MARINE SCIENCE

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Paper 5180/01
Structured
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Key messages

- Candidates should be advised to check their answers to make sure their response is clear and that they address the question as it has been asked.

- Centres should remind candidates of the need to take care in questions requiring calculations to ensure they follow the instructions given in the question.

General comments

Many candidates performed well on this paper showing a wide range of knowledge and understanding of the syllabus. However, when explanations were required only stronger candidates were able to respond appropriately. The quality of writing was generally good. Candidates appeared to have no difficulty completing the paper in the time allotted.

Comments on specific questions

Question 1

(a)   Stronger candidates were able to identify these features correctly. However weaker candidates gave a wide range of answers, particularly for the phylum. Those candidates who recognised that they had been given the genus and species of the fish in the question, almost always answered correctly.

(b)   This part was usually well answered. The most common error was to reverse the pectoral and pelvic fins. Some weaker candidates gave all the correct answers but in the incorrect places and so gained no credit.

(c)   Although there were many correct answers here, a number of candidates gave "swimming" alone which was considered to be insufficient and too general.

(d)   The role of the dorsal fin was not well known. Many candidates offered a list of possible manoeuvres such as "yawing" and "pitching" along with reference to "rolling". Furthermore, for those candidates who restricted their descriptions to rolling, it was common for them to suggest that the dorsal fin is for rolling, rather than to prevent rolling.

(e) (i)   Weaker candidates suggested that the swim bladder was involved in excretion, in breathing or was simply another type of fin. Stronger candidates often referred to buoyancy. However those candidates who referred only to floating could not gain credit as this suggested that the fish spent all of their time on the surface.

(ii)   It was rare for candidates to gain full credit here. Those who gained any credit usually referred to the fact that the fish would need to swim continuously (not just migrate) or, in answers from the strongest candidates, that the pectoral fins provide lift. Some candidates identified that fish without swim bladders have long pectoral fins, but did not go on to explain how these avoided the need for a swim bladder. Those candidates who suggested that the swim bladder is involved in breathing often stated that fish lacking a swim bladder have lungs. Some candidates referred to body fat, and then linked this with low mass, rather than low density.

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Question 2

(a)   Strong answers included features of the habitat in a mangrove forest. A considerable number of candidates only described the habitat as being watery and having trees and so did not include critical information such as reference to the water being shallow or the base being muddy. It was only stronger candidates who described variations in salinity or that the conditions would be hot, humid or have high rainfall. There were cases of candidates giving answers that would have been better suited to **(b)**.

(b)   The avoidance of erosion was a very common creditworthy suggestion along with a range of descriptions of the forest acting as a breakwater. Relatively few candidates gained full credit, despite often filling the available space and this was often due to repetition.

(c) (i)   Many candidates answered this question well. However, weaker candidates often misread or misinterpreted the question, giving states where there was the smallest gain or the largest loss in mangrove area.

(ii)   Candidates used a range of strategies to complete this calculation. Some totalled the areas in the two years and then determined the change. There were some errors in calculations seen here. Other candidates used a more direct route of totalling the changes. Here some candidates simply ignored the fact that some were gains and others losses and added up all the values. In this case candidates could only gain partial credit.

Question 3

(a)   This was very well answered with a large majority of candidates gaining full credit. Almost all candidates realised that each organism should appear in the table and there were no reported cases where candidates attempted to give names, rather than letters.

(b)   There were many speculative guesses as to the purpose of a dichotomous key. Those candidates who recognised the term usually referred to identification or classification.

Question 4

(a)   The majority of candidates knew the meaning of the term export. Only the very weakest mixed this up with import, or suggested that there was two-way trading, involving imports and exports.

(b)   Candidates only had to determine the number of months with a negative trade balance as shown in the last column of the table. Most achieved this.

(c)   Selecting "April" from the table was straightforward for most candidates. However weaker candidates often gave the value of the trade balance for April, which was not accepted.

(d)   Most candidates completed the calculations for both the total import value and the value of the trade balance, arriving at the correct answer. Where the import value was incorrect, this error was carried forward into **(ii)**, if the candidate had reasonably subtracted their calculated import value from the export value given.

(e)   A wide range of possible answers were allowed here and most candidates opted for two of the most likely: "supply", "demand" and "price". A range of other alternatives was accepted, including "distance", "quality" and "trade barriers".

Question 5

(a)   The term aquaculture was well known and most candidates answered well, referring to the rearing of aquatic organisms. Specific examples of aquatic organisms, such as shellfish or fish were allowed. Some candidates described intensive and extensive methods, but these were not required.

