External assessment 2022

# Marine Science

## Paper 2

**Time allowed**

- Perusal time — 10 minutes
- Working time — 90 minutes

**General instructions**

- Answer all questions in this question and response book.
- Write using black or blue pen.
- QCAA-approved calculator permitted.
- Planning paper will not be marked.

**Section 1  (55 marks)**

- 9 short response questions

# Section 1

## Instructions

- If you need more space for a response, use the additional pages at the back of this book.
    - On the additional pages, write the question number you are responding to.
    - Cancel any incorrect response by ruling a single diagonal line through your work.
    - Write the page number of your alternative/additional response, i.e. See page …
    - If you do not do this, your original response will be marked.

**DO NOT WRITE ON THIS PAGE**

**THIS PAGE WILL NOT BE MARKED**

Do not write outside this box.

## QUESTION 1 (4 marks)

The graphs show data collected from benthic communities occurring at two marine carbon dioxide vent locations — a low $CO_2$ site (pH = 8.1) and a high $CO_2$ site (pH = 7.7). Hard corals were classified as either massive or structural, i.e. branching.



Key — Low $CO_2$ ; High $CO_2$
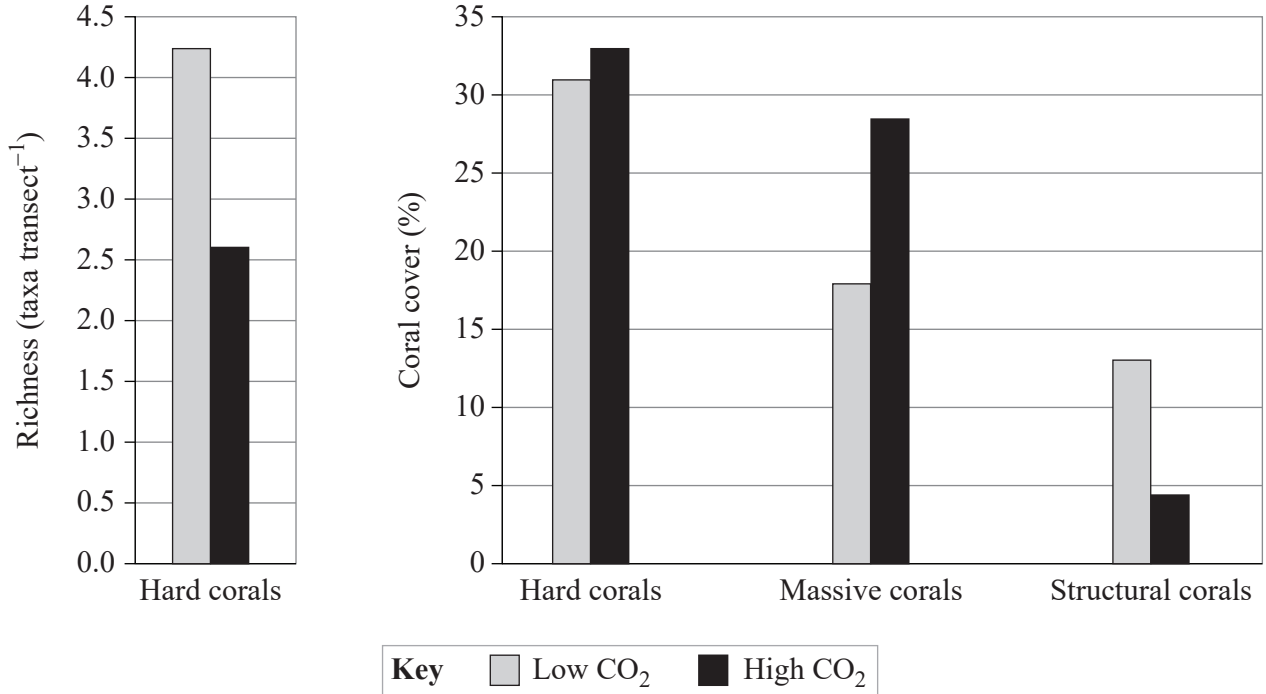
a) Draw two conclusions about the effects of high $CO_2$ on the percentage cover of hard corals.

