MARINE SCIENCE

Paper 5180/01
Structured

Key messages

- Candidates should read the instructions for each question with care. Questions asking for use of data should include or manipulate correctly selected data.
- Some questions may not have answer lines because candidates are asked to answer elsewhere on the paper, such as on a figure or graph. Candidates should take care not to miss these questions.

General comments

This paper contained questions of varying levels of difficulty. Some questions were answered well by all candidates. Others were more challenging and required descriptions or explanations. Most candidates attempted the majority of questions and had no difficulty with the space and time allowed.

Comments on specific questions

Question 1

(a) Many candidates answered this question well. Most candidates could identify the example of each of a mammal, bony fish, reptile and algae. The most frequent difficulty was between recognising a mollusc and an arthropod.

(b) (i) Candidates often gave the correct genus of the basking shark. The incorrect answer of "Cetorhinidae" was common. Those candidates giving both the genus and species name could not gain credit.

(ii) Most candidates selected the species name from the figure. This was correct if given with or without the genus name.

Question 2

(a) This question required an explanation of the term "genetic engineering". Weaker candidates could not express their answer clearly enough to gain credit. Responses that repeated the terms genetic and engineering were often not precise enough.

(b) A wide range of possible suggestions was allowed here and most candidates opted for the idea of genetic engineering for disease resistance or increased profit.

(c) (i) Most candidates could perform this simple calculation of the change in mass of the salmon, demonstrating they understood the information provided in the table.

(ii) Many candidates correctly used the data from the table to give the mass of both types of salmon and then to calculate the difference in the time taken for the salmon to reach 290 g. Weaker candidates did not calculate the difference in time, or did not use data from the table.

(iii) The majority of candidates gained at least partial credit here for the idea of more profit. Other responses needed to go further than repeating the idea that the salmon would grow faster.

(iv) Stronger answers to this question referred to GE salmon escaping and breeding with wild salmon. Some candidates found it difficult to clearly express their answers. Answers that were not sufficiently specific did not gain credit, such as the idea of "GE being harmful".

Question 3

(a) (i) The numerical answer for this question could refer to the highest or lowest extent of the thermocline. Most candidates answered in terms of the deepest depth of the thermocline. The unit was challenging for weaker candidates with "depth/m" being seen. This answer did not gain credit.

(ii) Most candidates could describe the trend from the graph. Fewer answers used data from the figure, as instructed in the question. Candidates should take care to read the question carefully.

(iii) Some candidates did not answer this question. Those that attempted the question usually gained full credit. Candidates should be reminded to read all of the question paper carefully, because some answers will be on figures, rather than on answer lines. The line added to the graph could be a diagonal straight line or curved. To gain full credit, the line needed to extend to 4000 m.

(b) (i) The majority of candidates could name photosynthesis as the process in which plants use carbon dioxide.

(ii) Most candidates described the trend in the graph well. Others did not use full sentences, just the term "increase", or just the word "decrease" which were not sufficient for stating the trend between depth of water and light intensity.

(iii) Only stronger candidates gained full credit here. Many referred to light rather than the idea of more light in the top 30 m of sea water. Candidates who identified that there is more light, often then gave thorough explanations of photosynthesis by phytoplankton, or the idea of the development of a food chain.

Question 4

(a) Candidates were asked to suggest what is meant by the term navigation. Many candidates could not express their answers and instead gave descriptions of the equipment required for navigation, which was tested later in the question.

(b) Although the majority of candidates drew the route taken by the boat, a significant number only included the first two stages of the journey, or forgot to include arrows on the lines showing the route. Some candidates did not answer this question.

(c) (i) Most answers correctly stated the direction of travel of the boat.

(ii) Candidates found this slightly more challenging than **(i)**.

(d) Nearly all candidates named two navigational aids on a boat. The most common answers were GPS and compass.

Question 5

(a) (i) This question was answered very well. Candidates who did not gain credit often quoted values from the table without answering the question.

(ii) "Vitamins", "minerals" and "water" were all seen in good answers. Named examples of vitamins and minerals were also accepted.

(b) The idea of preserving fish for later use was frequently seen and could be expressed in several different ways, such as "to give a longer shelf life" or simply "to last longer". Other correct responses referred to export or travelling distances. Some responses repeated the question, stating the fish would be preserved, or prevented from spoiling and could not be awarded credit. Stronger candidates recognised the words "other reasons" in the question.

