2B

Investigation

Predator–Prey Simulation

Ecologists often use models and simulations to help understand natural processes. In this investigation, you will simulate a predator–prey relationship between two species: the great horned owl and the white-footed deer mouse (Figure 1).

Figure 1

INQUIRY SKILLS

- ○ Questioning
- ○ Hypothesizing
- ● Predicting
- ○ Planning
- ● Conducting
- ● Recording
- ● Analyzing
- ● Evaluating
- ● Synthesizing
- ● Communicating

Question

Can a predator–prey relationship effectively regulate the size of both species' populations?

Prediction

Predict what pattern will describe the changes in size of the predator and prey populations.

Experimental Design

In this investigation, you will use models of predators and prey to simulate the predator–prey cycle responsible for population regulation.

Materials

- metre stick
- 20 10 cm × 10 cm cardboard squares (predator)
- 200 3 cm × 3 cm paper squares (prey)
- masking tape
- graph paper
- 2 coloured pencils

Procedure

1. Use masking tape to mark out a 1 m × 1 m boundary on a flat tabletop or floor. You may also use a flat desktop.
2. Scatter five prey cards throughout the area. Hold a predator card at least 10 cm above the surface and drop it in the marked area, trying to capture as many prey as possible.
3. If the predator card touches at least three prey cards, remove those prey cards. They have been eaten.
4. If the predator card does not touch at least three prey cards, remove the predator card and leave the prey cards. The predator has starved.
5. If at any time the number of prey or predators drops to zero, replace them with five prey or one predator card as needed.
6. Copy Table 1 in your notebook. Leave room for additional rows, and give it a title. Record the number of surviving prey and surviving predators. This represents one generation. You will need to record 20 generations.
7. Double the population of surviving predators and surviving prey. They have reproduced.
8. Scatter enough prey cards to represent the new population of the area.

Table 1

Generation	Initial prey	Prey caught	Surviving prey	Initial predators	Surviving predators
1	5			1	
2					
3					
4					

9. Continue to repeat Steps 3 through 8 for a total of 20 generations.
10. Graph the number of prey and predators present at the beginning of each generation. Use a scale of 0–200 for prey and 0–20 for predators. Include this as part of your results.

Conclusion

Complete the following items to answer the question posed at the beginning of the investigation.

Analysis

(a) Which population showed the first increase in size?

(b) Which population showed the first decrease in size?

(c) What maximum predator population was reached in your simulation?

(d) What maximum prey population was reached in your simulation?

Evaluation

(e) What factors limit the size of the owl (predator) population?

(f) What factors limit the size of the mouse (prey) population?

(g) Use the results of your simulation to describe the principle of time lag.

Synthesis

(h) Explain how your results might change if the area were larger or smaller.

(i) Copy the idealized predator–prey cycle shown in Figure 7 in your notebook. What aspects of your simulation would cause your predator–prey cycle to differ from the idealized model?

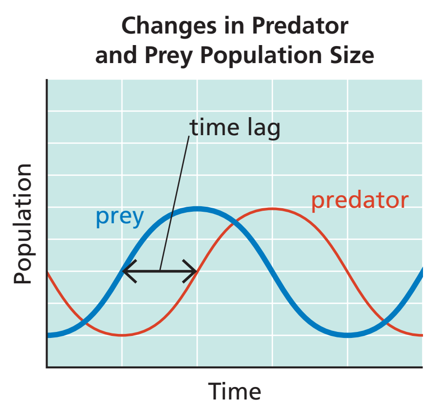

Figure 7

(j) What factors cause predator–prey cycles among actual populations to differ from the idealized predator–prey cycle?

(k) Explain how the owl population could be replenished even when all of the owls present have starved to death.