

MARINE SCIENCE

Paper 0697/01
Structured

Key message

Candidates need to ensure they read the question and all the information supplied carefully to help them to construct an appropriate answer.

General comments

Candidates were well prepared for the exam, and most attempted to answer all questions. There were some strong performances to many questions.

Comments on specific questions

Question 1

- (a) Most candidates achieved at least partial credit here. The most common error was to give a predator of sea turtles rather than a prey of sea turtles. A small number of candidates appeared to have misunderstood the direction of the arrows.
- (b) Many candidates referred to photosynthesis, carbon dioxide and water or light. Some candidates referred to energy from the sun rather than light energy (there being other forms of radiation). Many candidates also stated that energy was produced by the primary producers. Only stronger candidates gained full credit as others often referred too vaguely to food being passed on from the producers, rather than energy or a stated carbohydrate.
- (c) Weaker candidates misinterpreted the question and gave reasons for the decline in sea turtle populations. Others stated the effects on the other members of the food web. It was insufficient to state that the sea turtle population is decreasing as an explanation for the increased population of jellyfish, as this has been given in the question.
- (d) Weaker candidates gave vague statements such as “protect the sea turtles” or “stop catching the turtles” rather than making it illegal or banning it, or suggested increasing primary productivity by planting sea grass. Many candidates stated that a protected area was needed, in the form of an MPA, sanctuary area or island, or that nesting beaches should be protected.

Question 2

- (a) The majority of candidates scored at partial credit here, demonstrating a good understanding of classification. Errors occurred in all three answers required, but the most common was an error in class.
- (b) (i) Many candidates correctly described the idea that gametes were released, or that fertilisation occurs outside of the body, but relatively few described the process of fertilisation as fusing of the gametes, often repeating the term “fertilise” from the question. Weaker candidates described the production of gametes, rather than their release (into the water), which was insufficient as all sexually reproducing organisms produce gametes, whether this is for internal or external fertilisation.
 - (ii) Candidates often tried to describe planktonic larvae as young forms. Few used the word juvenile, with some saying they were the second stage of development, or came after the egg. Few candidates were able to describe planktonic as meaning floating with the current.

- (iii) Many candidates thought that being planktonic meant they would avoid predators, rather than understanding that external fertilisation leads to a large number of offspring, many of which will be eaten, but that the parents do not need to care for the young, so many can be produced. A few stronger candidates suggested it was so that they could move to new areas, but few suggested there was an abundant food supply for them, in the form of phytoplankton.
- (c) (i) Many candidates were able to achieve credit here, but those who only referred to the skin being cast off did not, as skin is constantly shed by mammals.
- (ii) Many candidates stated it was to allow the organism to grow, and some also explained that the shell did not grow, or was of a fixed size or shape, and so needed to be removed.

Question 3

- (a) A number of candidates gave the effects of global warming rather than the causes, or gave vague answers, such as cutting down trees, rather than the idea of vast numbers of trees being removed through deforestation. Many could name a greenhouse gas, but some simply stated that carbon was released, which was insufficient for credit.
- (b) (i) Most candidates showed some knowledge about tides, but few gained credit for their discussion of currents. There were two critical areas in the description of tides, which many candidates omitted: the fact that the rise and fall of sea level is regular and that tides are influenced by the effects of the gravity of the sun/moon. Credit was most often awarded was for the understanding of the gravity from the sun and/or moon affecting tides.
- (ii) Many candidates stated that the sea level rises but this was not sufficient for credit.
- (c) (i) Many candidates correctly identified pH as being a measure of acidity or alkalinity of the seawater, but a significant number mixed up salinity and pH, referring to salt content here.
- (ii) Many candidates identified this as relating to the salt content of the seawater, but did not mention concentration of units of measurement and so did not gain full credit.

