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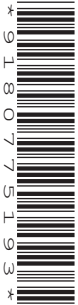
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MARINE SCIENCE

9693/03

Paper 3 A2 Structured Questions

May/June 2017

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.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

Write your answers in the spaces provided on the Question Paper.

Electronic calculators may be used.

You may lose marks if you do not show your working or if you do not use appropriate units.

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.

This document consists of **16** printed pages and **4** blank pages.

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

- 1 The genus *Sargassum* is a group of macroscopic brown algae found in many parts of the world's oceans. Some species are free-floating. Other species are attached to rocks or coral reefs, in shallow water.

(a) Fig. 1.1 shows an attached *Sargassum* species, *S. flavicans*.

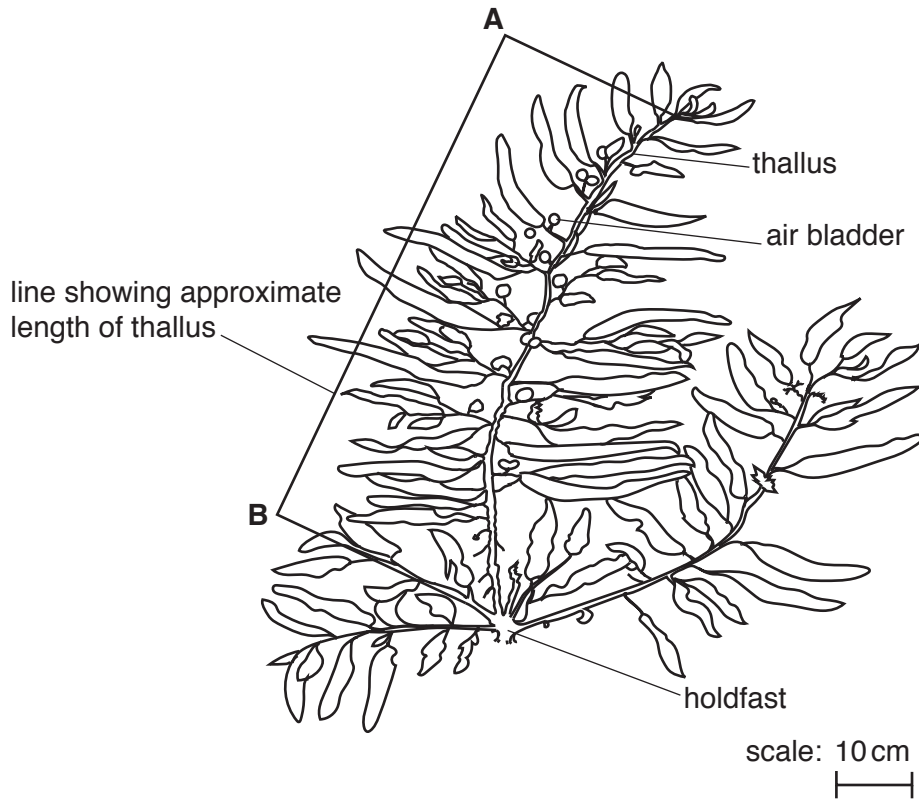


Fig. 1.1

- (i) State the function of the holdfast.

.....
 [1]

- (ii) Suggest how the air bladders are important to photosynthesis.

.....

 [2]

- (iii) The line labelled **A-B** on Fig. 1.1 shows the approximate length of a thallus of *S. flavicans*.

Use the scale to estimate the length of the thallus shown in Fig. 1.1.

..... [2]

(iv) Use your answer to (a)(iii) and your knowledge of photosynthesis to suggest why these algae are found mainly in shallow water up to a depth of six metres.

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

(b) Other species of *Sargassum* always float freely as large mats on the surface of the open ocean.
Complex ecosystems form within these mats.

Describe the role of the free-floating *Sargassum* species in marine ecosystems.

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..... [3]

(c) One species of *Sargassum*, *S. muticum*, is often introduced with molluscs imported for aquaculture.

Suggest **two** harmful effects of the introduction of *S. muticum* to marine ecosystems.

