



# Cambridge International AS & A Level

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**MARINE SCIENCE**

**9693/03**

Paper 3 A2 Structured Questions

**October/November 2020**

**1 hour 30 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. Blank pages are indicated.

Answer **all** the questions in the spaces provided.

1 Arcata Bay is one of the largest estuaries in California, United States of America.

Fig. 1.1 shows a plan of Arcata Bay.

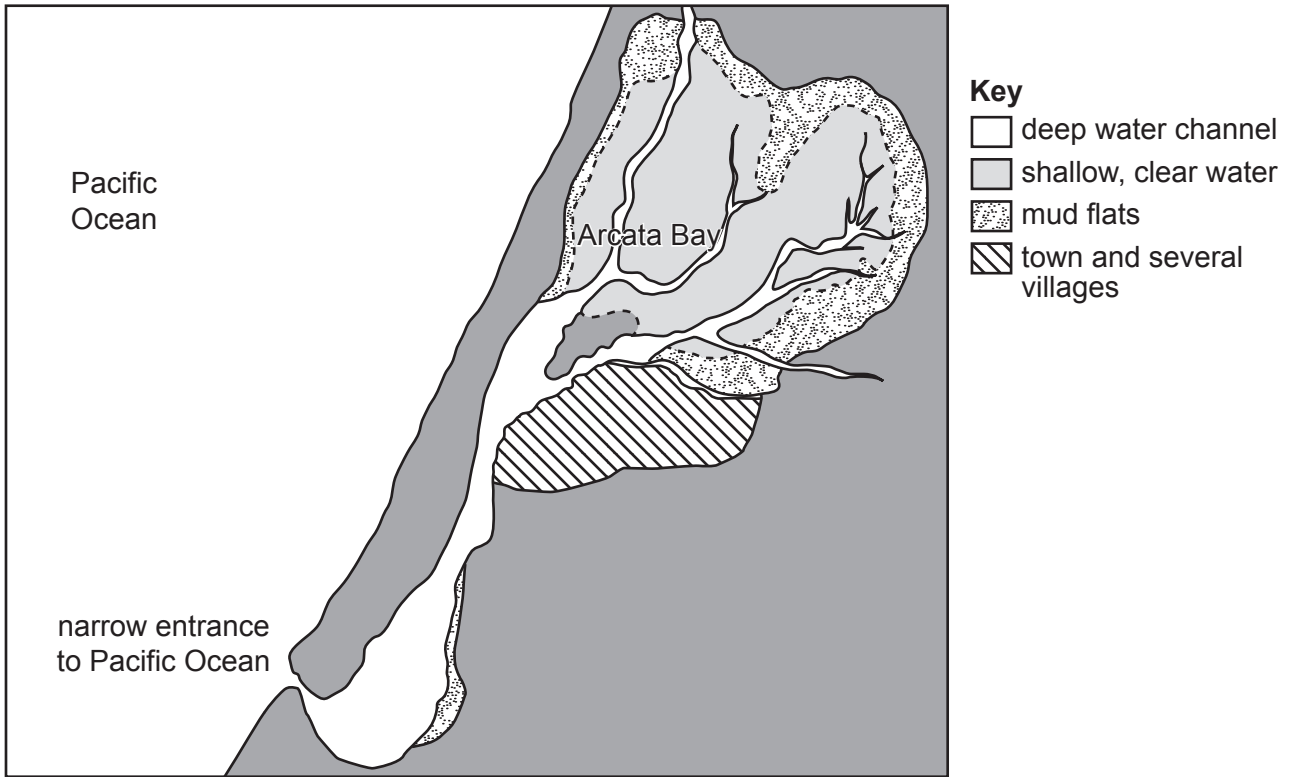


Fig. 1.1

(a) (i) Several rivers drain into Arcata Bay to form an estuary.

State the meaning of estuary.