Question 4

- (a) (i) Most candidates stated that sewage would kill organisms, with no understanding of the events leading to that. Few recognised that sewage contains nutrients, but more understood that it leads to eutrophication or algal blooms, and some noted this would reduce the oxygen concentration in the water, or could block sunlight.
- (ii) Fewer candidates answered correctly here than in (i). Many candidates did not seem to understand the term heavy metal, and thought it was a heavy metallic item that would crush the reef. A few stronger candidates correctly referenced bioaccumulation and that this may kill organisms in higher tropic levels.
- (b) (i) A number of candidates did not answer the question asked and explained reasons why the grouper fish population might have declined or the consequence of this on the health of a reef. Those who did gain credit stated that the catch per unit effort decreased, but often then simply repeated that the population of grouper had declined.
- (ii) A significant number of candidates suggested aquaculture, which is not a fisheries practice, as it may be used to increase the number of endangered species, but it would not be appropriate to release fish to be recaptured. Some candidates who did suggest an appropriate method, stated that it allowed the fish to reproduce, or reach maturity to reproduce, with few mentioning that the fishing practice would reduce the number of fish caught.

Question 5

- (a) Many candidates misread the latitude as 40° , rather than $35^\circ 40'$. A significant proportion of candidates reversed the answers for latitude and longitude, so the number of candidates gaining full credit here was relatively small. A few candidates simply gave letters, X, Y and/or Z.

- (b) (i) (ii)** The majority of candidates answered these two questions correctly.
- (iii)** Fewer candidates answered this correctly than **(i)** and **(ii)**, but many were able to state current or wind. The most common errors were stating temperature or weather.
- (c)** Many candidates knew the function of the echo sounder was to find depth of the water or to locate fish, with common errors being to locate other ships. Some gave two responses which were essentially the same e.g. “determining depth” and “identifying underwater objects”.
- (d) (i)** The majority of candidates correctly identified purse seining equipment, with the most common error being trawling identified, or ticking more than one box.
- (ii)** References to overfishing and catching untargeted species were common ways of gaining credit here.

Question 6

- (a) (i)** Many candidates referred to growth in one form or another, with a few gaining credit for references to energy. Some candidates also correctly suggested hormones, antibodies or enzymes, which are beyond the scope of the specification.
- (ii)** Many candidates gained credit here. Most referred to energy, with a few suggesting insulation. Relatively few opted for descriptions of protection.
- (iii)** The function of nucleic acids was much less well known. Only a relatively small proportion referred to genetic material or to protein synthesis. The most common errors were suggesting energy, growth or development.
- (b)** Many candidates scored at least partial credit with many gaining full credit. Candidates generally provided answers across the range, with the most common being to earn an income. Stronger candidates generally recognised it is a good source of protein, or other named nutrient, and that it was easily available.
- (c) (i)** Weaker candidates often misread the term putrefaction as purification and described ideas about washing and cleaning the fish. Many candidates achieved partial credit here, with reference to the action of bacteria. Stronger candidates also stated the names of some of the chemicals that cause the bad smell.
- (ii)** This was answered well by most candidates who often referred to cutting, cooking, the use of oil or brine and sealing. Some candidates demonstrated a detailed knowledge of the process by quoting cooking times and temperatures for pre-cooking and after sealing.

Question 7

- (a) (i)** Many candidates referred to conservation or protection of habitats or species, but few gained full credit. Those who did often gave the idea of education about the ecosystem or fundraising for conservation projects. A significant proportion of candidates only gave benefits of tourism, or any industry, such as providing jobs or generating income.
- (ii)** Many candidates found this question challenging. Very few candidates made any attempt to refer to noise/smell or unsightliness or to conflicts at the harbour, with those who did gain credit citing the conflict over certain areas of the ocean, and tourists getting in the way of commercial fishing.
- (iii)** This was generally well answered. However, “selling fish” was insufficient as this is what fishers would have done even without tourists, but some candidates did suggest they may achieve higher prices, or fish for more valuable items, such as lobsters, to provide to the tourist market.
- (b)** Just “seeing fish” was insufficient to gain credit as a benefit for tourists, as they would be able to do this elsewhere. Candidates needed to give some idea of improvement of the experience, for example, more species, or a greater number of organisms to be seen, or lack of damage to the habitat. Few candidates gained credit for the benefits to fishers, often getting part way in terms of there being more fish available but not adding the necessary extra detail that the fish would overspill from the MPA, so fishers may then fish close to the MPA to increase their catch.

