# Populations in Ecosystems: AQA A Level Biology Exam Questions by To

18 questions · 48 marks · about 62 minutes. Answer in the spaces, then check the mark schemes at the end.

**Question 1 · A level Paper 2 · June 2023 · Q07.1 · 2 marks**

**0 7 . 1** In the following passage, the numbered spaces can be filled with biological terms.

An ecosystem supports a certain size of population of a species, called the ___(1)___ capacity. There are often numerous habitats within an ecosystem. Within a habitat, a species occupies a ___(2)___ governed by an adaption to both ___(3)___ and biotic conditions. Populations of different species form a ___(4)___ .

Write the correct biological term beside each number below that matches the space in the passage.

**[2 marks]**

1 _____

2 _____

3 _____

4 _____

**Question 2 · A level Paper 2 · June 2017 · Q02.1 · 2 marks**

**0 2** Dengue is a serious disease that is caused by a virus. The virus is carried from one person to another by a mosquito, *Aedes aegypti*. One method used to try to reduce transmission of this disease is the Sterile Insect Technique (SIT). This involves releasing large numbers of sterile (infertile) male *A. aegypti* into the habitat. These males have been made infertile by using radiation.

**0 2 . 1** Explain how using the SIT could reduce transmission of dengue.

**[2 marks]**

_____

_____

_____

_____

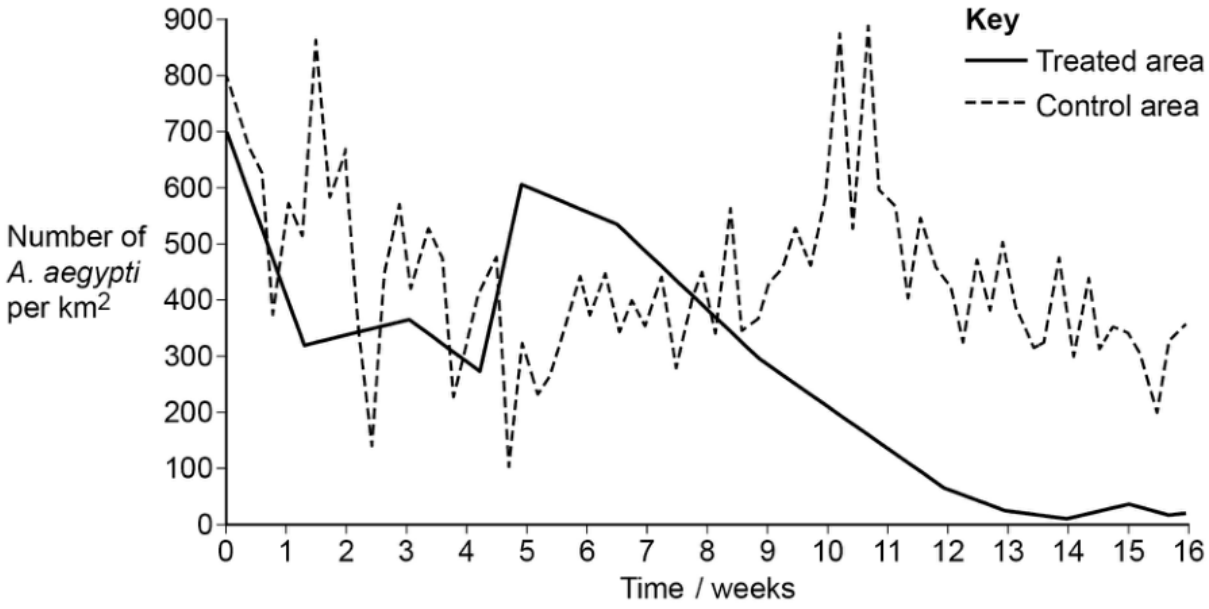

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**0 2 . 4** Recently a new method was developed to control *A. aegypti*. Scientists produced transgenic males carrying a 'lethal gene' which kills their offspring before they can reproduce.

The scientists released transgenic males every week in one area of a city in Brazil. At regular intervals they determined the number of *A. aegypti* per $km^2$ in the area where transgenic males were released and in a control area where no transgenic males were released.

**Figure 2** shows their results.

**Figure 2**




Suggest why the scientists released more transgenic males every week.

**[1 mark]**


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**Question 4 · A level Paper 2 · June 2024 · Q05.2 · 3 marks**

**0 5 . 2** In potato plant fields, fat hen plants can grow up to a height of 2 m and absorb large quantities of nutrients from the soil.