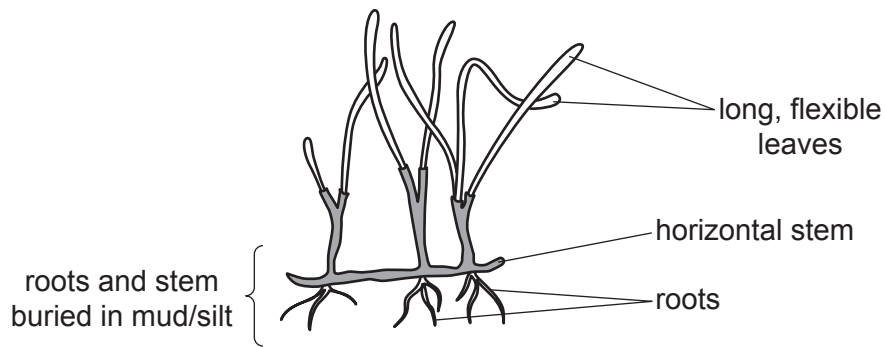
.....  
..... [1]

(ii) Extensive seagrass beds are found in shallow clear water.

Explain why seagrass is only found in shallow clear water in Fig. 1.1.

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..... [4]

(iii) Fig. 1.2 shows the structure of seagrass found in Arcata Bay.



**Fig. 1.2**

Use Fig. 1.2 to suggest how the structure of seagrass plants helps to modify the conditions in the shallow water, making it more suitable for seagrass to survive.

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..... [2]

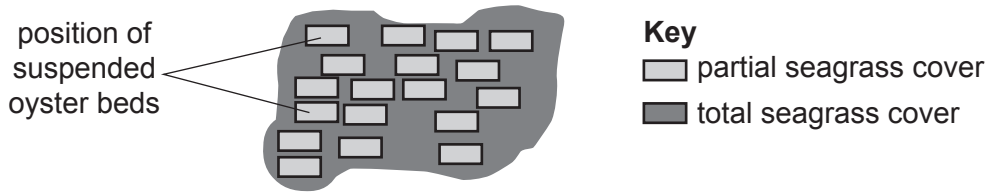
(b) Oyster farming has taken place in the same shallow water as the seagrass beds since the 1950s. Oysters used to be cultured on the sea bed and harvested by dredging.

Since 2001, the oysters have been cultured in beds, attached to long lines suspended above the seagrass.

(i) Use all the information provided to suggest why the culture method was changed in 2001.

.....  
..... [1]

(ii) Fig. 1.3 shows seagrass cover below and around the suspended oyster beds.



**Fig. 1.3**

In 2017, the oyster farming company applied to increase the oyster beds by 34%.

Use the information provided and your own knowledge to explain why commercial fishermen might object to the proposed increase.

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..... [4]

[Total: 12]

2 (a) The albacore tuna, *Thunnus alalunga*, is an important commercial species in the Indian, Pacific and Atlantic Oceans.

(i) Fig. 2.1 shows some of the main stages in the life cycle of tuna.

