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**MARINE SCIENCE**

**9693/04**

Paper 1 A2 Data-Handling and Free-Response

**May/June 2017**

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.

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This document consists of **11** printed pages.

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)	both <b>axes</b> (x and y) labelled ; suitable, linear <b>scale</b> ; <b>plots</b> correct $\pm \frac{1}{2}$ small square ; ; straight <b>bars</b> (that do not touch) / lines, identified by <b>key</b> ;	<b>5</b>	plots to cover at least half the grid  <b>A</b> labels to lines
1(a)(ii)	<i>any 3 of:</i> correct subtraction (157–54 <b>OR</b> 103) ; division by starting population, multiplied by 100 $((103 \div 157) * 100)$ ;	<b>2</b>	<b>A</b> 66 (%) / 65.6 for two marks <b>A</b> negative percentage
1(a)(iii)	<i>any 3 of:</i> idea of, fish populations from areas fished may not be representative / <b>AW</b> ; fishermen may lie / exaggerate catch / illegal catch / bias / different fishing methods may have been employed ; by-catch / discard not counted ; idea of, not random sample ; idea of, juveniles / small sizes not counted ;	<b>1</b>	

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Question	Answer	Marks	Guidance
1(b)(i)	<p><i>any 3 of:</i></p> <p>cod population decreases because of (over)fishing/ harvesting / <b>AW</b> ;</p> <p>so less predation of sea urchins, so sea urchin populations increased ;</p> <p>(over)fishing / harvesting of sea urchins decreases population ;</p> <p>fewer sea urchins / less food for cod, so cod population falls further ;</p> <p>high crab population reduces sea urchin population ;</p>	<b>3</b>	
1(b)(ii)	<p><i>any 3 of:</i></p> <p>loss of sea urchins increases kelp ;</p> <p>so crab population increases, due to shelter / kelp OR crabs can't be removed ;</p> <p>idea of, more / high number of, crabs eating sea urchins, so sea urchin population can't recover / idea of, positive feedback / <b>AW</b> ;</p> <p>idea of, cod has insufficient food / lack of prey for cod / lack of sea urchins for cod ;</p> <p>idea of, too few adult cod to breed, so population cannot recover ;</p>	<b>2</b>	<p><b>A</b> population can't recover as too few reach maturity</p> <p><b>A</b> many years to replenish recruitment classes</p>

Question	Answer	Marks	Guidance
2(a)	<p><i>any 2 of:</i></p> <p>general trend is (internal body fluid salinity) increase ;</p> <p>low increase / it is level, between 10 (arbitrary units) and 28 (arbitrary units) ;</p> <p>correct numerical manipulation / initial increase less steep than final increase ;</p>	2	<p><b>A</b> salinity increases except between 10 and 28 for <u>two</u> marks</p> <p><b>A</b> no increase MUST have 10 and 28 for MP2</p>
2(b)	<p><i>any 3 of:</i></p> <p>ref. to <u>osmoregulation</u> / <u>osmoregulator</u> ;</p> <p>at low salinities / hypotonic solutions, salmon pumps in / takes salt into, <u>gills</u> <b>OR</b> at low salinity / hypotonic solutions, salmon produces dilute <u>urine</u> ;</p> <p>(in increasing salinity) salmon pumps out / secretes salt from <u>gills</u> <b>OR</b> (in increasing salinity) salmon produces concentrated <u>urine</u> ;</p> <p>ref. to active transport / protein pumps / ATP use / need for energy ;</p> <p>salmon drink water (in high salinities / increasing salinities) ;</p>	3	<p><b>I</b> any inappropriate named ions</p> <p><b>I</b> ref. to euryhaline</p> <p><b>A</b> chloride / sodium chloride / sodium <b>A</b> chloride pumps</p> <p><b>A</b> excrete</p>
2(c)	<p>crab can (osmo)regulate within a range of salinities, so can tolerate, a range of / changing, salinities ;</p> <p>mussel is an osmoconformer / cannot (osmo)regulate, so can only live in specific / stable / high(er) salinities ;</p>	2	<b>ORA</b>

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Question	Answer	Marks	Guidance
3(a)	<p><i>water quality- at least 1 of:</i></p> <p>(a) stirring up silt / substrate / sediment / sand / mud <b>OR</b> increases turbidity</p> <p>(b) idea of, reduces light penetration / <b>AW</b> ;</p> <p>(c) silt damaging gills ;</p> <p>(d) release of, toxins / heavy metals, from substrate ;</p> <p>(e) <u>nutrient</u> release can cause, algal blooms / eutrophication / description of ;</p> <p><i>productivity &amp; food webs – max 6 of:</i></p> <p>(f) reduced photosynthesis ;</p> <p>(g) less <u>primary</u> productivity ;</p> <p>(h) loss of, food / energy, for primary consumers / herbivores ;</p> <p>(i) damaging, habitats / seabed / substrate / coral / reef ;</p> <p>(j) (toxins / heavy metals / chemicals) bioaccumulate / description of ;</p> <p>(k) difficult for predators to see prey <b>ORA</b> / affects on breeding ;</p> <p>(l) increased food for / benefits, (some) filter feeders / shellfish ;</p>	7	<p><b>I</b> seabed unqualified</p> <p><b>A</b> idea of, silt / AW damages coral <u>polyp</u></p> <p><b>A</b> named toxins – not antifouling paint ;</p> <p><b>I</b> reduced oxygen unqualified</p> <p><b>A</b> <u>nutrient</u> release from sediment causes increase in productivity</p> <p>Productivity needs to be in context of producers or plants or less photosynthesis.</p> <p><b>I</b> productivity unqualified</p> <p>e.g. can't find mates, damage to gametes / larvae</p>