Fat hen has a negative effect on the growth of potato plants.

Use the information provided to explain why.

In your answer, name the type of competition occurring between fat hen plants and potato plants.

**[3 marks]**


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**Question 5 · information from earlier in the question**

**0 4** A scientist identified and counted the invertebrate species present in samples taken at two sites in a river. The scientist also measured the rate of water flow at each site.

His results are shown in **Table 2** and **Table 3**.

**Table 2**

| Invertebrate species | Site 1 | Site 2 |
|---|---|---|
| Anglers' Curse mayfly | 17 | 5 |
| Flat-headed mayfly | 6 | 8 |
| Slate Drake mayfly | 0 | 6 |
| Water beetle | 12 | 13 |
| Midge fly | 13 | 13 |
| Total number caught | 48 | 45 |

**Table 3**

| | Site 1 | Site 2 |
|---|---|---|
| Index of diversity | | 4.7 |
| Rate of water flow / cm $s^{-1}$ | 1–14 | 30–60 |

**Question 5 · AS Paper 1 · June 2019 · Q04.4 · 2 marks**

**0 4 . 4** Use information in **Table 2** and **Table 3** to suggest and explain a reason for the difference in the numbers of Slate Drake mayfly at these sites in this river.

**[2 marks]**


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**0 5** Scientists investigated the effect that the release of heated water into a river from a power station had on the biodiversity of a local fish community over 29 years.

They measured the species richness and the number of fish of each species at the same site in October every year. The scientists used this information to calculate an index of diversity (*d*) of fish for each year.

**Figure 7** and **Figure 8** show their results.

**Figure 7**

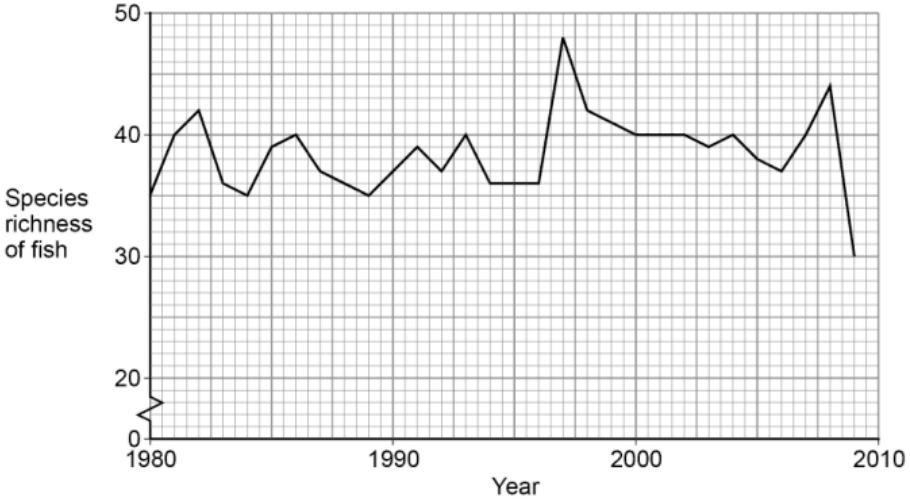
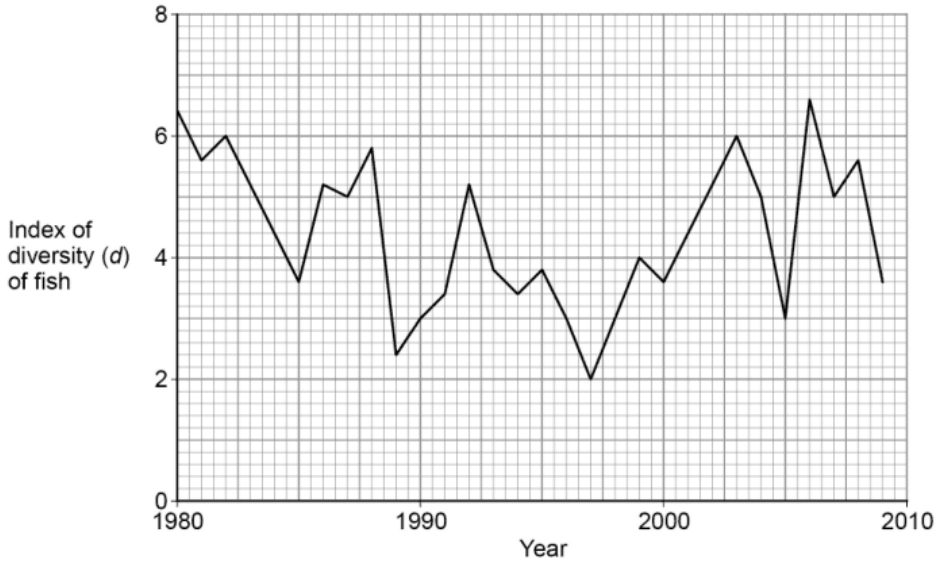