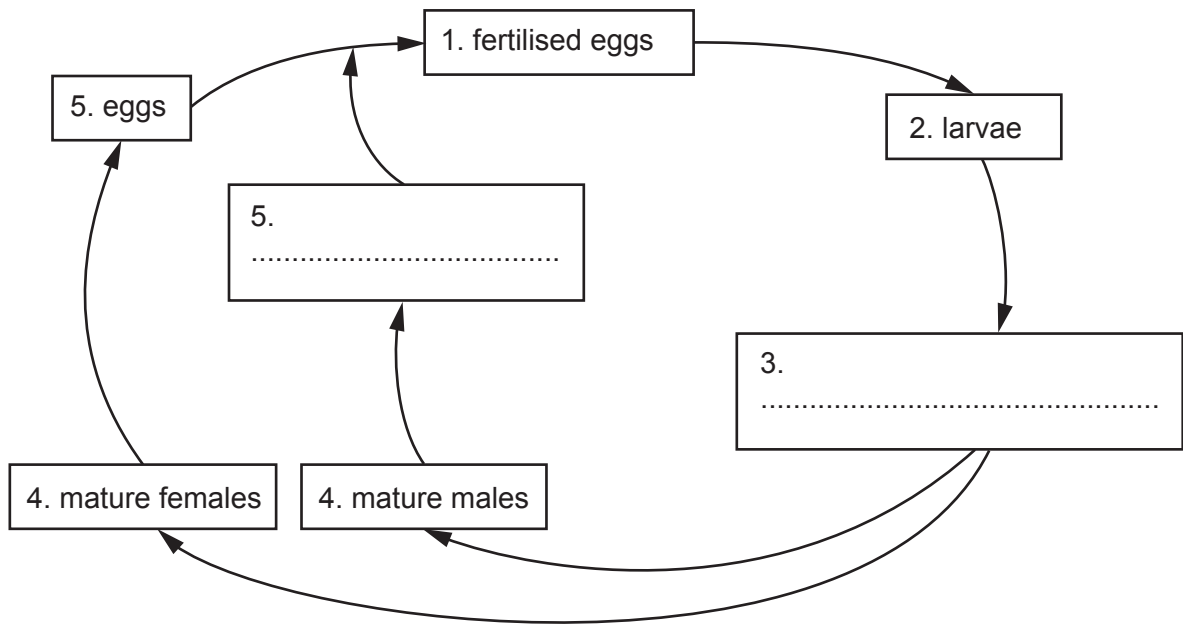


Fig. 2.1

Complete Fig. 2.1 by writing in the missing stages in the life cycle. [2]

(ii) Tuna use external fertilisation. State **one** advantage and **one** disadvantage of this type of fertilisation.

advantage .....

.....

disadvantage .....

.....

[2]

(iii) During the spawning season, older females can release eggs for more months than younger females.

Suggest why older females can release eggs for more months than younger females.

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..... [2]

(b) State **two** ways in which the life cycle of salmon differs from the life cycle of tuna.

1 .....

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2 .....

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[2]

(c) Albacore tuna swim continuously and migrate long distances.

(i) Explain why tuna must consume large quantities of food each day.

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[2]

(ii) Describe how the ventilation system in tuna allows enough oxygen to be obtained so that the fish can swim continuously.

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[3]

[Total: 13]

- 3 (a) Illegal fishing is an international issue.

State **one** method of enforcement available if illegal fishing has taken place.

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 ..... [1]

- (b) Various monitoring methods are used to try to reduce illegal fishing. These include fishermen having to use logbooks to record their catch and patrol aircraft observing fishing boats to check for illegal fishing.

Complete Table 3.1 to show an advantage and disadvantage of each method.

**Table 3.1**

<b>monitoring method</b>	<b>advantage</b>	<b>disadvantage</b>
logbooks	cheap and can be used on any fishing vessel, in any language	
patrol aircraft		cannot arrest fishing crew and cannot inspect catch or gear

[2]

- (c) Two other methods of monitoring include Vessel Management System (VMS) and Automatic Identification System (AIS).

VMS was designed as a ship monitoring and tracking system, while AIS was designed for ships to communicate with each other and with shore. AIS depends on a communication satellite signal. Only AIS information is freely available.

Fig. 3.1 shows part of the coastline of Indonesia. Map **A** tracks a fishing vessel using AIS. Map **B** tracks the same fishing vessel using VMS and AIS.

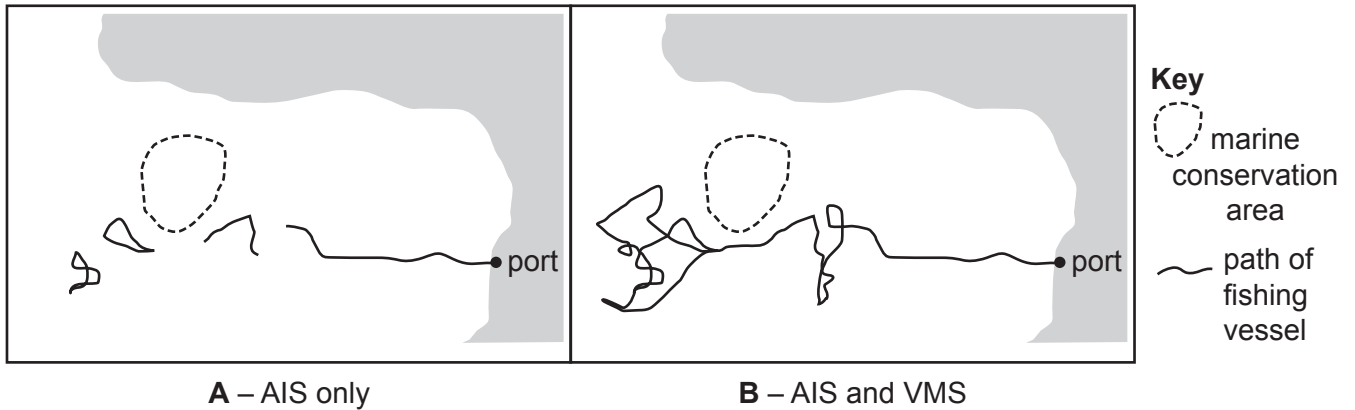


Fig. 3.1

- (i) Suggest **and** explain the advantages of using combined data from both VMS and AIS rather than relying on data from AIS only.