*[2 marks]*

b) Explain the impact of high $CO_2$ on fish populations. *[2 marks]*

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## QUESTION 2 (3 marks)

Explain the value of an extensive seagrass meadow in a marine protected area to the sustainability of the local fishery.

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## QUESTION 3  (7 marks)

The graph shows the concentration of atmospheric carbon dioxide from the RCP8.5 emission scenario and the projected pH of surface waters off the Queensland coast from a climate model.
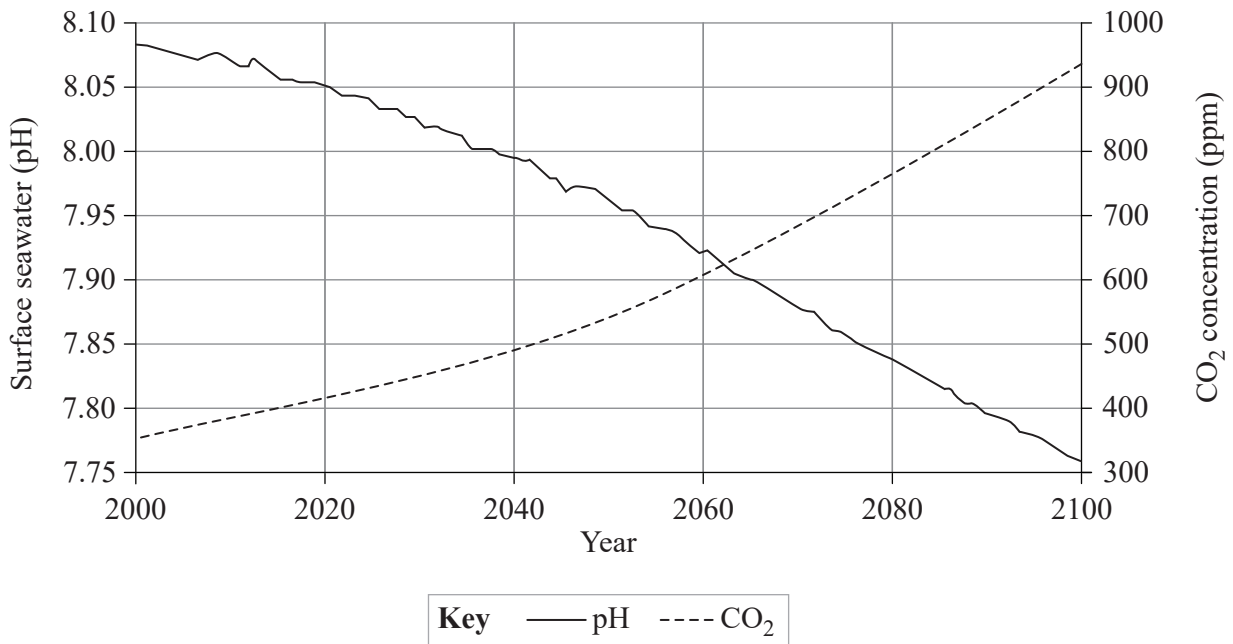


a)  Predict two ecological implications of this scenario for the Great Barrier Reef in 2100. Show your reasoning.                                                     *[4 marks]*

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b) Explain how the resilience of the Great Barrier Reef ecosystem would affect the way it responds to the changes predicted by the RCP8.5 emission scenario.  *[3 marks]*