**Figure 8**





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**Question 6 · A level Paper 3 · June 2023 · Q05.3 · 4 marks**

**0 5 . 3** A journalist studied **Figure 7** and **Figure 8** (on page 16) and concluded that releasing heated water from a power station has no effect on local fish communities.

Use all the information to suggest reasons why the journalist's conclusion might **not** be valid.

**[4 marks]**

**Question 7 · information from earlier in the question**

**0 9** A coral reef is an underwater ecosystem formed as a ridge of mainly calcium carbonate deposits. Algae are photosynthesising organisms. Some algae grow on coral reefs. Succession results in a wide variety of fish living on coral reefs.


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Ecologists investigated the effect of two fish species, the redband parrotfish and the ocean surgeonfish, on algal growth on an artificial reef. They made this artificial reef by submerging many large concrete blocks at a depth of 16–18 metres off the coast of Florida. They attached four large wire cages, **A**, **B**, **C** and **D**, to each block and populated the cages as shown.

**A** – No fish

**B** – Two redband parrotfish

**C** – Two ocean surgeonfish

**D** – One redband parrotfish and one ocean surgeonfish

After 34 weeks, the ecologists measured the mean percentage cover of all algae within each set of wire cages. The ecologists used a statistical test to find out whether the mean for each set of cages was significantly lower than the mean for set **A**.

**Table 3** shows the probability (P) values that the ecologists obtained using this statistical test.

**Table 3**

| Set of cages | P value |
|---|---|
| **B** | =0.841 |
| **C** | <0.001 |
| **D** | =0.634 |

**0 9 . 3** Using all the information, evaluate the effect of the two fish species on algal growth on coral reefs.

**[5 marks]**


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**Question 8 · information from earlier in the question**

**0 2** Dengue is a serious disease that is caused by a virus. The virus is carried from one person to another by a mosquito, *Aedes aegypti*. One method used to try to reduce transmission of this disease is the Sterile Insect Technique (SIT). This involves releasing large numbers of sterile (infertile) male *A. aegypti* into the habitat. These males have been made infertile by using radiation.

**Question 8 · A level Paper 2 · June 2017 · Q02.2 · 3 marks**

**0 2 . 2** Describe how the mark-release-recapture method could be used to determine the population of *A. aegypti* at the start of the investigation.

**[3 marks]**

**Question 9 · A level Paper 2 · June 2022 · Q05.3 · 1 mark**

The scientists used the mark-release-recapture method to determine the number of lemurs in one area of forest. They captured, marked and released a first sample of 30 lemurs. A week later, they captured a second sample of 25 lemurs from the same area of forest. The scientists calculated that there were 250 lemurs in that area of forest.

**0 5 . 3** Suggest **one** precaution needed when marking the lemurs to make sure the estimate of the number of lemurs is valid.

**[1 mark]**


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**Question 10 · A level Paper 2 · June 2019 · Q09.1 · 5 marks**

**0 9** The sundew is a small flowering plant, growing in wet habitats such as bogs and marshes. The soil in bogs and marshes is acidic and has very low concentrations of some nutrients. The sundew can trap and digest insects.

