Marine Science 2019 v1.3

IA1: Sample assessment instrument

Data test (10%)

This sample has been compiled by the QCAA to assist and support teachers in planning and developing assessment instruments for individual school settings.

Student name

Student number

Teacher

Exam date

Marking summary

Criterion	Marks allocated	Provisional marks
Data test	10	
Overall	**10**	

Conditions

Technique	Data test
Unit	Unit 3: Marine systems — connections and change
Topic/s	Topic 1: The reef and beyond Topic 2: Changes on the reef
Time	60 minutes + 10 minutes perusal
Seen/Unseen	Unseen questions and datasets
Other	QCAA-approved graphics calculator permitted

Instructions

Use the datasets to respond to the associated items in the spaces provided. Each item is associated with the dataset that immediately precedes it.
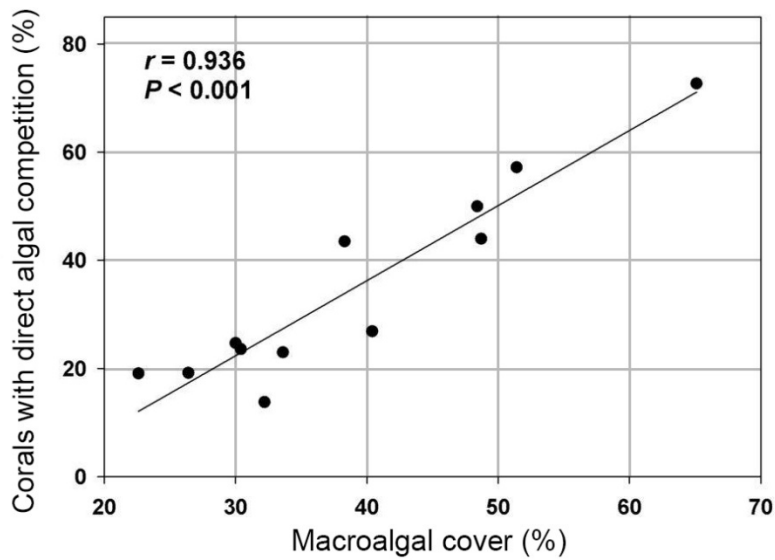
Data test summary

| Dataset	Item	Objective		
		Apply understanding	Analyse evidence	Interpret evidence
1	1	2		
	2		4	
	3	1		
	4			2
2	5			2
	6		2	
	7			2
	8	3		
	9			2
Total		6	6	8	20
Percentage		30%	30%	40%	100%

Dataset 1

The graphs below show patterns in macroalgal cover, coral competition and water clarity.

Figure 1: Patterns in macroalgal cover and juvenile coral density and competition

Source: Burkepile, DE, Allgeier, JE & Shantz, AA et al. 2013, 'Nutrient supply from fishes facilitates macroalgae and suppresses corals in a Caribbean coral reef ecosystem', *Scientific Reports*, vol. 3, article 1493, http://doi.org/10.1038/srep01493.

Figure 2: Partial effects plots of changes of macroalgal cover along gradients of water clarity (Secchi depth, in m)
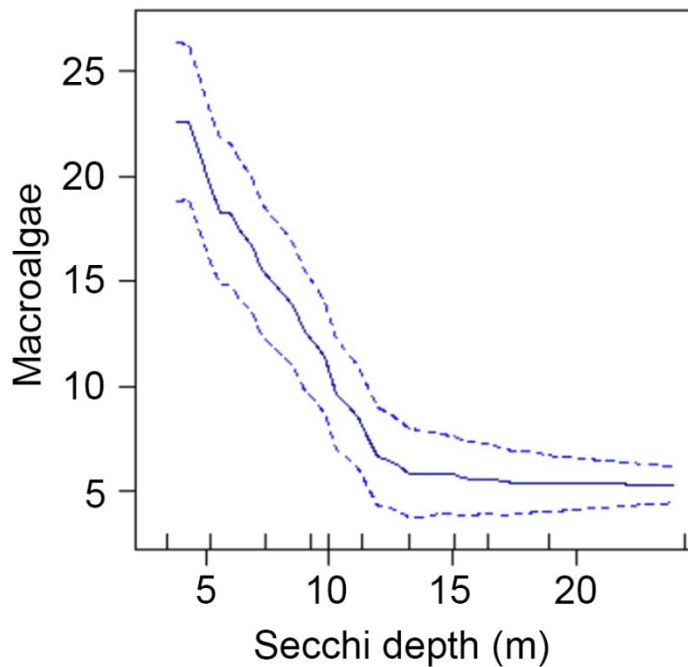
Source: De'ath, G & Fabricius, KE 2008, *Water quality of the Great Barrier Reef: Distributions, effects on reef biota and trigger values for the protection of ecosystem health*, final report to the Great Barrier Reef Marine Park Authority, Australian Institute of Marine Science, Townsville, p.59, https://hdl.handle.net/11017/416.