## QUESTION 4 (8 marks)

Coral cores have been taken from sites on the Great Barrier Reef and their luminescence measured. The graphs show luminescence and observed discharge of a nearby river from 1920 to 2010, and the luminescence of the entire proxy record.
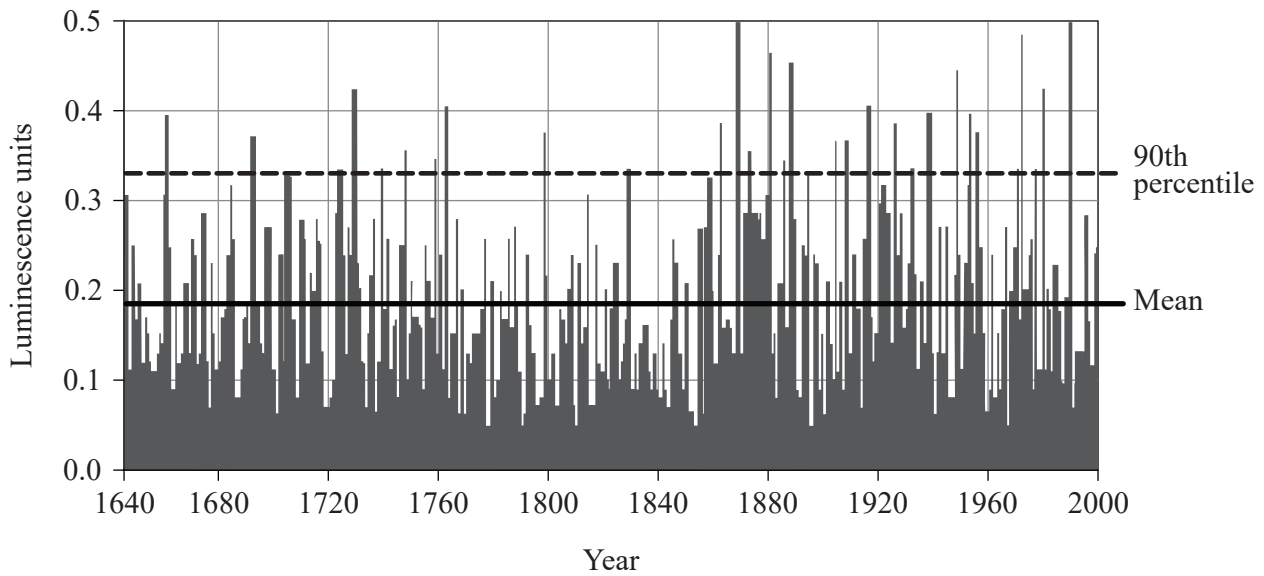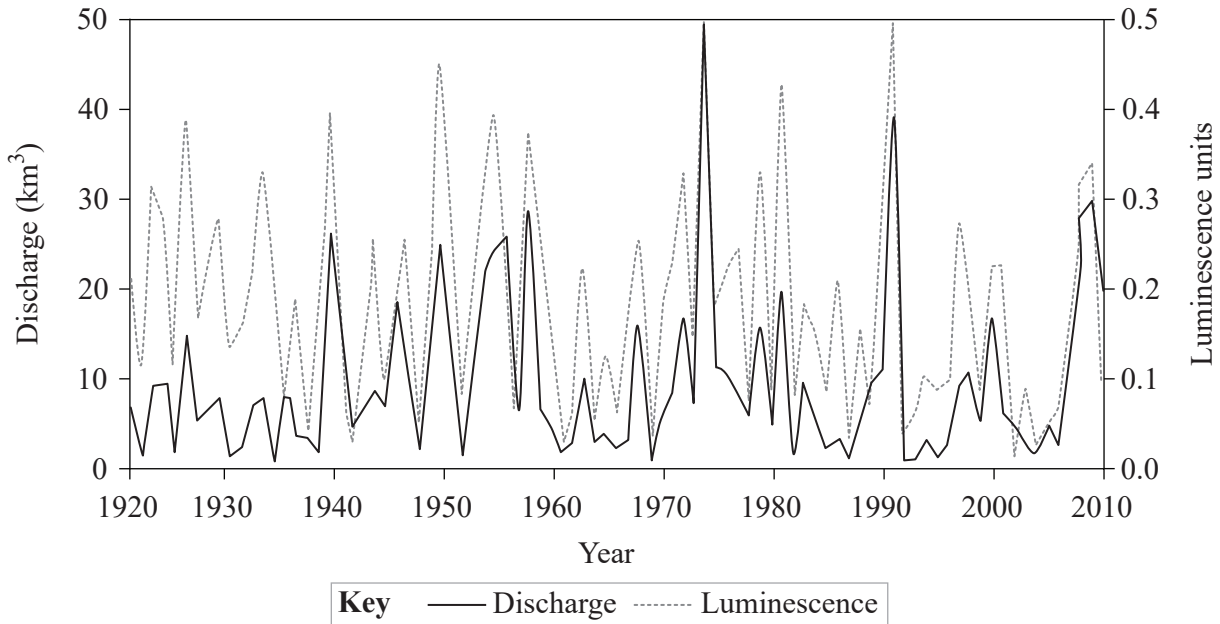
a) Draw conclusions about the frequency and intensity of flooding before and after 1860. *[5 marks]*

