Marine Science marking guide and response

External assessment 2022

Combination response (103 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.

Queensland Government | QCAA Queensland Curriculum & Assessment Authority

For all Queensland schools

Marking guide

Paper 1: Multiple choice

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

Paper 1: Short response

Q	Sample response	The response:
21	Both are used to manage fisheries to maximise yields. The MEY sets limits to maximise profits for the fishery as a whole and is often set below the MSY. The significance of using MEY compared to MSY is that lower catch rates increase the market value of the target species.	• identifies a similarity **[1 mark]** • identifies a difference **[1 mark]** • recognises their significance **[1 mark]**
22	Similarity: Regions A and B have both been subject to multiple consecutive years of disturbance over a similar time period. Difference: Region A maintained a consistent coral cover of around 30% while region B's coral cover declined from 40% to approximately 20%. Significance: Region A is more resilient to disturbance than region B.	• identifies a similarity **[1 mark]** • identifies a difference **[1 mark]** • recognises their significance **[1 mark]**

Q	Sample response	The response:
23	Order *Alcyonacea* 1. Eight-fold symmetry 2. Base attaches to hard substrate (sessile)	• classifies organism as *Alcyonacea* **[1 mark]** • identifies one reason **[1 mark]** • identifies a second reason **[1 mark]**
24	Volcanoes are a source of carbon dioxide (CO_2), so the volcanic activity would have caused elevated atmospheric concentrations of CO_2. This increased atmospheric CO_2 would have caused an increased concentration of dissolved CO_2 in the ocean. Dissolved CO_2 forms carbonic acid (H_2CO_3). This acid then releases a bicarbonate ion (HCO_3^-) and a hydrogen ion (H^+). The hydrogen ion bonds with free carbonate ions (CO_3^{2-}) in the water, forming another HCO_3^-. That carbonate would otherwise be available to marine animals for making calcium carbonate ($CaCO_3$) shells and skeletons. High concentrations of atmospheric CO_2 make it more difficult for calcifying organisms to form aragonite shells, giving those species a disadvantage. The extremely high atmospheric CO_2 of the Triassic-Jurassic boundary would have given calcifying species such a disadvantage that they would have gone extinct.	• identifies that volcanism as the likely source of the high carbon dioxide at the Triassic–Jurassic boundary **[1 mark]** • identifies how high atmospheric carbon dioxide would cause a high concentration of dissolved carbon dioxide in the ocean **[1 mark]** • identifies that dissolved carbon dioxide forms carbonic acid releasing hydrogen ions, which in turn bonds with carbonate ions to form bicarbonate **[1 mark]** • identifies that this reduces the availability of carbonate ions **[1 mark]** • identifies how this reduced availability of carbonate ions is a disadvantage for calcifying species **[1 mark]**

Q	Sample response	The response:
25a)	$\mathrm{N} = 39$ $\Sigma n(n-1)$ $= 6 \times 5 + 0 \times 0 + 1 \times 0 + 29 \times 28 + 2 \times 1 + 1 \times 0$ $= 844$ $SDI = 1 - \left(\frac{\Sigma n(n-1)}{N(N-1)}\right) = 1 - \left(\frac{844}{39 \times 38}\right) = 1 - \frac{844}{1482} = 1 - 0.57$ $SDI = 0.43$	• substitutes $\Sigma n(n-1)$ **[1 mark]** • calculates $\left(\frac{\Sigma n(n-1)}{N(N-1)}\right)$ **[1 mark]** • identifies SDI as 0.43 **[1 mark]**
25b)	Site B is likely to have higher coral diversity because it has higher fish species diversity (+0.24) and higher abundance (+10).	• predicts site B **[1 mark]** • contrasts species diversity **[1 mark]** • contrasts species abundance **[1 mark]**
26	Extensive aquaculture requires lower levels of management than intensive. Extensive uses lower stocking densities than intensive. Extensive has lower yields than intensive.	• provides one difference **[1 mark]** • provides a second difference **[1 mark]** • provides a third difference **[1 mark]**
27	Combining bag limits with marine reserves can help protect target species from overfishing. This precautionary approach means the fish population will still benefit outside the reserves.	• identifies a precautionary measure that links fisheries management **[1 mark]** • describes how the measure links to the precautionary principle in ecosystem management **[1 mark]**

