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School code

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School name

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Attach your
barcode ID label here

Book

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of

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books used

External assessment 2024

Question and response book

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 (45 marks)

- 11 short response questions



DO NOT WRITE ON THIS PAGE
THIS PAGE WILL NOT BE MARKED

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.
-

QUESTION 1 (1 mark)

Contrast hermatypic and ahermatypic scleractinian corals.

QUESTION 2 (2 marks)

Identify two of the main types of fisheries.

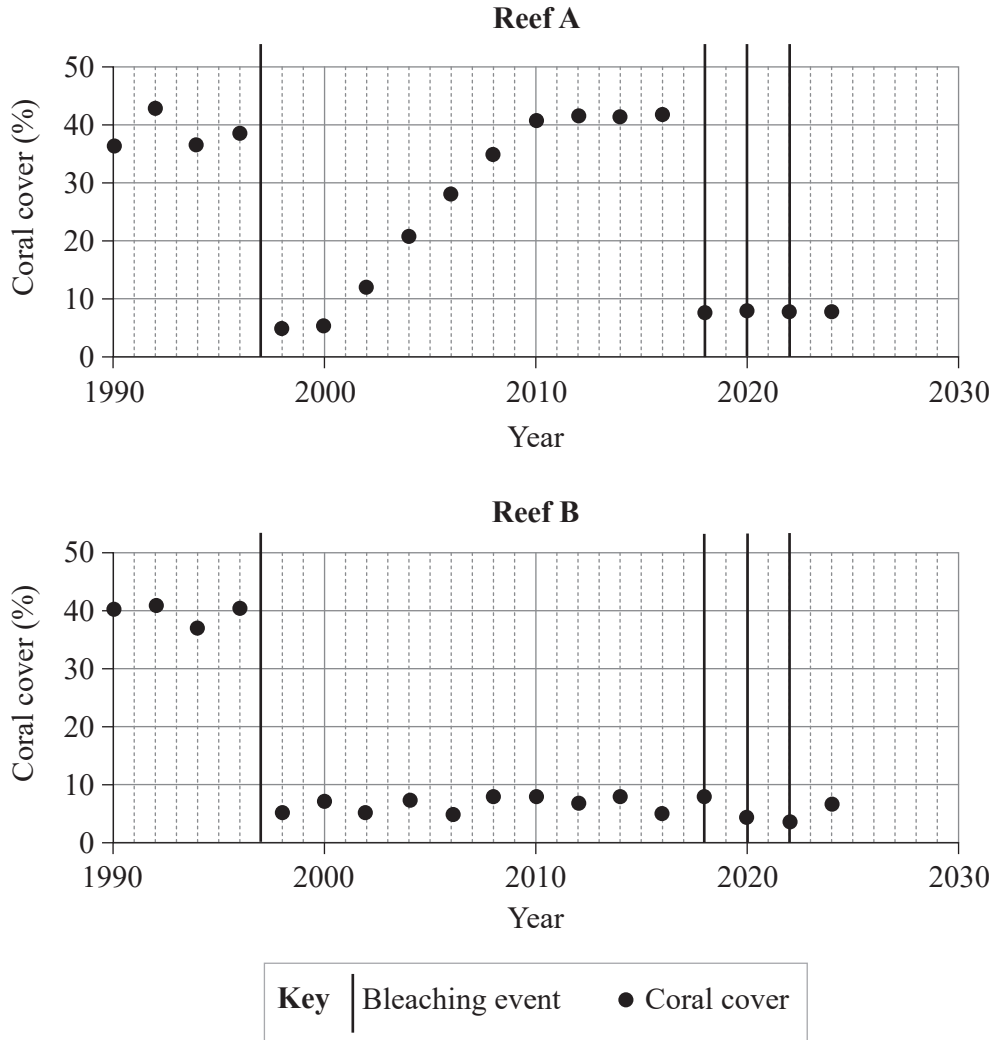
1.

2.

Do not write outside this box.

QUESTION 3 (3 marks)

The graphs show temporal trends in coral cover from 1990 to 2024 for two different reefs. The graphs also show the four major bleaching events that occurred during this time.



