UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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MARINE SCIENCE **9693/03**

Structured Questions **May/June 2013**

Paper 3

1 hour 30 minutes

Candidates answer on the question paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen on both sides of the paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Write your answers in the spaces provided on the question paper.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

Electronic calculators may be used.

This document consists of **15** printed pages and **1** blank page.

1 Fig. 1.1 shows the distribution and abundance of different types of algae on a reef.

For Examiner's Use

The thickness of the horizontal lines represents the relative abundance of each type of alga at different positions on the reef.

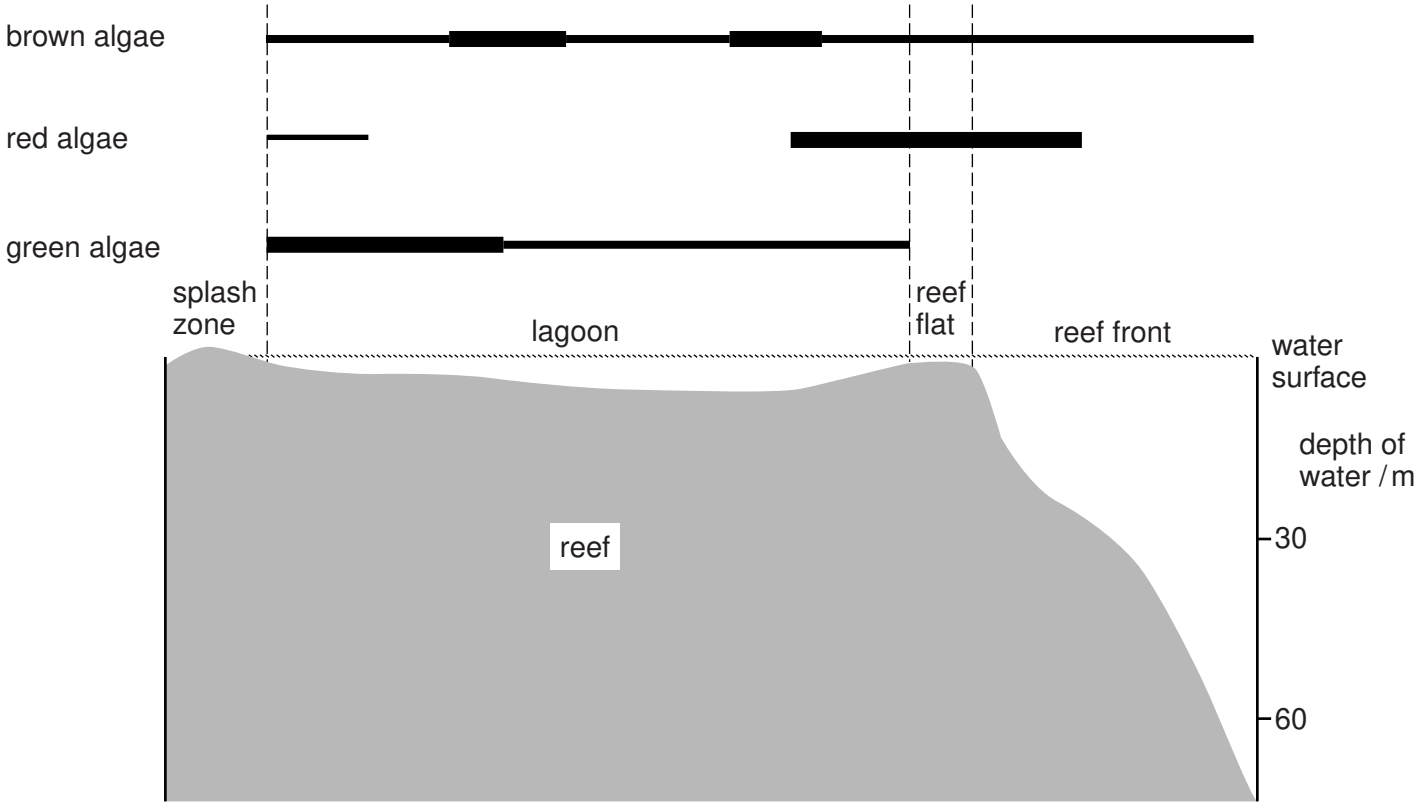

Fig. 1.1

(a) (i) With reference to Fig. 1.1, explain the distribution of the green algae.

