Marine Science marking guide and response

External assessment 2023

Combination response (94 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.

Where no response to a question has been made, a mark of 'N' 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	D
2	D
3	A
4	C
5	B
6	A
7	A
8	B
9	D
10	B
11	D
12	A
13	B
14	C
15	C
16	B
17	C
18	D
19	C
20	A

Paper 1: Short response

Q	Sample response	The response:

21	International waters are freely accessed by different nations. Species that migrate through these areas are at risk due to the different management strategies of each nation.
	To accommodate this, international agreements exist to protect migratory species.
		• explains
		  – that international waters have no restrictions **[1 mark]**
		  – that countries have different ways to manage migratory species **[1 mark]**
		  – why international agreements are needed **[1 mark]**

22a)	An argument for mangrove conservation is an ecological argument. From an ecological perspective, mangrove habitats should be preserved because mangroves provide critical habitat. Mangroves play a critical role supporting commercial fisheries as nursery grounds for juveniles. The above-ground roots also slow down water flows and reduce erosion from the shoreline.	• identifies an argument for mangrove conservation **[1 mark]** • explains a reason that is linked to the argument **[1 mark]** • explains a second reason that is linked to the argument **[1 mark]**
22b)	Monitor and minimise the impact of surface runoff from land near mangroves. Runoff can cause erosion and introduce pollutants, which can reduce water quality in mangrove habitats.	• identifies a management strategy **[1 mark]** • provides an explanation **[1 mark]**

Q	Sample response	The response:
23a)	$N = 16$ $SDI = 1 - \left(\dfrac{\sum n(n-1)}{N(N-1)}\right)$ $= 1 - ((1(1-1) + 3(3-1) + 0(0-1) + 3(3-1) + 5(5-1) + 0(0-1) + 2(2-1) + 1(1-1) + 0(0-1) + 1(1-1)) / (16 \times 15))$ $= 1 - \dfrac{34}{240}$ $SDI = 0.86$ (to two decimal places)	• shows correct substitution **[1 mark]** • determines SDI = 0.86 **[1 mark]**

23b)	Similarity: **The species richness** (7) **and diversity** (SDI of 0.84 and 0.86) **in reefs A and C are similar.**
	
	Difference: **Reef B is dominated by one species** (grazing herbivores), **which causes its SDI to be much lower than reefs A and C.**
	
	Significance: **Reef B could be under stress since its diversity is lower than the other two reefs.**
		• identifies
		  – a similarity **[1 mark]**
		  – a difference **[1 mark]**
		  – the significance **[1 mark]**

Q	Sample response	The response:
24a)	Increased rainfall	• identifies an effect on weather conditions **[1 mark]**

24b)	Increased rainfall may cause increase in surface runoff and nutrient discharge from local waterways. This could result in an algal bloom that decreases light availability for coral growth.	• describes
		  – an impact from the weather condition identified in Question 24a) **[1 mark]**
		  – how this impact affects a chosen marine environment **[1 mark]**

25a)	RCP 2.6	• identifies RCP 2.6 **[1 mark]**
25b)	The pH scale is a measure of the concentration of H^+ ions; however, a high H^+ ion concentration leads to a low pH value. This is reflected in the graphs because the concentration of H^+ ions increases after 2000, and the pH decreases.	• explains the relationship between $[H^+]$ and pH **[1 mark]** • identifies evidence to support relationship **[1 mark]**
25c)	Coral reefs will have a higher dissolution rate than accretion rate at the pH in an RCP 8.5 scenario. This will reduce the growth rate of coral, leading to lower biodiversity of coral and fish species on the reef.	• describes a consequence of low pH for coral reef ecosystems **[1 mark]** • describes a second consequence for coral reef ecosystems **[1 mark]**

Q	Sample response	The response:
26a)	The precautionary principle involves exercising caution in management decisions and helps to ensure no unnecessary or unwanted effects on the environment.	• explains the precautionary principle **[1 mark]**
26b)	E-monitoring as part of dynamic spatial zoning is a management technique that should be implemented since the fish species is migratory. E-monitoring is used to monitor species numbers and behaviours and involves sensors and video cameras capable of monitoring and recording fishing activities.	• identifies a management technique **[1 mark]** • explains the management technique **[1 mark]**
27	The feed conversion ratio of a species is the feed requirement per unit of body weight gain. A low feed conversion ratio means that less food is required to produce a marketable fish and so the product costs less to grow.	• explains the – low feed conversion ratio **[1 mark]** – lower cost of production **[1 mark]**

Paper 2: Short response

Q	Sample response	The response:
1a)	The higher the levels of dissolved oxygen, the higher the percentage of corals and species richness. This means coral reefs will be found distributed in marine waters with high levels of dissolved oxygen.	• identifies the relationship **[1 mark]** • explains coral distribution **[1 mark]**
1b)	Warm water temperature (in the range of 18–29 °C) Light availability for photosynthetic zooxanthellae	• identifies an abiotic factor **[1 mark]** • identifies a second abiotic factor **[1 mark]**

2a)	If tiger sharks are removed from this scenario, the seagrass competition hierarchies are altered due to overpopulation of turtles (herbivores). Overgrazing by turtles results in reduced seagrass coverage and possible degradation of the entire ecosystem.	• identifies the effect of tiger shark removal on
		  – turtle populations **[1 mark]**
		  – seagrass meadows **[1 mark]**
		• explains an effect on seagrass meadows **[1 mark]**

