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

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

5466176767

MARINE SCIENCE **9693/03**

Structured Questions **May/June 2011**

Paper 3

1 hour 30 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.
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	
3	
4	
5	
6	
7	
Total	

This document consists of **14** printed pages and **2** blank pages.

For Examiner's Use

1 **(a)** Gross productivity is the total carbon fixed by a plant per unit time.

Net primary productivity is calculated by subtracting the carbon used by the plant in respiration from the gross productivity.

The effect of depth on net productivity of a marine alga was investigated at two different temperatures. The results of the investigation are shown in Fig. 1.1.

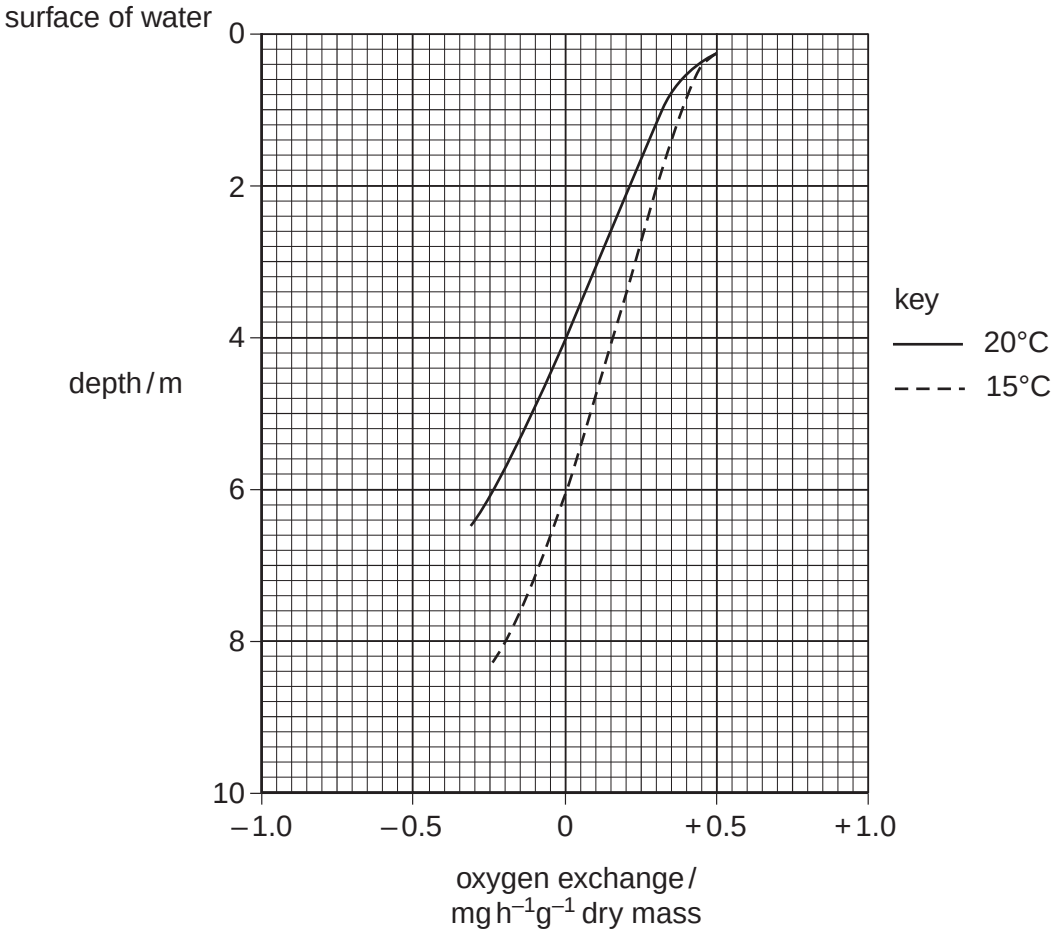

Fig. 1.1

Suggest why net primary productivity is more useful than gross productivity to compare the productivity of different seas.