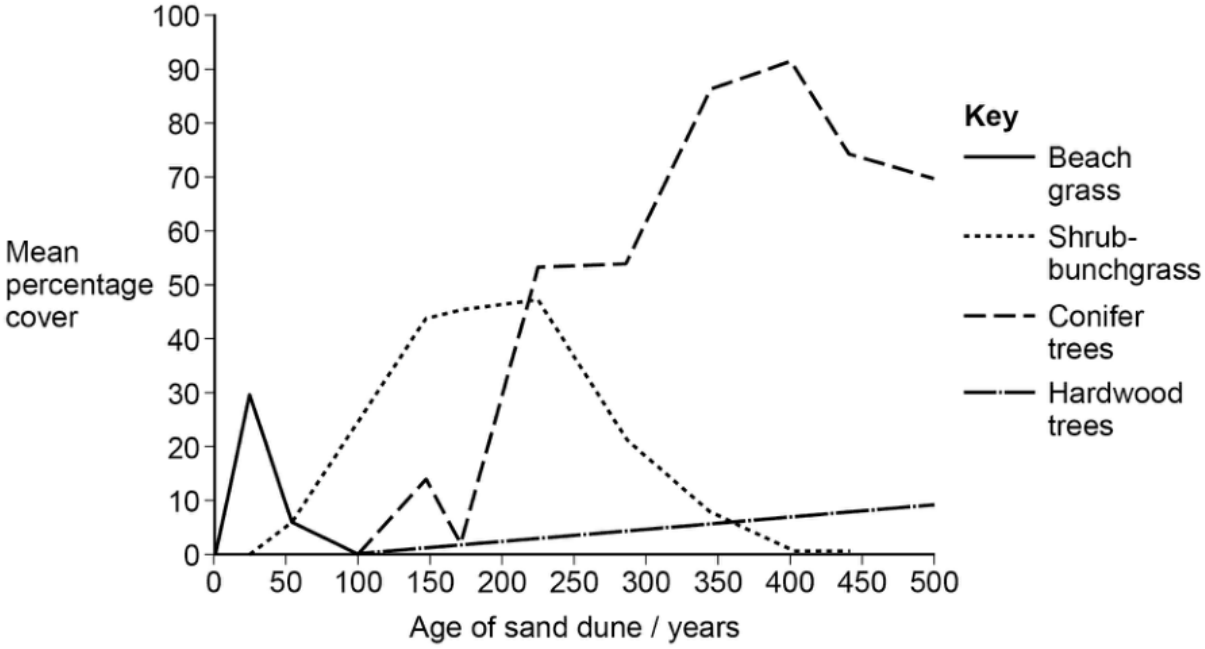
**0 9 . 1** Describe how you could estimate the size of a population of sundews in a small marsh.

**[5 marks]**


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**0 4** Scientists investigated the process of succession on sand dunes. They measured the percentage cover of different species of plants on sand dunes of different ages. Some of the results the scientists obtained are shown in **Figure 5**.

**Figure 5**




**0 4 . 1** Describe how you would determine the mean percentage cover for beach grass on a sand dune.

**[3 marks]**


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**Question 12 · A level Paper 2 · June 2019 · Q01.1 · 4 marks**