(b) (i)   Many candidates arrived at the correct numerical value of 2.4, but gained just partial credit as they had been asked to calculate the change in dissolved oxygen content. In this case the change was negative, so some means of indicating this was also required.

(ii)   Only the weakest candidates did not gain credit here, indicating a positive, rather than a negative relationship.

(iii)   Candidates found the explanation for the relationship they had previously described much more demanding. The use of higher amounts of oxygen for respiration was sometimes described, but only stronger candidates described why there would be greater usage. In addition, few candidates realised that with added food, there would be more surplus or more waste produced by the fish and that this would result in a greater population of bacteria. A small number of candidates linked their understanding that the food would create a layer on the water's surface which would prevent oxygen entering from the air and gained credit for this. However those who suggested that the food would heat up the water, reducing solubility of oxygen, were not rewarded as there was no evidence to suggest this would be the case.

Question 6

(a)   Most candidates were able to interpret the bar chart and the key to give the correct answer in (i), and also went on to identify the correct two fish in (ii).

(b)   The role of lipids in providing energy (either directly or as a store) or as means of insulation was well known in (i). In addition, most candidates could also identify the role of protein in growth, repair or as material for body building in (ii). "As a source of energy" was also accepted for the role of protein, whether or not it had already been given as the role of lipid.

(c)   "Vitamins", "minerals" and "carbohydrates" were common correct responses to this part. Named examples of a vitamin and/or a mineral were also accepted. The most common error was to suggest "fats", presumably because these candidates did not realise that these had already been given, as lipids, in the figure.

Question 7

(a) (i) Many candidates misunderstood the focus of the question and simply described a FAD, rather than explaining the principles on which it works. Therefore there were often details of mooring lines and anchorage by concrete blocks, along with the idea that a FAD is a floating object of some kind, with only the last of these three points gaining credit. That FADs attract fish was less often described, although many did refer to this in a variety of ways, sometimes directly and in other cases describing the way that food chains are built up around the FAD. A significant minority of candidates suggested that migratory fish use FADs for navigation.

(ii)   Simple explanations that fish can be caught near a FAD were insufficient to gain credit. Further detail were required in explanations, such as fish being more easily found or more easily caught and that less fuel would need to be used and that fishing near to FADs would be more profitable.

(b)   Candidates often focused more on the possible damage to nets caused by entanglement with the FAD or with coral, than about the detrimental effects on fish populations. Stronger answers explained that large-scale net fishing in areas of high population density is likely to include catching of non-target or endangered species along with juveniles, and that continuous fishing in this way results in over-fishing, which is unsustainable.

Question 8

(a) (i) Weaker candidates often described a method of fish processing, rather than explaining why it is important to process the fish. There were often lengthy descriptions of killing microorganisms by a variety of procedures. Only stronger candidates went beyond this basic idea and explained that as a result of processing, fish stay fresh for much longer and would then be available for long distance transport, including export. The idea that processed fish has more customer appeal or is more valuable was addressed by very few candidates.

(ii)   This question was only answered well by stronger candidates and many other candidates appeared not to have read the question carefully enough. Stronger answers referred to a method of processing that kills microorganisms using heat. Very few gave the correct answer "canning". "Freezing" was a much more common response. However, this method does not use heat and it also kills very few microorganisms.

(b)   Many candidates knew that nuclear radiation is involved in the process of irradiation. Unfortunately this was insufficient to gain credit as more detail was required in terms of the type of radiation and its possible sources. Few candidates referred to gamma radiation or X-rays and even fewer to sources such as cobalt-60 or caesium-137. Stronger candidates occasionally gained credit for describing the use of different intensities or time of treatment and some named the types of radiation. More candidates stated that irradiation kills bacteria however almost none realised that the fish must be cut up before being treated with radiation.

(c)   This question was sometimes not attempted. There were many varied, speculative suggestions, but only those who understood the process were able to indicate that rancid food has an unpleasant taste or smell. Details regarding the oxidation of fats were given by only the strongest candidates.

Question 9

(a)   Most candidates had some understanding of the meaning of the terms herbivore and carnivore. However often candidates omitted the critical word "only" from each of the answers. Thus, answers such as "herbivores eat plants" and "carnivores eat animals/meat" were both insufficient to gain credit, as in each case the description would also be true of omnivores.

Definitions of population were often vague, referring to "numbers of organisms" rather than indicating that a population is of one species. Although references to a habitat or environment were frequent, far fewer candidates referred to the population being determined at a specific time.

(b)   The most common answers were "temperature", "light" and "oxygen", with many candidates giving at least two of these. Weaker candidates often gave biotic factors such as "food" or "predators" or gave pollution which was considered to be too vague.

