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**MARINE SCIENCE**

**9693/01**

Paper 1 AS Structured Questions

**May/June 2016**

**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.

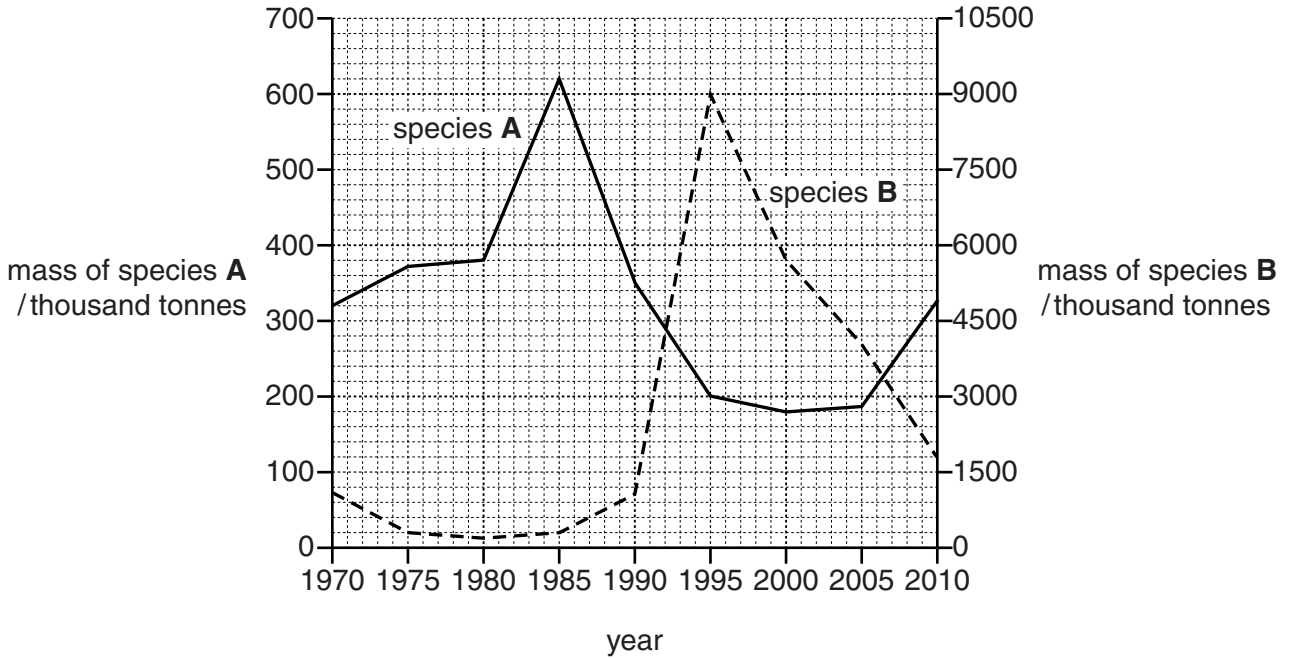
At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **16** printed pages.

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

- 1 (a) Fig. 1.1 shows the changes in the masses, in thousand tonnes, of two species of marine fish, **A** and **B**, in part of the North Atlantic Ocean between 1970 and 2010. One of the species is a predator of the other.



**Fig. 1.1**

- (i) Calculate the mean decrease per year in the mass of species **A** between 1970 and 1995. Show your working.

..... [2]

- (ii) With reference to Fig. 1.1, suggest which species is the predator and which is the prey. Give a reason for your answer.

predator .....

prey .....

reason .....

.....

..... [3]

- (b) Humans are important predators of many marine fish such as cod.  
 Fig. 1.2 shows the total mass of adult cod and the total mass of cod predated by humans in part of the North Sea from 1972 to 2004.

