

MARINE SCIENCE

Paper 0697/01
Structured

Key messages

Candidates should be encouraged to spend time reading the questions carefully and should consider all the information given to allow them to work through situations where they need to apply their knowledge to new situations and to understand all they need to do to achieve credit.

Candidates need to become more familiar with the different types of preservation applied to fish products, and to consider the particular environmental problems of different fishing methods.

General comments

Candidates demonstrated a good understanding of many of the basic ideas from the specification, and attempted most questions. Candidates planned their time well to complete the question paper, with few answers left blank. Some candidates needed to consider different aspects of the specification and how knowledge from different areas may need to be incorporated in answers to provide more detail.

Comments on specific questions

Question 1

- (a) Most candidates most were able to gain at least partial credit here. Some candidates mixed up autolysis and putrefaction, and some candidates put proteins for lipids.
- (b) (i) Only stronger candidates answered this fully correctly. Some candidates made comments such as that it is easier to catch the fish or that more fish would be caught, rather than considering the factors involved in the trading.
(ii) Candidates generally understood why preservation is important to fish being exported. Many candidates mentioned reducing spoilage or maintaining quality of the fish, but some candidates did not mention that this allows the fish to remain edible for longer periods of time.
- (c) (i) This question was either answered very well, with candidates achieving full credit or very poorly with candidates achieving no credit. Candidates are expected to be familiar with this method of preservation.
(ii) Candidates were generally less familiar with irradiation as a form of preservation, with most candidates mentioning cobalt-60 or one of the specific methods. Candidates often mentioned radiation, but did not mention either gamma or ionising radiation.

Question 2

A number of candidates only gave a single letter for all their answers, rather than including all the species which had the feature. Candidates should be encouraged to read the whole of the question carefully to understand what they need to do to score full credit.

Question 3

- (a) (i) The majority of candidates answered this correctly, with some candidates occasionally writing the stages in reverse order.



- (ii) Many candidates did not answer this question as expected, often naming the type of reef in the diagram, rather than describing the attachment of the coral polyps to a solid or stable substrate and their subsequent growth.
- (iii) Many candidates noted that the lagoon in **J** was deeper than the one in **M**. Some candidates described how the abiotic features of the lagoons would differ, which was awarded credit.
- (b) Some candidates provided a list of ways in which carbon dioxide is released, but did not mention carbon dioxide, or that it is a greenhouse gas. Many candidates noted that the sea levels would rise, and this would cause islands to sink or be flooded. Fewer candidates mentioned reef erosion as a result, or the greenhouse effect.

Question 4

- (a) (i) Few candidates could easily identify the rhizome, with many candidates labelling the leaves or roots as the rhizome.
- (ii) Many candidates correctly identified the trophic level as 1 or first. Some candidates named the trophic level instead, or gave two different trophic levels, one for the seagrass and then stated that **B** was trophic level two, even though they had been given the information in the question that it was a photosynthetic organism.
- (b) The classification table was often well completed, but some candidates forgot that phylum came below kingdom, or mixed up the genus and species labels, or gave both genus and species in the species box.
- (c) Two examples were required here, and stronger candidates gave these. Others made the error of suggesting sunlight or carbon dioxide.
- (d) (i) Candidates are expected to know that zooxanthellae are found within the tissues of coral polyps, but many candidates did not recall this as it was asked in a different context. Candidates also needed to state more than just corals (as people often refer to the solid reef structure) or just polyps.
- (ii) This was only answered well by stronger candidates. Some candidates mentioned it is a mutualistic relationship, and some that zooxanthellae photosynthesise. Fewer candidates noted that the excess food or oxygen produced is passed onto the coral polyp.
- (e) Often candidates did not mention the type of organisms involved in decomposition, but usually understood that it is a process where cells and their contents are broken down in some way. Fewer candidates mentioned that this is to allow the nutrients to be reabsorbed by producers.

