# ***Workshop on Predation* – T. Herbert**

(modified in 2007 by Dana Krempels)

***Pre-Workshop Preparation: Read Chapter 53, pages 1159 - 1171 of Biology by Campbell. Also, read the articles at* http://www.bio.miami.edu/dana/dox/lynx_hare.html.**

## *I. Basics of the predator-prey relationship*

1. What is the name of the food source for a predator?

2. What is the food source for prey?

3. Are all prey species herbivores? Give examples of some that are not, and what eats them.

Prey: _____ Predator: _____
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4. Whenever an animal eats a food item, only about 10% of the energy in that food item is converted into the biomass of that animal. About 90% is lost as entropy as the animal uses the energy in the food for cellular work, and homeostasis. Discuss the implications, in terms of energy transfer from one feeding (trophic) level to another, of predators that feed on herbivores, versus predators that feed on secondary (and higher) consumers.

5. When is a human a predator? When--if ever--is a human prey?

6. What the key similarity or difference between the predator-prey relationship and the host-parasite relationship? What about the host-parasitoid relationship?

7. What the key similarity or difference between the predator-prey relationship and a competitive relationship between two species?

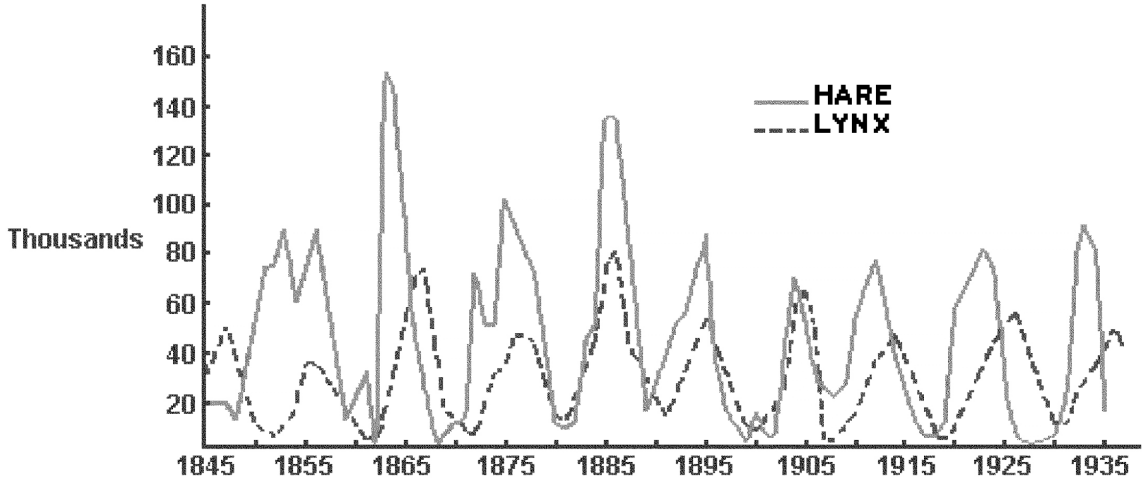
8. In terms of evolutionary results, what is the difference between competition between two different species, and competition between members of the same species?

## *II. Canadian Lynx and Snowshoe Hare: Fact or Myth?*

## A. Background

In 1937, MacLulich published a paper analyzing data collected by fur trappers selling pelts to The Hudson Bay Company over a period of nearly 100 years. From these data, a "classic" Lynx vs. Snowshoe Hare population fluctuation phenomenon emerged, as shown below. MacLulich noted that the "boom" and "bust" of hare and lynx population seem to mirror each other, with the lynx peaks and valleys coming slightly after those of the hares.

An interesting, but non-academic, overview of this phenomenon can be found at **http://lynx.uio.no/jon/lynx/cglynx1a.htm** complete with photographs.




1. How did the MacLulich and other earlier students of the population fluctuations of lynx and hare explain the population fluctuations?

2. What are some other, more recent hypotheses that could be used as alternate explanations? For some ideas, visit **http://www.bio.miami.edu/dana/dox/lynx_hare.html**.

## B. Exercise: Becoming a Predator or Prey

**Each person in the group should choose to be a Lynx or a Snowshoe Hare. Imagine how you would be living, feeding, foraging, hiding, etc. Picture yourself in the winter boreal forest, and imagine what challenges you would face.**

**Go around the circle of predator and prey and have each lynx or hare answer one of the following questions. As you discuss these questions, think about how your lynx or hare behavior might be more complicated than first imagined.**

1. (**Lynx**) The number of hares is decreasing rapidly because you, your conspecifics, and predators of other species are eating them. Simple predator-prey theory describes a relationship between the predator and prey. But what is the relationship between you and your conspecifics? What about predators of other species? How might intraspecific (i.e., between members of the same species) interactions differ in their evolutionary impact compared with interspecific (i.e., between members of the same species) interactions?

