

CANDIDATE  
NAME

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**MARINE SCIENCE**

**9693/04**

Paper 4 A2 Data-Handling and Free-Response

**May/June 2015**

**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 **11** printed pages and **1** blank page.

## Section A

Answer **both** questions in this section.

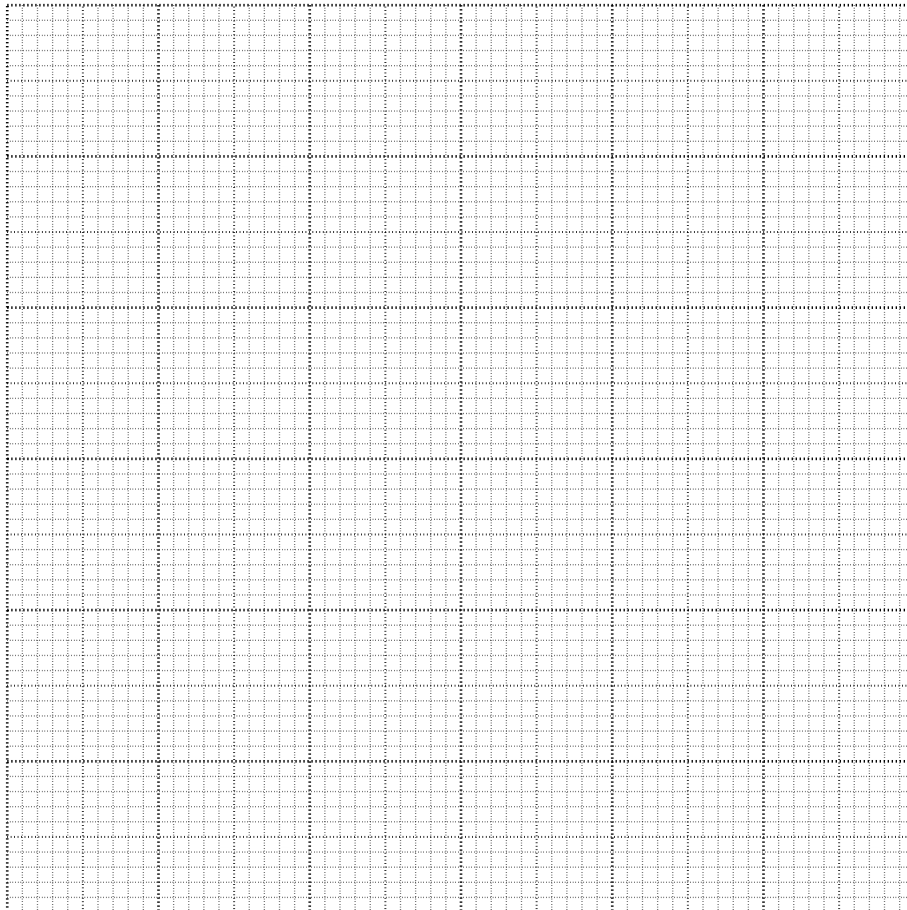
- 1 Mangrove forests in intertidal zones are considered to be areas of high ecological importance. A long term survey was carried out to investigate the change in area covered by mangroves in the Mekong Delta in Vietnam. The catch per unit effort of local fisheries in the same area was also determined.

Catch per unit effort is defined as the annual catch divided by the number of boat days.

Table 1.1

year	area of mangrove forest in Mekong Delta /hectares $\times 1000$	catch per unit effort /tonnes per boat day
1978	72	3.0
1982	85	3.1
1986	76	2.9
1990	60	2.6
1994	63	1.0
1998	69	1.2

- (a) On the grid below, plot a graph of the data in Table 1.1.







- (a) Using the formulae below, calculate the surface area:volume ratio of the egg of the kutum.

Show your working.

$$\text{surface area of sphere} = 4 \pi r^2$$

$$\text{volume of a sphere} = \frac{4}{3} \pi r^3$$

surface area: volume ratio = .....[2]

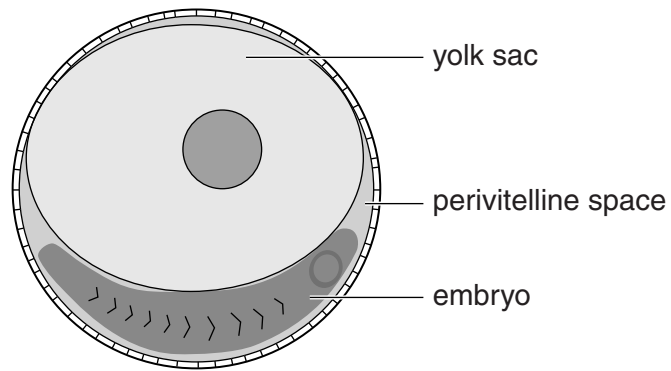
- (b) Describe how increasing egg diameter affects the surface area:volume ratio of the eggs.

