs with advanced students to help them complete the given tasks in pairs.
3. Evidence of Learner's Modalities:

    Auditory- Listening to other students and the instructor during instruction.
    Visual- Succession posters, lab packets, adaptation homework
    Kinesthetic- conducting adaptations lab

Name: _____

Adaptations

Research four aquatic animal adaptations online and capture your research below.

Aquatic Organism Name	*Adaptation*	*Advantage of Adaptation*

Name:_____ Period #_____

Eat and Glow

Due Date: _____

Follow the directions to complete each of the three activities. Make sure that as you are completing the activities you are recording all of the necessary information.

You will also need to research some information about Daphnia and Artemia (Brine Shrimp). Research the following information about each:

	Daphnia	**Artemia**
Characteristics		
Life Cycle		
Habitat		
Adaptations		

Activity #1: Daphnia and Acidity

How might the increase levels of acid affect the Daphnia? Make a prediction.

What is the variable in this experiment?

What is the control in this experiment?

What are the constants in this experiment?

Directions

1. Fill and label six baby food jars with the six treatment solutions.
    a. Jar #C – 30 mL of natural water
    b. Jar #1 – 30 mL of natural water and 2 mL of vinegar solution
    c. Jar #2 – 30 mL of natural water and 4 mL of vinegar solution
    d. Jar #3 – 30 mL of natural water and 8 mL of vinegar solution
    e. Jar #4 – 30 mL of natural water and 16 mL of vinegar solution
    f. Jar #5 – 30 mL of vinegar solution
2. Add 5 Daphnia to each of the six jars.
    a. To add Daphnia – Take the Daphnia from the beaker in a pipette and put the end of the pipette below the surface of the solution is being add to and gently squeeze the Daphnia out of the pipette. If the Daphnia are exposed to air, the air will be trapped under their outer covering and it will float or not move. If this occurs, replace this Daphnia with a different one.
3. Allow the Daphnia to swim in the jars for approximately 25 minutes. Observe them.
    a. Observations:

4. Add 10 mL of sugar dye solution to each of the six jars and let the Daphnia feed for about 10 minutes.
5. Observe the Daphnia under the UV light using a viewer. Remember DO NOT look directly at the light. Count of number of glowing Daphnia in each jar. If they are glowing it means they are eating. Complete the following table.

	Room Light – # Moving	Room Light – # Not Moving	UV Light – # Glowing	UV Light – # Not glowing
Control Jar				
Jar #1 (mildest)				
Jar #2				
Jar #3				
Jar #4				
Jar #5 (strongest)				

6. Place Daphnia in Recovery Tank and clean up. All solutions can be dumped down the drain.
7. Make a graph of your data and answer the following questions:
    a. At what treatment level did the change in the Daphnia's environment affect the organisms' need to eat, and eventually their ability to survive?

    b. In the real world, what would cause this kind of pH (acidic) change?

    c. If the Daphnia were to die because the change in pH levels, how would that affect the rest of the ecosystem?

d. If the Daphnia live in an isolated habitat (no ability to leave) what would their chances of survival be?

e. If the pH changes, why might animals living in a non-isolated ecosystem, have a better chance of survival than organisms found in an isolated ecosystem.

f. Graph of Data:

Activity #2: Brine Shrimp, Acidity and Tolerance Differences

How might the increase levels of acid affect the Brine Shrimp? Make a prediction.

What is the variable in this experiment?

What is the control in this experiment?

What are the constants in this experiment?

Directions

1. Fill and label six baby food jars with the six treatment solutions.
    a. Jar #C – 30 mL of natural water
    b. Jar #1 – 30 mL of natural water and 2 mL of vinegar solution
    c. Jar #2 – 30 mL of natural water and 4 mL of vinegar solution
    d. Jar #3 – 30 mL of natural water and 8 mL of vinegar solution
    e. Jar #4 – 30 mL of natural water and 16 mL of vinegar solution
    f. Jar #5 – 30 mL of vinegar solution
2. Add 5 Brine Shrimp to each of the six jars.
    a. To add Brine Shrimp – Take the Brine Shrimp from the beaker in a pipette and put the end of the pipette below the surface of the solution is being add to and gently squeeze the Brine Shrimp out of the pipette. If the Brine Shrimp are exposed to air, the air will be trapped under their outer covering and it will float or not move. If this occurs, replace this Brine Shrimp with a different one.
3. Allow the Brine Shrimp to swim in the jars for approximately 25 minutes. Observe them.
    a. Observations:

4. Add 10 mL of sugar dye solution to each of the six jars and let the Brine Shrimp feed for about 10 minutes.
5. Observe the Brine Shrimp under the UV light using a viewer. Remember DO NOT look directly at the light. Count of number of glowing Brine Shrimp in each jar. If they are glowing it means they are eating. Complete the following table.

