



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

CANDIDATE  
NAME

CENTRE  
NUMBER

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CANDIDATE  
NUMBER

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**MARINE SCIENCE**

**9693/03**

Structured Questions

**October/November 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 The distribution of sea grasses was investigated in a coastal area of Florida. Fig. 1.1 shows the results of this investigation.

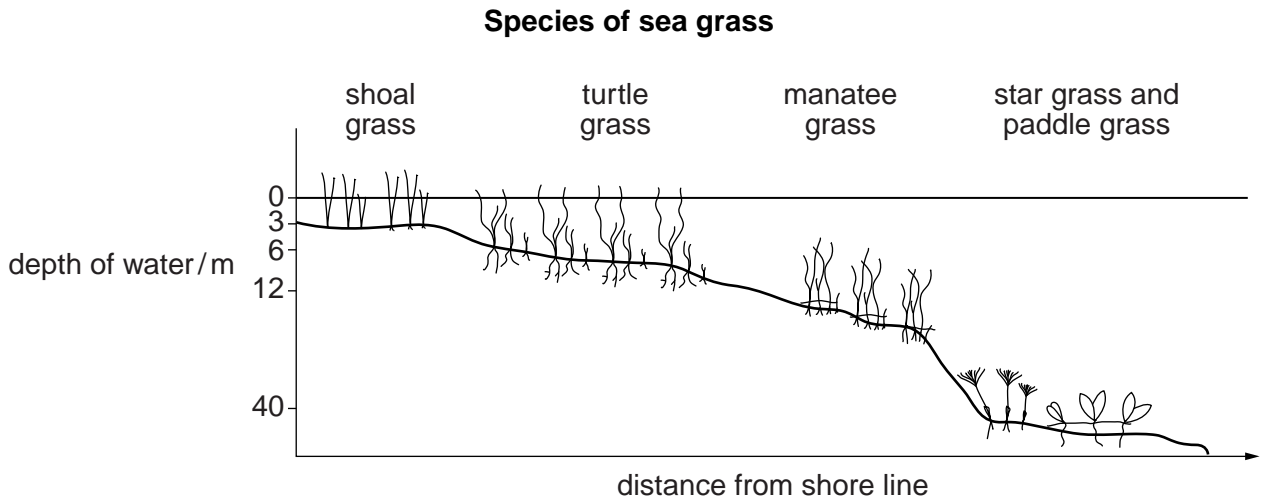


Fig. 1.1

- (a) (i) Using the information in Fig. 1.1, describe the distribution of sea grasses.

.....  
.....  
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.....  
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.....  
.....  
.....  
.....  
.....  
.....[4]

- (ii) Suggest **two** environmental factors, other than depth, that may influence the distribution of sea grasses.

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

(b) Two features of sea grass are

- 1 long horizontal stems with roots extending into the sea bed
- 2 thin ribbon-like leaves

(i) Suggest how each of these features allows sea grass to survive in coastal areas.

feature 1 .....

.....

.....

feature 2 .....

.....

..... [2]

(ii) Suggest how the presence of sea grass helps to reduce coastal erosion.

.....

..... [1]

(iii) Sea grass and coral are often found in the same areas. Sea grass has a high nutrient requirement for both nitrogen and phosphorus. Coral grows well in clear, nutrient-poor water.

Suggest how the presence of sea grass provides a suitable environment for the growth of coral.

.....

.....

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.....

.....

.....

.....

.....

..... [3]

[Total: 12]

2 (a) (i) State what is meant by the term *osmoregulation*.

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

(ii) Fig. 2.1 shows the movement of water and ions between the body of a marine bony fish and its environment.

