Lynx Eats the Hare

Environmental Science Predator–Prey Activity

Introduction

Perform this card game simulation of the interspecific interaction between a predator population and that of its primary prey. Discover the inextricable link between the two populations in this engaging and surprisingly realistic and involving activity.

Concepts

- Predator
- Prey
- Population growth

Background

An interaction between a species (predator) that feeds upon another species (prey) is called a *predator–prey relationship*. The example used in this game is the relationship between the lynx, a catlike predator found in northern American forests, and the snowshoe hare, a rabbit-like species with large back feet. When snowshoe hares are abundant in a given area, the lynx population in the area will be well fed and the survival rate of their offspring high. As a result, the lynx population grows as well. As the number of lynx increases, a larger number of snowshoe hares will be eaten—resulting in a hare population decrease. As the population of hares decreases, the lynx population begins to decline as well.

The predator–prey relationship is an example of a *density-dependent limiting factor*. A density-dependent limiting factor affects the population density (number of organisms per a given area) when it reaches a certain level. Other examples of density-dependent limiting factors are competition, parasitism, and disease. As a population grows beyond the maximum population size that a particular environment will support (known as the *carrying capacity*) limiting factors act to reduce the population. The size of the population will shrink, then grow again, and so on. The resulting cycle of population changes may be repeated indefinitely.

Activity Overview

The predator–prey relationship and the cycles of lynx and hare populations will be simulated while playing an interactive card game.

Materials

Flat surface, at least 15″ square

Graph paper or computer graphing software

Hare cards, 51

Lynx card

Lynx Eats the Hare Data Table

Lynx tally sheet

Ruler

Tape, colored or masking

Procedure

1. Use tape to mark off a square, 15″ on each side, on a tabletop or other flat surface. The square represents the area inhabited by a population of hares.

2. Begin the simulation by populating the habitat with three hare cards—spatially dispersed within the square.

3. Randomly toss the lynx card into the square in an effort to capture as many hares as possible. A hare is considered captured if any portion of the lynx card touches the hare card. In order to survive and reproduce, the lynx must capture at least three hares when tossed. When the hare population is at this stage, lynx survival is virtually impossible. Remove any hares captured and enter the results for the first generation on the Lynx Eats the Hare Data Table.

4. The hare population doubles between generations—multiply "Hares Remaining" by two and enter the resulting number in the "Number of Hares" column for the second generation. For example, if no hares were captured in generation one, there will now be six hares in generation two. Place the required number of hare cards in the square. If no lynx survived the previous generation another moves into the area. Toss the newly recruited lynx—repeating step 2. Remove any captured hares and enter the new tallies on the Lynx Eats the Hare Data Table.

5. By generation 5 or 6 the lynx should be able to capture three hares when tossed. If successful, the lynx survives until the next generation and also produces offspring—(one offspring per three hares captured.) Toss the lynx card once for each lynx.

6. As the population builds it is important to separately tally each lynx's kills, removing captured hares after each time the card is tossed. Determine lynx survival and reproduction using individual lynx capture numbers. Remember, each lynx can only produce an offspring if three hares are captured. Once the total number of lynx is four or more, the individual lynx capture numbers should be tallied on the Lynx Tally Sheet and the totals entered on the Lynx Eats the Hare Data Table.

7. Between generations 9 and 11, the populations will probably crash back to, or near, zero. If and when this happens be sure to begin subsequent generations with at least three hares. Carry the simulation through 20 generations, by which time the cycle will be well on its way to repeating and the next few generations can be more accurately predicted.

8. After 20 generatons have been completed, use computer graphing software or graph paper to graph the population changes of both the lynx (Column 2) and the hare (Column 3) versus the generation number (Column 1).

9. Answer the *Post-Lab Questions*.

Post-Lab Questions

1. Based on the results, describe the relationship between the hare and lynx populations.

2. What would happen to the hare population if the lynx became extinct?

3. What would happen to the lynx population if the hare became extinct?

4. List at least three other factors that may influence the lynx and hare populations.

5. What would most likely happen to the vegetation in a given area during times of low hare populations?

Teacher's Notes

Lynx Eats the Hare

Materials Included in Kit

Lynx Eats the Hare card deck, 5   Lynx Tally Sheet and Data Table

Additional Materials Needed (for each lab group)

Flat surface, at least 15″ square   Ruler

Graph paper or computer graphing software   Tape, colored or masking

Teaching Tips

- Enough materials are provided in this kit for 30 students working in groups of six. All materials can be reused. This laboratory activity can reasonably be completed in one 50-minute class period.

- The data is best analyzed graphically. For each animal, make a plot of population totals (the first two columns) versus generation number. By plotting the hare population and the lynx population side by side on the same graph, the relationship between the two becomes abundantly clear.

- The most evident pattern is the near exponential initial increase in the prey (hare) population followed by a proportional increase in the predator (lynx) population. Students should note the lag time between the two populations. The predator population responds directly to fluctuations in the prey population—recovery follows recovery and crash follows crash.

- Students should keep in mind that, as in any simulation (even sophisticated computer models), certain assumptions are made and many variables overlooked. Natural populations are subject to myriad pressures and disturbances such as immigration, emigration, overgrazing, disease, floods, droughts, fires, and extreme cold spells—to name a few. Many of these factors will compound each other. Disease spreads more easily as population density increases. Hares intensively competing for food in overpopulated areas will be less able to resist droughts or freezes. The enormous complexity of a relatively simple system is awe-inspiring.

