

CANDIDATE
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MARINE SCIENCE

9693/03

Paper 3 A2 Structured Questions

May/June 2019

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.

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.

Answer **all** questions.

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 **17** printed pages and **3** blank pages.

Answer **all** questions in the spaces provided.

- 1 Seaweed farming is the main source of income in traditional village communities on a few small tropical Indonesian islands. The seaweeds are grown on horizontal ropes, held in place by wooden posts in sheltered bays with shallow clear water. They are harvested every few weeks by wading out to the ropes at low tide.

Fig. 1.1 shows seaweed collection at low tide.



Fig. 1.1

- (a) (i) State **and** explain **three** ways in which the conditions where the seaweeds are farmed enable them to grow quickly.

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..... [3]

- (ii) Suggest how farming seaweed in the bays could benefit local fishing.

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..... [2]

- (b) The seaweed farmed is a red alga. Red algae can grow at depths down to 35 m. It is farmed at depths of between 1 m and 7 m, where it is able to grow rapidly.

Explain how the pigments in red algae enable them to photosynthesise and grow rapidly at these depths.

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..... [4]

- (c) Seaweed farming usually involves the whole family. The hard physical work of harvesting, drying and packing the seaweed for distribution is very labour intensive.

Tourism is gradually spreading to these islands.

Suggest **and** explain the social impacts on the community if tourism increases.

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..... [3]

[Total: 12]

2 (a) Adult groupers are solitary fish, but during the breeding season they swim many kilometres to reach spawning grounds.

(i) The Nassau grouper occupies three main habitats during its life cycle.

Describe the stages of the life cycle that happen in each of these habitats.

offshore between 56 to 160 km

.....

.....

inshore seagrass beds and estuaries

.....

.....

shallow water and deep water reefs

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[4]

(ii) State **two** similarities between the life cycle of grouper and tuna.

1

2

[2]

(iii) Several species of grouper and tuna are in danger of extinction.

Explain how their spawning behaviour may have contributed to these species becoming endangered.

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..... [3]

3 India is a major exporter of high value prawns worldwide. There are over 30 000 prawn trawlers fishing in the shallow waters around the Indian coastline. Small-mesh fishing nets are trawled for many hours to catch adult prawns living on the sea bed. This method of fishing also catches fish and other species as bycatch.

(a) (i) Name the type of trawling used for prawn fishing.
..... [1]

(ii) It has been estimated that prawn trawling is responsible for a third of the world's bycatch. Explain how prawn trawling results in so much bycatch.

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..... [2]

(iii) Use the information provided to suggest **and** explain why returning the bycatch to the sea would not benefit the bycatch species.

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..... [2]

(b) Prawn harvests have decreased greatly over the past 10 years. In order to increase stocks, marine conservation zones have been created in a few coastal sites. All commercial fishing is banned inside these zones.

Explain how the creation of marine conservation zones could improve stocks of prawns and fish in coastal areas.

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..... [3]

- (c) Some commercial prawn fishermen are ignoring the ban and continue trawling for prawns inside marine conservation zones.

Two methods of monitoring fishing are the use of satellites and inspection of catch.

Discuss the effectiveness of these two methods to monitor prawn trawling in India.

satellites

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inspection of catch

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[4]

[Total: 12]

- 4 (a) Sea bass are fish that live in the sea or in estuaries where sea water has been diluted by fresh water. The fish can be reared in cages suspended in the water.

Fig. 4.1 shows two possible sites, **A** and **B**, for a new aquaculture business to produce sea bass.

