Duckweed blooms

ACTIVITY OVERVIEW

STEM Focus Area: Water Quality

Learning Goal: To understand how the concentration of nitrogen in an aquatic ecosystem could affect other aspects of the ecosystem and that an indicator species can reflect the health of an ecosystem

Youth Learning Targets:

- "I understand you can figure out the quality of water in an ecosystem by looking at indicator species."
- "I can create an experiment to see how chemicals in the water can affect life in the water."

LEARNING ENVIRONMENT

Activity Duration: two/three weeks

Class Size: Small or Large

Type of Space: Indoor

Age of Youth: Grades 6-8

Guiding Question: What is the question to explore OR the problem or challenge to solve?

How can the introduction of chemicals to an aquatic ecosystem affect other aspects of that ecosystem?

Through this activity, youth will:

- Create test and control conditions
- Track populations of a laboratory-made ecosystem
- Develop an understanding of what an indicator species is

Facilitator Prep

- Provide a designated space for the samples to sit undisturbed for a few weeks
- Prepare the materials before the activity

Literacy Connection: Great books to get youth support learning about plant life cycles! *(available on Amazon).*

- *One Well: The Story of Water on Earth* by Rochelle Strauss (Author), Rosemary Woods (Illustrator)
- *The Water Princess* by Susan Verde (Author), Georgie Badiel (Author)

DoS: Authentic Stem Practices

- ✓ Predict and hypothesize
- ○ Develop and use models
- ✓ Measure materials
- ✓ Observe
- ○ Investigate

- ✓ Record observations
- ✓ Analyze and infer
- ✓ Share and communicate data
- ✓ Interpret data
- ✓ Test and revise
- ✓ Draw conclusions and relationships
- ○ Have voice and agency, make decisions and guide their own learning

PREPARATION

Materials

Per group:

- 4 plastic cups
- water
- 125 ml of the liquid fertilizer (you can get this at local hardware store)
- 60 colonies of common duckweed species (
  - *Lemna Minor*: https://www.modernaquarium.com/duckweed-lemna-minor-4oz-cup/?sku=FLDUCKP
- grease pencil or marking pen
- hand lens
- graph paper

Shared:

- several pairs of scissors
- labels or tape
- pens
- 10 ml graduated cylinder
- 100 ml graduated cylinder
- hot water
- liquid nutrient solution (ensure there is enough for each team)

Content

- All living things are products of their environment. An **indicator species** is a species that responds specifically to the qualitative conditions of a community or habitat.
  - For instance – mutations or dramatic population decreases of amphibians within an aquatic ecosystem might indicate a decrease in the water quality of that ecosystem. Streams dominated by a particular type of midge fly larva are often polluted with organic wastes like sewage.
  - Duckweed can also be considered an indicator species for aquatic ecosystems.
- **Point source contamination:** pollution that come from an discrete source
- **Leach**: The ability of a substance to move through soil over time.
- Common Misconception: When you fertilize your lawn, those chemicals often don't stay in the land. When water runs across the landscape, whatever is on the ground travels with it.

Inquiry

- How many different ways do we use water?
- How clean is the water that you use? What are ways we can figure out how clean it is?
- How will the populations of the duckweed differ between the samples?
- What's different about them? Why?
- What does this mean?

DoS:

- ✓ Organization: I practiced the activity/technology, prepared materials/extras/place to record youth ideas, and completed an activity (including timings).
- ✓ Materials: Materials are appropriate for teaching the learning goals; youth will be able to use them and will think they are appealing.
- ✓ Space Utilization: The space is set up appropriately for the activity and there will be no safety issues or distractions.
- ✓ Relevance: I have researched why the content matters to youth's everyday lives.
- ✓ Content Learning: I have become familiar with the content.
- ✓ Inquiry: I have become familiar with how authentic, age-appropriate inquiry practices look in this activity.