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 .....  
 .....  
 ..... [2]

- (ii) Indonesia has recently made the data from VMS freely available, so that, when combined with AIS, all its fishing fleet can be tracked.

Suggest the advantage to the Indonesian fishing industry of sharing their fishing fleet tracking data.

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 ..... [1]

- (d) The catch made by smaller fishing vessels is often transferred to larger factory vessels while still at sea. The factory vessels later carry the catch to port.

- (i) Suggest **two** advantages of transferring catch to factory vessels.

1 .....  
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 2 .....  
 .....

[2]



One problem with transferring catch at sea is that legal and illegal catch can become mixed together. Some fishing boats switch off their AIS when they are fishing illegally, or when they are transferring illegal catch.

Argentina allows only Argentinian vessels to fish for squid within 483 km of the shore. There is no restriction on squid fishing outside this restricted fishing zone.

Fig. 3.2 shows the restricted fishing zone around part of the coastline of Argentina. Each star (\*) represents a different non-Argentinian fishing vessel. The stars show the positions where each vessel stopped transmitting AIS signals for at least 24 hours.

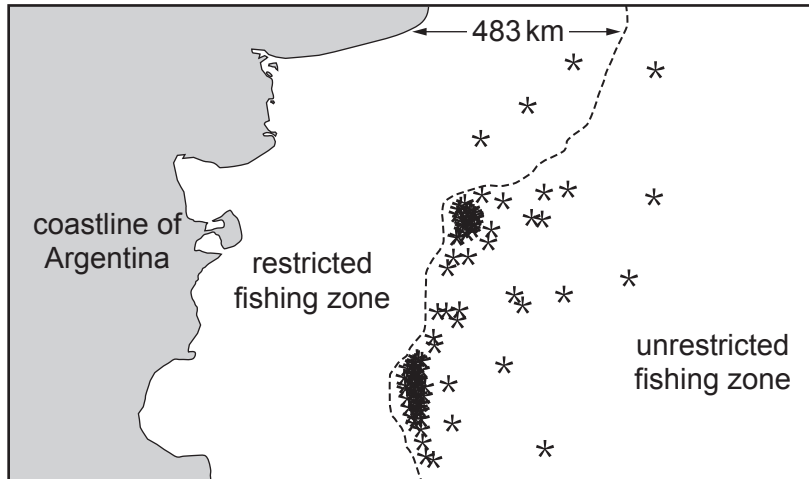


Fig. 3.2

- (ii) Use the information provided in Fig. 3.1 and 3.2 to discuss the evidence that illegal fishing and illegal transfers are taking place along the border between the restricted fishing zone and the unrestricted fishing zone.

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..... [3]

[Total: 11]



- 4 (a) Between 1950 and 2010, production of fish by aquaculture increased by 120 million tonnes.

Production by commercial fishing increased by 60 million tonnes between 1950 and 1990 and then stayed the same until 2010.

Suggest why aquaculture production is still increasing but production from commercial fishing is not.

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..... [3]

- (b) New aquaculture projects are being set up in many different countries.

Fig. 4.1 shows a flow diagram of an aquaculture project in Africa. Water from the fish-rearing tanks is recycled in a closed system that treats the water.