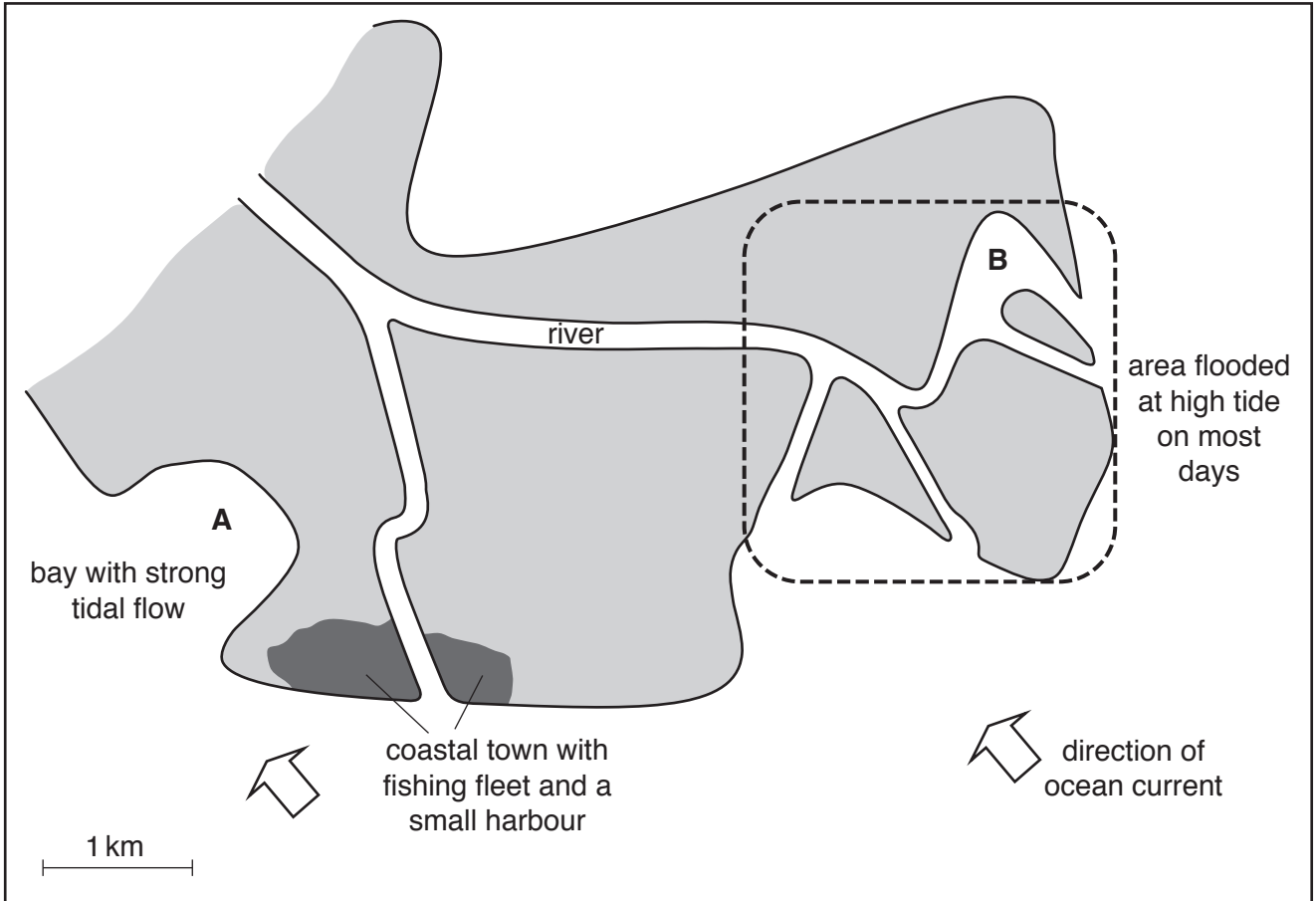


Fig. 4.1

- (i) Suggest and explain why site **A** might not be suitable for an aquaculture business.

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..... [3]

- (ii) Discuss, with reasons, whether the water quality at site **B** is likely to be suitable for the aquaculture of sea bass.

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..... [3]

- (b) The global expansion of aquaculture has increased concern about the quality of food it produces, the impact on the marine environment, and its sustainability.

The Aquaculture Stewardship Council (ASC) was set up in 2010. It works with everyone associated with aquaculture, including producers, retailers, scientists, conservation groups and consumers to:

- recognise and reward responsible aquaculture through the ASC aquaculture certification programme and seafood label.
- promote best environmental and social choice when buying seafood.
- contribute to transforming seafood markets towards sustainability.

- (i) State **and** explain **two** effects of the expansion of aquaculture on the marine environment that are a cause for concern.

1

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2

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[2]

- (ii) Suggest **two** ways in which an ASC certification programme could help an aquaculture producer become more responsible.

1

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2

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[2]

[Total: 10]

5 Iceland is a large island in the North Atlantic Ocean. Sea temperature around the Icelandic coast is influenced by two main currents:

- polar currents from the Arctic
- an offshoot of the Gulf Stream (warm water) from the Gulf of Mexico.

Fig. 5.1 represents the main water currents around Iceland.