- If several groups are conducting the simulation, other variables may be introduced. Disease or fire could reduce the hare population at any stage in the cycle. Human hunting or trapping activity could impact either population. Ask the students to imagine the outcome if the lynx were exterminated. Note the well-known impact on deer populations throughout North America—populations no longer regulated by natural predators. Studies have shown that natural predation pressure maintains the overall health and size of prey populations at optimal levels.

- Extra lynx cards have been given in case the original lynx card used in the activity is misplaced.

- Additional *Lynx Eats the Hare* card decks are available from Flinn Scientific, Catalog No. FB1884.

- The decades long study of wolves and moose at Isle Royale provides a real-life example of population trends. www.isleroyalewolf.org (accessed May 2013).

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12
    Systems, order, and organization
    Evidence, models, and explanation

Content Standards: Grades 5–8
    Content Standard A: Science as Inquiry
    Content Standard C: Life Science, reproduction and heredity, regulation and behavior, population and ecosystems, diversity and adaptations of organisms

Content Standards: Grades 9–12
    Content Standard A: Science as Inquiry
    Content Standard C: Life Science, interdependence of organisms; behavior of organisms

Teacher's Notes *continued*

Answers to Post-Lab Questions *(Student answers will vary.)*

1. Based on the results, describe the relationship between the hare and lynx populations.

   When the hare population is high, the lynx population begins to grow as well. This causes the hare population to decline. As the hare population declines, so does the lynx population.

2. What would happen to the hare population if the lynx became extinct?

   The hare population would grow very rapidly and would probably still reach its carrying capacity and eventually crash.

3. What would happen to the lynx population if the hare became extinct?

   If the hare population became extinct, the lynx population would most likely become decimated as well.

4. List at least three other factors that may influence the lynx and hare populations.

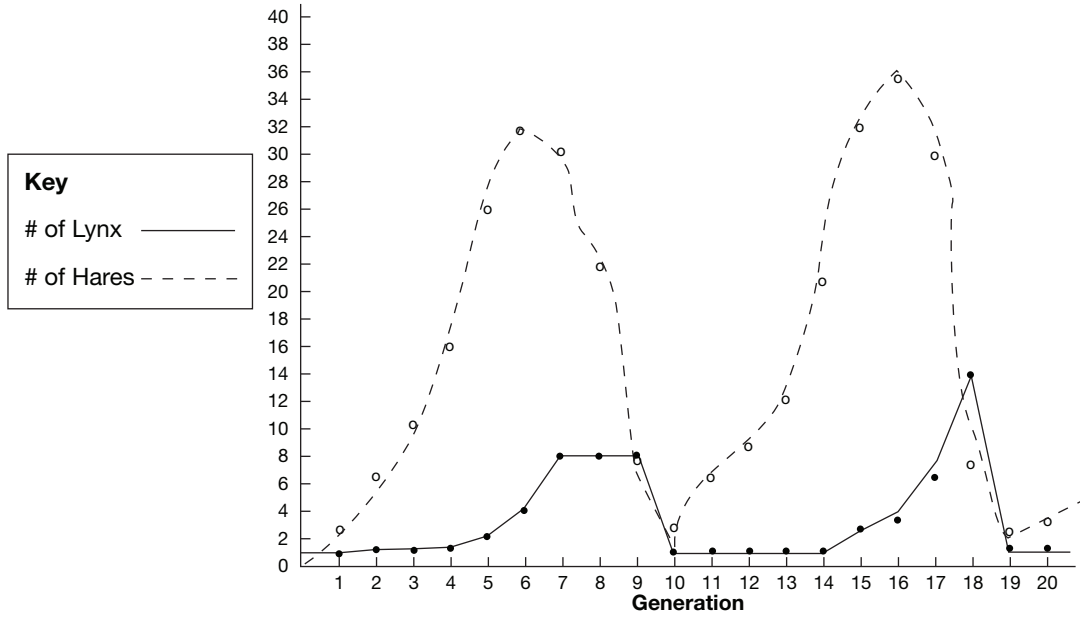   *Hunting, trapping, extreme weather conditions, disease, etc.*

5. What would most likely happen to the vegetation in a given area during times of low hare populations?

   The vegetation would most likely grow rapidly when the hare population is low.

Sample Data Table and Graph

Generation of Hares	Number of Lynx	Number of Hares	Hares Eaten	Hares Remaining	Lynx Starved	Lynx Surviving	Lynx Offspring
1	1	3	0	3	1	0	0
2	1	6	1	5	1	0	0
3	1	10	2	8	1	0	0
4	1	16	3	13	0	1	1
5	2	26	8	16	0	2	2
6	4	32	17	15	0	4	4
7	8	30	19	11	4	4	4
8	8	22	18	4	4	4	4
9	8	8	8	0	8	0	0
10	1	3	0	3	1	0	0
11	1	6	2	4	1	0	0
12	1	8	2	6	1	0	0
13	1	12	2	10	1	0	0
14	1	20	4	16	0	1	1
15	2	32	14	18	0	2	2
16	4	36	21	15	0	4	4
17	8	30	26	4	1	7	7
18	14	8	8	0	14	0	0
19	1	3	1	2	1	0	0
20	1	4	1	3	1	0	0

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Teacher's Notes *continued*

Lynx Eats the Hare Graph

Lynx Eats the Hare—Super Value Kit **is available from Flinn Scientific, Inc.**

Catalog No.	Description
FB1880	Lynx Eats the Hare—Super Value Kit
FB1884	Lynx Eats the Hare Card Deck

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.

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