Question 5

- (a) (i) Most candidates knew that **C** acts as an anchor to hold the FAD in place, but many candidates suggested **A** is used as a fishing platform, rather than as a shady area which attracts the fish to gather below it, or as a marker for fishermen to find it. Many candidates understood the function of the coconut leaves, but some suggested it is a food source to attract the fish.
- (ii) Candidates who stated “fishing near the shore” did not gain credit, as this could mean inshore fisheries. They needed to identify some of these types of areas.
- (iii) Many candidates were able to recognise that by-catch of some type was an environmental problem of gill nets. Common errors included suggesting that they damage corals or the seabed, but gill nets are suspended by floats, unless they become ghost nets, which usually was not mentioned.
- (b) (i) Candidates needed to consider the number of fishing hours in each area before and after the FAD was placed and should have noted that fewer hours in total were spent fishing after the FAD was in place. This would imply there were more fish caught at the FAD, so more fish were caught or caught in less time, than in the reef and mangroves, so less fishing effort occurred in the reef and mangrove areas. Candidates often found this hard to describe, and mentioned more fish at the FAD, but did not then link this to less effort going into the other areas. The question asked for an

explanation of the change in effort at the reef and mangroves, so if these areas were not mentioned, they could not achieve full credit.

- (ii) Some candidates achieved partial credit here, by stating that biodiversity would increase, or fish stock would increase, but fewer candidates linked this to the nursery areas remaining undisturbed so adult fish could complete their reproduction.
- (c) (i) Many candidates showed some of their working and gained partial credit for this. A small number of candidates selected the information from the incorrect island, or tried to use the CPUE value in their calculation. A common error was failing to multiply the total catch figure by 1000 before starting the calculation, so an answer of \$66.94 was given.
- (ii) Only stronger candidates answered this correctly. Some candidates recognised that overfishing was occurring or likely to occur around island **R**, but other candidates thought that the higher the number, the worse the fishery, rather than understanding the higher the value, the more fish are in the area. Some candidates described the data but did not make any links to the long-term effect and others just stated an increase or decrease in earnings without any explanation.
- (d) Most candidates scored at least partial credit, with many candidates correctly identifying positive and negative impacts.

Question 6

- (a) While stronger candidates answered this well, many others did not recognise that the pie chart percentages add up to 100%, and tried a variety of calculations, with some candidates adding them all up to get to 100% or finding the mean of the different values. Candidates need to be familiar with pie charts and should be able to interpret this type of graph.
- (b) Stronger candidates often achieved credit for recognising that this caused eutrophication in the water and were able to give a good account of how this occurred. Weaker candidates sometimes mentioned the nitrates or phosphates in the water, or that it caused the death of marine organisms but with little explanation of why this happened.

Question 7

- (a) Many candidates scored at least partial credit here, often for precipitation or rainfall. Evaporation or temperature were also given frequently, with fewer candidates remembering freshwater input from rivers, or upwelling bringing additional nutrients to the surface of the oceans.
- (b) The strongest candidates answered this well. Other candidates mentioned a membrane but did not always include that it was a semi-permeable or selectively permeable membrane. Some candidates found expressing themselves clearly more difficult, as they needed to consider if they were discussing salt concentration or water concentration when discussing osmosis; some candidates thought the salt was moving in or out, rather than water.

Question 8

- (a) (i) The majority of candidates correctly identified India as the country with the lowest consumption.
- (ii) A common incorrect answer given was France; but the majority of candidates were able to correctly identify Thailand as having the greatest increase in consumption of fish and seafood products.
- (b) (i) The majority of candidates were able to correctly identify the general trend shown by the data of an increase in consumption of fish and seafood products over the time period.
- (ii) Some candidates stated that more seafood products were available without explaining why this may have been the case and did not mention that a greater variety of products may increase the appeal of these products to consumers who had not previously eaten these products, or that it would reduce the price so making it more affordable.

MARINE SCIENCE

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| <p>Paper 0697/02 Paper 2</p> |
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Key messages

Candidates should:

- make sure that they understand the meaning of each command word listed in the syllabus
- use vocabulary and detail in their answer that is accurate and of an IGCSE level
- practise data analysis using unfamiliar data to build confidence
- be familiar with all the mathematical skills required in the syllabus.

General comments

The general standard of responses was very high and many candidates had clearly prepared well for this examination series. Many candidates demonstrated excellent, detailed factual knowledge of all topics and this was particularly evident in the longer answer questions in **Section B**. Most candidates use key vocabulary accurately and with confidence. Mathematical skills were also generally very strong and graph plotting was a strength of the candidature.

