

**Investigative Lab 35**

## Dynamic Populations

### *Determining the Size of a Moving Population*

**Question** How can you determine the size of a population of organisms when the organisms move around or are hard to locate?

**Lab Overview** In this field investigation you will discover how to use the mark-recapture method to estimate the size of a population of moving organisms. You will then use the mark-recapture method to do your own population study of local garden invertebrates.

**Introduction** In the Prelab Activity you will read about one study in which a fisheries biologist used the mark-recapture method to estimate the size of a trout population. Then you will estimate the trout population of a stream two years after a severe flood. In your own field investigation you will locate a population of garden invertebrates, such as snails, and do your own mark-recapture study.

**Prelab Activity** In June 1995, storm clouds brewed over Shenandoah National Park in Virginia. Torrential rains fell, and in just three days, as much as 61 cm of rain soaked the area. Streams overflowed, and trees were uprooted. Huge amounts of debris washed downstream, scouring the streambeds and killing many trout. In many stream areas, the trout were eliminated. When it was all over, fisheries biologists assessed the damage. They asked, “Will the trout population be able to recover on its own, or will we need to intervene by introducing new trout to the area?”

The notebook pages below show the data of a fisheries biologist who has just returned from the damaged stream site. Using the formula in the notebook, calculate the estimated population of trout found in 100 m<sup>2</sup> of the stream in October 1998. Insert your answer in the data table on the right-hand side of the notebook.

Staunton River (testing section = 100 m <sup>2</sup> )		Calculations:	
1st capture 10/1/98 Number of trout captured and tagged = 28		Date	Number of trout per 100 m <sup>2</sup>
2nd capture 10/4/98 Number of trout captured = 35 Number of 2nd capture fish that had tags = 7		Oct '93	120
Formula Total estimated trout population = Number in 1st capture × number in 2nd capture Number of marked animals recaptured		Oct '94	100
		Oct '95	0
		Oct '96	20
		Oct '97	40
		Oct '98	_____

## Prelab Questions

1. What question were you and the fisheries biologists trying to answer by measuring the trout population over time?  

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2. Based on the data in the notebook, how long did it take for the trout population to recover from the flood?  

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3. Do you think the number of organisms captured in a mark-recapture study is important?  

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4. Consider the trout population size just after the flood. Hypothesize possible sources for the trout that re-established the population.  

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## Materials

- area where snails or other garden invertebrates live (ivy or other ground cover, flowerbed)
- meter stick or metric tape measure
- bucket or other container
- felt-tip permanent marker (for marking snails)

## Procedure



1. Locate a flowerbed or other garden area that has a snail population on the school grounds or in your backyard. The information in the table on the next page will help you choose an appropriate study area. (**NOTE:** *Do not carry out your investigation on private property unless you have specific permission from the property owner.*)

Good Snail Habitats	Places to Avoid
<ul style="list-style-type: none"> <li>• <i>Plants that grow from bulbs</i> Snails are attracted to plants that grow from bulbs, such as irises and calla lilies. Look under the leaves and at the base of the leaves.</li> <li>• <i>Ground cover such as ivy, African daisy, or other plants</i> These plants provide good hiding places for snails. Look on the ground under the plants and under the leaves.</li> <li>• <i>Lemon trees</i> Snails eat the leaves of lemon trees and other citrus trees. You can use a dwarf citrus tree as your entire study area. Look underneath the leaves.</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Grassy areas</i> Since snails tend to hide from predators and sunlight, they are unlikely to be found in open grassy areas during the day.</li> <li>• <i>Cacti, roses, or other thorny plants</i> There may be some snails on these plants, but the plants have many sharp spines and thorns that can hurt you.</li> <li>• <i>Junipers, woody shrubs</i> These tall shrubs are prickly and woody, making it hard to move the branches away to look for snails.</li> <li>• <i>Fragile gardens</i> Avoid areas with fragile flowers that may be trampled and destroyed.</li> </ul>

2. Measure your study area with a meter stick or metric tape measure. For best results, the study area should be about 4 m<sup>2</sup>. Record measurements and make a sketch of your study area below.

**CAUTION:** *Be aware of physical hazards in the study area to avoid injuring yourself or others.*

3. Work with your team to search the entire study area for snails, and collect the snails in a bucket or other container. You may find snails under plants, on walls behind plants, or on the underside of leaves. Take care not to harm the snails and the surrounding plants. **CAUTION:** *Be aware of any poisonous or prickly plants and avoid insects that bite or sting. Alert your teacher in advance to any allergies you may have.*

4. Use a felt-tip marker to mark each snail you have captured with a *small* “X” on its shell.



5. Record the number of snails you have captured and marked below. Then gently release the marked snails back into your study area. **CAUTION:** *Wash your hands with soap when you are finished working with the animals.*

Number of snails captured and marked: \_\_\_\_\_

6. Wait at least one day for the snails to redistribute themselves, but not longer than one week.
7. Return to your study area and capture snails again as you did in Step 2. When you have finished collecting, record the total number of snails and the total number of marked snails below.

**Number of snails captured:** \_\_\_\_\_

**Number of marked snails recaptured:** \_\_\_\_\_

### Analysis and Conclusions

1. Write a brief description of your study area in the space below. What environmental factors can you identify that might make it possible for a population of snails to live there? Explain.

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2. Use the mark-recapture formula to determine the size of the snail population in your team's study area.

$$\text{Total population} = \frac{\text{Number captured first time} \times \text{number captured second time}}{\text{Number of marked animals recaptured}}$$

Size of snail population in the study area: \_\_\_\_\_

3. Compare your data with your classmates. What was the largest snail population estimate? Describe the environment where this population is found.

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4. In general, biologists using the mark-recapture method to estimate population size assume that the mark or tag needs to be inconspicuous. Why might a more obvious mark affect your population estimate?

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5. What factors could affect your estimates?

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6. Why is mark-recapture a good method to use for this population?

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### Extension

A snail population living and feeding in a home garden can weaken or destroy many plants. Fortunately, there are many nontoxic methods for controlling the population of snails in a garden. Nontoxic methods do not introduce toxic chemicals into the food chain. Cornmeal, crushed eggshells, diatomaceous earth, wood shavings, and cocoa bean shells are nontoxic materials often used to repel snails. Try spreading one of these materials in the area you studied and do another mark-recapture study several days afterwards to see if the population of snails has diminished. **CAUTION:** *Check with your teacher before carrying out any investigations.*

