MARINE SCIENCE

Paper 5180/01
Structured

Key messages

- Candidates demonstrated a good understanding of classification, reproduction and formation of tsunamis.
- Candidates need to become more familiar with the causes and effects of spoilage of fish and fish products and become more aware of the differences between intensive and extensive aquaculture.

General comments

Candidates demonstrated a good understanding of many of the basic ideas from the specification. More detail was often needed to gain the higher-level marks. Most candidates attempted most questions. On some occasions candidates reused words from the stem of the question and did not add any of their own knowledge to their answer. Some candidates need to consider different aspects of the specification and how knowledge from different areas may need to be incorporated in answers to provide the required detail.

Comments on specific questions

Question 1

(a) Most candidates correctly identified the reptile, and often the flowering plant, although some incorrectly stated the macroalgae D and sea anemone F as flowering plants. Many also correctly identified the echinoderms. A few candidates only gave one letter for each description, which limited the marks they could achieve.

(b) Some candidates correctly identified that this was a beneficial relationship between the two organisms, with fish gaining a food supply and the turtle being cleaned. Some candidates were only able to give the benefit to the fish, while a few candidates did not note the information about a symbiotic relationship and provided answers such as ‘they live in water’.

(c) Many candidates recognised they both undergo sexual reproduction, and that they both use external fertilisation to achieve this. Some candidates did then state they also both undergo asexual reproduction, and either budding or fragmentation. Candidates needed to consider the one type of reproduction both use, and then discuss the one that they both do.

Question 2

(a) Many candidates were familiar with the steps involved in the formation of a tsunami and gave the steps in the correct order.

(b) Most candidates knew that converging plates or subduction zones were involved in the formation of a tsunami, with some also understanding that the plates may become locked together and suddenly release, causing a sudden massive movement of water. A common error in weaker candidates’ answers was mentioning transform boundaries causing tsunamis.

Question 3

(a) Higher achieving candidates were often able to achieve this mark, by making it clear it is an area that is under a countries control, along with the resources found there. Many candidates did not mention any idea of control by the country.

(b) (i) Candidates generally scored well on this question. Many candidates could name three boat building materials or give an advantage of one named material.

(ii) Candidates found this question more difficult, often giving features of any boat or safety items rather than for a pole-and-line tuna fishing boat, stating ‘strong poles and lines’ or ‘a place for workers’.

(c) All candidates achieved at least one mark, with many achieving both, showing a good knowledge of electronic navigational aids.

Question 4

(a) (i) Mid-range candidates and above were often able to give a correct answer, with many correctly stating nitrates, but nitrogen, a gas, was not awarded a mark. Weaker candidates often stated ‘pH’ or ‘carbon dioxide’.

(ii) Only a few candidates knew this was diffusion, with many stating upwelling.

(b) Some of the more able candidates could explain the movement of water through a semi-permeable membrane or state the cell would lose water. Others were unsure and stated that water or solutes would move into the cell and others stated that the cell would float or sink.

Question 5

(a) (i) More than half the candidates gave a use of phosphates in primary producers, usually for a named nucleic acid. Incorrect suggestions included for growth or for photosynthesis, which were too vague.

(ii) Half the candidates either mentioned eutrophication or a large increase in the population of algae causing problems, but few gave details for the award of further marks.

(iii) Many candidates mentioned upwelling or decomposition and breakdown of dead organisms. Some of the more able candidates gave excellent explanations of dead organisms sinking, decomposing, nutrients being released and returned to the surface through upwelling.

(b) Few candidates scored full marks here, but half the candidates did score a mark for correctly obtaining the values for phosphate excreted for each food type which could be clearly seen in their working. Common errors were candidates not dividing the difference by the value for normal food. A small number of candidates did not show their working, only their final answer.

(c) Candidates did need to know the difference between intensive and extensive aquaculture to answer this question, and this knowledge did not appear to be secure for candidates. Many talked about tanks or cages rather than differences in stocking densities or natural feeding in extensive and artificial food in intensive. Some stated that intensive aquaculture in tanks was more controlled and so the phosphate could be controlled better from intensive systems.

(d) (i) This was generally well answered by candidates, with answers including providing protein or being a food source or providing jobs or an income.

(ii) Few candidates scored on this question, with those that did usually stating that escaped fish may outcompete wild stocks or spread disease or parasites to the wild stock.