Question	Answer	Marks	Guidance
3(b)	<p><i>any 3 of:</i></p> <p>(Antifouling paint contains) TBT / mercury / copper / lead / heavy metals</p> <p>bioaccumulation / biomagnification / not broken down / pass along food chains / <b>AW</b> ;</p> <p>ref. to, sex reversal of molluscs / imposex in molluscs / sterility in molluscs / interferes with sex ratio in molluscs ;</p> <p>idea of, (resulting in) less food for later trophic level ;</p>	3	<b>A</b> marine named examples of molluscs
3(c)(i)	<p>(<i>Genetic engineering</i>) changing of the, genetic material / DNA / genes / alleles, of an organism ;</p> <p>(<i>Selective breeding</i>) (humans choose) individuals (of same species) mated for specific characteristics / alleles / traits ;</p>	2	Individuals are selected for a particular feature to breed
3(c)(ii)	<p><i>benefits-at least 1 of:</i></p> <p>cheap method (for detecting pollution) ;</p> <p>quick / <i>in-situ</i> method ;</p> <p>can be used by unskilled operator / little training needed ;</p> <p><i>risks-at least 1 of:</i></p> <p>escape / get into the wild ;</p> <p>breed with native species / transfer gene into wild populations ;</p> <p>any other qualified risk escape / getting into the wild, e.g. food chain effect / competition ;</p>	3	

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Question	Answer	Marks	Guidance
4(a)	<p><i>negative conflict of tourism on fishing- at least 1 of:</i></p> <p>(a) loss / damage to fishing areas / reefs / habitats / beaches ;</p> <p>(b) loss of nursery / spawning grounds ;</p> <p>(c) reduced fish population / reduced catch ;</p> <p>(d) damage to nets / fishing gear ;</p> <p>(e) loss of fishing areas, due to bans / protected zones / conservation zones ;</p> <p>(f) idea of, (more) pollution / litter / sewage ;</p> <p>(g) tourist industry takes employment / not enough people to enter fishing / conflict of employment ;</p> <p>(h) idea of, tourism raises cost of living for fishermen / prices rise / inflation / loss of housing / <b>AW</b> ;</p> <p>(i) reduced income (from fishing) ;</p> <p>(j) loss of harbour space ;</p> <p>(k) fishing boats conflict with tourist boats for space ;</p>	<b>6</b>	<p><b>To award full marks, at least one mark should be from each section</b></p> <p><b>I</b> environment</p> <p><b>I</b> noise pollution and light pollution</p> <p>award income mark <b>once</b> only</p> <p>award boat conflict mark <b>once</b> only</p>





Question	Answer	Marks	Guidance
4(b) (i)	<p><i>any 5 of:</i></p> <ul style="list-style-type: none"> <li>(a) availability of stock / adults for spawning / brood stock ;</li> <li>(b) (so that) fish are not taken from wild / not depleting wild stocks ;</li> <li>(c) availability of food (stocks) ;</li> <li>(d) that is not from wild / e.g. uses fish waste / trimmings / <b>AW</b> ;</li> <li>(e) water purification systems / clean water / low stocking density / don't over feed ;</li> <li>(f) to reduce, pollution / disease spread / for disease management / prevent eutrophication ;</li> <li>(g) minimise use of, antibiotics / pesticides ;</li> <li>(h) to prevent development of resistance ;</li> <li>(i) available labour force / <b>AW</b> ;</li> <li>(j) availability of location <b>OR</b> suitable location that does not destroy habitats / mangroves ;</li> <li>(k) transport access / roads / rail, for supplies in and / or products out ;</li> <li>(l) sufficient profit potential / idea of, economic benefit / <b>AW</b> ;</li> <li>(m) (due to) market demand / access to export market / suitable exchange rates ;</li> </ul>	<b>5</b>	

Question	Answer	Marks	Guidance
4(b) (ii)	<p><i>advantage- at least 1 of:</i></p> <p>(a) rehabilitation of depleted stocks / replenishing populations / <b>AW</b> ;</p> <p>(b) restoring food webs / ecological balance ;</p> <p><i>disadvantage- at least 1 of:</i></p> <p>(c) (however) genetically weak stocks / weakens gene pool / inbred fish / poor genetic diversity / deleterious alleles transfer to wild ;</p> <p>(d) cultivated stocks are not well adapted / are weaker / susceptible to predators / <b>AW</b> ;</p> <p>(e) spread disease / parasite transfer ;</p> <p>(f) over-population / over-predation / damage to food chains / idea of, competition ;</p>	<b>4</b>	<p><b>To award full marks, at least one mark should be from each section (i.e. at least one advantage and one disadvantage)</b></p> <p><b>A</b> named examples of diseases / parasites</p>