

## 20.4.1 Conservation: why species are lost, and how forests, fish and species are saved

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_ **Total: 33 marks**

**KEY WORDS** endangered 濒危 • conservation 保护 • extinct 灭绝 • captive breeding 人工繁育  
• seed banks 种子库

### Objective

Sheet 20.4 had two questions on this unit; the syllabus has nine statements, and almost all of them are **explain** questions. This sheet covers the rest: why a species becomes **endangered** 濒危 and then **extinct** 灭绝, how **forests** 森林 and **fish stocks** 鱼类种群 are conserved and what each measure actually does, how **captive breeding** 人工繁育 works and what **AI** and **IVF** add to it, why we run **conservation** 保护 programmes at all, and why a species with a tiny population is still in danger. This sheet covers syllabus 20.4.

**You must be able to:**

- describe a **sustainable resource** 可持续资源 as one produced as rapidly as it is removed, so that it does not run out
- explain how forests are conserved using education, protected areas, **quotas** 配额 and replanting
- explain how fish stocks are conserved using education, **closed seasons** 休渔期, protected areas, controlled net types and **mesh size** 网目尺寸, quotas and **monitoring** 监测
- explain why organisms become endangered or extinct: climate change, habitat destruction, hunting, overharvesting, pollution and introduced species
- describe how endangered species are conserved: monitoring and protecting species and habitats, education, captive breeding programmes and **seed banks** 种子库
- describe the use of **artificial insemination** 人工授精 and **in vitro fertilisation** 体外受精 in captive breeding
- describe the reasons for conservation: maintaining **biodiversity** 生物多样性, reducing extinction, protecting vulnerable **ecosystems** 生态系统, and maintaining ecosystem functions
- explain the risks to a species whose population falls, reducing its **genetic variation** 遗传变异

## 1 Worked examples

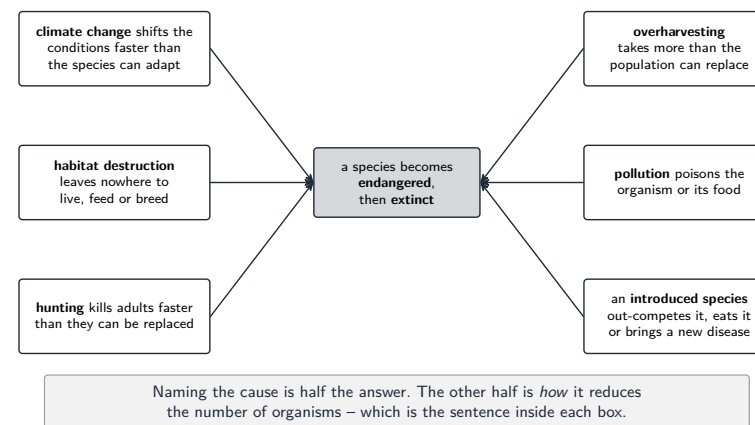
Study these first. Each one shows a **method** that a question later on this sheet needs.

### ■ Sustainable means the rate, not the amount

A **sustainable resource** is one that is **produced as rapidly as it is removed**, so that it does not run out.

- It is a statement about **two rates** being equal. “A resource we can use for a long time” is not the definition and does not earn the mark.
- The two examples the syllabus uses are **forests** and **fish stocks**. Both are living, so both can replace themselves – if we take no more than they replace.

### ■ Why a species is lost



Naming the cause is half a mark's work. Say **how** it reduces the number of organisms:

- climate change** – conditions change faster than the species can adapt, so its habitat becomes unsuitable;
- habitat destruction** – nowhere to live, feed or breed; often from clearing forest for farming or building;
- hunting** – adults are killed faster than they can be replaced;
- overharvesting** – more is taken than the population can replace;
- pollution** – poisons the organism, or kills what it eats;
- introduced species** – out-competes the native species for food or space, eats it, or brings a disease it has no resistance to.