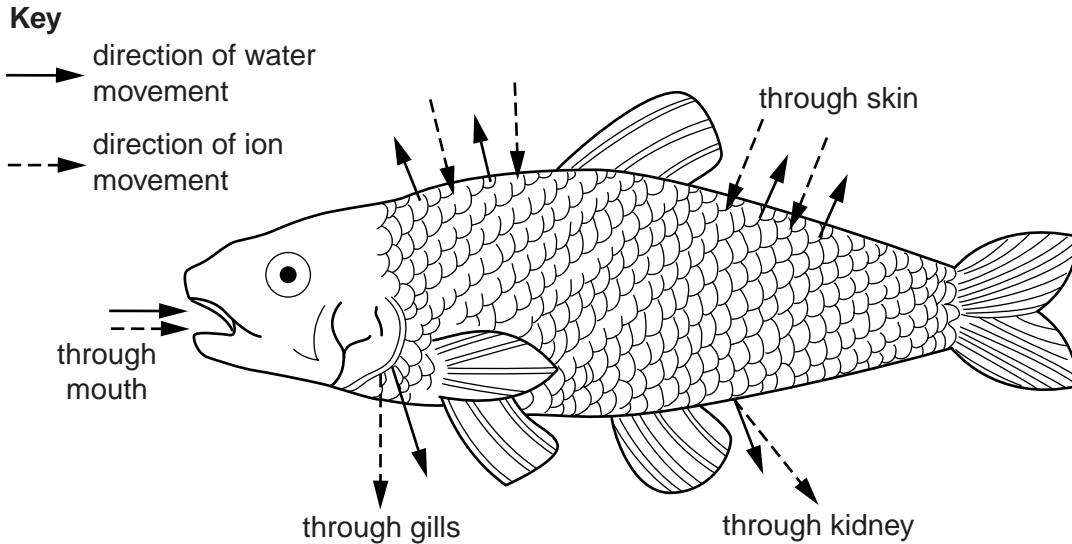


Fig. 2.1

With reference to Fig. 2.1, and your own knowledge, describe osmoregulation in this fish.

.....  
 .....  
 .....  
 .....  
 .....  
 .....  
 ..... [4]

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

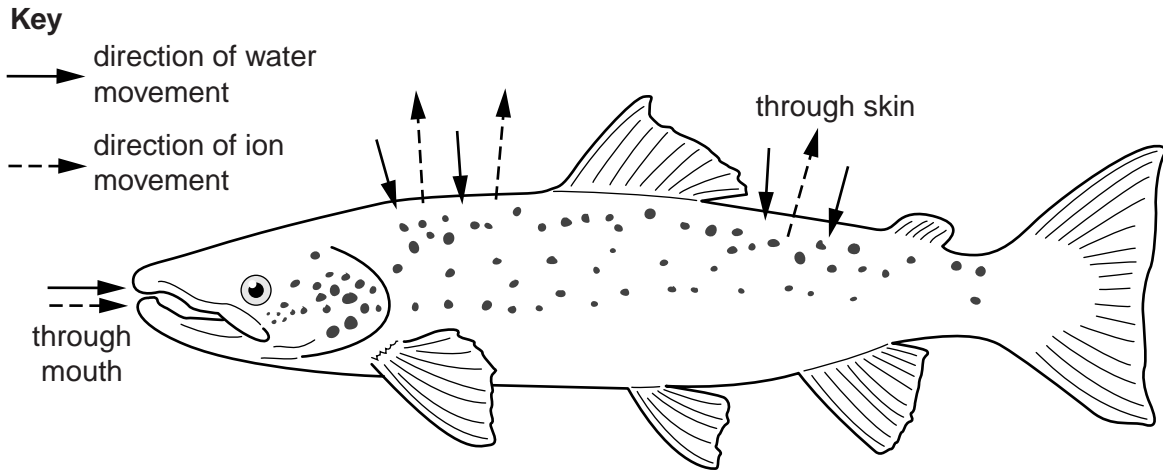
.....  
 ..... [1]

(ii) Give **one** example of a euryhaline fish.

..... [1]

Fig. 2.2 shows the movement of water and ions through the skin and mouth of a euryhaline fish in fresh water.

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**Fig. 2.2**

- (iii) On Fig. 2.2, draw arrows to show the direction of movement of ions and water through the gills. [2]
- (iv) Explain the movement of ions and water through the skin of the fish.

.....

.....

.....

..... [2]

[Total: 11]