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b) Infer how land use changes since 1860 have affected the health of the Great Barrier Reef near this river. *[3 marks]*

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## QUESTION 5 (7 marks)

The table shows data from Australian surveys of a sector of the southern bluefin tuna catch.

| Year | Harvest (tonnes) | Harvest (number of fish) | Released (number of fish) | Release rate (%) | Total allowable catch (tonnes) |
|------|------------------|--------------------------|---------------------------|------------------|-------------------------------|
| 2005 | 789.6 | 53 060 | 11 070 | 21 | 5120 |
| 2015 | 742.1 | 41 623 | 15 016 | 36 | 5665 |

a) Identify the main type of fishery represented in the data. Explain your reasoning. *[2 marks]*

b) Determine if there is sufficient data to establish the overall status of the fish stock. Explain your reasoning. *[2 marks]*

c) Contrast the data from 2005 and 2015 to draw a conclusion about changes in the sustainability of the fishery.

*[3 marks]*

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**QUESTION 6 (10 marks)**

a) List the life cycle stages of a typical reef-forming hard coral. *[4 marks]*

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b) Explain the process of site selection for coral. *[3 marks]*

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c) Explain the role of connectivity in species replenishment in hard corals. *[3 marks]*
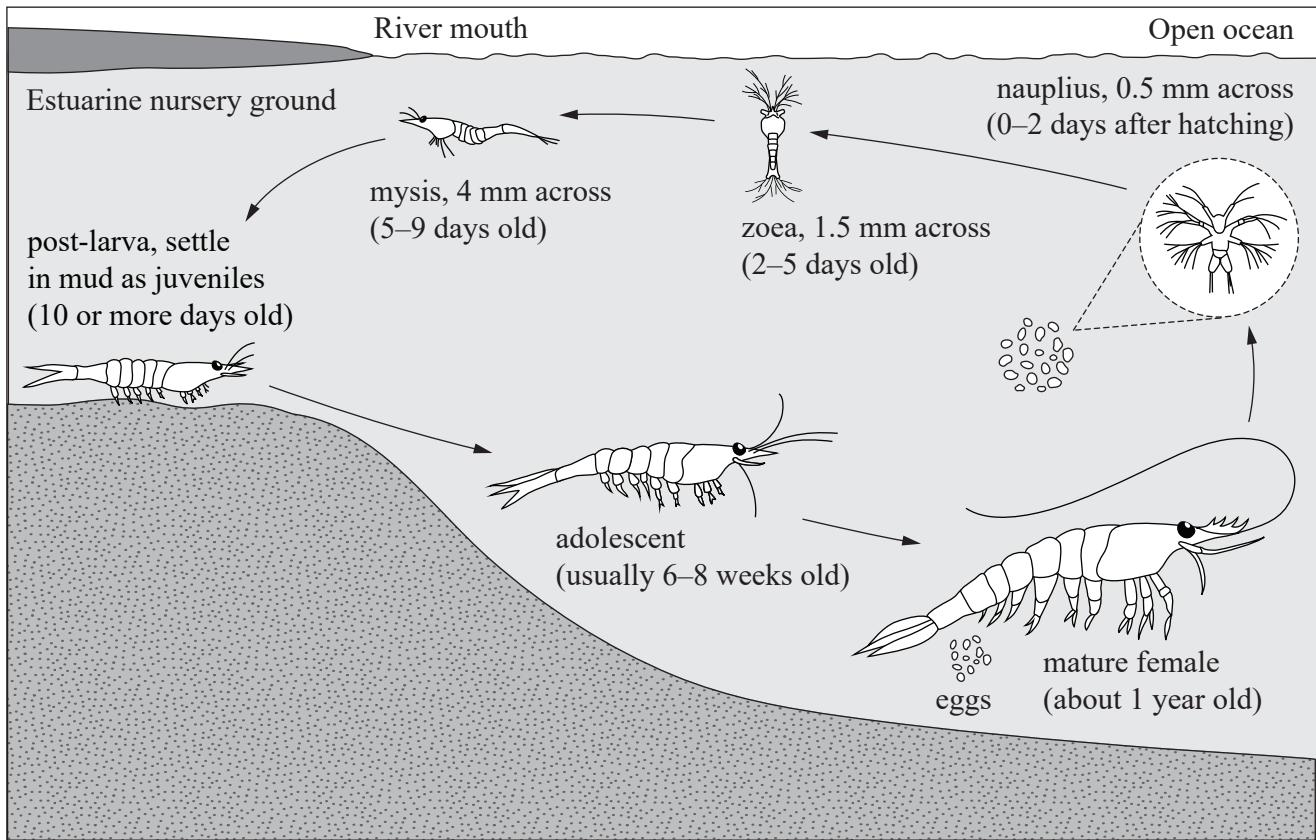
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## QUESTION 7  (4 marks)

Explain what affects the abundance of different forms of calcium carbonate in deep sea floor sediments.

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## QUESTION 8  (8 marks)

The diagram shows the life cycle and factors affecting survival of a species of prawn. The table shows the production value of these prawns for different fishery types.



|  | Annual production value of prawns ($m) | | |
| --- | --- | --- | --- |
| **Fishery type** | **2008–09** | **2014–15** | **2018–19** |
| Aquaculture | 80 | 100 | 80.5 |
| Wild caught | 90 | 116 | 120 |

a)  Identify why this prawn species is a target species for both aquaculture and commercial fisheries.

