



# Mark Scheme (Results)

June 2019

Pearson Edexcel International Advanced  
Level In Biology Pearson Edexcel (WBI04)  
Paper 01 The Natural Environment and  
Species Survival

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Summer 2019

Publications Code WBI04\_01\_1906\_MS

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## General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question Number	Answer	Mark
<b>1(a)</b>	<p><b>C</b> mitochondria</p> <p><i>A is incorrect because bacteria and fungi both have cell membranes</i> <i>B is incorrect because bacteria and fungi both have cytoplasm</i> <i>D is incorrect because bacteria and fungi both have ribosomes</i></p>	<b>(1)</b>

Question Number	Answer	Mark
<b>1(b)</b>	<p><b>C</b> glycogen granules</p> <p><i>A is incorrect because plants and fungi both have cell membranes</i> <i>B is incorrect because plants and fungi both have a cell wall</i> <i>D is incorrect because plants and fungi both have Golgi apparatus</i></p>	<b>(1)</b>

Question Number	Answer	Additional Guidance	Mark
<b>1(c)</b>	<ol style="list-style-type: none"> <li>1. {enzymes / named enzyme} are involved in {decomposition / breakdown of organic matter / eq} ;</li> <li>2. idea that these enzymes are involved in the <b>hydrolysis</b> of {named organic molecule / named bond} ;</li> <li>3. Golgi apparatus (in fungi) involved in modification of (these) enzymes ;</li> <li>4. Golgi apparatus (in fungi) package these enzymes into vesicles to be released / eq ;</li> </ol>	<p><b>N.B.</b> These mark points may need to be pieced together</p> <p><b>3 DO NOT ACCEPT</b> in bacteria</p> <p><b>4 DO NOT ACCEPT</b> in bacteria <b>ACCEPT</b> vacuoles for vesicles</p> <p><b>N.B. only penalise once</b></p>	<b>(3)</b>

Question Number	Answer	Additional Guidance	Mark
<b>1(d)</b>	<ol style="list-style-type: none"> <li>1. (mitochondria in fungi) {involved in (aerobic) respiration / ATP production / eq} ;</li> <li>2. respiration produces carbon dioxide ;</li> </ol>	<b>1 DO NOT ACCEPT</b> in bacteria	<b>(2)</b>

Question Number	Answer	Additional Guidance	Mark
<b>2(a)</b>	<ol style="list-style-type: none"> <li>(infection / damage) increases blood flow / results in vasodilation / eq ;</li> <li>so {white blood cells / antibodies / eq} {are brought to / leak out into} the site of infection ;</li> <li>credit role of white blood cells in infection ;</li> </ol>	<p><b>1 ACCEPT</b> histamine increases {blood flow / permeability of capillaries}  <b>IGNORE</b> capillaries / veins dilate</p> <p><b>2 IGNORE</b> macrophages if present in the blood</p> <p><b>3 e.g.</b> antibodies for opsonisation, phagocytosis</p>	<b>(2)</b>

Question Number	Answer	Additional Guidance	Mark
<b>2(b)(i)</b>	<ol style="list-style-type: none"> <li>{substance / chemical / drug / medicine} ;</li> <li>that {kills / inhibits the growth of / eq} {(a different) bacteria / microorganism / prokaryote} ;</li> </ol>	<p><b>1 DO NOT ACCEPT</b> produced by a virus</p> <p><b>2 ACCEPT</b> bacteriostatic / bactericidal</p> <p><b>DO NOT ACCEPT</b> virus</p> <p><b>IGNORE</b> pathogens</p>	<b>(2)</b>

Question Number	Answer	Additional Guidance	Mark
<b>2(b)(ii)</b>	<ol style="list-style-type: none"> <li>because bacteria are becoming resistant (to antibiotics) ;</li> <li>caused by mutation ;</li> <li>idea that {we will not have anything to treat bacterial infections / antibiotic will no longer be effective} ;</li> </ol>	<p><b>1 DO NOT ACCEPT</b> immune</p> <p><b>3 ACCEPT</b> there is an evolutionary race</p>	<b>(2)</b>

