Cambridge International AS & A Level

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MARINE SCIENCE **9693/04**

Paper 4 A2 Data-Handing and Free-Response **October/November 2016**

MARK SCHEME

Maximum Mark: 50

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.

Cambridge is publishing the mark schemes for the October/November 2016 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

This mark scheme will use the following abbreviations:

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

Question	Answer	Marks	Guidance
1(a)(i)	*any 1 of:* show effect of exposure to air / control experiment ; compare with exposure to air ;	**1**	**I** controlled variable
1(a)(ii)	*any 4 of:* no / small difference at 5 °C in air and 5 °C in water (for all species / species from each area) ; species in group A and B / *D. contorta* and *P. palmata* have large / significant drop in oxygen at –20 °C ; species in group C / *F. spiralis* show no change after exposure to –20 °C / **AW** ; ref to oxygen concentration linking to rate of photosynthesis / **AW** ; freezing / treating at –20 °C kills / stops photosynthesis of *D. contorta* and *P. palmata* / species from area A and B ; ref. to overlap in standard deviation showing significant / non-significant differences ;	**4**	
1(b)(i)	both **axes** labelled (area of shore **OR** species and percentage amino acid release) ; suitable linear **scales** ; **plots** (bars) correct ± ½ square ; key / different temperatures clearly identified ;	**4**	**A** two different y axes for the different temperatures bars to cover at least ½ grid
1(b)(ii)	breakage / damage, to cells;	**1**	

Question	Answer	Marks	Guidance
1(c)	*any 3 of:* (a) ref to adaptations to particular areas of shore / **AW** ; (b) area C species / *F. spiralis* has greatest exposure time ; (c) area C species survives greatest range of temperatures / survives freezing / **AW** ; (d) area C species show least effect of temperature on photosynthesis / amino acid release ; (e) area C species / *F. spiralis* are freeze resistant / cell membranes / cell walls do not break ; (f) ref. to area B species / *P. palmata* having intermediate values for effect and is found in 'intermediate zone' ;	**3**	**ORA** area A and B species for MPs (b), (c), (d), (e)

Question	Answer	Marks	Guidance
2(a)(i)	*any 1 of:* males grow bigger / faster ; prevents mating behaviour ; prevents different sized fish causing cannibalism ; idea of, uniform harvest sizes / times ;	**1**	
2(a)(ii)	may affect human health if fish are contaminated ; may leak into water and affect other organisms ; may enter into food chains / idea of bio-accumulation ;	**2**	**A** health effect described
2(b)(i)	*any 2 of:* methyltestosterone has bigger effect than temperature ; in absence of methyltestosterone temperature has no effect / **AW** ; at higher levels / 40 and 60 mg dm^{-3} of methyltestosterone, increased temperature causes a decrease in percentage of males / **ORA** ; increasing methyltestosterone has an effect up to 40 mg dm^{-3} / no effect from 40 to 60 mg dm^{-3} ; correct manipulation of data ;	**2**	**A** percentage of males is higher at lower temperatures and higher methyltestosterone

Question	Answer	Marks	Guidance
2(c)	*positive* less pollution / health effects / **AW** ; *any 1 of:* *negative* if tilapia escape, may cause unbalanced sex ratio in the wild / affect breeding ; consumer resistance to GM fish ;	**2**	

Question	Answer	Marks	Guidance
3(a)	*causes* evaporation increases salinity ; rivers / glacier melt reduce salinity ; rain / precipitation / **AW** ; *effects* ref. to osmosis ; in high salinity ref to water loss / **ORA** ; *adaptations* 1. osmoregulators regulate ionic concentration / **AW** ; 2. ref. to correct example ; 3. (in high salinity) drink sea water ; 4. excrete ions ; 5. through gill pumps ; 6. active transport ; 7. concentrated (hypertonic) urine ; 8. ref. to urea in sharks ; 9. osmoconformers remain isotonic to water ;	**7**	must have points from all 3 areas for full marks (max 5 for adaptations) **ORA** for mark points 3, 4, 5, 6, 7 in low salinity

Question	Answer	Marks	Guidance
	10. so do not lose water ; 11. ref. to euryhaline species tolerating a range of salinities / stenohaline species tolerating a limited range ;		
3(b)	*'causal'* fossil fuel burning releases carbon dioxide ; example of increased release of fossil fuels (e.g. power stations) ; volcanic eruptions ; deforestation ; *effects on organisms* 1. temperature increase in sea water / **AW** ; 2. photosynthesis of algae / green plants / increase primary productivity ; 3. coral bleaching ; 4. glacier melting / **AW** ; 5. alters water salinity ; 6. changes in direction of ocean currents ; 7. loss of shore habitats due to coastal erosion ; 8. carbon dioxide dissolves in sea water, to form carbonic acid / increased acidity ;	**8**	must have minimum of 1 'causal' mark for full marks

Question	Answer	Marks	Guidance
	9. coral bleaching / skeleton dissolving ; 10. food availability is affected (due to impact on producers – algal blooms etc.) ; 11. change in ranges of species ; 12. change in community composition / food webs / new, predators / prey ;		

Question	Answer	Marks	Guidance
4(a)	*any 3 of:* restrict by season ; restrict by location / refuge zone ; restrict by method / mesh sizes / pole and line ; restrict by fish size / age ; restrict by fishing intensity / boat numbers / engine size / amount of fishing gear / **AW** ; market oriented tools ; monitoring mark (laws / patrols / inspections / **AW**) ;	**3**	**A** examples, e.g. Marine Stewardship Council

Question	Answer	Marks	Guidance
4(b)	*for:* 1. prevent extinction of species / preserve biodiversity ; 2. (to preserve) for future generations ; 3. protects breeding sites / allows juveniles to reach breeding age ; 4. greater catch levels outside of reserve (due to replenishment from within) ; 5. more tourism income ; 6. reduced pollution / damage to coral reefs ; *against:* 7. reduced fishing industry jobs ; 8. reduced (economic) development ; 9. cost implications of policing reserve ; 10. reduced food (from fishing or aquaculture) ; 11. reduced tourism revenue from hotels etc. ; 12. concentrates tourist interest in certain areas which can lead to issues such as pollution, disturbance by tourist boats etc.;	**7**	Max 5 from *For* or from *Against* to ensure balanced argument for full marks.

Question	Answer	Marks	Guidance
4(c)	1. cost effectiveness / **AW** ; 2. breeding programme (to reduce risk of genetic effects on wild population) ; 3. risk of introducing disease from aquaculture / clean water / prevention of disease ; 4. food availability / released tuna could have an impact on the food chain ; 5. predation effects ; 6. fecundity / breeding ; 7. suitability of location of release / effects on other organisms / number that can be released ; 8. risk of accidental catch by fishing vessels ; 9. age of fish on release ; 10. (long term) monitoring programme to evaluate success of venture (for the future) ; 11. availability of labour force ; 12. close proximity of tanks to ocean ;	**5**	