(c) Most candidates selected “water” for partial credit. Fewer knew the temperature of steam would be 115 °C, rather than 65 °C or 37 °C. More candidates knew that the high temperature deactivates enzymes and prevents putrefaction.

Question 6

(a) (i) Labelling the decapod crustacean did not appear to cause problems for candidates, with the exception of the carapace, or thorax label, which many misidentified as the abdomen.

(ii) Candidates should make it clear where their labels are pointing to. If the label was between the thorax and abdomen, credit could not be awarded. A significant number of candidates did not attempt this question.

(b) Candidates found this question challenging. Many responses gave partial descriptions of the life cycle. Some confusion was seen over whether fertilisation is internal or external, with descriptions sometimes contradicting when the word “external” was used. References to eggs and sperm were common, with fewer responses giving any description of the remainder of the life cycle apart from growth.

Question 7

(a) (i) Few candidates gave one or more aims of fisheries management. Correct answers often described the aim of increased earnings. Candidates often referred to sustainable fishing methods, or protecting endangered species. This aspect of fisheries management was provided in the question and therefore could not be given credit.

(ii) Many responses gave two clear descriptions of how fisheries practices are regulated and enforced. Quotas, closed seasons and closed areas were the most common correct answers. The response “laws” was insufficient.

(b) Some answers here were too broad to meet the aims of the Marine Stewardship Council. Such answers referred to protecting the marine environment rather than promoting sustainable fishing practices, or preventing overfishing.

Question 8

(a) This question was answered extremely well. Full credit was awarded for listing three types of marine pollution, other than litter, or from giving two types and explaining the source of one of these types. Weaker responses referred to types of litter only, so did not answer the question. Other examples that were seen were not relevant to the marine environment. The most common type of pollution in answers was oil or fuel, then sewage.

(b) (i) Many candidates found this question demanding. They were asked for suggestions of two ways that ghost nets kill turtles. Many responses repeated the stem, referring to trapping or entanglement, without explanation of how this could kill a turtle. Likewise, “by eating it” or “cuts” from the net needed to go further to explain how the digestive system could get blocked or the cuts could lead to blood loss or infection that could kill a turtle. Strong answers included the inability of the turtle to swim once trapped and therefore the turtle not being able to feed, breathe or escape predators.

(ii) Most candidates knew that plastic nets are relatively cheap and strong. Others took note of the information given, that plastic nets do not break down easily in the sea and amplified this to correctly suggest that plastic nets are long lasting or do not need to be replaced often. Candidates who repeated the information given without adding their own suggestion could not gain credit here.

(c) Only stronger candidates answered this question well. Candidates often described a range of net and hook types, but few clearly described drift nets. There was credit available for the use of weights and buoys, the net being set at different depths and the fish being caught in the net by the operculum or gills. These descriptions were seen in the strongest answers.

Question 9

(a) Most candidates gained at least partial credit for this question. Lagoons and continental shelves were the least frequently seen correct answers. Many candidates incorrectly thought hydrothermal vents and abyssal plains were suitable answers.

(b) Very few candidates could name two international fisheries resources. Many named fishing equipment, such as types of net.

(c) Many candidates used excellent examples to explain the term overexploitation, such as catching more fish than the maximum sustainable yield, or overfishing. Weaker candidates could not express their ideas, and tended to use the word “exploit” rather than explaining it.

Question 10

(a) (i) This question was answered very well. Most answers included the exchange or goods or services. The strongest answers gained full credit for stating that this is without money.

(ii) Most candidates answered this correctly. A few candidates were too vague in their responses to gain credit with answers such as “goods are sold”. If these responses had said “where goods are sold” credit could have been awarded.

(b) Candidates answered this question very well. Nearly all candidates could identify the definitions of “unlimited wants” and “opportunity cost”. Most could also correctly define “resources”.

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Paper 5180/02
Paper 2

Key messages

- Candidates should be reminded to use precise, accurate vocabulary, particularly in longer questions.
- Candidates should ensure they read the command words of questions carefully and give appropriate answers based on these command words.
- In questions containing data, candidates are reminded to explore all aspects of the data to answer the question.