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(ii) Explain why both red and brown algae can grow at greater depths than green algae on the reef front.

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(b) Cyanobacteria are microscopic organisms that live on or around reefs. In shallow water they form layers on the surface of rocks, corals and large algae. They also form layers on the surface of water.

(i) Suggest how cyanobacteria contribute to the oxygen cycle of the Earth.

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(ii) Some of the cyanobacteria on the surfaces of large algae are able to convert nitrogen gas to ammonia which becomes part of the nutrients dissolved in the ocean.

Suggest how these cyanobacteria may contribute to the productivity of the sea.

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(c) In water polluted by phosphates, cyanobacteria grow excessively, forming 'blooms' that cover the water surface.

(i) Suggest **one** source of phosphate pollutants.

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(ii) Suggest **one** possible consequence of an algal bloom.

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.....[1]

[Total: 12]

[Turn over

2 **(a)** In an investigation, the surface area and the volume of a number of marine organisms was measured and used to calculate the surface area to volume ratio.

Table 2.1 shows the results of this investigation.

Table 2.1

organism	surface area / cm^2	volume / cm^3	surface area: volume ratio
A	54	27	2.0 : 1
B	84	12	7.0 : 1
C	125	250	0.5 : 1
D	270	180	1.5 : 1

Fig. 2.1 shows a cross section of one of the organisms in the investigation.

Fig. 2.1

(i) With reference to Table 2.1, explain why this is most likely to be a cross section of the body of organism **B**.

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(ii) Suggest which organism in Table 2.1 is most likely to need a transport system. Explain your answer.

Organism .....

Explanation .....

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(b) Fig. 2.2 shows a diagram of the structure of part of a gill from a fish.

For Examiner's Use

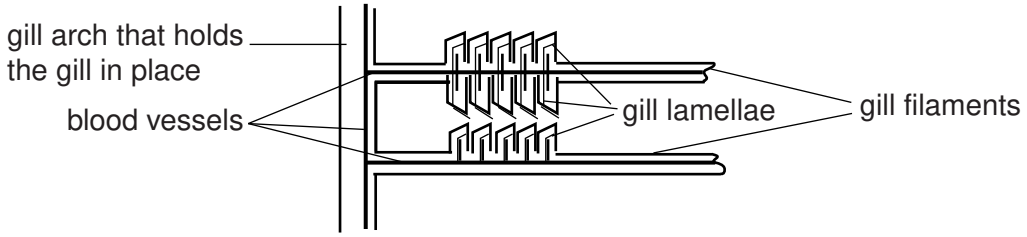

Fig. 2.2

(i) Suggest how the gill filaments and gill lamellae help a fish obtain sufficient oxygen.

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.....[1]

(ii) Explain why the movement of water caused by ventilation, and the flow of blood through the gills, help to improve the efficiency of the gills.

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[Turn over

(c) Table 2.2 shows some features of three types of fish and their gills.

Table 2.2

type of fish	feature of fish				
	body mass / g	**activity**	**ratio of gill area to body mass / $cm^2\,g^{-1}$**	**number of filaments**	**number of lamellae per mm of filament**
salmon	520	high	2.5 : 1	1606	19
skipjack tuna	33 500	high	14 : 1	6066	32
bluefin tuna	256 500	high	9 : 1	6480	24

(i) Salmon, skipjack tuna and bluefin tuna are all pelagic fish.
The total surface area of the gills of a salmon is 1300 cm^2 and that of a skipjack tuna is 469 000 cm^2.
Calculate the surface area of the gills of the bluefin tuna.
Show your working.

[2]

(ii) Suggest an explanation for the differences in gill surface area of salmon and tuna.

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(iii) The length of the gill filament, in skipjack and bluefin tuna, is approximately the same.
Suggest how the difference in the number of lamellae per mm of gill filament of the two types of tuna could affect their oxygen supply.