Q	Sample response	The response:
28	The coral cover (coral recovery) at both reefs recovered to pre-disturbance levels (within 10 years). Coral community functional diversity is predicted to take much longer to recover at reef B. Some communities do not recover as quickly due to differences in functional diversity in different locations.	• identifies a similarity **[1 mark]** • identifies a difference **[1 mark]** • recognises their significance **[1 mark]**

Paper 2: Short response

Q	Sample response	The response:
1a)	The graph shows there is a net increase in overall hard coral cover associated with high CO_2 locations. Massive coral's percentage cover increases in high CO_2 locations, whereas structural coral's percentage cover decreases in high CO_2 locations. Structural corals are more susceptible to effects of low pH conditions because they become brittle and break.	• provides a valid conclusion **[1 mark]** • provides a second valid conclusion **[1 mark]**
1b)	Fish populations would decrease in richness in high CO_2 locations. This is due to a decrease in species richness and associated habitat complexity associated with a decrease in structural corals in high CO_2 locations.	• explains that fish species richness would be lower in the high CO_2 site **[1 mark]** • explains that it is because of the reduced richness of hard coral species **[1 mark]**
2	A seagrass meadow is a nursery ground for eggs and food and protection for young animals from predators. It would promote the health of any connected habitats and their associated food webs. This positively supports commerical fish stocks, allowing MSY to be harvested.	• identifies the value of the seagrass meadow as a nursery **[1 mark]** • identifies the value of a marine protected area in promoting connectivity **[1 mark]** • explains how values link to sustainability of the local fishery **[1 mark]**

Q	Sample response	The response:
3a)	CO_2 emissions of the climate model scenario show a very high concentration, over 900 ppm of atmospheric carbon dioxide by 2100. This corresponds with a decline in pH from around 8.1 to around 7.7 in 2100. The effect of this would be to increase ocean acidification and increase water temperature. We would therefore expect that the diversity of species (particularly coral and fish) on the Great Barrier Reef (GBR) will decline and the structure of the reef would also be predicted to be weakened due to the acidity of the waters around the GBR by 2100.	• identifies one effect of increased CO_2 concentration/reduced pH **[1 mark]** • identifies a second effect of increased CO_2 concentration/reduced pH **[1 mark]** • predicts one ecological implication **[1 mark]** • predicts a second ecological implication **[1 mark]**
3b)	Coral reef resilience (which is the ability of an ecosystem to recover from disturbances) would likely mitigate some of these changes in the short term. However, since ocean acidification is a permanent change and not a short-term disturbance, the ecosystem would not be able to return to its original state. Therefore, we would not expect to see these changes by the end of the century, but there would be a time-delay on a resilient reef.	• explains that resilience would offset changes in the short term **[1 mark]** • explains that ecosystem changes would not be observed immediately **[1 mark]** • explains that eventual changes will be observable over time **[1 mark]**

Q	Sample response	The response:
4a)	The luminescence and river discharge appear to be well-correlated. This means that luminescence can be used to infer the river discharge. Thus, peaks in luminescence before 1922 likely correspond to flood events. At around 1860 there is an increase in the frequency and intensity of peaks in luminescence. This indicates that floods are occurring more frequently after 1860 than before, and that these floods are larger events.	• identifies that luminescence and discharge are correlated **[1 mark]** • explains that luminescence can be used to infer river discharge **[1 mark]** • explains that peaks in luminescence can be used to identify past flood events **[1 mark]** • draws a conclusion about the flood frequency after 1860 **[1 mark]** • draws a conclusion about the flood intensity after 1860 **[1 mark]**
4b)	Land use changes in terrestrial ecosystems, e.g. land clearing for grazing, can increase run-off and the sediment load of rivers. This is the likely cause of the increase in frequency and intensity of flood events. The flood events and increased sediment load decreases water quality on nearby reefs, connecting terrestrial and marine ecosystems via river discharge.	• identifies a relevant change in land use **[1 mark]** • explains how the change in land use affects the quality of water in terrestrial ecosystems **[1 mark]** • explains how the quality of the water affects the health of the reef **[1 mark]**