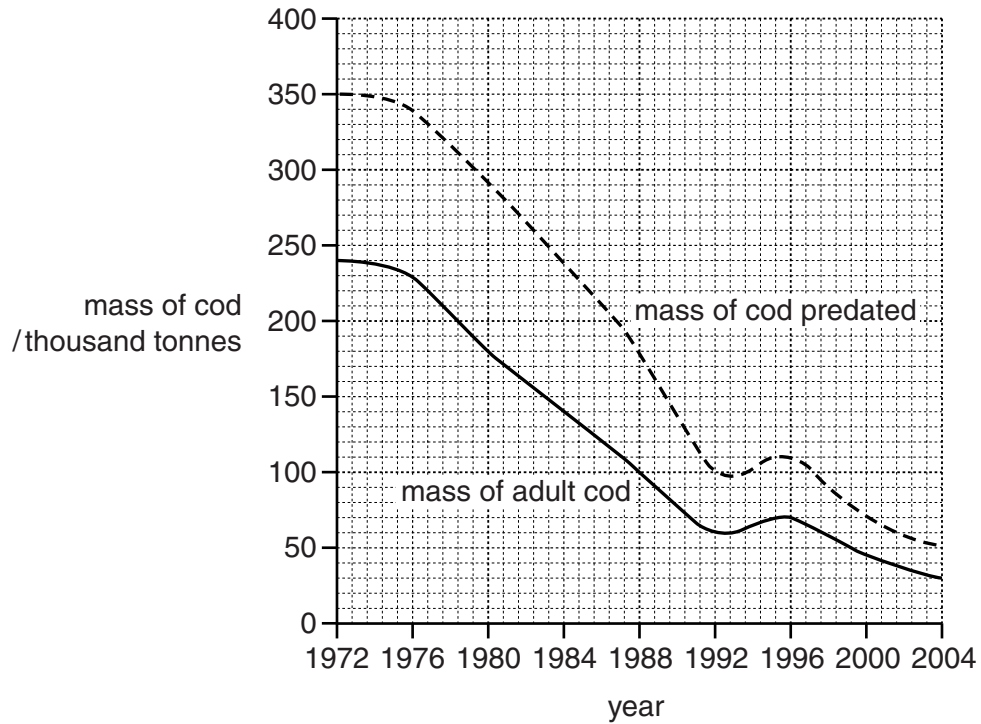


Fig. 1.2

- (i) Describe the patterns in the mass of adult cod and the mass of cod predated between 1972 and 2004.

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..... [3]

- (ii) Suggest an explanation for the overall change in mass of adult cod between 1972 and 2004.

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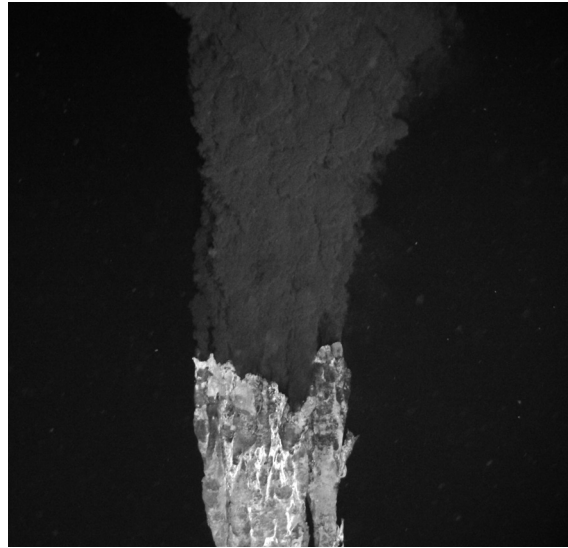
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..... [2]

[Total: 10]

- 2 Hydrothermal vents are an example of an extreme environment. Fig. 2.1 shows part of a hydrothermal vent.



**Fig. 2.1**

- (a) (i) State **two** physical properties associated with hydrothermal vents.

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..... [2]

- (ii) Explain how tectonic processes lead to the formation of hydrothermal vents.

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(b) Fig. 2.2 shows energy flow through part of a hydrothermal vent community.