**0 1 . 1** Succession occurs in natural ecosystems. Describe and explain how succession occurs.

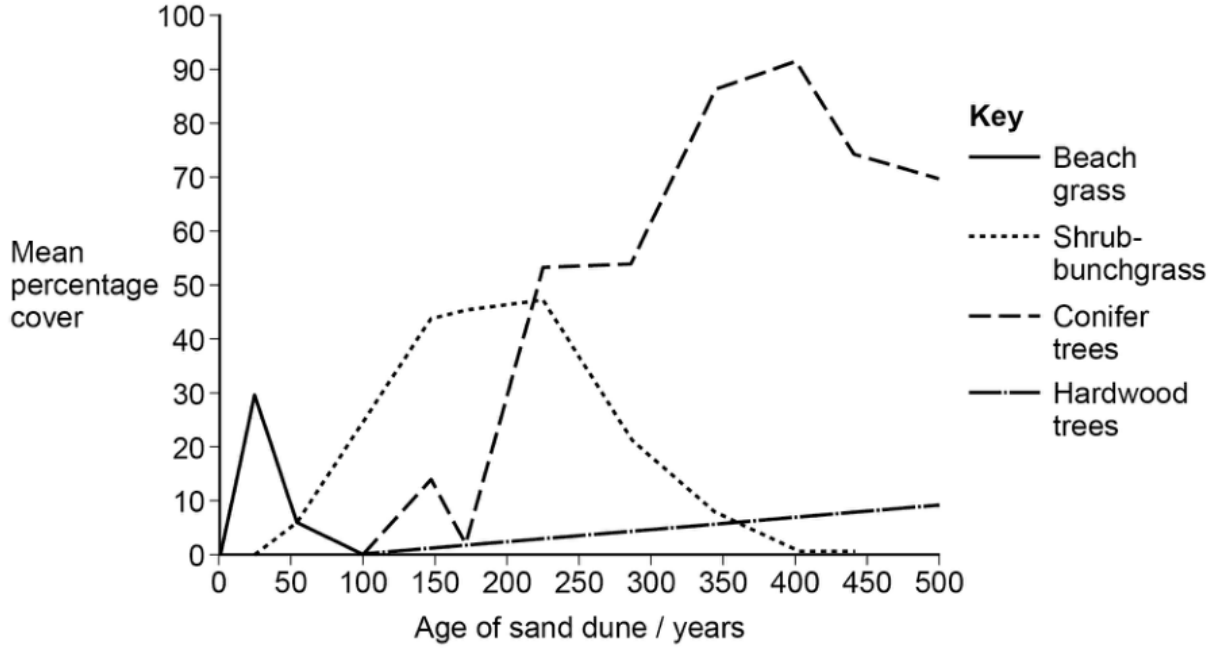
**[4 marks]**


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**Question 13 · information from earlier in the question**

**0 4** Scientists investigated the process of succession on sand dunes. They measured the percentage cover of different species of plants on sand dunes of different ages. Some of the results the scientists obtained are shown in **Figure 5**.

**Figure 5**





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**Question 13 · A level Paper 2 · June 2018 · Q04.2 · 4 marks**

**0 4 . 2** The scientists concluded that the results shown in **Figure 5** were due to succession taking place.

Use **Figure 5** to explain why the scientists reached this conclusion.

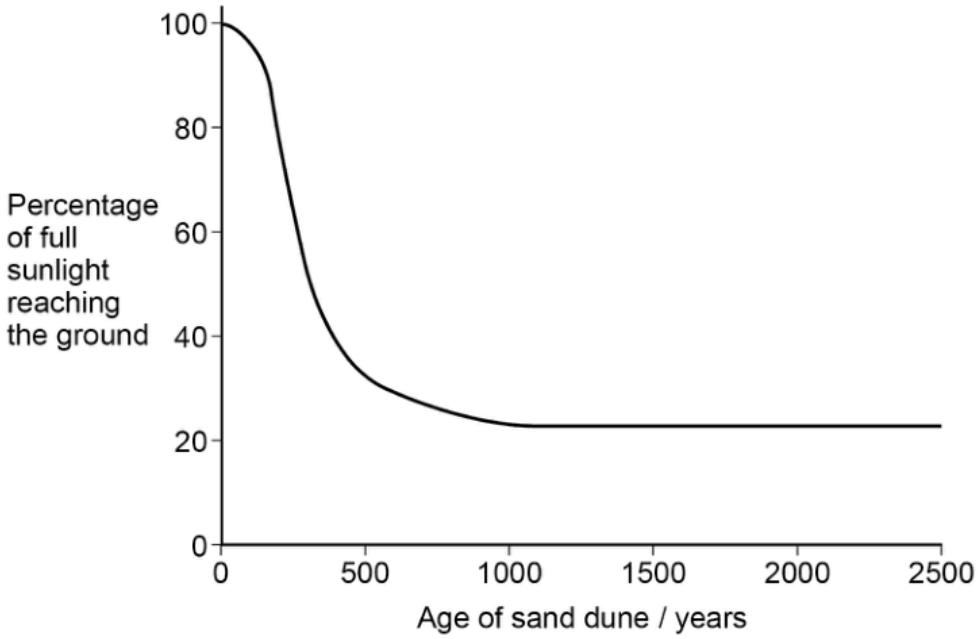
**[4 marks]**


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**Question 14 · A level Paper 2 · June 2018 · Q04.3 · 1 mark**

The scientists also investigated how the proportion of sunlight reaching the ground changed during succession. Some of the results the scientists obtained are shown in **Figure 6**.

**Figure 6**




**0 4 . 3** Use **Figure 5** to explain the results in **Figure 6**.

**[1 mark]**

**Question 15 · information from earlier in the question**

**0 9** A coral reef is an underwater ecosystem formed as a ridge of mainly calcium carbonate deposits. Algae are photosynthesising organisms. Some algae grow on coral reefs. Succession results in a wide variety of fish living on coral reefs.


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**Question 15 · A level Paper 2 · November 2021 · Q09.2 · 2 marks**

**0 9 . 2** Explain how succession results in a wide variety of fish living on coral reefs.

Do **not** describe the process of succession in your answer.

