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**MARINE SCIENCE**

**9693/03**

Paper 3 A2 Structured Questions

**May/June 2019**

MARK SCHEME

Maximum Mark: 75

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**Published**

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

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This document consists of **16** printed pages.

**PUBLISHED****Generic Marking Principles**

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

**GENERIC MARKING PRINCIPLE 1:**

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

**GENERIC MARKING PRINCIPLE 2:**

Marks awarded are always **whole marks** (not half marks, or other fractions).

**GENERIC MARKING PRINCIPLE 3:**

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

**GENERIC MARKING PRINCIPLE 4:**

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

**GENERIC MARKING PRINCIPLE 5:**

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

**GENERIC MARKING PRINCIPLE 6:**

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

This mark scheme will use the following abbreviations:

<b>;</b>	separates marking points
<b>/</b>	separates alternatives within a marking point
<b>()</b>	contents of brackets are not required but should be implied / the contents set the context of the answer
<b>R</b>	reject
<b>A</b>	accept (answers that are correctly cued by the question or guidance you have received)
<b>I</b>	ignore (mark as if this material was not present)
<b>AW</b>	alternative wording (where responses vary more than usual, accept other ways of expressing the same idea)
<b>AVP</b>	alternative valid point (where a greater than usual variety of responses is expected)
<b>ORA</b>	or reverse argument
<b><u>underline</u></b>	actual word underlined must be used by the candidate (grammatical variants excepted)
<b>MAX</b>	indicates the maximum number of marks that can be awarded
<b>+</b>	statements on both sides of the + are needed for that mark
<b>OR</b>	separates two different routes to a mark point and only one should be awarded
<b>ECF</b>	error carried forward (credit an operation from a previous incorrect response)

Question	Answer	Marks	Guidance
1(a)(i)	<i>any 3 of:</i> clear / shallow water <b>and</b> allows maximum / more / enough, light / right wavelength, for photosynthesis ; sheltered bays <b>and</b> protected from storms / rough seas / wave action ; tropical / warm <b>and</b> optimum temperature for, growth / photosynthesis ; cultured on ropes <b>and</b> closer to light for photosynthesis ; cultured on ropes <b>and</b> (closer to surface) so more carbon dioxide (from dissolution) for photosynthesis ; cultured on ropes <b>and</b> so less competition for space ;	<b>3</b>	
1(a)(ii)	<i>any 2 of:</i> seaweed provides more habitat for, fish / invertebrates ; provides a source of food for fish ; provides, protection / shelter, from predators ; provides a source of oxygen (for fish / invertebrate respiration) ;	<b>2</b>	
1(b)	<i>any 4 of:</i> most light / all wavelengths, penetrate, between 1 and 7m / shallow water / at this depth ; contains chlorophyll (a) ; which absorbs red light in shallow water ; and blue light in deeper water ; contains other <u>named</u> pigment(s) ;  extra / accessory, pigments allow seaweed to absorb, more / different, wavelengths ;	<b>4</b>	<b>A</b> light penetration decreases with depth  <b>R</b> chlorophyll <i>b</i>  e.g. phycobilins / phycocyanin / phycoerythrin / carotenes / carotenoids / xanthophyll
1(c)	<i>any 3 of:</i> people change to work in tourism ; as there is less physical work / less labour intensive ; higher / easier income ; seaweed farming will decrease / become unsustainable <b>OR</b> way of life lost ; due to lack of labour / fewer family members work in seaweed farming ; <i>idea of:</i> cultural exchange ;	<b>3</b>	<b>I</b> ref. to pollution