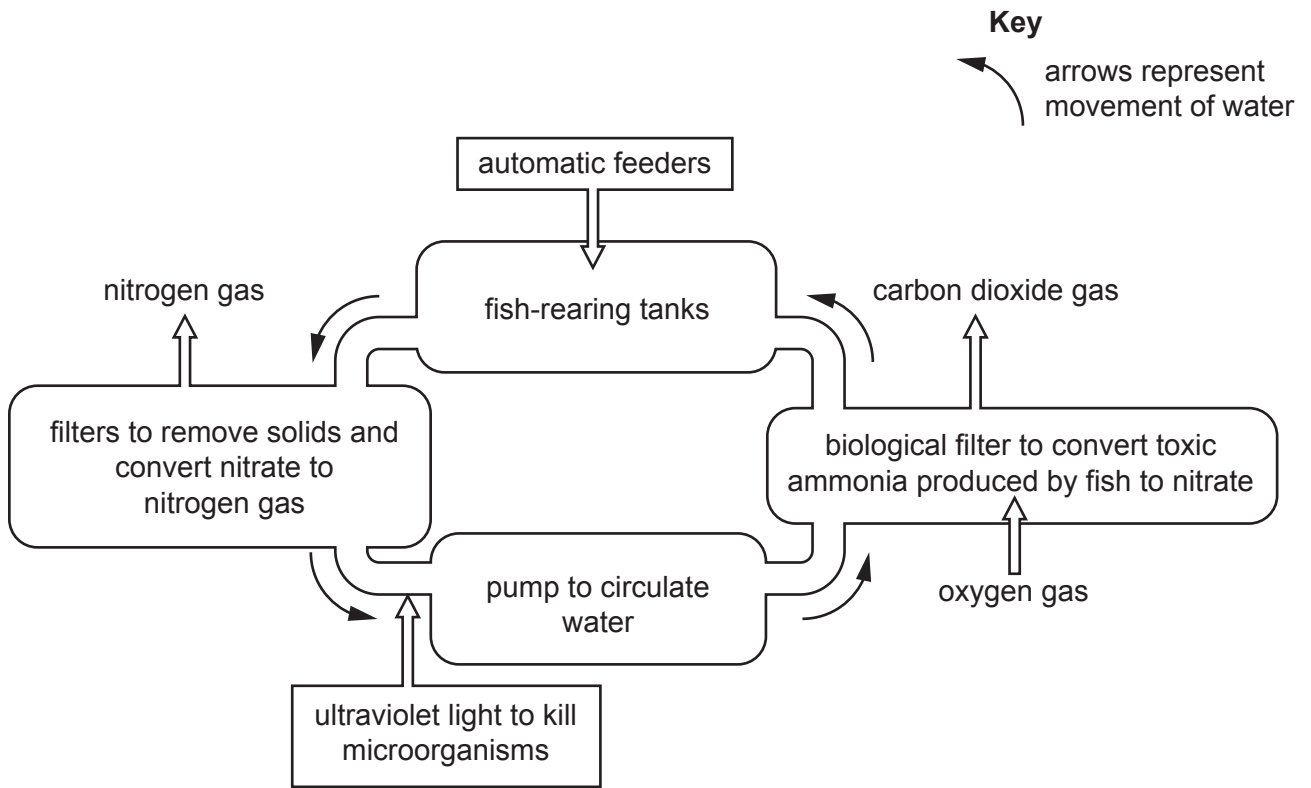


Fig. 4.1

- (i) Three requirements for a sustainable aquaculture system are clean water, efficiency of food use and disease management.

Describe how the system in Fig. 4.1 meets each of these requirements.

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..... [4]

(ii) State **two** requirements, other than those listed in (b)(i), for a sustainable aquaculture system.

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[2]

(iii) Suggest **two** disadvantages of the aquaculture system shown in Fig. 4.1.

1 .....

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2 .....

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[2]

(iv) Suggest **two** ways in which the aquaculture system in Fig. 4.1 reduces the negative impacts of aquaculture.

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[2]

(c) Some aquaculture systems rear fish which are released into the sea to increase the populations of wild fish.

Explain why fish raised in aquaculture are often unsuccessful in increasing populations of wild fish.

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[3]

[Total: 16]

- 5 It is estimated that eight million tonnes of plastic refuse enters the oceans every year. Plastic refuse usually floats and is carried by surface currents.

Fig. 5.1 shows the main global surface currents.

