CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

MARINE SCIENCE **9693/04**

Data-Handling and Free-Response

Paper 4 **May/June 2013**

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 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.

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.

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

Section B
Answer **all** questions.
Write your answers on the lined pages provided.

Electronic calculators may be used.

For Examiner's Use	
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Total	

This document consists of **11** printed pages and **1** blank page.

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International Examinations

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Section A

Answer **all** questions in this section.

1 An investigation was carried out to compare the growth rate of salmon that have been modified by genetic engineering (GM salmon) with normal "wild type" salmon.

Twenty freshly hatched GM salmon and twenty freshly hatched wild type salmon were kept in two separate tanks and given daily feeds in excess of requirements.

Salmon were weighed at regular intervals and mean masses calculated. The results are shown in Table 1.1.

Table 1.1

number of days from first feeding	mean mass of GM salmon/g	standard deviation of mean mass of GM salmon	mean mass of wild type salmon/g	standard deviation of mean mass of wild type salmon
0	10	2	15	3
250	500	25	450	31
350	1000	75	500	53
450	1700	64	625	76
550	2400	52	1100	43
650	4500	67	1600	73
750	6000	82	2500	66

(a) Plot line graphs of mean mass of salmon against number of days from first feeding. Use the same axes for both GM salmon and wild type salmon.
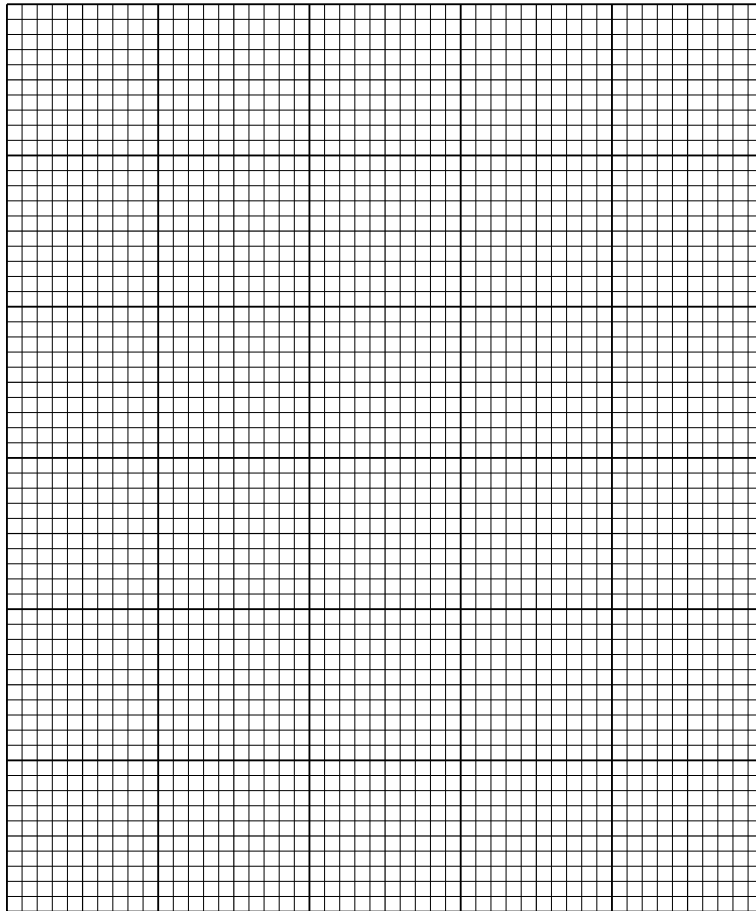
[3]

(b) (i) Use your graph and the values of standard deviation in Table 1.1 to compare the rates of growth for the GM and wild type salmon.

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(ii) Explain how genetic engineering can alter the growth rate of salmon.

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(c) A hypothesis has been proposed that keeping farmed salmon in small, restrictive tanks will lead to faster growth than in large tanks that allow unrestricted swimming.

Describe an experiment that could be carried out to test this hypothesis.

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[Total: 12]

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2 It has been suggested that desalination plants can have a negative impact on the biodiversity of nearby marine ecosystems.

The number of different marine species found in an area of coast near to a desalination plant was measured by sampling. A second, similar area, but with no desalination plant, was also assessed as a control.

In each area, the number of different species and the number of individuals of each species was determined. Some of the results of a sample are shown in Table 2.1.

Table 2.1

species	number of individuals of each species	
	near desalination plant	**control area**
long spined urchin	14	27
giant clam	8	10
feather star	8	28
red sea crab	35	2
Christmas tree worm	2	12
Mediterranean oyster	0	14

(a) With reference to Table 2.1, describe the impact of the desalination plant on the biodiversity of the local marine community.

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(b) Using your knowledge of osmoregulation in marine organisms, and the effects of desalination plants on water quality, suggest and explain reasons for the impact of the desalination plant on the local marine community.

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[Total: 8]

Section B

Answer **all** questions in this section.

Write your answers on the lined pages provided.

3 (a) Explain the ecological importance of primary producers in marine ecosystems. [4]

(b) Describe and explain the factors that influence the rate of photosynthesis of marine phytoplankton. [7]

(c) Describe and explain the effects on food chains of releasing mercury into marine environments. [4]

[Total: 15]

4 (a) Suggest and explain the impact that purse seine fishing, trawling and factory ships may have on fish stocks and habitats. [6]

(b) Explain how the replanting of mangroves can help with the rehabilitation of depleted fish stocks. [4]

(c) During the 20th century, grey seals in Scottish waters were threatened with extinction due to hunting. Successful conservation campaigns led to a dramatic increase in the population of grey seals. Whilst the population of the grey seal increased, it was noted that some other local species such as the common seal and puffin (a sea bird) decreased.

Grey seals eat a range of commercially important fish species, including cod, sand eels and haddock.

Using the grey seal as an example, together with your own knowledge, evaluate the arguments for and against conserving marine species. [5]

[Total: 15]

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