Question Number	Answer	Additional Guidance	Mark
<b>2(c)(i)</b>	<ol style="list-style-type: none"> <li>1. as the velocity increases up to 10 (<math>\text{cm s}^{-1}</math>) the number of bacteria trapped increase / eq ;</li> <li>2. as the velocity increases above to 10 (<math>\text{cm s}^{-1}</math>) the number of bacteria trapped decrease / eq ;</li> </ol>	<p><b>NB</b> 'as the velocity increases the number of bacteria trapped increase and then decrease' = 1 mark</p>	<b>(2)</b>
<b>2(c)(ii)</b>	<ol style="list-style-type: none"> <li>1. (as the velocity increases) more bacteria going into the {filter / nanowires};</li> <li>2. (above a velocity of <math>10 \text{ cm s}^{-1}</math>) the bacteria get pushed out of the nanowires / nanowires bend too much / nanowires do not respond fast enough / eq ;</li> </ol>	<p><b>1 ACCEPT</b> more get trapped</p> <p><b>2 ACCEPT</b> nanowires break</p>	<b>(2)</b>

Question Number	Answer	Additional Guidance	Mark
<b>3(a)</b>	<ol style="list-style-type: none"> <li>1. on agar / in a broth / in nutrients / eq ;</li> <li>2. use of aseptic technique / description of aseptic technique ;</li> <li>3. incubated at a stated temperature in the range of 25° C to 35°C ;</li> <li>4. credit another detail of culture conditions needed ;</li> </ol>	<p><b>1 IGNORE</b> grown in a petri dish</p> <p><b>2</b> e.g. sterile equipment, autoclaved media, working by a bunsen burner</p> <p>4. e.g. appropriate pH, appropriate growth factors, appropriate length of time in the range of 24 hours to 1 week, description of ensuring that conditions are not anaerobic</p>	<b>(3)</b>

Question Number	Answer	Additional Guidance	Mark
<b>3(b)(i)</b>	<ol style="list-style-type: none"> <li>1. protein coat / capsid / capsomeres ;</li> <li>2. nucleic acid / DNA or RNA / genetic material ;</li> </ol>	<p><b>IGNORE</b> antigens</p> <p><b>IGNORE</b> comments about the structure of the nucleic acids</p> <p><b>DO NOT ACCEPT</b> envelope, glycoproteins, enzymes, named enzymes, egs of cell structures</p>	<b>(2)</b>

Question Number	Answer	Additional Guidance	Mark
<b>3(b)(ii)</b>	<ol style="list-style-type: none"><li>1. because they are {not alive / non-living};</li><li>2. (need to use the host cell) to replicate / for synthesis of genetic material / for protein synthesis / eq ;</li><li>3. need to use (host) cell's {enzymes / named enzyme / monomers / named monomer / ribosomes } (to make protein / nucleic acids);</li></ol>	<p><b>N.B.</b> all points can be accepted in the context of a specific virus</p> <p><b>1 DO NOT ACCEPT</b> dead</p> <p><b>2 ACCEPT</b> cannot reproduce without a host cell</p> <p><b>DO NOT ACCEPT</b> to grow</p>	<p><b>(2)</b></p>

Question Number	Answer	Mark
<b>3(b)(iii)</b>	<p><b>C</b> T helper cell</p> <p><i>A is incorrect because the host cell of HIV is the T helper cell</i>  <i>B is incorrect because the host cell of HIV is the T helper cell</i>  <i>D is incorrect because the host cell of HIV is the T helper cell</i></p>	<b>(1)</b>

Question Number	Answer	Additional Guidance	Mark
<b>3(b)(iv)</b>	<ol style="list-style-type: none"> <li>idea that each virus has a {specific / host / target} cell ;</li> <li>each virus has {attachment molecules / receptors / eq} for the host cell ;</li> <li>host cells have (specific) {binding sites / receptors / eq} (that viruses bind to);</li> </ol>	<p><b>2 IGNORE</b> antigens</p> <p><b>3 IGNORE</b> antigens</p>	<b>(2)</b>