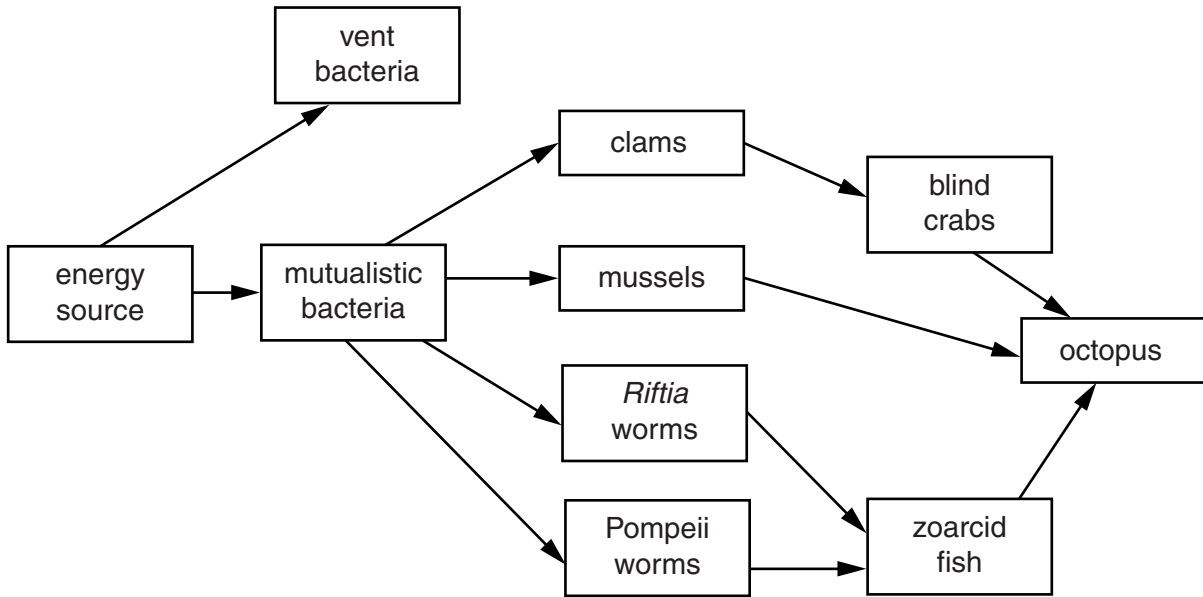


Fig. 2.2

(i) Name the energy source for this hydrothermal vent community.

..... [1]

(ii) State which organisms are the producers in Fig. 2.2.

..... [1]

(iii) Zooplankton feed on vent bacteria and are eaten by galatheid crabs. Galatheid crabs are eaten by ratfish.

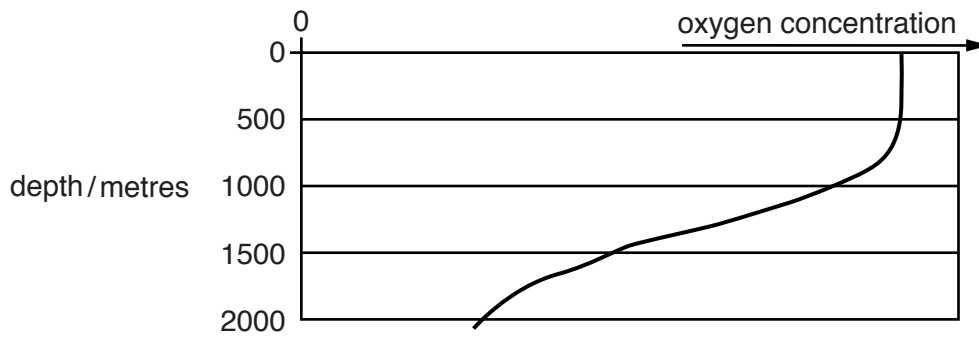
Add this information to Fig. 2.2. [2]

(iv) Explain the role of the mutualistic bacteria shown in Fig. 2.2.

.....  
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 .....  
 .....  
 .....  
 ..... [3]

[Total: 12]

3 Fig. 3.1 shows how the oxygen concentration in sea water varies with depth.



**Fig. 3.1**

**(a)** Explain the shape of the graph between

**(i)** the sea surface and a depth of 500 m,

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..... [3]

**(ii)** 1000 m and 2000 m.

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..... [2]

(b) Sea water contains a reservoir of dissolved nutrients, including phosphorus.

(i) State **two** functions of phosphorus in living organisms.

1 .....

2 ..... [2]

(ii) Explain how phosphorus in sea water becomes part of the sediment in the sea bed.

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..... [3]

[Total: 10]

4 (a) Explain how each of the following factors may contribute to reef erosion.

(i) hurricanes

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

(ii) high water temperatures

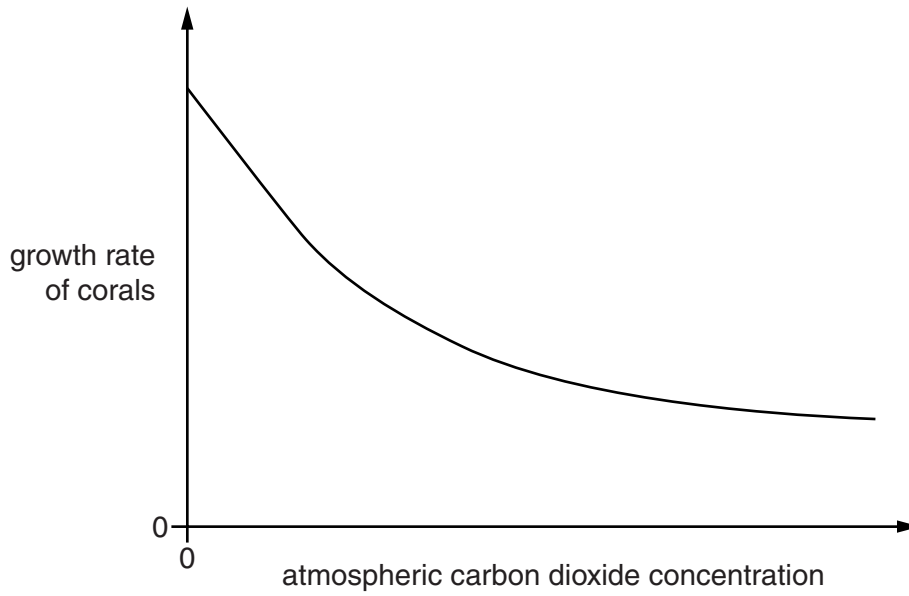
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..... [2]

