Key

Ecological Relationships

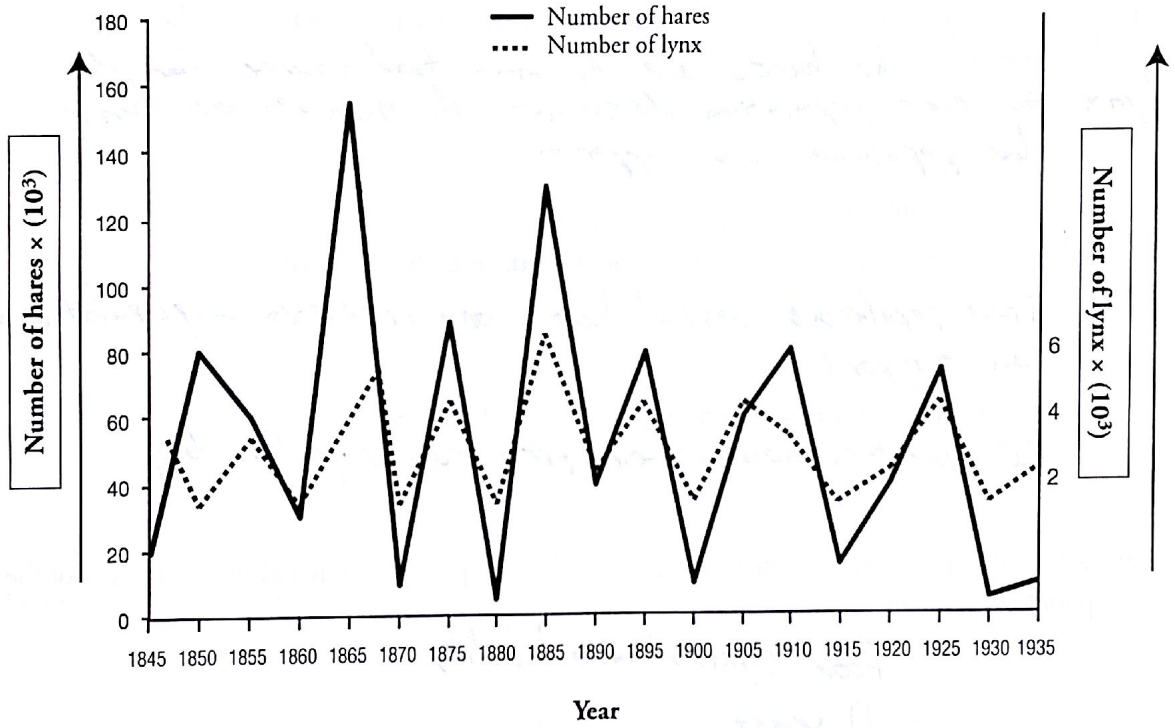
What symbiotic relationships are seen in ecosystems?

Why?

All living organisms need each other in some way to survive. This can include the interactions between predators and their prey, the close associations between and among living things (**symbiosis**), or the competitive relationships between and among species. All of these relationships may be equally advantageous to the parties involved, or they may be more beneficial to one organism over the other.

Model 1 – Predator–Prey Relationships

Relationship between Snowshoe Hares and Lynx



1. Refer to the graph in Model 1.
   a. What does the y axis on the left represent?

   Population of hares

   b. What does the y axis on the right represent?

   Population of lynx

   c. For both y axes, what value do the numbers on the axes need to be multiplied by?

   1000 (10^3)

2. What was the approximate population of snowshoe hares in 1865?

   155 - 160,000

3. What was the approximate population of lynx in 1865?

4,000

4. When the number of snowshoe hares is high, what happens to the number of lynx? Use actual data from the graph to support your observation. The population of lynx rises as the numbers of hares increases. The population spike of hares in 1865 is followed by a drastic increase in lynx.

5. What happens to the population of lynx as the number of snowshoe hares decreases? Use actual data from the graph to support your observation. The lynx population drastically decreases as the hare decreases. Each drop in hare population is quickly followed by a drop in lynx population.

6. Propose an explanation for the apparent cause and effect relationship between the populations of lynx and hares. The hares are the main food source for the lynx so their population determines the number of lynx the population can support.

7. What does this information tell you

   a. about the effect of size of prey populations on the number of predators?

   Prey populations control how many predators an environment can support.

   b. about the effect of predators on the populations of their prey?

   If predators spike their prey can rapidly drop.