The majority of candidates attempted all questions and had good exam technique, with many showing evidence of planning what they would include in the longer answer questions. A few candidates found some of the questions challenging, particularly data handling questions. In preparation, candidates should try to gain confidence when analysing unfamiliar sets of data. A small number of candidates tended to underestimate the depth required in some of the answers, especially when describing the principles of the four-stroke diesel engine and the chemical and physical factors that affect primary producers. Some candidates also confused the meanings of some of the command words, such as 'describe' and 'explain'. It is important that candidates recognise what each command word requires in the answer.

Comments on specific questions

Section A

Question 1

This question focused on the changes in catches of anchovies and skipjack tuna over time. In the first part of the question, candidates were given data comparing the catches. The second part involved data about the analysis of the gut contents of tuna.

- (a) (i) Candidates were asked to draw a line graph to show how the catches of both anchovies and skipjack tuna changed over time. Graph drawing was a strength and many candidates gained full credit. Most were able to label the axes fully, selected sensible linear scales, plotted points accurately, joined the points with straight lines, and labelled the lines. Candidates should try to use at least half of the grid when selecting scales and use sensible increments (this reduces the risk of incorrectly plotting points). Candidates should also make sure that they do not take lines beyond the first and last points.
- (ii) This question was answered well with most candidates gaining at least partial credit and many gaining full credit. A few candidates recognised that the line went up and down but did not give the date of the turning point. When candidates are asked for a description of a trend and there is more than one mark allocated it is good practice to identify the turning point.

- (ii) This question required candidates to look at the data and then suggest why the skipjack tuna population increased and then decreased. At the start of the question candidates were told that skipjack tuna eat anchovies. Only a minority of candidates recognised that the anchovy-skipjack tuna population was an example of a predator-prey relationship. Many gained credit for suggesting other reasons for the changes, such as demand, fishing intensity, and migration. Candidates should be clear in their answers to link the factors to the changes, for example, clearly stating that catch increases because demand increases.
- (b) (i) This question asked candidates to calculate the percentage of tuna that had anchovies present in their gut. Most candidates were able to calculate the percentage correctly.
- (ii) This question focused on why using gut analysis may not give an accurate measure of the anchovy population. Many candidates gained partial credit but only a minority went on to give a second reason. Common correct reasons included, tuna eating other species, anchovies being digested, anchovies being eaten by other species, and tuna migrating in from other areas.
- (c) This question asked candidates to give two methods used by governments to maintain sustainable fishing. Most candidates were able to give two different methods. A few candidates gave two methods that were in fact the same thing, for example, using quotas and restricting the number of fish that can be caught. When asked for lists candidates should always make sure that the answers are different.

Question 2

The contexts for this question were aquaculture of salmon, balanced diets, and the environmental sustainability of using insect derived feed pellets compared with fish derived feed pellets. In the first part of the question candidates were presented with a table showing the nutritional data of wild salmon and aquaculture produced salmon. In the second part of the question candidates were given a table showing the effects of growing the salmon on insect pellets compared with fish pellets.

- (a) (i) This question asked candidates to identify a human diet component not present in the table. Most correctly stated carbohydrates, fibre, or water.
- (ii) This question required candidates to use the information in the table to calculate the mass of protein present in 2.4 kg of wild salmon. Most candidates were able to complete the calculation correctly but a few did not realise that the table gave the mass in grams rather than kilograms.
- (iii) In this question candidates had to look at the data in the table and give two explanations why eating the wild salmon may be healthier than the salmon from aquaculture. Most were able to list two reasons such as higher vitamin D, lower fat, higher protein, or higher iron. Fewer gave reasons for each of the substances. Weaker answers often gave general points about the use of pesticides in aquaculture rather than using the data in the table.
- (b) (i) This question asked candidates to state the name of the molecule that is a polymer of amino acids. Many candidates found this question challenging and gave incorrect answers such as starch, glycogen, or DNA.
- (ii) In this question, candidates had to calculate the rate of growth of the salmon fed with insect-based pellets. Most were able to calculate the difference in mass but some of these candidates went on to divide the change by the time taken. If a rate is asked for there needs to be a measure of time. Credit was available for the use of the correct units and while many candidates gave correct units, a significant number forgot to put the units.
- (iii) This question required candidates to use the information in the table and their own knowledge to discuss whether using insect-based pellets is more sustainable than fish-based pellets. Most candidates were able to score at least partial credit, usually for stating that the increase in mass was similar for both types of pellets or for fish based pellets. Many candidates recognised that the insect-based pellets cause more release of faeces but only a minority went on to explain that this could lead to pollution. The strongest answers gained full credit for giving reasons for and against the environmental sustainability of the insect-based pellets. With 'discuss' questions, candidates should try to explore the data fully and give explanations.

