Harvard Forest LTER Schoolyard Ecology

Vernal Pool Data Analysis Lesson Plan: That's a Lot of Mosquito Larvae! Using simple mathematical formulas and random sampling, students can estimate the populations of commonly found species in the vernal pool.

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MASSACHUSETTS ENVIRONMENTAL TRUST http://www.massenvironmentaltrust.org/

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Curricular areas: Mathematics: Data analysis/ Graphing, Science: Ecology

Grade Level: 3+

Enduring Understanding: We can use estimation to count very large amounts of things.

Essential Questions:
Can we count how many animals live in our vernal pool?
What will we find the most of? The least?

Assessments:
Performance Objectives:
1. Using field guides students correctly identify the kinds of animals they find in the vernal pool.
2. Using field note sheets, students record the animals found in three random samples of pool water.
3. Using formula sheets and calculators, students will find a reasonable estimated population of a species living in the vernal pool.

Curriculum Standards:

Massachusetts Mathematics Frameworks

3.N.12 Understand and use the strategies of rounding and regrouping to estimate quantities, measures and the results of whole number computation.

3.D.1 Collect and organize data using observations, measurements, surveys or experiments and identify appropriate ways to display the data.

Massachusetts Science and Technology Frameworks

1. Classify plants and animals according to the physical characteristics that they share.

Massachusetts English Language Arts Frameworks

1.2 Follow agreed upon rules for class discussions and carry out assigned rules in self-run small group discussions.

INSTRUCTIONAL STRATEGIES OR GOALS	ACTIVITIES
DAY 1 If it has not been introduced in previous lessons, the teacher explains how to use the ***Self-Assessment Rubric*** and the ***Field Notes*** Sheet before visiting the vernal pool. The teacher breaks the class into teams of 6 for a pool site visit and demonstrates the correct way of collecting, counting and returning the animals in each sample.	Each team takes 3 samples from different areas of the pool using a pan attached to the end of a pole (approximately 1liter size) and emptying it into a small white plastic basin. Samples should be taken from the water column, the area between the surface and the bottom. To count, students transfer each animal into a second white basin using a plastic spoon. Students record each of their observations on their ***Field Note*** Sheets.
DAY 2 Teams from the previous day share the species and amounts they observed and recorded on their sample sheets. Teacher asks the students to predict how many of each species may be living in the vernal pool and records on chart paper. The teacher explains that we can test our hypotheses or predictions by using mathematical formulas like a scientist would.	Students review their 3 ***Field Note*** Sheets and discuss their results with the class. Students predict the population of the different species found based on the results of their sampling.
DAY 3 On an overhead, the teacher introduces the ***Estimated Volume*** sheet and the ***Estimated Population*** sheet using hypothetical data.	In their teams, students choose 1 species and use their ***Field Note*** sheets, the ***Estimated Volume*** sheet and the ***Estimated Population*** sheet to find the average number of each animal found in their samples and multiplying it by the number of liters in the pool. Optional exercise: Students make estimates using the numbers from each of their three samples, as well as the average, to get a sense of the variation present.
DAY 4 Teams present their results in poster form to their classmates and compare them to the predictions they had made. Discussion questions can be: • What was found the most? The least? • Why might some species populations be larger? Smaller? • Would our numbers be the same every month? Every season? Every year?	

Management Tips:

- Discuss ahead of time the *Self-Assessment Rubric* so students are aware of what is expected from their participation.
- Model and stress collecting samples *gently*.
- Groups of 6 students allow each child to have a "hands-on" role in the group. One child collects for the team, one child counts for the team, for 3 samples.

Tools and Resources:

- Harvard LTER Schoolyard Program Web pages: Protocols and Data, suggested reading, related research: http://harvardforest.fas.harvard.edu/museum/vernal.html
- ***Field Notes*** Sheets - 3 per student
- ***Self-Assessment Rubric*** – 1 per student
- ***Estimating Volume*** Sheet – 2 - 3 per student
- ***Estimated Population*** Sheet – 2-3 per student
- Collecting pans – 1 per team (a pan attached by 2 hose clamps to a 1" dowel or broomstick)
- White basins – 2 per team (smaller size - these can usually be found in Dollar Stores)
- Plastic spoons – 1 per team
- Field Guides
- Calculators
- Pencils
- Clipboards
- Chart paper

Sample # _____

Name_____Date_____Time_____

Field Notes

Diameter	Depth	Air Temperature	Water Temperature	Sunny or shaded?
m.	cm.	C°	C°	

Sketch what you see in your sample of water:

Use your Field Guide to identify the organisms. Count them and record.

Organism	How Many?
1.	
2.	
3.	
4.	
5.	

