

MARINE SCIENCE

Paper 5180/01
Structured

Key messages

- Candidates should read the instructions for each question with care.
- Some questions may not have answer lines because candidates are asked to answer elsewhere on the paper, such as on a figure or in a table. 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) (i) Most candidates answered correctly. The most common incorrect answers were respiration, or named photosynthetic organisms, such as algae, rather than naming the process.
- (ii) The majority of candidates correctly stated that herbivores are organisms that only eat plants, or named other producers. Vague answers that referred to organisms that eat plants without implication of 'only' plants were insufficient. An animal that eats plants may eat other animals, so without that critical word the answer was incomplete.
- (iii) Few candidates could explain the importance of both nitrates and phosphates for the growth of seagrass. Often credit was awarded for stating that nitrates are needed for amino acid or protein production. The importance of phosphates was rarely mentioned.

Weaker responses that did not gain credit repeated the question and referred to strong or fast growth only, or that these minerals are required for photosynthesis.

- (b) (i) While most candidates did the correct calculation and gained credit, the most common error was to add, rather than subtract, the values.
- (ii) Very few candidates calculated the percentage increase. Candidates should appreciate that a percentage change can be more than 100%.
- (iii) Most candidates predicted an increase in the green sea turtle population. Many could link this to a reason, usually more food for the turtles.

Question 2

- (a) (i) Few candidates could name both fishing methods. The most common method correctly identified was pole-and-line. The diagram of beam trawling was more frequently misidentified as another trawling method, or incorrectly labelled as net fishing. The syllabus should be used to guide teachers to the level of detail required from candidates.
- (ii) Most candidates showed a good understanding and gained at least partial credit here, usually referring to 'damage to reefs', 'by-catch', 'catching juveniles' or the 'likelihood of overfishing'. There

were very few responses which came close to gaining either of mark points 4 or 5, although some referred to throwing fish back but did not indicate whether these fish would be dead or alive.

- (b) The majority of candidates named two navigational aids and described how each could aid navigation. Weaker candidates often did not answer the question as set and described how echo sounders or buoys could be used to aid fish location. Others believed that GPS could be used to plot a course or identify other vessels, or that radio would be used to 'check the news/weather forecast'. GPS, compass and echo sounder were the most commonly identified navigation aids.

Question 3

- (a) (i) Most candidates could name the mangrove habitat, but fewer could name the rocky shore. Many candidates had difficulty in understanding what was meant by feature, with some responses detailing organisms that would be found in each habitat. The most commonly identified features of the mangrove were 'shallow' and 'muddy' and for rocky shores 'high wave action'. Other than those, very few correct points were given.
- (ii) Only stronger candidates answered this question correctly. These candidates gave ideas about 'increased yield', 'eutrophication' or 'habitat loss'. Impacts were credited whether negative or positive.
- (b) Most candidates gained partial credit here. The most common error was to refer to what might be living in the two habitats, rather than differences between the water in the two sites. Some candidates looked at the figure and described the ocean being darker.

Question 4

- (a) (i) More candidates could identify the region of the graph that represents Maximum Sustainable Yield than the region that represents under fishing. The incorrect responses of **L**, **M** or **N**, were more frequently seen than **J**.
- (ii) Few candidates could correctly interpret the graph. Most expressed ideas relating to fishing effort at **M** being under fishing, which was incorrect. Other incorrect responses assumed that time was along the x-axis of the graph.
- (iii) The majority of candidates appeared not to understand what was required here. There were many references to over or under fishing but these rarely recognised the idea of previous fishing efforts having an impact on current MSY. Few candidates mentioned climate change, disease or birth rate and few gained full credit.
- (b) The majority of candidates gained at least partial credit. References to quotas, closed seasons and closed areas were common and ideas about gear restrictions were also frequently given. Weaker candidates gave insufficient description regarding not overfishing, without explaining how this might be achieved.

Question 5

- (a) This was usually answered correctly but some candidates omitted it.
- (b) Although the question specifically referred to trends between 2007 and 2010, a number of candidates described changes across the whole table. This was a particular issue for export quantity. Weaker candidates misinterpreted the requirements and described overall earnings, rather than earnings per thousand tonnes in the second case. Another common error was to simply compare the values in 2007 and 2010, rather than describe the trend between these years, as required.
- (c) A number of candidates gave answers about increased demand and changes in supply, with reference to higher price being less common.