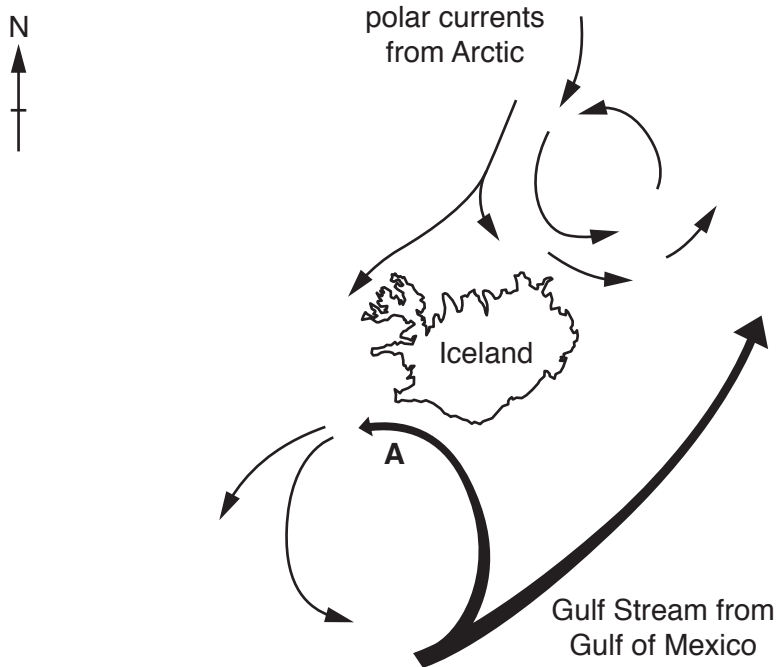


Fig. 5.1

(a) State **two** factors which cause water currents to form.

- 1
- 2 [2]

(b) Over the past 15 years, the current at point **A** has gradually moved closer to the south coast of Iceland.

The catch of mackerel in southern Icelandic waters has increased from zero in the early 2000s to 1 million tonnes in 2016. There have never been any mackerel along the north coast.

Use the information in Fig. 5.1 to suggest why mackerel numbers are increasing along the south coast.

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- [2]

- (c) Puffins are seabirds which nest in burrows on sea cliffs all around Iceland. Fig. 5.2 shows a puffin with several sand eels in its beak.



Fig. 5.2

Over the past 15 years puffins on the south coast of Iceland have suffered an almost complete breeding failure, with numbers reduced from hundreds of thousands to a few hundred. The number of puffins breeding along the north coast has remained high and constant.

Puffins and mackerel feed on sand eels, which form large shoals in Icelandic waters. Puffins usually fly around 16 to 20km from their burrows to find sand eels to feed their chicks. A survey in 2015 showed that puffins on the south coast travelled 120km to find sand eels.

Use all the information to suggest **and** explain why the number of puffins on the south coast has collapsed in recent years, while the number along the north coast has remained constant.

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..... [3]

(d) Fig. 5.3 shows how the mean sea temperature changed around southern Iceland from 1880 to 2015.