- (c) Most candidates achieved at least partial credit here. The most common answer was 'boat repair'. Some candidates did not provide quite enough detail, for example stating 'roads' rather than good roads / fast roads, or some indication that items could be easily and quickly transported to / from the harbour. Other candidates repeated themselves, such as boat building, then boat repair. Weaker candidates listed navigational equipment, without stating that they may be for sale there.

Question 8

- (a) (i) Ocean A was often misidentified as the Pacific Ocean, with some also misidentifying the Indian Ocean.
- (ii) Only stronger candidates answered this correctly, with the most common correct answer being "demand", with exploitation being described as overfishing or fishing effort. Some candidates offered a second correct response, but they rarely supplied a third correct response.
- (b) (i) Candidates needed to distinguish between fish accidentally caught and fish that were then landed as part of the catch. As there is a ban on shark fisheries these species must be returned to the ocean, so any shark species kept would be illegal, leading to the consequences of an illegal action. Many candidates suggested changing type of fishing gear, or monitoring/surveillance of catches. Weaker candidates suggested banning catching sharks, so had not taken note of the information supplied, or suggested using different fishing gear, or even smaller mesh sizes. Some candidates had clearly misunderstood the question, believing it to be about shark fishing, rather than sharks caught accidentally.
- (ii) Almost all candidates gave the correct answer of 2017. Those who gave 2015 had identified the year in which the fewest of any single type of shark had been accidentally caught.
- (iii) Many candidates gave the idea that the shark population decreased, or gave a reason for the decrease. A second answer often gave a reason, commonly migration, for the decrease, but this could not gain further credit.
- (c) (i) The term, "consumer", was correctly described by most candidates. Those who did not gain credit often referred to consumers in a food web or referred to the specific example given in the question. Some simply re-used the term "consume", rather than explaining that this involved using or buying.
- (ii) This was answered well by the majority of candidates. Weaker candidates often omitted the need for shark caught in their response, which then implied there were fewer sharks.

MARINE SCIENCE

Paper 0697/02
Paper 2

Key messages

Candidates should be advised to:

- make sure that they understand the demands of all the command words listed in the specification
- use linear scales with sensible increments for graphs
- read questions thoroughly
- ensure that they add sufficient depth to answers.

General comments

The general standard of the scripts was very high and candidates were clearly very well prepared. Stronger candidates showed confident data analysis, accurate graph plotting, well-structured extended answers and a good understanding of what each command word required. Weaker candidates tended to produce graphs that were inaccurately plotted, gave extended answers with a lack of depth and showed confusion over the demands of the different command words.

Comments on specific questions

Section A

Question 1

- (a) (i) This question required candidates to plot a line graph with linear scales on the axes. Many excellent graphs were seen, and most candidates took care to label axes and plot points carefully. Weaker candidates sometimes did not use linear scales, extrapolated the line beyond the first or last point, or did not label axes. However, graph plotting was a strong skill of many candidates.
- (ii) Most candidates were able to correctly state that the tuna catch increased. Many also went on to give the turning point as 2000 and stated that after this, the catch fell.
- (iii) Many candidates were able to correctly give at least two possible reasons for the decrease in tuna catch, typically a fall in population, a fall in demand or the imposition of fishing restrictions. Where candidates did not answer well, it was often because they simply referred to demand or changes in population without giving a direction for the change in demand or population.
- (b) (i) This calculation was completed correctly by many candidates. A few candidates clearly made an error when using a calculator and got the wrong final answer.
- (ii) Similarly to (i), most candidates went on to correctly calculate that it would take 4 years to recover the start-up costs.
- (iii) Many candidates were able to correctly suggest some factors that would cause a longer period of time to recover start up costs. The most frequently seen answers were increases in labour and maintenance costs, and a fall in demand. Weaker candidates tended to give vague statements such as supply and demand rather than stating a decreased demand. Some candidates misunderstood the question and discussed fishing rather than aquaculture.

