GREAT LAKES LEARNING

LESSONS & ACTIVITIES BASED ON THE MONTHLY GREAT LAKES NOW PROGRAM

EPISODE 2207 | MARCH OF THE SALAMANDERS

SUPERIOR SALAMANDERS

Image Credit: Great Lakes Now

OVERVIEW

This lesson will explore the phenomenon of **salamander migration**—across a main road—in Presque Isle Park near Lake Superior and the efforts to protect the population from the effects of human activity. Students will learn about the salamander migration, including the unique female-only population, to vernal pools.

LESSON OBJECTIVES

- **Know** why salamanders migrate to vernal pools in the spring and what dangers they face
- **Understand** how certain salamander populations may have come be comprised only of female members
- **Be able to** model the way that indicator species tell scientists about the health of an ecosystem

WHAT YOU'LL NEED

- Computer or mobile device with Internet access to view video and online resources
- Notebooks and pencils
- Chart paper
- Sticky notes
- Markers
- Lab supplies (see individual activities for a full list)
- Copies of the Student Handouts

**Note: while not explicit in nature, this lesson involves topics/terms related to the concept of sexual reproduction and may not be appropriate for all learning audiences.*

GreatLakesNow Detroit Public TV

Michigan LEARNING CHANNEL A PUBLIC MEDIA PARTNERSHIP

INTRODUCTION

Many organisms—from frogs to snails to dragonflies—reproduce by laying eggs in water during the springtime. But getting to that water in order to lay eggs may be more difficult for some species than others—especially when human activity gets in the way.

This lesson will explore the phenomenon of the spring migration of blue-spotted salamanders—across a main road—at Presque Isle Park near Lake Superior to lay eggs in the temporary wetlands of the region. Students will learn about efforts that have been taken to try and keep the at-risk salamander population from harm during migration season, and explore the way that genetics change in a population over time due to reproductive patterns.

This lesson includes multiple activities, including lab activities, that can span the course of several sessions or be adapted to fit the needs of your group's meeting format.

Some prior knowledge* with which students should be familiar includes:

- Food chains and food webs
- Genes, alleles, traits,
- Mitosis and meiosis
- Sexual reproduction
- Watershed and wetlands
- Percentages and frequency

Follow this QR Code or hyperlink to the Episode Landing Page!

Check out our full collection of lessons for more activities related to topics like these.

****The sequence of these activities is flexible, and can be rearranged to fit your teaching needs.***

NGSS CONNECTIONS

Phenomenon: Salamander Migration

- HS-LS2.C.1
- HS-LS2.B.2
- SEP-2
- SEP-4
- MS-LS1.B.1
- MS-LS1.B.2
- HS-LS2.A.1
- SEP-7

During the course of the lesson, students will progress through the following sequence** of activities:

- Class discussion to elicit or activate prior knowledge
- Learning how all-female salamander populations exist and survive
- Close reading **a video**
- Teacher notes on blue-spotted salamanders and how they serve as an indicator species
- Watch a segment from *Great Lakes Now*
- Class discussion to debrief the video
- Simulate changes in the gene poole
- Model how an indicator species can provide information on an ecosystem

The lesson progresses through three major sections: **launch, activities, and closure.** After the launch of the lesson, you are ready to begin the lesson activities. Once finished with the activities, students will synthesize their learning in the closure. You can select the activities that are best suited for your learners, your teaching goals, and sequence them in a way that makes sense within your learning progression and the scaffolds of the lesson.

If you use this lesson or any of its activities with your learners, we'd love to hear about it!

Contact us with any feedback or questions at:
GreatLakesNow@DPTV.org

TEACHER BACKGROUND INFORMATION

by Great Lakes Now Contributor, Gary G. Abud, Jr.

**This information can be presented by the teacher as notes to students at the teacher's discretion.*

Many people have heard the common nature lore that salamanders can regrow their tail if it were to get chopped off, but did you know that it is, in fact, true? Salamanders are a fascinating species for a whole host of other reasons, but they do possess a regenerative ability to regrow limbs, their tail, and even parts of some organs like their heart and brain.