(iii) high levels of sediment in the water

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..... [3]



(b) Fig. 4.1 shows the effect of atmospheric carbon dioxide concentration on the growth rate of corals.



**Fig. 4.1**

(i) Describe the relationship between atmospheric carbon dioxide concentration and the growth rate of corals.

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

(ii) Suggest an explanation for this relationship.

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.....  
..... [3]

[Total: 10]

5 Ocean currents are a feature of physical oceanography.

(a) Suggest what is meant by the term *ocean current*.

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..... [2]

(b) State **three** factors which help produce ocean currents.

1 .....  
.....  
2 .....  
.....  
3 .....  
..... [3]

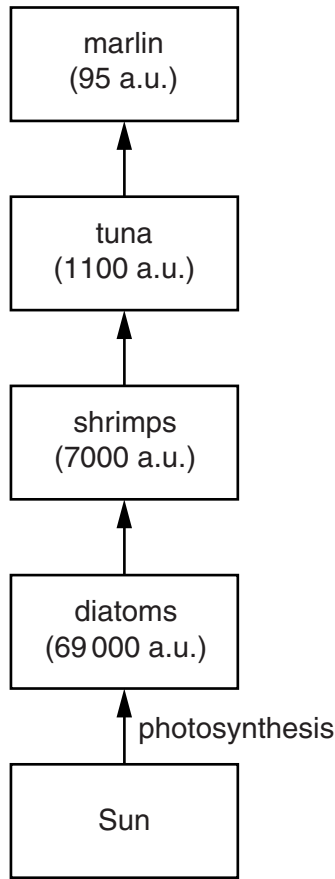
(c) Describe the role of the wind in the process of upwelling.

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..... [4]

[Total: 9]

**Question 6 starts on page 12.**

6 Fig. 6.1 shows a marine food chain. The numbers represent the amount of energy, in arbitrary units, at each trophic level.



**Fig. 6.1**

(a) (i) Describe the role of photosynthesis in the food chain in Fig. 6.1.

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

(ii) With reference to Fig. 6.1, explain what is meant by the term *trophic level*.

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

- (b) The arrows in Fig. 6.1 represent the transfer of energy between trophic levels. The amount of energy at one trophic level that passes to the trophic level above depends on the trophic level transfer efficiency (TLTE) which is defined by the formula:

$$\text{TLTE} = \frac{\text{energy at present trophic level}}{\text{energy at previous trophic level}} \times 100\%$$

The TLTE for the energy transfer between the diatoms and the shrimps is 10.1%.

The TLTE for the energy transfer between the tuna and the marlin is 8.6%.

- (i) Calculate the TLTE for the energy transfer between the shrimps and the tuna.

Show your working.

.....% [2]

- (ii) Suggest and explain why there are differences between these TLTE values.

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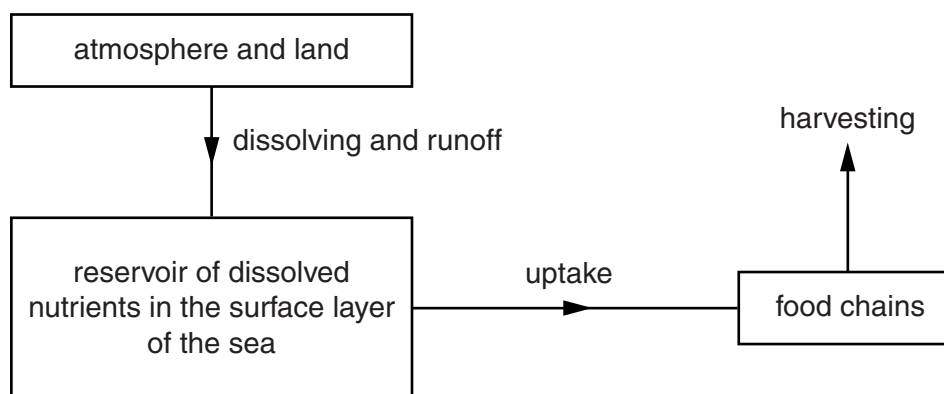
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..... [4]

[Total: 10]

7 Nutrients are cycled in marine ecosystems. Fig. 7.1. shows some of the processes involved in these cycles.



**Fig. 7.1**

**(a)** With reference to Fig. 7.1, outline how the activities of humans may decrease the reservoir of dissolved nutrients in the sea.

