Experiment # *Lemna minor* (Duckweed) Population Growth

**Introduction** – Students will grow duckweed (*Lemna minor*) over a two to three week period to observe what happens to a population of organisms when allowed to grow without predation or competition.

**Objectives** - Understand some of the factors that affect population growth, like method of reproduction (asexual or sexual), length of life cycles, exponential growth, carrying capacity, and competition.

**Hypothesis** – As a group decide on the shape of the graph of duckweed growth you will see over the next two weeks. In your lab book draw the shape of the graph and explain your reasoning.

**Materials For each group:**
- 10-oz paper cup
- Plastic bottle or beaker
- Forceps
- Light source (fluorescent light, greenhouse light, or window)
- 2-3 healthy duckweed plants
- Magnifying glasses
- Miracle Grow Solution

**Background:** Duckweed is an aquatic plant of the genus *Lemna*. It can be seen floating on top of the water in rivers, ponds, and lakes. A thick growth of duckweed looks like bright green "scum" on the surface of the water. Closer observation reveals that the scum is actually made up of tiny, individual plants. Duckweed plants can reproduce by seeds but seldom do. More commonly, they reproduce asexually by producing a new plant that grows off of the old one. When the new plant grows its own roots, it breaks off from the old plant. The growth of a population of duckweed can be determined by simply counting the number of thalli that appear over a period of time.

**Procedure:**
- Obtain a container and fill with about 250 mL of pond water
- Decide on how much Miracle Grow solution you would like to add. Be sure to record this in the data.
- Take a pair of forceps and obtain two or three duckweed plants and transfer them to your container of pond water.
- Look at the duckweed plants using the magnifying lens and sketch them in their lab book. Label the parts of the duckweed.
- Write your names on the container and place the container under a light source.
- Over the next 8-10 class periods count the number of plants observed in the container and record observations. Make a data table in which to record the date and the number of plants in the container.
- After 8-10 days plot the data on a graph, with the x-axis representing time and the y-axis representing the number of plants.

**Data Table**
Graph

Results – What were the results of the experiment?

Conclusion – Your conclusion should: 1. State your hypothesis again. 2. Explain why your hypothesis was supported or not supported using the data generated from the experiment.

Experimental Error – Identify and describe the possible effects of any experimental errors during this investigation.

Questions:

1. Describe what happens to the population of duckweed over time. Do you see a pattern in the graph? Can you identify different phases in the population growth?

2. Which region of the graph represents the fastest population growth? The slowest?

3. Are there regions on the graph that represent no population growth at all? Where are they located?

4. What can you conclude about a population of plants when it is allowed to grow in the absence of any predators or competition of any kind?

5. Compare the growth of the tree snake population in a new area to the growth of the duckweed population in their experiment. How are these two situations alike? How are they different?
Overview

In this two-part lesson, students are introduced to the ecology of population growth. First, students grow an aquatic plant called duckweed over a period of two to three weeks. They observe what happens to a population of organisms when it is allowed to grow without predation or competition from other organisms. In the second part of the lesson, students view videos about invasive species that spread quickly and threaten other naturally occurring species. Then they apply what they learned from their duckweed experiment to develop a proposal for controlling the growth of an invasive species in their community.

Objectives

Understand some of the factors that affect population growth, like method of reproduction (asexual or sexual), length of life cycles, exponential growth, carrying capacity, and competition

Plot data to generate population growth curves

Conduct an experiment on population growth using scientific techniques including observation, data collection, and analysis

Suggested Time

Part I: one class period to set up, a few minutes of each class period over the next two to three weeks to collect data, and one class period to analyze data and discuss results

Part II: one class period

Multimedia Resources

Biological Invaders QuickTime Video

Leafy Spurge QuickTime Video

Duckweed JPEG Image

Recipe for Pond Water PDF Document

Materials

For each group:

10-oz paper cup

250 mL bottled spring water (in a plastic container)

Forceps

Light source (fluorescent light, greenhouse light, or window)
2-3 healthy duckweed plants
Magnifying glasses

For each student:

Notebook
Graph paper
Ruler
Pencil

Before the Lesson

Review the concepts of predation and competition among organisms.

Obtain a supply of healthy duckweed from a biological supply company for Part I of the lesson. See ordering info below.

Gather the rest of the materials for the experiment.

Identify the invasive plant species in your region. If possible, collect samples of these plants to bring in to class.

Optional: Invite a local ecologist to speak to your class about invasive species in your area. Your state's department of environmental management is a good resource.