But beyond the seemingly magical ability to regrow a lost body part, salamanders serve a special function for humans in their ecosystem—they are an indicator species. That means that the more salamanders we see in an ecosystem the better an indicator it is of the health of that ecosystem.

That's one reason scientists count and track the number of salamanders in a region—an activity that provides opportunities for citizen scientists to get involved in their local communities, as well.

Tracking the number of salamanders is one way to indicate the relative health of an ecosystem over time. Because salamanders, like many other small amphibians, are quite sensitive to environmental changes, when the population declines, it reveals that there is some sort of problem in the ecosystem.

Because salamanders reproduce in transient wetland environments—which are at risk of destruction by human development—learning more about the salamanders may help with conservation efforts around the Great Lakes.

There are many types of salamanders that exist in nature. Some are small and others larger in size when fully grown, but all follow a common life cycle.

Once the females lay eggs the life cycle of the new salamander begins. The salamander grows in the egg until it hatches out of the egg. At that point it is known as a larva. It has gill buds and no legs at all. Over time, the gill buds disappear and legs appear—first the fore legs and then the hind legs—until, finally, the juvenile emerges out of the water onto land and grows into a full adult salamander.

The female salamanders combine genetic material from the males (known as sperm) with their own genetic material contained in their eggs to fertilize the eggs, resulting in the start of a new salamander and beginning the life cycle all over again. Unlike many sexually reproductive organisms that directly transfer genetic material through mating, it is typical within the salamander species for the males to leave sperm in the water and for the females to collect it.

Fascinatingly, some populations of salamanders are all female and can reproduce all on their own—effectively cloning themselves. How that happens? Scientists are still figuring that out.

Image Credit: Great Lakes Now

LESSON LAUNCH

A. Warm Up

The warm up is intended to be structured as teacher-facilitated, whole-group student discussion activities. It helps students to begin thinking about the topic at the center of the lesson.

1. Ask students to list out on a piece of paper **five things that** come to mind when thinking of **salamanders**.
2. Have students pair up with a partner to share their five ideas with each other. If any ideas appear on both lists, have students circle those.
3. Then, engage students in a whole-group discussion to ask them to share any ideas that were circled.
4. Generate a list of the circled ideas.
5. Ask for volunteers to share any ideas that were not circled that they think are really important to include in this topic.
6. Generate a separate list of those ideas.
7. At the end of making the two lists, have students copy down one single list of all the circled ideas and important ideas in their notebooks or on their paper.
8. Ask students individually to rank the ideas in the list from most to least relevant.
9. Ask for some students to share which term should be most relevant and why they think that is. Engage the whole group in discussion to arrive at consensus about the most relevant idea related to salamanders that they already know about or that came to mind during this exercise.

B. Bridge to Learning

After the warm-up activity has concluded, help students prepare for the learning that is about to come:

1. Ask students to individually draw out what they think is the life cycle of a salamander.
2. Have students compare their life cycle drawings with a partner or two.
3. Invite a few volunteers to share what features they included and why.
4. Explain that today we will be learning about salamanders, including how a very specific part of their life cycle is at risk in the Great Lakes—the beginning.

C. Close Reading a Video

Start by explaining that there are multiple species of salamanders in the Great Lakes region, all of which follow similar life cycles. Then, show **this video clip of the start of the salamander life cycle** and ask students to talk with a partner about what they notice and wonder about the video. Next, invite a few students to share their responses. Last, have students make connections to the most relevant class idea from the warm up activity in Part A and to compare the video with their life cycle diagrams they drew in Part B.

D. Background Information Notes

Explain that we are going to build on these ideas and learn more about salamanders in this lesson. Then proceed to give the notes from the **Teacher Background Information**.

ACTIVITY 1: WATCH A GREAT LAKES NOW SEGMENT

This activity is a video discussion of a *Great Lakes Now* episode segment.