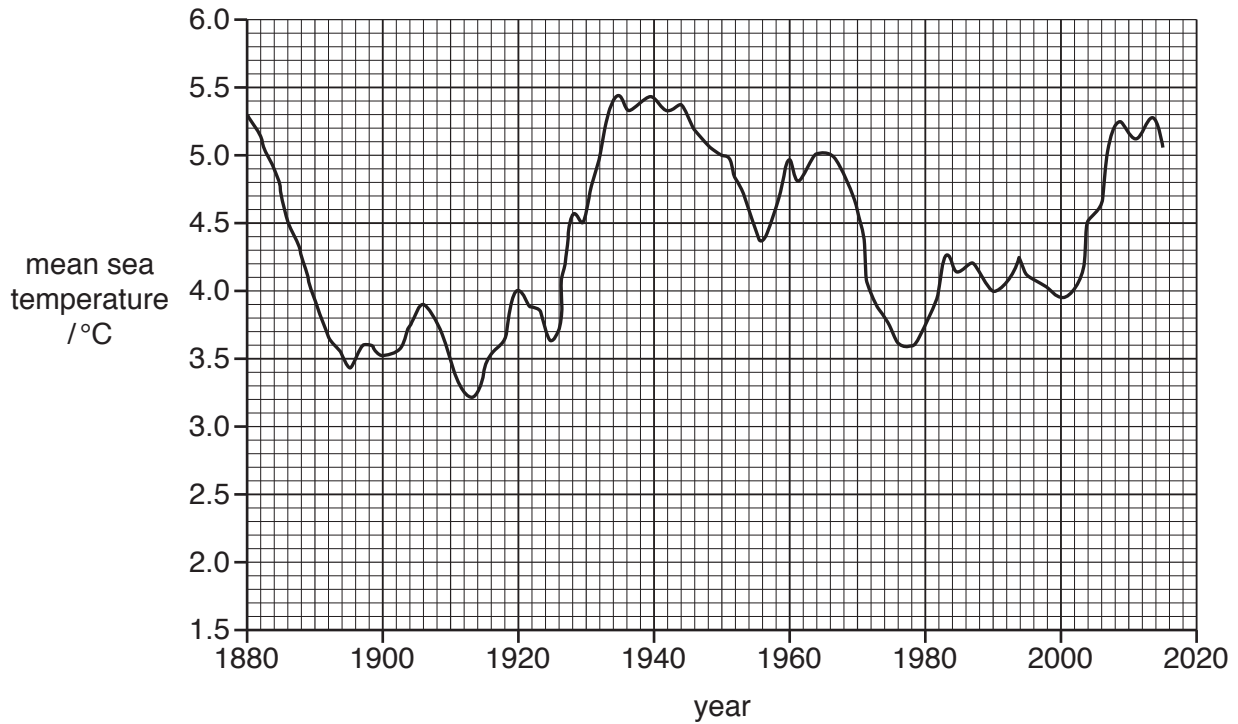


Fig. 5.3

Most scientists agree that the change in sea temperature around southern Iceland is the result of global warming.

(i) Name the gas released into the atmosphere from burning fossil fuels, which is the main cause of increasing global temperatures.

..... [1]

(ii) Describe how the information in Fig. 5.3, without reference to other sources of data, could be considered to provide evidence against global warming.

.....

 [3]

[Total: 11]

6 Read the information about coastal areas.

Humans use coastal areas for water, shipping, ports, food from fisheries and aquaculture developments and recreation such as fishing and diving.

Approximately half of the world's population lives in coastal areas. This is expected to increase greatly by 2025 as the number of people migrating to coastal areas is increasing.

Coastal areas worldwide are destinations for tourists and offer a major source of income for some regions.

Management of coastal areas to cope with growing pressures involves many conflicts of interest. These can be difficult to control because different government departments control industry, housing, tourism, road building, sanitation and environmental protection.

(a) Describe what is meant by a *conflict of interest*.

.....
 [1]

(b) A coastal manager of a large expanding town, 5 km from the coast, is assessing the issues involving two applications for further development in an area of mangrove forest close to the town.

Fig. 6.1 represents a map of the area showing the proposed applications.