Question 6

(a) (i) Around a third of candidates were able to score at least one mark, often for identifying the lowest water temperature, or identifying the region where water temperature was the most stable. The candidates found identifying the water depth where temperature was 6 ºC the most difficult.

(ii) Candidates often named two physical factors but did not state 'high' or 'low'.

Question 7

(a) Most candidates achieved marks on **(i)** and **(ii)**, with the occasional candidate incorrectly stating sunlight or phytoplankton for **(i)**.

(b) (i) This was a more difficult question for candidates, with a few candidates stating that the slow-growing corals had enough time to grow larger, but far fewer were able to state that this was because the competition between the two types of coral was reduced, in favour of the slow-growing corals.

(ii) Many candidates correctly identified two years when crown of thorns outbreaks occurred**.**

(iii) The majority of candidates gave a reason for harvesting the giant triton.

(iv) Candidates found this more difficult, with some candidates gaining a mark, usually for recognising that with fewer giant triton there would be more crown of thorns starfish. Fewer were able to explain what happens further along the food chain.

(v) Most candidates scored some marks here, with lower achieving candidates often not naming the method, but describing with enough detail to gain a mark. Few candidates achieved all marks.

Question 8

(a) The majority of candidates scored well on this question with the most common error an incorrect function of the bony skeleton.

(b) (i) Candidates needed to recognise that the gut contains bacteria and enzymes, which cause putrefaction or autolysis, so removal reduces the occurrence of putrefaction or autolysis. Some candidates did state that gutting reduces the occurrence of autolysis or putrefaction, but many gave more vague answers such as 'bacteria affect the guts' or 'gutting kills the micro-organisms'.

(ii) Few candidates recognised that lowering the temperature of the fish slows down the action of bacteria and enzymes and all the reactions occurring in the body; rigor mortis, rancidity, putrefaction or autolysis, so allowing the fish to stay fresh for longer.

(iii) Most candidates scored at least one mark, usually for providing employment. Those who did not score had often mentioned its protein content, which is a social advantage rather than an economical advantage.

Question 9

(a) Few candidates understood what the term 'opportunity cost' referred to, so many omitted both parts of this question. A few candidates were able to give an opportunity cost, but only the best candidates achieved a mark for **(ii)**, by stating that the increase in fish stock eventually spills into the surrounding ocean, so increasing catches.

(b) (i) Half the candidates gained this mark, with the most common error being to state 'to prevent overfishing' which is in the stem. The most common answer was to prevent extinction of the fish, with a small number stating to leave enough fish for reproduction.

(ii) Few candidates recognised that the fish present in the area were large adult fish, so the spawning rate may be decreased, impacting the future population size, or the idea that as it is small scale

fishing few large fish may be taken, which allows for sufficient reproduction to maintain the stock. Some candidates did score for the idea of a lack of reproduction occurring in the area.

(iii) Few candidates were familiar with methods used to determine the maximum sustainable yield for a fish stock. Of those who did score, they usually mentioned tag – release – recapture.

(iv) Candidates found this question difficult, with a few recognising that a fish of this size is very rare, and that the price of rare items is high due to the 'wants' of people.

MARINE SCIENCE

Paper 5180/02
Paper 2

Key messages

Candidates should always be clear of the requirements of each of the listed command words and use key vocabulary in their answers. When analysing unfamiliar data, starting answers with descriptions of patterns can help to frame a good answer.
Candidates should ensure they plot points on graphs accurately and choose sensible, linear scales for axes.

General comments

Many candidates demonstrated excellent, detailed factual knowledge, used key vocabulary confidently and analysed data effectively. Some candidates did not provide the level of detail needed in longer questions and found analysis of data difficult. Candidates should also use key vocabulary where appropriate and understand the requirements of each command word. Maths and graph skills were generally strong.

Comments on specific questions

Section A

Question 1

(a) Most candidates gained one mark for this question.

(b) (i) The most common answers were about the age and sex of the sharks.

(ii) Most candidates were able to use a percentage although a few divided 200 by 65.

(iii) This question required candidates to draw a bar chart. The standard of answer was generally very good, and most candidates selected appropriate, linear scales, labelled the bars, and labelled the axes. Many candidates gained at least four marks. The most common errors were to not label axes or to use a non-linear vertical scale.

