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**MARINE SCIENCE**

**9693/04**

Paper 4 A2 Data-Handling and Free-Response

**May/June 2016**

MARK SCHEME

Maximum Mark: 50

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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 will not enter into discussions about these mark schemes.

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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)

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Question	Expected answers	Additional guidance	Marks
1 (a)	<p>temperature <b>AND</b> (solar) exposure reduce zooxanthellae number/ <b>ORA</b> ;</p> <p>temperature has greater effect (than solar exposure)/ <b>ORA</b> ;</p> <p>suitable manipulation of data to support description ;</p>		[3]
(b)	<p><i>any 4 of:</i></p> <p>place coral <u>in tanks</u> with different salinities ;</p> <p><b>two</b> stated variables constant (pH/temperature/illumination/ mass of corals/ sediment/ oxygen/ carbon dioxide/ species of coral ;</p> <p>leave for a stated time ;</p> <p>count <b>number</b> of zooxanthellae in each polyp ;</p> <p>using a microscope/ counting grid/ <b>AVP</b> ;</p> <p>repeat <b>and</b> find means ;</p>		[4]
(c)	<p><i>any 3 of:</i></p> <p>loss of habitats for reef fish ;</p> <p>less (primary) productivity/ photosynthesis ;</p> <p>less, energy flow/ food transfer through food chain ;</p> <p>idea of time taken for stocks to recover/ breed ;</p>		[3]

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<b>Question</b>	<b>Expected answers</b>	<b>Additional guidance</b>	<b>Marks</b>
<b>[Total: 10]</b>			
<b>2 (a)</b>	<p><i>any 3 of:</i>            increased <b>diffusion path / distance</b> ;            reduced surface area leads to less oxygen uptake ;            less <u>respiration</u> ;            less energy release (for growth)/less production of ATP ;            impaired water flow ;            reduced blood flow ;</p>		<b>[3]</b>
<b>(b) (i)</b>	<p>both <b>axes</b> labelled with units ;            suitable linear <b>scales</b> ;  <b>plots</b> correct <math>\pm \frac{1}{2}</math> square ;</p>		<b>[3]</b>
<b>(ii)</b>	<p>extrapolation of appropriate curve/line of best fit ;            value in line with candidate's line ;</p>	<b>ECF</b> incorrect line	<b>[2]</b>
<b>(c)</b>	<p><i>any 2 of:</i>            lower oxygen (in warmer water) ;            higher <u>respiration</u> rate of fish (in warmer water) ;            less <u>diffusion</u> of oxygen ;</p>		<b>[2]</b>
<b>[Total: 10]</b>			

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<b>Question</b>	<b>Expected answers</b>	<b>Additional guidance</b>	<b>Marks</b>
<b>3 (a)</b>	<p><i>any 2 of:</i>            (extensive)            part of the natural water ;              natural water provides cleaning ;              natural water provides food ;              no control over temperature/pH/oxygen ;              low(er) stocking density ;              no/less use of pesticides/antibiotics ;              more labour intensive ;</p>	<b>ORA</b> if phrased in terms of intensive but must be clear which system is discussed	<b>[2]</b>

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Question	Expected answers	Additional guidance	Marks
(b)	<p><i>any 8 of:</i></p> <p><b>SPAWNING AND LARVAE</b></p> <ol style="list-style-type: none"> <li>adult brood fish kept for spawning / not taking grouper from wild ;</li> <li>place eggs / larvae into (plastic) <u>tanks</u> <b>OR</b> (outdoor) (concrete) <u>ponds</u> ;</li> <li>(larvae) feed with larvae / rotifers / shrimp / plankton <b>OR</b> keep illuminated for phytoplankton growth ;</li> </ol> <p><b>JUVENILES / FINGERLINGS</b></p> <ol style="list-style-type: none"> <li>(transfer fingerlings into) <u>nursery</u> tanks ;</li> <li>feed on fish / <u>protein</u> pellets ;</li> <li>from trimmings / plant protein <b>OR</b> not from wild fish ;</li> </ol> <p><b>ADULT</b></p> <ol style="list-style-type: none"> <li>put (larger fish) into cages in open water / ponds ;</li> </ol>	<p><b>I</b> cages</p> <p><b>A</b> other named small invertebrate <b>I</b> feed with pellets</p>	

