Populations & Sustainabilty

Model Answers 1

Level	A Level
Subject	Biology
Exam Board	OCR
Module	Genetics, evolution and ecosystems
Topic	Populations & sustainability
Booklet	Model Answers 1

Time allowed: **47 minutes**

Score: **/35**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E
>69%	56%	50%	42%	34%	26%

Question 1

The commercially grown tobacco plant, *Nicotiana rustica*, has many pests. One such insect pest is *Manduca sexta*, which causes damage to the stems and leaves of *N. rustica*.

The tiny wasp *Cotesia congregata* lays its eggs inside the body of *M. sexta*. When the larvae develop they feed on the body of the host, eventually killing it.

N. rustica produces a volatile organic compound called volicitin when its leaves are damaged.

Volicitin attracts *C. congregata* at high concentrations.

Which of the following explains why *N. rustica* releases volicitin?

1 volicitin release reduces herbivory in *N. rustica*
2 volicitin release increases *M. sexta* growth rate
3 volicitin release reduces parasitism of *M. sexta* by *C. congregata*

A. 1, 2 and 3

B. Only 1 and 2

C. Only 2 and 3

D Only 1

[1]

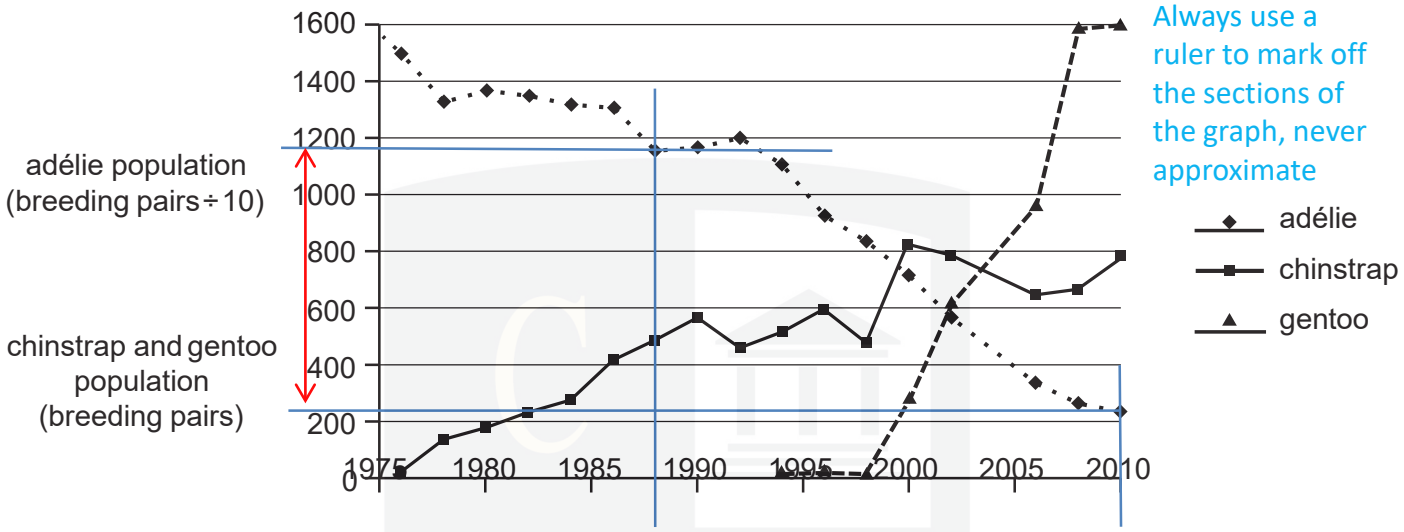
Volicitin release increases parasitism as it attracts C. congregata so 3 is wrong

Volicitin release decreases M. sexta growth rate as the wasp larvae feed of it so 2 is wrong

Question 2

Penguins are flightless birds that eat fish. Most species of penguin live near the coast of Antarctica or on the many islands that surround Antarctica.

Fig. 17 shows the populations of three penguin species on an island off the coast of Antarctica.



Always use a ruler to mark off the sections of the graph, never approximate

Fig. 17

(a) (i) Before 1975 the only penguin species on the island was the adélie penguin. Chinstrap penguins were first recorded on the island in 1976.

The changes in the chinstrap penguin population are not directly related to abiotic factors.

Suggest explanations for the changes in the population of **chinstrap** penguins between 1976 and 2010.