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

[Total: 12]

2 Fig. 2.1 shows the position of the operculum (gill cover) of a bony fish.



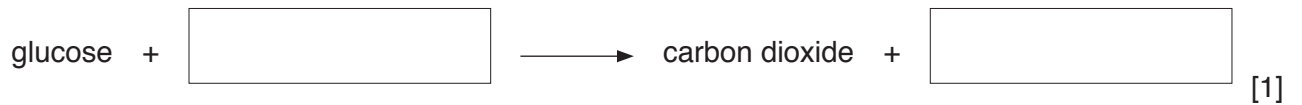
Fig. 2.1

(a) Describe how pumped ventilation causes the operculum to move outwards and inwards.

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.....
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.....
.....[3]

(b) An investigation was carried out into the rate of respiration in fish at different water temperatures.
The rate of respiration was estimated by counting the number of times the operculum moved outwards and inwards in one minute.

(i) Complete the word equation for respiration.



(ii) Explain why the rate of operculum movement can be used to investigate the rate of respiration.

.....
.....
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.....
.....[3]

In the investigation a fish was placed in water at 5°C and left for five minutes. The movement of the operculum was then counted for one minute.

This was repeated, using the same fish, at temperatures of 10°C, 15°C, 20°C, 25°C and 30°C.

The whole investigation was repeated two more times, using a different fish each time.

Table 2.1 shows the results of this investigation.

Table 2.1

temperature of water /°C	number of operculum movements per minute			
	fish 1	fish 2	fish 3	mean
5	35	30	38	34
10	79	66	85	77
15	104	98	110	104
20	128	137	122	129
25	133	140	151	
30	143	154	169	

(iii) Complete Table 2.1 by writing in the mean values of the number of operculum movements per minute at 25°C and at 30°C. Give your answer to the nearest whole number. [1]

(iv) State the trend shown by the rate of operculum movement.

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

(v) Explain why the rate of operculum movement changes as the temperature changes.

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.....[3]

[Total: 12]

3 Fig. 3.1 shows the life cycle of a marine shrimp.

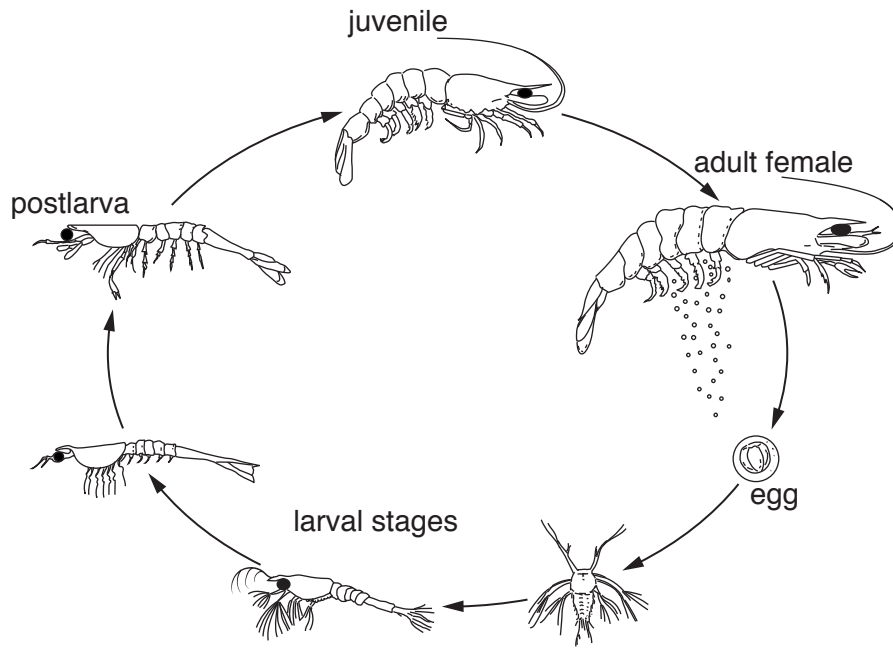


Fig. 3.1

(a) State the habitat of each of the following stages in the life cycle of a shrimp.

adult shrimp

egg

larval stages [3]

(b) A female shrimp can produce 10 000 to 1 million eggs at a time.