Question 10

(a)   Candidates were expected to know the three principal aims of fisheries management: maintaining employment, increasing earnings and the protection of fisheries resources. Many candidates gave two ways in which the last of these might be achieved, but could only gain partial credit.

(b)   The meaning of the term endangered was well known, with a large majority of candidates referring to possible or imminent extinction. The idea that endangered organisms are in low numbers was insufficient, without further qualification regarding extinction.

(c)   There were many correct answers to this question. However, those who repeated the term "conserve" were not fully credited as a synonym was needed. Few candidates referred to the idea that conservation is carried out with the future in mind.

(d)(i)   This question was generally answered well. A few candidates sometimes omitted one of the values, most commonly 8000, or included the value of the turtles in their calculations.

(ii)   Good answers referred to population or migration monitoring or protecting it from harm by people. However many candidates only suggested that the engraving helped to identify a tortoise, and did not give a reason how or why individuals or the species may benefit from the engraving. A significant minority of candidates stated that predators would be less likely to attack a tortoise with an engraved shell.

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Key messages

* Candidates should ensure that they are familiar with all command words. The term "explain" requires more than a simple description.

* When answering discussion questions, candidates should be careful to consider as many aspects of the topic as possible.

* Candidates should use precise terminology and be careful not to confuse terms such as asexual and sexual reproduction.

* Candidates should be reminded to read the questions carefully and should give the required number of points asked for where this is stated in the question.

General comments

In general, the standard of answer was very high and almost all candidates attempted all the questions on the paper. Mathematical skills were generally good although some candidates found calculating means and growth rates challenging. There was no graph plotting question. Candidates were, however, required to draw a line of best fit and use it to determine intercept values from the axes.

Comments on Specific Questions

Section A

Question 1

(a) (i)   Most candidates correctly identified the sword fish and barracuda as the two species with the highest catch in 2009.

   (ii)   Most candidates correctly identified the catch of sea bass in 2012 as 32.7 tonnes.

   (iii)   Most candidates correctly calculated the total catch of all six species in 2013 and gave the correct units. A few candidates forgot to give units. Some candidates made errors when calculating the total and some calculated the catch for the wrong year.

(b) (i)   This question was answered well with the majority of candidates correctly stating a decrease. A few candidates did not give the overall trend and instead gave a detailed description of the changes year by year. Stronger candidates were able to identify the overall pattern however.

   (ii)   A range of correct reasons for the decrease in catch were suggested by candidates. The most common were the idea of reduced fishing effort, reduced stocks and overfishing. Where candidates did not gain full credit, it was usually for suggesting that demand had increased (which would not explain a decrease in catch unless it was linked to overfishing), or stating the same point twice. It is good practice for candidates to give two different reasons. Some candidates gave lists with more than two reasons in answer to this question. If two reasons are asked for, candidates should not give more than two reasons.

(c) (i) Stronger candidates recognised the instruction to use both tables, and then correctly divided the value of catch by the catch listed in **Table 1.1**. Some candidates did not attempt this question and others did not read the question carefully and so did not extract the required information from **Table 1.1**. A significant number of candidates did not include any working and so were unable to gain any credit if the final answer was wrong.

(ii) Stronger candidates often gained full credit but many candidates found this question challenging. Candidates frequently stated that the value had increased in 2012, to gain partial credit, but did not then support their answer with a calculation. Some candidates correctly recognised the change of 1.67 (thousand dollars per tonne) but did not state that it was an increase. These candidates needed to give the direction of any change for credit.

(iii) Many candidates gave strong, well-considered answers which described a correct method that could be used on the sea bed and correctly recognised that demersal fish live on the sea bed. A common error was for candidates to confuse the term "demersal", with the term "pelagic". Some candidates wrote about using pole and line to conserve fish stocks and had not understood that demersal fish live on the sea bed. Candidates needed to be clear that demersal refers to the area above the sea bed and not just deep water.

(d) Of those candidates that did recognise the term demersal and therefore gave a suitable fishing method, only the strongest candidates were able to answer the question fully and explained their choice of method.

Question 2

(a) (i) Most candidates were able to correctly draw a line of best fit. Common mistakes were extrapolating the line, not drawing a line from the start of the data, joining up the points or starting the line at the origin.

(ii) This question was generally well answered with most candidates correctly using the line of best fit to determine the intercept on the *y*-axis. Some candidates did not show how the value was determined as was asked for in the question. Some candidates did not use the *x*-axis correctly and selected 18.2 rather than 19.