Do not write outside this box.

Compare the coral cover of reefs A and B using data in the graphs.

Similarity: _____

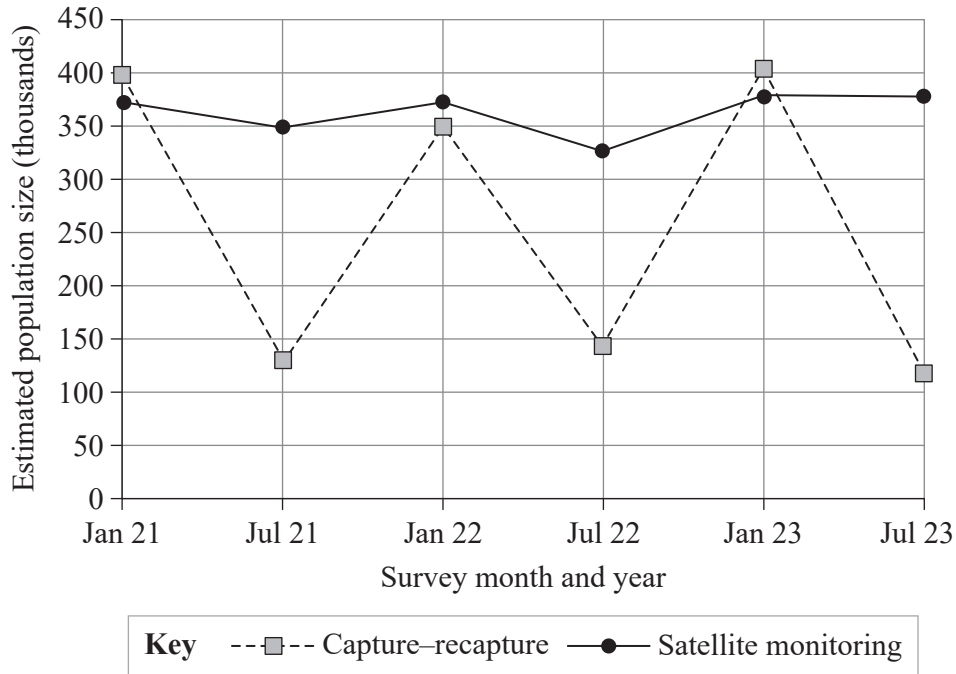
Difference: _____

Significance: _____

Do not write outside this box.

QUESTION 4 (6 marks)

A migratory fish population was sampled using capture–recapture and satellite monitoring methods to determine an estimated population size in Australian waters. The graph shows the results of surveys conducted from 2021 to 2023. The table shows capture–recapture data for January 2024.



Number of individuals in capture 1	Number of individuals in capture 2	Number of marked individuals in capture 2
95 000	87 000	19 000

Do not write outside this box.

a) Use the Lincoln index to calculate the estimated size of the fish population in January 2024. Show your working.

[2 marks]

$$N = \frac{M \times n}{m}$$

b) Identify two factors that can affect the reliability of this fish population data.

[2 marks]