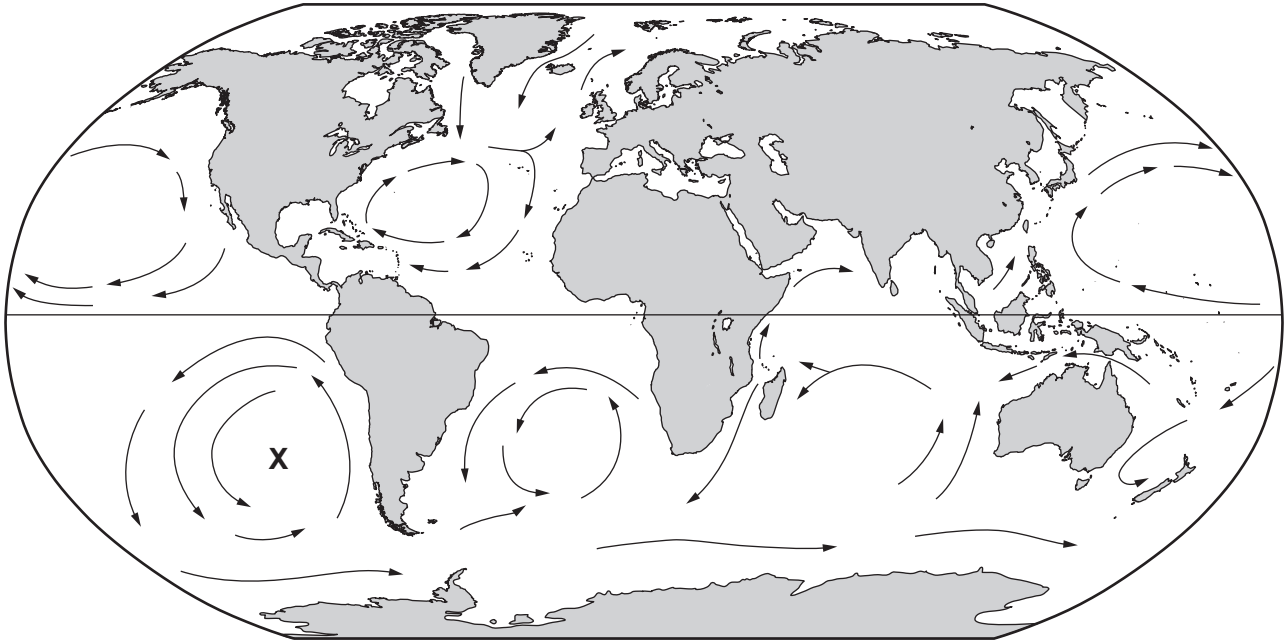


Fig. 5.1

- (a) (i) Name the effect that produces ocean currents as a result of the Earth's rotation.

..... [1]

- (ii) State **two** other causes of ocean currents.

1 .....

2 .....

[1]

- (iii) Plastic refuse eventually gathers in ocean areas to form huge floating masses. One of these areas is marked at **X** on Fig. 5.1.

Suggest why plastic often collects in this area.

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..... [1]

- (b) Plastics remain in the environment for a long time and much of the plastic that has ever existed is still around today. Plastics are eventually broken down into small pieces called microplastics.

Table 5.1 shows the estimated number of years for some plastics to break down.

**Table 5.1**

type of plastic	estimated number of years to break down
styrofoam cup	50
plastic bottle	450
fishing line	

- (i) Fishing line takes an estimated 34% longer to break down than plastic bottles.

Calculate the estimated number of years for fishing line to break down.

Space for working.

..... [2]

- (ii) Explain **one** way that fishing line poses a threat to marine animals.

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(c) Microplastics are a similar size and density to phytoplankton.

Edible shellfish such as mussels feed on phytoplankton.

Suggest why scientists are concerned about the increasing volume of microplastics in the marine environment.

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(d) Several companies are developing an alternative to plastic made from waste prawn shells.

Suggest **and** explain the advantages of using this alternative to plastic.

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..... [4]

[Total: 14]





6 A marine conservation organisation carries out projects with local communities all over the world to help to conserve the marine environment. This work has resulted in the setting up of Locally Managed Marine Areas (LMMAs), which are managed by local communities.

(a) Suggest why LMMAs are often more successful than government-directed projects.

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..... [2]

(b) Suggest **two** reasons why it is important to conserve coral reefs.

1 .....  
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2 .....  
..... [2]

- (c) In Madagascar, international volunteers are working in an LMMA to assess the effectiveness of a complete fishing ban on the health of coral reefs.

The volunteers map the reef and collect information about different aspects of the reef at regular intervals over a period of time.

Two sorts of information that are collected by the volunteers are:

- the percentage of the reef that is bleached and where the bleaching is located
- the number of different species living on the reef and the size of the populations of these species.

- (i) Suggest how this information can be used to assess whether the health of a coral reef is improving.

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- (ii) Suggest why there may be conflicts of interest between the local managers of the LMMAs and tourists to Madagascar.

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[Total: 9]

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