3 Fig. 3.1 shows the main stages in the life cycle of a grouper.

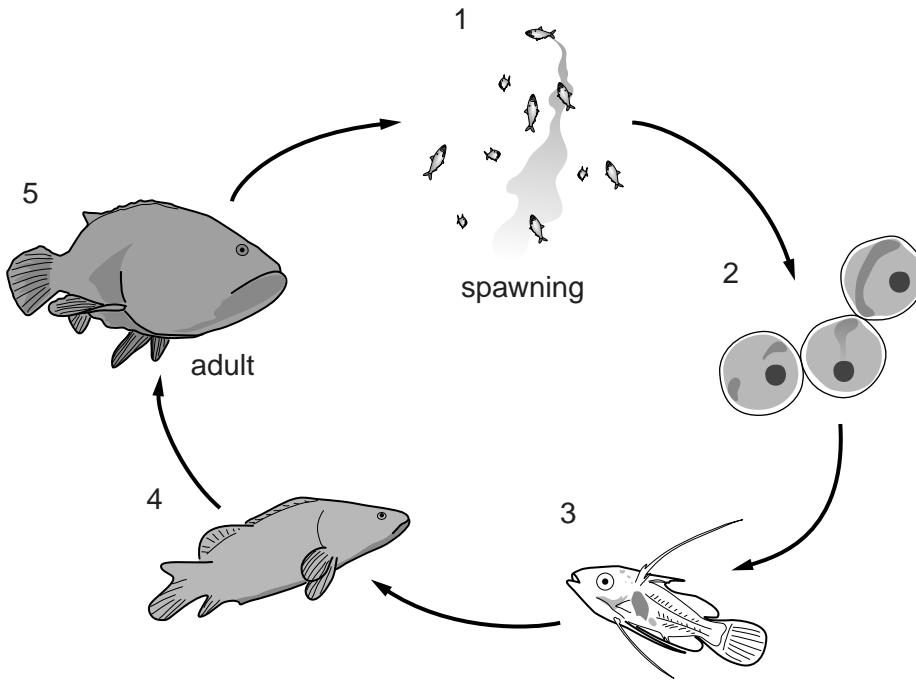


Fig. 3.1

(a) (i) Identify each of the stages labelled 2, 3 and 4 in Fig. 3.1.

- 2 .....
- 3 .....
- 4 ..... [3]

(ii) Complete Table 3.1 by stating the habitat in which each stage is found.

Table 3.1

stage	habitat
1	
2	
3	
4	

[4]

(b) Describe the similarities and differences between the life cycle of a grouper and the life cycle of a tuna.

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Similarities .....

.....

.....

.....

Differences .....

.....

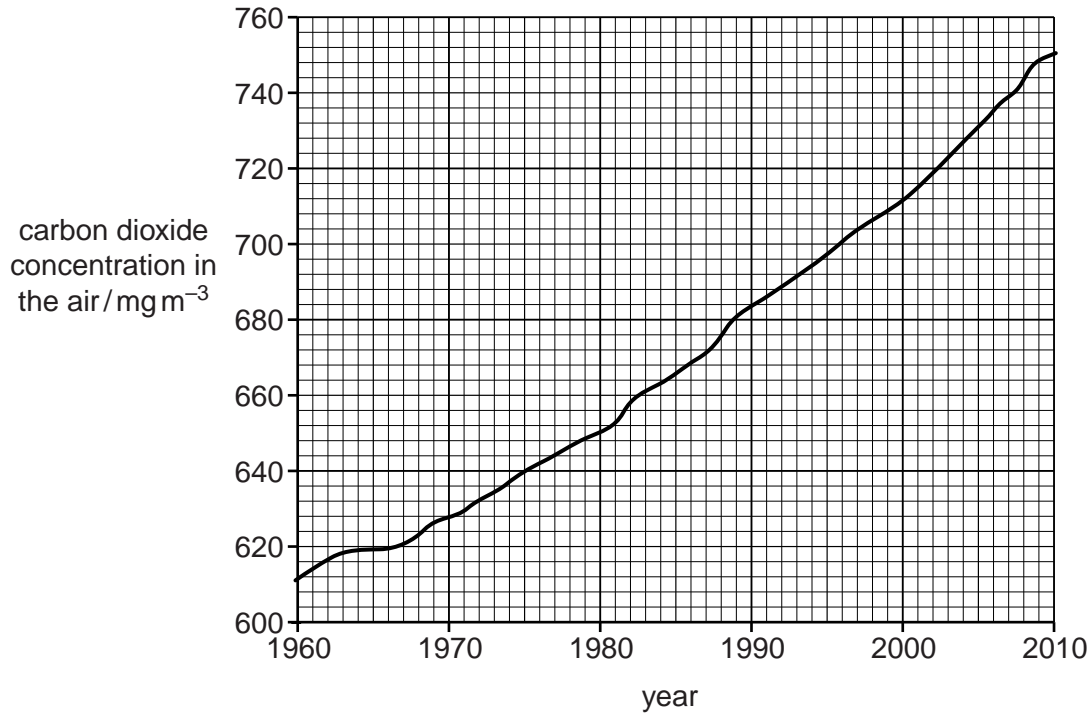
.....