1. _____
2. _____

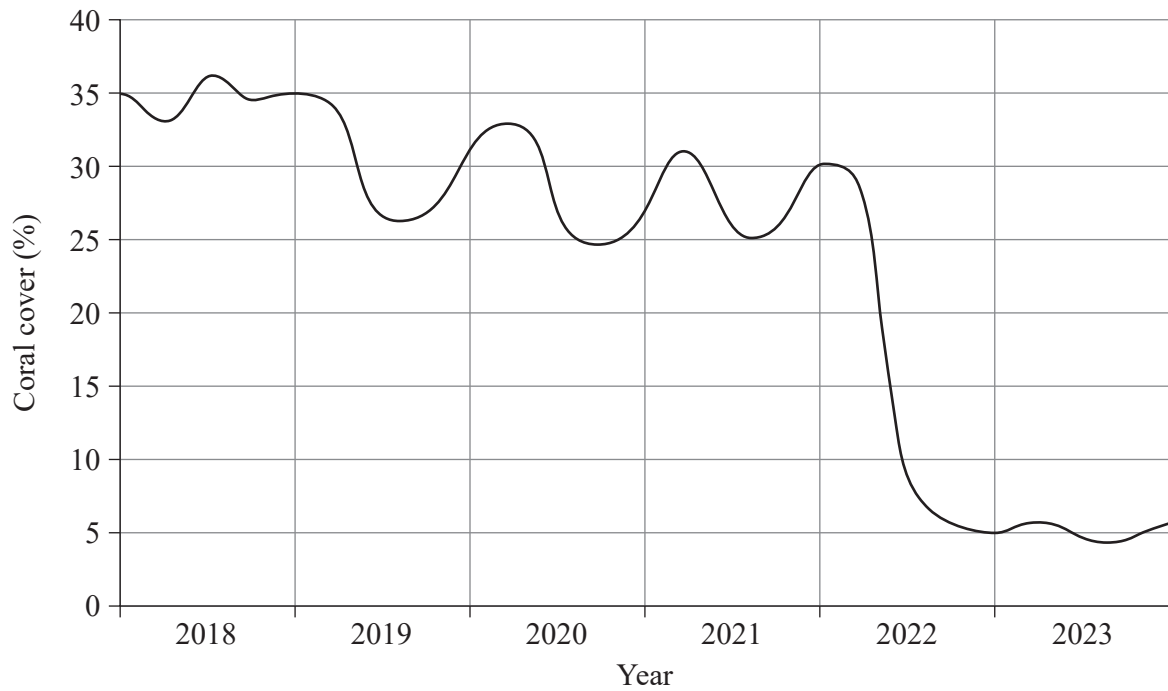
c) Infer whether capture–recapture is a reliable method of estimating the fish population size. Use evidence from the graph to support your response.

[2 marks]

Do not write outside this box.

QUESTION 5 (7 marks)

The graph shows coral cover on a reef.



The table shows the factors affecting the reef from 2018 to 2023.

Factors affecting coral reef	2018	2019	2020	2021	2022	2023
Water quality	Poor	Very poor	Very poor	Moderate	Moderate	Moderate
Crown-of-thorns starfish outbreak	–	1	2	1	1	–
Cyclone	–	–	–	–	1	–

a) Identify when the ecological tipping point occurred for the reef. Show your reasoning. [2 marks]

Do not write outside this box.

b) Infer how each factor contributed to the reef reaching its ecological tipping point.

[5 marks]

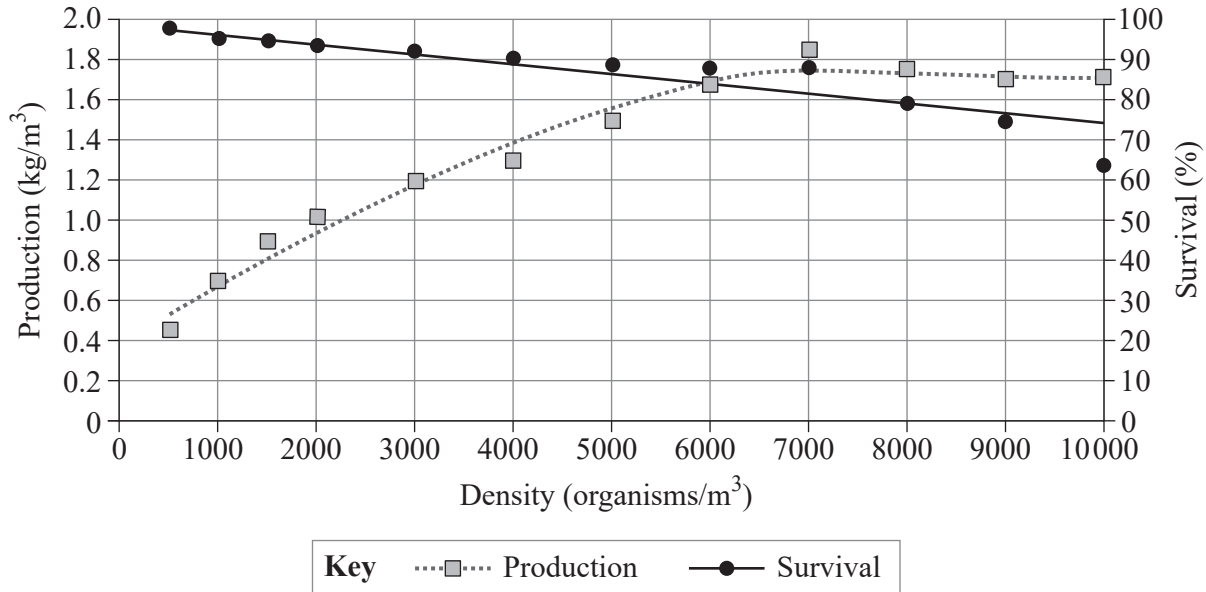
QUESTION 6 (3 marks)

