Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

CANDIDATE NUMBER | | | | |

4921866947

MARINE SCIENCE **9693/04**

Paper 4 A2 Data-Handling and Free-Response **October/November 2018**

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.

CAMBRIDGE International Examinations

Section A

Answer **both** questions in this section.

1 Surface longline fishing is a fishing method in which trawlers tow long fishing lines with baited hooks along the surface of the water. It is used to catch albacore tuna.

The catch of albacore tuna from an area of the Indian Ocean around Mauritius was recorded each month, every year, from 2005 to 2011. This information was used to calculate the mean catch of albacore tuna per month.

In order to determine fishing effort each month, the total number of hooks used to catch fish was recorded. This was used to calculate the mean number of hooks used for each month over the time period.

The results are shown in Table 1.1.

Table 1.1

month	mean albacore tuna catch/kg	standard deviation of mean albacore tuna catch/kg	mean number of hooks used	catch per unit effort /kg hook^{-1}
Jan	6200	600	720	8.6
Feb	9000	2700	1100	8.2
Mar	5800	500	680	8.5
Apr	6200	600	700	8.9
May	5800	300	680	8.5
Jun	4000	300	550	
Jul	3200	500	400	8.0
Aug	4000	800	500	8.0
Sep	5000	700	600	8.3
Oct	4500	600	550	8.2
Nov	9500	3000	1100	8.6
Dec	8500	1500	1000	8.5

(a) (i) Explain what is shown by the standard deviation of the mean albacore tuna catch.

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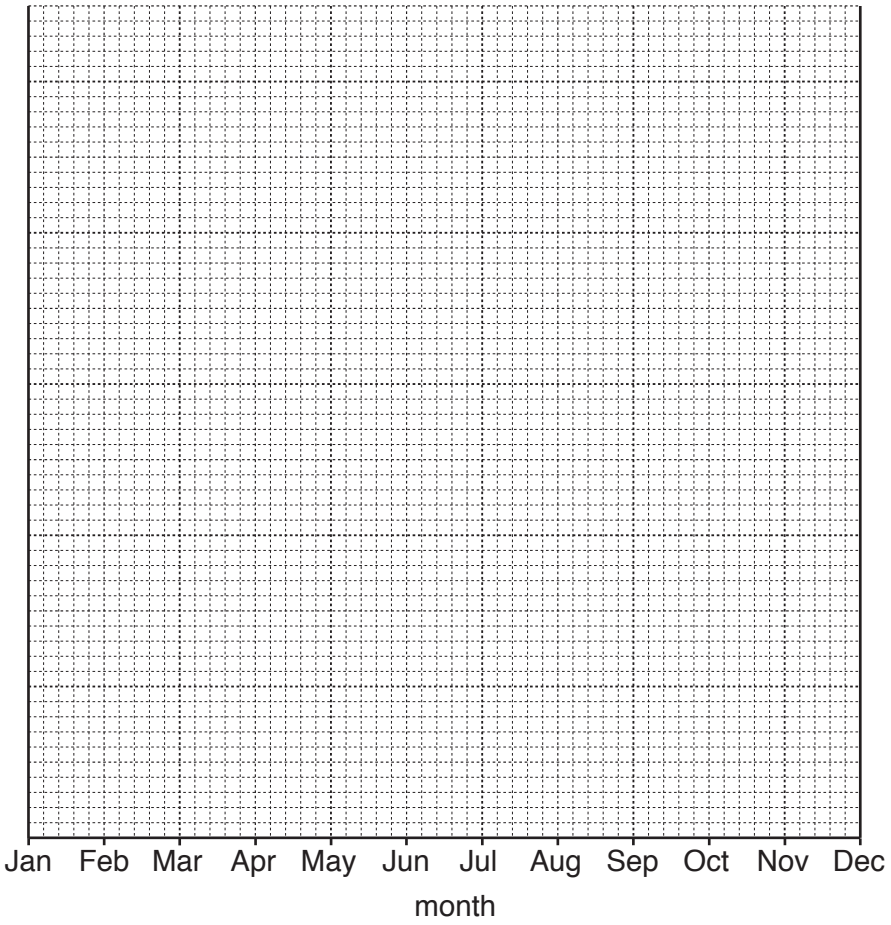
(ii) Plot a graph to show how the mean albacore tuna catch and mean number of hooks used changes. Label both *y*-axes fully and include the units.



[5]

(b) Catch per unit effort is considered to be a better comparative measure of the health of fish stocks than mean catch alone.

$$\text{catch per unit effort} = \frac{\text{mean albacore tuna catch}}{\text{mean number of hooks used}}$$

Calculate the catch per unit effort for June.

..... kg hook^{-1}
[1]

(c) In order to determine whether the albacore tuna fishing was sustainable, the catch per unit effort for each month was calculated in 2015.

Table 1.2 shows the catch per unit effort for each month during 2015.

Table 1.2

month	catch per unit effort /kg hook^{-1}
Jan	9.2
Feb	9.4
Mar	9.1
Apr	8.9
May	8.6
Jun	9.2
Jul	8.9
Aug	8.2
Sep	8.3
Oct	9.1
Nov	8.6
Dec	8.9

Discuss whether the information in Tables 1.1 and 1.2 indicates that albacore tuna fishing is sustainable.

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2 A student investigated the effect of water temperature on the ventilation rate of tilapia.

Three tilapia were placed into separate tanks of water. The number of times each fish opened its mouth within a period of thirty seconds was recorded.

The water temperature was maintained at 10 °C using a thermostatically controlled water bath.

The experiment was repeated at different temperatures.

The results are shown in Table 2.1.

Table 2.1

temperature /°C	number of times mouth opened in 30 s				mean ventilation rate /mouth openings min^{-1}
	fish 1	fish 2	fish 3	mean	
10	3	5	2	3	6
15	5	9	6	7	14
20	9	12	13		
25	11	18	11	13	26

(a) (i) Calculate the mean ventilation rate, to the nearest whole number, for fish placed in water at 20 °C.

..... mouth openings min^{-1}
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(ii) The student concluded that increasing the temperature increases the rate of ventilation.

Discuss the extent to which the data support this conclusion.

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(b) Describe how you would carry out an experiment to determine the effect of increasing carbon dioxide concentration on the ventilation rate of tilapia.

You should give full practical details including equipment and explain how you would generate valid results. Sodium hydrogencarbonate solution can be added to water to increase carbon dioxide concentration.

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Section B

Answer **both** questions in this section.

3 In 2010, the Deepwater Horizon oil platform exploded causing a large oil spill in the Gulf of Mexico. The effects of the spillage have been felt for many years since.

(a) Explain how oil on the surface of the water would have affected food webs in the open ocean.

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(b) The oil killed seagrass and large areas of mangrove around coastal areas.

Explain how the death of seagrass and mangroves could affect marine ecosystems, other than the effects on food webs.

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(c) Describe how biotechnology could be used to help clean up oil spills.

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4 Wild populations of giant clams have decreased since the 1990s.

Giant clams are now raised by aquaculture in some Pacific Islands for food, and to help in conservation efforts by releasing cultivated clams into the wild.

(a) State what is meant by the term *conservation*.

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(b) **(i)** Outline the process used for the aquaculture of giant clams.

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(ii) Explain the risks associated with releasing cultivated giant clams into the wild.

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(c) Giant clams are osmoconformers.

Explain the meaning of the term *osmoconformer* **and** explain the effects on the clams of being placed in water of very high and very low salinities.

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