Name_____Date_____

Estimated Population Worksheet

You can estimate the population (how many) of a species that might be living in the vernal pool. It would be impossible to count each animal, but using random sampling and the amount of water in the pool helps scientists make a reasonable estimate of how many might be living there.

Follow these steps to estimate populations like scientists do:

1. Choose 1 of the species you found in your sampling:

   _____

2. Add the total number of that species found in each of of your 3 samples.

   Sample 1_____

   Sample 2_____

   Sample 3_____

   Total _____

3. Divide the total by 3. This is called the **average**.

   _____

4. Multiply the average by the number of liters of water in the vernal pool.

   _____ x _____= _____
   average liters estimated population

Name_____Date_____

ESTIMATING VOLUME IN THE VERNAL POOL

Follow the steps below to estimate the volume of water in the vernal pool.

Enter the radius in meters (1/2 the diameter)
(round to the nearest meter) _____

Multiply it by the same number. X _____
(This is called r^2, or radius squared)

= _____

Multiply by pi X 3.14

= _____

Multiply by the depth written as a decimal
(ex. 84 cm = .84 cm). X . _____ cm
*If your depth is < 10 cm you will need to
Add a zero after the decimal point.
ex. 9 cm = .09 cm

= _____ m^3
cubic meters

We need to divide the number by 2
because the sides of the pool slope to
the center. divided by 2 =_____ m^3
cubic meters

Every cubic meter has 1000 liters. X 1,000

=_____ LITERS

Name_____Date_____

Field Work Self-Assessment Rubric

	Always 3	Sometimes 2	Not Yet 1	Points
I showed respect for all living things in and around the area of fieldwork.				
I did my assigned role in my team and settled disagreements peacefully.				
My data sheet is neat and accurate.				
I used materials safely and responsibly.				

Total Points _____

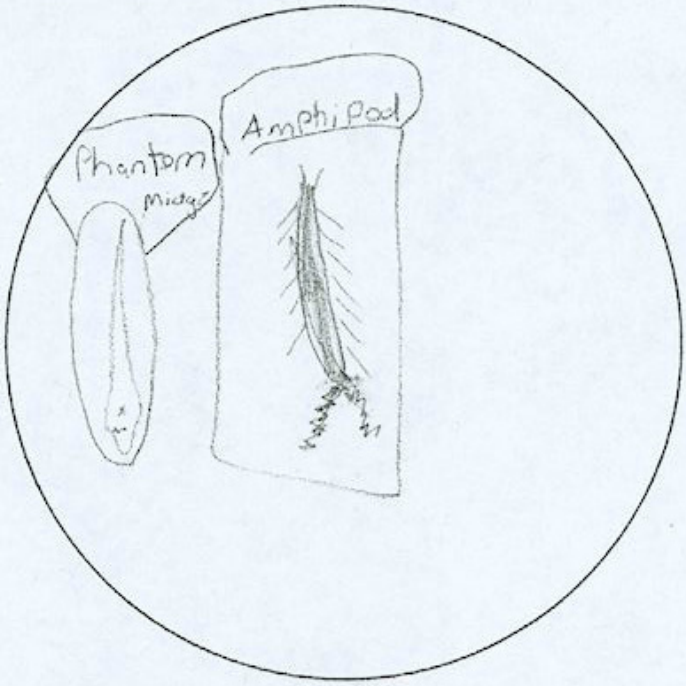
Sample # 1

Name Kiley Boy Date 1-9-07

Field Notes

Diameter	Depth	Air Temperature	Water Temperature	Sunny or shaded?
20 m.	90 cm.	8 C°	-2 C°	sunny

Sketch what you see in your sample of water:



Use your Field Guide to identify the organisms. Count them and record.

Organism	How Many?
1. Phantom midge	11
2. Amphipod	1
3.	
4.	
5.	

Sample # 1

Name Connor L Date Jan. 9, 2007

Field Notes

Diameter	Depth	Air Temperature	Water Temperature	Sunny or shaded?
20 m.	8 cm.	8 C°	-2 C°	Sunny

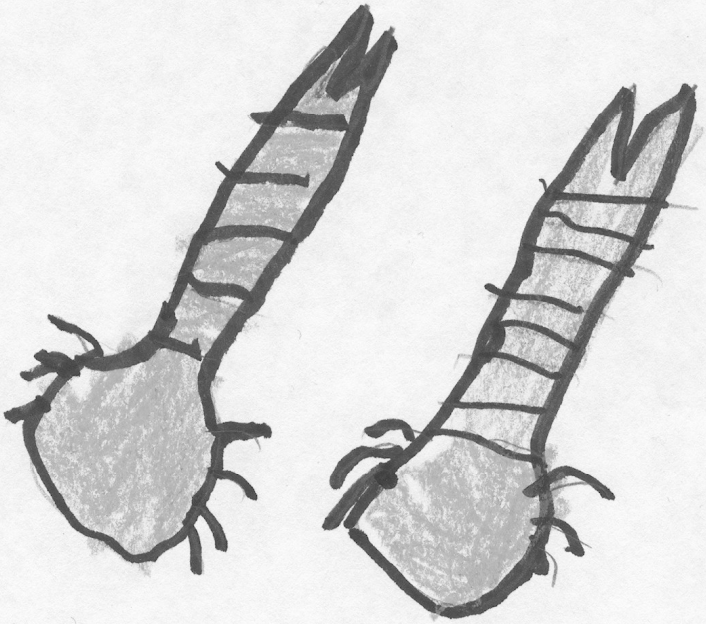
Sketch what you see in your sample of water:

