

MARINE SCIENCE

Paper 5180/01
Structured

Key messages

- Candidates need to make sure they fully understand what the question is asking, and ensure they answer all aspects of the question.
- Candidates also need to ensure they are secure with the use of scientific language and terminology, and understanding of definition of key terms.
- Candidates could be encouraged to highlight keywords in a question to refer back to as they are developing their answers.

General comments

Most candidates clearly put a lot of effort into their work, confidently attempting to answer questions they felt familiar with. Candidates often did not provide sufficient detail and depth in their longer answers, and needed to understand the difference in the command words, e.g., how they are expected to answer a 'describe' question differently to an 'explain' question.

There were a number of blank answers to questions and candidates should be encouraged to return to difficult questions and attempt an answer to all questions.

Comments on specific questions

Question 1

- (a) Most candidates were able to identify at least one of the oceans, with the most common error being labelling the Atlantic Ocean as the Pacific Ocean.
- (b)(i) Candidates often gained at least partial credit. Some candidates identified the continental shelf as the continental slope and some mistook the trench for the abyssal plain. The other error was labelling the seamount as a coral atoll or the volcano as the coral atoll rather than the coral growing around the volcanic island.
- (ii) Candidates were told that point **A** showed where a river entered the ocean, so they needed to recognise that the water in this area would have a large influx of freshwater, that would not be present at location **B**. They then needed to explain that the freshwater would lower the salinity of the water at point **A**. Many candidates could state that the salinity at **A** was lower but few went on to explain why.
- (iii) Candidates gave a wide variety of answers, including temperature, pH or in flow of river water, which were not sufficient for credit. It was generally stronger candidates who gave the answers of rainfall, precipitation or evaporation.
- (c) Although candidates are usually able to explain that run-off brings nutrients into the ocean, few applied this knowledge to this situation. While some candidates did state there were more producers in this area, many attributed that to increased sunlight. However, river water is often turbid and so reduces the sunlight penetration compared to the open ocean.

Question 2

- (a) (i) Many candidates recognised the sea cucumber as an echinoderm with the most common error being to classify them as cnidaria.
- (ii) Most candidates recognised the tube feet and that they were for movement.
- (iii) Many candidates recognised this as external fertilisation and were able to state that the released sperm and released eggs fused while in the water. Fewer candidates mentioned that the larvae drifted before settlement. A few candidates impressively went well beyond the specification and mentioned the names of the different larval stages.
- (b) (i) The reading of the figures from the graph needed to be accurate. Many candidates took a reading of 14 for the value in the year 2000 but did not look closely enough at the value for 2003, which was below half a small square and so they needed to select a value of less than one, i.e., 0.9 to 0.5, in order to complete the calculation with sufficient accuracy.
- (ii) Candidates needed to recognise that the fishery was in decline or that the value of the fishery was decreasing. This could be seen by the great reduction in catch of the medium and high value species along with the increase in low value catch. Many candidates were able to score at least partial credit with a description of something happening to the high, medium or low value species.
- (iii) Weaker candidates rarely answered correctly and many of them omitted this question. Other candidates stated a quota which reduces the number of organisms caught so leaving more to reproduce in the future. Where candidates mentioned maximum sustainable yield (MSY) they needed to explain that fishing needed to be below the MSY in order for the fishery to start to repopulate. A significant number of stronger candidates gave two management practices but did not always explain them.
- (c) (i) Most candidates correctly stated that the relationship was that the price decreased for smaller sea cucumbers or that the price was greater for larger specimens. However, few recognised the shape of the curve or that the rate of increase in value was greater as length increased.
- (ii) Of the candidates who answered this question, many were able to say that catching at 7 centimetres would limit the reproductive capacity of the population which could lead to a reduction in the population size or to local extinction. Some candidates related the difference in catch size to the value rather than the population as they had not read the question carefully enough.