Describe the relationship between corals and zooxanthellae.

Do not write outside this box.

QUESTION 7 (7 marks)

The graph shows the relationship between production and survival at different stocking densities of whiteleg shrimp in an aquaculture system. The table compares the parameters for intensive and extensive systems.



	Intensive	Extensive
Density (organisms/m ³)	9000	1000
Feed conversion ratio	1.65	1.57
Total costs (\$/m ³)	11.75	6.02

- a) Predict the carrying capacity of the aquaculture system. Justify your prediction using evidence from the graph. [2 marks]

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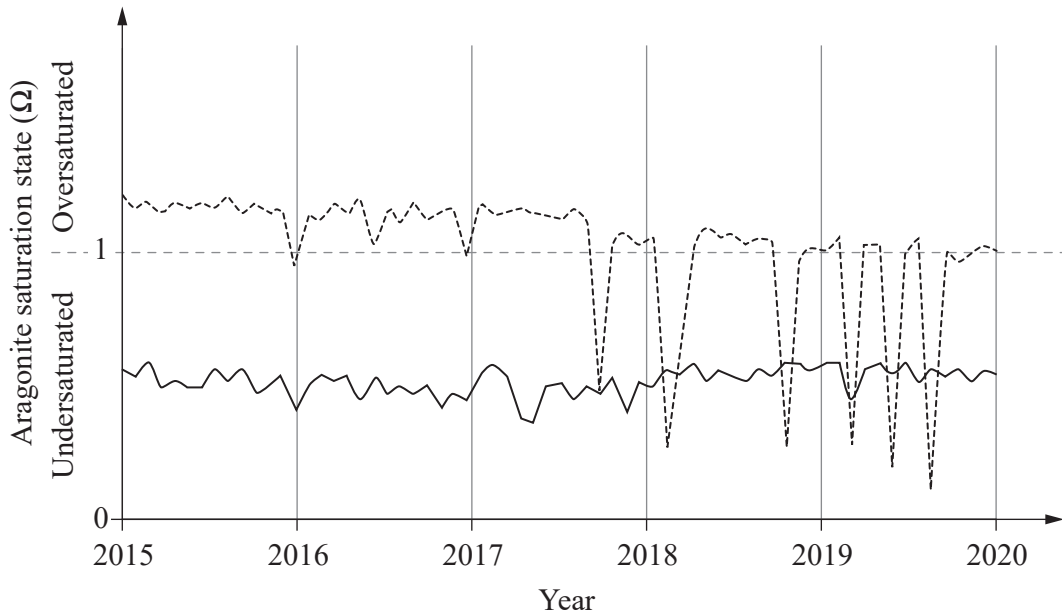
b) Identify two factors that could reduce the carrying capacity of an intensive aquaculture system. [2 marks]

c) Explain three differences between intensive and extensive aquaculture systems using data from the graph and table. [3 marks]

Do not write outside this box.

QUESTION 8 (5 marks)

The graph shows the aragonite levels on a fringing reef monitored before and after land clearing in nearby river catchment areas. Land clearing occurred from 2016 to 2020.



Key - - - - - Samples from shallow water (depths < 20 m)
 — — — — — Samples from deep water (depths ≥ 20 m)

- a) Compare the effect of land clearing on the aragonite saturation state in shallow and deep water.

[3 marks]

Similarity: _____

Do not write outside this box.