Question 2

- (a) Many excellent pyramids of biomass were seen. Where candidates did not gain credit, it was often due to drawing an inverted pyramid or not adding labels.
- (b) (i) Stronger candidates explained that both organisms gained from the relationship and stated that the damselfish gained food (while not simply restating the question) and the coral was able to obtain more light for photosynthesis. Answers that did not gain credit often referred to only one organism benefitting from the relationship, and/or rewrote the question rather than explaining the benefits.
- (ii) Only stronger candidates answered this correctly. Those candidates who gained full credit explained all the specific linkages in the food web. Weaker candidates gave very general answers, such as “less food”, or “fewer habitats”, and did not relate the loss of biodiversity to the coral reef food web.
- (c) (i) Most candidates were able to correctly calculate the mean distance. Some candidates rounded their answer incorrectly so only gained partial credit.
- (ii) Most candidates were able to correctly state that the presence of more predator models decreased the distances. Very few went on to manipulate the data or to state that there was a large decrease when one predator model was added but smaller decreases when more were added.
- (iii) This question was answered well by many candidates who often gave excellent explanations. Many explained that shoaling behaviour would confuse predators and decrease predation. Many candidates also noted that the data showed that the swimming speed increased when in a shoal and that this was due to improved hydrodynamic efficiency.

Section B

Question 3

- (a) This question required candidates to explain the features of sea cucumbers. Most candidates were able to gain at least partial credit with many gaining full credit. Weaker candidates sometimes confused sea cucumbers with coral polyps, stating that they have one opening for a mouth and anus and have stinging cells in tentacles.
- (b) This question required candidates to describe the method of beam trawling and to explain the environmental damage. Most candidates were able to explain that benthic trawling damages the seabed and they often went on to explain that it catches a lot of bycatch. Stronger candidates explained how the net is held open by a wooden or metal beam and that it is towed by a boat. Weaker candidates confused benthic trawling with open water trawling or gave vague descriptions of using a net. Some candidates gave vague effects such as overfishing as a consequence, rather than specifically stating it catches a lot of bycatch.
- (c) This question required candidates to describe methods that could be used to conserve sea cucumbers and there were many fully answers that were awarded full credit. Common ideas included the setting up of protected areas, protected seasons, banning scuba diving and setting quotas. A few candidates gave vague answers such as banning fishing, or banning gear. These candidates needed to give more specific details in their answers.

Question 4

- (a) (i) Many candidates found this question challenging and confused EEZs with areas within a nation where economic activity is encouraged. Many candidates referred to a 200 metre exclusion zone and needed to take more care with units. Stronger candidates gained full credit and explained that the EEZ prevents other nations from fishing in the area and that this protects fish stocks and the fishing industry of the nation. A common error was also to state that all fishing is banned in an EEZ.
- (ii) This question required candidates to state two different international organisations involved in fisheries management. A significant number of candidates did not give any named examples, gave local examples rather than international examples, and/or referred to MPAs. The most common correct examples were CITES and MSC.

- (b) This question required candidates to discuss the different factors that affect seafood product prices. Common correct answers referred to changes in supply and demand, product quality, transport, processing costs, labour costs, the effect of poor weather and price fixing by governments. Weaker answers often only focused on supply and/or demand and often did not give a direction, for example, simply stating that fish supply would affect price. Candidates should always give as much detail as possible, in this case, stating that a fall in demand would lead to a decrease in price.



MARINE SCIENCE

Paper 0697/03
Practical Assessment Paper

Key message

Candidates need to ensure they read a question through carefully and thoroughly to understand what they are being asked to do.

General comments

Candidates seemed well prepared for the exam and generally demonstrated a good understanding of the practical aspects of the course, with well-developed scientific skills. Teachers need to continue to ensure candidates are given the opportunity to carry out the stated investigations, or to watch videos of the activities being performed.