Question Number	Answer	Additional Guidance	Mark
<b>4(a)</b>	<ol style="list-style-type: none"> <li>idea that they are difficult to find because they are {endangered / few in number / solitary} ;</li> <li>idea that they are camouflaged ;</li> <li>idea that they are deep in the water ;</li> <li>idea that the oceans are very large ;</li> </ol>	<b>1 IGNORE</b> distribution not known makes them hard to find	<b>(2)</b>

	5. idea that they are moving around ;		
Question Number	Answer	Additional Guidance	Mark
<b>4(b)(i)</b>	1. skin / scales / teeth / blood / faeces / urine / eq (in the water) ;	<b>ACCEPT</b> dermal denticles / semen / sperm / eggs / decomposing sharks <b>IGNORE</b> cells / gills / saliva	<b>(1)</b>

Question Number	Answer	Additional Guidance	Mark
<b>4(b)(ii)</b>	<p>1. idea that when the concentration of eDNA from whale shark is high the concentration of eDNA from mackerel tuna is high ;</p> <p>2. sharks seen when there is higher concentrations of eDNA from whale sharks / eq ;</p> <p>3. sharks seen when there is higher concentrations of eDNA from mackerel tuna / eq ;</p>	<p><b>N.B.</b> All points can be accepted in the context of either year</p> <p><b>ACCEPT</b> converse throughout</p> <p><b>1 ACCEPT</b> positive correlation</p>	<b>(3)</b>

Question Number	Answer	Additional Guidance	Mark
<b>*4(b)(iii)</b>	<ol style="list-style-type: none"> <li>1. idea of collecting several samples of water ;</li> <li>2. in different areas (of the Arabian Gulf) ;</li> <li>3. idea of recording whether the whale shark was seen or not ;</li> <li>4. idea of extracting the (e)DNA (from the sample) ;</li> <li>5. reference to {<b>PCR / polymerase chain reaction</b>} ;</li> <li>6. reference to (gel) <b>electrophoresis</b> ;</li> <li>7. idea of identifying the {bands / profiles} of (e)DNA as shark or tuna ;</li> <li>8. use known standards of both whale shark and mackerel tuna DNA / eq ;</li> <li>9. credit an indication of how the concentration of (e)DNA could be calculated ;</li> </ol>	<p><b>QWC focussing on clarity of account</b></p> <p><b>5 ACCEPT</b> a description that includes idea of the amplification of (e)DNA</p> <p><b>6 ACCEPT</b> a description that includes the idea that (e)DNA is on agar with a current applied</p> <p><b>N.B.</b> idea of comparing bands to known bands of whale shark and mackerel tuna = 2 marks</p>	<b>(6)</b>

Question Number	Answer	Mark			
<b>5(a)(i)</b>	<p><b>C</b></p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>20810</td> <td>8863</td> <td>11947</td> </tr> </table> <p><i>A is incorrect because GPP is the highest</i>  <i>B is incorrect because GPP is the highest</i>  <i>D is incorrect because respiration is not energy in a trophic level</i></p>	20810	8863	11947	<b>(1)</b>
20810	8863	11947			

Question Number	Answer	Mark
<b>5(a)(ii)</b>	<p><b>C</b> <math>\text{kJ m}^{-2} \text{yr}^{-1}</math></p> <p><i>A is incorrect because GPP is the energy per unit area in a given time</i>  <i>B is incorrect because GPP is the energy per unit area in a given time</i>  <i>D is incorrect because GPP is the energy per unit area in a given time</i></p>	<b>(1)</b>

Question Number	Answer	Mark
<b>5(a)(iii)</b>	<p><b>C</b> 8.96</p> <p><i>A is incorrect because efficiency = <math>(6 \times 100) \div 67 = 8.96</math></i>  <i>B is incorrect because <math>(6 \times 100) \div 67 = 8.955522388059701</math> rounds up to 8.96</i>  <i>D is incorrect because efficiency = <math>(6 \times 100) \div 67 = 8.96</math></i></p>	<b>(1)</b>

Question Number	Answer	Mark
<b>5(a)(iv)</b>	<p><b>B</b> energy is transferred to the environment</p> <p><i>A is incorrect because you cannot make energy</i>  <i>C is incorrect because not all organisms increase in size as you go up trophic levels</i>  <i>D is incorrect because there are not always fewer organisms at higher trophic levels</i></p>	<b>(1)</b>