[3]

- The chinstrap and adelie penguins occupy similar niches or the niches overlap
- This is the competitive exclusion principle
- Chinstrap population increases as there are resources such as food and nesting sites available
- Chinstrap population increases as there little competition
- Eventually the population levels off as competition increases with the arrival of gentoo

The question does not refer to the gentoo penguins but they are on the graph. This is where exam technique pays off, the examiner doesn't want to make life easy for you but the introduction of gentoo is there for a reason. Always use ALL the information given to you even if you're not sure

(ii) Calculate the mean annual decrease in the **adélie** penguin population between **1988** and **2010**.

Show your working. Give your answer to **three significant figures**. **[2]**

Anything between 796 and 876 per year or y^{-1} or if the number of pairs was calculated

anything between 398 and 438 per year

(b) Adélie penguins need a habitat that contains sea-ice. Gentoo and chinstrap penguins can survive without access to sea ice.

Scientists have claimed that the population changes in the three penguin species on the island suggests that the Antarctic temperature is increasing.

(i) Discuss whether the information in Fig. 17 supports the scientists' claim.

You should refer to the data in Fig. 17 in your answer. **[3]**

Supports

- Both gentoo and chinstrap populations increase and they are not reliant on ice or adelie decreases and they are ice reliant
- Chinstrap increased from 0 to 800 whereas adelie dropped from 1600 to 220 over the same period

Does not support

- Competition between chinstrap, gentoo and adelie will explain the trends
- Correlation does mean the same as causation

Causation is when a change in one variable is a result of a change in another variable

Correlation is when a change in one variable is reflected by a change in another variable

(ii) Scientists working in the local area monitored water temperatures and populations of other water animals around the island between 1976 and 2010.

Suggest **two** further pieces of evidence that the scientists might have found to support their claim.

[2]

- A reduction in the extent of the ice
- Changes in ocean currents
- Changes in the penguin food populations
- New diseases or parasites
- New animal species on land
- Change in population of aquatic plants

This is a suggest question so many answers are plausible. Think about the work you did on biodiversity and the effect of physical factors on populations

[Total: 10]

Question 3

The Madidi National Park, in the South American rainforest, is home to a wide variety of species. The largest predator in the area is the jaguar. These large cats are well camouflaged and hunt mostly at night. A single individual can cover a very large area.

(a) In 2007 the Wildlife Conservation Society (WCS) attempted to estimate the population of jaguars in the Madidi National Park.

- Digital camera traps were placed in areas that jaguars were likely to visit.
- If an infrared beam was broken by an animal, the camera was activated.
- The camera then took a photograph of the animal.

(i) Suggest why it was **not** appropriate to estimate the number of jaguars using the capture-recapture technique. **[2]**

- The estimate will not be accurate as the numbers are very low
- Trying to catch jaguars is very dangerous

Let's say you catch 3 jaguars and in one area you catch 4, this extra one will have a much bigger influence on the statistics because the numbers are so low

(ii) Most studies estimate the population density of jaguars in the South American rainforest to be 5 individuals per 100 km^2.

In the 2007 study:

- 100 camera traps were set up covering an area of 271 km^2.
- 28 images of 9 different jaguars were recorded.

How well do these results support a population estimate of 5 individuals per 100 km^2? **[4]**

- These results suggest a population of 3/3.3 jaguars per 100km2
- Which is below the estimate
- It does not support it
- The numbers are low so repeatability is low
- Some jaguars may not have been photographed

Find out how many jaguars there would be in 1 km^2 by dividing 9 by 271 then multiply it by 100 to find the number per 100km^2

(iii) Other evidence used to estimate the jaguar population includes footprints and reports of sightings by local humans.

Suggest one disadvantage of each of these methods for estimating the size of the jaguar population.

human sightings • Seeing the same individual twice or misidentification

footprints • The same jaguar may leave many footprints, or footprints may disappear

[2]

(b) The Madidi National Park is also home to approximately 260 000 humans who support themselves by means of cattle-farming, and the production of timber and brazil nuts (a large nut harvested from a local native tree).

Conservationists have been working with:

- local people to promote sustainable use of these resources; and
- government agencies to maintain the quality of the national park.

Explain why the Madidi National Park is an example of conservation rather than preservation.

[3]

- It's conservation because there are local people there
- They farm the area for nuts
- The farming is sustainable
- They take active measures to maintain biodiversity

Preservation is when an area is cordoned off and human interference is not allowed

[Total: 11]

Question 4

This question is about management of ecosystems.

Mink are small carnivorous mammals. In recent years, many mink have escaped from fur farms.

The Hebridean Mink Project is working to remove this invasive species from Scottish islands. The mink arrive on an island by swimming. Once on the island, they reproduce and act as predators on the native mice.

Fig. 1.1 is a graph recording the growth of a mink population from its first arrival on a new island.