Use your Field Guide to identify the organisms. Count them and record.

Organism	How Many?
1. Phantom Midge	11
2. Amphipod	1
3.	
4.	
5.	

Connor H

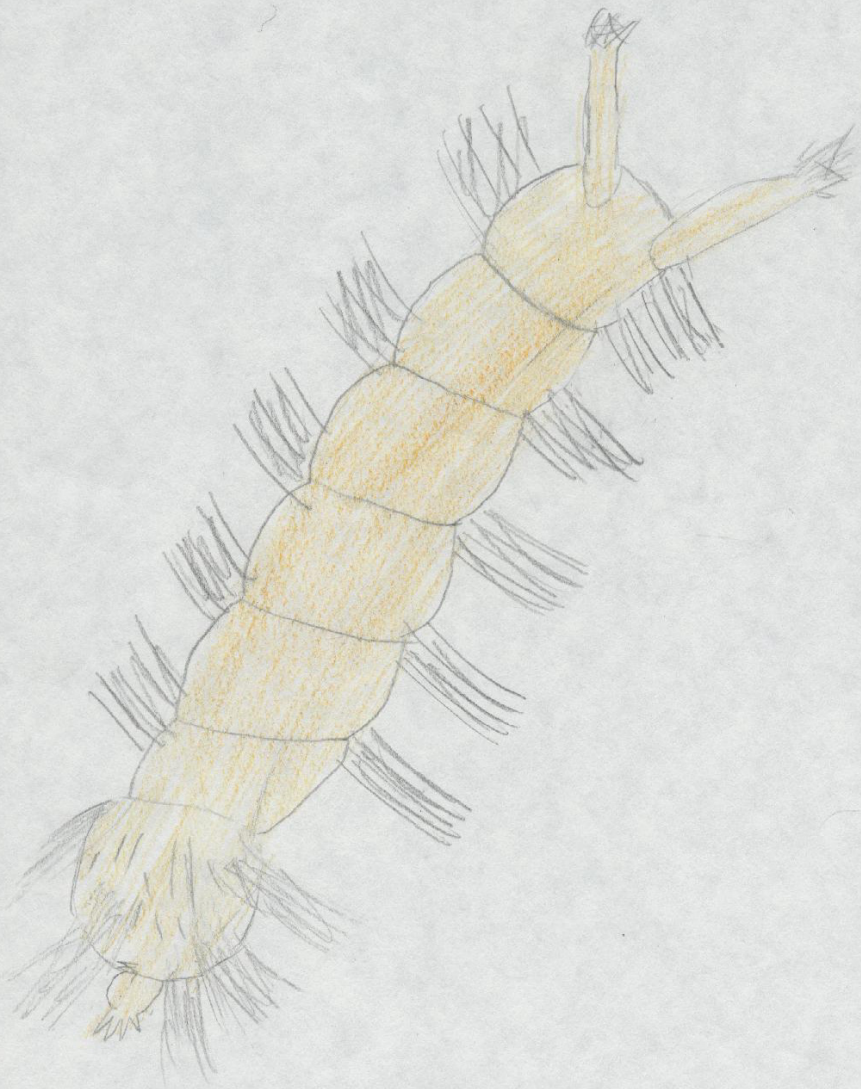
Mosquito
Larva



est: 332,800
3/30/07

Whit Wales

Mosquito Larva



est: 332,800

3/30/07

Name Zachary Date 1-9-07

ESTIMATING VOLUME IN THE VERNAL POOL

Follow the steps below to estimate the volume of water in the vernal pool.

Enter the radius in meters (1/2 the diameter)
(round to the nearest meter) 10

Multiply it by the same number.
(This is called r^2, or radius squared) X 10

= 100

Multiply by pi X 3.14

= 314

Multiply by the depth
(depth in centimeters written as a decimal) X .90

= 282.6 m^3
cubic meters

We need to divide the number by 2
because the sides of the pool slope to
the center. divided by 2= 141.3 m^3
cubic meters

Every cubic meter has 1000 liters. X 1,000

= 141,300 LITERS