Predator-Prey Simulation

Strand Biological Communities

Topic Investigating the interactions between predator and prey populations

Primary SOL

LS.8 The student will investigate and understand interactions among populations in a biological community. Key concepts include
- b) the relationship between predators and prey;
- c) competition and cooperation;
- d) symbiotic relationships; and
- e) niches.

Related SOL

LS.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
- a) data are organized into tables showing repeated trials and means;
- d) models and simulations are constructed and used to illustrate and explain phenomena.

LS.7 The student will investigate and understand that interactions exist among members of a population. Key concepts include
- a) competition, cooperation, social hierarchy, territorial imperative.

LS.10 The student will investigate and understand that ecosystems, communities, populations, and organisms are dynamic, change over time, and respond to daily, seasonal, and long-term changes in their environment. Key concepts include
- b) factors that increase or decrease population size.

Background Information

Review population dynamics—factors that influence the numbers of births and deaths and the amount of immigration and emigration. If focusing on coyotes, ask students to brainstorm what they know about this species. Tell students that this predator is making a comeback in Virginia, and give more details about the species. Have students prepare by generating food chains that include the predator and prey species. Ask students their opinions of predators, and have them discuss the importance of predators to communities. You may want to include a reading of a story about a predator-prey relationship.

Materials

- Large pieces of construction paper or student desks marked off as habitats
- Construction paper cut into large and small squares
- Copies of the attached "Predator-Prey Simulation Data Sheet" worksheet
- Graph paper
- Colored pencils

Vocabulary

environment, habitat, niche, population, predator, prey, relationship

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

While it is not feasible to experiment with real predator and prey populations, it is possible to generate data through simulations that model the interactions that occur within a population, particularly between predator and prey. Students often feel that predators are "bad" because they kill smaller, weaker animals for food. Modeling the effects that predators have on habitats can help students realize that predators are not bad and that they play an important role, or niche, in maintaining stable communities. You may substitute any predator or prey animal in the simulation. Coyotes make an interesting choice as this species has reappeared in Virginia in recent years. If your students have been studying other species, such as owls and voles in an owl pellet dissection, these species would be a good choice for this simulation.

1. Group students into teams, and have each team use a large piece of construction paper or a desktop to represent a habitat, such as a grassy field. The small squares of construction paper represent rabbits, and the larger squares represent coyotes. Have teams perform the following steps:
2. Place three rabbits on the habitat. Toss a coyote into the habitat by tossing it up and allowing it to fall on the habitat. It should not slide across the habitat into the rabbits, but it might land on top of one or more of them, meaning that it "eats" them. The coyote needs to eat three rabbits to survive. As the coyote square will not land on three rabbit squares in this generation, the coyote will starve and die. Remove the dead coyote, and remove any rabbits that are "eaten." Record on the attached "Predator-Prey Simulation Data Sheet" the number of remaining rabbits as generation 1.
3. For generation 2, double the number of rabbits left from the previous generation. Put all the second-generation rabbits around the habitat. The first generation coyote starved, but another will now migrate into the habitat. Record the number of prey and predators at the beginning of generation 2. Toss a coyote into the habitat, as before. If the predator lands on less than three prey, it will die. Remove the eaten rabbits and the dead coyote, if necessary, as before.
4. Begin generation 3 by doubling the number of remaining rabbits and allowing a third-generation coyote to migrate into the area, if necessary. Record the data at the beginning of generation 3.
5. Continue with the following generations. Eventually the rabbit population, which continues to double each generation, will be large enough to sustain a coyote. Whenever a coyote starves, a new coyote migrates into the habitat. There should always be at least three rabbits in the prey population at the beginning of a generation. If the rabbits should be decimated or eliminated, new rabbits will migrate into the habitat. Once a coyote survives, it also reproduces. The coyote will produce a pup for every three rabbits it eats. For example, if the coyote eats six rabbits, it will produce two pups.
6. Continue the simulation, making predictions at the end of each generation, until you have worked through 25 generations.
7. When finished, make a double-line graph of the data, with one color line representing the rabbit population and another color line representing the coyote population.

Assessment

- **Questions**
  - How could the population dynamics be described in this simulation?
  - Using the graphed data, could you make a prediction about the future of these populations?
  - What would happen to the rabbit population if the coyotes were unable to fulfill their niche within the community?
- **Journal/Writing Prompts**
  - Describe outside factors that could affect the ability of predators and prey in their traditional environment. Explain whether such factors cause an increase or decrease in the population size.
- **Other**
  - Summarize of the predator-prey simulation.

Extensions and Connections (for all students)

- Have students repeat the simulation, introducing other factors that affect population. This could be done by making event cards for students to draw for each generation. Cards could include unfavorable events such as harsh weather or disease that kill a certain percentage of the rabbits. Favorable events could improve rabbit reproduction rates or increase immigration. Human interaction could include unfavorable events (e.g., hunting, habitat destruction) that reduce population and favorable events (e.g., reduction in numbers of other predators) that would increase population.
- Play a video clip showing an example of a predator-prey relationship. Show in segments and allow students to make predictions.
- Have students complete research on predator-prey species relationship of interest to them.

Strategies for Differentiation

- Coyotes and rabbits are not the only example of predators and prey. Have students think of other examples of predators and prey and compare their relationship with the classroom simulation.
- Have students create their own population simulation.
- Have students use a computer-generated predator-prey simulation, such as one found on the Internet.

Predator-Prey Simulation Data Sheet

Name: _____ **Date:** _____

Generation	Rabbits at Start	Coyotes at Start	Rabbits Surviving	Coyotes Surviving
1	3	1		
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
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