First, inform students that they will be watching a *Great Lakes Now* segment discussing the blue-spotted salamander population in Presque Isle Park in the northern Great Lakes region. During the video they need to jot down four things they took away from the video using the **4 Notes Summary Protocol**.

Then, if students are not already familiar, introduce them to the 4 Notes Summary Protocol, which they will use after they finish watching the video, where they write down one of each of the following notes:

- **Oooh!** (something that was interesting)
- **Aaah!** (something that was an ah-ha moment)
- **Hmmm…** (something that left them wanting to know more)
- **Huh?** (a question they have afterward)

Next, have students watch the segment from episode 2207 of *Great Lakes Now* called **March of the Salamanders**

Last, have students complete their individual 4 Notes Summary and then discuss those in groups of 3-4 students.

Teaching Tip: Use the Student Handouts to help students organize their thinking in writing around each of the lesson protocols.

Post-Video Discussion

After the groups have had time to go over their 4 Notes Summaries, invite a handful of students to share out some of their notes, eliciting at least 1-2 of each of the 4 Notes and listing those somewhere for the whole group to see.

Ask students to turn back and talk with their groups to make connections between the *Great Lakes Now* video and what they remember from the warm-up activities.

How is what we saw in the video the related to what we discussed earlier in this lesson during the warm up?

After giving the groups some time to talk, bring the whole group back together for a shareout and discussion of ideas.

In this culminating discussion, the goal is to help students make connections between the video segment and what they discussed during the warm up activities earlier in the lesson about what they anticipated about the salamander species in the Great Lakes.

Once the discussion finishes, have each student write a "**Sum It Up**" statement in their notebooks. This is a single sentence that captures the big idea of what was just learned.

Have 2-3 students share out their **Sum It Up** statements before concluding this activity.

ACTIVITY 2: READ ABOUT VERNAL POOLS

Many species reproduce by laying their eggs in water, and some don't need very much water at all. The phenomenon of vernal pools, small areas of water that form in the spring and last only a short time, can be a great breeding ground for small egg-laying organisms in the Great Lakes.

Image Credit: Greg Lashbrook, Courtesy: Great Lakes Now

In this activity, students will use a **Think Pair Square Protocol** for discussing the what they will read about this very topic.

First, have students partner up and distribute the article **April Showers Bring Vernal Pools and Baby Salamanders** by Kathy Johnson from *Great Lakes Now*. Allow time for students to individually read the article, and have them jot down three things they took away from the article using the **Rose Thorn Bud Protocol**—in their notebook or using the handout.

Then, give students time after reading to discuss the article that they read with their partner. Have students share their rose, thorn, and bud with each other, including how those points connect to each other. The pair should come up with a statement to summarize all of their article takeaways.

Next, have two student pairs join up, standing near each other to form the four corners of a square, to discuss the article and what they talked about in their pairs. Encourage them to come to a consensus about which point they found most important or interesting in the article.

***Teaching Tip*: This article indirectly discusses sexual reproduction concepts such as sperm, egg, and fertilization in salamanders. Determine the age appropriateness of this article for your students' background knowledge after reading it yourself first.**

Last, have each group craft a summary statement of the most important point from their discussion and ask for a volunteer in each group to share that key point with the whole group.

As student groups share their most important point, record their ideas on the board and have students copy the list of student ideas down into their notebooks.

Once the shareout is complete, ask students to return to their groups and discuss one last question* based on the article:

Based on the article, what impact do you think human activity could have on the vernal pools and salamander reproduction?

After giving the groups some time to discuss this question, invite conversation from the entire class to see what consensus can be reached.

Be sure to encourage students to support their claims with evidence and reasoning as they discuss in the whole group.

ACTIVITY 3: MODELING INDICATOR SPECIES

Image Credit: Greg Lashbrook, Courtesy: Great Lakes Now

Background:

An indicator species is a species that, when it is in abundance, indicates a healthy ecosystem or shows the impact of human activity. This is due to how dependent the species is on certain conditions in the ecosystem for its ability to reproduce/survive.