(iv) Many candidates found this question challenging. Stronger answers explained that the data clearly showed that there was a difference in the behaviour of the sharks and described several aspects of this. Only the very strongest discussed how any aspects of the data did not support the conclusion. Candidates should always explore the strengths and weaknesses of data and conclusions.

(c) Most were able to gain at least one mark, often for stating that there would be more revenue generated as tourists would be more likely to see sharks. Stronger answers explored disadvantages as well as advantages, such as the dangers of sharks to sailors, pollution, and the effects on food chains.

Question 2

(a) (i) Strong answers explained how the gene is taken from other fish, combined with a promoter, and injected into eggs. Some candidates used clear, accurate and detailed vocabulary, often referring to the use of techniques such as cutting DNA with enzymes.

(ii) This mathematical question tested candidates' ability to use a graph to calculate the rate of growth of the salmon. Many candidates were able to gain all three marks. Some candidates calculated the increase in mass of the salmon but did not divide this by the time taken. A small number of candidates were confused by the term 'mean rate' and tried to calculate mean values by adding up different masses of salmon and calculating a mean mass. Candidates should ensure that they are fully familiar with all the maths skills listed in the syllabus.

(iii) This question was well answered by many candidates with most gaining at least one mark. Most recognised that the GM-salmon would reach market size quicker but only stronger candidates went on to give a second benefit.

(b) Most candidates were able to correctly use the data and the formula to calculate the feed efficiency index.

(c) (i) Only stronger candidates recognised that the starting masses of the GE and non-GE salmon were different and so would require different starting masses of food. The question was about experimental design and candidates understanding of how to generate valid data.

(ii) This data analysis question generated a wide range of answers. Some excellent answers were seen that fully explored the data, recognising that the GE-salmon feed more efficiently thus reducing the food waste, and reducing the risk of pollution due to decay of waste food. Weaker answers often gained one mark, typically for recognising that the reduced waste would lead to less spread of disease.

(d) Most candidates were able to suggest at least one reason for the higher price of wild salmon, such as higher consumer demand or increased costs of fishing.

Section B

Question 3

(a) Most candidates gained at least one mark with many going on to gain all three. Common correct ideas included that there is high productivity so that a large amount of energy enters food webs and there are many sheltered areas that species can escape from predators or can be used for breeding.

(b) This question was well answered by most candidates with many gaining five or six marks. Most had clearly learnt this topic well and gave excellent descriptions of the external anatomy of decapods and explained each part.

(c) This question was also well answered with many gaining at least three marks, and a significant number going on to gain five or six. Many correctly described how the traps are baited to lure in species that cannot get out. Many also described how the traps are anchored to the seabed (or weighted) and attached to a line and marker buoy at the surface. Excellent descriptions of the effects of the traps were seen, with many explaining that bycatch is a problem and that the traps can damage the seabed and coral. Some candidates restricted their answer to the description of how the traps are used and did not mention impact. Candidates should make sure that they read questions carefully.

Question 4

(a) Many candidates found this question challenging and gave answers about overfishing with insufficient detail.

(b) This question about the benefits of building artificial reefs was well answered by many candidates and many gained at least three marks. Most recognised that the reefs would increase biodiversity, would act as a habitat, would increase fish stocks, and could act as a tourist attraction.

(c) Many candidates found the question challenging and gave answers focused on enforcement and prevention of overfishing. The syllabus lists several methods: tag-release-recapture, gut content analysis, age and growth, fecundity, abundance, and yield prediction. Strong answers were focused on these aspects and described how each is used. Candidates should be clear to focus on all aspects that are listed on the syllabus.

MARINE SCIENCE

Paper 5180/03
Practical Assessment Paper

Key messages

Candidates need to continue to develop their graphical skills, in terms of selecting a suitable scale to ensure the data is well spread on the graph and develop an understanding of how to draw a line of best fit. Candidates found the extended method and results question difficult, but most were able to make some suitable points. There were a few practical techniques, such as slope of a shore and sediment particle size distribution, that candidates seemed less familiar with. Practical work is encouraged, and candidates should have the opportunity to complete these practical techniques or see them demonstrated. Candidates appeared to have sufficient time to complete the paper.

