InkBiology

ANSWER BOOK

Populations and their limits: what stops the numbers rising

Ecology, populations and environmental change · Unit B20

AQA 3.7.4 · OCR A 6.3.2 · Edexcel A Topic 5 · CAIE 18.1, 18.2

6 questions · 21 marks

NAVY EDITION

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SECTION A · Short, 1 to 2 marks

A1 **B1** the population size that a particular environment can support over a sustained period, given the resources available in it. **B1** the damage done by too many individuals takes time to feed back as deaths and failed breeding, so the population overshoots and is usually followed by a crash to below the original level. [2]

SECTION B · Standard, 3 to 5 marks

B1 **B1** lag phase: numbers barely move because there are few individuals to reproduce, so even a birth rate above the death rate produces very few offspring, and the organisms are still acclimatising. **B1** log phase: resources are plentiful and little is in the way, so birth rate greatly exceeds death rate and the population multiplies by a constant factor in each equal interval. **B1** slowing phase: food per individual falls, waste accumulates and disease spreads more easily between crowded hosts, so birth rate falls, death rate rises and the gap between them narrows. **B1** stationary phase: birth rate and death rate match, and the population fluctuates about a level rather than sitting on it, because the factors setting that level vary with the weather and the season. [4]

B2 **B1** when prey are abundant the predators are well fed and rear more young that survive. **B1** a predator population can only respond to a food supply by reproducing, and reproduction takes time, so the rise in predator numbers appears months or years after the rise in prey. **B1** by the time predator numbers have risen the prey are being eaten faster than they breed and fall, so predators then starve and fall in turn, and with predation relieved the prey recover and the cycle repeats. **B1** if predators set prey numbers the predator peak should come first, so the lag argues that the prey drive the predators rather than the reverse; the Yukon experiments on snowshoe hares raised density about threefold by adding food, about twofold by excluding predators and about elevenfold by doing both, so the two act together. [4]

B3 **M1** estimated population = (number in the first sample × number in the second sample) ÷ number in the second sample that were marked. **M1** (150 × 120) ÷ 18 = 18 000 ÷ 18. **A1** an estimated population of 1000 voles. **A1** density = 1000 ÷ 3.0 = about 330 voles per hectare, which needs its unit to be a density at all. [4]

B4 **B1** a niche is the role a species plays in its community, meaning all the conditions it can tolerate and all the resources it uses, and it is not the same thing as a habitat. **B1** the range of conditions the first species can tolerate is wider than the range in which it is found, because its larvae settle and survive low on the shore when the other species is absent. **B1** lower on the shore the second species grows faster and undercuts or smothers the first, so interspecific competition removes it from that part of the shore without any direct attack. **B1** competition therefore trims the conditions a species could occupy down to the conditions it does occupy, and where two similar species coexist they usually differ in some dimension of the niche instead. [4]

B5 **B1** fewer marked animals are found in the second sample, and that number is the denominator of the index, so a smaller denominator makes the estimated population too high. **B1** she should leave a shorter interval between the samples: long enough for the marked animals to mix back in, but not long enough for many of them to moult. **B1** she should use a mark that survives handling and is placed where it is not rubbed off or hidden, using a light, non-toxic paint that neither harms the animal nor makes it conspicuous to predators. [3]