Climate conditions, such as temperature and relative amount of precipitation are two key factors that salamander populations can tell us about. That's because they require temporary wetlands—shallow areas of a watershed that get filled with water after snowmelt or spring precipitation but dry up quickly once temperatures rise as summer appears—to reproduce. If there isn't enough precipitation, the land remains too dry for the salamanders to lay their eggs; if temperatures are too hot too early in the season, wetlands will dry up before they can lay their eggs. When the salamander population is small, it can indicate that the conditions weren't supportive of their reproduction, and that is a bad sign for the ecosystem since salamanders fall in the middle of the food web.

Larger species in the ecosystem eat salamanders, but salamanders also eat smaller species—like insects, spiders, or worms—and a disruption in the number of salamanders means that the food chain of an ecosystem can get out of balance.

First, inform students that they will be connecting what they learned about the salamanders in Activities 1 and 2 to other species around the world. Discuss some of the background information with them in the previous section of this activity.

Then, show these 2 video clips from PBS LearningMedia about indicator species:

1. **Hooded Warblers in Kentucky**
2. **Frogs in Gorongosa Park**

Next, ask students to discuss with a group of 3-4 students how the hooded warblers, frogs, and salamanders compare and connect by all being indicator species. Engage the entire group in a discussion about what indicators species are and what they do for an ecosystem. Encourage them to back up their claims with evidence and reasoning during the discussion.

Last, invite students to go back to their groups and create a flowchart on chart paper or a large dry erase board that will model how indicator species work to tell scientists about the health of an ecosystem. They can use a specific example such as the frogs, warblers, or salamanders; or, they could create a generic model.

Once all the groups have students display all of their models next to one another and engage the class in a discussion of what features they think are most important in a model that communicates how indicator species work.

Extend their thinking during the discussion by asking them how an indicator species might tell us about the impact of human activity on a particular ecosystem. Have students cite how their models could be applied to accomplish this goal.

ACTIVITY 4: SIMULATING POPULATION GENETICS

In this activity, students will explore the genetics of an entire population and simulate the ways in which the gene poole of a population can change over time. The purpose of this activity is to help students appreciate how an all-female population of salamanders can arise and survive out of multiple species of salamanders that can exist within an ecosystem.

Before completing the activities, distribute copies of the article **Genetic Mystery: The All-Female Salamanders of the Great Lakes** by Lorraine Boissoneault of *Great Lakes Now* for students to read. After reading, have students complete the **4 Notes Summary Protocol,** using the student handout in this lesson, where they write down one of each of the notes about the article, discuss their notes with a partner and, eventually, discuss with a group.

Points of Discussion

Talk with the class about the concept of **genetic frequency**—how often a particular trait appears within a population of individuals expressed as a percentage. As the number of individuals with that trait decreases over time, so does the frequency of that gene within the population, meaning the gene poole has less frequency of that trait over time. Eventually, the frequency can reach zero, which results in a particular trait, and the genes that encode the trait, having a frequency of 0% and thus disappearing from the population altogether.

Give some common trait examples, like hair color, and calculate the frequency of it in your group to illustrate the concept to students.

Mapping the frequency of a particular trait within the gene poole of a population over time can allow us to see how the genetics of a population can change from one assortment to another based on the traits that reproducing individuals possess when they have offspring.

***Teaching Tip**: This article indirectly discusses sexual reproduction concepts such as sperm, egg, and fertilization in salamanders. Determine the age appropriateness of this article for your students' background knowledge after reading it yourself first.*

Image Credit: Great Lakes Now

Candy Dish Natural Selection Simulation

First, fill a dish with a large number of different colors of candy (e.g., M&Ms, Skittles, Starburst, etc.) Then, record the frequency of each color/flavor in a data table. Next, have students pass around the dish and take just **1 piece of candy** from the dish and eat it. Last, recalculate the frequency of each color/flavor to compare to the original data.