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[Total: 15]

3 **(a)** Describe the life cycle of the giant clam (*Tridachna gias)*.

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(b) **(i)** State **one** way in which the life cycle of oysters differs from that of giant clams.

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(ii) State **two** ways in which the life cycle of oysters is similar to that of giant clams.

1 .....

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2 .....

.....[2]

(c) The giant clam is a large mollusc, with a mass of 200 kg and a diameter of 120 cm. It is the most endangered of the clam species.

Suggest **one** reason why this species of clam may be endangered.

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[Total: 9]

[Turn over

4 **(a)** A number of fisheries collected data over a period of 10 years.
Fig. 4.1 summarises how the value of the catch varied with the percentage of the fish population caught.

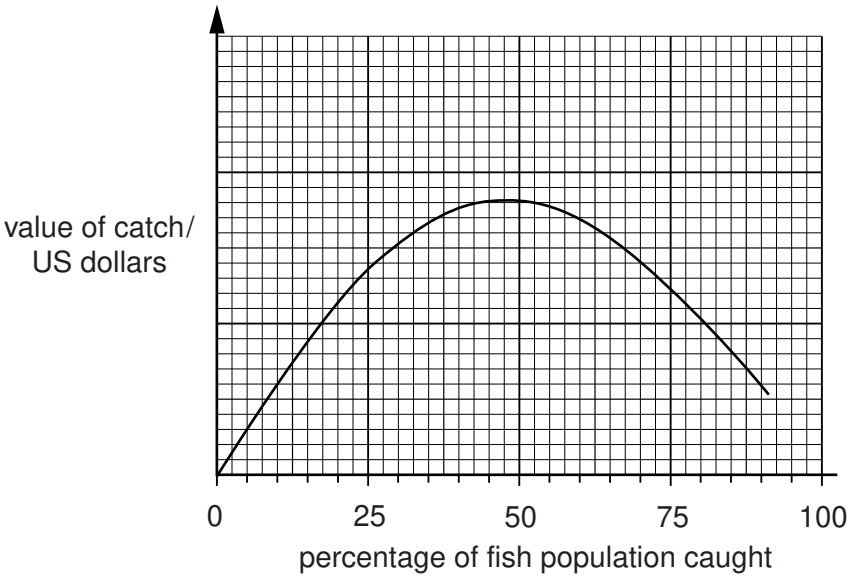

Fig. 4.1

Suggest reasons for the shape of the curve shown in Fig. 4.1.

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(b) Fig. 4.2 shows how the cost of fishing and the value of the catch vary with the percentage of the fish population caught.

For Examiner's Use

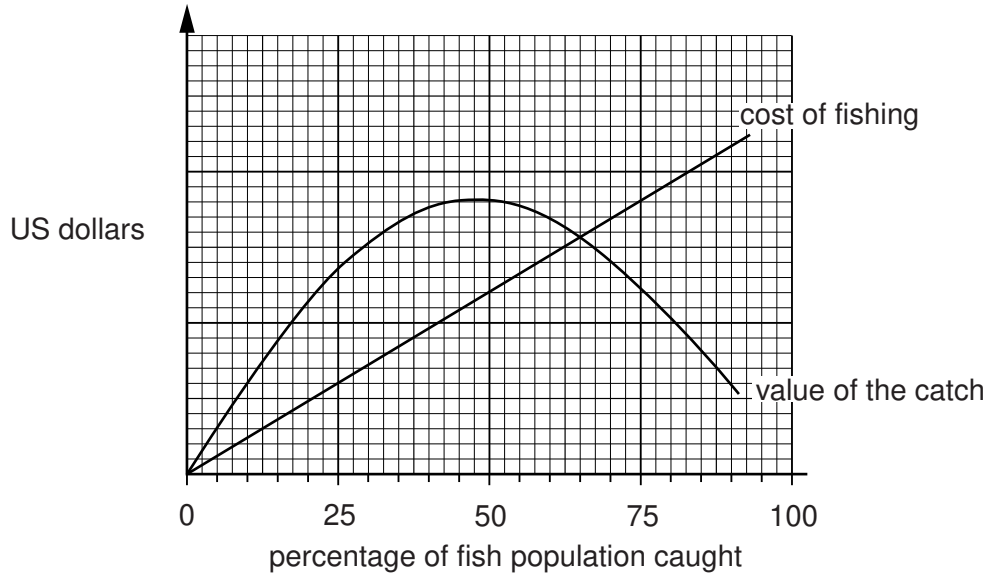

Fig. 4.2

Suggest and explain how a fishery could use the information in Fig. 4.2 to ensure that it remains profitable.

