

Mark scheme - Populations and Sustainability

Question	Answer/Indicative content	Marks	Guidance
1	D	1	
	Total	1	
2	B \}	1	<p>Examiner's Comments</p> <p>Around two thirds of candidates also achieved this mark. The most common incorrect response was A, suggesting that some candidates are unclear about how exponential growth (stage W) can be described.</p>
	Total	1	
3	A ✓	1	<p>Examiner's Comments</p> <p>The correct response, A, was selected by many candidates. Response D was the most commonly selected incorrect response.</p>
	Total	1	
4	<p>a i</p> <p>1 penguin species have overlapping / AW , <u>niches</u> ✓</p> <p>2 <u>competitive exclusion</u> ✓</p> <p>3 increase as , food / nesting sites / resources (available) ✓</p> <p>4 increase as , no / little , competition / limiting factors ✓</p> <p>5 plateau / drop, because of (increased) competition ✓</p> <p>6 drop / plateau , due to , arrival of / <u>competition</u> from , gentoo ✓</p>	3 max (AO2.6)	<p>ALLOW 'fish' as AW for 'food' throughout for this question only</p> <p>CREDIT marking points 3-5 in the context of either intraspecific or interspecific competition</p> <p>3 IGNORE refs to predator</p> <p>3 & 4 ALLOW increase as no competition for food = 2 marks</p> <p>3 & 4 ALLOW increase as outcompetes Adélie for food = 2 marks</p> <p>5 CREDIT reached carrying capacity</p> <p>5 & 6 'plateaus because of competition from gentoo' = 2 marks</p> <p>Examiner's Comments</p>


				<p>Most candidates achieved 2 out of the 3 available marks with a smaller number achieving all 3. Marking points 3 and 4 were commonly credited, 5 and 6 less so, 1 and 2 rarely. The question tested the skill of interpreting and explaining graphs.</p> <p>Candidates who did not make it clear which part of the graph their explanation referred to did not receive any credit. Thus, for example, 'there was plenty of food available' might hint at an explanation for the first part of the graph but unless this was explicitly linked to the increase in chinstrap numbers no mark was credited. A large number of candidates were content to offer an explanation for only the increase in chinstrap population and so did not access the final two marking points.</p>
		<p>ii</p> <p>836 (± 40) / 8.36 (± 0.4) $\times 10^2$, (individuals) y^{-1}</p> <p>or</p> <p>418 (± 20) / 4.18 (± 0.2) $\times 10^2$, per year / y^{-1} ✓✓</p>	<p>2 (AO2.6)</p>	<p><i>Max 1 if answer not given to 3 SF</i> <i>Max 1 if no / incorrect units given</i></p> <p>ALLOW per annum / a year , as units</p> <p><i>If 'pairs' interpreted as individuals</i></p> <p><i>If answer incorrect allow 1 mark for 83.6 (± 4) / 8.36 (± 0.4) $\times 10^1$ or 41.8 (± 2) / 4.18 (± 0.2) $\times 10^1$, <u>per year / y^{-1}</u></i></p> <p><u>Examiner's Comments</u></p> <p>This calculation proved problematic for many candidates. Many found the y-axis difficult to interpret and very few attempted to give units. A good proportion of responses gave answers as a percentage decrease rather than the mean annual decrease as asked for.</p>
	b	<p>i</p> <p><i>supports because...</i></p> <p>1 Adélie / ice-reliant / AW , penguin (population) decreased OR gentoo / chinstrap / non- ice-reliant , penguin</p> <p>2 (population) increased ✓</p> <p>3 figs that support either point given above ✓</p>	<p>3 max (AO3.1) (AO3.2)</p>	<p><i>Marks must reference support / AW</i></p> <p>2 Must quote 2 numbers and 2 years or a calculated , increase / reduction 2 IGNORE units</p>