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Question	Answer	Marks	Guidance
2(a)(i)	<p><b>minimum of 1 and max 2 for each habitat</b></p> <p><i>offshore</i> :</p> <p>ref. to collecting in shoals / groups (for spawning offshore) ;</p> <p>eggs fertilised, externally / in the water / broadcast spawning or description of ;</p> <p>(develop into free-floating) larvae in, surface of ocean / plankton ;</p> <p><i>inshore</i>:</p> <p>(where) juveniles, feed / grow ;</p> <p><i>idea of</i>: to avoid competition with adults ;</p> <p><i>reefs</i>:</p> <p>where they develop into adults / where fish reach maturity ;</p> <p>develop first as female and then become male ;</p>	<b>4</b>	
2(a)(ii)	<p><b>any 2 of:</b></p> <p><i>idea of</i>: spawning grounds / spawn in open ocean ;</p> <p>planktonic / open ocean, larvae ;</p> <p>external fertilisation / broadcast spawning ;</p> <p><b>AVP</b> ;</p>	<b>2</b>	<p>e.g. no fresh water stage / no parental care / both are <i>r</i>-strategists / larvae undergo metamorphosis</p>

Question	Answer	Marks	Guidance
2(a)(iii)	<p><i>any 3 of:</i></p> <p><i>idea of:</i> all the eggs / fish are in one place ;</p> <p>spawning grounds / migration routes, known to fishermen / predators ;</p> <p>catch large numbers of (mature) fish at the same time ;</p> <p>too few left to maintain population / population unsustainable ;</p> <p>adults take years to become sexually mature ;</p> <p><i>idea of:</i> lots of, egg / larvae wastage ;</p>	<b>3</b>	
2(b)	<p><i>any 4 of:</i></p> <p>1 grouper / benthic fish move more slowly / less active / use less energy (than tuna / pelagic fish) (so) less oxygen demand ;</p> <p>2 correct linkage of surface area (of gills) to, movement of fish / oxygen demands / diffusion rates / gas exchange ;</p> <p>3 larger area of lamellae obtain more oxygen in grouper / benthic fish (from faster water flow) ;</p> <p>4 longer filaments obtain more oxygen in tuna / pelagic fish (from slower moving water) ;</p> <p>5 close packing of lamellae obtain more oxygen in tuna / pelagic fish (from slower moving water) ;</p> <p>6 slower moving water / greater resistance to flow, in tuna / pelagic fish, allows more time to obtain oxygen / greater diffusion / maintains diffusion gradient / greater gas exchange ;</p>	<b>4</b>	1 ref. to ram and pumped ventilation and respiration

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Question	Answer	Marks	Guidance
3(a)(i)	benthic (trawling) ;	<b>1</b>	
3(a)(ii)	<i>idea of:</i> lots of organisms on, sea bed / sea floor / substrate / benthic zone ; small mesh catches everything in its path <b>OR</b> most organisms too big to escape ; nets in the water / fishing, for a very long time, so catches lots ;	<b>2</b>	
3(a)(iii)	<i>any 2 of:</i> most will be dead / injured / suffocate / drown (due to lack of oxygen) ; as they have been in nets for several hours ; bycatch taken a long way from their habitat / bycatch might not be able to get back to suitable habitat ; habitat destroyed by benthic trawling ;	<b>2</b>	
3(b)	<i>any 3 of:</i> allows more, prawns / fish, to reach maturity ; more (chance of) breeding / reproduction ; more recruitment / allows, population to increase / stocks to replenish ; sea bed undisturbed, so more food / habitat for, prawns / other species <b>OR</b> allows habitat to recover ; increased stocks to migrate outside conservation zone ;	<b>3</b>	



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Question	Answer	Marks	Guidance
3(c)	<p><b>MAX 2 from each:</b></p> <p><i>satellite monitoring</i>  shows the exact boat position ;  can track multiple boats at the same time ;  can track all areas of the ocean day and night ;  so boat can be tracked if inside the conservation zone ;</p> <p>(but) do not know if boat was <u>fishing</u> inside conservation zone ;  (but) not all boats fitted with satellite technology / it can be switched off ;</p> <p><i>catch inspection</i>  shows the, species caught / amount caught / volume of catch / bycatch ;  (but) you cannot determine if fishing took place inside or outside the conservation zone / can't tell where the boat has been ;  bycatch could be disposed of / hidden before inspection ;  log book can be checked against catch ;  fishing method could be modified ;</p>	<b>4</b>	