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..... [1]

(b) **(i)** Explain why oxygen uptake can be used to measure net primary productivity.

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..... [2]

(ii) With reference to Fig. 1.1 describe the relationship between net primary productivity and depth. Suggest an explanation for this relationship.

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.....[3]

(c) Compensation point occurs when oxygen exchange is zero.

With reference to Fig. 1.1 state the depth in the water at which the alga reaches compensation point at each of the following temperatures.

(i) 15 °C depth …… m

(ii) 20 °C depth …… m [2]

(iii) Suggest an explanation for this difference in depth.

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.....[3]

(iv) The surface temperature of a tropical sea is between 20 to 24 °C and the surface temperature of temperate sea is between 6 to 8 °C.

Suggest how the temperature difference between these seas would affect their productivity. Explain your answer.

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.....[2]

[Total: 13]

2 **(a)** The oxygen consumption of shore crabs was investigated in different oxygen concentrations. The oxygen consumption of three inactive shore crabs was measured. Each crab had a different mass.

For Examiner's Use

The results are shown in Fig. 2.1.

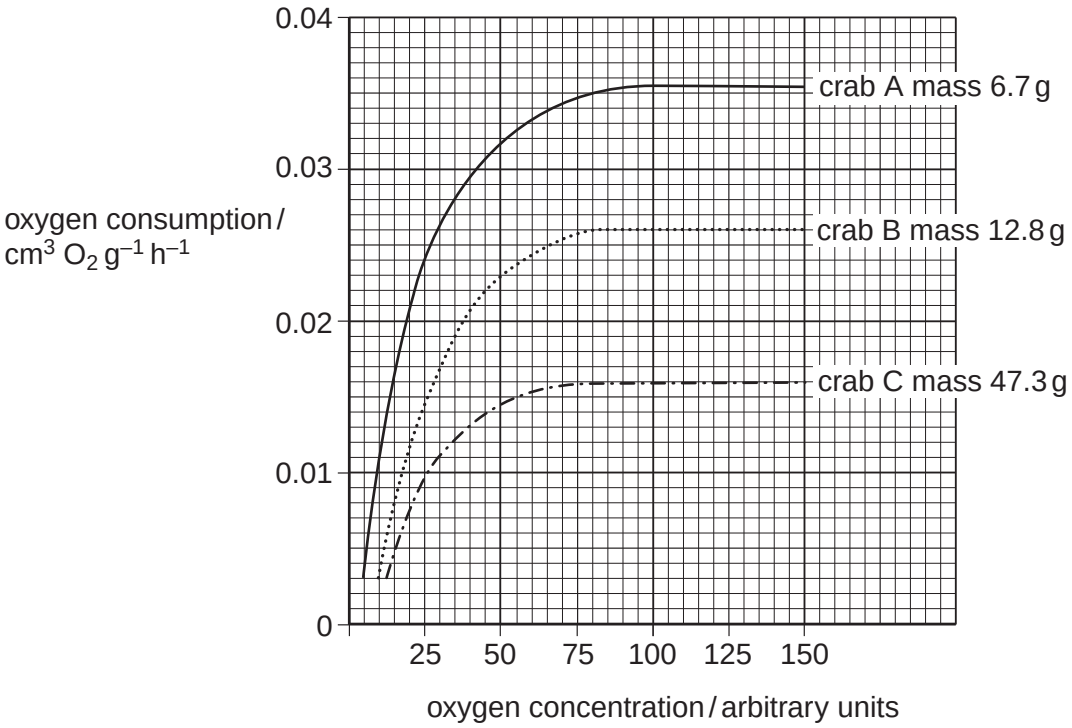

Fig. 2.1

(i) With reference to Fig. 2.1 describe the relationship between oxygen consumption and body mass.

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..... [2]

(ii) Between 80 to 150 arbitrary units, the oxygen consumption is independent of the oxygen concentration.