Comments on specific questions

Section A

Question 1

- (a) Many candidates correctly identified at least one of the features, but many labelled the heart or liver as the gonad, or confused the swim bladder and the gut.
- (b) Candidates completed good quality drawings of the gill and nearly all made the drawings an appropriate size, and kept lines neat. Many did not attempt to draw in any gill filaments, or did so at angles that were not appropriate.
- (c) (i) The majority of candidates achieved full credit here.
- (ii) Many candidates correctly completed the calculation, but some multiplied the 2.5 and 4.5, as they were unable to rearrange the equation. A few measured their own drawing and used that to calculate from.

Question 2

- (a) Most candidates correctly identified the three habitats, and that the fish from the seabed was either able to camouflage or was flattened. For the coral fish, candidates often offered behavioural adaptations, or other adaptations not visible from the photograph.
- (b) (i)–(iii) Many candidates completed these questions correctly, with the most common error being in (i), with candidates either misreading the end scale mark, not recognising the scale marks were in increments of 2, or forgetting to subtract the initial start point reading.
- (iv) The majority of candidates correctly identified fish L as being the open ocean species.

Question 3

Candidates often had difficulty in clearly expressing how they would complete these tests. Some candidates drew small diagrams to help explain what they were doing which often helped.

- (a) Candidates often had difficulty with describing how to measure the slope of the beach, with many candidates simply explaining how to measure the length of the slope rather than the angle of the

slope. Candidates often knew that a pair of graduated poles were placed at the top and bottom of the slope. A few candidates understood they needed to know the horizontal distance between the two poles, and the difference in height between the two poles to calculate the angle.

- (b) Measuring tidal amplitude was generally answered well. Some candidates only measured it at the beginning and end rather than at stated time intervals, or showed a misunderstanding of the word “amplitude” by stating they would measure the amplitude when they were measuring the height of the water each hour, to calculate the amplitude.
- (c) Candidates generally answered this well and knew this investigation. However, some candidates found calculating the mean problematic, as many stated that multiple results would be collected, and a mean calculated, rather than explaining how to calculate the mean.

Question 4

- (a) A number of candidates gave no headings in their tables, and a significant error was repeating the (%) sign in the body of their table, after they had “percentage” in the heading of their column. Relatively few candidates indicated in the table headings that this was gut contents, and so did not achieve full credit.
- (b) Candidates generally gained credit for the graph, with the most common errors being not leaving a gap between the bars, or rounding all the numbers down when plotted, so the plots for 7.7 and 47.6 were incorrect.
- (c) Most candidates gave at least one effect the plastics had on the turtles, with many providing two effects. Candidates often mentioned entanglement, but did not describe how or why that was a problem.

Question 5

- (a) Many candidates focussed on the first sentence in the question rather than the stated hypothesis, which is regarding rate of photosynthesis, and so many suggested methods for finding the depth at which red and green algae grew, and then finding the light intensity using a Secchi disc. These candidates achieved partial credit. Candidates who presented an investigation into the relative rates of photosynthesis of each type generally knew to measure oxygen production. Some suggested measuring growth rates, but often suggested very short time frames to complete this in. Some candidates would only test the red algae in low light intensity and green at high light intensity, so it would not be possible to draw a valid conclusion from this method. Stronger candidates answered this well and provided a detailed method that would provide useful results. Some candidates again drew their experimental set-up which in some cases was relevant.

Candidates generally knew to present results in a table and produce a graph, but these needed to relate to the experimental method they had described. Some candidates, having measured light intensity with a Secchi disc, presented a table that had photosynthesis in, when they had not mentioned that in their method. A few candidates were able to refer back to the hypothesis, either directly or by stating that the algae that produced the most oxygen bubbles in a unit of time was undertaking the most photosynthesis at a set light intensity, and to compare those to see if the results supported the hypothesis.

- (b) Many answers required more detail as the ideas suggested were often generalised. If suggested readings were inaccurate, candidates needed to provide a reason for this, e.g. difficulty in counting number of bubbles that may be produced very quickly, and offer an improvement, e.g. by filming the bubbles and counting them again afterwards, or in slow motion, or using a gas syringe to collect the gas and measuring the volume of oxygen produced. Stronger candidates suggested using different colour light, or different species of algae.