**[2 marks]**

**Question 16 · information from earlier in the question**

**1 0** Read the following passage.

Tropical rainforests are among the most biologically diverse ecosystems in the world. Their varied plant communities support a high biodiversity of animal species. Tropical rainforests form in parts of the world with high annual rainfall and high mean temperatures providing moist, warm conditions. Nutrient recycling occurs rapidly on the ground of these rainforests. The recycling of nitrogen-containing compounds from dead organic matter sustains the growth of plants.

Each year, large areas of rainforests are lost due to fires. Natural regeneration of rainforests occurs slowly by secondary succession. Secondary succession is similar to primary succession but occurs in areas previously inhabited. There is conflict between the needs of humans and conservation of rainforests. Deforestation by humans is removing large areas of rainforests. Farming practices have prevented the natural regeneration of rainforests by secondary succession.

Use the information in the passage and your own knowledge to answer the following questions.


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**Question 16 · A level Paper 2 · June 2025 · Q10.5 · 2 marks**

**1 0 . 5** Farming practices have prevented the natural regeneration of rainforests by secondary succession (lines 12–14).

Suggest **two** farming practices that prevent the natural regeneration of rainforests by secondary succession.

**[2 marks]**

1 _____

_____

_____

2 _____

_____

_____


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**0 2** In northern India, there is a conflict of interests between farmers of livestock (eg cows) and people trying to conserve ibex (a type of wild goat).

When livestock are given extra food, their populations can grow too large and compete with ibex.

**0 2 . 1** Name the type of competition between livestock and ibex.

**[1 mark]**

---

Livestock will outcompete ibex if they:

- are in the same habitat
- eat a similar diet.

Scientists investigated this conflict of interests.

**Table 1** summarises some of the scientists' findings.

**Table 1**

| Type of livestock | Difference between livestock food and ibex food* | Difference between livestock habitat and ibex habitat* |
|---|---|---|
| Cow | 1.0 | 1.5 |
| Horse | 0.5 | 0.0 |
| Yak | 0.0 | 2.0 |

* A score of 0.0 indicates that the food or habitat is the same.


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**Question 18 · A level Paper 3 · November 2020 · Q02.2 · 3 marks**

**0 2 . 2** There must be a balance between the need for conservation of the ibex and the need for farmers to keep livestock.

Using **all** the information, suggest and explain **three** actions that the farmers could take to achieve this balance.

**[3 marks]**

1 _____

_____

_____

_____

2 _____

_____

_____

_____

3 _____

_____

_____

_____


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## Mark schemes

**Question 1 · A level Paper 2 · June 2023 · Q07.1 · 2 marks**

| | | | |
|---|---|---|---|
| **07.1** | (1) carrying<br>(2) niche<br>(3) abiotic<br>(4) community;; | 2<br>(2 x AO1) | All 4 correct = **two** marks.<br>2 or 3 correct = **one** mark.<br>1 correct = **zero**.<br>(3) Accept physical, chemical, physicochemical or non-living. |

**Question 2 · A level Paper 2 · June 2017 · Q02.1 · 2 marks**

| | | | |
|---|---|---|---|
| 02.1 | 1. Compete (with fertile males) to mate/for food/resources<br>OR<br>intraspecific competition;<br>2. Do not reproduce/breed<br>OR<br>Reduces population (of mosquitoes); | 2 | 1. Must convey idea of competition.<br>2. Accept: 'fewer mosquitoes'/'fewer offspring'. |

**Question 3 · A level Paper 2 · June 2017 · Q02.4 · 1 mark**

| | | | |
|---|---|---|---|
| 02.4 | To maintain number/competition as they die/have a short life span; | 1 | Accept: to replace mosquitoes that have died. |


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**Question 4 · A level Paper 2 · June 2024 · Q05.2 · 3 marks**

| | | | |
|---|---|---|---|
| **05.2** | 1. Interspecific (competition);<br>2. Less/no light (for potato plant) **so** less/no photosynthesis;<br>3. Less nitrates/nitrogen to produce amino acids/protein/DNA/RNA/ATP<br>**OR**<br>Less phosphate/phosphorus to produce DNA/RNA/phospholipids/RuBP/GP/triose phosphate/NADP/ATP; | 3<br>(3 x AO2) | 3. Accept any named organic nitrogen or phosphorus containing molecule. |

