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

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

MARINE SCIENCE **9693/04**

Data-Handling and Free-Response **For Examination from 2009**

SPECIMEN PAPER

1 hour 15 minutes

Candidates answer Section A on the question paper.

Additional Materials: Answer Booklet/Paper

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.

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.

For Examiner's Use	
1	
2	
Total	

This document consists of **8** printed pages and **0** blank pages.

UNIVERSITY of CAMBRIDGE International Examinations

Section A

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Answer both questions in this section

1 Chilean sea bass *Dissostichus eleginoides* is a large predatory fish found in cold, deep sub-Antarctic waters. The fish can grow to more than 6 feet long and 200 lbs, and can live to be nearly 50 years old. It is a slow growing fish that does not reproduce until 10-12 years of age. Chilean sea bass is fished using a bottom trawl or longline. It became a popular seafood item in the early 1990s.

Table 1.1 shows recent catch data for this species.

Table 1.1

	total catch/ metric tonnes	fishing effort/hours	CPUE
1991/92	12500	17236	
1992/93	5788	3377	
1993/94	5648	4267	
1994/95	8911	8250	
1995/96	8740	2600	
1996/97	10371	2990	
1997/98	11170	4327	
1998/99	17278	4239	
1999/00	13689	5901	
2000/01	12733	8981	

(a) Calculate the Catch Per Unit of Effort (CPUE) for 1991 to 2001 by using the data in Table 1.1, (dividing the total catch by the fishing effort), and **write the figures in the CPUE column of the table**. [1]

(b) Plot the values for CPUE on Fig. 1.1 below, using the right hand scale.

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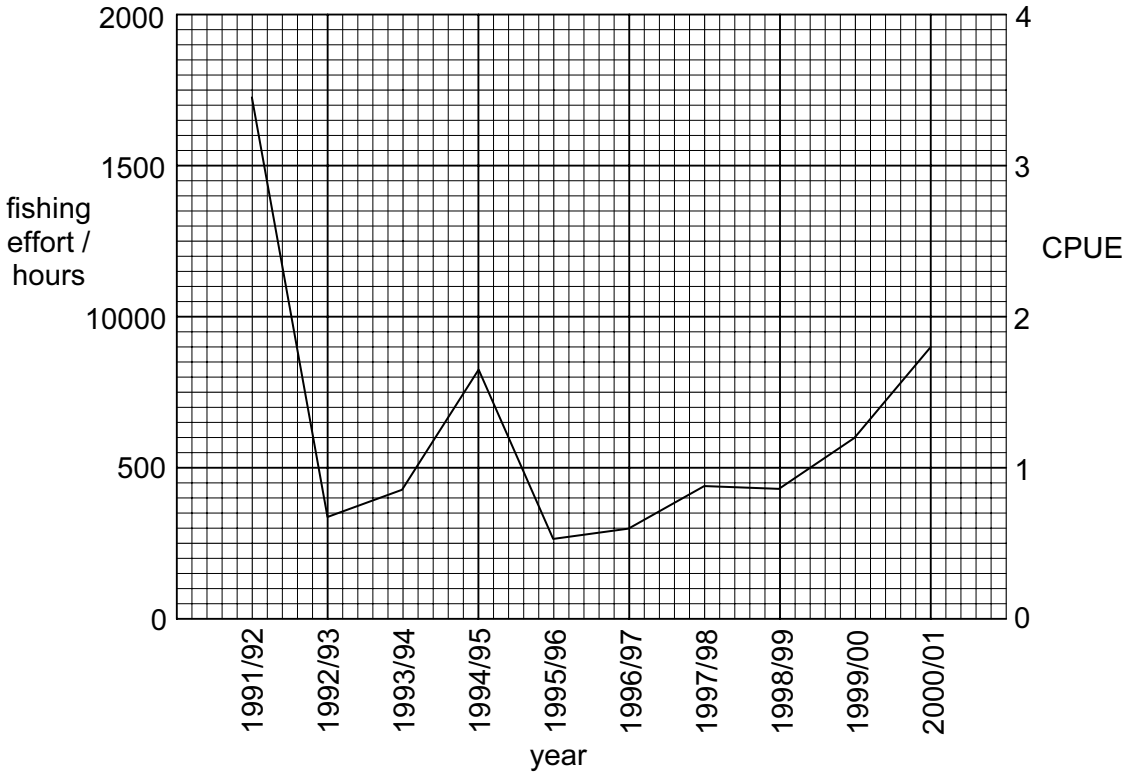

Fig. 1.1

[2]

(c) Describe the changes in total catch, fishing effort and CPUE after 1998/99.

