

## Activity 26

# Tolerance to Overcrowding

**Rationale:** At what point in time is the vermiculture too densely populated? Most critters have a tolerance for some overcrowding usually determined by the lack of food and/or abundance of waste.

### Objectives

- 1) Design a study to determine if *E. fetida*/*E. andreii* have a maximum population density.
- 2) Design the experimental setup
- 3) Set up experiments, collect data, and analyze the data.

### PDE Standards:

#### Science and Technology

3.1.7. A,B,C

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

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

½ -L mini bins (used in previous tolerance activities)

Fresh bedding

### Introduction

The problem of overcrowding is apparent in most ecological systems. The carrying capacity of a niche is determined in large part by the number of predators and food supply. The worms in the vermiculture have no predators affecting the study. The food supply is adequate and the waste, castings, could be removed. To determine if there is a behavioral tolerance to overcrowding, this activity will compare the number of cocoons produced with the number of hatchlings produced from cocoons. For

commercial growers, the time to harvest worms and castings is more word of mouth and past experience. This may work, but a scientific study could confirm these assumptions.

### **Strategies**

This activity needs to be started as soon as a sufficient number of mature worms are available. This is another low coaching inquiry activity on tolerance. The students need to arrive at a specific number of worms per mini bin or Habitat and the idea that successful reproduction could be used to measure the tolerance. This can be a group per population study or preferably, several groups with 4 sample populations. In the analysis, the number of cocoons and hatchlings produced by the least crowded Habitat will be used as the control number. All other numbers will be compared to that value in Data Table 2.

### **Procedure**

- 1) Place freshly shredded paper (bedding) in the mini bins.
- 2) Mix with worms and cocoon-**free** aged vermicompost or peat (50%) potting soil.
- 3) The new bedding should be half aged and half fresh.
- 4) Add water equal to three times the mass of the new bedding only. Mix thoroughly.
- 5) Add about  $\frac{3}{4}$  liter in volume to each mini bin.
- 6) Collect 60 mature worms.
- 7) Place 4 in one container, 8 in another, 16 in another, and 32 in another container.
- 8) Add the appropriate amount of foodstuff to each container for the number of mature worms. Keep sufficient foodstuffs available, but do not overfeed.
- 9) Once a week look for cocoons, collect the cocoons, and place them on damp filter paper in a plastic Petri dish. Place them in safe darkened room temperature locations. Shoe boxes work well.
- 10) Be sure the filter paper remains damp.
- 11) Record the number of cocoons collected from each mini habitat.
- 12) Record the data in the journal and in Data Table 1.
- 13) Place all hatchlings in the Habitat or in a new Habitat.
- 14) Complete Data Table 1 and Data Table 2.
- 15) Draw conclusions from the results.

### **Expectations**

The students should be able to:

- 1) design an experiment for tolerance to overcrowding.
- 2) design an experimental set up.
- 3) collect appropriate data.
- 4) record and analyze data.

**Data Table 1 Group**

<b># of worms</b>	<b>cocoons</b>	<b>hatchlings</b>	<b>Cocoons per worm</b>	<b>Hatchlings per worm</b>
<b>4</b>				
<b>8</b>				
<b>16</b>				
<b>32</b>				

**Data Table 2**

<b># of Worms</b>	<b>Average # of Cocoons Per Worm</b>	<b>(-) Ave # of cocoons for 4 worms</b>	<b>Difference In Averages</b>	<b>Average # of Hatchlings Per worm</b>	<b>(-) Ave # of hatchlings for 4 worms</b>	<b>Difference in Averages</b>
<b>4</b>		<b>XXXX</b>	<b>XXXX</b>		<b>XXXX</b>	<b>XXXX</b>
<b>8</b>						
<b>16</b>						
<b>32</b>						