Carolina Biological Supply Co.
2700 York Rd.
Burlington, NC 27215
Phone: 336-584-0381
Fax: 800-227-7112
Toll Free: 800-334-5551
Website: www.carolina.com
E-mail: carolina@carolina.com

Lemma Minor CE16-1820 100-150 plants $5.25
Salvinia CE-1860 50-100 plants $5.75

The Lesson

Part I: Population Growth of Duckweed
1. Ask students:
What would happen to a population of plants if it were allowed to grow in the absence of any predators or competition of any kind?

List student responses on the board.

2. Tell students that they are going to conduct an experiment over the next two to three weeks to explore this question. They will grow duckweed, an aquatic plant, in an environment without any predators or competition from other species. Show several Duckweed in its natural habitat to help students recognize this common aquatic plant.

3. Contrast the growth of duckweed with the growth of plants that are more familiar to students, e.g., flowering plants. Discuss how most plants reproduce. (They grow flowers, pollinate, produce seeds, and then the seeds become new plants, usually over the course of a year.) Then examine a Duckweed. Point out the thallus (body of plant) and the roots.

Duckweed is an aquatic plant of the genus Lemna. It can be seen floating on top of the water in rivers, ponds, and lakes. A thick growth of duckweed looks like bright green "scum" on the surface of the water. Closer observation reveals that the scum is actually made up of tiny, individual plants. Duckweed plants can reproduce by seeds but seldom do. More commonly, they reproduce asexually by producing a new plant that grows off of the old one. When the new plant grows its own roots, it breaks off from the old plant. The growth of a population of duckweed can be determined by simply counting the number of thalli that appear over a period of time.

4. Divide the class into groups of three to five, depending on the amount of materials you have available. Give each group a plastic container filled with about 250 mL of artificial pond water (see Recipe for Pond Water (PDF)), a small paper cup containing two or three duckweed plants, and forceps. Have students look at the duckweed plants and sketch them in their notebooks. Tell them to label the parts of the duckweed. Then have students write their names on their container, transfer the plants to the container using the forceps, and place the container under a light source.

5. Over the next ten class periods, have students count the number of plants they observe in their container and record their observations in their notebooks. Instruct students to make a data table in which to record the date and the number of plants in the container. Then have students plot their data on a graph, with the x-axis representing time and the y-axis representing the number of plants. Their graph should look similar to the one below.

Duck Graph

6. Ask each group to prepare a presentation that includes an enlarged drawing of the graph on newsprint and answers to the following questions:
Describe what happens to the population of duckweed over time. Do you see a pattern in the graph? Can you identify different phases in the population growth?

Which region of the graph represents the fastest population growth? The slowest?

Are there regions on the graph that represent no population growth at all? Where are they located?

Which part of the graph represents the smallest population? The largest population?

What can you conclude from your graph?

What factors seem to be either limiting or encouraging growth?

What happens to a population of plants when it is allowed to grow in the absence of any predators or competition of any kind?

7. Have students present their findings to the class.

Part II: Invasive Species

8. Show students Biological Invaders. As they watch, have them jot down answers to the following questions (either on the board or on a handout):

What is meant by the term invasive species?

Why is the brown tree snake considered an invasive species?

How does the brown tree snake end up in new environments?

What threats does the brown tree snake pose to naturally occurring species in these new environments?

Why does the brown tree snake population thrive in new environments? What adaptations does the brown tree snake have that help it thrive?

9. In groups of three to five, have students discuss the questions, using their notes for reference.

10. Next, have each group of students compare the growth of the tree snake population in a new area to the growth of the duckweed population in their experiment. How are these two situations alike? How are they different?

11. Now show Leafy Spurge. Discuss the following questions after watching the video:

Where does leafy spurge come from?

Why is it a problem?
How does the leafy spurge adapt to survive in new environments?

How is the leafy spurge controlled in its natural environment and in new environments? What potential problems could arise from controlling the population of leafy spurge, as seen in the video?

What adaptations in leafy spurge are similar to the adaptations you identified in duckweed?

12. Have groups of students prepare short presentations based on the scenario below:

Duckweed has invaded your local rivers, ponds, and lakes! As a team of local ecologists, your job is to develop a proposal for controlling the population of duckweed. In your proposal, include the following information:

the possible sources of the duckweed

the environmental conditions in your area that allow the duckweed to grow so rapidly

how the duckweed could be prevented from entering your area

Have each group present their proposal to the class. Debate the pros and cons of each.

Exotic Species Link: [http://www.pbs.org/wgbh/evolution/library/10/3/l_103_03.html](http://www.pbs.org/wgbh/evolution/library/10/3/l_103_03.html)
Leafy Spurge Video: http://www.teachersdomain.org/asset/tdc02_vid_spurge/