

Chapter 3

1. Why will intraspecific competition decrease the further a population is from K ?

Answer

The further from K , the smaller the population so that fewer individuals are competing for any limited resources, such as food or space. Close to K , whichever resource sets the carrying capacity will be in short supply and more individuals will be competing for what remains.

2. Why should the average size of a fish beginning reproductive activity become smaller in heavily-fished populations? Why is this likely to be a genotypic rather than a phenotypic effect?

Answer

Our fishing techniques aim to capture large fish and allow smaller fish to escape. At high F , most large fish are caught and few escape. Those not mated will have failed to pass their genes on; those which have are successful. The earlier that mating commences, the more likely that an individual have mated before being caught. The selective pressure of the fishing net those that delay their maturity will be less successful. Under this intense selective pressure, high F will favour a reduction in the age at which reproduction starts. In the absence of competition, fish may reproduce earlier because they are in better condition, perhaps because of an abundance of food. However, larger fish produce more eggs, so investing in growth, rather than early reproduction, is perhaps more likely when competition is slight.

3. Use the equation in Figure 3.2 and the following data to derive the maximum rate of increase for a starting population of 50 when

- (i) $K = 1000, r = 0.36$
- (ii) $K = 1000, r = 0.18$
- (iii) $K = 500, r = 0.36$

You will probably find it useful to create a table like that in Figure 3.2(b) for each calculation.

What do you notice about the effect of r and K across these examples? What is a quick way to calculate the maximum rate of increase in these simple models?

Answer

- (i) 90 (ii) 45 (iii) 45

As the population increases the effect of K is have a greater and greater effect on r , so that close to K the net increase in the population becomes very small.

A comparison of all the data (these three calculations, plus the example given in the text) shows that doubling either r or k both serve to double the maximum rate of increase.

The maximum rate of increase given K can be calculated quickly as

$$0.5 \times r \times N$$

$$\text{when } N = 0.5K$$

4. Study Figure 3.7 and answer the following questions.

- (i) Why is the balance weighted in favour of reproduction at the start of the rainy season?
- (ii) Why is the balance weighted in favour of growth (conditioning) at the end of the rainy season?
- (iii) What are the costs and benefits (risks and returns) for froglets attempting to produce a second generation in the middle of the rainy season?

Answers

- (i) At this time of the year, a typical rainy seasons will have enough time remaining to allow at least one spawning and for the offspring from that spawning to grow and condition themselves for the dry season.
- (ii) Most rainy seasons will not leave sufficient time for the offspring from a spawning to grow and condition themselves before the dry season starts.
- (iii) The risk is of the rainy season ending too soon so that the cost of the spawning effort is wasted - the tadpoles die before they grow into conditioned froglets. A long rainy season may allow a second reproductive effort, producing many more offspring and more conditioned froglets carrying the parental genes through to the next dry season. A cautious population which never hedged its reproductive investment would have a smaller proportion of the population carrying its genes after an unseasonably long rainy season.

5. Populations of the woodlouse *Porcellio scaber* were sampled from two different habitats on the same day. The number of individuals in different size classes (which approximate to age classes) were as follows:

Population

		A	B
Size (age) class	1	297	203
	2	91	112
	3	32	87
	4	10	41
	5	1	19

- (i) Would such data enable us to construct a cohort or a static life table?
- (ii) Draw an age pyramid for each population. Which of the two populations most closely approximates to a stable age distribution? Give your reasons.
- (iii) One of the habitats sampled was a frequently-disturbed compost heap and the other a long-established rough pasture. Which population most likely came from each habitat...and give your reasons for your choices.

Answer

- (i) Static life table – the data is only for one sampling occasion and shows the proportions at that time. It does not allow us to follow one cohort through its life.
- (ii) A – it has the bottom heavy appearance of a rapidly growing population, with most individuals in the younger age groups. The distribution is much more even in B.
- (iii) A – compost heap; B - rough pasture. This assumes that a population is likely to be close to its carrying capacity and limited by intraspecific competition in the older and less disturbed habitat.