*[1 mark]*

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b) Identify an attribute in this prawn's life cycle that makes it desirable to farm.
Show your reasoning. *[3 marks]*
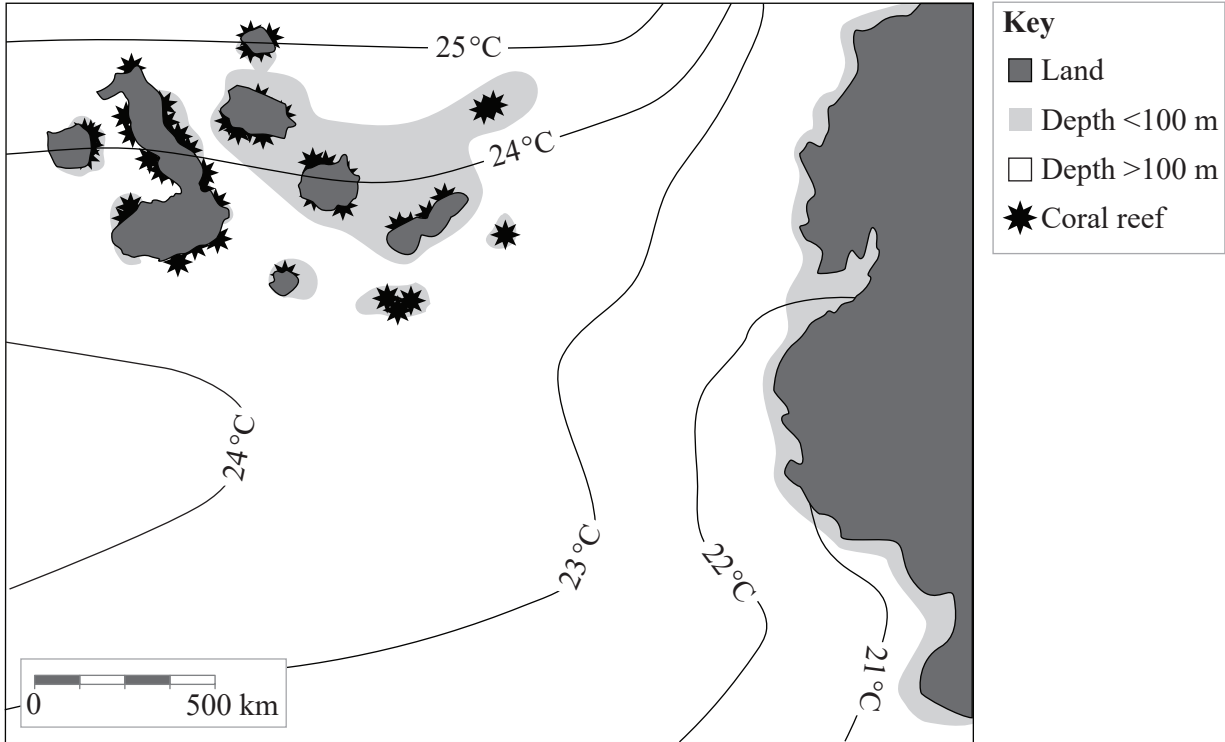
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c) Explain how the life cycle of this prawn affects the ability of government regulators to
accurately set and implement a total allowable catch limit. *[4 marks]*

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## QUESTION 9  (4 marks)

The diagram shows the depth and mean sea surface temperature of water around a group of coral reefs.



Explain how abiotic factors have affected the distribution of coral reefs in this region.

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**ADDITIONAL PAGE FOR STUDENT RESPONSES**

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Write the question number you are responding to.

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# References

**Question 1**

Graphs based on data derived from

Fabricius, KE et al. 2011, 'Losers and winners in coral reefs acclimatized to elevated carbon dioxide concentrations', *Nature Climate Change*, vol. 1, pp. 165–169, www.nature.com/articles/nclimate1122.

**Question 3**

Graphs based on data derived from

Dunne, JP et al. 2013, 'GFDL's ESM2 Global coupled climate–carbon earth system models. Part II: Carbon system formulation and baseline simulation characteristics', *Journal of Climate*, vol. 26, no. 7, pp. 2247–2267, https://doi.org/10.1175/JCLI-D-12-00150.1.

Meinshausen, M, et al. 2011, 'The RCP greenhouse gas concentrations and their extension from 1765 to 2300', *Climatic Change*, vol. 109, no. 1, p. 213, https://doi.org/10.1007/s10584-011-0156-z.

**Question 4**

Graphs based on data derived from

Lough, JM, Lewis, SE & Cantin, NE 2015, 'Freshwater impacts in the central Great Barrier Reef: 1648–2011', *Coral Reefs*, vol. 34, pp. 739–751, https://doi.org/10.1007/s00338-015-1297-8.

**Question 8**

The Life history of a banana prawn diagram is adapted from

CSIRO 1983, 'What happens to banana prawns?', *ECOS*, iss. 36, pp. 7–13, www.ecosmagazine.com/?paper=EC36p7