OCR
RECOGNISING ACHIEVEMENT

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
Advanced GCE

BIOLOGY

2805/03

Environmental Biology

Thursday **20 JUNE 2002** Afternoon 1 hour 30 minutes

Candidates answer on the question paper.
Additional materials:
Electronic calculator

Candidate Name	Centre Number	Candidate Number

TIME 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

- Write your name in the space above.
- Write your Centre number and Candidate number in the boxes above.
- Answer **all** the questions.
- Write your answers, in blue or black ink, in the spaces on the question paper.
- Read each question carefully before starting your answer.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [ ] at the end of each question or part question.
- You will be awarded marks for the quality of written communication where this is indicated in the question.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	15	
2	15	
3	15	
4	15	
5	15	
6	15	
TOTAL	90	

This question paper consists of 18 printed pages and 2 blank pages.

Registered Charity Number: 1066969
[Turn over

Answer **all** questions.

1 The management of North Sea fisheries involves investigations by scientists in the UK in order to assess the impact that fishing has on fish population sizes.
The Spawning Stock Biomass (SSB) is the total mass of a species population capable of reproducing.
Fig. 1.1 shows the changes in SSB of cod populations in three fishing areas around the UK between 1968 and 1998.

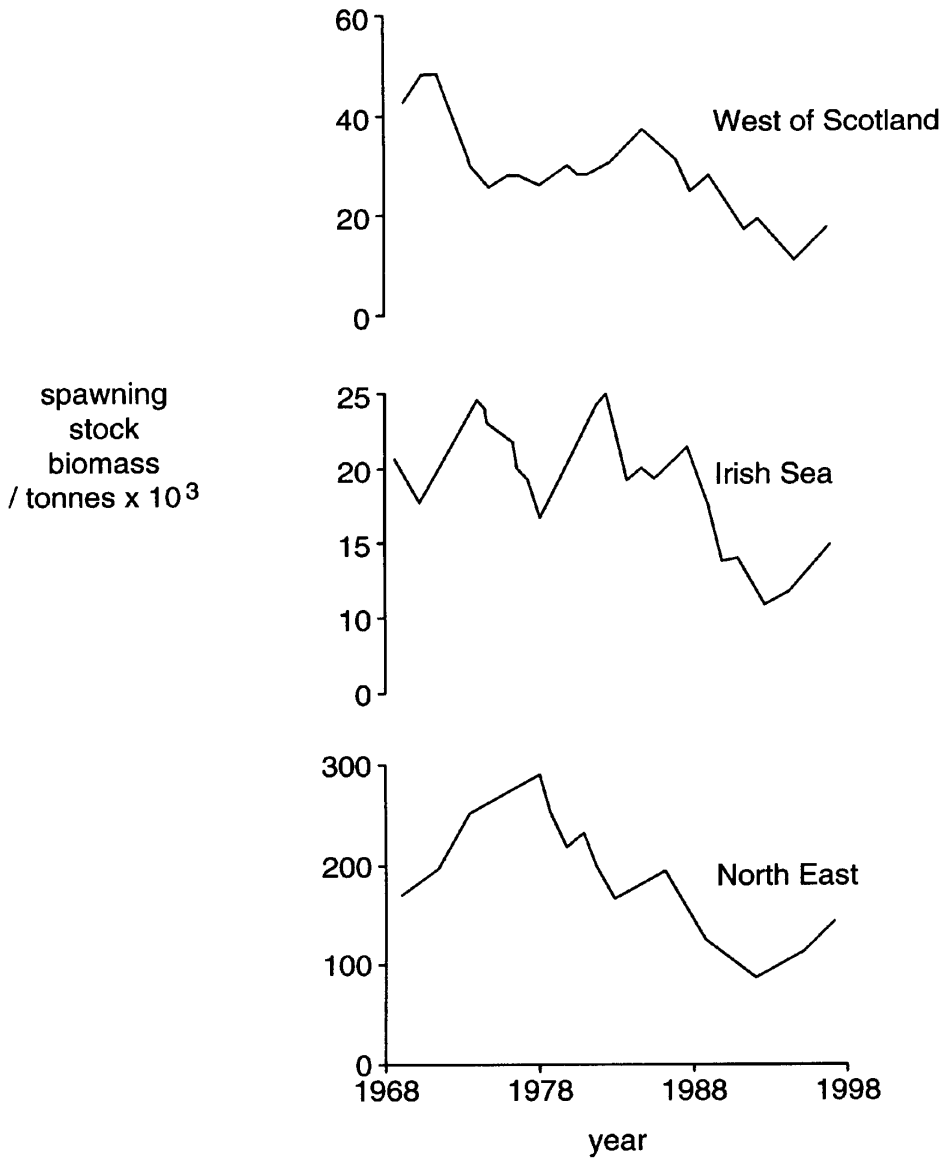

Fig. 1.1

(a) State **three** factors which could have contributed to the fluctuations in the SSB figures for these fish populations.

