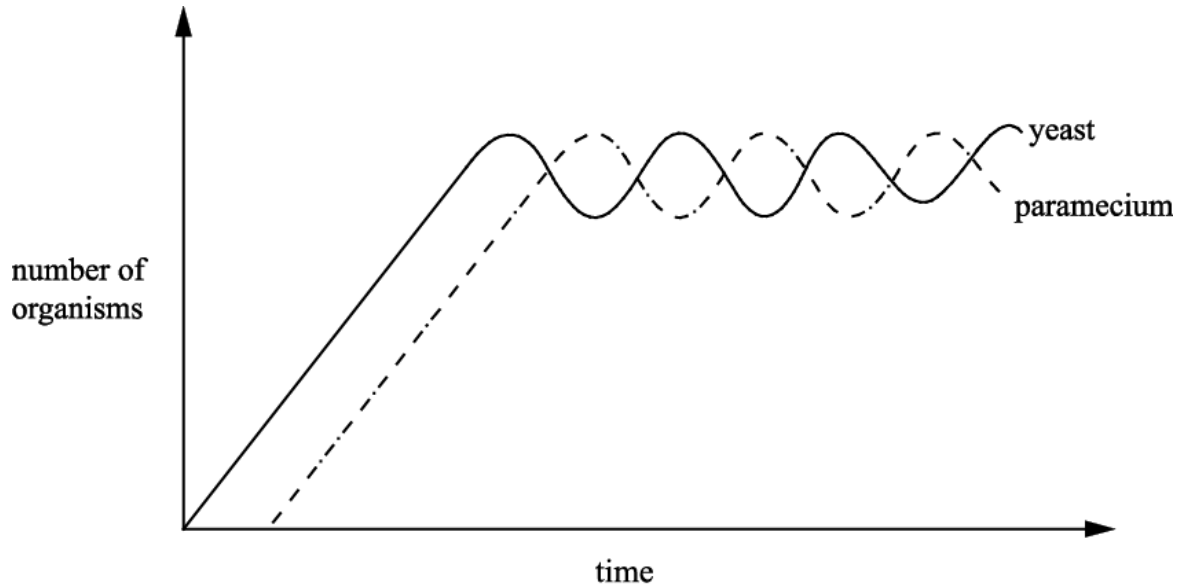


Populations and Sustainability

1. The graph shows a population of yeast and a unicellular organism, *Paramecium*, grown in a fermentation chamber.



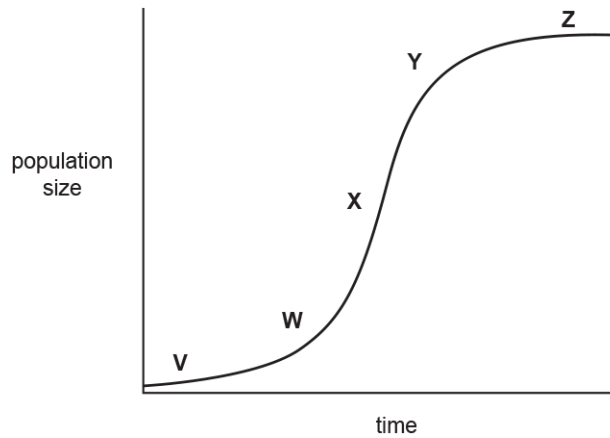
Which **one** of the following statements best describes the relationship between the two organisms?

- A. The *Paramecium* and yeast populations are complementary to each other.
- B. The yeast thrives in the relationship at the expense of the *Paramecium* population.
- C. The *Paramecium* feeds on the yeast and reduces the number in the yeast population.
- D. The two populations are in equilibrium and stable due to a type of negative feedback.

Your answer

[1]

2. The graph shows a typical population growth curve.



Which row correctly describes what is happening at each of stages V to Z ?

	V	W	X	Y	Z
A	reproduction rate is higher than death rate	as time doubles population doubles	population size is proportional to time	population growth is slowing	reproduction rate is similar to death rate
B	reproduction rate is higher than death rate	as time doubles population more than doubles	reproduction rate is much higher than death rate	population growth is slowing	reproduction rate is similar to death rate
C	reproduction rate is higher than death rate	as time doubles population doubles	population size is proportional to time	population growth is decreasing	reproduction rate is similar to death rate
D	reproduction rate is higher than death rate	population is increasing rapidly	reproduction rate is much higher than death rate	population is decreasing	reproduction rate is similar to death rate

Your answer

[1]

3. The sea marigold, *Calendula maritima*, is a rare species that is critically endangered and has been included in an *ex situ* conservation project.