Suggest how these crabs can maintain constant oxygen consumption over this range of oxygen concentration.

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..... [3]

(b) In another investigation, oxygen consumption was measured in these shore crabs during a period of activity.

For Examiner's Use

Suggest what effects activity would have on the oxygen consumption of the crabs. Explain your answer.

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.....[4]

[Total: 9]

3 **(a)** Table 3.1 shows information about the breeding of three different types of tuna and of the North Atlantic salmon.

For Examiner's Use

Table 3.1

breeding information	type of fish			
	Skipjack tuna	**Southern Bluefin tuna**	**Yellowfin tuna**	**North Atlantic salmon**
sexual maturity	1 year	6 – 7 years	2 – 3 years	4 – 5 years
spawning	all year in tropical waters yearly in temperate waters	yearly or less	all year in tropical waters twice per year in temperate waters	yearly 90 to 95% die after one spawning
spawning grounds	many locations in ocean	one location in ocean	many locations in ocean	upstream in home river
number of eggs	100 000 – 2 000 000	3 – 5 000 000	2 – 3 000 000	500 000 – 800 000
egg development	ocean surface	ocean surface	ocean surface	nests in river bed

(i) Using the information in Table 3.1, state which type of fish has the highest fecundity. Give a reason for your answer.

type of fish .....

reason .....

.....[1]

(ii) State **two** differences between breeding in tuna and salmon.

1 .....

.....

2 .....

.....[2]

(b) Many tuna stocks are overfished. Using the information in Table 3.1 suggest which type of tuna would benefit most from closed fishing areas. Explain your answer.

type of tuna .....

explanation .....

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.....

.....[3]

(c) **(i)** North Atlantic salmon living in colder areas stay in the river longer before entering the sea. They also remain in the sea longer before returning to the river.

Suggest an explanation for this.

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.....[2]

(ii) Suggest why most wild salmon fishing is carried out as the fish swim upriver to spawn.

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.....[2]

[Total: 10]

[Turn over

For Examiner's Use

4 **(a)** State what is meant by the term *sustainable fishing.*

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.....[2]

(b) A global supermarket chain has proposed plans to support sustainable fishing.

The basis of the plan is to buy fish only from fisheries that use sustainable methods and have been certified by the Marine Stewardship Council (MSC).

The supermarket chain could then create a 'MSC brand image' to encourage their customers to buy this fish at a slightly increased price.

(i) Suggest **one** reason why a global supermarket chain would be interested in supporting sustainable fishing.

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.....[1]

(ii) Suggest **one** reason why their customers might buy fish with the 'MSC brand image' at a higher price.

.....

.....[1]

(iii) Suggest **one** benefit MSC fishermen might gain if this plan were carried out.

.....

.....[1]

(c) A large fishery in a small coastal town plans to change to sustainable fishing over a period of 5 years.

(i) State **one** short-term problem of this fishery changing to sustainable fishing.

.....

.....[1]

(ii) Suggest the long-term benefits of sustainable fishing to the whole community of the town where the fishery is located.

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.....[2]

[Total: 8]

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5 Aquaculture systems can achieve high efficiency by a high stocking density (a large number of fish per unit volume). This may reduce the oxygen content of the water.

For Examiner's Use

Fig. 5.1 shows the saturated oxygen content of fresh water and sea water at different temperatures.