Question 6

- (a) Most candidates gained full credit. Amongst those responses with errors, no specific pattern was seen regarding misconceptions.
- (b) Many candidates gave detailed answers. The ideas of care, clean, cool and quick had clearly been taught well in some centres. A few candidates indicated that keeping fish alive would prevent spoilage and some hinted that this was what they meant without actually stating that the fish were not dead with answers such as 'use anaesthetic to slow metabolism'.
- (c) Many misconceptions were seen regarding how irradiation reduces fish spoilage. Incorrect answers referring to heat or freezing were common. Many candidates did refer to killing bacteria but often linked this to an incorrect method. There were also very many references to enzymes being killed by irradiation. Stronger candidates referred to gamma and x-rays and occasionally to a source of gamma radiation. Weaker candidates referred to other methods of preserving fish, such as canning.

Question 7

The three features were generally well known, although the last two were often reversed. Candidates should pay attention to the labelling order. The role of the operculum was frequently correct as was the function of the caudal fin. The function of the lateral line was less well known. Often functions were given in terms of detecting prey, without explaining that this was as a result of detecting water movements or vibrations.

Question 8

- (a) Most candidates could state two or three features of a harbour. The complete range of possible responses on the mark scheme were seen. Similar responses such as loading and unloading could only be credited once.
- (b) (i) The most common answers referred to an increased market for fish, either directly to tourists or to resorts, and to the alternative use for fishing boats as transport. The idea of increased income was often implied but not clearly stated.
- (ii) Candidates usually understood that there are conflicts between fisheries and tourism. Most candidates realised that the sole use of reef or fishing areas by one group would exclude the other and that damage to reefs may occur by either group. Many candidates referred to the greater attraction (and pay) of jobs in the tourist industry than in fishing. It was clear that the weakest candidates did not understand the idea of conflict as they continued to repeat answers that would have gained credit in the previous part.
- (c) (i) Many misconceptions were seen regarding the meaning of the term ecotourism. Weaker descriptions simply described tourism. Almost all those who gained credit referred to low impact activities or those which did no/little harm to the habitat/environment. Occasionally candidates gained credit for the idea of education but almost none described involvement of either the local population or tourists in conservation schemes.
- (ii) Those candidates who did not gain credit for this question often described areas, such as safe areas or conservation areas.

Question 9

- (a) There were many candidates who did not read the question properly and described the whole life cycle of the lobster often with considerable correct detail. A high number of candidates did not elaborate on the term fertilisation and repeated it in their answer. In some answers it was unclear whether release of gametes meant into the water, from male into female or simply from gonads and so no credit could be awarded here.
- (b) (i) Environmental control or a description of an environmental factor that is controlled was commonly given, as was the need to feed the lobsters. The other ideas given in the mark scheme were less commonly given.

- (ii) Those candidates who understood the meaning of abiotic usually gained full credit. However, there were many candidates who included biotic factors such as the availability of food or absence of predators. Reference to temperature, oxygen and salinity were the most commonly given correct answers.
 - (iii) Many candidates incorrectly stated that the reason for releasing the young lobsters was to teach them to find food, rather than that by this stage they would already be able to find food for themselves. Many also incorrectly believed that 12-week-old lobsters, only a few centimetres long, would already be mature and ready to reproduce. There were only very rare references to the problems of keeping them in aquaculture units.
- (c) Candidates had difficulty explaining why there is a minimum harvesting size for these lobsters. Many referred to the value of lobsters when sold, which was not relevant. Some candidates realised that harvesting lobsters smaller than 87 mm would lead to depletion of stocks. Few candidates continued their responses to explain that if smaller lobsters were harvested then reproduction would be prevented.

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Paper 5180/02
Paper 2

Key messages

Candidates are advised to:

- use key, scientific terminology;
- explore questions fully rather than focusing on one or two points;
- ensure that they know what each command word requires;
- know all the required mathematical skills, such as the calculation of percentages;
- understand the nature of the classification system for living things;
- be careful to plan extended answers and organise their answers in a logical sequence.