Which of the following options, **A** to **D**, is a disadvantage of conserving the sea marigold *ex situ*?

- A** it could reduce genetic diversity in sea marigolds
- B** sea marigolds are collected from the wild as seeds
- C** sea marigold seeds are stored in large numbers
- D** sea marigolds will be at risk from grazing by herbivores

Your answer

[1]

4(a). 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.

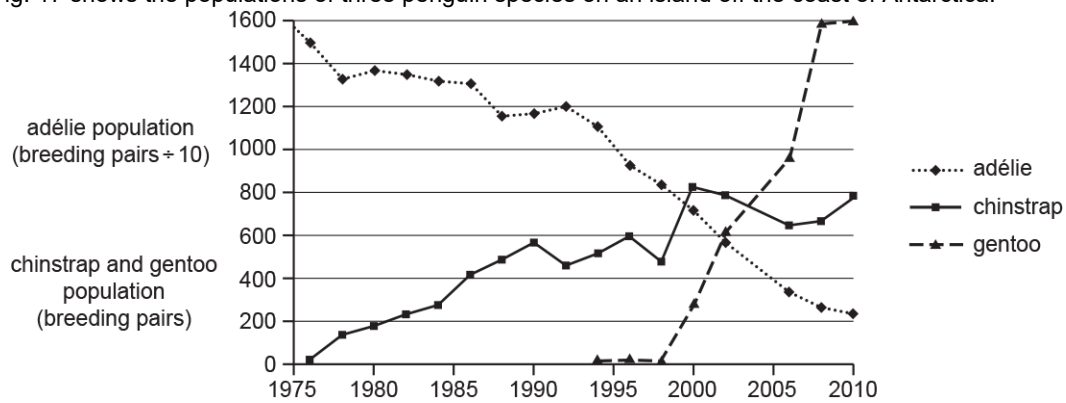


Fig. 17

- 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]

- 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**.

Answer [2]

(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]

- 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.

1

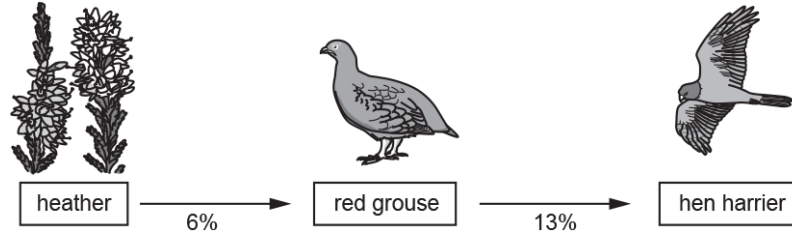
2

----- [2]

5. Heather is a plant with a woody stem that grows on upland areas of the UK such as the North York Moors. These areas are often described as heather moorland.

Heather moorland is a habitat that is relatively common in the UK but rare elsewhere in the world.

The diagram shows an example of biomass transfer in a heather moorland ecosystem.



The numbers below the arrows represent the percentage of biomass transferred to the species shown in the next trophic level.

The hen harrier is the top predator on heather moorland in the UK.

Scientists are concerned about a recent decrease in the population of hen harriers.

The current estimate of the hen harrier population in the UK is 545 pairs. This represents 71% of the estimated population in 2004.

- i. Calculate the estimated population of UK hen harriers in 2004.

Estimated population = pairs [2]

- ii. Since 2004, the population of red grouse in the UK has been relatively stable and it is not thought that the population has been affected by changes in climate.

Suggest an explanation for the decrease in hen harrier numbers since 2004.

----- [1]

6. The Madidi National Park is 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]

7. Listed below are three approaches, A, B and C, that can be taken to maintain biodiversity:

A	<i>ex situ</i> conservation
B	<i>in situ</i> conservation
C	preservation

For each of the statements below, indicate whether it could be consistent with *in situ* conservation, *ex situ* conservation or preservation by inserting the correct **letter or letters** in the table.

	Approach
organisms are not removed from their natural habitat	
human intervention is happening	

[2]

8. Peat bogs are ecosystems that contain unique communities of invertebrates, bird species, and wetland plants.

Sphagnum mosses represent a vital part of peat bog ecosystems. These species of moss require a high soil moisture content.

Almost all of the peat bogs in the UK have been affected by human activity.