1 .....

2 .....

3 .....

[3]

The decline in the SSB in all these areas suggests that the intensity of cod fishing in these areas is no longer sustainable.

(b) Explain what is meant by *sustainable* fishing.

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Fig. 1.1 shows that, by 1998, the SSB began to increase in all three fishing areas. This was a result of various measures imposed on the fishing industry by the European Union.

(c) List **three** such measures which allowed the cod population to increase.

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[3]

(d) Explain why some of these measures have been controversial.

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One way of estimating fish population sizes is to use the capture-recapture method. In such an operation on North Sea cod, 800 fish were tagged and returned to the sea. Over the next six weeks, 160 tagged fish were recaptured out of an estimated catch of 20 000 fish.

(e) Calculate the estimated size of the cod population in this area. Show your working.

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(f) List **two** assumptions that are made when using the capture-recapture method.

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2 .....

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[2]

[Total : 15]

2 During the late 1950s, cereal seeds were treated with insecticides, such as DDT and dieldrin. As well as killing insects, these compounds caused the death of many other species, including long-tailed field mice, which ate the treated seeds. Table 2.1 shows the results of an investigation during which dieldrin levels were measured in a number of mice trapped both before and after treated seeds were sown.

Table 2.1

	mean concentration of dieldrin per mouse / parts per million
before seed treatment	0.19
after seed treatment	11.51

(a) (i) Calculate the mean percentage increase in dieldrin concentration in these mice. Show your working.

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(ii) Explain how this increase in concentration has come about.

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At about the same time, populations of birds of prey, such as peregrine falcons, also fell dramatically. This was largely the result of poor reproductive rates.

(b) Explain how this decline in peregrine falcon numbers was linked to the increased dieldrin levels in mice.

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[Turn over

Another species in decline in the UK during the twentieth century was the red squirrel. At the same time, the grey squirrel, which was introduced into the UK during the nineteenth century, has taken over the habitats of the red squirrel. It is not absolutely clear why the grey squirrel has replaced the red squirrel, but the decline of the red squirrel is a good example of competitive exclusion.

(c) Explain what is meant by

(i) *habitat*;

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(ii) *competitive exclusion.*

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Fig. 2.1 shows the changes in populations of red and grey squirrels in Scotland and Wales between 1973 and 1989. The lines in Fig. 2.1 show changes in comparison with the populations in 1973.

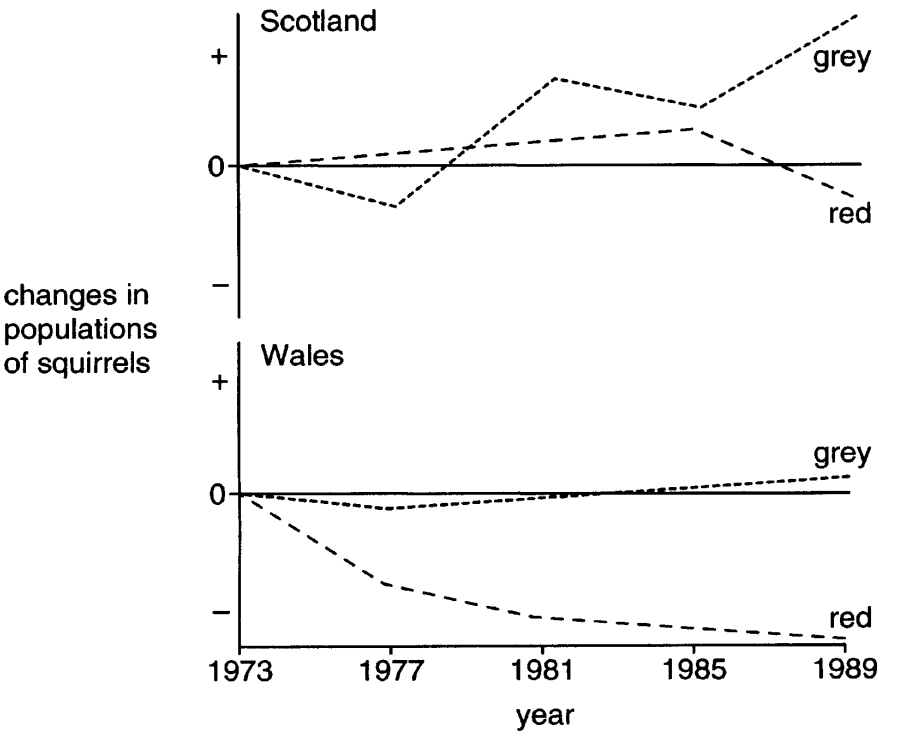

Fig. 2.1

(d) With reference to Fig. 2.1,

(i) describe the changes in squirrel populations in Scotland and Wales;

Scotland .....