Question 1 (2 marks)

Determine the:

    a. percentage macroalgal cover that corresponds to a 40% direct competition with coral (refer to Figure 1)

Answer: …………………%

    b. Secchi depth that corresponds to the highest macroalgal cover (~22.5%) (refer to Figure 2).

Answer: …………………m

Question 2 (4 marks)

Identify the relationship between percentage macroalgal cover and:

    a. direct competition with coral

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    b. water clarity (Secchi depth).

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Dataset 2

The figure below shows coral core samples taken from three different sites.

In the figure, the colours represent individual coral genera within the reef matrix (see the inset key), the depth of each core is represented in cm, and U-series ages (AD±2σ errors) from the cores are shown adjacent to where they were taken from each core.

Figure 3: Core logs of fossil coral assemblages at Pelorus Island, Great Barrier Reef
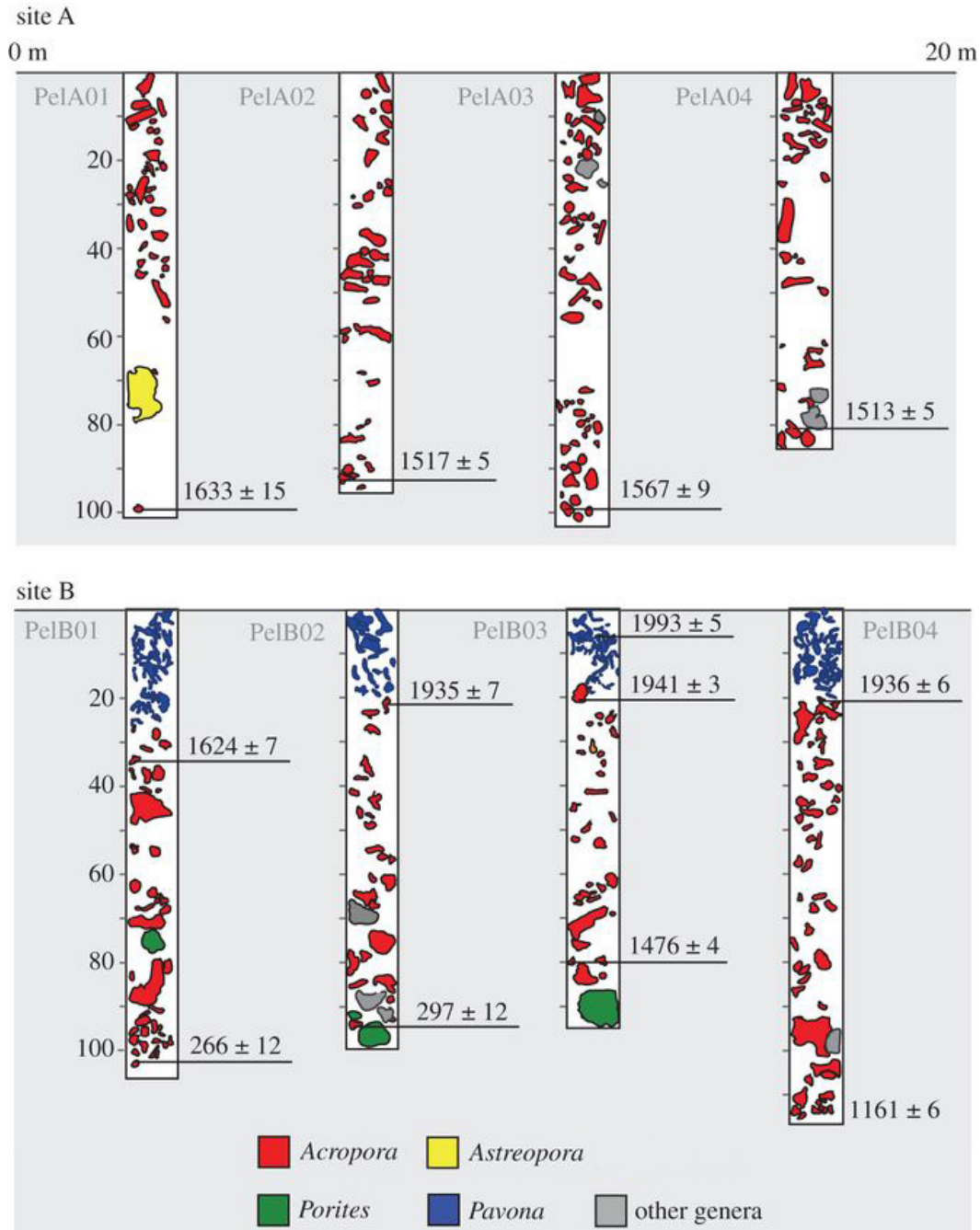
Question 3 (1 mark)

Identify the transect distance used at each site.