**Question 5 · AS Paper 1 · June 2019 · Q04.4 · 2 marks**

| | |
|---|---|
| **04.4** | 1. Less food/prey at site 1;<br>2. (So more) mayfly starve;<br>**OR**<br>3. Less oxygen at site 1;<br>4. (So) less respiration/ATP/energy (for mayflies);<br>**OR**<br>5. More predators/Anglers' Curse at site 1;<br>6. (So more) mayfly killed/eaten/removed;<br>**OR**<br>7. More competition at site 1;<br>8. (So more) mayfly starve; |

| | |
|---|---|
| 2 | Mark in paired statements.<br>Accept converse statements in context of site 2. e.g.<br>1. More food/prey in site 2.<br>2. (So) mayfly grow/ survive/reproduce. |


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**05.3**

1. The species richness/*d* are lower after 29 years;
2. The data is only for one (fish/local) community/site

   **OR**

   The data might not be representative of all fish communities

   **OR**

   Other communities might have different (fish) species;
3. (The measurements) only done in October

   **OR**

   The community might be different at other times of year (other than October);
4. The volume/temperature of the heated water (released each year) might have varied

   **OR**

   Timing/frequency of heated water release (each year) not known;
5. Fluctuations suggest other **named** factor had an effect (on biodiversity/species richness/*d*);
6. Species richness/*d* are not the only measures of 'effect';
7. Don't know when the power station opened

   **OR**

   There is no data before 1980

   **OR**

   There is no data before heated water was


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| | |
|---|---|
| **09.3** | 1. Significant (difference/decrease) with **C** (compared with **A**);<br>2. No significant (difference/decrease) with **B and D** (compared with **A**);<br>3. Reference to less than 5%/0.05 probability that difference is (less likely) due to chance<br>**OR**<br>Reference to more than 95%/0.95 probability that difference is not due to chance;<br>4. Species of algae not known<br>**OR**<br>Species of algae may differ (on other reefs);<br>5. Only done off (coast of) Florida<br>**OR**<br>Not done on other reefs; |
| | 6. Only done at 16 to 18 metres<br>**OR**<br>Not done (on reefs) at other depths;<br>7. Only 34 weeks;<br>8. Concrete/artificial reef could affect results/growth<br>**OR**<br>Natural reef results/growth may differ; |


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**Question 8 · A level Paper 2 · June 2017 · Q02.2 · 3 marks**

| | | | |
|---|---|---|---|
| 02.2 | 1. Capture/collect/sample, mark **and** release;<br>2. Leave time for mosquitoes/*Aedes* to disperse before second sampling/collection;<br>3. (Population =) number in first sample × number in second sample divided by number of marked in second sample/number recaptured; | 3 | 3. Accept: correct equation. |

**Question 9 · A level Paper 2 · June 2022 · Q05.3 · 1 mark**

| | | | |
|---|---|---|---|
| **05.3** | (Marking) does not affect survival/predation/recapture; | 1 (AO3) | Accept. Mark does not rub/wash off/is non- toxic.<br>Ignore 'does not harm' on its own unless it relates to survival/predation/recapture.<br>. |


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| | | | |
|---|---|---|---|
| 09.1 | 1. Use a grid<br>**OR**<br>Divide area into squares/sections;<br><br>2. Method of obtaining random coordinates/numbers e.g. calculator/computer/random numbers table/generator;<br><br>3. Count number/frequency in a quadrat/section;<br><br>4. Large sample **and** calculate mean/average number (per quadrat/section);<br><br>5. Valid method of calculating total number of sundews, e.g. mean number of plants per quadrat/section/$m^2$ multiplied by number of quadrats/sections/$m^2$ in marsh; | 5 | 1. Accept use of tape measures/map/area with coordinates.<br><br>1. Accept Belt transect.<br><br>2. If transect method used accept quadrats at regular intervals or current mark point 2.<br><br>3. Accept % cover in quadrat/section.<br><br>3. Ignore amount/abundance.<br><br>4. Accept large sample **and** calculate mean %.<br><br>4. Accept large sample **and** method of calculating mean.<br><br>4. Accept many/multiple for large sample but ignore several.<br><br>4.If a specific number is given it must be 10 or more.<br><br>5. Do not allow 'scale up' without further qualification.<br><br>5. Do not award if % cover determined. |


