



Cambridge International AS & A Level

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MARINE SCIENCE

9693/31

Paper 3 A Level Theory

May/June 2024

1 hour 45 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 75.
- The number of marks for each question or part question is shown in brackets [].

This document has **20** pages. Any blank pages are indicated.

Section A

Answer **all** questions in this section.

1 (a) The Salinas y Arenales Regional Park is a protected natural area on Spain's Mediterranean coast.

Fig. 1.1 shows the location of the Salinas y Arenales Regional Park.

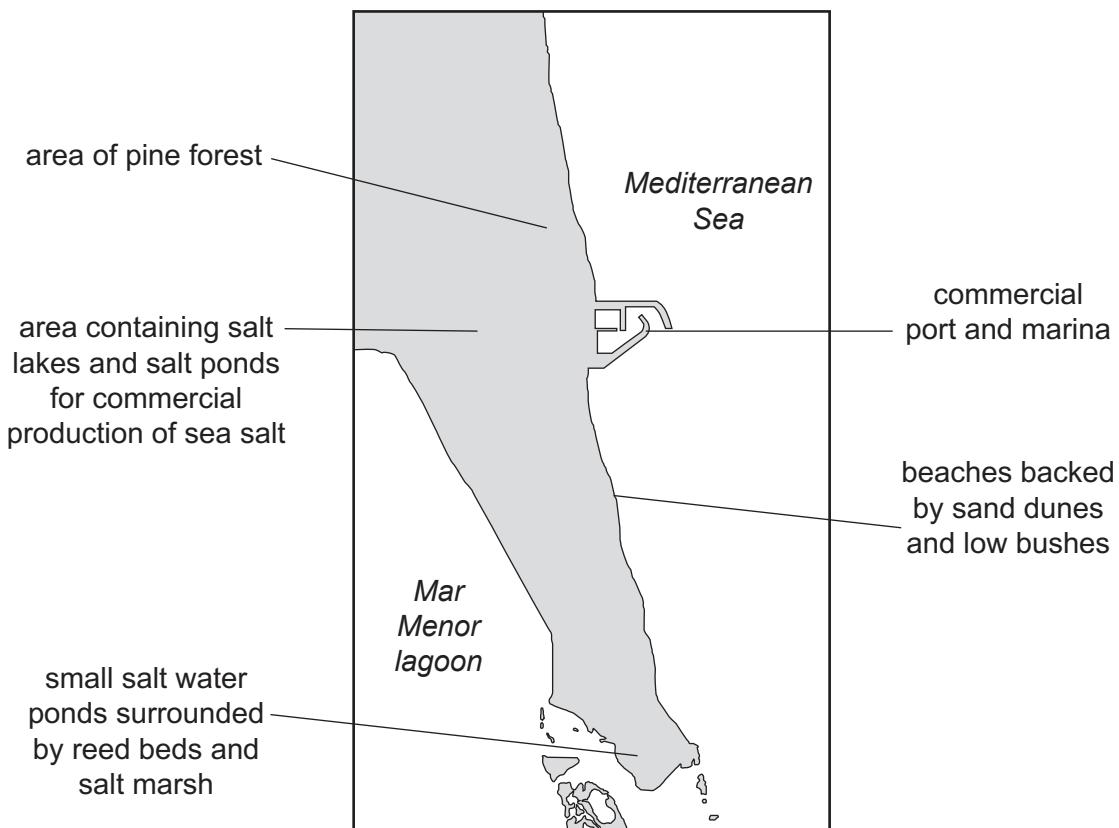


Fig. 1.1

The Salinas y Arenales is a protected area due to its ecological diversity.

State the meaning of the term ecological diversity.

.....
.....

[1]

(b) A conservation project has been set up to protect and enhance the habitat for wildlife in this area.

Two species that are particularly important are:

- Audouin's gull (*Larus audouinii*), which is on the IUCN red list of threatened species
- Spanish killifish (*Aphanius iberus*), which is on the IUCN red list of endangered species.

(i) State the meaning of the term endangered species.

.....

..... [1]

Fig. 1.2 shows a pair of Audouin's gulls next to their nesting site on an embankment surrounding one of the salt ponds. The salt pond contains fish which are the main food source for the gulls.



Fig. 1.2

(ii) Some of the embankments surrounding the salt ponds have gradually eroded over time. Other embankments are now covered with plants.

Conservation work has constructed new embankments to increase the numbers of Audouin's gull and Spanish killifish.