2. (**Hare**) You have to eat, too! Being a good member of Order Lagomorpha (the Mammalian order that includes rabbits, hares, and pikas), you don't usually eat Lynx (though a Knight of the Round Table sometimes makes a tasty snack). What do you eat in the spring and summer? The fall? Winter? What type of community interaction do you share each of the different types of things you eat?

3. (**Lynx**) What will happen to the predator and prey populations if the predator population size is reduced to one individual - you?

4. (**Hare**) What will happen to the predator and prey populations if the prey population size is reduced to one individual - you?

5. (**Lynx**) Recall the data on the relationship between lynx and hare populations as analyzed by MacLulich. What is your relationship to the trappers? (Consider all possibilities!)

6. (**Hare**) Now it's your turn to recall the data on lynx and hare populations collected by Hudson Bay Company fur trappers. What is your relationship to the trappers? Again, be sure to consider all possibilities.

7. (**Lynx**) More recent research suggests that snowshoe hare population numbers fluctuate even when lynxes are excluded from the environment.
   a. What might be responsible for this "natural" fluctuation in your population numbers?

   b. What are the implications of this phenomenon, in terms of population numbers for lynxes and snowshoe hares over time, even when the populations do not interact?

8. (**Hare**) Would you expect to see the same type of "natural" fluctuations in the lynx population in the absence of snowshoe hare prey? Discuss! Why or why not?

## ***III. Predator/Prey Relationships: Graphical Representations***

1. Using what you already know about the lynxes and hares, draw a graph of hypothetical population sizes of predator and prey plotted over time. Label axes with correct units! When you are finished, provide an appropriate legend for this, Figure One.

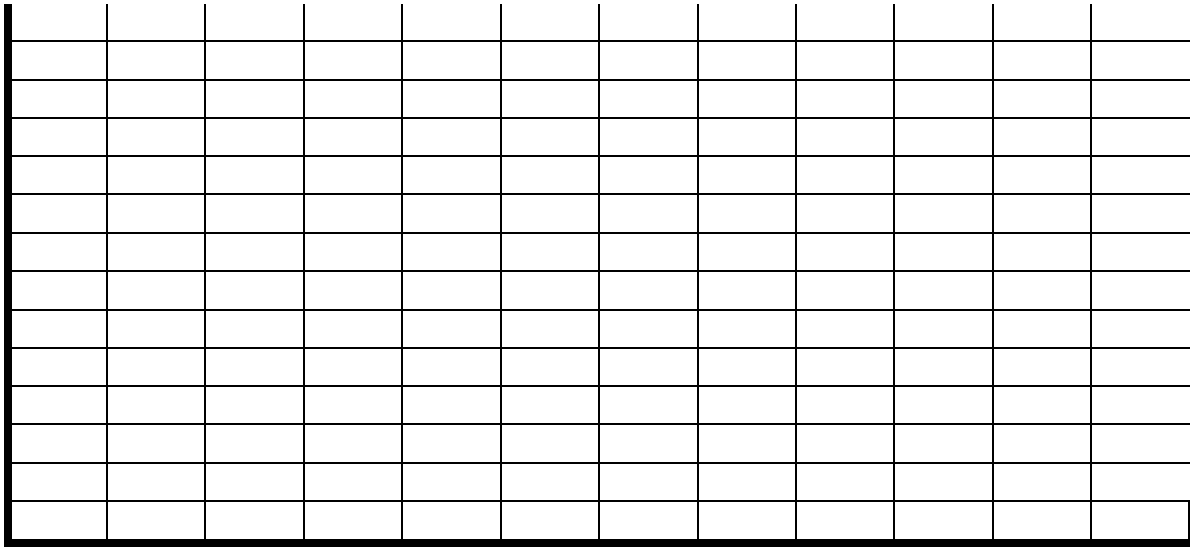


Figure 1. _____

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2. Now, draw a graph with predator numbers represented by the vertical axis and prey numbers represented by the horizontal axis. Label axes with correct units! (# animals/unit area) and provide an appropriate legend for Figure Two.