(iii) Many candidates found this question challenging. A significant number gave explanations of how to calculate the growth rate of the fish and suggested dividing the length of the fish by the number of days it had grown. Some candidates did not appreciate that the question asked them to explain how the mean length is calculated, and instead explained how the measurements of length are made.

(iv) Only the strongest candidates gaining full credit for this question. Very few candidates understood that they needed to calculate the difference in length and many candidates added the lengths together.

(v) This question was generally answered well with most candidates correctly suggesting at least one factor that would affect the growth rate of the fish. A significant number of candidates did not appreciate that the context of the question was an experiment into the growth of fish kept in marine tanks and so factors such as habitat loss, predation and climate change were not relevant. The most common correct answers given were temperature, oxygen concentration, food and salinity.

(b) (i) This question was well answered by most candidates who gained full credit.

(ii) This question was challenging for most candidates. Very few recognised that accuracy would be affected by the loss or gain of fish. However, a small number of very strong answers were seen that gave excellent explanations of how emigration or fish reproduction would affect accuracy. Many candidates simply considered how practical and human errors would affect accuracy, or discussed problems with catching the fish such as smaller fish escaping through nets.

Section B

Question 3

(a) Few candidates gave a correct definition of the term biodiversity. Only stronger candidates referred to the number of different species. Many candidates simply stated that biodiversity is a measure of the number of organisms and did not refer to species.

(b) (i) Most candidates were able to give the name of a correct arthropod, usually crabs or lobsters. Most were also able to state at least one correct feature. A few candidates confused arthropods for echinoderms and a small number gave descriptions of fish such as tuna.

(ii) Most candidates were able to gain at least partial credit for this question but only the strongest gained full credit. The most common correct examples of echinoderms given were starfish and sea cucumbers. Some candidates confused echinoderms for coelenterates and gave descriptions of jellyfish or coral. The most common correct feature stated by candidates was the presence of tube feet. Only the strongest candidates made a correct reference to pentaradial symmetry. Others stated that echinoderms possess radial symmetry (often confusing them with coelenterates) or even bilateral symmetry.

(c) Many candidates gave excellent, detailed and factually correct answers that fully described both the asexual and sexual reproduction stages of coral life cycles. A few candidates confused the terms sexual and asexual reproduction, and some incorrectly stated that fertilisation is internal. Weaker candidates often referred to the settling of eggs rather than larvae onto a substrate. A small number of candidates confused the production of corallite with coralline.

Question 4

(a) (i) Most candidates were able to state that a compass is used to help travel in a particular direction, but fewer went on to explain that this is because the compass needle will point to north. Some candidates gave excellent answers with very thorough descriptions of how the needle points to magnetic north or described gyroscopic compasses.

(ii) Most candidates were able to correctly state that radar enables the detection of ships or obstacles. A significant number of candidates confused radar with sonar, and stated that it can be used to detect underwater obstacles or fish shoals. Only stronger candidates made reference to the transmission and reflection of waves, with many other candidates simply stating that waves are sent out. Weaker answers did not explain the use of radar as the question required and simply described its use.

(iii) Most candidates were able to gain at least partial credit for giving a correct use of radar, such as finding the water depth, locating fish shoals or detecting underwater obstacles. A few weaker candidates confused sonar with radar, stating that it is used to detect ships or is used as a communication method. Only stronger candidates explained that sonar transmitters send out waves that are reflected. A few candidates thought that sonar attracts fish rather than detecting them.

(b) Good answers discussed many different aspects of aquaculture rather than only focusing on one or two. Weaker candidates tended to only consider a few aspects such as profits, yields and health risks. Some excellent answers that were logically organised and considered many aspects were seen, and there was a high quality of written language used by many candidates. Some candidates did not read the question carefully however, and so rather than discussing the advantages of aquaculture, wrote answers that discussed the disadvantages of aquaculture and also the advantages of harvesting fish from the sea.

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Paper 5180/03
Practical Assessment Paper

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Key messages

- Candidates should be provided with the opportunity to develop their skills in choosing a hypothesis to test and performing investigations based on this in preparation for Question 5.

- Candidates should ensure they are familiar with the names of external features of organisms and the differences between features (e.g. parapodia, antennae, tentacles).

- Candidates should be encouraged to regularly practice their drawing skills throughout their course with the aim of drawing specimens with accurate proportions.

General comments

Stronger candidates showed familiarity with the practical activities and investigations, and clear evidence of having examined and compared a variety of species during their course. They ensured they answered the question asked, and included all relevant details about practical investigations, giving a thorough explanation of methods used. They could identify sensible risks associated with practical work rather than giving generalised answers. Some weaker candidates were able to present appropriate data tables to show results, but when giving the method, answers lacked the detail required.