		<p>4 <i>does not support because...</i> idea that changes could be explained by (chance) <u>arrival</u> of , gentoo / chinstrap (and subsequent competition) ✓</p> <p>5 change in another described factor could explain changes (in a single species) ✓</p> <p>correlation does not mean causation ✓</p>	<p>4 ALLOW only disease present in Adélie only or change in food availability that favours , gentoo / chinstrap or new predator that preys more on Adélie</p> <p><u>Examiner's Comments</u></p> <p>This AO3 question tested the candidates' ability to assess whether a claim was supported by evidence presented and, as such, answers that did not mention whether or not the evidence supported the claim were unable to gain marks. However, 2 marks were commonly credited, usually for good descriptions of supporting evidence with figures. When discussing whether evidence supports a claim, candidates are expected to consider both sides of the argument, but most responses did not address reasons why the claim might not be supported. Those that did often did not suggest a plausible reason that would be consistent with the evidence presented – merely stating, 'there could be other factors'. A few were able to clearly express the idea that correlation does not imply causation.</p> <p>When asked to discuss whether evidence supports a claim, or to evaluate the support given by evidence to a claim, candidates are advised to consider reasons that support and reasons that do not support the given claim.</p> <p>Exemplar 4</p> <p>You should refer to the data in Fig. 1 in your answer.</p> <p>The examiner supports the claim as from 1992 to 2010 the population size of Adélie penguins is decreasing. ✓ Reasons suggest that sea temp in Antarctica is increasing as ice is melting and penguins are dying. ✓ The population decreases by 920 breeding pairs = 10% from 1992 to 2010 and gentoo penguins their population as a whole increases by 370 and 1600 breeding pairs respectively. This is because these penguins are not reliant on sea ice so when temp increases and ice melts their population size doesn't change.</p> <p>This typical response achieves two marks easily for explaining how the evidence</p>
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			<p>supports the claim but fails to address why the evidence might not support the claim.</p> <p>Exemplar 5</p> <p><i>Adelie dec. on ice melt</i> <i>Man n.</i> <i>By high the Chan iii</i></p> <p>You should refer to the data in Fig. 17 in your answer. The data supports the scientist's claim. It states that Adelie penguins need a habitat containing ice and with climate change, temperatures increase melting the ice. As a result, the population of Adelie penguins is declining. In 1985, the population was 1300 (reading point 10) but in 2010 this had decreased dramatically to 600 (reading point 10) of 1300. In addition, the both the Chinstrap and Gentoo species have not been confirmed to increase they are not affected by sea ice. However, the decrease in Adelie could be as a result of another factor not climate change - parasites. The Adelie species might not be resistant to parasites which both the other penguin species are. [3]</p> <p>This response addresses both sides of the argument and achieves full marks.</p> <p>Exemplar 6</p> <p><i>Both the chinstrap and gentoo population increases whereas the Adelie population decreases due to less competition. Although overall the Adelie population decreases it still fluctuates. For example in 1978 it increases from 1300 to 1380 but then at in 1988 it decreases again to 1100 showing another factor could be affecting the population.</i> [3]</p> <p>This response correctly mentions an increase in chinstrap and gentoo and a decrease in Adélie penguins but it does not link these statements to supporting the claim.</p>
	<p>ii</p>	<p>1 <u>reduction</u> in extent of ice ✓</p> <p>2 <u>change</u> in ocean current ✓</p> <p>3 <u>change</u> in (penguin) <u>food</u> (species or population) ✓</p> <p>4 <u>new</u> , disease / parasite ✓</p> <p>5 <u>change</u> in predator (species or population) ✓</p> <p>6 new animal (species) present on <u>land</u> ✓</p> <p>7 <u>change</u> in population of (aquatic) plants ✓</p>	<p>2 max (AO3.2)</p> <p>1 ALLOW increased rate of ice melt 1 IGNORE sea level changes</p> <p>3 IGNORE fish or other named aquatic animal</p> <p>5 ALLOW plausible examples, e.g. seals, orcas, sharks.</p> <p>Examiner's Comments</p> <p>This AO3 question was generally low scoring. Most candidates stated the type of evidence</p>

				that might be available but, as the question asked for evidence that would <i>support</i> such a claim, plausible answers had to be in the context of a <i>change</i> from previous levels. Hence, 'extent of sea ice' did not get a mark but 'reduced sea ice' did. Many candidates repeated information given in the stem about water temperature or water animals, not recognising the significance of 'further' in the question.
			Total	10
5	i	<p>FIRST CHECK ON ANSWER LINE If answer = 767 or 768 award 2 marks</p> <p>$545 \times 100/71 \checkmark$</p>	2 max(AO 2.2)	<p><i>If answer incorrect</i> ALLOW max 1 mark for 76.6</p> <p>ALLOW max 1 mark for 1535 (quoting individuals rather than pairs)</p> <p>Examiner's Comments</p> <p>Most candidates did this calculation successfully. Others multiplied 545 by 0.71 and so gave an answer lower than 545, which does not make sense in the context of the question.</p> <p>Exam tip Estimate the size of an expected answer and then use this estimate to accept the calculated answer, or to reject it and try again.</p>
	ii	deliberate killing to maintain grouse numbers / pollution / pesticides / disease / loss of another food source / competition from new predator \checkmark	1 (AO2.5)	<p><i>Mark as prose</i> IGNORE habitat loss</p> <p>ALLOW hunting</p>
		Total	3	
6		<p><i>conservation because...</i> there are (local) people there } <u>sustainable</u> use } (area used for) logging / farming / nut production } active measures / work, to</p>	3 max	<p>Cannot be implied from another marking point. Look for positive statement, CREDIT if preservation people would not be there</p> <p>CREDIT logging / farming / nut production, not consistent with preservation</p> <p>CREDIT preservation would leave park</p>

