19.4 Predation

Learning objectives

- Explain what is meant by predation.
- Explain how the predator–prey relationship affects the population size of the predator and prey.

Specification reference: 3.7.4

In Topic 19.3 we looked at interspecific competition. We shall now turn our attention to one type of interspecific relationship, the predator–prey relationship. A **predator** is an organism that feeds on another organism, known as their **prey**.

As predators have evolved they have become better adapted for capturing their prey - faster movement, more effective camouflage, better means of detecting prey. Prey have equally become more adept at avoiding predators - better camouflage, more protective features such as spines, concealment behaviour. In other words the predator and the prey have evolved alongside each other. If either of them had not matched the adaptations of the other, it would most probably have become extinct.

Predation

Predation occurs when one organism is consumed by another. When a population of a predator and a population of its prey are brought together in a laboratory, the prey is usually exterminated by the predator. This is largely because the range and variety of the habitat provided is normally limited to the confines of the laboratory. In nature the situation is different. The area over which the population can travel is far greater and the variety of the environment is much more diverse. In particular, there are many more potential refuges. In these circumstances some of the prey can escape predation because the fewer there are the harder they are to find and catch. Therefore, although the prey population falls to a low level, it rarely becomes extinct.

Study tip

Herbivores are sometimes considered as predators on plants.

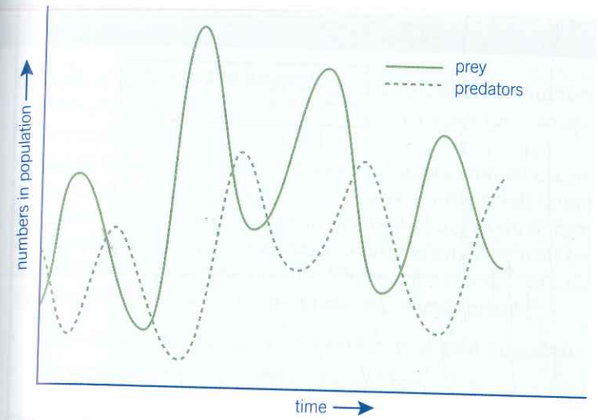
Evidence collected on predator and prey populations in a laboratory does not necessarily reflect what happens in the wild. At the same time, it is difficult to obtain reliable data on natural populations because it is not possible to count all the individuals in a natural population. Its size can only be estimated from sampling and surveys. These are only as good as the techniques used, none of which guarantee complete accuracy. We must therefore treat all data produced in this way with caution.

Effect of predator–prey relationship on population size

The relationship between predators and their prey and its effect on population size can be summarised as follows:

- Predators eat their prey, thereby reducing the population of prey.
- With fewer prey available the predators are in greater competition with each other for the prey that are left.
- The predator population is reduced as some individuals are unable to obtain enough prey for their survival or to reproduce.
- With fewer predators left, fewer prey are eaten and so more survive and are able to reproduce.
- The prey population therefore increases.
- With more prey now available as food, the predator population in turn increases.

This general predator–prey relationship is illustrated in Figure 1. In natural **ecosystems**, however, organisms eat a range of foods and therefore the fluctuations in population size shown in the graph are often less severe.



▲ **Figure 1** *Relationships between prey and predator populations*

Although predator–prey relationships are significant reasons for cyclic fluctuations in populations, they are not the only reasons, disease and climatic factors also play a part. These periodic population crashes are important in evolution as there is a **selection pressure** which means that those individuals who are able to escape predators, or withstand disease or an adverse climate, are more likely to survive to reproduce. The population therefore evolves to be better adapted to the prevailing conditions.

The Canadian lynx and the snowshoe hare

The long-term study of the predator–prey relationship of the Canadian lynx and the snowshoe hare was made possible because records exist of the number of furs traded by companies such as the Hudson Bay Company in Canada over 200 years. By analysing these records the relative population size of the Canadian lynx and the snowshoe hare can be determined. The data collected are shown as a graph in Figure 3.

1. State what assumption is being made if we use the number of each type of fur traded as a measure of the population size of each species.
2. Describe the changes that occur in the populations of Canadian lynx and snowshoe hare.
3. Explain the changes that you have described.