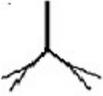
Question Number	Answer	Additional Guidance	Mark
<b>5(a)(v)</b>	<p>1. idea that {energy has been 'lost' / decreases due to respiration / eq} ;</p> <p>2. idea that there will not be enough energy to sustain {organisms (on another trophic level) / another trophic level} ;</p>	<p><b>1 ACCEPT</b> only <math>6 \text{ kJ m}^{-2} \text{ yr}^{-1}</math>  <b>DO NOT ACCEPT</b> all energy lost</p> <p><b>2 DO NOT ACCEPT</b> NPP / no energy</p>	<b>(2)</b>

Question Number	Answer	Additional Guidance	Mark
<b>5(b)(i)</b>	<p><b>Similarities :</b></p> <ol style="list-style-type: none"> <li>1. both made of glucose ;</li> <li>2. both contain (1 - 4) glycosidic bonds ;</li> </ol> <p><b>Differences :</b></p> <p><b>Any two from</b></p> <ol style="list-style-type: none"> <li>3. starch composed of <math>\alpha</math> glucose and cellulose made of <math>\beta</math> glucose ;</li> <li>4. starch (amylopectin) has 1 - 6 (glycosidic) bonds and cellulose does not</li> <li>5. starch (amylopectin) is branched and cellulose is {unbranched / straight} ;</li> <li>6. in starch, glucose molecules are not inverted and cellulose has every other glucose molecule inverted ;</li> </ol>	<p><b>DO NOT PIECE TOGETHER</b></p> <p><b>1 ACCEPT</b> both are polysaccharides</p> <p><b>4 ACCEPT</b> starch has 1-4 and 1-6 (glycosidic) bonds and cellulose has 1-4 (glycosidic) bonds only ;</p> <p><b>5 ACCEPT</b> starch contains branched and unbranched molecules but cellulose is unbranched</p>	<b>(4)</b>

Question Number	Answer	Additional Guidance	Mark
<b>5(b)(ii)</b>	<ol style="list-style-type: none"> <li>1. {seeds / starch} {are an energy store / provide a source of energy (for embryo plant) / eq} ;</li> <li>2. (starch) {compact / branched / hydrolysed quickly / eq} ;</li> <li>3. cell wall has to {have (high) strength / be strong} ;</li> <li>4. molecules (cellulose) held together with lots of hydrogen bonds / eq ;</li> </ol>	<p><b>1 ACCEPT</b> broken down into glucose to be used in respiration</p> <p><b>2 IGNORE</b> has no osmotic effect</p> <p><b>4 ACCEPT</b> cellulose forms microfibrils</p>	<b>(3)</b>

Question Number	Answer	Additional Guidance	Mark
<b>6(a)(i)</b>	<ol style="list-style-type: none"> <li>1. father was Rh positive ;</li> <li>2. idea that the father passed the {Rh positive / dominant} allele onto the child ;</li> </ol>	<p><b>2 DO NOT ACCEPT</b> gene</p> <p><b>IGNORE</b> faulty</p>	<b>(2)</b>

Question Number	Answer	Additional Guidance	Mark
<b>6(a)(ii)</b>	<p>1. 100% if the father is homozygous / eq ;</p> <p>2. 50% if the father is heterozygous / eq ;</p>	<p><b>ACCEPT</b> description of homozygous and heterozygous From a genetic diagram provided the father's genotype has been labelled</p> <p><b>DO NOT ACCEPT</b> genes for alleles</p> <p><b>ACCEPT</b> 50 : 50 / 1 in 2 / <math>\frac{1}{2}</math></p>	<b>(2)</b>

Question Number	Answer	Mark
<b>6(b)(i)</b>	<p><b>C</b> </p> <p><b>A</b> is incorrect because antibodies have two antigen binding sites  <b>B</b> is incorrect because antibodies have two antigen binding sites  <b>D</b> is incorrect because antibodies only have one attachment site to phagocytes</p>	<b>(1)</b>