General comments

The standard of candidates' answers was generally high and many showed a very good, detailed knowledge of the syllabus. Graph plotting was a strength, mathematical skills were good and most had an impressive knowledge of the processes involved in fish spoilage. Some candidates' knowledge of boat structures and fishing techniques was less strong, and some found analysing data challenging. Most candidates attempted all of the questions with few blank responses.

Comments on specific questions

Section A

Question 1

(a) (i) This question produced a range of responses. Many candidates were able to correctly state the roles of marine protected areas, but a significant number of weaker candidates gave vague answers such as, "areas where species are protected". It is important to use precise language when giving definitions in order to gain full credit.

(ii) Graph plotting was a strength of many candidates and there were many excellent graphs. Where candidates did not gain full credit, it was typically due to: not adding labels, not leaving gaps between bars and/or choosing a scale that did not use half of the axis. When selecting linear scales, it is good practice to select increments that facilitate easy plotting. For example, scales that go up in multiples of 10 are easier to use than those that go up in multiples of seven.

(b) (i) Most candidates were able to correctly identify the two-year period which showed the largest change in catch. Some candidates did not give two-year periods or misread the question and gave the smallest change in catch.

(ii) Most candidates calculated the change in catch as 1150 to gain at least partial credit. There was some confusion about the units with some candidates giving units of "catch/kg". The heading in the first line of the table separated the description from the unit and was not part of the unit itself.

(c) Most candidates were able to correctly gain at least partial credit with some gaining full credit. Most were able to recognise that the seabream population would rise. Other popular correct responses included ideas of increased reproduction, increased demand, increased fishing effort and increased nutrition. Few candidates referred to the idea that fish would spill over from the MPA into surrounding areas. Where candidates did not gain credit, they gave answers that would have explained a decrease in catch, such as overfishing.

(d) Most candidates were able to gain at least partial credit, usually for correctly suggesting a disadvantage to the fisherman, such as a loss of catch. Only stronger candidates recognised that the MPA would help to ensure catches in the long term (increasing sustainability), with many simply referring to more fish being available.

Question 2

(a) (i) Most candidates correctly identified the phytoplankton as the producers and the herring as the third trophic level. A few candidates simply stated plankton, which could have represented phytoplankton or zooplankton, and some confused the third trophic level with the tertiary consumer, giving the tuna as an answer.

(ii) Many candidates gave excellent, well explained, correct answers to this question. Most were able to recognise that the zooplankton population would decrease, with many going on to explain that this would be due to increased herring populations eating more of them. A few candidates failed to gain credit as they thought that tuna feed directly on zooplankton, and so predicted that the zooplankton population would increase. A small number of candidates incorrectly discussed the phytoplankton population rather than the zooplankton population.

(iii) The majority of candidates accurately drew the pyramid of biomass with the phytoplankton on the base. Where candidates did not gain credit, it was typically for inverting the pyramid or for not labelling it.

(b) (i) Most candidates correctly calculated the percentage energy lost. Where errors were made, it was usually for incorrectly rounding the answer. Candidates should be careful to round decimals correctly.

(ii) Stronger candidates gave at least three methods of energy loss, such as heat loss, excretion, parts not being eaten and/or indigestible parts. Where candidates did not gain credit, it was usually for giving vague answers that restated energy is lost, and did not give specific methods of energy loss. Some candidates confused excretion and egestion.

(c) Only the strongest candidates answered this question correctly and gained full credit. These candidates recognised that the nutrients are released from the bodies of the fish during decomposition and that these then become available to producers and so to the rest of the food chain. Some candidates suggested that the inorganic nutrients would be taken up directly by other fish, and others simply restated the question stem, that overfishing removes nutrients.

Section B

Question 3

(a) (i) Most candidates found this question very accessible. Wood, aluminium and fibre glass were all described, and many went on to give correct explanations as to their suitability.

(ii) This question generated a wide range of responses. Some excellent, detailed answers were seen that fully described many of the parts of a fishing boat. All of the features listed in the mark scheme were seen and many candidates clearly had an excellent understanding of the design of fishing boats. Many gave detailed descriptions of the engines, hull, navigation and safety equipment. Where candidates did not gain credit, it was usually due to focusing their answer on one or two features, or misinterpreting the question and explaining the purpose of fishing boats.