Question 3

- (a) (i) Most candidates recognised there were five trophic levels. A few stated four, possibly not recognising algae as a separate trophic level. Candidates should understand that producers are also a trophic level.
- (ii) Again, most candidates recognised octopuses as being the organism on the fourth trophic level but some candidates who had stated four trophic levels in the food chain, stated reef sharks.
- (iii) Candidates needed to identify all three carnivores as trigger fish, octopuses and reef sharks. The most common error was to include sea urchins which are herbivores rather than carnivores.
- (iv) Candidates needed to refer to biomass transfer rather than only energy transfer, which sometimes limited the credit achieved. Some candidates mentioned that algae were the producers and sea urchins were consumers but did not go any further to explain why biomass is lost between trophic levels.
- (b) While some candidates were able to state the impact that harvesting of sea urchins had on the populations of algae and trigger fish, fewer explained fully that the algae increased as there were fewer grazers eating them or thought the trigger fish would decrease as they had less food available to them.
- (c) (i) Many candidates could explain that protein is used for repair or growth or as an energy source.

- (ii) A majority of candidates knew that proteins were made from amino acids. Incorrect examples included glucose and disaccharides.
- (iii) Many candidates stated two other essential components but some candidates only gave one.

Question 4

- (a) Few candidates seemed to be familiar with the process involved in pole and line fishing. Few could describe baitfish capture with many just saying the baitfish were caught using a rod and line rather than with lift nets. For (ii) they often stated that the bait fish would be put on ice or stored in a cold room rather than understanding that the bait fish were kept alive for later use when a tuna shoal is found. For (iii) candidates again found it difficult to explain how bait fish were used, often saying they were put onto the hook on the pole and line in order to attract the tuna. These candidates achieved partial credit for saying that the baitfish were used to attract the tuna, but they needed to show an understanding that the baitfish thrown into the sea had been incapacitated before that, so that they are swimming slowly to encourage the tuna to the area around the boat.
- (b) Many candidates stated that the tuna fish were washed or placed in water before being frozen or chilled with few mentioning gutting the fish quickly to reduce spoilage.
- (c) Many candidates were able to give at least one, and usually two methods of preservation, such as canning and freezing.
- (d) Some candidates were unsure of rancidity and described enzyme breakdown of the fish instead. Many other candidates recognised that rancidity was the cause of the foul smell with stronger candidates able to state it was the oxidation of fats occurring.

Question 5

- (a) Many candidates found this question challenging. Whilst they understood that the conditions in dry monsoons were opposite to the wet monsoons, few correctly placed the words in the correct box.
- (b) Candidates often explained what a high biodiversity was, rather than explaining that it is the number of different species as well as the species richness or the number of each species. They needed to show a greater understanding of biodiversity in terms of the number of species present in an ecosystem as well as the number of each of those species. For example, an ecosystem may have one dominant species with very high numbers and a small number of several other different species. This is less biodiverse than an area with the same number of species in total but a higher number of each of those species.

Question 6

- (a) Many candidates were able to achieve partial credit here, mainly for understanding that a compass indicates direction while a chart is used for their location and route planning. Few candidates mentioned any other points that charts show, such as water depth, lighthouses or light ships or other navigational points.
- (b) Few candidates were able to explain the function of a navigational buoy to indicate a safe passage or safe channel between them or that they indicated a danger in the area. The most common error was to suggest that it shows direction which was insufficient for credit. Others suggested that it was to help keep sailors alive if their boat sank.
- (c) Some stronger candidates were able to explain that radar detects other vessels or objects nearby but few mentioned anything more. Many candidates confused radar with sonar and said it could detect objects under the vessel rather than on or above the ocean.

Question 7

- (a) Some candidates gave quite vague answers, such as that the coral needs a particular temperature to grow at or that if the water is too hot or too cold the coral cannot grow. These were too vague for credit. Few recognised that clear water allows for the sunlight to reach deeper or to allow better penetration of the sunlight into the water, to increase rate of photosynthesis. Some candidates recognised that zooxanthellae were present in the corals.