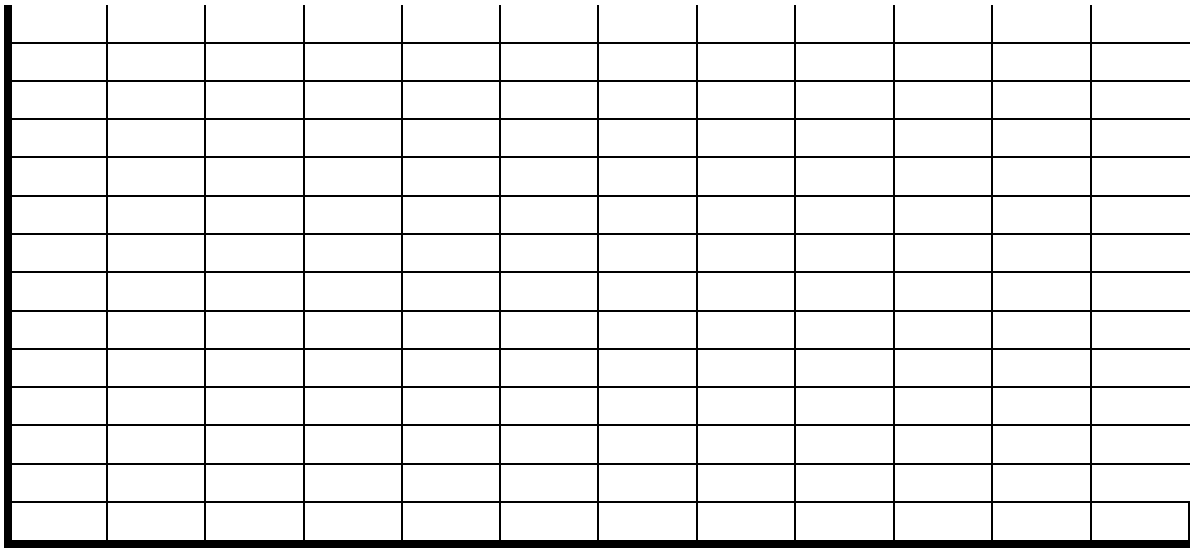

Figure 2. _____

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3. Choose any time point/interval from Figure 1. With a straight-edge (you can use anything from a ruler to the edge of your notebook), draw a vertical line intersecting the number of predator and prey living at that time. Plot a point at these two coordinates on Figure Two, and label it #1.

4. Repeat this process for ten later times from Figure 1, and number the points (#2, #3, etc.)

5. What do the points on Figure 2 tell you about the relationship between the two populations? Does it have anything to do with time progression?

6. To clarify your answer to #5, redraw the Figure 2, placing point #1 (from the earlier time) in the same position as where you previously had point #2 (later time). Place point #2 where point #1 used to be. (That is: reverse the positions of points #1 and #2 from Figure 2, and plot them in Figure 3, below. Label your axes appropriately, as usual.

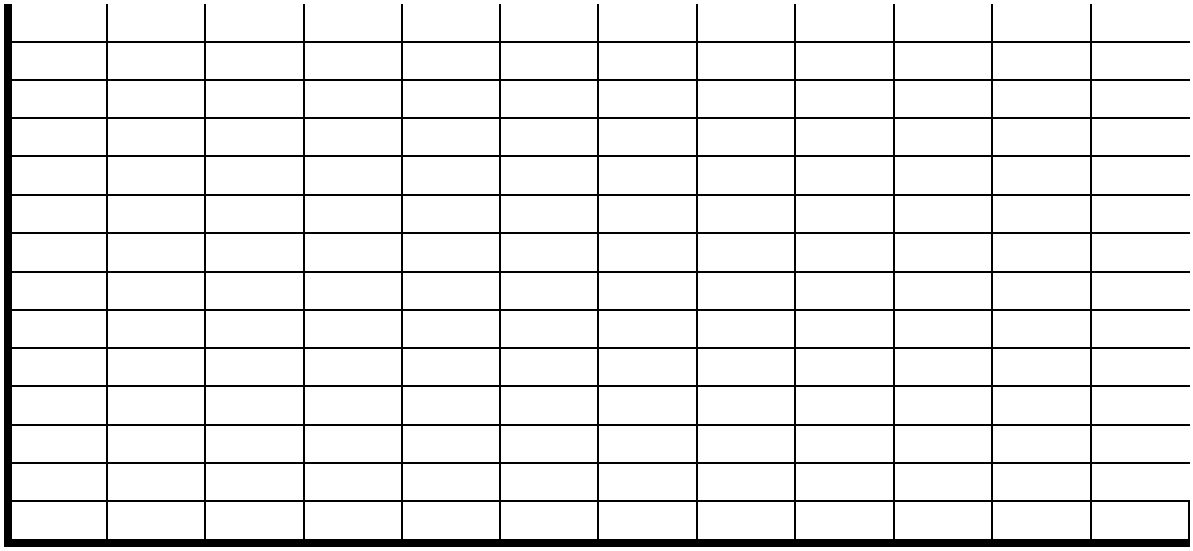

Figure 3. _____

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7. What do these plots (Figures 2 and 3) imply about the actual effects of the species we are calling the "predator" and "prey" on each other's population numbers?

8. What factors besides predation by Lynxes might affect Snowshoe Hare populations? Discuss.

9. What factors besides a shortage of Snowshoe Hare prey might affect Lynx populations? Discus.