INTERNATIONAL BACCALAUREATE
BACCALAURÉAT INTERNATIONAL
BACHILLERATO INTERNACIONAL

ENVIRONMENTAL SYSTEMS
STANDARD LEVEL
PAPER 3

Name

Number

Friday 12 May 2000 (morning)

1 hour 15 minutes

INSTRUCTIONS TO CANDIDATES

- Write your candidate name and number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Section I: Answer one Option from Section I in the spaces provided.
- Section II: Answer two Options from Section II in the spaces provided.
- You may continue your answers in a continuation answer booklet, and indicate the number of booklets used in the box below. Write your name and candidate number on the front cover of the continuation answer booklets, and attach them to this question paper using the tag provided.
- At the end of the examination, indicate the letters of the Options answered in the boxes below.

OPTIONS ANSWERED		EXAMINER	TEAM LEADER	IBCA
SECTION I	. . . .	/15	/15	/15
SECTION II	. . . .	/15	/15	/15
SECTION II	. . . .	/15	/15	/15
NUMBER OF CONTINUATION BOOKLETS USED	. . . .	TOTAL /45	TOTAL /45	TOTAL /45

SECTION I

Options on analysing ecosystems – Options A, B and C

The compulsory question below relates to the detailed study of an ecosystem in either a marine, terrestrial or freshwater environment.
*Select the ecosystem on which you will base your answers by marking (×) **one** box only.*

A	MARINE	pelagic	neritic	bathyal	littoral	mangroves	coral reefs
		. . . .	. . . .	. . . .	. . . .	. . . .	. . . .

B	TERRESTRIAL	tropical forest	temperate forest	tropical grassland	temperate grassland	desert	tundra
		. . . .	. . . .	. . . .	. . . .	. . . .	. . . .

C	FRESHWATER	lakes	rivers	bogs	swamps	marshes	estuaries
		. . . .	. . . .	. . . .	. . . .	. . . .	. . . .

1.   Name an organism in the ecosystem which you have investigated:

. . . .

(a)   Using the diagram below, discuss the **biotic** factors influencing this organism.

Disease		Competition

Organism

Food

Predation/
Herbivory

──────────────►   Direct effect

- - - - - - - - - - ►   Indirect effect   *[5]*

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(This question continues on the following page)

(Question 1 continued)

(b) For the named organism, draw a food-web diagram below to show the relationships between the organism and at least **six** other organisms in the ecosystem. Next to the name of each organism you show, state the trophic level to which it belongs. *[4]*

(c) Describe how you would determine the biomass of the named organism. *[3]*

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(d) Describe how you would determine the gross productivity of the named organism. *[3]*

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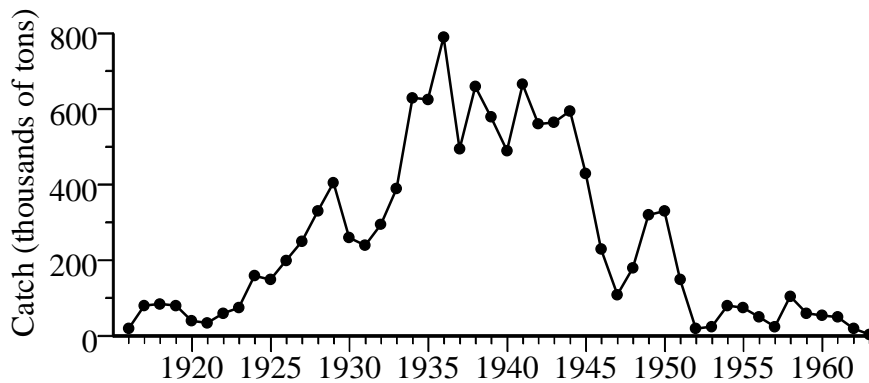
SECTION II

*This section contains a question on each of Options D, E and F. Answer **two** of these questions, related to your chosen options.*

Option D – Impacts of resource exploitation

2. The graph below shows the annual catch (in thousands of tonnes) of sardines (a small fish) from the Pacific coast of North America from 1916 to 1963.

(a) Describe and explain the shape of the graph. *[4]*

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(b) Give **one** advantage and **one** disadvantage of fish as a source of human food. *[2]*

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(This question continues on the following page)

(Question 2 continued)

(c)   Name a commercial farming system (aquatic or terrestrial) and name a traditional food production system (in a comparable environment – aquatic or terrestrial).   Compare the efficiency, energy use, and impacts on the environment of the two systems.   *[6]*

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(d)   About one third of the global catch of fish is turned into animal food supplements or fertilisers.   Discuss the efficiency of this in terms of feeding the human population.   *[3]*

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Option E – Conservation and biodiversity

3. The table below gives the number of flowering plant species for several tropical regions in the Americas, together with the area of each of the regions in km^2.

Region	Surface area in km^2	Estimated total number of species
Amazon Basin	7 050 000	30 000
Northern Andes	383 000	40 000
Atlantic coastal forests of Brazil	1 000 000	10 000
Central America including Mexico	2 500 000	19 000

[Data from A. Henderson, *Nature*, 231, 1991]

(a) (i) Which region has the greatest number of species per unit area? *[1]*

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(ii) Which region has the lowest number of species per unit area? *[1]*

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(iii) Explain the range of biodiversity shown in the data above. *[2]*

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(This question continues on the following page)

(Question 3 continued)

(b) (i)   Explain what is meant by the term *endangered species*, giving an example.   *[2]*

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     (ii) List **three** factors which may lead to a species becoming endangered.   *[3]*

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(c) Give **three** ways in which efforts are made to protect endangered species, with an example
     for each.   *[3]*

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(d) How might natural selection lead to an increase in species diversity?   *[3]*

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Option F – Pollution

4. The River Gurgle flows through an area of open farmland and forest with a few small towns. A group of students took samples from the river at two sites. They worked in equal numbers for an equivalent time at each site. Site A is just downstream of the point where effluent (liquid waste) enters the river, Site B is about 5 km downstream. The numbers of organisms collected from the two sites were as follows:

Organism	**Site A**	**Site B**
Organisms with a high or medium oxygen requirement		
Mayfly larvae	0	200
Caddis fly larvae	0	70
Small fish	0	2
Water beetles	1	20
Organisms able to tolerate low oxygen levels		
Red chironomids	3000	20
Tubificid worms	20 000	5

(a) (i) These data measure pollution indirectly. Explain this statement. *[1]*

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(ii) Explain the data above. *[4]*

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(This question continues on the following page)

(Question 4 (a) continued)

      (iii) Name **three** abiotic factors, other than oxygen, that might vary along an environmental gradient between sites A and B. *[1]*

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(b) Describe **three** ways in which the effluent at site A might be controlled. *[4]*

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(c) A large school is considering using plastic cups instead of glasses and ceramic mugs. Describe the environmental impact assessment that should be carried out to investigate whether the change might be more or less 'environment friendly'. *[5]*

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