2b)	Loss of tiger sharks (the top level predator) would reduce the abundance of seagrass meadows, which are a nursery for young fish. The loss of fish nurseries would reduce the abundance and diversity of fish in fisheries.	• describes how removing sharks would impact local fisheries **[1 mark]** • identifies the importance of seagrass beds to the fishing industry **[1 mark]**

Q	Sample response	The response:
3a)	Ocean water resists pH change because of the presence of the carbonate buffering system.	• identifies carbonate buffering system **[1 mark]**

3b)	Natural: decaying organic matter
	Anthropogenic: burning of fossil fuels and deforestation
		• identifies
		  – a natural source of atmospheric CO_2 **[1 mark]**
		  – an anthropogenic source of atmospheric CO_2 **[1 mark]**
		  – a second anthropogenic source of atmospheric CO_2 **[1 mark]**

3c)	Carbon dioxide is absorbed from the atmosphere and reacts with ocean water to form carbonic acid. Carbonic acid forms bicarbonate and excess hydrogen ions. Bicarbonate ions can split further to release hydrogen and carbonate ions, increasing levels for both.	• describes the
		  – reaction of carbon dioxide and water to form carbonic acid **[1 mark]**
		  – breakdown of carbonic acid (H_2CO_3) to release bicarbonate (HCO_3^-) and hydrogen (H^+) ions **[1 mark]**
		  – increase in carbonate (CO_3^{2-}) ions **[1 mark]**
		  – increase in hydrogen ions **[1 mark]**

3d)	Shell-forming organisms require carbonate ions to grow their shells. The carbonate buffering system leads to an increase in carbonate ions when there is more CO_2 in the atmosphere. Since carbonate is required to buffer excess hydrogen ions, there is less available for shell growth, resulting in reduced growth and weaker shells.	• explains that carbonate is required to grow shells **[1 mark]**
		• identifies the implications are
		  – reduced/slower growth **[1 mark]**
		  – weaker shells **[1 mark]**

Q	Sample response	The response:
4a)	Site selection is performed by the coral planula.	• identifies coral planula **[1 mark]**

4b)	A healthy reef has a balanced population of grazers (biotic), which keep algae under control. This creates available space (abiotic) allowing for coral settlement.	• identifies
		  – an abiotic factor **[1 mark]**
		  – a biotic factor **[1 mark]**
		• explains
		  – the abiotic factor **[1 mark]**
		  – the biotic factor **[1 mark]**

5	Fish species, such as red emperors, migrate across multiple habitats during their life cycle. Each stage of a reef fish's life cycle occurs in a different habitat, including the open ocean, mangroves, estuaries, seagrass beds and coral reefs. Connectivity among these habitats is essential to allow species to complete a full life cycle and replenish population numbers. If one of the habitats is lost in this connective chain, or is located too far away, the survival of the fish species will be reduced.	• identifies an example of a relevant fish species **[1 mark]**
		• explains
		  – that the identified species moves between habitats during its life cycle **[1 mark]**
		  – the importance of connectivity in species replenishment **[1 mark]**

Q	Sample response	The response:
6a)	66 – 6 = 60%	• identifies percentage **[1 mark]**
6b)	Global fisheries are in decline. The percentage of stocks fished at biologically sustainable levels has decreased between 1978 and 2017, from 90% to 66%. Only 6% of fish stocks are underfished in 2017.	• concludes that global fisheries are in decline **[1 mark]** • identifies a piece of supporting data **[1 mark]** • identifies a second piece of supporting data **[1 mark]**
7a)	2016–17	• identifies 2016–17 **[1 mark]**

7b)	Total value of prawn production experienced a decline in the period 2016–17 to 2021–22.
	This may be due to reduced availability of prawn stocks or a reduction in price per kilogram.
		• identifies a
		  – decline in production value **[1 mark]**
		  – possible reason for the trend **[1 mark]**
		  – second possible reason for the trend **[1 mark]**

7c)	Similarity: Since 2006–07, there has been a similar proportion of wild caught to aquaculture produced value year to year.
	Difference: Predicted economic value will increase as a total and the proportion of aquaculture will increase relative to wild caught.
	Significance: Total economic value is predicted to increase for aquaculture, while wild caught is predicted to remain stable or slightly decline in the coming years. This may mean the wild caught population is less likely to be overfished.
		• identifies
		  – a similarity **[1 mark]**
		  – a difference **[1 mark]**
		  – the significance **[1 mark]**

Q	Sample response	The response:
7d)	Prawns are a desirable farm species due to their: • fast growth rate. Shorter times for quality production of protein mean lower costs per kg of protein produced. • low feed conversion ratio. A lower FCR represents a more efficient use of feed resources and so lower cost per kg protein produced.	• identifies an attribute **[1 mark]** • explains this attribute **[1 mark]** • identifies another attribute **[1 mark]** • explains this attribute **[1 mark]**
8a)	The southern Great Barrier Reef has the highest proportion of reefs with very high coral cover because it has 9/20 (45%) reefs, which is a higher proportion than 4/53 (8%) for central GBR and 4/54 (7%) for northern GBR.	• determines the southern region **[1 mark]** • provides reasoning **[1 mark]**
8b)	Similarity: From 2020 onwards, both reefs increased coral cover (by ~10%), indicating a period of recovery. Difference: Between 2012 and 2017, the southern GBR had an overall increase in coral cover (from 12% to 37%) whereas the northern GBR decreased coral cover (from 28% to 8%).	• identifies a similarity **[1 mark]** • identifies a difference **[1 mark]**
8c)	There were only 20 sample reefs in the southern location.	• identifies a valid limitation of the data **[1 mark]**