

## Activity 25

### Tolerance of Cocoons and Hatchlings to NaCl

**Rationale:** Recently storms have caused fresh water soils to become contaminated with sea water. A recent study by M. Kerr and A.J Stewart in the *Journal of Undergraduate Research*, pp 21 -25, Volume III, 2003, completed a very straight forward study of salt water and *E. fetida*. The following activity is an adaptation of that study.

#### Objectives

- 1) Design an experiment to study the tolerance of cocoons and hatchlings to NaCl.
- 2) Determine if cocoons hatch in vermicompost laced with various percentages of NaCl.
- 3) Determine if hatchlings survive.

#### PDE Standards

##### Science and Technology

3.1.7. A,B,C

3.2.7. A,B,C,D,E,F

3.5.7. D

3.6.7. A,B

3.7.7. A,B,C,D

##### Environment and Ecology

4.1.7. A,B,C

4.2.7. A,C

4.6.7. A,B,C

##### Math

2.1.8. A,B,D,G

2.2.8. A,B,F

2.3.8. A,B,D

2.4.8. A,B,D,F

2.5.8. A,B,C,D

2.6.8. A,B,C,E,F

2.7.8. B,C,D

2.8.8. F,G,H,I,J

2.11.8. A,B

#### Materials

Saltwater aquarium test kit

NaCl (table salt)

100-mL graduated cylinders (2)

I-L food containers (mini bins)

Plastic spoons

CBL2

Vernier salinity sensor

TI 83/84

Balance

Good potting soil, at least 50% peat

## Introduction

Contaminated soils are in desperate need of remediation. Rains can dilute NaCl and leach it from the soil slowly, depending on the amount of rain. If worms can tolerate salty soils, then salt tolerant worms could help remediate the soils. This experiment will focus on the tolerance of cocoons to various NaCl concentrations.

## Strategies

As with previous rigorous inquiry activities introducing a new variable, considerable coaching will be needed. There are few if any articles available at the middle school level for students to read. A review/discussion of the tolerance of humans to NaCl water will be needed. A student led discussion needs to take place of people surviving at sea for extended periods of time sipping seawater, thirstiness after eating high salt content foods, the bitter taste/thirst of sea water, etc. Students can be coached to the realization that freshwater fish cannot be placed in the ocean and vice versus (with few exceptions, salmon and eastern freshwater eels). Students can begin to brainstorm weeks prior to introducing this Activity. Activity 25 will simply address the hatching of worms in cocoons placed in vermicompost of various NaCl concentrations. A review of making solutions is necessary and a discussion of converting ppm to ppt (‰) to pph (%). Coaching is required for this experimental design.

## Procedure

- 1) Determine the size and type of test containers.
- 2) Determine the amount of NaCl to add to 1.0 L of distilled water.
- 3) Determine what types of soils to use.
- 4) Make up solutions, approximately (0, 2, 4, 8, and 16% by weight).
- 5) Punch larger holes in the lid for air to enter.
- 6) Add about 100 mL of aged and dry vermicompost to each of 5 containers. Be careful to have no worms or cocoons. Castings are fine.
- 7) Add 50 mL of the 1% solution to the container marked 1%.
- 8) The 0% will become the control.
- 9) Repeat with each solution and each appropriate container. Let them stand for a day.
- 10) Shake the container to mix any excess solution with vermicompost.
- 11) Collect 50 young light colored cocoons.
- 12) Place each set of 10 cocoons in one of the five containers.
- 13) Store them in an empty worm bin.
- 14) Check the containers each day to see how many cocoons have hatched.
- 15) When hatchlings are observed, add a teaspoon of cold cooked oatmeal, made with water.
- 16) Record the number of hatchlings.
- 17) Complete Data Table 1.
- 18) Draw conclusions from the results.

## Procedure Optional

- 1) Press the APPS button; select Datamate.
- 2) Set up the salinity sensor.

- 3) Check the salinity of the different solutions. Record the data in the journal and Optional Data Table 1.
- 4) Repeat Step 3 with a salt water aquarium test kit.

### Expectations

The students should be able to:

- 1) design a reasonable experiment.
- 2) design the set up.
- 3) set up the experiment and collect the appropriate data.
- 4) record the measurements and complete Data Table 1.
- 5) understand the connection between tolerance and weight loss.

**Data Table 1** **Mortality of hatchlings and cocoons**

<b>NaCl (%)</b>	<b>Initial # of cocoons</b>	<b>Final # of cocoons</b>	<b>Loss of cocoons</b>	<b># of hatchlings observed</b>	<b>Final # of hatchlings</b>	<b># of surviving hatchlings</b>
<b>0</b>	<b>10</b>					
<b>2</b>	<b>10</b>					
<b>4</b>	<b>10</b>					
<b>8</b>	<b>10</b>					
<b>16</b>	<b>10</b>					

**Optional Data Table** **Comparison of the solutions' % concentration**

<b>% concentration</b>	<b>Prepared %</b>	<b>Salinity Sensor</b>	<b>+/- difference</b>
<b>0</b>			
<b>2</b>			
<b>4</b>			
<b>8</b>			
<b>16</b>			