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..... [2]

(d) Using the information provided, explain the indications that the Chilean sea bass population was becoming over-fished in the late 1990s.

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..... [2]

(e) Suggest what further data would be required to successfully manage the Chilean sea bass fishery.

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..... [3]

[Total: 10]

2 The mangrove red snapper *Lutjanus argentimaculatus* is an important market species in SE Asia. It spawns in the open sea and the larvae are planktonic while the juvenile fish are found in mangrove estuaries and freshwater streams. The ability of the juvenile fish to withstand salinity changes depends on capacity to regulate internal ionic concentration within a narrow range.

Table 2.1 summarises the concentrations of major solutes in sea water and in the blood plasma of the mangrove red snapper.

Table 2.1

	Osm (mOsm/litre)	Na^+	K^+	Ca^{2+}	Mg^{2+}	Cl^-
sea water	1000	459	10	10	53	538
mangrove red snapper	337	180	4	3	1	160

(a) Using the information provided, describe how the blood plasma of mangrove red snapper differs from sea water.

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..... [2]

(b) Explain why marine bony fish drink sea water.

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..... [2]

The salinity tolerance of the juvenile fish is associated with the development of gills. Osmoregulation is carried out by mitochondria-rich chloride cells in the gills. Na^+ K^+ ATPase (NKA) molecular pumps in the membrane of chloride cells actively transport Na^+ out and K^+ in, providing the driving force for osmoregulation.

Fig. 2.1 is a diagram of a chloride cell showing the position of an NKA pump.

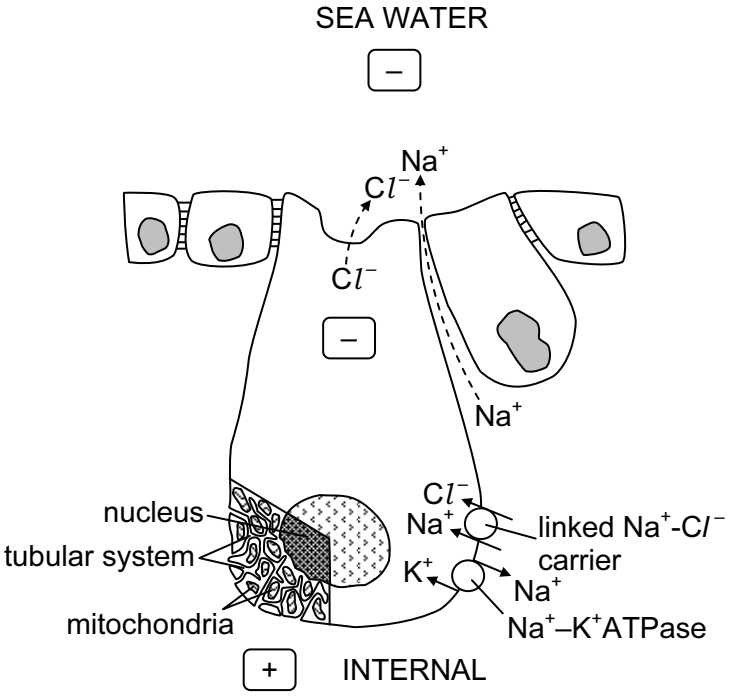

Fig. 2.1

(c) Explain why large numbers of mitochondria are needed in these cells.

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..... [2]

Fig. 2.2 shows the density of chloride cells in the gills of juvenile mangrove red snappers reared at different salinities.