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

- (c) Rainbow trout and brown trout eggs require clean, running water with a high oxygen concentration to survive. Using Table 2.1 and your own knowledge, suggest and explain reasons for this.

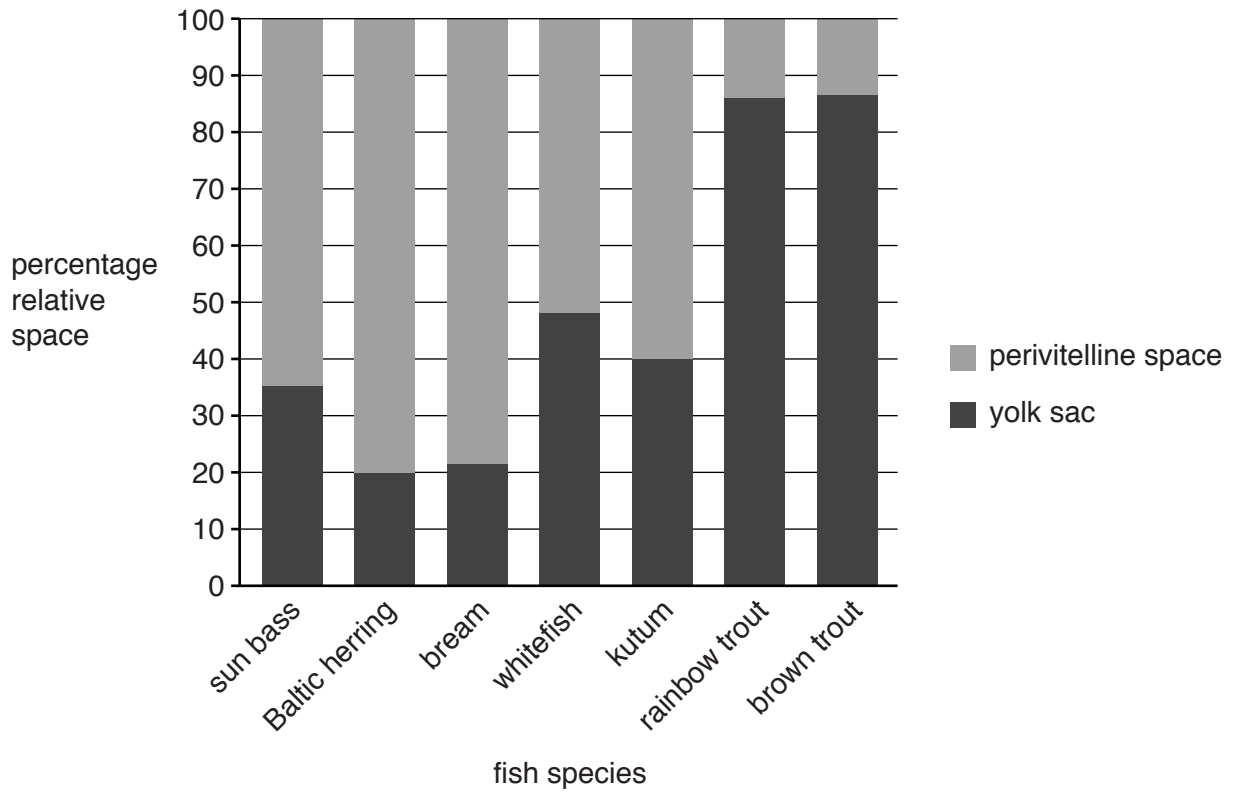
.....  
 .....  
 .....  
 .....[2]

- (d) Fish eggs consist of several parts including a yolk sac, perivitelline space and embryo as shown in Fig. 2.1.



**Fig. 2.1**

A further investigation was carried out into the relative space in the egg taken up by the yolk sac and by the perivitelline space. The results are shown in Fig. 2.2.



**Fig. 2.2**

The yolk sac contains nutrients that the fish uses during embryonic development and the first few days of free swimming life.

Suggest and explain **one** factor that may affect the size of the yolk sac that the different species possess.

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.....

.....

.....[2]

[Total: 7]











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