Section B

Question 3

- (a) This question asked candidates to name a boat building material and a reason for its use. Most were able to suggest one from aluminium, wood or fibreglass. Most were also able to give a valid reason such as lightness or strength.
- (b) This question asked candidates to describe the method and environmental impacts of long-lining. The question asked for both the method and the impacts so to be awarded full credit, candidates needed to have points from both. Many were able to describe the use of many hooks, the use of barbed hooks, the use of floats and bait. Some candidates referred to hooks but did not state that many are used and others confused this method with rod and line fishing, or bottom long-lining (by suggesting that the line is anchored to the seabed). Many were able to correctly state that bycatch is an issue with long-lining and that the lines can easily become ghost lines and entangle other species.
- (c) This question required candidates to describe the principles of the four-stroke diesel engine. Many very strong answers were seen that used excellent key vocabulary, such as the cycle of induction, compression, power/combustion, exhaust. Many candidates correctly gave the positions of the inlet and outlet valves at each of the stages and explained the movement of the piston and the inflow of air and outflow of exhaust gases. Some candidates confused the diesel engine with a petrol engine and referred to the roles of spark plugs. Weaker candidates gave answers that confused the events of each stage, such as incorrectly stating that the inlet valve is closed during induction and that air flows in through the exhaust valve.

Question 4

- (a) This question assessed candidates' understanding of plate tectonic theory. Most were able to gain at least partial credit with many going on to get full credit. Many candidates gave very impressive, highly detailed answers that explained Wegener's theory of tectonics, referred to the breakup of Pangea, explained that the plates float on magma, and that the plates move. Fewer referred to the role of convection currents in the magma.
- (b)(i) Most candidates answered this question that asked for an outline of photosynthesis well. Most knew that light is the source of energy, and that water and carbon dioxide are combined to produce glucose and oxygen. Some candidates missed products or reagents, for example stating that only glucose is produced. Many referred to chlorophyll but only a minority gave its role in absorbing light energy.
- (ii) Candidates were asked to explain how the chemical and physical properties of sea water affect the growth of primary producers. Stronger answers listed a wide range of factors, including light, carbon dioxide concentration, pH, temperature, and salinity. Most candidates were able to list at least two factors and stronger answers went on to explain how each of these factors would affect productivity, such as the effect on water movement in and out of organisms, photosynthesis rate, and chemical reaction rates. Weaker answers tended to either focus on one or two aspects or just list factors.

MARINE SCIENCE

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| <p>Paper 0697/03 Practical Assessment Paper</p> |
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Key messages

Candidates need to ensure they read questions carefully and look at all the information given to them before completing their answers.

Candidates should be reminded to show their working for any mathematical questions and to ensure they place units in the header of columns in results tables.

Candidates also need to understand how to draw a scale line on a drawing.

General comments

Candidates did well on this paper, demonstrating a confidence and knowledge of practical work. Candidates usually showed a good knowledge of food tests and completed the graph question well. Candidates found the extended method and results question more challenging, but most candidates were able to make some suitable points. Candidates appeared to have sufficient time to complete the paper, and only a few questions were left unanswered.

Comments on specific questions

Question 1

- (a) Most candidates were able to achieve at least partial credit here, usually for the drawing being a suitable size with neat lines. Many candidates completed accurate drawings and achieved full credit. However, in some cases the caudal fin was drawn too large in relation to the rest of the body.
- (b) Most candidates knew the lateral line, but some candidates labelled a median fin and a paired fin. Candidates need to ensure that label lines are drawn with ruled straight lines without any arrowheads.
- (c) (i) Fewer candidates completed this question. Of those who did, some candidates drew the scale line on their drawing rather than on the photograph. Some candidates also measured the length of their drawing and used that measurement for the scale rather than using the stated length given in the question.
(ii) Many candidates achieved at least partial credit, with using the actual length of their own drawing to calculate the scale as the most common error. A small number of candidates did not calculate the correct answer and had not shown their working and, therefore, could not be awarded partial credit. A few candidates also rounded incorrectly at the end of their calculation.