General comments

The general standard of answers was high and many candidates gave very good, detailed answers and were well prepared for the exam. Most were able to analyse the data given, but there was a tendency to focus answers on only one or two aspects rather than fully exploring a topic, which is required for this paper. Mathematical skills were generally very good. Answers to extended questions were generally good but some candidates did not add enough detail and often did not use key terminology. Questions on the phenomenon of El Niño and the classification of organisms were the least well answered.

Most candidates were able to read graphs accurately and manipulate data to reach correct conclusions. Many excellent, detailed factual answers were seen that gave impressive accounts of the effects of pollution, the internal anatomy of bony fish and benefits of using artificial reefs. However, some candidates underestimated the level of detail required for some of the longer questions and had difficulty in organising answers to these questions. Using bullet points to help to organise answers may be a strategy for candidates for such questions. When considering data, candidates should try to explore the data fully and if a question has been allocated several marks, they should try to give several points rather than focusing on only one.

Comments on specific questions

Section A

Question 1

- (a) (i) The majority of candidates were able to identify the blue crab as the organism with the highest calcium content. A few candidates misunderstood the question and stated the highest calcium content.
- (ii) Many candidates were able to correctly identify the highest and lowest masses of protein. A significant number did not include units or gave an incorrect unit such as '/ g'. Candidates should remember that the slash in the table header is to separate the unit and is not a part of it. A few candidates misunderstood the question and gave the names of the seafood rather than the masses.
- (iii) Stronger candidates often gained full credit. Common mistakes were: dividing the mass of salmon by the mass of protein and not multiplying by 1000 to convert grams into kilograms. Candidates should be encouraged to show all their working as credit can be obtained for correct methodologies, even if the final answer is incorrect.

- (iv) This question generated a mixed range of answers. Many candidates understood that the tuna contained 2% of the RDA, which was 0.9 mg, and were able to correctly calculate 0.018 mg. Some candidates divided 0.9 by 2 and others did not divide by 100.
- (v) Most candidates were able to give one component, with the most common suggestions being fibre and water. Some candidates suggested minerals or vitamins when examples of vitamins and minerals were already given in the table.
- (b) The majority of candidates were able to gain at least partial credit for recognising that the salmon had the highest lipid content. Many went on to explain that lipids are energy-rich molecules. A few candidates listed other substances such as vitamin A and calcium. Candidates should take care not to include incorrect items when giving a list.
- (c) This question generated a wide range of answers. Stronger candidates often gained full credit and gave excellent, detailed answers that explained that dead organisms sink, are decomposed by bacteria on the seabed and nitrate is returned to the surface by upwelling. Weaker candidates often gained partial credit for the idea of decomposition but frequently did not refer to the sinking of dead organisms or the role of bacteria. There was some confusion over the form in which nitrogen is recycled with many candidates simply referring to the upwelling of nitrogen gas.

Question 2

- (a) (i) This question was well answered by the majority of candidates. Most were able to correctly use the graph to determine the year with the highest catch of anchovies. A few candidates misread the graph and gave the year with the highest pilchard catch.
- (ii) Most candidates were able to correctly identify the catch of anchovies in 1974. A few candidates were not able to use the x-axis scale correctly and gave 2.4 million tonnes.
- (b) (i) Only stronger candidates answered this question well and gave answers that fully explained El Niño. Many referred to changes in weather conditions and/or currents but did not give specific details. For example, many referred to the warming of the water but did not state that it is the surface water that warms. There was some confusion about the direction in which the winds change and many candidates confused El Niño with La Niña. Weaker candidates tended to give vague answers such as, “the weather becomes stormy and worse”.
- (ii) Most candidates were able to correctly state that El Niño causes the anchovy catch to decrease, but a significant number thought that it led to an increase. Some candidates tried to give an explanation rather than a description. Candidates should be careful to read command words before writing their answers.
- (iii) Some excellent, detailed answers were seen that gained full credit. Stronger candidates recognised that there would be less upwelling of nutrients, leading to less primary productivity and food for the anchovies. Many also understood that El Niño could affect the migration of anchovies, their reproduction and/or predator number. Weaker candidates often did not read the question carefully and discussed demand and fishing intensity. Candidates should always be careful to read questions thoroughly to ensure that their answers are relevant.
- (c) (i) Many candidates were able to recognise that the overall trend was an increase until 1986, followed by a decrease. Many candidates did not gain credit as they gave a detailed description of the change in catch, rather than a trend. If a trend is asked for in a question, an overall view is required rather than a detailed description.
- (ii) Most candidates gained at least partial credit with many gaining full credit. Where candidates did not gain more than partial credit, it was usually for focusing their answer on one or two aspects such as the demand or fishing effort. Candidates should always try to explore questions fully and look for several reasons if a question has a higher mark allocation. Weaker candidates often recognised the effect of demand but did not look for other causes of the changes in pilchard catch.