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Question 4 (2 marks)

Compare the temporal change in coral diversity between Site A and Site B.

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Question 5 (2 marks)

Infer which site shows the greatest change in the *Acropora* assemblage and the year range in which this occurred.

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Dataset 3

Scientists investigated the biodiversity of hard coral on Moffatt Reef in Hypothetical Bay. Their investigation lasted several months. The scientists recorded the number of individual coral colonies in multiple underwater video transects. Table 1 summarises their results.

In writing your response, you may use the abbreviations given in the table for the species' names.

Table 1: Mean number of coral recorded on Moffatt Reef in Hypothetical Bay

Species of coral	Mean number of individual coral colonies		p-value
	Site A	Site B	
Fungia fungites (FF)	14	0	< 0.001
Stylophora pistillata (SP)	25	11	< 0.05
Acropora hyacinthus (AH)	19	21	< 0.001
Acropora tenuis (AT)	32	3	< 0.001

Question 6 (2 mark/s)

Contrast the difference in the mean number of individual coral colonies in Site A and Site B for *Fungia fungites* and *Acropora hyacinthus*.

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Question 7 (2 marks)

Draw a conclusion about what the different p-values in Table 1 show. Give reasons for your conclusion.

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Question 8 (3 marks)

Calculate the species diversity for Site B (to two decimal places) using the following formula:

$$SDI = 1 - \left(\frac{\sum n(n-1)}{N(N-1)}\right)$$

where:

N = total number of organisms of all species

n = number of organisms of one species

Show your working.

$SDI_{Site\ B}$ =………………… (2 d.p.)

Question 9 (2 marks)

In a follow-up experiment, two individual coral colonies were observed in Site B of Moffatt Reef in Hypothetical Bay.

Infer the probability that these two individual coral colonies were from the same species. Give a reason for your response.

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Instrument-specific marking guide (ISMG)

Criterion: Data test

Assessment objectives

2. apply understanding of the reef and beyond or changes on the reef to given algebraic, visual or graphical representations of scientific relationships and data to determine unknown scientific quantities or features

3. analyse evidence about the reef and beyond or changes on the reef to identify trends, patterns, relationships, limitations or uncertainty in datasets

4. interpret evidence about the reef and beyond or changes on the reef to draw conclusions based on analysis of datasets

The student work has the following characteristics:		Marks
• consistent demonstration, across a range of scenarios about the reef and beyond or changes on the reef, of – selection and correct application of scientific concepts, theories, models and systems to predict outcomes, behaviours and implications – correct calculation of quantities through the use of algebraic, visual and graphical representations of scientific relationships and data	> 90%	10
– correct and appropriate use of analytical techniques to correctly identify trends, patterns, relationships, limitations and uncertainty – correct interpretation of evidence to draw valid conclusions.	> 80%	9
• consistent demonstration, in scenarios about the reef and beyond or changes on the reef, of – selection and correct application of scientific concepts, theories, models and systems to predict outcomes, behaviours and implications – correct calculation of quantities through the use of algebraic, visual and graphical representations of scientific relationships and data	> 70%	8
– correct use of analytical techniques to correctly identify trends, patterns, relationships, limitations and uncertainty – correct interpretation of evidence to draw valid conclusions.	> 60%	7
• adequate demonstration, in the reef and beyond or changes on the reef, of – selection and correct application of scientific concepts, theories, models and systems to predict outcomes, behaviours and implications – correct calculation of quantities through the use of algebraic, visual and graphical representations of scientific relationships and data	> 50%	6
– correct use of analytical techniques to correctly identify trends, patterns, relationships, limitations and uncertainty – correct interpretation of evidence to draw valid conclusions.	> 40%	5

The student work has the following characteristics:		Marks

• demonstration, in scenarios about the reef and beyond or changes on the reef, of elements of
   – selection and correct application of scientific concepts, theories, models and systems to predict outcomes, behaviours and implications
   – correct calculation of quantities through the use of algebraic, visual or graphical representations of scientific relationships or data
	> 30%	4

– correct use of analytical techniques to correctly identify trends, patterns, relationships, limitations or uncertainty – correct interpretation of evidence to draw valid conclusions.	> 20%	3

• demonstration, in scenarios about the reef and beyond or changes on the reef, of elements of
   – application of scientific concepts, theories, models or systems to predict outcomes, behaviours or implications
   – calculation of quantities through the use of algebraic or graphical representations of scientific relationships and data
	> 10%	2

– use of analytical techniques to identify trends, patterns, relationships, limitations or uncertainty – interpretation of evidence to draw conclusions.	> 1%	1
• •does not satisfy any of the descriptors above.	≤ 1%	0