Question 2

- (a) Candidates were more familiar with the echinoderms than the annelids, often naming the annelids as arthropods, or sometimes arachnids. A number of candidates knew the two correct groups but placed them on the wrong answer lines.
- (b) Candidates correctly identified which species had tube feet and a segmented body more often than the setae and pentaradial symmetry. Most candidates scored at least partial credit.



- (c) (i) Most candidates were able to calculate the mean correctly, but a small number of candidates did not divide by 5 or made an error in writing incorrect numbers down for the calculation. A few candidates wrote an incorrect answer without any working and, therefore, could not be awarded credit for their working.
- (ii) Candidates found this question more challenging, with some candidates giving a single number only instead of the required ratio. While some candidates simplified the numbers, others did not. Some candidates only gave a ratio to the nearest integer rather than to one decimal place as asked for.

Question 3

- (a) Stronger candidates usually answered this questions well, but some weaker candidates mixed up the tests and described the incorrect test, e.g. iodine test for starch. Candidates needed to be clear about the difference between testing for reducing sugars and non-reducing sugars, as full credit could only be awarded to candidates who explained that non-reducing sugars needed to be hydrolysed first.
- (b) (i) Some weaker candidates drew this as a single body of water, sometimes stating “mixture of fresh and sea water” rather than understanding that the fresh water would float on the sea water.
- (ii) Stronger candidates usually recognised the difference in density and stated that the less dense fresh water floats above the sea water, or the converse. Fewer candidates went on to explain the reason for the difference in densities due to the salts found in sea water.
- (iii) Most candidates could state this was a hydrometer, with incorrect answers including barometer, scale or measuring cylinder.

Question 4

- (a) (i) Candidates showed that they were familiar with drawing suitable results tables, which were often neatly constructed using a ruler and pencil and showing appropriate headings. A few candidates placed their units in each cell of the table rather than in the column headings, with the headings of some being too vague, e.g. mass (g) rather than fish mass (g); this could have been the mass of the ovaries rather than the mass of the fish.
- (ii) Many candidates were able to correctly calculate the number of eggs; the most common incorrect answer was 4675. Some candidates had not recognised that they needed to account for the sample being 0.1 g.
- (b) In this question, candidates often choose a poor scale and so they needed to work out the intervals having been given the uppermost value. A few weaker candidates gave the values from the table (34, 43, 60, 92, 110), while others forgot to add to the y-axis heading the ‘000’s. Most candidates scored at least partial credit for their axes.
Many candidates plotted the five points well with the second, fourth or fifth point being the most commonly incorrect points.
Drawing an appropriate line of best fit was more challenging, with some candidates drawing a line between their first and last point without looking at how the other points were distributed on either side of their line and sometimes ended up with an imbalance. Most candidates were able to read the appropriate value from their graph, but some candidates did not read to a high enough degree of accuracy, i.e. to the nearest 1000.
- (c) Most candidates were able to state the relationship between mass of fish and fecundity, which required more than a one word answer of ‘positive’.

Question 5

- (a) Most candidates made a good effort to describe a method, but some candidates’ responses only included an appropriate safety measure. The most common relevant points made included the use of a transect line and quadrat, but many candidates did not mention random or systematic sampling and drawing a table and adding appropriate headings and units. Some candidates mentioned repeats but did not state a minimum number of results to collect (usually three) and did not state to find a mean. Ideally candidates should know that the mean is one type of average. As

this was an investigation into red algae, which can be quite large, the percentage cover of the quadrat was a more useful measure than counting the number of red algae within the quadrat. Some candidates did not state that they would repeat the investigation at several different (stated) heights above the low tide mark, or only said to repeat at one other height, which was insufficient for credit. Few candidates made enough of a comment on the hypothesis for credit.

- (b) The strongest candidates gained at least partial credit, usually for suggesting repeating the investigation on other rocky shores or at different times of the year. A few candidates suggested investigating different types of algae, such as brown or green. A few candidates made points in this section that would have been appropriate to make in (a).