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Question	Expected answers	Additional guidance	Marks
	<p><b>GENERAL POINTS</b></p> <p>8. monitor / adjust oxygen ;</p> <p>9. maintain / monitor temperature ;</p> <p>10. separate different sizes / ages of fish ;</p> <p>11. ref. to nets / cage to prevent predator access / escape of grouper ;</p> <p>12. ref. to antibiotics / pesticides / vaccines / sterilising tanks ;</p> <p>13. ref. to restricted use of antibiotics ;</p> <p>14. ref. to filtration of waste / cleaning of water / preventing waste entering water / not overfeeding ;</p> <p>15. ref. to low stocking densities ;</p> <p>16. example of economic sustainability ;</p>	<p><b>A</b> not overcrowded</p> <p>e.g. food from local sources / transport costs</p>	<b>[8]</b>

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<b>Question</b>	<b>Expected answers</b>	<b>Additional guidance</b>	<b>Marks</b>
<b>(c)</b>	<p><i>any 5 of:</i>            release of pollution / disease from shrimp farm <b>OR</b>            eutrophication ;</p> <p>loss of reefs / beaches / mangroves / coastal areas /            areas of beauty ;</p> <p>reducing biodiversity / fish populations ;</p> <p>smell / unsightliness due to shrimp farms ;</p> <p>loss of <u>tourists</u> / <u>tourism</u> ;</p> <p>conflicts / competition for employment ;</p> <p>tourist traffic disrupting aquaculture ;</p> <p>conflict over land usage / less land for hotels ;</p>		<b>[5]</b>
			<b>[Total: 15]</b>



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Question	Expected answers	Additional guidance	Marks
4 (a)	<p><i>any 10 of:</i></p> <ol style="list-style-type: none"> <li>1. (physical) damage to coral/sea bed/reefs/ seafloor ;</li> <li>2. leakage of heavy metals/corrosion/toxins/ dispersants ;</li> <li>3. accumulation into food chains ;</li> <li>4. ref. to TBT ;</li> <li>5. (oil) loss of habitats/mangroves/coastal areas ;</li> <li>6. (oil) causes feather or fur damage/poisoning/ inhalation ;</li> <li>7. (oil) causes fish death due to gill damage ;</li> <li>8. (oil) reduces light penetration ;</li> <li>9. (resulting in) reduced phytoplankton/coral productivity ;</li> <li>10. (wreck) negative value of tourism ;</li> <li>11. positive value of ecotourism on species conservation/awareness ;</li> <li>12. substrate for growth of coral/provides habitat / nursery grounds/artificial reef ;</li> <li>13. creates niches/food chains ;</li> <li>14. increases biodiversity/conservation of species ;</li> </ol>	<p><b>A</b> both damage sea bed / tanker causes more damage to seabed</p> <p><b>A</b> reduced photosynthesis</p> <p><b>A</b> both eventually provide substrate</p>	<b>[10]</b>

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(b)	<p><i>any 5 of:</i></p> <p>lower trophic levels have lower concentrations ;</p> <p><u>bioaccumulation</u> / <u>biomagnification</u> ;</p> <p>fish at higher trophic levels eat many of those at lower trophic levels ;</p> <p>mercury does not break down / is not digested ;</p> <p>mercury is not excreted / removed from tissues / <b>AW</b> ;</p> <p>mercury damages CNS / can cause miscarriage / fetal abnormalities ;</p> <p>mercury can cross placenta ;</p>		[5]
			[Total: 15]