		maintain, biodiversity / habitat / park }		<p>untouched CREDIT active management NB preservation would leave park untouched by people = mp 4 not mp 1</p> <p>Examiner's Comments The majority of candidates knew the definitions of conservation and preservation and were able to use information given in the question to exemplify why Madidi is an example of conservation to gain at least two marks. All marking points were seen but surprisingly few referred to the contextual examples of logging, farming or nut harvesting given in the introduction. Some candidates simply stated definitions without reference to the example and gained one or two marks. A small minority of candidates discussed in situ and ex situ conservation, gaining no credit.</p>									
		Total	3										
7		<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td style="text-align: center;">Is consistent with...</td> <td></td> </tr> <tr> <td style="text-align: center;">organisms are not removed from their natural habitat</td> <td style="text-align: center;">B and C</td> <td style="text-align: center;">✓</td> </tr> <tr> <td style="text-align: center;">human intervention is happening</td> <td style="text-align: center;">A and B</td> <td style="text-align: center;">✓</td> </tr> </table>		Is consistent with...		organisms are not removed from their natural habitat	B and C	✓	human intervention is happening	A and B	✓	2 (AO2.5)	<p>ALLOW <i>in situ</i> and preservation</p> <p>ALLOW ex situ and in situ</p> <p>Examiner's Comments Most candidates achieved 1 mark and almost half got both. A number only put 1 letter in each box, despite the emboldened instruction. All three letters appeared often in the lower box, suggesting a misunderstanding about preservation on the part of some candidates.</p>
	Is consistent with...												
organisms are not removed from their natural habitat	B and C	✓											
human intervention is happening	A and B	✓											
		Total	2										
8	i	<p>no / less, planting AND <i>idea of</i> trees remove water from the bog (1) no ditch AND <i>idea of</i> ditch drains water from the bog (1) no / controlled, grazing AND <i>idea of</i> overgrazing disrupts the food chain (1) no / less, burning AND <i>idea of</i></p>	3										

		death of organisms from rare species (1)		
	ii	<i>idea that</i> preservation leaves ecosystems untouched, or without human interference (1) <i>idea that</i> most peat bogs have been damaged already and require management and restoration (1)	2	
		Total	5	
9		<i>preservation because</i> no visitors allowed OR human interference / peat extraction/ tree planting, restricted ✓ <i>not preservation / is conservation because</i> the habitat was being managed / example of management described (e.g. water levels raised / ditches blocked) OR the habitat had already been changed / was not the original habitat ✓	2 max (AO3.2)	DO NOT ALLOW no human interference
		Total	2	
10	i	10 / 11 / 12 / 13 / 14 ✓	1 (AO 2.2)	<p>DO NOT CREDIT if more than 2 s.f.</p> <p><u>Examiner's Comments</u></p> <p>A few candidates achieved this mark. Candidates who didn't achieve the mark did not appreciate the significance of the emboldened word 'estimate' and wrote an answer that was within the acceptable range but to 3 significant figures.</p> <p> OCR support</p> <p>The 'Maths for Biology' website offers support on how to estimate results:</p> <p>https://www.ocr.org.uk/subjects/biology/maths-</p>