..... [3]

[Total: 10]

- 4 (a) Fig. 4.1 shows the concentration of carbon dioxide measured in the air from 1960 to 2010 at a monitoring station in Hawaii.

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Use



**Fig. 4.1**

- (i) State the trend shown by Fig. 4.1.

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

- (ii) Calculate the mean rate of change of carbon dioxide concentration per year in the air during these fifty years. Show your working.

[2]





5 (a) Read the information about the supply of food for species produced by aquaculture.

Data produced by the Fisheries and Agriculture Organization of the United Nations (FAO) shows that the world production of food for people by aquaculture increased from less than 1 million tonnes in 1950 to 52.5 million tonnes in 2008. It is predicted to continue to increase.

Most aquaculture systems provide food for the cultivated species by using fish from wild stocks, especially herring, anchovy, pilchard, mackerel and whiting. These are sometimes used as live fish, or sometimes processed to produce fish meal and fish oil.

Approximately one third of the world fish catch is used to produce fish meal and fish oil. Aquaculture uses over 85% of the fish meal and just over 50% of the fish oil produced.

The wild fish requirements to produce 1 kg of three farmed carnivorous species are listed.

- Marine shrimp            2 kg
- Salmon                    4 kg
- Tuna                        22 kg

Omnivorous and herbivorous fish, such as Tilapia and catfish, and filter feeders such as oyster and clams, can use food from plant sources so the requirement for fish meal and fish oil is limited. Trials using plant based food sources have not been successful for carnivorous fish.

(i) In 2000, Chile produced 263 000 tonnes of salmon by aquaculture.

If only wild fish were used to feed the salmon, calculate the number of tonnes required.

(1 tonne = 1000 kg.) Show your working.

[2]

(ii) Suggest why there is concern about the use of wild fish for feeding cultivated fish.

.....

.....

.....

.....

..... [3]

(iii) Suggest **one** way in which aquaculture could continue to expand without increasing the demand for fish meal and fish oil.

.....

..... [1]

- (b) Kelp is a source of iodine and algin, which are used in a variety of ways, such as food processing, cosmetic manufacture and medicine.

Fig. 5.1 shows two possible locations for an aquaculture development for cultivating kelp.

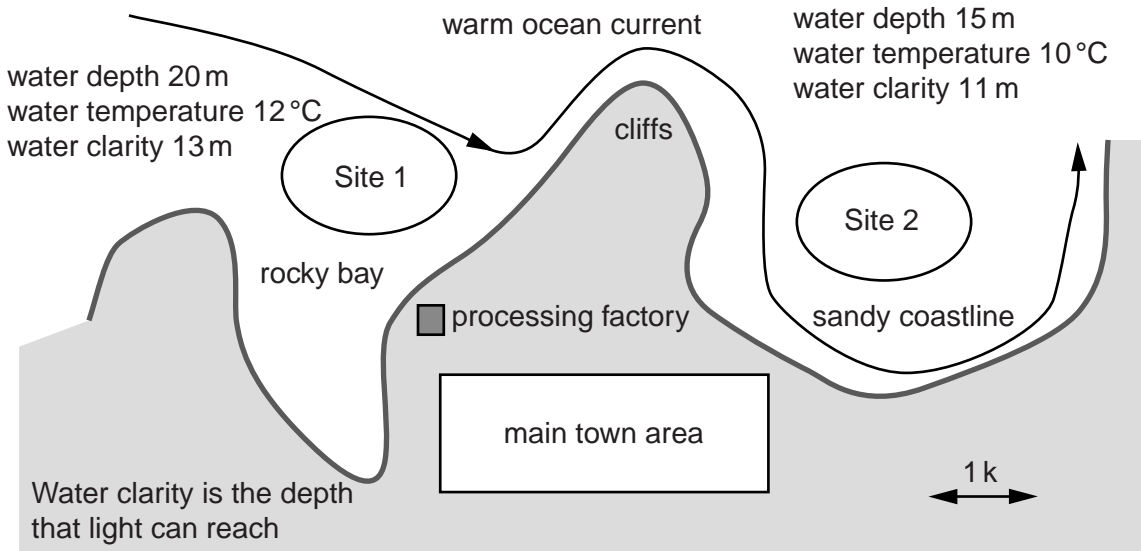


Fig. 5.1

- (i) Describe the features that are suitable for kelp aquaculture at **both** sites.

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

- (ii) Explain why site 1 may be more suitable than site 2.