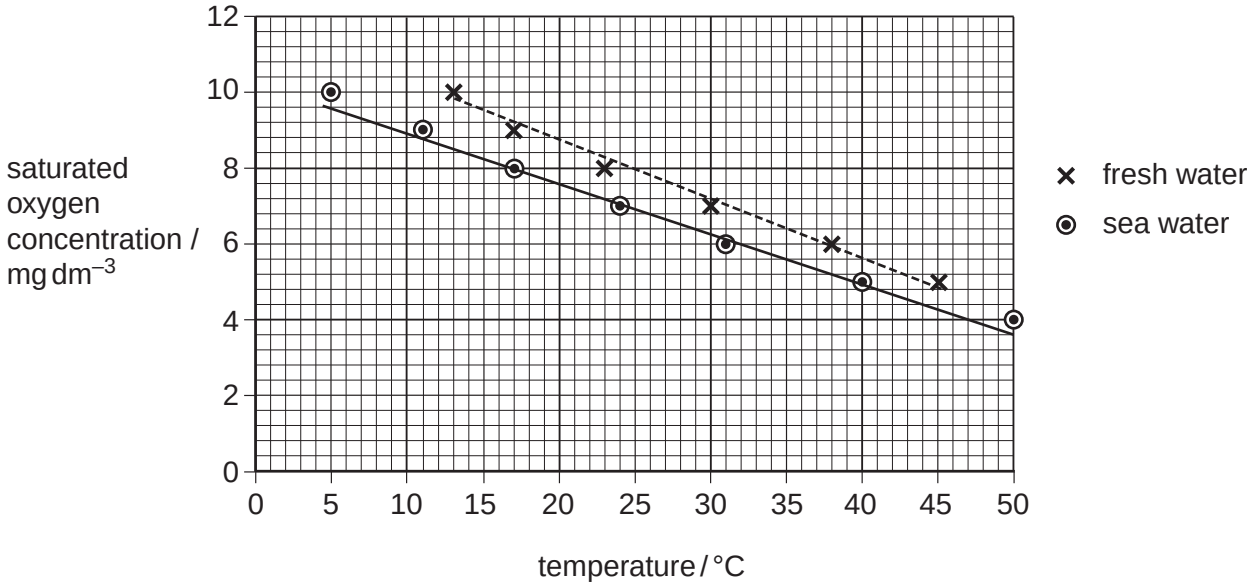

Fig. 5.1

(a) The effect of stocking density on oxygen saturation by the milk fish *Tilapia* was tested using different tanks.

One tank contained sea water at 30 °C and the other contained freshwater at 15 °C.

(i) Use the information in Fig. 5.1 to find the saturated oxygen concentration in each of the following.

seawater at 30 °C .....

freshwater at 15 °C ..... [2]

(ii) The stocking density that halves oxygen saturation in 1 hour was measured.

In sea water at 30 °C this was 1.5 kg m^{-3} *Tilapia* and in fresh water at 15 °C this was 4.6 kg m^{-3} *Tilapia*.

Suggest an explanation for this difference.

.....

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..... [2]

(iii) State **two** different methods by which the oxygen content could be maintained in an aquaculture system. Explain the advantages of each system.

method 1 .....

advantages .....

.....

method 2 .....

advantages .....

.....[4]

(b) Table 5.1 gives information about different foods tested on *Tilapia.*

Table 5.1

food	percentage protein content	cost / pence kg^{-1}	percentage feed efficiency	percentage protein efficiency
high protein pellets	65	75	35	6.5
low protein pellets	45	50	29	7.6
milling waste	15	15	13	10.2

The feed efficiency is the conversion of dry food mass eaten to wet fish mass gained.

The protein efficiency is the conversion of dry protein eaten to dry mass tissue protein.

(i) Use the information in Table 5.1 to suggest **one** reason for the variation in percentage feed efficiency.

.....

.....[1]

(ii) Use the information in Table 5.1 to suggest why there is variation in the percentage protein efficiency.

.....

.....[1]

(c) Suggest **one** factor, other than cost, that would be considered before choosing a diet for *Tilapia*.

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.....[1]

[Total: 11]

[Turn over

For Examiner's Use

6 **(a)** Antifouling paint is used on ships and boats. It is a source of marine pollution.

Explain why antifouling paint is used.

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.....[2]

(b) Tributyltin (TBT) was first used in the 1970's. It has broad spectrum toxicity and was also used for treating wooden lobster pots and marine aquaculture equipment.