Suggest why female shrimp are larger than male shrimp.

.....

..... [1]

(c) Shrimp use external fertilisation.

Suggest **one** advantage and **one** disadvantage of external fertilisation over internal fertilisation.

advantage

.....

disadvantage

..... [2]

(d) Table 3.1 shows features of two species of shrimp found in the Gulf of Mexico.

Table 3.1

feature	brown shrimp	pink shrimp
spawning depth / m	46 to 90	4 to 42
habitat for postlarvae	underwater parts of marsh plants	dense seagrass beds

(i) Suggest how brown and pink shrimp spawning at different depths increases the chance of survival of the larvae of both species.

.....
 [1]

(ii) State **two** advantages of vegetation as a habitat for the postlarvae of both species of shrimp.

1

 2
 [2]

[Total: 9]

4 Read the information about sea bass in the North Sea.

Sea bass are slow-growing fish and take between four and seven years to mature.

During the spawning season from December to April, adult sea bass migrate from their inshore habitats to offshore spawning sites.

Pelagic trawlers target the fish during the spawning season and are responsible for a 25% reduction in adult sea bass numbers.

In Northern European countries, sea bass is an important species for marine recreational fishing using a rod and line. Recreational fishing accounts for 25% of all sea bass caught.

In January 2015, large numbers of juvenile sea bass were detected in shoals of adult fish. As a result, the European Commission imposed an emergency ban on all pelagic trawling for sea bass until the end of April 2015.

- (a) (i) Explain why a large number of juveniles in shoals was a reason to impose the emergency ban on pelagic trawling.

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..... [2]

- (ii) State **two** measures that could be imposed to limit sea bass catches by recreational fishermen using rod and line.

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..... [2]

(b) Figs. 4.1 and 4.2 show data on sea bass in the North Sea from 1985 to 2013.