For Examiner's Use

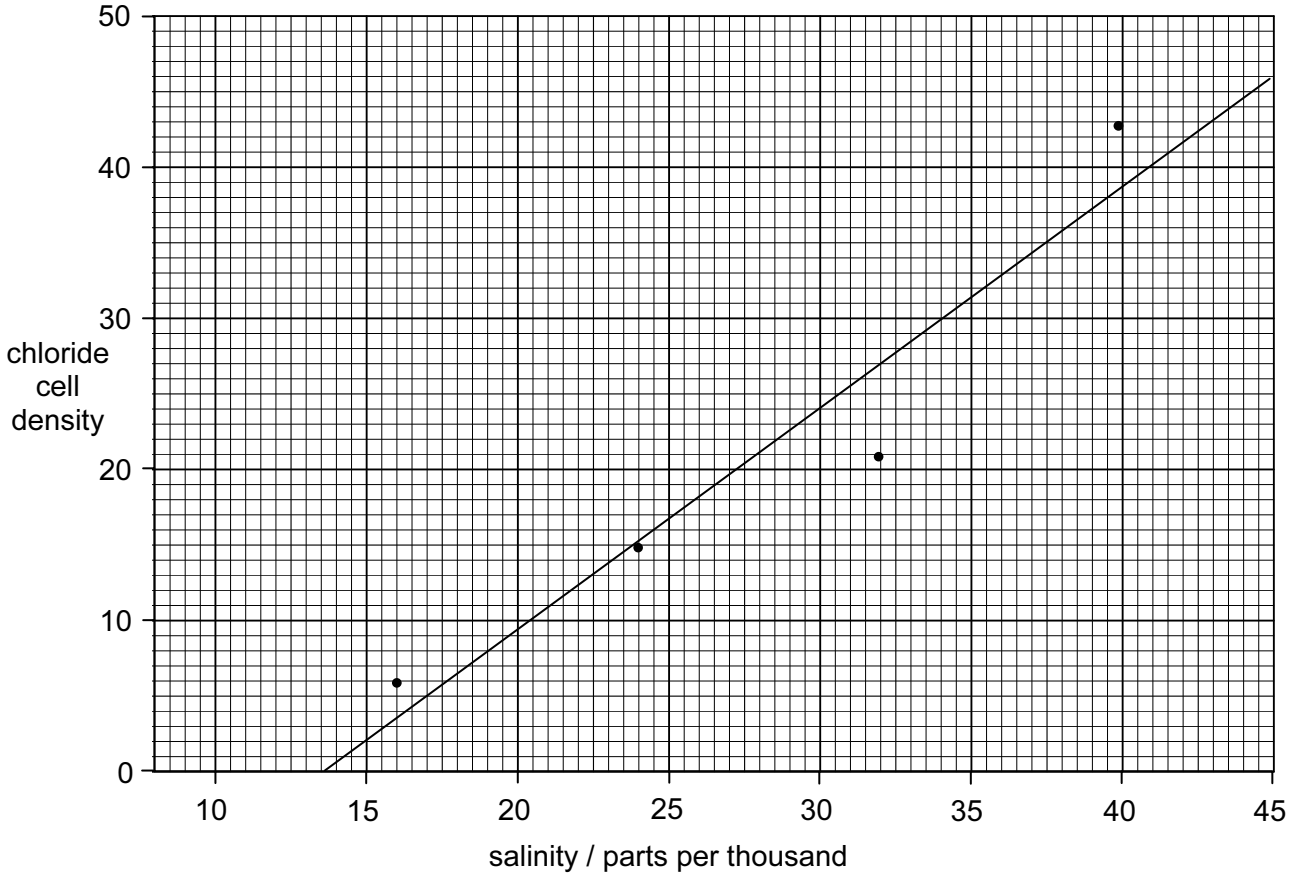

Fig. 2.2

(d) Describe how changes in salinity affect the density of chloride cells in the epithelium of the gills of juvenile fish.

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..... [2]

(e) Suggest why less food is required to maintain the growth rates of juvenile fish reared in brackish water.

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..... [2]

[Total: 10]

Section B

Answer all questions this section

3 **(a)** Explain what you understand by the term *ecotourism*. [2]

(b) Describe how different types of ecotourism may support conservation. [8]

(c) Discuss the potentially harmful effects of ecotourism that could undermine conservation. [5]

[Total: 15]

4 **(a)** Explain what you understand by the term *fertilisation*. [2]

(b) Describe the advantages of internal fertilisation and parental care of offspring in whales. [8]

(c) Discuss the disadvantages of external fertilisation and lack of parental care in tuna. [5]

[Total: 15]