Difference: _____

Significance: _____

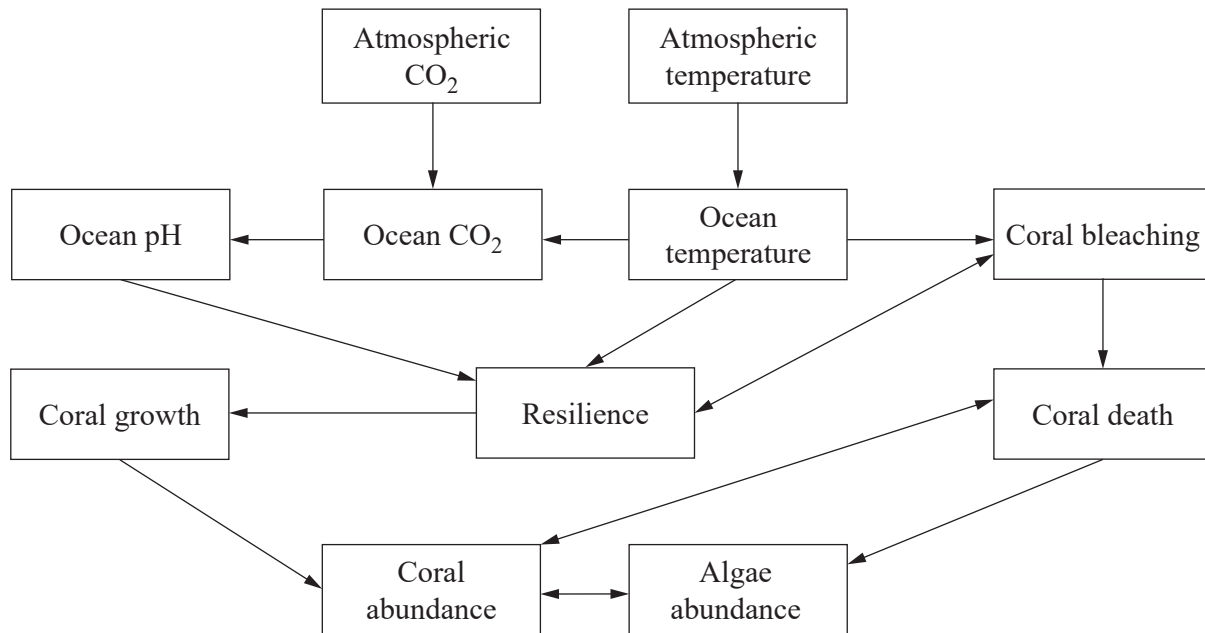
b) Predict an effect of changing aragonite concentrations on corals and the nearby fringing reef ecosystem.

[2 marks]

Do not write outside this box.

QUESTION 9 (5 marks)

The diagram shows the relationships between atmospheric factors, ocean processes and coral and algae abundance.



a) Identify the change in atmospheric condition that drives coral bleaching.

[1 mark]

Do not write outside this box.

b) Use the diagram to predict the short-term (in weeks or months) and long-term (in years) effects of increasing atmospheric carbon dioxide levels on coral reef species.

Show your reasoning.

[4 marks]

Do not write outside this box.

QUESTION 10 (3 marks)

Describe how corals influence the habitat complexity and species diversity of a reef ecosystem.

Do not write outside this box.

QUESTION 11 (3 marks)

Explain how an increase in ocean temperature affects the ocean's ability to absorb and store carbon dioxide using the biological pump.

END OF PAPER

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ADDITIONAL PAGE FOR STUDENT RESPONSES

Write the question number you are responding to.

Do not write outside this box.

References

Question 7

Data from Rodríguez-Olague, D, Ponce-Palafox, JT, Castillo-Vargasmachuca, SG, Arámbul-Muñoz, E, de los Santos, RC & Esparza-Leal, HM 2021, 'Effect of nursery system and stocking density to produce juveniles of whiteleg shrimp *Litopenaeus vannamei*', *Aquaculture Reports*, vol. 20, article 100709, CC BY-NC-ND 4.0, <https://doi.org/10.1016/j.aqrep.2021.100709>.



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