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(c) Describe and explain **two** measures by which a fishery might ensure the sustainability of the catch.

1 .....

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2 .....

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[Total: 10]

5 **(a)** Table 5.1 shows data collected by the Food and Agriculture Organization of the United Nations (FAO) about the production of tuna by aquaculture and its market value from 1999 to 2008.

Table 5.1

		1999	2001	2003	2005	2007	2008
Atlantic bluefin	production/tonnes	471	1077	1837	3200	3454	1471
	value/US$ × 1000	6470	13919	20725	38615	49513	30091
Pacific bluefin	production/tonnes	0	521	517	3402	2162	2193
	value/US$ × 1000	0	7014	6985	30815	19172	14116
southern bluefin	production/tonnes	1373	3889	2373	2231	2139	4532
	value / US$ x 1000	23204	105721	53276	31968	32986	74188
yellowfin	production/tonnes	29	0	0	1138	730	730
	value/US$ × 1000	73	0	0	10472	6585	4699
Total	production/tonnes	1873	5487	4727	9971	8485	8926
	value/US$ × 1000	29749	126654	80986	111889	108256	123094

(i) Describe the trend in **total** tuna production from 1999 to 2008.

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.....[2]

(ii) Use the data in Table 5.1 to calculate the difference between the price per tonne of Atlantic bluefin tuna and yellowfin tuna in 2008.
Show your working.

[3]

(iii) Suggest **one** reason for this difference in the price per tonne of these two species of tuna.

For Examiner's Use

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(b) Read the following information about bluefin tuna.

> Research into breeding bluefin tuna in fish farms has been taking place for over thirty years, but has presented many problems.
>
> Bluefin tuna are very large fish, growing up to 2 m in length and weighing up to 450 kg. They can take 10 years to reach maturity and often fail to breed in captivity. Young fish are easily damaged and can be killed by swimming into the sides of sea pens.
>
> Most fish farms catch young tuna and keep them for 2–3 years before selling them for human food. Research has now resulted in young tuna being raised from eggs taken from wild stock. These can be used to supply fish farms which grow the fish to market size. Captive tuna are fed on small wild fish. It takes about twenty tonnes of these wild fish to produce one tonne of tuna.

(i) Use the information in the passage to suggest how the farming of bluefin tuna could damage the environment.

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.....[2]

(ii) Use the information in the passage to identify **two** practical difficulties of farming bluefin tuna.

1 .....

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2 .....

.....[2]

[Total: 10]

6 **(a)** In 2002 the fully laden oil tanker, *Prestige,* was damaged during a severe storm and sank, losing about a third of its load. The sunken ship continued to leak oil over the next two years.

In 2004, remotely controlled equipment was used to remove the oil remaining in the storage tanks. Oil-digesting microorganisms were pumped into the tanks.

In 2006 it was discovered that a large amount of oil was still present.

The area affected has coral reefs, a major fishing area and is a migratory route for many seabirds.

(i) Describe the possible ecological impacts of the sinking of the *Prestige*.

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(ii) Explain the reasons for using oil-digesting microorganisms.

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(b) In the Bahamas, old ships are modified to remove pollutants, then towed to specific places and deliberately sunk.

For Examiner's Use

(i) Suggest **two** environmental benefits of sinking these ships.

1 .....

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2 .....

.....[2]

(ii) Suggest the economic benefits to the local community of sinking these ships.

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[Total: 11]

7 A meeting between government officials and stakeholders took place to discuss the development of marine conservation zones around the coast of a country.