### ■ Conserving a forest and conserving a fish stock

| measure                | forests | fish stocks | what it actually does                                                                             |
|------------------------|---------|-------------|---------------------------------------------------------------------------------------------------|
| education              | ✓       | ✓           | people understand why the resource matters and accept the rules                                   |
| protected areas        | ✓       | ✓           | a region where no felling or fishing is allowed, so the population there can breed and spread out |
| quotas                 | ✓       | ✓           | a limit on how much may be taken, so removal does not exceed replacement                          |
| replanting             | ✓       | –           | a new tree is planted for each one felled, so the forest replaces itself                          |
| closed seasons         | –       | ✓           | no fishing during the <b>breeding season</b> , so the fish can reproduce undisturbed              |
| net type and mesh size | –       | ✓           | a <b>larger mesh</b> lets <b>young fish escape</b> , so they survive to breed                     |
| monitoring             | ✓       | ✓           | counting the population, so the quotas can be changed if it is still falling                      |

- Every one of these works by making the **rate of removal** no greater than the **rate of replacement**. Tie your answer to that and it is rarely wrong.

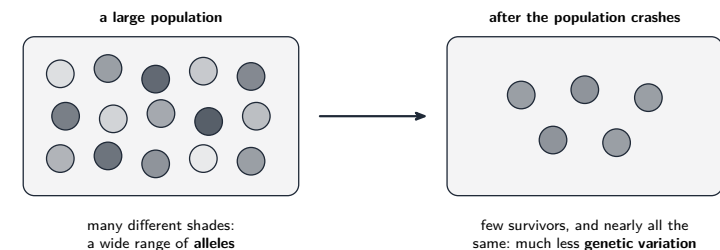
### ■ Conserving a species itself

| method                                                | what it is                                                                                                                     |
|-------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| <b>monitoring and protecting</b> species and habitats | counting the population and making its habitat a protected area                                                                |
| <b>education</b>                                      | so that local people support the programme rather than hunting the species                                                     |
| <b>captive breeding programmes</b>                    | breeding the species in zoos or reserves, then releasing individuals into the wild                                             |
| <b>seed banks</b>                                     | storing seeds of many varieties in cool dry conditions, so a plant species can be grown again even if it is lost from the wild |

**Artificial insemination (AI)** places sperm from a chosen male into a female without the two animals meeting, so animals in **different zoos** can be bred together. **In vitro fertilisation (IVF)** fertilises an egg **outside the body** and places the embryo into a female. Both let a programme choose which individuals breed, which keeps as much genetic variation as possible in a very small population.

**Why we bother** – the four reasons the syllabus lists: maintaining or increasing **biodiversity**; reducing **extinction**; protecting **vulnerable ecosystems**; and maintaining **ecosystem functions**, which means nutrient cycling and the resources we get from nature – food, **drugs** 药物, fuel and **genes** for crop breeding.

### ■ Why a small population is still in danger



With little variation, the species is far less likely to contain an individual that can survive a new **disease** or a change in the environment, so the whole population is at risk from one event.

When a population falls, most of its **alleles** are lost with the individuals that carried them.

With little genetic variation, the species is far less likely to contain an individual that survives a new **disease** or a change in the environment, so a single event can wipe out the whole population.

- That is the reason protecting the last few individuals is not enough on its own,

and why breeding programmes work hard to avoid breeding close relatives.

## 2 Practice

Now use the methods above.

**2.1** Explain why a forest managed by replanting can be described as a sustainable resource. [2]

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**2.2** State **three** reasons why a species may become endangered. [3]

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**2.3** Describe **two** ways in which a forest can be conserved. [2]

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**2.4** Describe **three** ways in which fish stocks can be conserved. [3]

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**2.5** State what a seed bank is, and explain why one is kept. [2]

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**2.6** Explain why a species with a very small population is still at risk, even when it is fully protected. [3]

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## 3 Exam-style questions

**3.1** Which method conserves a fish stock by letting young fish escape from the nets? [1]

|   |   |
|---|---|
| A | B |
| C | D |

- A a quota on the mass of fish landed
- B a closed season during the breeding period
- C an increase in the mesh size of the nets
- D a protected area where no fishing is allowed

**3.2** Only 60 individuals of a rare antelope remain, and all of them live in zoos. The zoos run a captive breeding programme.

