Marine Science marking guide and response

External assessment 2025

Combination response (90 marks)

Assessment objectives

This assessment instrument is used to determine student achievement in the following objectives:

1. describe and explain the reef and beyond, changes on the reef, oceans of the future and managing fisheries
2. apply understanding of the reef and beyond, changes on the reef, oceans of the future and managing fisheries
3. analyse evidence about the reef and beyond, changes on the reef, oceans of the future and managing fisheries to identify trends, patterns, relationships, limitations or uncertainty
4. interpret evidence about the reef and beyond, changes on the reef, oceans of the future and managing fisheries to draw conclusions based on analysis.

Note: Objectives 5, 6 and 7 are not assessed in this instrument.

Purpose

This document consists of a marking guide and a sample response.

The marking guide:

- provides a tool for calibrating external assessment markers to ensure reliability of results
- indicates the correlation, for each question, between mark allocation and qualities at each level of the mark range
- informs schools and students about how marks are matched to qualities in student responses.

The sample response:

- demonstrates the qualities of a high-level response
- has been annotated using the marking guide.

Mark allocation

Where a response does not meet any of the descriptors for a question or a criterion, a mark of '0' will be recorded.

Allow FT mark/s — refers to 'follow through', where an error in the prior section of working is used later in the response, a mark (or marks) for the rest of the response can still be awarded so long as it still demonstrates the correct conceptual understanding or skill in the rest of the response.

Marking guide

Multiple choice

Question	Response
1	C
2	A
3	C
4	B
5	B
6	B
7	C
8	A
9	B
10	C
11	D
12	D
13	D
14	A
15	B
16	D
17	A
18	D
19	A
20	C

Paper 1: Short response

Q	Sample response	The response:
21a)	Carbon source: burning fossil fuels Carbon sink: carbon sequestration in ocean	• identifies a carbon source **[1 mark]** • identifies a carbon sink **[1 mark]**
21b)	pH	• identifies an oceanic abiotic factor **[1 mark]**
22	Ca^{2+} CO_3^{2-}	• identifies calcium ion and carbonate ion **[1 mark]**
23	The reef must not be exposed to any other stressors (e.g. cyclone, COTS, pollution or increased water temperature) while it recovers. Recovery is also aided by the presence of calcifiers, which encourages site selection by other corals.	• describes a condition necessary for reef recovery **[1 mark]** • describes a second condition necessary for reef recovery **[1 mark]**

Q	Sample response	The response:
24a)	2 to 8 metres	• identifies 2–8 m **[1 mark]**
24b)	As depth increases, dissolved oxygen concentration decreases.	• identifies the changes in oxygen concentration with depth **[1 mark]**
24c)	4 mg mL^{-1} is the lowest concentration of dissolved oxygen in which coral can survive. No living coral is found below 10 m, where dissolved oxygen is < 4 mg mL^{-1}.	• draws a conclusion **[1 mark]** • justifies the conclusion with – data from graph 1 **[1 mark]** – data from graph 2 **[1 mark]**
25	The change in distribution is because of rising sea temperatures. Warmer sea temperature negatively affects fish's physiology, as well as reducing the availability of baitfish and food aggregations, reducing prey. Therefore, the fish relocate to cooler waters to maintain body functions and access to food.	• identifies the change in distribution is due to increasing ocean temperature **[1 mark]** • explains how temperature affects fish **[1 mark]**

Q	Sample response	The response:
26a)	The highest-ranking species has changed from branching coral to macroalgae.	• identifies the change in highest ranking species **[1 mark]**
26b)	Prior to overfishing, the species richness on the reef was high (52 species) whereas, after overfishing, this was significantly reduced (33 species). Species evenness was higher prior to overfishing than after, especially for high-ranking species.	• identifies a difference in diversity **[1 mark]** • identifies a second difference in diversity **[1 mark]**
26c)	If the reef does not show hysteresis, the species rank and abundance will recover to be similar to what is shown before overfishing. If the reef displays hysteresis, the relative abundance will stabilise in an alternate stable state, and species rank will remain similar to that seen after overfishing. Then, as the reef recovers from this alternate state, the species rank and relative abundance data could differ to that of before overfishing, as the path of recovery is different to that of degradation.	• infers that if data – is similar to before overfishing, hysteresis is not shown **[1 mark]** – remains similar to after overfishing, hysteresis may be shown **[1 mark]** • provides a reason **[1 mark]**