The following management activities were planned in a peat bog ecosystem:

- the planting of a small area of conifer trees at the edge of the peatland
- a ban on the extraction of peat for use as compost
- reintroduction of natural sphagnum mosses
- the construction of a ditch as a flood prevention measure
- extended grazing by cattle and a large flock of sheep
- managed burning to create new growth for livestock grazing
- the construction of a boardwalk to replace several sets of footpaths

i. Suggest improvements that could be made to these plans.

Explain why your improvements would help conservation of the peat bog ecosystem.

[3]

ii. Explain why the **preservation** of peat bog ecosystems is **not** a strategy that can be used in most cases.

[2]

9. A peat bog habitat had been damaged by peat extraction and by management of a neighbouring farmland. Ecologists decided to treat the peat bog in the following way:

- A buffer region was created between the peat bog and the neighbouring farmland.
- No visitors were allowed on the land.
- Ditches were blocked to raise water levels.
- Peat extraction, tree planting and the use of fertilisers were banned.

A student suggested that this was an example of preservation.

Evaluate the student's conclusion.

[2]

10. The Lake District is the largest National Park in England, covering an area of 2362 km².

It contains a wide variety of species, some of which are under threat or endangered. The resident human population is 41 000. In 2016 the Lake District received 18.4 million tourists.

The proportion of Lake District land used for different purposes is shown in Fig. 18.

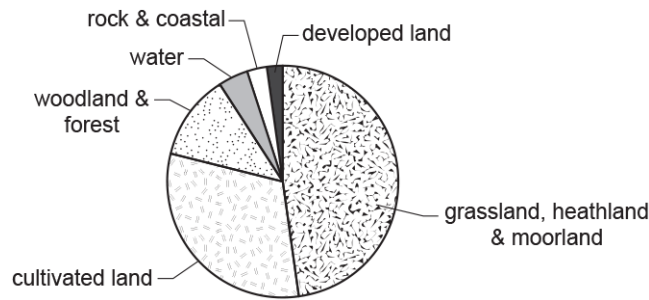


Fig. 18

The Lake District contains large areas where timber is produced. One of the aims of the management of National Parks is to produce timber sustainably.

- i. Using Fig. 18, **estimate** the percentage of land that is covered by woodland and forest.

estimate = % **[1]**

[6]

11.

- i. The biomass of large fish in the Southern Ocean is a food resource for humans. It is increasingly harvested by powerful, long-distance trawlers. If over-exploited, the Southern Ocean ecosystem may be permanently altered.
- o Suggest two measures that an international treaty might impose, to prevent fishing from causing permanent damage to the Southern Ocean.
 - o Identify the practical difficulties that might prevent your two measures from being effective.

First measure -----

Difficulty-----

Second measure-----

Difficulty-----

[4]

- ii. Krill can also be harvested as a human food source.
 The fishing industry aims to harvest large fish.
 Some environmentalists say that krill harvesting should be increased.

Use this information and **Table 21.1** to put forward arguments for and against harvesting krill instead of large fish as a human food source.

[2]

12(a). Beavers were hunted to extinction in the UK about 500 years ago. Recently a trial reintroduction in Scotland was hailed as a great success after researchers found that the animals had 'transformed the landscape'. After five years the beavers had:

- constructed dams – the largest of which was 18 m long and 1.6 m high
- felled trees
- created canals
- built lodges (large nests)
- successfully reproduced.

i. Beavers are considered to be a keystone species.

Explain why they are a keystone species in their native Canada.

[2]

ii. One benefit of the reintroduction of beavers in Scotland was an increase in habitat diversity.

Explain how the following activities could have contributed to increased habitat diversity.

Constructed dams -----

Felled trees -----

Built lodges -----

[3]

iii. Suggest **one** other benefit of the reintroduction of beavers.

[1]

(b). Increasing habitat diversity may lead to an increase in species diversity and genetic diversity.

Explain why species diversity and genetic diversity may be increased as a result of the beavers' activity.

[2]

(c). Some land owners have expressed concern about the impact that beavers can have on rural businesses.

Suggest **two** arguments that may be used by local business leaders against the introduction of beavers. State whether these outweigh the arguments presented by the naturalists.

argument 1

argument 2

[4]

- iii. Islands, such as Madagascar, often have species that are different from those on the nearest land mass because they are reproductively isolated.
State **three** other conditions that must be present in order for speciation to occur.

1

2

3

[3]