Q	Sample response	The response:
5a)	Recreational, because the harvest is well below TAC.	• identifies recreational **[1 mark]** • provides a reason **[1 mark]**
5b)	There is insufficient data to determine the status of the overall fish stock. The supplied data is for a single sector of the southern bluefish tuna stock.	• determines that there is insufficient data **[1 mark]** • provides a valid reason **[1 mark]**
5c)	The number of fish harvested has decreased from 53 060 in 2005 to 41 623 in 2015. Over this time, the catch weight of the fish has increased, from 0.014 tonnes per fish to 0.017 tonnes per fish. This means that, on average, the fish are larger, which indicates that the sustainability of the fishery has improved.	• identifies a difference **[1 mark]** • identifies a second difference **[1 mark]** • concludes that the sustainability of the fishery has improved **[1 mark]**

Q	Sample response	The response:
6a)	gametes, zygotes, planulae, polyp budding	• identifies – gametes **[1 mark]** – zygotes **[1 mark]** – planulae **[1 mark]** – polyp budding **[1 mark]**
6b)	Planulae use coarse environmental cues, such as light and crustose coralline algae, to select suitable habitat sites. Planulae can also use chemical cues to indicate habitats where individuals have previously been successful. Cues can either induce or inhibit settlement.	• explains how planulae use environmental cues to select suitable sites **[1 mark]** • explains how planulae use chemical cues **[1 mark]** • explains that the cues can have a positive or negative response to settlement **[1 mark]**
6c)	Population, genetic, community and ecosystem connectivity are all required in species replenishment. Because habitats are often patchy, local sub-population interactions influence the characteristics of the overall population, including its genetic diversity. Much of the population connectivity is achieved by the transport of young from one population to another in a similar but spatially separated habitat. The strength of ecosystem connectivity is positively correlated to species replenishment.	• identifies at least one relevant type of connectivity in species replenishment **[1 mark]** • explains the role of the type of connectivity in species replenishment **[1 mark]** • explains the strength of ecosystem connectivity is positively correlated to species replenishment **[1 mark]**
7	Calcium carbonate is present in two separate forms (aragonite and calcite) in differing amounts depending on the organism that made it. As calcium carbonate shells of dead organisms sink, their solubility increases with depth and pressure. Aragonite is more soluble than calcite, so it will dissolve first. Therefore, the position of the CCD and the ratio of aragonite and calcite in dead organisms will affect the composition of seafloor sediment.	• identifies calcite and aragonite as the two forms of calcium carbonate **[1 mark]** • explains solubility is affected by depth or pressure **[1 mark]** • identifies that aragonite is more soluble than calcite **[1 mark]** • explains how the position of the CCD affects the calcium carbonate composition in deep sea floor sediments **[1 mark]**

Q	Sample response	The response:
8a)	Economic value — the target species has retained its value over time.	• identifies economic value **[1 mark]**
8b)	Rapid maturation. The prawn reaches adulthood in 1 year. This means the prawn has spawned and is ready for harvest in under 18 months.	• identifies a plausible attribute growth **[1 mark]** • identifies a reason linked to the data **[1 mark]** • identifies how this makes it desirable to farm **[1 mark]**
8c)	The prawn's complex life cycle is heavily affected by external factors, such as currents, resulting in rapid changes to population. As the first four larval stages are planktonic, it is difficult to predict adult population stock. The prawn's short life cycle of one year means that scientists can't produce stock information in time for fisheries to set quotas. Total allowable catch would only account for the live adult catch but the rest of the life cycle stages are migratory, making it difficult to implement a TAC if juveniles are caught as bycatch.	• identifies rapid population changes **[1 mark]** • identifies the difficulty of predicting adult populations for organisms with planktonic larval **[1 mark]** • identifies an implication of setting stock limits for organisms with short life cycles **[1 mark]** • identifies an implication of implementing TACs for migratory species **[1 mark]**
9	Temperature and light availability control the distribution of reefs in this region. Most of the region is deeper than 100 m, which is too deep for coral reefs because of the limited light. In the areas adjacent to the continent that are shallow enough, much of it is too cold for coral reefs. The coral reefs therefore occur on the islands because it is both shallow enough and warm enough to support them.	• identifies light availability as a factor **[1 mark]** • explains that most of the area is too deep for coral reefs **[1 mark]** • identifies temperature as a factor **[1 mark]** • explains that most of the areas adjacent to the continent that are <100 m are too cold for coral reefs **[1 mark]**