(b) (i) Answers to this question were very mixed and there was significant confusion as to how pole and line fishing is carried out. Strong answers described the use of a single, barbless hook, often referred to the throwing of bait and explained the low environmental impacts of the method. Many candidates incorrectly referred to the use of multiple hooks, barbed, baited hooks and suggested that it would have a major impact due to high levels of bycatch.

(ii) Similarly to **(i)**, this question generated a wide range of response. Some excellent descriptions of long-lining were given that described the use of multiple, barbed, baited hooks and explained the negative impacts due to high catch rates and bycatch. A number of candidates confused long-lining

with pelagic trawling with nets and others thought that it was a method whereby lines were set on the sea bed and left for some time.

Question 4

(a) (i) Most candidates gained at least partial credit on this question. Most understood that extensive aquaculture involves the rearing of fish and many explained that this is in open water. A few candidates confused extensive aquaculture with intensive aquaculture and referred to closed water systems and the intensive feeding of fish.

(ii) This question was challenging for many candidates, but many excellent, detailed answers were also seen. Strong answers described how the escape of fish could lead to breeding with wild fish, could affect the gene pool and could lead to competition with other species affecting food chains. The release of fish waste and other substances into the open water were also well described. Where candidates did not gain credit, they often misinterpreted the question and gave answers that described the process of aquaculture. Many candidates also gave descriptions of how aquaculture is used to protect wild populations.

(b) Candidates generally found this question very accessible, and many excellent, detailed accounts of the processes of spoilage were seen. Many candidates were able to use correct vocabulary and name the four processes: rigor mortis, putrefaction, autolysis, and rancidity. Most were able to explain each of the processes, frequently recognising the roles of oxidation, bacteria and enzymes. Misunderstandings tended to be: putting the stages of rigor mortis in the wrong order, and confusing the roles of bacteria and enzymes in autolysis and putrefaction.

MARINE SCIENCE

Paper 5180/03
Practical Assessment Paper

Key messages

Candidates should be reminded to read the questions carefully before starting to answer.
Candidates should ensure units are written in the headings of the tables only and never repeated with the data in the body of the table.
When producing graphs, candidates should be encouraged to place the variable that they changed onto the *x*-axis, with the results they collected placed on the *y*-axis.

General comments

Stronger candidates were well prepared for the exam and were familiar with the practical activities and investigations. They showed clear evidence of having developed their skills in drawing biological specimens through the use of construction lines on original photographs. They included relevant details about practical investigations, giving a complete description of the method required and could identify sensible risks associated with practical work rather than giving generalised answers. Weaker candidates were still able to present appropriate data tables to show results, but when giving methods, lacked the detail of all steps required to complete their chosen method.

Comments on specific questions

Section A

Question 1

(a) All candidates made a very good attempt at this question, and most drawings were of a suitable size, had the main features of the fish included and the lines were usually neat. Many candidates also achieved an outline that clearly represented the fish, often using many construction lines from the original photograph to assist them.

(b) Label lines were generally neatly and accurately drawn, touching the feature they were labelling. The majority of candidates were able to correctly identify the operculum and first dorsal fin, but many confused the pectoral fin for the pelvic fin.

(c) (i) Many candidates drew a scale line but a significant number of candidates did not complete this part of the question. Of those who did draw a scale line, a small minority did not draw it to show the total length of the fish and showed body length only. Once a correct scale line had been completed, many candidates gave the length of the drawing rather than the actual length of the specimen as given.

(ii) This question was answered well by almost all candidates.

Question 2

(a) Most candidates were able to follow the dichotomous key to correctly identify all or most of the species. Candidates were familiar with this type of key.

(b) (i) Most candidates either knew, or could work out from the table, the units for density, although a significant number did not answer the question. A small minority gave cm^3/g, whilst weaker candidates stated g or cm as their answer.

(ii) Most candidates were able to read the scale accurately, but a number back-calculated the answer for coconut wood, giving their answer as 25.2 g. It was not possible to read the scale to that degree of accuracy and candidates should be encouraged to take the reading from the scale.

(iii) The calculation of the volume required a subtraction to be carried out. Weaker candidates did not do this well and often gave the answer as either 50 or 76. The majority of stronger candidates were able to calculate this correctly.

(iv) Candidates were generally able to calculate the density from the values they had recorded in their tables. Some candidates gave their answer to multiple decimal places, which was not required.