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

[Total: 12]

- 6 Data about the type of species and quantity of each species of fish obtained from the sea for food production are collected yearly. When the quantity for a species falls below ten percent of the original catch, the species is said to be 'collapsed'.

Fig. 6.1 shows the percentage of species collapsed between 1950 and 2006 and the predicted long term trend.

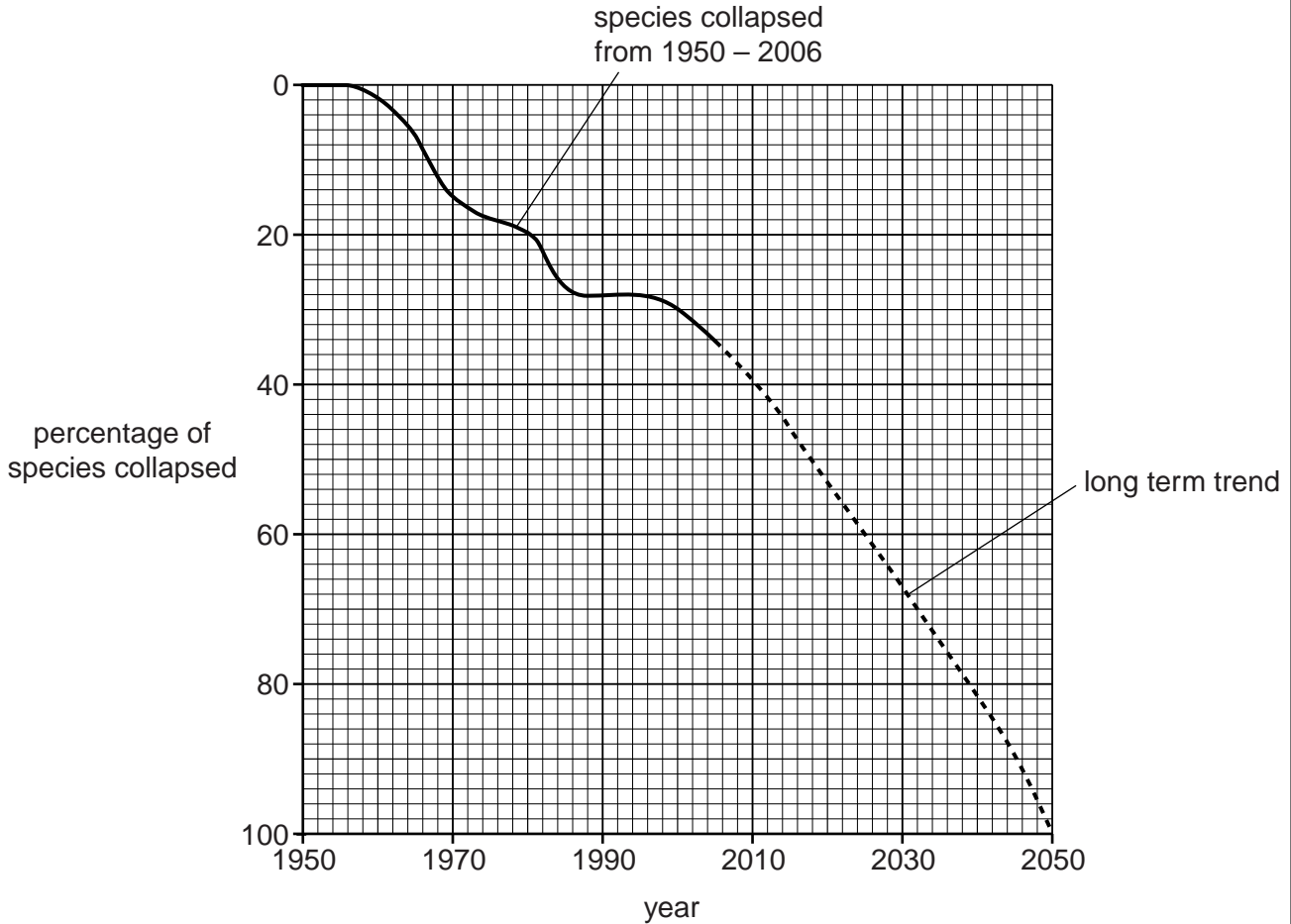


Fig. 6.1

- (a) (i) Use Fig. 6.1 to find the predicted percentage of species collapsed by 2020.

.....[1]

- (ii) Calculate the mean rate of percentage species collapse between 1950 and 2006. Give your answer to two significant figures.

[2]







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