The purpose of these marine conservation zones is to protect:
- nationally important marine wild life
- habitats of local marine wild life
- the structure and surface of the coastal land and the seabed.

Potential sites will be recommended by stakeholders. The stakeholders will consider how to balance the need to maintain biodiversity with economic activities for the local people.

Fig. 7.1 shows one potential site.

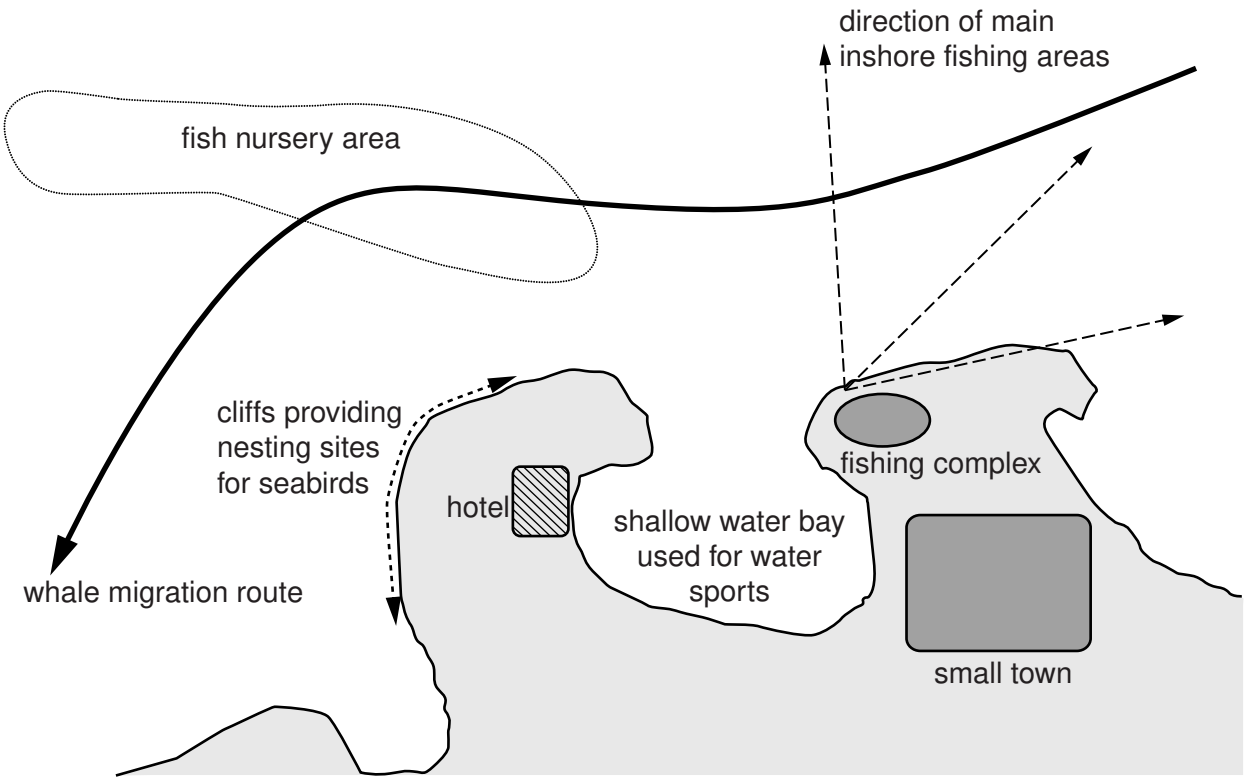

Fig. 7.1

(a) Suggest **one** reason why this site may be recommended as a marine conservation zone.

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.....[1]

(b) (i) State what is meant by the term *stakeholder.*

For Examiner's Use

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.....[1]

(ii) Identify **two** possible stakeholders in the area shown in Fig. 7.1. For each, give a reason for your answer.

1 .....

reason .....

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2 .....

reason .....

.....[4]

(c) Suggest and explain **one** way in which the current human activities in the area shown in Fig. 7.1 may need to change if the area is made into a marine conservation zone.

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[Total: 8]

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