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Question	Answer	Marks	Guidance
4(a)(i)	<p><i>any 3 of:</i></p> <p>strong tidal flow could cause damage to fish / sea cages ;</p> <p>strong tidal flow could wash away food / medication ;</p> <p>strong tidal flow increases the dangers of, getting to / working at the site / harvesting fish ;</p> <p>close to town so increased risk of pollution from, sewage / agricultural run-off / toxins / boat oil or fuel ;</p> <p>sewage from town contains pathogens which could cause disease in fish / oil from boats could clog gills of fish ;</p> <p>close to town so increased risk of poaching ;</p> <p><i>idea of:</i> conflict of interest with fishermen who want to fish in the bay / competition for fish sales ;</p> <p>energy used to swim against current rather than growth ;</p>	<b>3</b>	<p><b>A</b> strong current for strong tidal flow</p> <p><b>I</b> pollution unqualified</p>

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Question	Answer	Marks	Guidance
4(a)(ii)	<p><b>MAX 2 from each:</b></p> <p><i>suitable:</i>  flooding / ocean current / river flow, will bring in fresh oxygen supplies for fish respiration ;</p> <p>flooding / ocean current / river flow, brings fresh food supply <b>OR</b> removes waste products ;</p> <p>town further away, so less chance of pollution + example ;</p> <p>away from / protected from, strong, currents / tidal flow / waves, so less damage ;</p> <p><i>unsuitable:</i>  high levels of silt in river water could damage fish gills ;</p> <p>site is 1 km from river mouth, so neap tides might not flood the site ;</p> <p>resulting in less, oxygen / food supply / removal of waste ;</p>	<b>3</b>	

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Question	Answer	Marks	Guidance
4(b)(i)	<p><i>any 2 of:</i>  loss of habitat <b>and</b> causing loss of some species / loss of breeding grounds ;  wild population harvested as, feed / breeding stock <b>and</b> loss of wild population ;  pollution from the wastes / uneaten food <b>and</b> causing eutrophication / harmful algal blooms ;  escape of farmed fish / exotic species <b>and</b> outcompete wild fish / introduce disease / parasites ;  <i>idea of:</i> escape of farmed fish <b>and</b> might introduce new / undesirable, genes / alleles / genotypes ;  release of antibiotic into the water <b>and</b> increases bacterial resistance ;  converting land to aquaculture <b>and</b> displacement of people / financial hardship ;</p>	<b>2</b>	
4(b)(ii)	<p><i>any 2 of;</i>  <i>idea of:</i> providing advice about stocking (so fish are not overcrowded) ;  <i>idea of:</i> education about, alternative / sustainable, food sources ;  <i>idea of:</i> education about, disease control / use of antibiotics ;  <i>idea of:</i> education about impact on, the environment / habitats / other species;  <i>idea of:</i> information about best techniques to raise healthy fish ;  <i>idea of:</i> recognition / sustainable farming, opens up more markets / products more appealing ;</p>	<b>2</b>	<b>A idea of:</b> applying precautionary principle / recycling water

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Question	Answer	Marks	Guidance
5(a)	<p><i>any 2 of:</i>  wind ;  temperature ;  Coriolis effect ;  density ;  shape / geomorphology, of sea bed ;  salinity ;  tides ;</p>	<b>2</b>	
5(b)	<p>(Gulf Stream current brings) warm water further northwards / closer to south coast of Iceland ;  (warm water brings) prey species for mackerel further northwards ;  <i>idea of:</i> mackerel are warmer water species / mackerel cannot live in cold water ;</p>	<b>2</b>	
5(c)	<p><i>any 3 of:</i>  increase in mackerel numbers means less food for puffins ;  <i>idea of:</i> competition e.g. both eat sand eels ;</p> <p>puffins fly / travel further / uses more energy to find food ;  so more risk of predation (on adults or chicks) ;  less time spent feeding chick / less food for chick ;  fewer chicks survive to become adults ;  adult loses condition and needs more food for itself ;  sand eels have moved from south coast / too warm for sand eels on south coast ;</p>	<b>3</b>	
5(d)(i)	carbon dioxide ;	<b>1</b>	