- (b) Many candidates recognised that coral mining would cause loss of habitat for some species, with some linking this to a reduced biodiversity, but fewer related this to the fish stock or the fishery itself. Weaker candidates often stated ideas such as that the coral died or that the ecosystem is damaged. Candidates need to ensure they read questions carefully and answer all aspects of the question.
- (c) Many candidates who gained credit here mentioned it provides shelter or protection for fish, that it reduces wave energy hitting the shore or mentioned reduction of erosion.

Question 8

- (a) Most candidates achieved at least partial credit here. Whilst candidates often knew that mollusca was the phyla, many struggled with the concept of kingdom, often putting clams, decapods or chordates. Candidates will always be supplied with the genus and species name so they should be able to identify this information from the question. Some candidates confused the genus and the species name.
- (b) The majority of candidates were able to give at least one reason why giant clams have become endangered.
- (c) Some candidates wrote down the abbreviation for some conservation organisations rather than stating the full name as asked for in the question. Weaker candidates often stated the name of a species, or omitted an answer. Other candidates were more likely to provide the initials of an organization or just write in "Marine Conservation Organisation", while a few stronger candidates were able to correctly state the name of one or two conservation organizations.

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Paper 5180/02
Paper 2

Key messages

- Candidates should make sure that they know what each command word requires.
- The use of key terminology in answers is important.
- Candidates should be reminded to approach data analysis questions confidently, looking for patterns.

General comments

Some candidates gave excellent, detailed answers that explored questions fully and they were able to approach data analysis with confidence. A few candidates found some aspects of the paper challenging, especially data analysis, and some confused the meaning of command words such as “explain” and “describe”. Graph plotting and maths skills were generally very good. Most candidates were able to gain credit for the extended response questions in **Section B** that focus on Assessment Objective 1. Analysis of data was an area that many candidates found challenging and candidates would have benefited from practice analysis of data to determine patterns and to suggest explanations for the patterns.

Comments on specific questions

Section A

Question 1

- (a) (i) This question required candidates to plot a line graph. Most candidates demonstrated excellent graph skills and were able to produce a linear axis and plotted points correctly. A few candidates did not use a linear scale. Candidates should try to use increments on linear scales that make plotting of points easy, for example increments of 10, 20, or 50 rather than using 3 or 7.5. Most candidates labelled the vertical axis correctly, but a few did not label it.
- (ii) Most candidates were able to give at least one correct factor that would affect upwelling strength at different times of year. Common answers included wind speed, and temperature. A few candidates gave vague answers such as the climate. Candidates should always try to give specific factors.
- (b) Most candidates were able to correctly identify the zooplankton as a herbivore, but a small number suggested that the phytoplankton would be a herbivore.
- (c) (i) This question required candidates to calculate a mean value and then substitute this value into a formula to determine the depth anomaly of black rockfish. Many candidates were able to correctly calculate the mean and went on to then calculate the depth anomaly. A few candidates were unable to calculate the mean but gained partial credit for using their value to calculate a depth anomaly. Candidates should write down all the steps of calculations so that credit may be awarded for working even if the final answer is incorrect.
- (ii) This part of the question required candidates to bring all aspects together to explain the changes in height that the black rockfish swim at different times of the year. Stronger candidates explained that the black rockfish swim closer to the surface when there are stronger upwellings, and that upwellings would bring minerals to the surface to increase phytoplankton growth. Candidates should be careful when referring to nutrients in answers, as a few candidates implied that the upwellings would bring food for the rockfish up to the surface. Weaker candidates often gained some credit for recognising that the upwellings and depth anomalies of the rockfish were linked.