				for-biology/arithmetic-and-numerical-computation/
		ii	<p>1 limit size of area that is (felled) ✓</p> <p>2 replanting (of trees that have been felled) ✓</p> <p>3 minimum distance between (replanted) trees ✓</p> <p>4 allow time for new trees to fully grow / AW (before next felling) ✓</p> <p>5 reference to limiting soil erosion after felling ✓</p>	<p>2 (AO 2.5)</p> <p>1 ALLOW strip / rotational, felling</p> <p>2 ALLOW replace</p> <p>3 ALLOW optimum distance between (replanted) trees</p> <p>1&4 'rotate areas that are felled to allow trees to mature' = 2 marks</p> <p>1&5 'limit the size of the area that is felled to reduce soil erosion' = 2 marks</p> <p>Examiner's Comments</p> <p>Most candidates achieved at least one mark here. Even candidates who did not fully understand the concept of clear felling were able to offer reasonable suggestions such as replanting or limiting the size of the area that is felled. Many candidates stated 'allow trees to grow' without reference to being fully regrown before harvesting, so they couldn't be awarded marking point 4.</p>
		iii	<p>Please refer to the marking instructions on this mark scheme for guidance on how to mark this question.</p> <p>In summary: <i>Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.)</i> <i>Using a 'best-fit' approach based on the science content of the answer, first decide which of the level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.</i> <i>Then, award the higher or lower mark within the level, according to the Communication Statement (shown in italics):</i></p>	<p>Indicative scientific points may include</p> <p><i>Process of coppicing</i></p> <ul style="list-style-type: none"> • trunk cut close to ground level • several new shoots grow from cut surface • protect young shoots from grazers • process repeated after certain time • broadleaved species • rotational coppicing • can be repeated indefinitely <p><i>Benefits of coppicing...</i></p> <ul style="list-style-type: none"> • new stems grow more rapidly than saplings • lifespan of tree extended • provides variety of light levels

		<ul style="list-style-type: none"> award the higher mark where the <i>Communication Statement has been met.</i> award the lower mark where aspects of the <i>Communication Statement have been missed.</i> <ul style="list-style-type: none"> The science content determines the level. The Communication Statement determines the mark within a level. <p>Level 3 (5-6 marks) Describes the processes involved in coppicing in some detail and clearly explains some benefits to biodiversity. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated</i></p> <p>Level 2 (3-4 marks) Describes some processes involved in coppicing and explains a benefit to biodiversity. <i>There is a line of reasoning with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>Level 1 (1-2 marks) Describes the process of coppicing or explains a benefit to biodiversity. <i>There is an attempt at a logical structure with a line of reasoning. The information is, in the most part, relevant.</i></p>		<ul style="list-style-type: none"> fewer large trees means more light for smaller plants provides a variety of habitats roots prevent soil erosion maintains soil quality prevents succession large machinery not needed <p>Examiner's Comments</p> <p>Those who had a good understanding of coppicing and its benefits were able to move beyond Level 1 easily.</p> <p>Responses that were limited to Level 1 tended to fall into two categories: Some had little idea of what coppicing was but they were able to describe some clear benefits for biodiversity of rotational felling. Others described the process well but did not clearly describe the benefit.</p> <p>Responses in level two described clearly the processes involved in coppicing and at least one benefit to biodiversity that coppicing brings, usually in the form of increased light penetration to ground level. Many Level 2 responses also included information about economic benefits in terms of timber production.</p> <p>Exemplar 4</p> <p><i>coppicing is cutting a tree not fully and leaving parts of it out of the ground, allowing them to regrow from the same roots, they need to cut it a little high, so animals including deers to not have access to them and eating eat them As you cut the tree, as it is regrowing environmental factors and a selection pressures allows them to adapt to the new situation. This means the tree is better adapted and this increases biodiversity or cutting old trees allows sun light to pass through to lower levels allowing more plants to grow a of a new type, which increases the</i> [1]</p> <p>Additional answer space if required.</p> <p><i>biodiversity, by allowing more plants to grow and reproduce</i></p>
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		<p>0 marks No response or no response worthy of credit.</p>		<p>Towards the end, this response explains one clear benefit of coppicing with regard to light penetrating to ground level. However, the description of the process is weak, with the suggestion of some confusion about coppicing and pollarding, so the response is limited to Level 1.</p> <p>Exemplar 5</p> <p>The process of coppicing is cutting tree stems close to the ground to promote the growth of many side shoots. Once the side shoots have grown they can then be harvested for timber without leaving the tree alive so that it regrows new branches that can be harvested again. The potential benefits of coppicing to the biodiversity of woodland is due to it being occurring on a rotational basis. One year a section of woodland may be harvested, however others are left to provide a habitat for different species living there. This ensures biodiversity is maintained. As trees are not removed completely biodiversity overtime may increase as branched trees provide good shelter and areas for birds to nest as well as food for insects. This could increase the number of species in the area and both species evenness and richness which overall increases biodiversity.</p> <p><small>Additional answer space if required.</small></p> <p>This response describes coppicing well together with one clear benefit of coppicing, habitat variety, achieving Level 2.</p>
		Total	0	
11	i	<p>Measures fishing quotas (1) mesh size (1) species restriction (1) trawler size / days at sea (1) penalties / sanctions (1) monitoring / surveillance (1) publicity / public education (1)</p> <p>Difficulties area too large (1) expense of monitoring (1) monitoring hampered by, weather / seasons (1) false reporting of, catches / trawler size / mesh size / days (1) death of fish caught but not kept (because of restrictions) (1)</p>	4	<p>The difficulties should relate to the measures proposed.</p>
	ii	<p><i>argument for comparison of the energy in large</i></p>	2	<p>ALLOW the use of figures to illustrate the data comparison.</p>