8. What other factor would influence the size of the hare population in addition to the size of the population of lynx?

   - Food (grass) availability
   - Disease

STOP

Model 2 – Symbiosis

Organism 1	Organism 2	Description of the relationship	Symbiotic Relationship
Dog	Flea	The flea feeds on blood from the dog. There is no benefit to the dog and the itching and bites may lead to infection.	Parasitism
Fungus	Algae	The photosynthetic algae provide food for the fungus, which in turn provides a suitable living environment for the algae.	mutualism
Termite	Cellulose-digesting bacteria	The bacteria in the gut of the termite breakdown and feed on some of the cellulose taken in by the termite. The termite would be unable to digest cellulose without these bacteria and they gain an additional source of nutrition from the surplus digested cellulose.	mutualism
Shark	Remora	The Remora fish swim alongside the shark and take scraps of food that the shark drops during feeding. The shark does not eat the Remora and appears unaffected by its presence.	commensalism
Cattle	Cattle egret	The cattle egret follows herds of cattle and eats the insects that the cattle stir up as they move through the grassland. The cattle appear to be unaffected by the egrets.	commensalism
Human	Tapeworm	The tapeworm lives in the small intestines where it feeds and grows, robbing the human of essential nutrients.	parasitism

9. Refer to the information given in Model 2.

a. In the dog and flea relationship, is there a benefit for one of the organisms or for both?

only the flea

b. Is either the dog or the flea harmed by this relationship?

the dog

c. Which other relationship in Model 2 is similar to that between the dog and flea?

The human and tapeworm

10. Refer to the fungus and algae relationship in Model 2.

a. Is there a benefit for one of the organisms or for both?

Both

b. Is either the fungus or the algae harmed by this relationship?

no

c. Which other relationship in Model 2 is similar to that between the fungus and the algae?

The termite and cellulose digesting bacteria

11. Refer to the shark and remora relationship in Model 2.

a. In the shark and remora relationship, is there a benefit for one of the organisms or for both?

One, only the remora

b. Is either the shark or the remora harmed by this relationship?

no

c. Which other relationship in Model 2 is similar to that between the shark and the remora?

The cattle and the cattle egret

Read This!

Symbiotic relationships are identified by how they affect the organisms involved. The three types of symbiotic relationships are listed below.

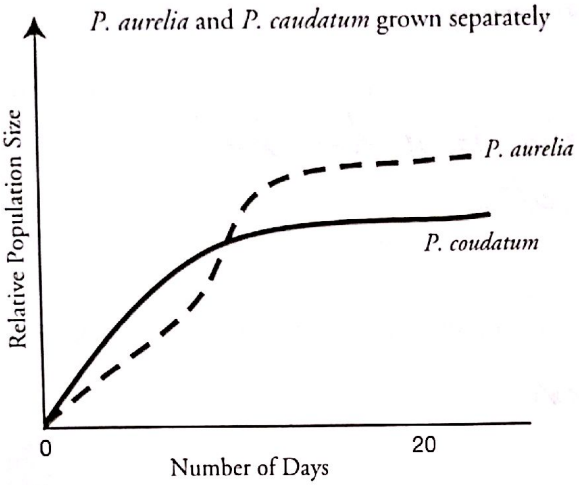
- **Mutualism:** Both organisms benefit from the relationship.
- **Parasitism:** One organism benefits and the other is harmed.
- **Commensalism:** One organism benefits and there is no effect on the other.

12. Using the information from the *Read This!* box, label each of the relationships in Model 2 as mutualism, parasitism or commensalism.

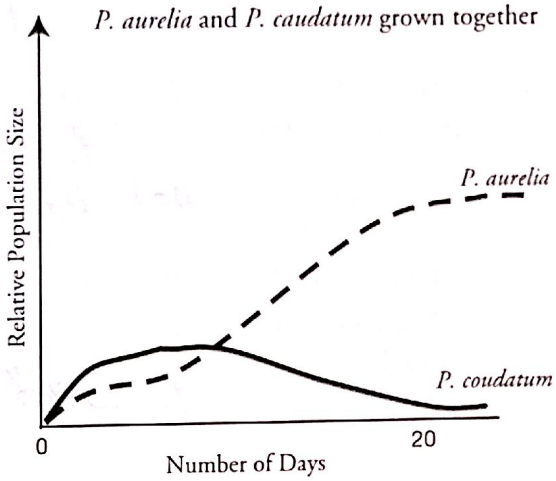
13. With your group, choose one of the organism pairs from Model 2 and justify why you categorized the relationship as you did.

