

CANDIDATE
NAME

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MARINE SCIENCE

9693/04

Paper 4 A2 Data-Handling and Free-Response

May/June 2017

1 hour 15 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.

Section A

Answer **both** questions in this section.

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

Section B

Answer **both** questions in this section.

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 **10** printed pages and **2** blank pages.

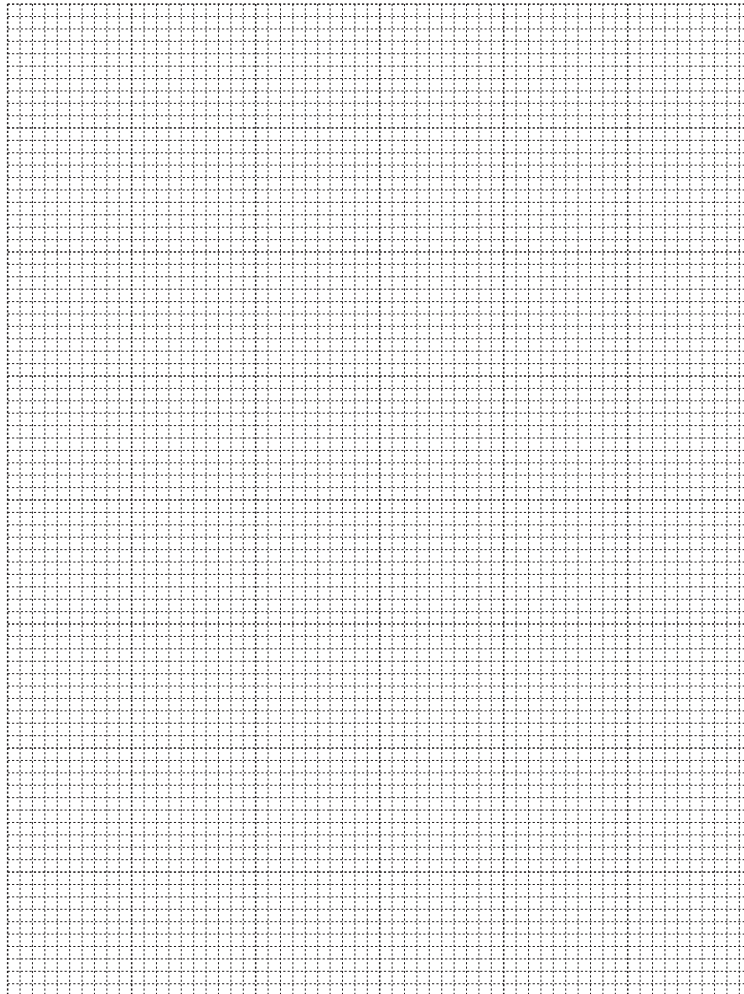
Section A

Answer **both** questions in this section.

- 1 The table shows the estimated populations of Atlantic cod and green sea urchins in an area of the Atlantic Ocean around New England from 1980 to 2010.

year	estimated population / thousand	
	Atlantic cod	green sea urchins
1980	157	0
1985	139	0
1990	142	12
1995	116	59
2000	117	64
2005	98	14
2010	54	8

- (a) (i) Plot a graph to show the populations of Atlantic cod and green sea urchins from 1980 to 2010.



- (ii) Calculate the percentage decrease in population of Atlantic cod between 1980 and 2010.
Show your working.

..... [2]

- (iii) The population estimates were based on the catches of fishermen.
Suggest **one** reason why this estimate may be inaccurate.

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..... [1]

(b) Fig. 1.1 shows part of a food web in the Atlantic Ocean near New England involving the Atlantic cod, crabs, green sea urchins and kelp.