TBT is an organic form of tin that is absorbed more easily than the inorganic ion. TBT has longer lasting effects than those of the copper and mercury compounds used previously.

(i) Suggest what is meant by the term *broad spectrum toxicity.*

.....

.....

.....[2]

(ii) TBT is known to enter marine food chains Suggest **one** reason why TBT may be found in high concentrations in carnivorous fish.

.....

.....[1]

(c) Since its introduction, the concentration of TBT in the sea has increased. Coastal waters have higher concentrations than the open sea. TBT binds to sediments so they retain higher concentrations than water.

(i) Suggest why coastal waters have higher concentrations of TBT than the open sea.

.....

.....[1]

(ii) In 1989 the use of TBT was restricted to vessels of more than 25 m in length. However, concentrations of TBT still remain high in the marine environment.

Suggest **one** reason for this.

.....

.....[1]

(d) The effect of TBT has been studied in a number of species of marine molluscs.

For Examiner's Use

Fig. 6.1 shows the effect of TBT on the growth of oysters exposed to different concentrations of TBT, measured in $\mu g\,dm^{-3}$.

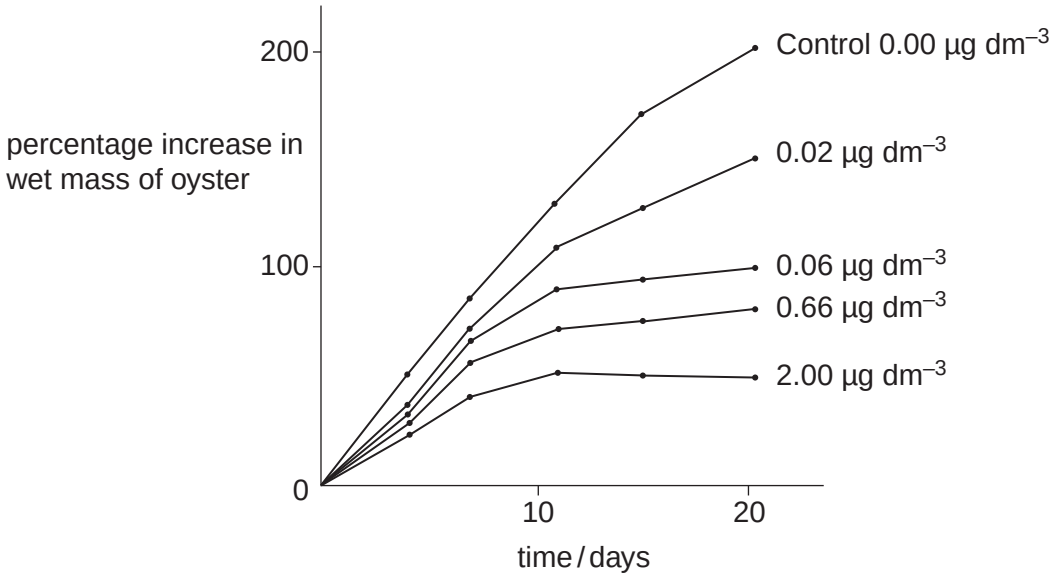

Fig. 6.1

(i) Describe the trend shown by these results.

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..... [1]

(ii) Suggest the likely effect of increased TBT in the marine environment on oyster culture.

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..... [2]

[Total: 10]

7 Fig. 7.1 shows a marine conservation area. This includes the land and the surrounding sea. There are different protection zones in which different activities are permitted.