Question	Answer	Marks	Guidance
5(d)(ii)	<p><i>any 3 of:</i>  no overall increase in mean temperature / temperature at start higher than current ;  temperatures have, cycled / fluctuated, (since 1880) ;  with alternating warm and cold periods ;  Iceland is currently in a warm phase ;  (if not global warming) in the next, 20 / few, years temperatures will probably decrease ;  suitable manipulation of figures to illustrate above ;</p>	3	

Question	Answer	Marks	Guidance
6(a)	<p><i>idea of:</i> opposing / different views (about how an area should be used) ;</p>	1	
6(b)(i)	<p>mangroves are part of coastal defences / protects coastline (from flooding) ;  as roots dissipate wave energy / roots, bind / stabilise, soil ;  if lost could lead to erosion of coast ;  may be breeding or nursery grounds for, juvenile / rare / endangered, species ;  they are an important habitat for other (land and marine) organisms ;  if lost, results in less recruitment of fish for fishing industry ;  <i>idea of:</i> act as carbon sinks (so removal will contribute to global warming) ;  (human) community loses supply of, fuel / building materials / raw materials ;</p>	3	

Question	Answer	Marks	Guidance
6(b)(ii)	<p><i>any 1 from housing:</i>  <i>idea of:</i> more housing available for expected increase in population ;</p> <p>reduces house prices in area (<i>idea of:</i> more affordable housing) ;</p> <p>brings more people to live in the area, so improving economy ;</p> <p>could also lead to improvements in sanitation / less overcrowding / improved living conditions ;</p> <p>inland mangrove cleared so there will be no soil erosion on coastline ;</p> <p>building houses provides employment for local, builders / trades people ;</p> <p><i>any 1 from tourism:</i></p> <p>building hotel provides employment for local, builders / trades people ;</p> <p>hotel / increase in tourism, creates new jobs / money into the economy ;</p> <p>(spin off development of) more shops / businesses for tourists in the town ;</p> <p>would improve roads / infrastructure of area ;</p>	<b>2</b>	<p>I ref. to the <u>amount</u> of mangrove removed</p> <p>Do NOT award MP6 and MP7– one or the other can be awarded</p>

Question	Answer	Marks	Guidance
7(a)(i)	more / twice as much, omega-3 in farmed salmon than wild <b>ORA</b> ;	<b>1</b>	
7(a)(ii)	<p><i>any 1 of:</i>  they have the <u>highest</u> levels of omega-3 oils ;  <i>idea of:</i> tuna / cod are higher value species for human consumption ;</p>	<b>1</b>	
7(a)(iii)	<i>idea of:</i> fishing pressure too great to maintain numbers of fish ;	<b>1</b>	

Question	Answer	Marks	Guidance
7(b)	omega-3 levels have decreased ; almost halved / reduced by 1.3g (per 100g of fish) / decreased by 48.1% ;	<b>2</b>	I simply quoting figures from graph
7(c)(i)	a length of DNA (deoxyribonucleic acid) / sequence of nucleotides ; that codes for a (specific), polypeptide / protein (product) <b>OR</b> that determines a particular trait / characteristic ;	<b>2</b>	
7(c)(ii)	(gene) to produce omega-3 oils ; promoter (gene) ;	<b>2</b>	
7(c)(iii)	<i>any 2 of:</i> people will not buy / shops will not sell the fish ; as they are unsure of the <u>long-term</u> effects of eating GM food ; lack of current research into effect of eating GM food ; some countries / EU, have banned GM foods for human consumption ;	<b>2</b>	I reduced sales unqualified