Question 2

- (a) Only stronger candidates answered this correctly. The syllabus states that candidates need to understand the nature of different molecules, such as polynucleotides. Some referred to nucleic acids but only a few gave a correct definition.
- (b) (i) This question required candidates to read two values from a graph to determine the increase in mass of salmon. Most were able to do this but a few candidates used the wrong line on the graph.
- (ii) Stronger candidates were able to use the graph to determine the change in mass, divide it by the time and go on to give the correct unit. A few candidates were able to calculate the change in mass but did not divide by the time.
- (iii) Most candidates were able to recognise that the mass of the GE salmon increased. Many also went on to give the point at which the rate increased. This question asked for a description of data trends and candidates needed to look for details within patterns such as turning points.
- (iv) This question asked candidates to suggest an advantage of growing GE salmon. Most candidates were able to recognise that salmon can be grown to market size rapidly to meet consumer demand.
- (v) Candidates needed to recognise that the GE salmon produce less waste food and faeces, so there would be less decay, eutrophication, and oxygen levels would be higher. Stronger candidates often gained full credit. Weaker candidates typically gained partial credit, often for recognising that there would be less risk of disease spread if there was less waste.
- (c) This question required candidates to look at the effects of growing GE and non-GE salmon with predator species and steelhead trout. Only stronger candidates were able to recognise that the steelhead trout were not affected by the presence of GE salmon compared with non-GE salmon (both with and without predators). Few candidates discussed the quality of the investigation, such as the lack of control experiments (for example, steelhead trout with no salmon), or the lack of replicates. When asked to discuss experimental data, candidates should explore all aspects of the data and the design of the experiment (e.g., if it is fully controlled and if it is possible to make a valid conclusion).

Section B

Question 3

- (a) This question asked candidates to describe a fish aggregating device (FAD) and explain how it functions. Stronger candidates answered well and described the structure of an FAD thoroughly, and then went on to explain how food chains form to attract top predators. Some candidates did not understand what fish aggregating devices are, often mistaking them for fish finding devices such as SONAR.
- (b) This question was answered well by many candidates. Many recognised that tag-release-recapture requires the marking of fish that have been caught followed by counting of the proportion of marked fish that are recaptured. The strongest candidates explained that the fish should be caught after allowing time to distribute and that the marking should not harm or affect the fish.
- (c) This question generated a wide range of responses. Stronger candidates gave specific pollutants, such as heavy metals, oils, fertilisers and plastic, and went on to explain the risks of each type of pollutant. Weaker candidates gave general answers about the effects of pollution without listing any specific pollutants. Candidates should always try to give specific details when answering these extended answer questions.

Question 4

- (a) (i) A number of candidates found this question challenging. Stronger candidates explained that EEZs are areas within which a nation can exploit resources such as fish and energy. Some candidates correctly explained that permits are needed to fish in these zones, and gave the correct distance

that EEZs extend from coastlines. A number of candidates confused EEZs with MPAs and suggested that they are areas within which fishing is banned.

- (ii) Most candidates were able to gain at least partial credit for this question, with many going on to get full credit. Stronger candidates discussed the effects of supply and demand, clearly stating that a high supply would reduce the price (or the converse). Weaker candidates gave vague answers such as, “supply and demand affect prices”. Candidates should try to give a clear direction in answers, such as an increase. Other correct answers included the effect of price controls, export distances and the costs of labour.
- (b) This question required candidates to describe the internal features of coral polyps and to explain the function of each. Stronger candidates often listed at least four features. Some candidates confused internal features with external features and a minority described the features of echinoderms. One common error was to list the calcium carbonate structure of coral as an internal structure.

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<p>Paper 5180/03 Practical Assessment Paper</p>

Key messages

It was noticeable that many candidates did not seem familiar with the required practical activities that they are expected to have carried out or seen demonstrated and so this often limited credit available. Some of these practical activities can be seen being demonstrated online. For ecological sampling on a beach, this can be modelled on school grounds instead.

General comments

Candidates did not appear to run out of time, so should be encouraged to return to any questions they have omitted and try to provide a response. Candidates also need to draw images, tables, and graphs in pencil so it is easier for them to make corrections, using a ruler for labelling lines, drawing axes and bars in their graphs.