Model 3 – Inter- and Intra-specific Competition

Graph A

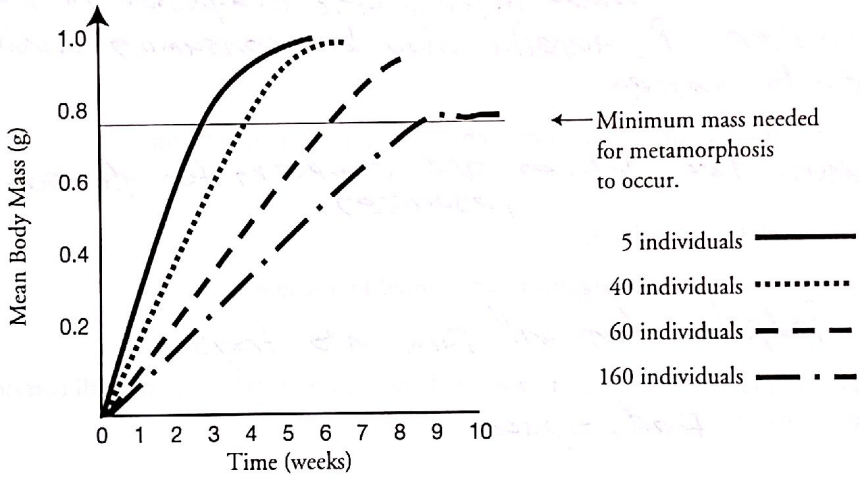


Graph B



Graph C

Rate of growth of *R. tigrina* tadpoles in populations of different sizes.



14. What are the names of the species in graphs A and B in Model 3?

P. aurelia and P. caudatum

15. Which graph shows competition between two different species?

B

16. Which graph in Model 3 shows population growth for only one species?

A

17. What is the difference between the growing conditions in graph A and graph B?

The species are separate in graph A and together in graph B

18. *P. caudatum* and *P. aurelia* are both species of *Paramecium,* a microscopic protozoan. *P. caudatum* is the larger of the two species. When grown separately, which of the two species reaches a larger relative population size after 20 days? P. aurelia

19. When grown separately is there a substantial difference in the relative population size of the two types of paramecia after 20 days? P. aurelia is higher but not by a lot

20. Compare graphs A and B in Model 3.

    a. Which population of species of *Paramecium* is more affected when the two species are grown together? P. caudatum

    b. Considering that *P. caudatum* is 50% larger in size than *P. aurelia,* develop a hypothesis with your group to explain why **interspecific competition** has an effect on the relative population size of *P. caudatum.* When interspecific competion is happening the smaller P. aurelia may be consaming available nutrients faster.

21. In a grammatically correct sentence, define interspecific competition.
When two species are competing for the same resources.

22. Refer to graph C in Model 3.

    a. Describe the species of organism represented by the graph.
Tadpoles that will turn into frogs

    b. These tadpoles are confined to a limited environment. What are they all competing for in that environment? Food, space

23. What is the minimum mean body mass required for metamorphosis of a tadpole to occur?
~,737

24. When there are only five tadpoles, how long does it take for metamorphosis to occur?
2-3 days

25. When the number of individuals is increased to 60, what is the effect on the time taken for metamorphosis to occur?
6 days

26. When the number of individuals is increased to 160, what is the effect on the time taken for metamorphosis to occur?
It increases

27. Propose an explanation for why the population size affects the number of weeks before metamorphosis of the tadpoles occurs.

Each individual tadpole has to compete for food with more individuals so it takes longer for each one to reach the metamorphosis mass.

28. The type of competition represented by graph C is referred to as **intraspecific competition**. What is different about this compared to the competition seen in graph B?

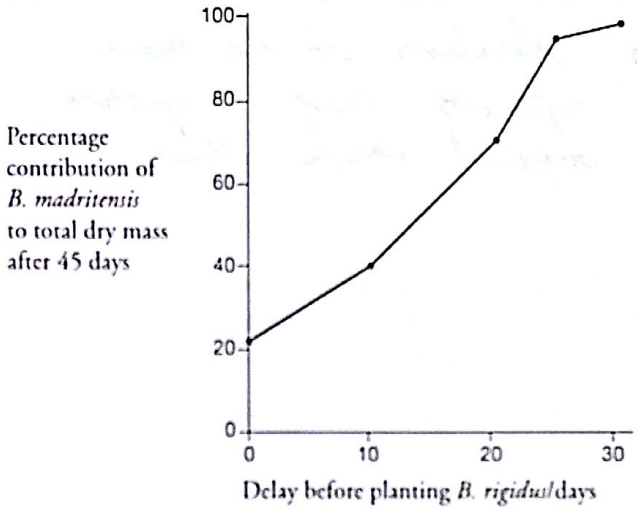
~~The~~ Members of the same species are competing against each other

STOP

Extension Question

29. An investigation was carried out into competition between two species of grass, *Bromus madritensis* and *B. rigidus*. Equal numbers of seeds of *B. madritensis* were sown in a number of different pots. In each pot, an equal number of seeds of *B. rigidus* was then sown a different number of days after *B. madritensis*. The results are shown in the graph below.

Given that the total dry mass of plant material was the same in each pot, summarize the main conclusions that can be drawn from this investigation. Suggest an explanation for the results when the delay before sowing *B. rigidus* was 30 days.



- when the delay mixing in B. rigidus is short the B. rigidus quickly takes over, thus preventing much growth by B. madritensis. This is interspecific competition. By the 20-30 day mark B. madritensis had grown sufficiently to take over the pots.