Section B

Question 3

- (a) (i) Many excellent definitions of a predator were seen, and most candidates understood that predators both hunt their prey and consume animals. Where candidates did not gain credit, it was usually due to referring to the consumption of organisms rather than animals. Organisms could refer to plants or animals and so is not a precise definition of a predator.
- (ii) Most candidates were able to gain at least partial credit and the majority showed an excellent understanding of the benefits of shoaling behaviour. The most common points seen were the ideas of improved feeding and protection against predators. Fewer candidates fully explained that both species benefit. Candidates should take care to define terms such as symbiosis in answers. A significant number of candidates incorrectly stated that breeding between the two species would be improved.
- (b) This question generated a wide range of responses. Stronger candidates correctly recognised that the classification group was 'class' and also correctly wrote down the genus and species. Many candidates incorrectly gave the classification group as 'family.' There was confusion as to the correct notation for genus and species. Candidates should be careful to give a capital letter for genera and a lower-case letter for species.
- (c) This question was found to be accessible by the majority of candidates with many gaining at least partial credit and a significant number gaining full credit. Most were able to identify at least four features of the internal anatomy of a bony fish and often gave correct functions. A few weaker candidates stated that fish possess lungs, and others referred to fish breathing. Some candidates gave only vague functions for the skeleton. Other common errors included the description of a swim bladder as a gall bladder and statements that the fins and opercula were part of the internal anatomy. However, most candidates demonstrated an excellent knowledge of the internal anatomy of bony fish.

Question 4

- (a) The syllabus gives clear definitions of the roles of management in the fishing industry. However, only stronger candidates were able to give two correct roles. Many gave vague ideas such as protecting fish, building up industry or conserving organisms. Candidates should be careful when giving answers to use precise language and should ensure that they understand all areas of the syllabus.
- (b) (i) This question was well answered by many candidates and it is clear that most had an excellent understanding of the roles of artificial reefs. Many referred to the role of the reefs as habitats and areas in which coral growth could increase. There were many excellent descriptions of the reefs as areas of conservation and places where fishers could gain an increased catch. Most candidates were able to identify the reefs as areas where diving could take place and many also recognised the role of the reefs in reducing wave energy. Where candidates did not gain much credit, it was typically due to their answers being focused on only one or two ideas.
- (ii) This question generated a wide range of responses. Stronger candidates tended to write answers that stated the types of pollution, such as plastic, oil and pesticides, and then went on to explain the effects of each. Weaker candidates often did not list specific pollutants and gave vague general effects such as 'harming food chains' or 'damaging habitats.' Several candidates seemed to find it difficult to structure their answers and would have benefitted from planning their answers first to identify the key points.

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

Key messages

- For calculations, candidates should be encouraged to check if their answers makes sense in comparison to other information supplied to them.
- Candidates should look at the mark allocation for a question and try to give sufficient information to gain full credit.

General comments

Candidates generally attempted all questions and were familiar with the practical activities required. They could give some detail of methods, with stronger candidates giving very detailed accounts. Many candidates were able to give some ideas for improvements or further studies to a method they had written. Some candidates gave a generalised answer for safety precautions, while stronger candidates suggested appropriate safety features.

