

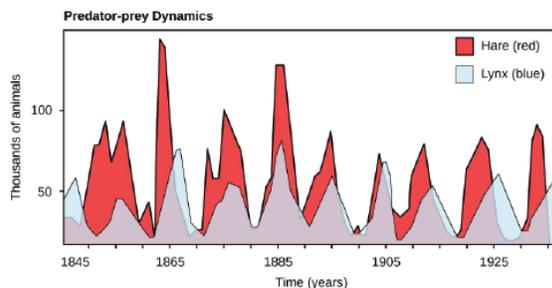
Introduction:

Mathematics gives us a practical way to describe the natural world. Today we will investigate how a special class of natural numbers gives some species an evolutionary advantage.

Populations of predators and prey in a community are not always constant over time. Instead, in many cases, they vary in cycles. Are these cycles related? In **predation**, a predator eats or attacks the body of its prey, with a positive (+) effect on the predator and a negative (-) effect on the prey.

Question 1. If a population of predators were very high, what changes would you expect to see the population of prey?

As far back as the seventeen-hundreds, fur trappers for the Hudson's Bay Company noted that while in some years they would collect an enormous number of Canadian lynx pelts, in the following years hardly any of the wild snow cats could be found - until, some years later, when the trappers found themselves again with an abundance of lynx.



Question 2. From the graph, can you identify any patterns or relationships relating changes in lynx to changes in hare population?

Question 3. What reasons could explain the rise and fall of the hare populations?

Cicadas do number theory?

Cicadas have the evolutionary disadvantage that they have *many* predators. They burrow into the earth almost immediately after hatching where they remain for a varying number of years. Periodical cicadas are grouped into broods based on the year they're scheduled to emerge. Once above

ground, the cicadas have about four to six weeks to stretch their wings and lay eggs, at which point their life cycles come to a close.

Question 4. Typically the whole brood of cicadas emerges from underground in the spring. Do you think emerging simultaneously is advantageous to the cicada population or disadvantageous? Explain.

Question 5. Suppose you are told that most predators have a two-to-ten-year population cycle. If there are two broods of cicadas, emerging every 12 and 13 years respectively, which brood is more vulnerable? Why?

Question 6. If a given cicada brood emerges every 17 years has a predator with a 5 year life cycle, how often will the cicadas face a peak predator population?

Question 7. If brood A emerges every 12 years and brood B emerges every 15 years, which brood is more vulnerable to predation?