Discuss with students that in this simulation, each candy represents an individual in a population of some species and each round of passing candy represents a generation; any candy that did not get eaten represents individuals that survived to reproduce and pass on their genes. Inform them you'll be repeating the steps for the next generation.

Now, refill the dish with additionals of every color that is remaining (e.g., add one red for every remaining red, etc.) and recalculate the frequencies. Pass the dish and have students again choose 1 piece of candy from the dish. Refill with additionals of each remaining color and recalculate the frequencies. Repeat again if you'd like additional data.

Have students compare the data between generations and discuss what they noticed happened to the frequencies and why. Ask what they would expect might happen if the simulation was allowed to continue for additional "generations."

Discuss how this might be used to simulate an all-female salamander population emerging from different salamander species.

LESSON CLOSURE

After the conclusion of all the activities, help students to make connections* between everything they did in the lesson and what they learned overall.

A. Free Recall

Group students in pairs or triads (e.g., in groups of 2-3 partners) and distribute the **Free Recall Protocol handout**, Alternatively, you can have students do this in their notebooks. Set a 3-min timer and have students generate a list of everything they can remember learning about in this lesson related to the central topic of the lesson. This doesn't have to be in depth, just whatever each group can call to mind. Have them draw lines between any terms that relate to one another. After the timer finishes, give groups a chance to volunteer to share aloud 2-3 things from their free recall lists and any of the connections that they made with those. Jot down any ideas that come up multiple times during the shareout for the whole group to see.

B. Lesson Synthesis

Give students individual thinking and writing time in their notebooks to synthesize their learning, by jotting down their own reflections using the **Word, Phrase, Sentence Protocol.**

In the Word-Phrase-Sentence Protocol, students write:

- A **word** that they thought was most important from the lesson
- A **phrase** that they would like to remember
- A **sentence** that sums up what they learned in the lesson

C. Cool Down

After the individual synthesis is complete, students should share their synthesis with a partner.

After sharing their syntheses, have students complete a **3, 2, 1 Review** for the lesson with their partner, recording in their notebooks or, optionally, on exit ticket slips to submit, each of the following:

- **3 things** that they liked or learned
- **2 ideas** that make more sense now
- **1 question** that they were left with

Invite several students to share aloud what they wrote in either the synthesis or 3, 2, 1 Review.

Lastly, ask one student volunteer to summarize what has been heard from the students as a final summary of student learning.

**Optionally here, the teacher can revisit the learning objectives and make connections more explicit for students.*

Teaching Tip: Use the Student Handouts to help students organize their thinking in writing around each of the lesson protocols.

NAME: _____

A Word, Phrase, Sentence Protocol

What is a **word** that you thought was most important from this lesson?

What is a **phrase** that you would like to remember from this lesson?

What is a **sentence** that sums up what you learned in this lesson?

3, 2, 1 Review Protocol

What are **3 things that you liked or learned** from this lesson's activities?

-
-
-

What are **2 ideas that make more sense** now to you?

-
-

What is **1 question that you were left with** after this lesson?

-

NAME: _____

Free Recall Protocol

With 1-2 partners, generate a list of everything you can remember learning about in this lesson related to the central topic of the lesson. Draw lines between any terms that relate to one another.

NAME: _____

4 Notes Summary Protocol

OOOH!

Something that was interesting to you

AAAH!

Something that became clearer; an "ah-ha" moment

HMMM...

Something that left you wanting to learn more

HUH?

Something you questioned or wondered

Sum It Up Statement:

Summarize your group discussion about your 4 Notes Summaries below:

NAME: _____

Think Pair Square Protocol

THINK

Write down your own individual ideas

PAIR

Summarize what you and your partner discussed

SQUARE

Summarize what your group discussed

NAME: _____

Rose, Thorn, Bud Protocol

ROSE

Something that "blossomed" for you in your learning

THORN

Something that challenged your thinking or was difficult to understand

BUD

Something that's new and growing in your mind — a "budding" idea