Comments on specific questions

Question 1

- (a) (i) The majority of candidates were able to use their drawing and observation skills well in this question. Some candidates did not receive credit for the proportions as they missed a leg from their drawing, or did not get the shape of the carapace or the length of the claw correct. Many candidates clearly showed the jointing of the legs, but some who had shaded their drawings did not show this. A few candidates made the drawing too large and drew over the question wording. Many candidates drew a lot of additional detail, demonstrating a good understanding of biological drawings. Centres should note that tracing paper is not permitted in this exam.
- (ii) The majority of candidates could accurately identify all three structures, but some candidates were not clear about the carapace of the crab.
- (b) (i) Although directed to measure the photograph of Fig. 1.1, where they were provided with a scale line to measure, many candidates did not measure this and so gave an incorrect value to use in their calculation.
- (ii) Many candidates were able to rearrange the formula to calculate the actual length of part Y, and any error from (i) was carried forward. Some candidates who did not gain credit here could have checked their answer to see if it made sense from the rest of the drawing. Calculating the length of part Y to be 53 cm should have alerted candidates to an error somewhere in their calculation that may have needed reviewing.

Question 2

- (a) (i) Many candidates could describe appropriate parts of the body here using correct terminology, but weaker candidates could have provided a little more detail, e.g. the fact that the caudal fins are the same shape, there are two dorsal fins or that they both have the same number of fins. Stronger candidates usually gave this detail.

- (ii) Candidates generally chose appropriate differences and expressed these well, but a small number of candidates used the same feature for similarities and differences, and a few believed one fish had two opercula. Weaker candidates gave more vague answers, such as “the fins are bigger in Fish A” (the pelvic fin was not larger in Fish A), and needed to look more critically at samples to aid precision in their answers.
- (b) (i) The majority of candidates accurately measured the length of the fish.
- (ii) The majority of candidates could accurately calculate the mean length of the fish, but a few of the weaker candidates subtracted 5 from their calculated total lengths, rather than dividing by 5.
 - (iii) Candidates found this question more challenging, but some stronger candidates recognised that 5 was a small sample compared to the numbers of fish usually found in a shoal. Many candidates could state that the size of individuals may be greater or smaller and some gave reasons for this, usually age or gender.

Question 3

- (a) Most candidates recognised that this investigation would require a Secchi disk, and were able to give some detail of how to use one. Weaker candidates sometimes referred to the time taken for the disc to disappear rather than understanding it is the depth that is important. Stronger candidates also recognised the need to undertake this by the waste pipe, and at several distances going away from the pipe, while weaker candidates just stated near the pipe and far from the pipe.
- (b) (i) Most candidates were able to give the correct food test and usually the correct colour change.
- (ii) The majority of candidates were able to give the correct test here, although some gave the Benedict test and colour change instead.

Question 4

- (a) (i) The majority of candidates gave a good table of ranked data. The most common error was either not adding units for tidal height, or placing the unit ‘m’ in the table alongside every tidal height reading. Units must be presented only in the headers of the table.
- (ii) Most candidates were able to draw appropriate scales for their graphs, but some chose unusual scales, such as 5 hour units, which made it difficult for them to plot with accuracy. The most common error was joining the points with a ruler rather than drawing a smooth line through the points as asked in the question.
 - (iii) Most candidates were able to read data correctly from their graph, but a small number chose a different time to read from.
- (b) Candidates often needed to provide a little more information as they knew that the tide was high between these times, but did not say it was greater than the draft of the boat allowing it to moor safely.

Question 5

- (a) Many candidates were familiar with this investigation, but the majority of candidates only discussed using a large and a small fish, rather than looking at a wider variety of sizes to see if the hypothesis held true. Most candidates knew to take a sample of the ovary to count the number of eggs, with some candidates quartering the ovary and trying to count all of the eggs in a quarter. Few candidates suggested taking several small samples from different areas of the ovary as egg size could differ. Only the strongest candidates mentioned separating the eggs by mixing in water, or using gridlines on a cloth to count random samples. Most candidates presented a table of some sort but they did not always accurately reflect their methods. Many candidates also showed they understood the type of graph required for their data, but some did not include axes/units, and some were able to link this back to the original hypothesis. While many candidates mentioned the number of eggs in the ovaries of small and large fish, this was not sufficient for the comment in relation to the hypothesis.

- (b) Candidates generally gained at least partial credit here, with many suggesting the test could be repeated with different species of fish, and some recognising that more samples would be needed as the total number of eggs may not be accurately counted. A few stronger candidates suggested using photography to aid in accurately counting the eggs.