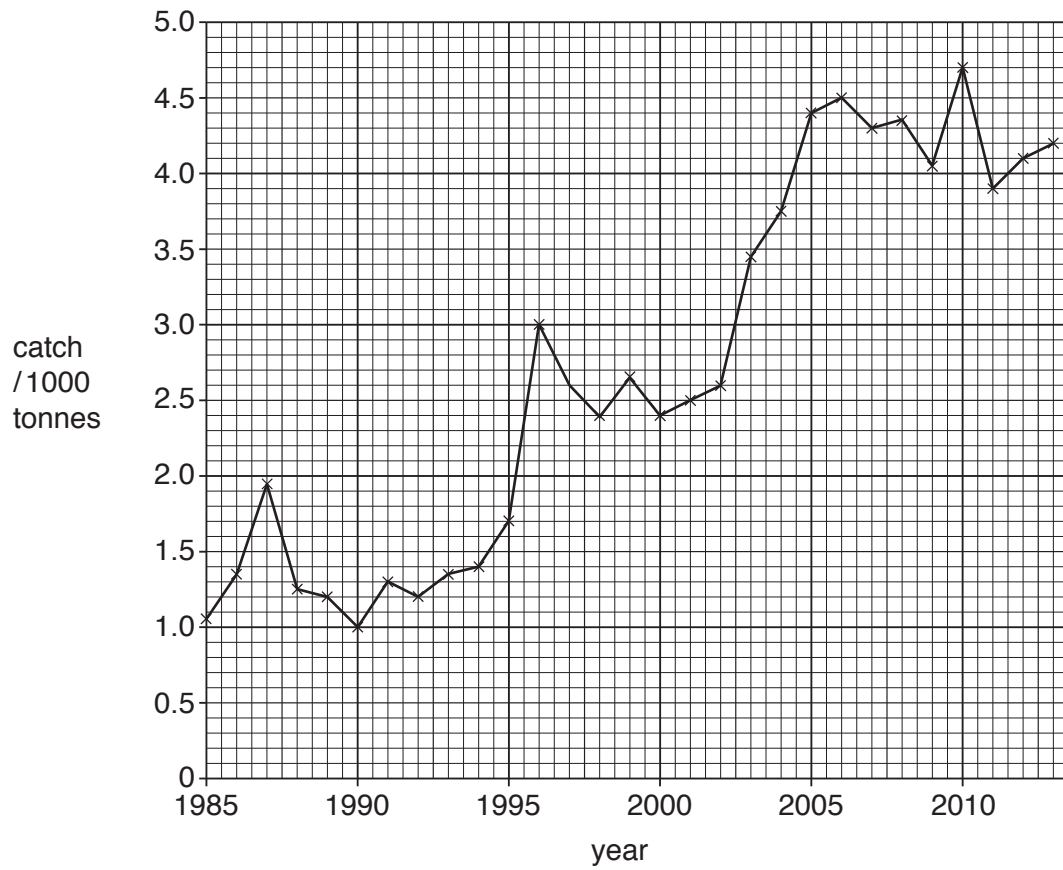


Fig. 4.1

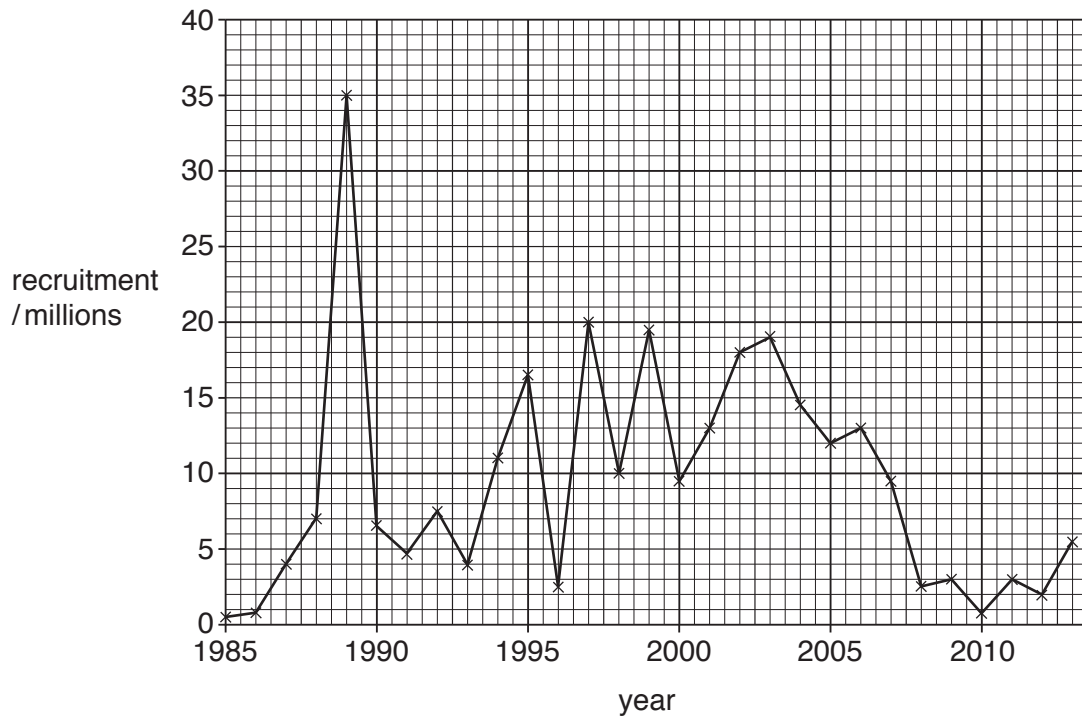


Fig. 4.2

- (i) Use the information in Fig. 4.1 to describe the trend in the catch of sea bass between 1985 and 2013.

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

- (ii) Use the information in Fig. 4.2 to calculate the percentage change in recruitment between 1989 and 2011.

Show your working.

..... [2]

- (iii) In 1992 and 2013 the fish stock had fallen to a similar low level.

Use the information in Fig. 4.1, Fig. 4.2 and the information about sea bass growth rate on page 9 to suggest why there was no need to impose fishing restrictions in 1993 but fishing restrictions were imposed in 2015.

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..... [2]

[Total: 9]

5 Fig. 5.1 represents the stages in grouper aquaculture.

Filtered seawater is pumped into land-based tanks which are also aerated.