(a) Describe what is meant by a captive breeding programme. [2]

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(b) Explain how artificial insemination and in vitro fertilisation help such a programme. [2]

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(c) Explain one problem that the very small population creates for the programme. [2]

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**3.3** The cod caught in one fishing area fell from 250 000 tonnes in 1970 to 30 000 tonnes in 2000. The government then introduced quotas, a closed season, a larger mesh size and a protected area.

(a) Explain how overharvesting caused the catch to fall. [2]

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(b) Explain how a quota helps the stock to recover. [2]

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(c) Explain how increasing the mesh size of the nets helps the stock to recover. [2]

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(d) Explain how a closed season helps the stock to recover. [2]

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(e) Give **two** reasons for conserving this fish stock, other than keeping the fishing industry going. [2]

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(f) Explain why the government also needs to monitor the stock. [1]

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## Solutions

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Each answer shows the steps, then the **result**.

### 2.1

- a tree is planted for every tree that is felled, so the forest **replaces** what is taken
- the rate at which wood is **produced** then equals the rate at which it is **removed**, so the resource does not run out

### 2.2

- any **three** of: **climate change**; **habitat destruction**; **hunting**; **overharvesting**; **pollution**; an **introduced species**

### 2.3

- any **two** of: **replanting** a tree for each one felled; setting up **protected areas** where felling is banned; setting **quotas** on how much timber may be taken; **education**, so that people accept and support the rules

### 2.4

- any **three** of: **quotas** on the mass of fish landed; a **closed season** during breeding; **protected areas** where no fishing is allowed; a **larger mesh size**, or controlled net types; **monitoring** the stock; **education**

### 2.5

- a seed bank stores **seeds** of many different varieties in cool, dry conditions
- so that a plant species can be grown again even if it is lost from the wild, which also preserves its **genetic variation**

### 2.6

- a small population contains only a **small number of alleles**, because most were lost with the individuals that carried them
- so there is little **genetic variation** in the population
- the species is then unlikely to contain an individual that survives a **new disease** or a change in the environment, so one event could kill them all

### 3.1 C

- a larger mesh lets the **young, smaller fish pass through** the net, so they survive to breed
- **A**, **B** and **D** all conserve the stock, but none of them works by letting young fish escape from a net

### 3.2

(a)

- the species is **bred in captivity**, in zoos or reserves, where it is protected from hunting and from predators

- individuals are later **released into the wild** to rebuild the wild population

(b)

- **artificial insemination** places sperm from a chosen male into a female without the animals meeting, so animals in **different zoos** can be bred together
- **in vitro fertilisation** fertilises the egg **outside the body** and the embryo is placed into a female; both let the programme choose which individuals breed, keeping as much genetic variation as possible

(c)

- with only 60 individuals there is very little **genetic variation**, and close relatives must often be bred together
- so the offspring are all similar, and the species remains vulnerable to a single disease or change in conditions

### 3.3

(a)

- the fish were caught **faster than they could reproduce** and be replaced
- so fewer adults were left to breed each year, and the population fell further, giving a smaller catch

(b)

- a quota **limits the mass of fish** that may be landed
- so removal no longer exceeds replacement, and enough adults are left to breed and rebuild the population

(c)

- a larger mesh lets the **young fish escape** through the net
- so they survive to reach breeding age and reproduce, instead of being caught first

(d)

- no fishing is allowed during the **breeding season**
- so the adults can reproduce undisturbed and their young survive, which increases the number of fish in the next generation

(e)

- any **two** of: maintaining or increasing **biodiversity**; reducing the risk of **extinction**; protecting a **vulnerable ecosystem**; maintaining **ecosystem functions** such as nutrient cycling; keeping a source of food, drugs or **genes** for the future

(f)

- so that the government can see whether the stock is recovering, and **change the quotas** if it is not