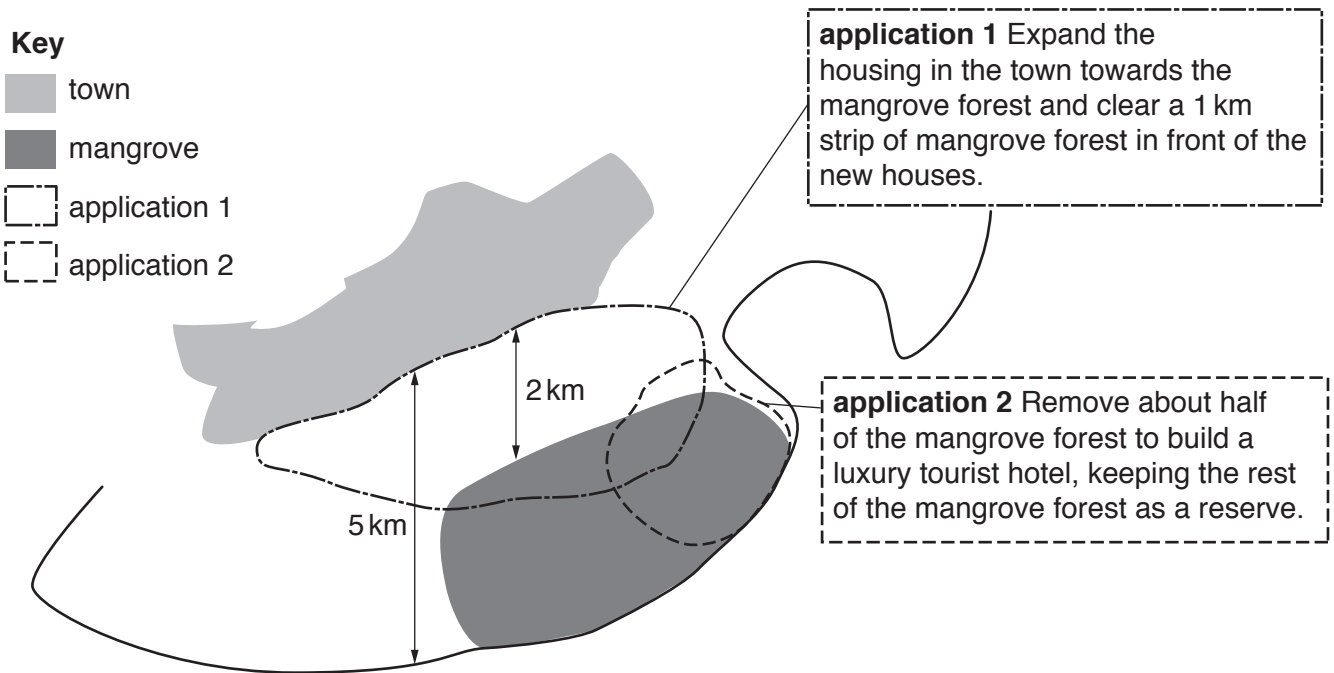


Fig. 6.1

(i) Explain the negative effects of the removal of mangrove forests from coastal areas.

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..... [3]

(ii) The use of land is a source of conflict of interest between the tourism department and the housing department.

Suggest **one** argument the housing department could make to support application 1 **and one** argument the tourism department could make to support application 2.

housing department

.....
.....

tourism department

.....
.....

[2]

[Total: 6]

- 7 (a) Omega-3 oils are an important part of the human diet. There is some evidence that they may help to reduce the risk of heart disease and stroke. Phytoplankton produce omega-3 oils, which are transferred to fish along food chains.

Table 7.1 compares the mass of omega-3 oils in a 100g serving of some marine fish.

Table 7.1

omega-3 oils source	mass of omega-3 oils / g per 100g serving
anchovies	2.1
sardines	1.8
farmed salmon	1.4
wild salmon	0.7
canned tuna	0.35
cod	0.3

- (i) Use Table 7.1 to suggest why eating farmed salmon is more beneficial in the human diet than eating wild salmon.

.....
 [1]

- (ii) Traditionally, farmed salmon have been fed on pellets made from fishmeal and fish oil, mainly from anchovies and sardines.

Use the information in Table 7.1 to suggest why these two species are suitable sources of fishmeal and fish oil.

.....
 [1]

- (iii) Wild stocks of both anchovies and sardines are now becoming unsustainable.

State the meaning of the term *unsustainable*.

.....
 [1]

- (b) Over the past 10 years, the percentage of fishmeal and fish oil in pellets used to feed farmed salmon has gradually decreased. It has been replaced by alternative feed ingredients such as soy and oil from canola.

Fig. 7.1 shows the effect of this change in feed on the mass of omega-3 oils in farmed salmon.

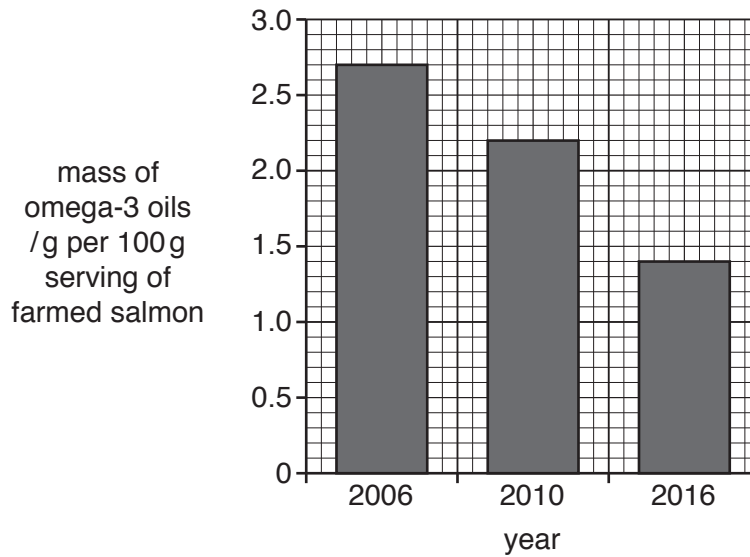


Fig. 7.1

Use the information in Fig. 7.1 to describe the effect of these fishmeal replacements on omega-3 oil levels in farmed salmon between 2006 and 2016.

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..... [2]

(c) One alternative to using fishmeal and fish oil in salmon feed is to replace them with genetically modified (GM) canola. GM canola has been genetically engineered to contain genes from phytoplankton and is rich in omega-3 oils.

(i) Define the term *gene*.

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

(ii) Suggest the **two** types of gene that would be transferred from phytoplankton to canola, to make GM canola.

1

2 [2]

(iii) If farmed salmon are fed on pellets containing GM canola oil, current regulations state that they must be labelled as having been fed on GM crops.

Suggest **and** explain why this labelling could present a problem for the sale of these fish.

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..... [2]

[Total: 11]

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