Q	Sample response	The response:
27a)	replication	• identifies a criterion **[1 mark]**
27b)	Replication ensures that the same habitats that support coral trout species are included multiple times in the region. Replication reduces the risk of species loss. If one area is affected by a negative pressure (e.g. flooding, COTs or bleaching), there will be other areas that remain untouched, allowing the coral trout species to continue to be represented in this section of the GBR.	• describes the criterion **[1 mark]** • explains how the criterion applies to coral trout species **[1 mark]**
27c)	A key management strategy would be to enforce size limits for commercial and recreational fishers in the habitat protection zones. This would help maintain the coral trout population by allowing small fish to move from the NTMR into the habitat protection zone and establish populations, without being fished.	• identifies a management strategy **[1 mark]** • explains how the management strategy maintains the coral trout population **[1 mark]**

Paper 2: Short response

Q	Sample response	The response:
1	Developing countries have limited access to technologies suitable to support aquaculture.	• identifies a factor **[1 mark]**
2	Dynamic spatial monitoring provides information about the migration patterns associated with the seasonal movement and life cycle stages of the species. This data is used to sustainably manage the fishery stock and habitats. This is effective as it ensures that all habitats used by the fish are protected and therefore the life-cycle of the fish can be sustained.	• describes that dynamic spatial monitoring is used to capture species migration data **[1 mark]** • explains how information is used to effectively manage the fishery **[1 mark]** • explains that dynamic spatial monitoring enables ecosystem-based management **[1 mark]**
3a)	1. fast growth rate 2. good market value	• identifies an attribute of barramundi **[1 mark]** • identifies a second attribute of barramundi **[1 mark]**
3b)	Cannibalism can be reduced by regularly sizing fish to keep fish of the same size together. By reducing the size difference in fish kept together, cannibalism would be reduced, as barramundi only eat fish up to 67% of their own length.	• infers a method for reducing cannibalism **[1 mark]** • provides reasoning **[1 mark]**

Q	Sample response	The response:
4a)	Reef B. Reef B demonstrated significant decline in mean zooxanthellae density (from 5.8×10^5 cells cm^{-2} to 0.5×10^5 cells cm^{-2}) and when zooxanthellae are expelled from coral, it bleaches.	• identifies reef B **[1 mark]** • provides reasoning **[1 mark]**
4b)	Similarity: The mean density of heat-tolerant zooxanthellae in both reef A and B declined across the 10-week period. Difference: The decrease in mean zooxanthellae density was far greater on reef B (~5.5×10^5 cells cm^{-2}) than reef A (~1.9×10^5 cells cm^{-2}). Significance: *Acropora* on reef A is more tolerant to heat stress events than on reef B, due to the type of zooxanthellae in its cells.	• identifies a similarity **[1 mark]** • identifies a difference **[1 mark]** • identifies a significance **[1 mark]**
4c)	A reduction in zooxanthellae density on reef A would mean that the coral's energy from respiration would be reduced. This is because zooxanthellae have a symbiotic relationship with coral, supplying the coral with glucose from photosynthesis.	• predicts that the coral's energy is reduced **[1 mark]** • justifies the reasoning **[1 mark]**
4d)	*Acropora* on reef B would become more tolerant to heat stress in the future as it does not regain its heat-sensitive zooxanthellae. This is because most of the zooxanthellae density that was lost on reef B was heat-sensitive, leaving *Acropora* with a higher proportion of heat-tolerant zooxanthellae, and therefore more tolerant.	• predicts *Acropora* on reef B will become more tolerant **[1 mark]** • justifies the response, referring to the second graph **[1 mark]**
5a)	Maximum sustainable yield (MSY) is the largest average catch that can be continuously taken from a stock under existing environmental conditions. Maximum economic yield (MEY) is the sustainable catch or effort level that allows for profit to be maximised.	• describes MSY **[1 mark]** • describes MEY **[1 mark]**
5b)	MEY should be used to manage a fishery in decline because the catch yield in MEY is lower than MSY, which would better allow the fishery to recover.	• identifies MEY **[1 mark]** • explains the use of MEY to support recovery **[1 mark]**