Suggest why using gravel (small stones) and mud from the salt ponds to construct the new embankments would be better for their long-term management than using gravel and soil from the surrounding area.

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..... [2]

(iii) Spanish killifish are carnivores and swim around the stones lining the embankments.

Suggest why the new embankments have caused an increase in the numbers of Spanish killifish.

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[2]

(iv) One of the main threats to biodiversity in the Salinas y Arenales protected area is a large increase in the numbers of yellow-legged gulls which also breed there. These gulls are larger than Audouin's gull and are omnivores.

Yellow-legged gulls produce large quantities of faeces. High numbers of these gulls have increased the concentration of nitrogen compounds in the salt ponds.

Explain how yellow-legged gulls pose a threat to biodiversity in this area.

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[4]

(c) Another aim of the conservation project is to improve priority habitats such as the coastal dunes and bushes.

In the past, American agave (*Agave americana*) and sour fig (*Carpobrotus acinaciformis*) were introduced to help stabilise the sand dunes. Now, these plants have become invasive species.

Fig. 1.3 shows these invasive plants.

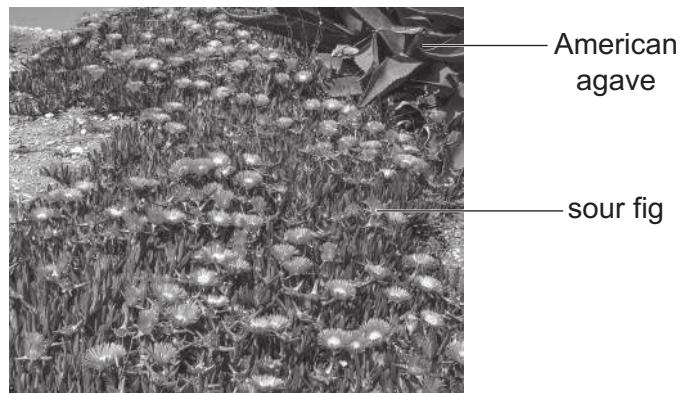


Fig. 1.3

Use Fig. 1.3 **and** your own knowledge to explain why these invasive species now pose a threat to biodiversity.

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[3]

[Total: 13]

2 (a) Fig. 2.1 shows two different methods of mussel aquaculture.