		fish and krill shows humans would get 100x more kJ / energy from krill than large fish (1) <i>argument against</i> would require large change to fishing industry / consumer habits or could impact ecosystem at first trophic level (1)		
		Total	6	
12	a	i	2	
		ii	Max 3	ALLOW any other valid point
		iii	Max 1	
	b		2	
	c		max 4	

			(of concern to foresters) likely to occur only in area near water – so not a strong argument ✓ damage to river bank needing costly repairs ✓ cost should be shared by all who benefit (including those downstream) so not a strong argument ✓		
			Total	12	
13	i		<i>Fossa has ...</i> longer , legs ✓ different (shaped / size) , ears ✓ (proportionally) bigger eyes ✓	1 max (AO2.3)	<p><i>Mark the first response only</i> <i>Assume 'it' refers to mongoose</i> IGNORE references head / body / shape ALLOW ora for mongoose throughout</p> <p>ALLOW longer tail / larger jaw</p> <p><u>Examiner's Comments</u></p> <p>The vast majority of candidates achieved this mark. Some were even able to correctly refer to proportional sizes. Those few responses that did not gain a mark tended to refer to differences not visible in the figure or vague differences in body shape.</p>
	ii		<p>1 allopatric speciation ✓</p> <p>2 different , selection pressure / environmental conditions (from mainland) ✓</p> <p>3 (random) mutation ✓</p> <p>4 (fossa-like) individuals with , mutation / (new) feature , survive / reproduce ✓ ora</p> <p>5 beneficial / AW , <u>alleles</u> passed on ✓</p> <p>6 <u>directional</u> selection</p>	4 max (AO2.5)	<p>3 ALLOW pre-existing genetic variation</p> <p>4 IGNORE best adapted / fittest</p> <p><u>Examiner's Comments</u></p> <p>This question differentiated well between candidates of differing abilities and two marks were most commonly scored. The best responses outlined the natural selection of cat-like features using technical terms. Many responses were not credited marks because they did not use the term 'alleles' correctly. Some conflated 'alleles' with 'genes' while others merely referred to traits, characteristics</p>

				<p>or features. Answers that ignored the context completely struggled to gain full marks as generic references to selection pressures or survival of the best adapted were not credited without a link to the Madagascar/fossa-like context. A minority of responses did not address the question, which the evolution of the fossa, and devoted their entire answer to issues of speciation, gaining little credit. Use of the A Level key term, 'directional selection', was rare.</p> <p>Exemplar 9</p> <p><i>This was a random mutation of a gene, producing an advantageous characteristic. When selection pressure was applied, the animals that showed the advantageous characteristic survived, reproduced and passed its advantageous characteristics on to the next generation. Over time the allele frequency of the characteristic increases leading to a formation of a new species.</i> [4]</p> <p>This response ignores the context of the question and simply discusses natural selection in generic terms. One mark has been credited for discussing mutations but, although the response alludes to marking points 2 and 4, as these are context-dependent, the marks have not been given.</p> <p>Exemplar 10</p> <p><i>Population isolated and under different environmental selection pressure. Gene mutation in an individual which cause them to be larger is considered an advantageous characteristic (more faster to catch food etc) so they are more likely to survive and pass on allele to offspring. Over time the allele frequency changes so that fossa are evolved.</i> [4]</p> <p>This response achieves full marks for the following marking points: 2 – recognising the context of an environment different from the African mainland, 3, 4 – recognising the context of a vacant large predator niche, and 5.</p>
	iii		3 max (AO1.2)	IGNORE refs to isolation

		<p>mutation / genetic diversity ✓</p> <p>natural / directional , selection ✓</p> <p><i>idea that</i> environment / selection pressure , is <u>different</u> from the 'other' population ✓</p> <p>time ✓</p>		<p>ALLOW genetically different / large gene pool</p> <p>ALLOW e.g. different food source</p> <p>ALLOW many generations</p> <p><u>Examiner's Comments</u></p> <p>This question was poorly answered with many candidates failing to appreciate the significance of 'other' in the question and, hence, listing methods of reproductive isolation. Mutation and different environmental conditions were the most commonly seen correct answers but references to natural selection and time were rare.</p>
		Total	8	