INTRODUCTION TO ACTIVITY (10 MINUTES)

- Start with a conversation about water:
  - How many different ways do we use water?
  - Is the water that you use clean? How do you know? How can we figure out how clean water is?
  - Water is an essential part of natural systems. One easy way we can quickly determine if there is a problem with the water in an ecosystem is by seeing a dramatic change in the population of an indicator species.
- We're going to do an experiment over the course of a few weeks to see how duckweed might respond to changes to the natural systems we usually find them in.

DoS:

- ✓ Space Utilization: I will use the space informally avoiding the lecture hall format.
- ✓ Purposeful Activities: This intro section gets youth on track for the learning goal.
- ✓ Content Learning: If age appropriate, I will accurately present content.
- ✓ Inquiry: In this or another section of the activity, youth carry out one or more inquiry practices.
- ✓ Relationships: I will make each youth feel welcome.
- ✓ Relevance: In this or another section, I will guide the youth in a sustained discussion of how the activity relates to their everyday lives.
- ✓ Youth Voice: In this or another section, I will allow youth the opportunity to make decisions about their learning experiences.

ACTIVITY ENGAGEMENT (20 MINUTES)

Pass out the materials to each team.

Setup the experiment

- Have the teams label their cups:
  - 1: Control
  - 2: 5ml
  - 3: 10ml
  - 4: 20ml
- Have them fill each cup with designated amount of liquid fertilizer (no fertilizer in cup 1)
- After, have them fill the rest of the cup with the difference between the amount of fertilizer and 100 ml of water.
  - 1: 100ml water
  - 2: 95ml water
  - 3: 90ml water
  - 4: 80ml water

- Once their cups are full, have them place 15 duckweed in each cup.

Record their observations

- Explain that over the next couple weeks, at the same time each day, you will come and count the number of duckweed in each cup.

DoS:

- ✓ Space Utilization: I will use the space informally avoiding the lecture hall format.
- ✓ Participation: All youth will have access to the activity.
- ✓ Purposeful Activities: This core section helps youth to move toward the learning goal.
- ✓ Engagement: This activity has youth physically engaged with their hands and their minds.
- ✓ Inquiry: In this or another section of the activity, youth carry out one or more inquiry practices.
- ✓ Reflection: If appropriate, I will ask youth questions during the core activity that will help them make sense of what they are learning.
- ✓ Relationships: I will take steps to share my enthusiasm and create a nurturing, safe learning environment.
- ✓ Relevance: In this or another section, I will guide the youth in a sustained discussion of how the activity relates to their everyday lives.
- ✓ Youth Voice: In this or another section, I will allow youth the opportunity to make decisions about their learning experiences.

FINAL REFLECTION AND RELEVANCE (5 MINUTES)

- At the end of the few weeks, have each group share how the populations of duckweed changed in each of their cups.
- How did your results compare to other peoples? How did the result differ between the cups of your own teams? Which saw the biggest change in population growth? What does this mean about fertilizer found in ecosystems? How could this affect populations of duckweed in natural ecosystems? How could this affect other organisms within those ecosystems?

DoS:

- ✓ Space Utilization: Again, I will use the space informally.
- ✓ Participation: I will prompt youth who do not have access to the activity to participate.
- ✓ Purposeful Activities: The closing section helps youth to reach the learning goal.
- ✓ Content Learning: I will help youth make connections between different ideas. I will create opportunities for youth to ask questions/provide ideas that show a deeper level of understanding.
- ✓ Inquiry: In this or another section of the activity, youth carry out one or more inquiry practices.
- ✓ Reflection. I will provide youth with a sustained opportunity to make sense of their learning.
- ✓ Relevance: In this or another section, I will guide the youth in a sustained discussion of how the activity relates to their everyday lives.
- ✓ Youth Voice: In this or another section, I will allow youth the opportunity to make decisions about their learning experiences.

REFERENCES

Duckweed Unlimited - Wisconsin Fast Plants: http://resources.fastplants.org/agriscience/agriscienceles son03.pdf