Q	Sample response	The response:
6a)	In areas where pH is low (< 8), aragonite saturation state is also low (< 3).	• describes the relationship **[1 mark]**
6b)	Corals at location X would show signs of stress. Location X shows evidence of ocean acidification, with a pH of 7.95 and an aragonite saturation state of less than 3. This may reduce the coral growth rate.	• predicts corals at location X would show signs of stress **[1 mark]** • justifies the prediction using pH and aragonite saturation data **[1 mark]**
7a)	A significant amount of Australian seafood is exported because the value of the product is higher overseas. Also, there is a higher demand for Australian seafood from overseas markets, especially for high-value products.	• identifies a reason for export **[1 mark]** • identifies a second reason for export **[1 mark]**
7b)	When demand for a product is high, the price of the product increases.	• describes how market demand influences the seafood price **[1 mark]**
8	From 1993 to 1998, effort was far greater than catch. This led to the closure of the fishery in 1999, which enabled the stock to begin to recover. In 2010, TACC was increased only because catch met TACC in the previous year. When catch did not meet TACC between 2010 and 2013, TACC was decreased. This allowed for the recovery of the stock.	• infers one way the data was used to inform a fishery management decision **[1 mark]** • explains the effect of this decision on the fishery **[1 mark]** • infers a second way the data was used to inform a fishery management decision **[1 mark]** • explains the effect of this decision on the fishery **[1 mark]**

Q	Sample response	The response:
9a)	Fish like snapper migrate between different habitats during their life-cycle. As adults they are often located on reefs, as their breeding grounds are offshore.	• explains that fish migrate between habitats during different stages of their life-cycle **[1 mark]** • explains a reason for migration to a reef **[1 mark]**
9b)	Commercial fisher logbooks are more reliable than recreational charter boat reports. Commercial fishers' data is monitored by fisheries and verified by monitoring of vessel movements. Enforcement also ensures their logbooks are accurate. Data from self-reported recreational boat charter reports may not be reliable, as charter boats deliberately target larger fish and undersized fish and bycatch are not reported.	• draws a conclusion that commercial fisheries logbooks are more reliable than recreational charter boat reports **[1 mark]** • describes the reliability of commercial fisheries logbooks **[1 mark]** • describes the reliability of self-reported recreational boat charter reports **[1 mark]**
9c)	Recreational fishers may not tag fish properly. Fish may may lose the tag.	• identifies a limitation **[1 mark]** • identifies a second limitation **[1 mark]**
10	20 000 years ago, sea levels were much lower than they currently are (~120 m) and the continental shelf was exposed. Therefore, the GBR was much further seaward than it is today. As sea levels continued to rise, the coral reefs continued to moved further inland to stay in shallow waters and the reefs in deeper water drowned. Sea levels have been stable for the last 6500 years, which means that the GBR has not significantly changed its distribution in this time.	• explains how sea levels 20 000 years ago influenced coral distribution **[1 mark]** • explains how sea levels have changed since **[1 mark]** • explains that coral distribution has remained relatively unchanged since sea levels stabilised **[1 mark]**

Q	Sample response	The response:
11a)	$H_2CO_3(aq)$	• identifies H_2CO_3 **[1 mark]**
11b)	The carbonate buffering system is present in sea water but is significantly reduced in fresh water. This means that high atmospheric carbon dioxide has a greater effect on fresh water, as it reduces the pH further than in sea water.	• identifies that oceans have a higher carbonate buffering capacity than fresh water **[1 mark]** • explains the effect on sea water and fresh water pH **[1 mark]**
11c)	As ocean temperature increases, the ability for the ocean to absorb carbon dioxide from the atmosphere decreases. This means that there would be less carbonic acid in the ocean and pH of the ocean would increase.	• explains the effect of increasing temperature on carbon dioxide uptake in oceans **[1 mark]** • explains the effect on pH **[1 mark]**