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Wales .....

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[2]

(ii) suggest **two** reasons for the different trends in each country.

1 .....

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2 .....

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[2]

[Total : 15]

3 Many countries have signed the Convention on International Trade in Endangered Species (CITES) agreement.

(a) State **three** of the difficulties which have occurred in trying to implement this agreement.

1 .....

2 .....

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[3]

Between 1970 and 1987, numbers of the African elephant, *Loxodonta africana*, fell from around 3 000 000 animals to 700 000. In the case of this species, the CITES agreement has proved very successful. Since 1987, numbers have stabilised, or even increased, in several countries.

(b) Explain how the CITES agreement helped to save the elephants.

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As well as animals, many plant species are also in decline. Destruction of tropical rain forest is contributing considerably to this.

(c) Discuss the reasons why there is so much concern about the destruction of tropical rain forest and why it is important that this is halted. (*In this question, 1 mark is available for the quality of written communication.*)

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For Examiner's Use

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QWC [1]

[Total : 15]

[Turn over

4 Table 4.1 shows the results of a belt transect analysis carried out by students to investigate the distribution of four common species of the periwinkle, *Littorina*, on a rocky shore. Fig. 4.1 shows the same data drawn as kite diagrams.

Table 4.1

Abundance scale: 1 = 1; 2–4 = 2; 5–9 = 4; 10–14 = 6; 15–19 = 8; > 20 = 10.

height above low water / m	*Littorina neritoides*		*Littorina saxatilis*		*Littorina littorea*		*Littorina littoralis*	
	number	abundance scale	number	abundance scale	number	abundance scale	number	abundance scale
10	63	10						
9	54	10						
8	7	4	3	2				
7			8	4	1	1		
6			17	8	3	2	2	2
5			6	4	13	6	9	4
4			1	1	6	4	16	8
3					2	2	5	4
2					1	1	1	1
1								
0								

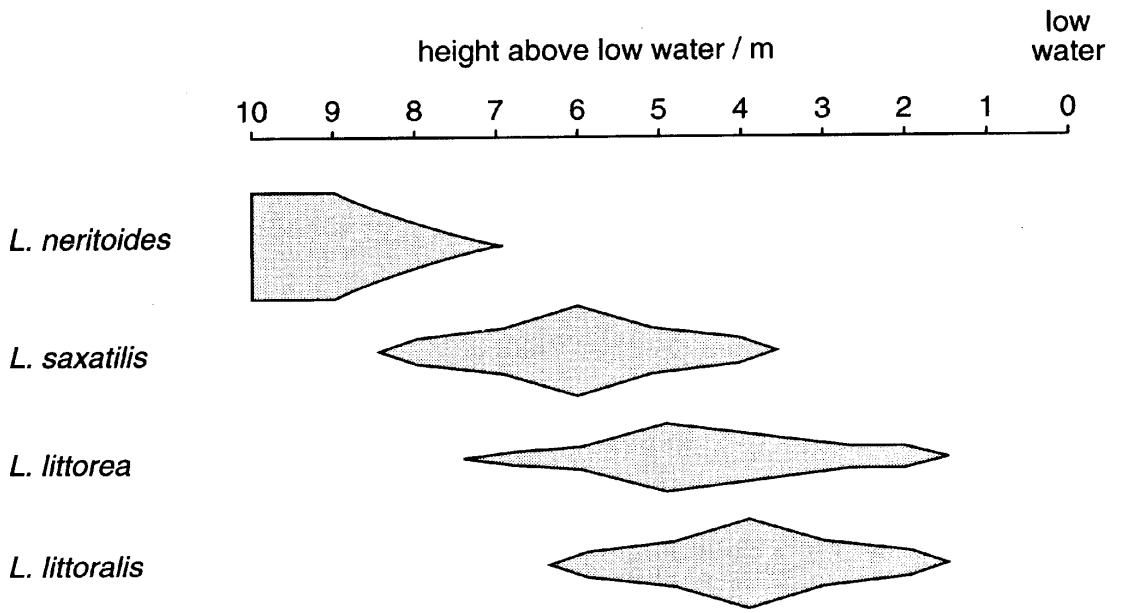

Fig. 4.1

(a) **(i)** Describe how such a belt transect would be carried out in order to obtain these data.

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(ii) Explain why a line transect would **not** provide data which could be plotted as a kite diagram.

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(b) With reference to Fig. 4.1, explain how interspecific competition may influence the distribution of these four species of periwinkle.

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An alternative way to investigate abundance is to use a random sampling method.

(c) (i) Describe **one** method of taking random samples.

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(ii) Explain why random sampling would **not** be an appropriate method for investigating the distribution of periwinkles on a rocky shore.