Comments on specific questions

Question 1

(a) Candidates generally answered this question well and the majority of drawings were a suitable size with the main features of the fish included. Some candidates found it challenging to produce accurate drawings however.

(b) Label lines were usually accurate and touched the feature they were labelling. The majority of candidates were able to identify all features correctly, although candidates could improve on identification of the anal fin, which was most often confused with the pelvic fin. When labelling the operculum, candidates needed to ensure they did not allow the label line to go too far forwards from the edge of the operculum.

(c) (i) The majority of candidates were able to accurately measure and record the length of the fish, although some candidates did not include units with their measurements. A significant number of candidates measured their drawing rather than the original photograph to obtain the measurement and so could not be credited for this.

(ii) Many candidates were able to calculate the magnification accurately, showing their calculation and formula as well. A small number of candidates had included a unit, showing an incomplete understanding of the term "magnification".

(d) Only stronger candidates were able to state there was a post-anal tail, and to identify a relevant feature of a chordate. Many candidates stated that the presence of fins or operculum made it a chordate. Candidates required a clear understanding of the features of chordates in general that could then be applied to individual species.

Question 2

(a) Stronger candidates were able to identify the phyla for both species but weaker candidates were most likely to identify the cnidaria correctly.

(b) Candidates generally showed good understanding of the features, with the most common error being a lack of understanding of the term parapodia. Candidates needed to show a clear understanding of the difference between parapodia, antennae and tentacles to achieve full credit.

Question 3

(a) Many candidates were familiar with the investigation into water content of sand and gave good accounts of the method. However, few candidates mentioned drying the sample until it was a constant mass, or how to calculate the percentage moisture content to be able to compare samples of differing initial mass. Credit was given to candidates who suggested other methods where the method was scientifically workable, including collecting the water and measuring its volume through evaporating and condensing the water coming off.

(b) Many candidates were able to give at least one environmental factor that would affect the water content of the sand. Candidates could have included information about the physical features of the sand itself and how they could affect the water content, but this was rarely seen.

(c) Many of the stronger candidates were able to answer well but few achieved full credit. The most common answers referred to less food being available and less shelter/protection on sandy shores, with some of the strongest candidates recognising that the instability of sand would affect species distribution.

Question 4

(a) The vast majority of candidates drew very neat, accurate tables, with suitable column headings with units included. Some candidates chose to write the units beside each value given in the table rather than in the column headings, while some candidates included units in both the column heading and beside each value. Candidates should be encouraged to ensure units are written in the headings of the tables only and not repeated with the data in the body of the table. The majority of candidates correctly ranked the data in pairs. A few candidates included additional columns, usually for "fish number", which was not required for the drawing of the graph.

(b) Most candidates drew good graphs with accurate, visible plots, of a reasonable size and a good line of best fit applied. Some candidates used a poor choice of scale. These candidates often chose to plot from zero upwards, rather than starting at 0.3, to ensure their plotted points covered the majority of the graph paper. A significant number of candidates also extrapolated their line, which was not suitable as they were not being asked to predict a value outside of the data supplied.

(c) The majority of candidates recognised the relationship between the mass and length of the fish, and made a clear statement to that effect. A small number of candidates simply stated the single word "positive" which was not a conclusion. They needed to give further information, such as "there was a positive correlation between the mass and length of the fish".

(d) The majority of candidates were able to correctly calculate the mean of the two sets of data, although a few added the data and forgot to divide by the number of samples.

Question 5

(a) Most candidates recognized that this method required a quadrat and sampling method and stronger candidates showed an understanding of the need for random sampling in population studies and how to carry this out. Most candidates understood the need for repeats, and to find the mean of several samples. Some candidates did not appreciate that the investigation was carried out on the shore while the tide was out and described snorkeling and diving to count the mussels. Most candidates mentioned a safety precaution for this investigation, but many referred to using goggles, which was not appropriate, or gave very generalised statements such as the need for a first aid kit.

(b)   A number of candidates included a description of a suitable table which was acceptable, rather than simply drawing an example of a results table. When candidates drew a table, they needed to ensure the columns for repeat results were clearly labelled. Stronger candidates also sketched an appropriate bar chart and labelled axes. Some candidates made statements about more mussels being found on the middle shore but most of these candidates did not then relate that back to the original hypothesis.

(c)   Many candidates could state there was difficulty in accurately counting the mussels in the sampling area, giving a variety of reasons for this. Stronger candidates showed their understanding of the limitations of population studies, and developed the idea of this method being an estimate of the total population, not an accurate count.