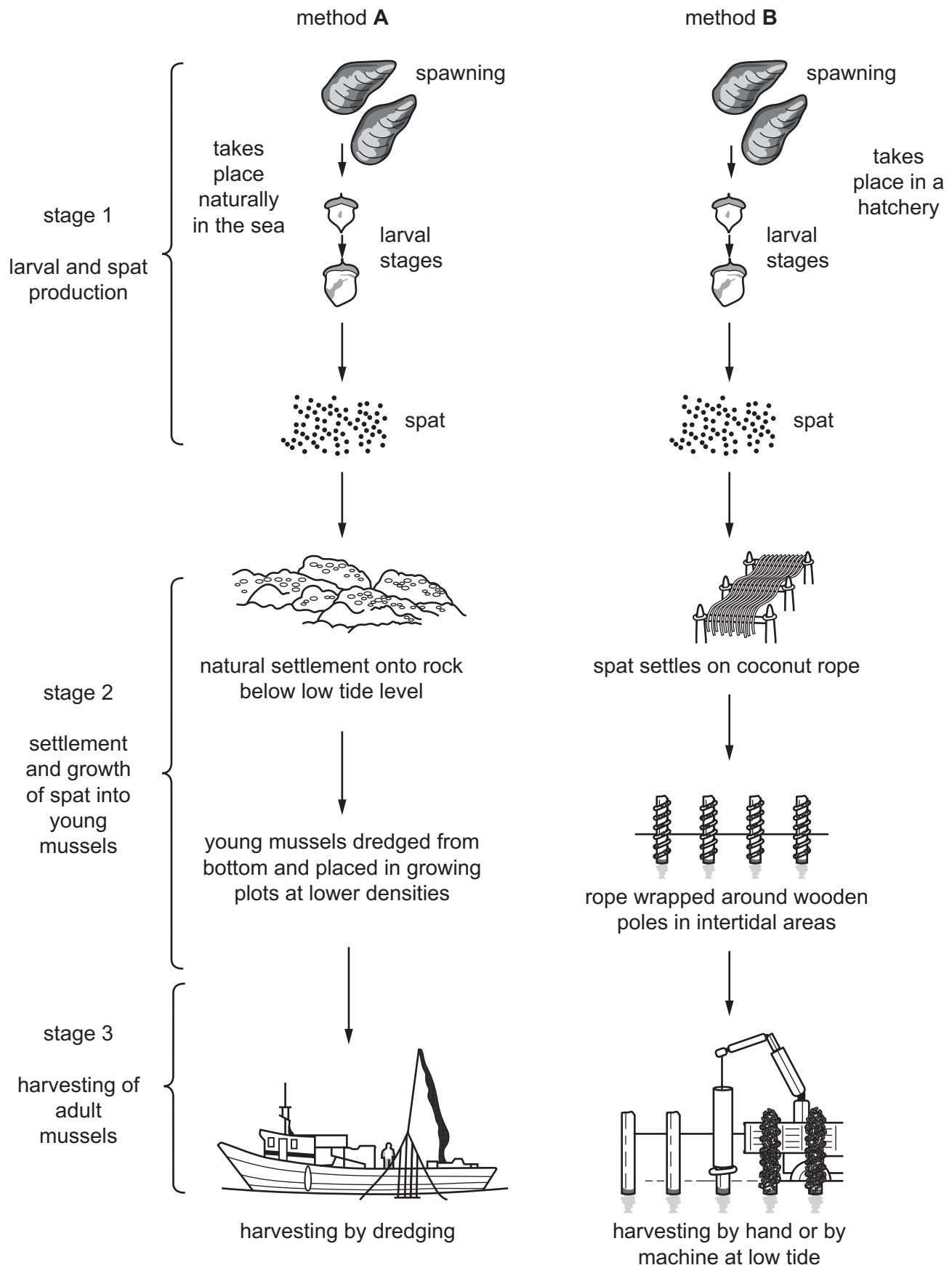


Fig. 2.1

(i) The mussel life cycle includes metamorphosis.

State the meaning of the term metamorphosis.

..... [1]

(ii) Larval and spat production for method **A** takes place naturally in the sea. Larval and spat production for method **B** takes place in a hatchery.

List **two** advantages and **two** disadvantages of using a hatchery to produce larvae and spat rather than allowing natural reproduction in the sea.

advantages of using a hatchery

1

.....

2

.....

disadvantages of using a hatchery

1

.....

2

.....

[4]

(iii) Suggest why the growth of adult mussels is usually faster using method **A** than using method **B**.

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[2]

(iv) Explain why harvesting using method **A** is more damaging to the environment than using method **B**.

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[2]

(b) (i) Mussels are checked regularly for shell damage. Shell damage can result in a loss of 2% of income from mussel aquaculture.

Low salinity is known to decrease mineral content in sea water.

Suggest why low salinity might increase shell damage in mussels.

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[2]

(ii) Suggest **two other** reasons why the mussels need to be checked regularly.

1

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2

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[2]

[Total: 13]

3 (a) The manufacture and use of clothing contributes to harmful effects on the marine environment.

Many items of clothing are now produced quickly and cheaply to follow the latest fashion trends. This is called fast fashion. Global surveys suggest that on average customers throw away 60% of their clothing less than a year after buying it.

Fig. 3.1 shows how clothing sales and use changed between 2000 and 2015.

Key

— clothing sales

--- average number of times an item of clothing is worn

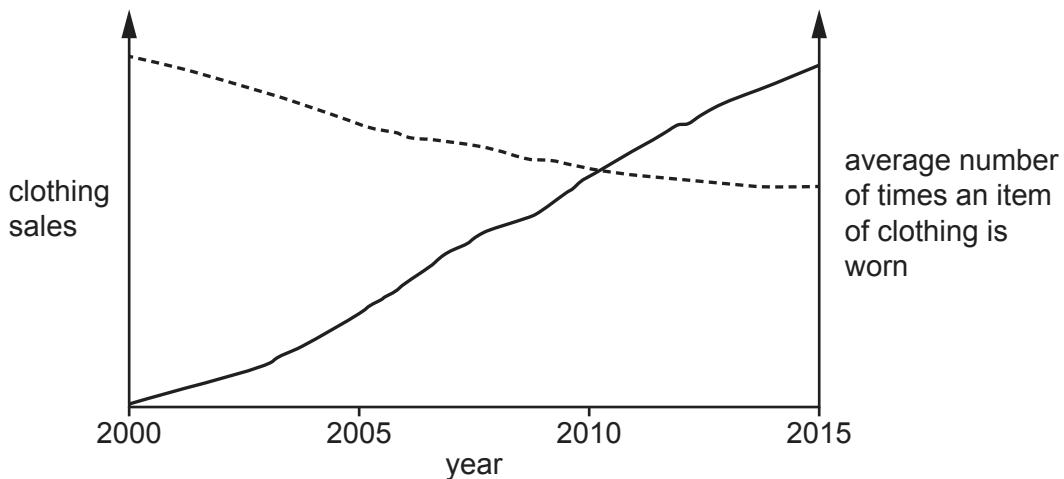


Fig. 3.1

Describe the trends shown in Fig. 3.1.