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**Question 11 · A level Paper 2 · June 2018 · Q04.1 · 3 marks**

| | | | |
|---|---|---|---|
| **04.1** | 1. Method of randomly determining position (of quadrats) e.g. random numbers table/generator;<br><br>2. Large number/sample of quadrats;<br><br>3. Divide total percentage by number of quadrats/samples/readings; | 3 | 1. Ignore line/belt transect<br><br>2. Accept many/multiple<br><br>2. Ignore point quadrat<br><br>2. If a specified number is given, it must be 20 or more |


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| | | |
|---|---|---|
| 01.1 | 1. (Colonisation by) pioneer species;<br>2. Pioneers/species/organisms change the environment/habitat/conditions/factors;<br>3. (Environment becomes) less hostile for other/new species<br>**OR**<br>(Environment becomes) more suitable for other/new species<br>**OR**<br>(Environment becomes) less suitable for previous species;<br>4. Change/increase in diversity/biodiversity;<br>5. (To) climax community; | 4 max |

2. Accept example of change e.g. forms soil/humus/organic matter/nutrients.

2. Must convey idea of change being caused by pioneers/species/organisms

3. Accept previous species out-competed.

4.Ignore increase in genetic diversity.


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**Question 13 · A level Paper 2 · June 2018 · Q04.2 · 4 marks**

| | | | |
|---|---|---|---|
| 04.2 | 1. Beach grass is the pioneer (species);<br><br>2. Pioneers/named species change the (abiotic) environment/habitat/conditions/factors;<br><br>3. (So) less <u>hostile</u> for named species<br>**OR**<br>(So) more <u>suitable</u> for named species;<br><br>4. Conifer/hardwood trees represent climax community; | 4 | 2. Must convey idea of change being caused by a species<br><br>2. Accept example of change e.g. more humus |

**Question 14 · A level Paper 2 · June 2018 · Q04.3 · 1 mark**

| | | | |
|---|---|---|---|
| 04.3 | 1. Trees block/reduce (sun)light; | 1 | Reject 'blocks' all of the light |


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**Question 15 · A level Paper 2 · November 2021 · Q09.2 · 2 marks**

| | | |
|---|---|---|
| **09.2** | 1. Increase in variety/diversity of species/plants/animals;<br>**OR**<br>Increase in number of species/populations;<br>2. Provides more/different habitats/niches<br>**OR**<br>Provides greater variety/types of food; | 2 |

1. Accept increase in biodiversity or species richness.

2. Ignore shelter/homes/environments.

2. Ignore 'more food' but accept 'more food sources'.

2. Accept 'less hostile' (environment).


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**Question 16 · A level Paper 2 · June 2025 · Q10.5 · 2 marks**

| | | |
|---|---|---|
| **10.5** | 1. Growing crops;<br>2. Animal farming<br>**OR**<br>(Land used for) grazing;<br>3. Ploughing (land);<br>4. (Applying) weedkillers/herbicides/pesticides;<br>5. Burning (fields/plants);<br>6. Building related to farming (barns/greenhouses); | 2 max (2 x AO2) |

1 Accept specific examples e.g. growing maize and accept 'monoculture'

2. Accept examples e.g. cattle farming

4. Accept insecticides

5. Reject burning fuel

**Question 17 · A level Paper 3 · November 2020 · Q02.1 · 1 mark**

| | | |
|---|---|---|
| **02.1** | Interspecific (competition); | 1 |


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| | |
|---|---|
| **02.2** | 1. Do not provide the livestock/cows/horses/yaks with extra food, **as** their populations will not grow large enough to cause competition<br><br>**OR**<br><br>Keep small numbers of livestock/cow/horse/yak, **so** their populations will not grow large enough to cause competition;<br><br>2. Do not farm horse/choose animals other than horse to farm, **as** they have the same habitat **and** (very) similar food to the ibex;<br><br>3. Keep horses (but) in enclosed/separate areas, **as** they occupy the same habitats as ibex;<br><br>4. Farm cows, **as** they have the least similar food **and** (one of the least similar) habitat (to that of the ibex);<br><br>5. Farm yaks, **as** despite eating the same food, they live in a very different habitat;<br><br>6. (Only) grow crops, **so** no competition; |

| | |
|---|---|
| 3 max | Requires suggestion **and** explanation for each mark<br><br>2. Accept farm fewer horses **as** they have the same habitat **and** (very) similar food to the ibex<br><br>3. Accept descriptions of enclosed areas, |


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