General comments

Candidates worked hard to answer all the questions, with only a few omissions, showing good time management skills during the exam. Mid-range candidates could be encouraged to highlight important information in the question to help them answer the questions with greater depth. Weaker candidates could be reminded to show their working for any mathematical questions and to ensure they only place units in the header of columns in results tables.

Comments on specific questions

Question 1

(a) All candidates achieved some marks here, with many completing excellent drawings and achieving 3 or 4 marks. A few candidates gave a drawing at the same size as the original, and candidates should be encouraged to try to make them a little larger. Candidates paid attention to the details in the specimen and drew with a sharp pencil using neat lines.

(b) All candidates achieved at least one mark here, with many achieving 2 or 3. Fewer candidates were able to label the parapodia. Most candidates correctly drew their label lines with a ruler and no arrowheads.

(c) Many candidates correctly rearranged the formula and divided by the magnification given. Fewer had accurately measured the width of the organism in the photograph and a small number of candidates did not show their working so partial credit could not be given to them.

Question 2

(a) (i) Lower achieving candidates were unsure of the classification of the organisms shown, with those gaining one mark fairly evenly split between which organism they could correctly identify.

(ii) A small number of candidates gave features of the organisms that could not be seen in the photographs, such as stinging cells. Many candidates achieved at least one mark, often for mentioning tentacles or oral disc.

(iii) Most candidates correctly noted the presence of the eye on the octopus, but many referred to the arms as tentacles. More able candidates identified the suction cups or described them with sufficient detail to achieve the mark.

(b) Most candidates correctly identified the volume of water in **(i)** while fewer correctly calculated the mass of salt in **(iii)** as they often did not subtract the mass of the bowl. Candidates found calculating the density of the sample more difficult, and many candidates found calculating the salinity very difficult, although more able candidates completed at least part of the final calculation. When calculating the density in **(ii)** some candidates did not give their answer to the correct number of decimal places. In **(iv)**, when calculating the salinity in ppt, candidates needed to recognise that 1000 cm^3 is 2/3rds of the 1500 cm^3 and so they needed to calculate 2/3rds of the mass of salt or calculate through as mass of salt ÷ volume × 1000.

Question 3

(a) Few candidates seemed familiar with this practical, although those who achieved marks often correctly described a sieving method using different-sized sieving plates in a machine.

(b) Some candidates scored 1 or 2 marks, but in general candidates found this difficult to describe and often did not seem familiar with finding the slope of a shore.

(c) Again, candidates found this difficult to score on, with some omitting an answer. More able candidates were likely to state that a microscope was needed to look at the specimens, and that they were collected using a fine net.

Question 4

(a) Most candidates could accurately calculate the mean, although occasional transcription errors occurred.

(b) Most candidates scored some marks for their table; candidates found it difficult to sort the two different values in cm or mm and appreciate which was the fish length and which was the diameter of the egg. A few candidates included units in the body of the table rather than in the column heading. Some candidates forgot to include units in the headings of each column. Weaker candidates sometimes did not correctly link the data.

(c) Candidates could often label the axes correctly, but chose poor scales, running from zero up to the maximum value, often meaning the actual points were plotted in a very small area of the graph. Candidates often drew a line from point to point rather than a single straight line. Those who attempted a single line of best fit sometimes lined up the first and last point to draw through, whilst others had more crosses above or below the line so did not quite achieve the mark.

(d) Most candidates were able to state the relationship between fish length and egg diameter. A small number of candidates did not answer this question.

Question 5

(a) Candidates were generally able to give an appropriate safety point to note when undertaking field work. Stronger candidates were able to describe how to obtain random numbers to identify where to place the quadrats to ensure data was random. Some candidates were also creative in how to identify areas covered by water for greater or shorted periods of time, and these were all accepted. The data presentation was often a little weaker, with some candidates omitting this section. Stronger candidates made sure that their table reflected the method they had chosen, while some of the weaker candidates described a method, but that method was not reflected in the headings of the results table they drew. Some candidates did make a comment on the results which reflected on the hypothesis, e.g. if the average height of the shells in the area underwater for longer is higher than the mean height of limpets higher on the shore, then the hypothesis is proven.

(b) A significant number of candidates omitted this question, with others generally scoring 1 or 2 marks for a relevant comment. Some candidates suggested testing at different times of the year, but the height of a limpet shell would be affected by abiotic factors other than temperature when underwater, such as turbulence, current speed etc.