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[Total : 15]

5 A student took a series of water samples at various points along a river and determined the Biological Oxygen Demand (BOD) for each sample. At each sampling station, the most abundant organisms present in the water were also noted.
Fig. 5.1 indicates the positions of the sampling stations and Table 5.1 shows the information gained from each sample.

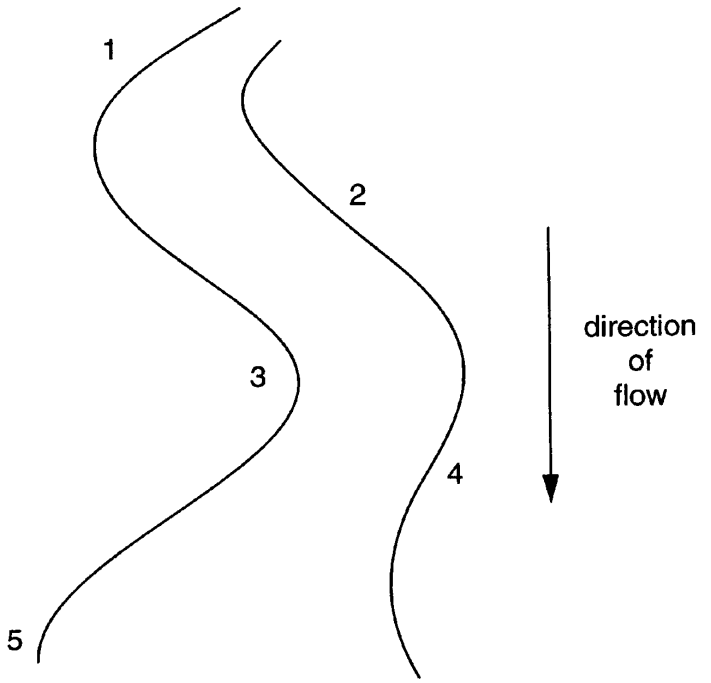

Fig. 5.1

Table 5.1

sampling station	most abundant organisms present	BOD mg dm^{-3}
1	*Tubifex* worms	260
2	*Chironomus*	140
3	*Asellus*	80
4	*Gammarus*	24
5	mayfly nymphs	3

(a) (i) State what is meant by BOD.

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(ii) Explain how BOD is measured.

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(b) Explain what is meant by an *indicator species*.

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(c) With reference to the information given in Table 5.1, explain

(i) how the organisms listed may be used as indicator species in other rivers;

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(ii) the changes in BOD between sampling stations 1 to 5.

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[Total : 15]

6 Fig. 6.1 shows levels of world inorganic fertiliser use since 1950.

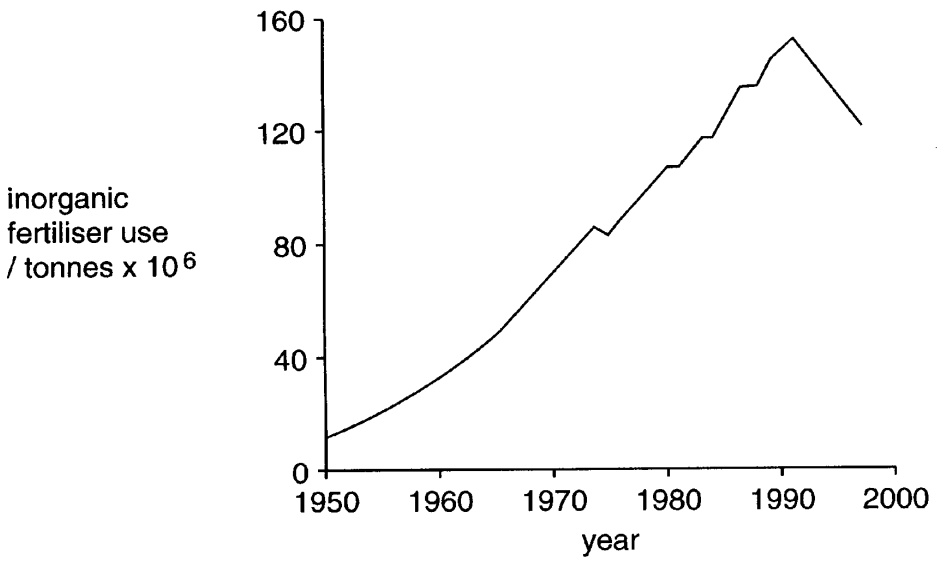

Fig. 6.1

The increasing use of inorganic fertilisers is known to be a cause of eutrophication of lakes and ponds.

(a) Explain the sequence of events which begins with the application of fertiliser and ends with the death of fish. (*In this question, 1 mark is available for the quality of written communication.*)

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QWC [1]

(b) Suggest **one** reason, other than the change to organic production, for the decrease in the use of inorganic fertilisers in the 1990s.

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(c) Discuss the advantages and disadvantages of organic farming.

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[Total : 15]