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..... [3]

**(b)** Runoff from the land affects the levels of dissolved nutrients in the sea.

**(i)** Explain how runoff can be harmful to marine organisms.

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..... [2]

**(ii)** Explain how runoff can be useful to marine organisms.

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..... [2]

[Total: 7]

8 (a) Read the information below and answer questions (i) and (ii).

Human pressures on coral reefs are categorised as either 'local' or 'global' in origin. These categories are used to distinguish between threats from human activities near reefs which have a direct and localised impact versus threats that affect reefs indirectly through human impacts on the global climate and ocean chemistry. Local threats include coastal development, pollution from runoff from land, marine pollution and overfishing and destructive fishing. Global threats include increased sea temperatures and increased atmospheric carbon dioxide concentration.

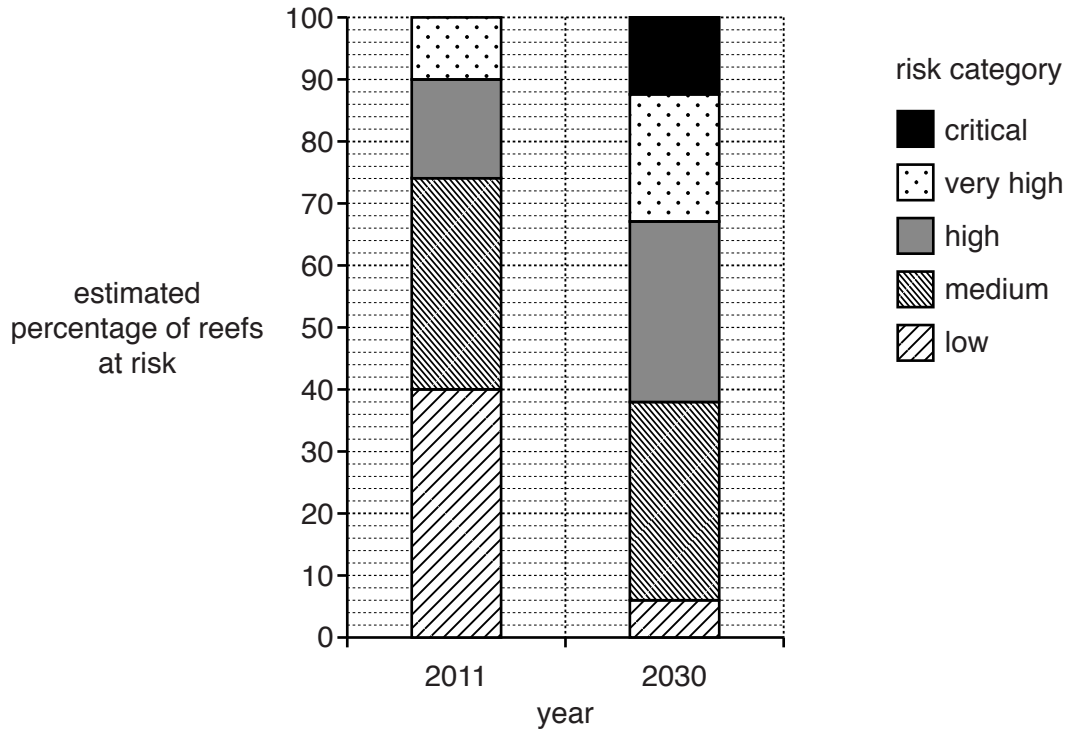
(i) Suggest how fishing could be a threat to coral reefs.

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

(ii) Explain why the loss of coral reefs leads to coastal erosion.

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..... [2]

(b) Fig. 8.1 shows the percentage of coral reefs in different risk categories in 2011 and the estimated percentage of reefs in the same risk categories in 2030.



**Fig. 8.1**

Using the information in Fig. 8.1, compare the changes in the risk categories from 2011 to 2030.

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..... [3]

[Total: 7]

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