It has long been observed that the population of snowshoe hares fluctuates in cycles. The question is whether these fluctuations are due mostly to predation by the lynx, mostly to changes in the food supply or mostly to a combination of both. To find out, ecologists fenced off 1 km^2 areas of coniferous forest in Canada where the hares lived. Separate areas were treated in four different ways:

- In the first set of areas, the hares were given extra food.
- In the second set of areas, lynx were excluded.
- In the third set of areas, the hares were given extra food and lynx were excluded.
- In the fourth set of areas, conditions were left unaltered as a control.

The results of the experiment are shown in Figure 4.

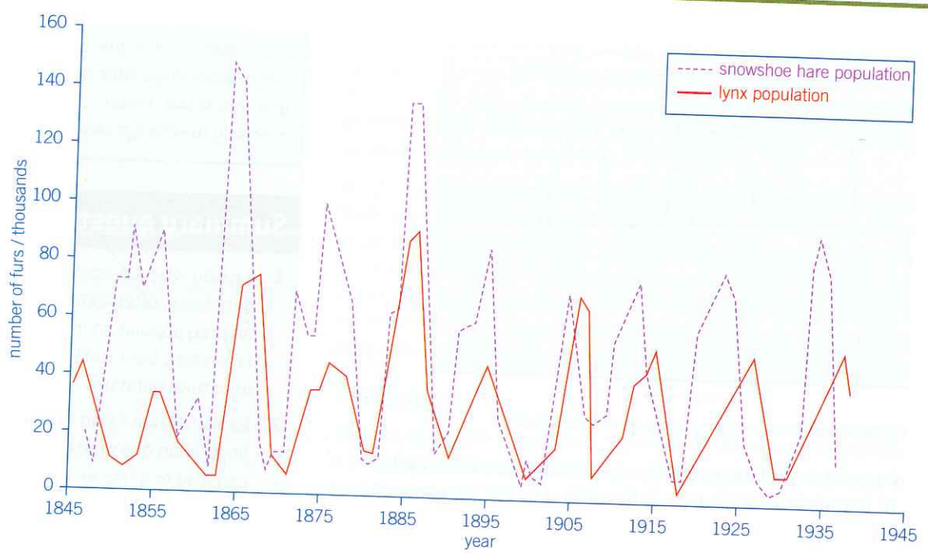
Study tip

When asked to describe predator–prey relationships from a graph you should use names to describe precisely the changes taking place.

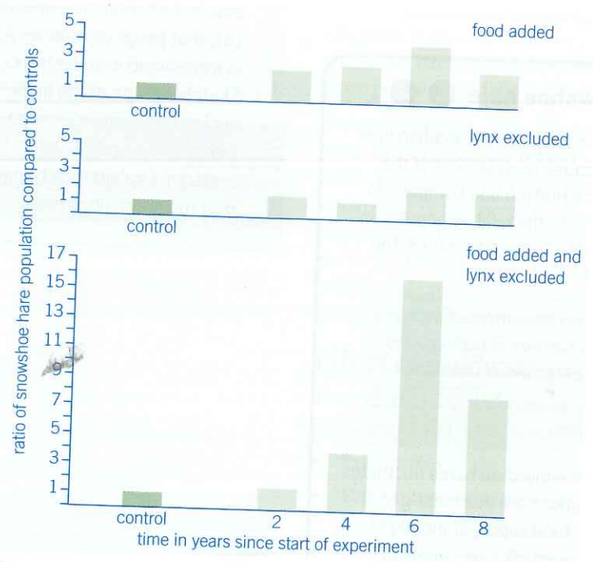
Summary questions

1. Explain why a predator population often exterminates its prey population in a laboratory but rarely does so in natural habitats.
2. Explain how a fall in the population of a predator can lead to a rise in its prey population.
3. A species of mite (A) is fed on oranges in a laboratory tank until its population is stable. A second mite species (B), that preys on species A, is introduced into the tank. Sketch a graph of the likely cycle of population change that the two species will undergo. Explain the changes that the graph illustrates.

▲ **Figure 2** *Canadian lynx catching a snowshoe hare*



▲ **Figure 3** *The predator–prey relationship illustrated by the number of snowshoe hare and lynx trapped for the Hudson Bay Company between 1845 and 1940*



▲ **Figure 4** *Snowshoe hare population experiment*

4 Calculate by how many times the addition of food increased the population after six years compared with the control.
5 Deduce which had the greater influence on the population of hares– the addition of food or the exclusion of the lynx. Explain your answer.
6 Deduce what conclusions can be drawn from this experiment.