	Room Light – # Moving	**Room Light – # Not Moving**	**UV Light – # Glowing**	**UV Light – # Not glowing**
Control Jar				
Jar #1 (mildest)				
Jar #2				
Jar #3				
Jar #4				
Jar #5 (strongest)				

6. Place Brine Shrimp in Recovery Tank and clean up. All solutions can be dumped down the drain.
7. Make a graph of your data and answer the following questions:
    a. At what treatment level did the change in the Brine Shrimp's environment affect the organisms' need to eat, and eventually their ability to survive?

    b. In the real world, what would cause this kind of pH (acidic) change?

c. If the Brine Shrimp were to die because the change in pH levels, how would that affect the rest of the ecosystem?

d. If the Brine Shrimp live in an isolated habitat (no ability to leave) what would their chances of survival be?

e. If the pH changes, why might animals living in a non-isolated ecosystem, have a better chance of survival than organisms found in an isolated ecosystem.

f. Graph of Data:

Comparison of Activity #1 and Activity #2:

1. Which organism was more tolerant of low pH levels?

2. What is the advantage for this organism to have a wider tolerance for pH?

3. What is the advantage to the other organism for not having such a wide tolerance range?

4. In what type of environment is each animal normally found?

5. How are these two organisms adapted for their environments?

6. How does the response of each animal to such an environmental stress, such as an increase in pH, affect its chances for survival?

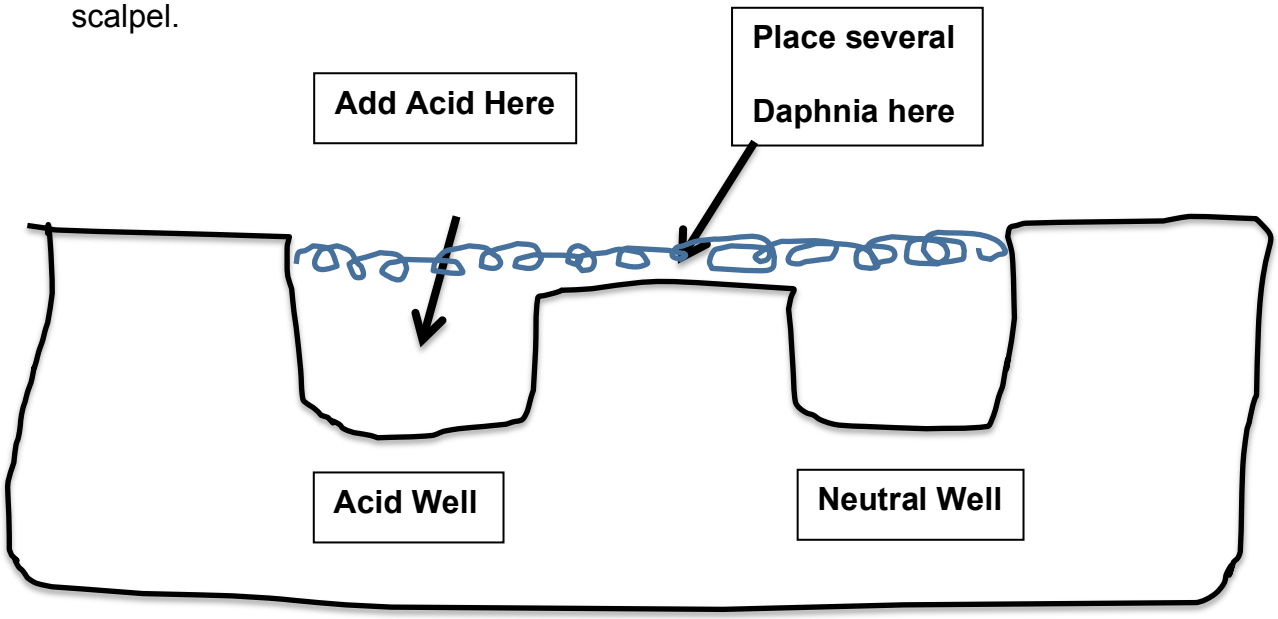
Activity #3: Changing the Isolation Factor

What is the difference between an isolated and non-isolated ecosystem?

Given the chance, will the Daphnia choose an acidic or neutral well? Make a prediction and explain why.

Directions

1. Design a non-isolated system that looks something like this out of your Styrofoam using a scalpel.



2. Fill your system with the natural water source. Make sure there is a clear channel between the 2 wells for the Daphnia to use.
3. Add 5 Daphnia to the channel between the acid and neutral well. At the same time as you add the Daphnia you should also add 1 drop of the prepared vinegar solution into the acid well.
4. Observe for a few moments, then return the Daphnia to the Recovery tank and dump the water down the drain.
5. Design a chart to keep track of the # of Daphnia in each well.

6. Repeat steps 2-5 only this time add the 5 Daphnia to the neutral well.
7. Repeat steps 2-5 only this time add the 5 Daphnia to the acidic well.

Were the results the same in all 3 experiments?

Is this experiment truly a non-isolated system?