Question Number	Answer	Additional Guidance	Mark
<b>*6(b)(ii)</b>	<ol style="list-style-type: none"> <li>1. {contaminated blood contains / mother's blood will then contain} rhesus {antigens / red blood cells} ;</li> <li>2. stimulating an {primary / (primary) immune} response (to rhesus antigen) ;</li> <li>3. phagocytes {engulf / eq} the {(red blood) cells / (rhesus) antigens} ;</li> <li>4. and become (rhesus) antigen presenting cells (to T helper cells) ;</li> <li>5. activating the {T helper / CD4} cells (to rhesus antigen) / eq ;</li> <li>6. T helper cells release cytokines to activate B cells (to rhesus antigens) / eq;</li> <li>7. which have (rhesus) antigen attached to them / which are presenting antigen (to themselves) / eq ;</li> <li>8. B cells {differentiate / specialise} into plasma cells that produce antibody (to rhesus antigen) ;</li> </ol>	<p><b>2 ACCEPT</b> humoral response / B cell response <b>IGNORE</b> cell mediates response</p> <p><b>3 IGNORE</b> macrophages</p> <p><b>4 ACCEPT</b> rhesus antigen binds to MHC</p> <p><b>5 ACCEPT</b> cause {T helper cells to divide / clonal selection / clonal expansion / eq}</p> <p><b>6 ACCEPT</b> cause {B cells to divide / clonal selection / clonal expansion / eq} <b>IGNORE</b> T killer cells</p> <p><b>7 DO NOT ACCEPT</b> B cells attach to antigen attached to macrophages</p> <p><b>8 DO NOT ACCEPT</b> B cells produce antibody</p>	<b>(6)</b>

Question Number	Answer	Additional Guidance	Mark
<b>6(c)</b>	<ol style="list-style-type: none"><li>1. to provide red blood cells to replace those destroyed by the antibodies ;</li><li>2. so that oxygen can be supplied to the {cells / tissues / organs / named example} ;</li><li>3. to remove antibodies (against rhesus antigen in the blood of the baby) / eq ;</li><li>4. so that (new) red blood cells are not {destroyed / opsonised / recognised by phagocytes / agglutinated / eq} ;</li></ol>	<b>3 ACCEPT</b> healthy person's blood will not contain antibodies (against rhesus antigen)	<b>(2)</b>

Question Number	Answer	Additional Guidance	Mark
<b>7(a)</b>	<ol style="list-style-type: none"> <li>1. the hydrogen that goes into GALP comes from the water / eq ;</li> <li>2. water is split by light / reference to <b>photolysis</b> ;</li> <li>3. producing H<sup>+</sup> and {electrons / OH} ;</li> <li>4. {chlorophyll / photosystem} releases electrons / eq ;</li> <li>5. so reduced NADP is formed / eq ;</li> <li>6. reduced NADP used in conversion of GP to GALP / eq ;</li> </ol>	<p><b>1 N.B.</b> this needs to be a statement</p> <p><b>3 Piece together</b> <b>ACCEPT</b> protons</p> <p><b>5 ACCEPT</b> NADPH for reduced NADP from an equation</p>	<b>(4)</b>

Question Number	Answer	Additional Guidance	Mark
<b>7(b)</b>	<ol style="list-style-type: none"> <li>1. (increase in temperature) increases kinetic energy of {(light-independent) enzymes / RUBISCO} ;</li> <li>2. therefore more {frequent collisions (between enzyme and substrate) / energy of collisions / eq} ;</li> <li>3. more {carbon fixation / eq} by RUBISCO ;</li> <li>4. so more GP to convert to GALP / eq ;</li> <li>5. increase in activity of enzymes involved in converting GP to GALP / eq ;</li> </ol>	<p><b>2 ACCEPT</b> more enzyme substrate complexes form</p>	<b>(3)</b>