..... [1]

(b) Many of the discarded clothes end up in landfill, where they decompose, or they are sent for burning. This releases carbon dioxide into the atmosphere and contributes to the increase in global sea water temperatures.

Describe how increasing sea temperatures affect corals.

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..... [2]

(c) Cotton is a natural fibre used in the production of clothes. It is often dyed using synthetic dyes which do not bind well to the cotton fibres. The dyes enter streams and rivers during the dyeing process and when the clothes are washed.

The dyes eventually enter the sea where they reflect sunlight falling on the water surface.

Suggest how these dyes could affect marine organisms.

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..... [3]

(d) Washing clothes made from synthetic fibres is estimated to produce 35% of the microplastics in the oceans.

Explain how microplastic is a problem for top predators in the oceans.

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..... [3]

(e) Use all the information provided to suggest how the fast fashion industry could reduce its environmental impact.

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..... [2]

[Total: 11]

4 (a) Price tariffs are a form of tax applied to imports from other countries, such as seafood.

(i) State **one** advantage and **one** disadvantage of introducing price tariffs to imported seafood.

advantage

.....
disadvantage

[2]

(ii) Chile, Norway, and the state of Alaska, USA, are the main producers of salmon for export. China is a major importer of salmon.

In January 2022 China introduced new temporary lower tariffs for the import of fresh, whole Atlantic salmon.

Predict the effects of these lower tariffs for salmon producers **and** for Chinese consumers.

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[2]

(b) Companies in Northern Europe and North America began making commitments to sustainable production of seafood in the early 2000s. These commitments have since expanded globally.

Seafood products are often labelled to show that they are fished sustainably. Examples of these labels are shown in Fig. 4.1.

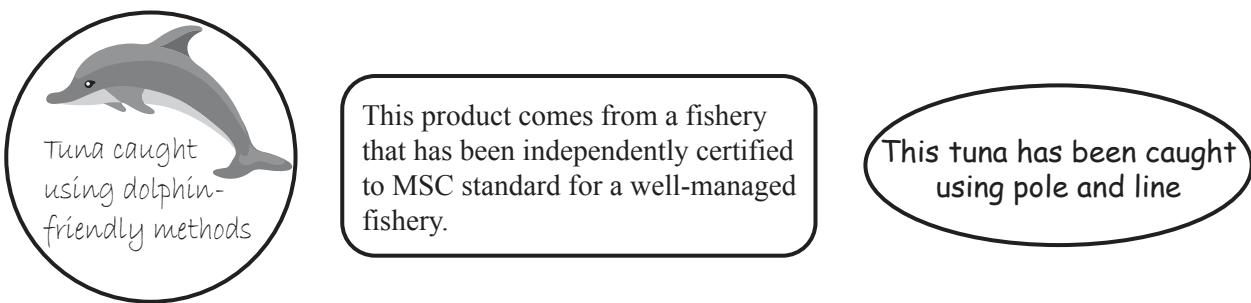


Fig. 4.1

(i) There are many different organisations which offer sustainability certifications.

Suggest why this might be a problem for consumers purchasing seafood.

.....

[1]

(ii) MSC stands for the Marine Stewardship Council, which is an international organisation working to promote sustainable fishing.

Fig. 4.2 shows a 5-year trend in the number of MSC-certified products available in three regions of Europe.



Fig. 4.2

Discuss the changes in the total number of MSC-certified products in the three regions.

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[3]

[Total: 8]

Section B

Answer **all** questions in this section.

5 Describe the main features of kelp **and** explain how it is adapted for living in intertidal areas and areas permanently covered by sea water on rocky shores.

[10]

6 (a) Describe the process of diffusion **and** explain its importance in marine organisms.

[8]

(b) Describe how water moves between cells and their environments **and** explain the effects of this water movement on plant cells and animal cells.

[7]

[Total: 15]

7 Compare the life cycle of a crustacean such as a shrimp, with that of a marine mammal such as a whale.

[5]

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