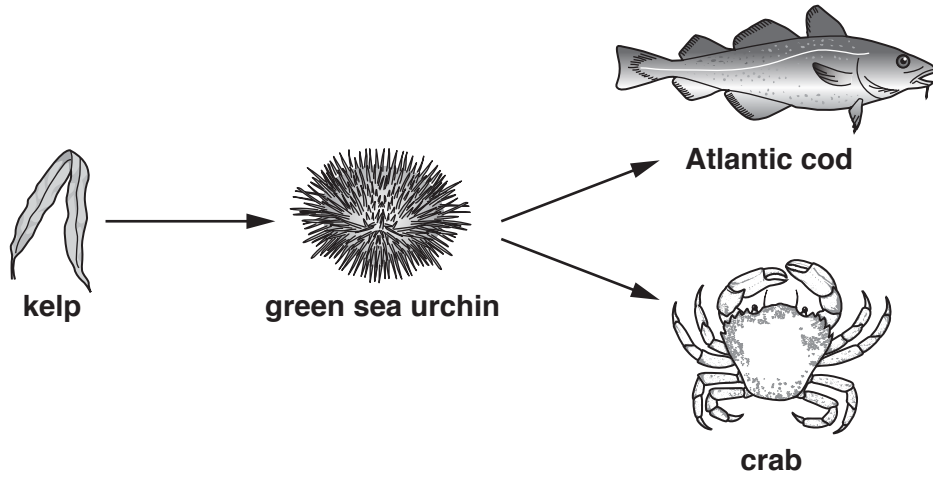


Fig. 1.1

- Atlantic cod was an important commercial catch throughout the twentieth century.
- As the cod stocks decreased in the 1990s, fishermen began to catch green sea urchins.
- Kelp now covers extensive areas of the sea bed.
- Crab populations increased due to finding shelter amongst the kelp.

(i) Use the information to explain the changes in populations of cod and green sea urchins shown in your graph on page 2.

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(ii) Explain why conservationists have warned that it will be very difficult to return the balance of the species to pre-commercial fishing levels.

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[Total: 13]

2 Chinook salmon, blue crabs and marine mussels were placed into water of different salinities. Fig. 2.1 shows the effects of this on the salinity of their internal body fluids.

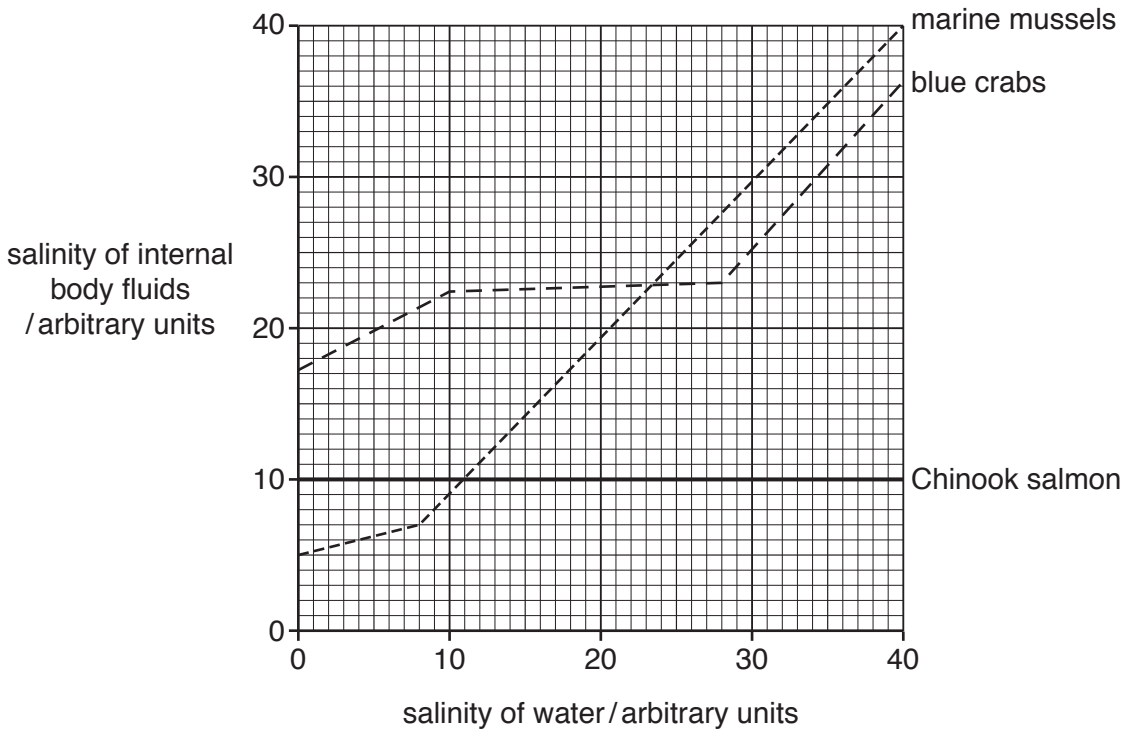


Fig. 2.1

(a) Describe the effect of increasing water salinity on the salinity of the internal body fluids of the blue crabs.

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(b) Explain the effect of increasing water salinity on the salinity of the internal body fluids of the Chinook salmon.

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- (c) The blue crab is restricted to estuarine conditions. The mussel is restricted to marine conditions.

Use the information in Fig. 2.1 to explain each of these ecological distributions.

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[Total: 7]

(b) Explain the possible ecological consequences of using marine antifouling paints.

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(c) Genetically engineered fish have recently been produced that contain a fluorescence gene from jellyfish. The fish fluoresce, glowing green, when under conditions of environmental stress such as the presence of pollution.

(i) State the meaning of the following terms.

genetic engineering

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selective breeding

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(ii) Suggest benefits **and** risks of using these fish as indicators of pollution.

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[Total: 15]

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