Question Number	Answer	Additional Guidance	Mark
<b>7(c)(i)</b>	<ol style="list-style-type: none"> <li>(plants grown in light have) more light energy for light-dependent reactions ;</li> <li>more photolysis ;</li> <li>more electrons {released / excited} from {chlorophyll / photosystems} ;</li> <li>more {ATP / reduced NADP / NADPH} produced ;</li> <li>so {light-independent reaction / Calvin cycle / carbon fixation / GP production} is <b>faster</b> ;</li> </ol>	<p><b>ACCEPT</b> converse argument</p> <p><b>1 ACCEPT</b> light is not a rate-limiting factor</p> <p>5. RuBP regenerated faster to bind more CO<sub>2</sub></p>	<b>(3)</b>

Question Number	Answer	Additional Guidance	Mark
<b>7(c)(ii)</b>	<ol style="list-style-type: none"> <li>respiration is greater than photosynthesis / eq ;</li> <li>RuBP regenerated too slowly to bind as much CO<sub>2</sub></li> <li>because the light intensity is very low ;</li> </ol>	<p><b>1 ACCEPT</b> more carbon dioxide being released by respiration than being used in photosynthesis</p> <p><b>DO NOT ACCEPT</b> no photosynthesis</p> <p><b>3 DO NOT ACCEPT</b> it was dark / no light</p>	<b>(2)</b>

Question Number	Answer	Additional Guidance	Mark
<b>8(a)(i)</b>	<ol style="list-style-type: none"> <li>1. global warming is the {average / mean} increase in the temperature of the {atmosphere / earth's surface} ;</li> <li>2. which correlates with a decrease in the area covered by sea ice ;</li> <li>3. {warmer / increase in} temperature melts the ice ;</li> <li>4. because the temperature is higher than the melting point of the ice (for long periods of time) ;</li> </ol>		<b>(3)</b>

Question Number	Answer	Additional Guidance	Mark
<b>8(a)(ii)</b>	<ol style="list-style-type: none"> <li>1. idea of drawing a line of best fit through the (known) data ;</li> <li>2. and extending it to 2020 ;</li> </ol>	<b>ACCEPT</b> by extrapolation for 1 mark if neither mp 1 or 2 awarded	<b>(2)</b>

Question Number	Answer	Additional Guidance	Mark
<b>8(a)(iii)</b>	<ol style="list-style-type: none"> <li>1. idea that the {area of ice / data / eq} fluctuates ;</li> <li>2. idea of {factor / named factor} that decreases {global warming / greenhouse gases / eq} could change ;</li> <li>3. idea of {factor / named factor} that increases {global warming / greenhouse gases / eq} could change ;</li> <li>4. idea that trend could change ;</li> <li>5. idea that data collected a long time ago may not be accurate due to technology ;</li> </ol>	<p><b>1 ACCEPT</b> 2020 might be on a {peak / trough / eq}</p> <p><b>2 ACCEPT</b> idea that efforts are being made to decrease global warming</p> <p><b>3</b> e.g. volcanic eruptions, forest fires, albedo effect</p> <p><b>4</b> e.g. the ice melts (even) faster / the prediction assumes that the trend will not change</p>	<b>(3)</b>

Question Number	Answer	Additional Guidance	Mark
<b>8(b)(i)</b>	1. 53333 ;	<p><b>ACCEPT</b> 53 334</p> <p><b>DO NOT ACCEPT</b> with units</p>	<b>(1)</b>

Question Number	Answer	Additional Guidance	Mark
<b>8(b)(ii)</b>	<ol style="list-style-type: none"> <li>1. {energy / fat} content of {eggs / berries / caribou} is low compared to the seals ;</li> <li>2. idea that a lot of {eggs / berries} have to be eaten ;</li> <li>3. idea that there will not be enough {eggs / berries / food} to sustain the bears ;</li> <li>4. bears will starve ;</li> <li>5. idea that bears {will not build fat reserves / will freeze to death in the cold / eq} ;</li> <li>6. idea that foraging for food might use more energy than it supplies ;</li> <li>7. idea that bears will have less energy for reproduction ;</li> <li>8. idea that caribou may have sufficient {energy / fat} content maybe sufficient but bears do not eat many of them ;</li> </ol>	<p><b>1 ACCEPT</b> these food sources</p> <p><b>3 ACCEPT</b> competition / fighting / moving out of area</p>	<b>(4)</b>