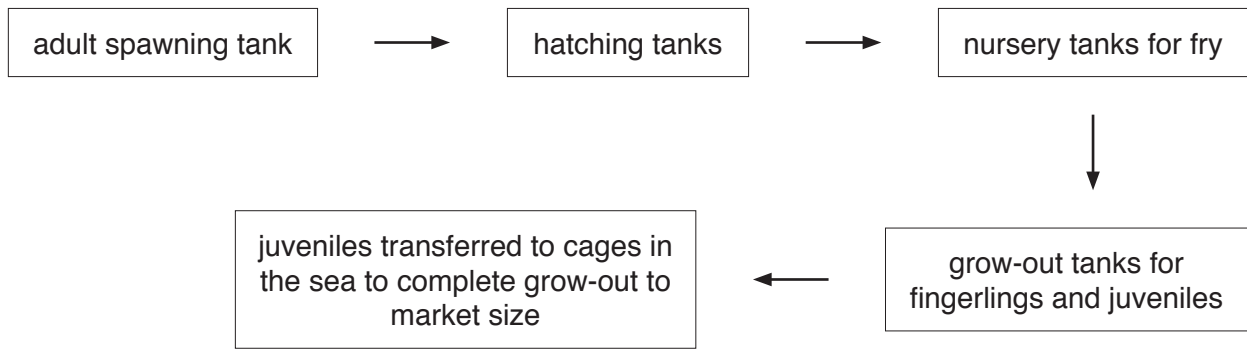


Fig. 5.1

(a) (i) Suggest why seawater is filtered before being pumped into the tanks.

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.....[1]

(ii) Explain why the water in the tanks is aerated.

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.....[2]

(iii) Suggest why the process shown in Fig. 5.1 can be considered semi-intensive.

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.....[2]

(b) (i) State **two** conditions required to induce spawning in the adult spawning tanks.

1

2 [1]

(ii) State which tank in Fig. 5.1 must contain phytoplankton in the water.
Give a reason for your answer.

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..... [2]

(iii) Adult grouper are usually fed on whole fish or pelleted feed made from whole fish.
Suggest **one** way in which the food supply could be made more sustainable.

..... [1]

(c) (i) In The Bahamas, goby 'cleaner fish' may be added to grouper spawning tanks.
State the type of interrelationship between the goby and the grouper.

..... [1]

(ii) Suggest **one** danger of adding goby fish from the wild directly to the spawning tanks.

..... [1]

[Total: 11]

6 Tuna catches along the Namibian coast in south west Africa have decreased significantly in recent years.

(a) The reduction in the catch has been blamed on seismic blasting during oil and gas exploration in the waters off the Namibian coast.

Seismic blasting is carried out by firing airguns underwater every 10 seconds causing very large sound vibrations in the water.

(i) Suggest why seismic blasting could affect tuna catch.

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(ii) Seismic blasting is unregulated.

The tuna fishing season lasts from October to April, with 70% of fish caught in February and March.

Use this information to suggest what steps the Namibian government can take to reduce the decline in tuna catch, but continue with oil and gas exploration.

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(b) Scientists have suggested tagging tuna that migrate through the area, so that they can be monitored by satellite.

State what information the satellite tag could provide.

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.....[1]

(c) Environmentalists are concerned that oil exploration along the Namibian coast could result in an oil spill.

(i) Explain how oil pollution could affect fish-eating seabirds in the area.

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(ii) Describe how biotechnology could be used to remove oil pollution from the environment.

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[Total: 12]

- (b) A beach hotel that is part of an international chain is going to be closed for redevelopment. All the existing guest rooms will be refitted and a new block of guest bedrooms built.

The company that owns the hotel wants to improve the way in which the hotel uses energy and water so it is more ecologically sustainable.

At present, energy is supplied from the main electricity supply for heating, lighting and air conditioning.

Water is supplied from the main water supply for cooking, washing, toilets, the swimming pool and grass sprinklers.

Suggest and explain **two** ways in which the use of energy and water by the hotel could be made more sustainable.

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2

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[4]

[Total: 10]

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