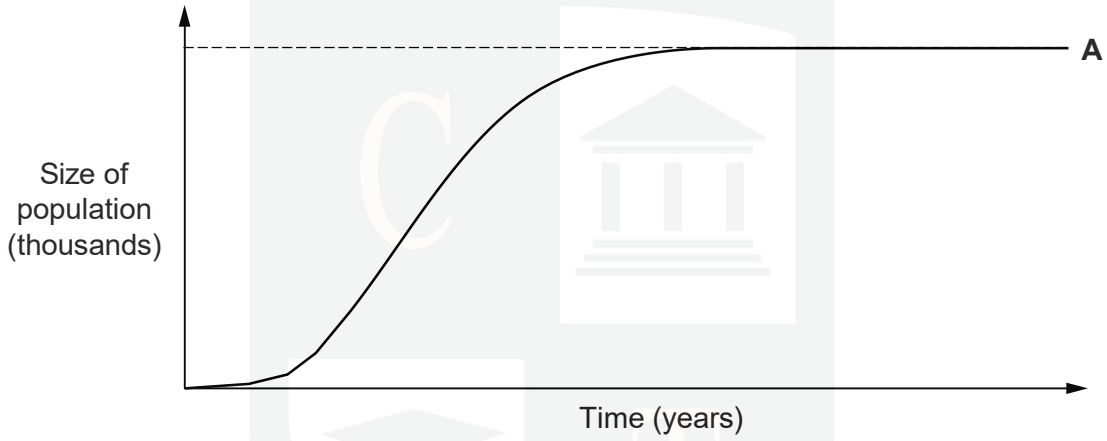


Fig. 1.1

(a) (i) The line **A** represents a limiting level to the size of the mink population on the island. The number of mink will not increase beyond it.

What name do ecologists give to such a limiting level for a population in a particular area?

[1]

- The limiting level for a population is its carrying capacity

(ii) Suggest **two** factors that limit the mink numbers on the island. **[2]**

- The number of mink numbers will be limited by the supply of food or mice
- Predation upon the mink will control numbers too
- Interspecific competition or intraspecific competition between mink limits numbers
- Disease will also limit the mink numbers particularly if the population becomes overcrowded and transmission is easier

(b) In the last century, large areas of natural woodland on the Scottish mainland were removed by the Forestry Commission. The large areas of land were replanted with closely-spaced conifer trees.

As the young conifers grew, they reduced the light reaching the ground. Other plant species died.

When mature, the conifers were felled for industries like paper and chipboard. The area was left covered with unwanted conifer branches.

(i) This method of producing timber is now regarded as **ecologically** undesirable.

Suggest why. **[2]**

- Producing timber in this way disrupt food chains and food webs
- It destroys habitats
- It also causes soil erosion
- Prevents the formation of a climax community
- It also causes loss of biodiversity and species richness

Fig. 1.2 is a photograph of a woodland that is managed differently.

Fig. 1.2

(ii) The woodland in Fig. 1.2 can supply timber continuously, sustainably and economically.

Discuss some social, aesthetic and ethical benefits of managing woodland in this way compared to coniferous monoculture.

[4]

- Some of the benefits of managing woodland this way include
- An educational benefit
- Improved well-being
- A recreational amenity or ecotourism
- It makes the landscape more attractive and has an aesthetic value
- Managing woodland in this way also maintains biodiversity and food webs

(c) The tall 'oak standards' in woodland like those in Fig. 1.2 are cut down close to ground level for sale to sawmills. Certain tree species, like the English elm (*Ulmus procera*) respond to the loss of a main trunk by natural vegetative propagation.

(i) Describe how this vegetative propagation would proceed after the cutting down of elm trees in such a woodland.

[2]

- Vegetative propagation begins with the production of root suckers
- These will arise from meristem or undifferentiated tissue
- The suckers will grow up and around in circles between the felled trees
- These will appear quickly within a few months

(ii) Vegetative propagation allows trees to survive the loss of a main trunk due to a natural event like fire or high winds. In Britain, many elm trees have been lost because of 'Dutch elm disease'. This disease is caused by the fungus *Ophiostoma ulmi*.

Why might vegetative propagation be less effective at enabling a tree to survive Dutch elm disease, compared to surviving fire or high wind?

[2]

- Vegetative propagation does not create genetic variation as the new sprouts are clones and genetically identical to the tree
- The new sprouts are as susceptible as the parent tree to the fungus attack
- The fungus remains in the tree and is spread by spores

One of the issues with asexual reproduction is the lack of genetic variety. It does provide however, a method of quickly colonising an area but if conditions change then all the individuals will be at risk, as they are all genetically identical having been produced by mitosis.

[Total: 13]