Comments on specific questions

Question 1

- (a) (i) Most candidates made a good attempt at the drawing. Some candidates did not include important features such as the eyes or the operculum. The majority of candidates made the drawing a suitable size and many carefully drew in the lateral line. Candidates who are weaker at drawing could be encouraged to use construction lines to aid them.
- (ii) Labelling of features was well attempted, but some candidates drew a line to a median fin and labelled it as 'median fin' rather than naming the fin they chose. A small number of candidates thought the pectoral fin was a median fin. The majority of candidates correctly labelled the lateral line and the operculum. In general, label lines were touching the feature, which is essential for credit to be awarded for each feature.
- (b) (i) Weaker candidates often did not attempt to draw a scale line on the drawing. A small number added a scale line to the photograph instead. Candidates needed to read the question carefully to see where they should have drawn the scale line. Candidates who had correctly drawn a scale line then sometimes measured the length of their drawing, or the length of the fish in the photograph, and added that in as the length needed for the scale line rather than using the given length of 36.2 cm.
- (ii) The majority of candidates correctly measured the length of the photograph of the fish to one decimal place, but some measured the length of the drawing instead.
- (iii) Many candidates correctly calculated the magnification, but a small number of candidates used different numbers to the values they had stated in (i) and (ii), and it was not clear where these values had come from.

Question 2

- (a) (i) Some candidates were not sure of the meaning of the term phylum and instead gave the kingdom they both belong to, and this was a typical error for weaker candidates.

- (ii) Many candidates found this difficult. While some classified organisms correctly, recognising that one was a cephalopod and one was a gastropod, some candidates wrote the names on the wrong line, i.e., stating organism **A** was the gastropod and **B** was the cephalopod.
- (b) The majority of candidates included ticks and crosses in their boxes, rather than leaving one blank, making it clear where the features were present or absent. Most candidates could state which organisms had external shells and antennae, but had far more difficulty in determining the foot and the suckers.

Question 3

- (a) Candidates did not seem very familiar with this investigation; there were various acceptable methods they could have used. Whilst many stated they would collect samples from different areas of the beach, quite often they just suggested sieving it but did not give any indication that it would be sieved several times through different sized sieves. Very few gave an example of mixing the sediments into water, shaking it vigorously and allowing it to settle, then measuring the depths of the different sized particle layers. A few candidates gave a list of equipment which generally did not gain any credit.
- (b) A small number of candidates explained how to find population density per metre squared on the beach rather than finding the density of the shells. Candidates did not seem very familiar with this practical as few mentioned a fully detailed method of obtaining this data. Candidates should think about accuracy, eg using a measuring cylinder rather than a beaker for finding the volume of the shells initially. A few candidates discussed the use of a quadrat to collect samples, rather than focussing on finding the mean of a collected sample, which was stated in the question.

Question 4

- (a) This was completed well by many candidates. Weaker candidates often drew two tables rather than one, or were unclear on how to present the data clearly.
- (b) A small number of candidates drew two graphs, one for each location. Plotting of the points for the bars was generally completed accurately. Labelling of axes was usually absent in weaker responses and some of these candidates also tried to plot a line graph rather than a bar chart. Most candidates chose an appropriate scale for the y-axis.
- (c) Many candidates were able to state that location **P** had higher biodiversity than location **Q**. Stronger candidates were also more likely to state that the number of all species of organisms in location **P** was higher.

Question 5

- (a) Weaker candidates often gave little information. Candidates were expected to explain how to find the speed of a current, and as this is a core practical, they are expected to have carried this out or seen it demonstrated. However, many candidates showed no knowledge of this practical. Weaker candidates rarely drew a table or suggested a graph that could be drawn for collection and analysis of results.
- (b) Many weaker candidates did not attempt this question, or suggested repeating the test. Stronger candidates were able to suggest examples of both an improvement and a limitation. Other candidates could often provide a single correct example of an improvement or limitation.