For Examiner's Use

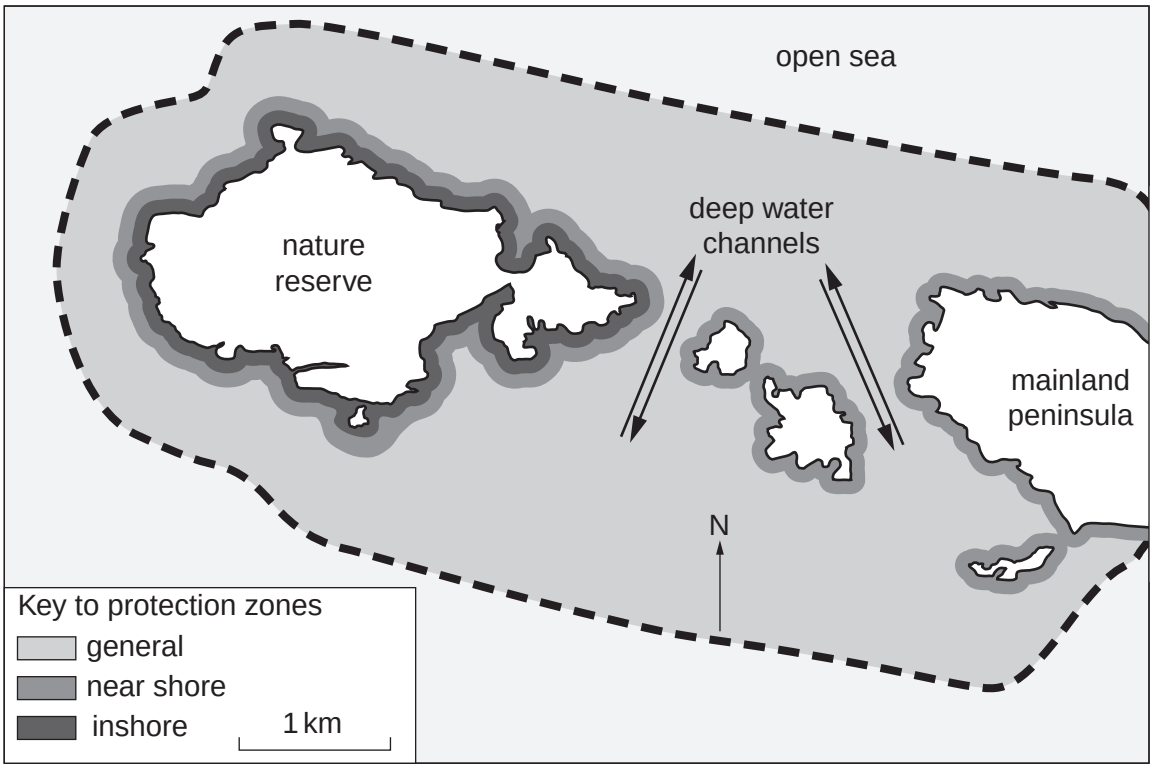

Fig. 7.1

Table 7.1 shows some of the activities permitted and not permitted in the different protection zones.

Key		
	permitted	✓
	not permitted	✗

protection zone	leaving litter	recreation					commercial fishing		
		diving	wreck salvage	midwater angling	speed boats	shellfish collecting	trawling	netting	potting
general	✗	✓	✗	✓	✗	✗	✗	✓	✗
near shore	✗	✓	✗	✓	✗	✗	✗	✓	✗
inshore	✗	✓	✗	✓	✗	✗	✗	✗	✗

(a) Assume that the shape of this marine conservation area is rectangular. Estimate the approximate area of the reserve. Show your working.

[3]

(b) (i) Suggest **two** reasons why the whole area may have been made a marine conservation area.

1 .....

.....

2 .....

.....[2]

(ii) State which zone of the marine conservation area has the greatest protection. Suggest a reason for this high level of protection.

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.....[2]

(c) (i) Suggest why commercial trawling is not permitted anywhere in this marine conservation area.

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.....[2]

(ii) Suggest why only one type of commercial fishing is allowed in part of this conservation area.

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.....[2]

(d) For each of the following recreational activities, suggest a reason for the type of permission given.

(i) wreck salvage is not permitted .....

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(ii) mid-water angling is permitted .....

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(iii) speedboats are not permitted .....

.....[3]

[Total: 14]

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