(v) The majority of candidates were able to identify the densest material, although a significant number gave coconut wood, which was rarely the case from the calculations using the values they had placed in the table.

(c) (i) The majority of candidates knew this was a hydrometer, but some candidates mistook it for a thermometer.

(ii) Candidates sometimes failed to gain credit here as they did not state that the hydrometer needed to be placed in both samples and a reading taken. Some weaker candidates stated that the hydrometer would sink more in denser water.

Question 3

(a) (i) Most candidates were able to give some of the details required here, but for full credit they needed to give the calculation that they would have used to calculate the actual percentage of water in each sample. Some of the candidates were not able to clearly identify initial and final mass, and carried out the subtraction the wrong way round. A few candidates confused this investigation with calculating a beach slope, or water turbidity.

(ii) Many candidates found this question challenging, as they needed to link the water content of different areas to the water requirements of different organisms. For example, organisms at **C** required constant water as they could not survive desiccation, while organisms at **B** were able to survive short periods of exposure. Some candidates commented on the water contents of the different areas, and some gave examples of species that may be found there, but did not give any explanations of why. Some candidates talked about the water content and how this would affect salinity, which was not relevant. Weaker candidates often listed other abiotic factors, such as light, temperature and pH.

(b) (i) Many candidates were able to identify 4 years, but a common error was to count every ring and to give 17 years as the age.

(ii) Many candidates were able to give the date of hatching based on their analysis of the age of the fish. However, some candidates gave dates in advance of when the fish was caught, e.g. 2019.

(iii) A number of candidates did not read the question carefully enough and did not realise that as the fish was caught at the end of 2016, the last set of growth rings had occurred during the year it was caught, i.e. 2016. Many candidates recognised the fastest growth was in the last year of life, but gave 2015 as their answer.

Question 4

(a) Most candidates drew neat, accurate tables, with suitable column headings including units. The majority of candidates correctly ranked the data in pairs, but a few weaker candidates only ranked the distance. A small number of candidates wrote “bubbles per minute (m)” which is incorrect as m is the SI symbol for metres.

(b) Most candidates made a good attempt at the graph, with accurate, visible plots of a reasonable size with a good line of best fit applied, with axes labelled and an appropriate scale chosen. A very small number of candidates drew a small graph, not making good use of the whole size of the graph paper available. Some candidates failed to continue their line to the last plot, which was on the *x*-axis, even though they had plotted the point.

(c) The majority of candidates were able to provide a relevant conclusion, either in terms of numbers of bubbles and distance, or light intensity and rate of photosynthesis.

Question 5

(a) This question was answered well, with almost all candidates gaining at least partial credit. Most candidates understood the methods involved, how to obtain reliable data and were able to give some details in their answer. Weaker candidates often forgot to state this needed to be done on both sample areas, on the same day. A few referred to counting crabs rather than burrows. Stronger candidates referred to random number tables or ways of obtaining random numbers. Some candidates were confused between random or systematic sampling and tried to include both in their method. Most candidates mentioned a safety precaution for this investigation, but a few gave very generalised statements such as having a first aid kit. Candidates needed to carefully consider what they were being asked to do, and to make a specific and appropriate suggestion for a safety precaution.

Most candidates correctly tabulated their results, with columns usually identified (often including units) and many candidates made reference to calculating mean or average values. Stronger candidates also sketched an appropriate bar chart with labelled axes. Although most candidates knew what the results showed, very few related this back to the original hypothesis.

(b) Many candidates could state there was difficulty in accurately counting the number of crab burrows in the sampling area, giving a variety of reasons for this. Candidates often stated that weather, trampling or wind impeded the experiment.

Stronger candidates showed their understanding of the limitations of population studies and had developed the idea of this method being an estimate of the total population, not an accurate count. Many candidates mentioned anomalous results, but few made a relevant comment regarding them, e.g. anomalous results should not be included in calculating the mean.

Many candidates suggested completing the investigation at different times of the year or in different locations, but few made relevant comments regarding investigating in relation to different factors. Some candidates suggested investigating in relation to different biotic or abiotic factors but needed to state what a relevant biotic or abiotic factor would be. In this case it could be to investigate distribution of crab burrows based on height above high tide line, or in relationship to moisture content of the sand.