

Assessment Schedule – 2015

Biology: Demonstrate understanding of the responses of plants and animals to their external environment (91603)

Evidence

Q1	Evidence	Achievement	Merit	Excellence
	<p>Maggots moving away from light is an example of a negative phototaxis. A taxis is a movement towards or away from a stimulus with direction; in this case the stimulus is light.</p> <p>Flatworms increasing their rate of turning in response to a chemical stimulus without direction is an example of a kinesis. A kinesis is a random movement, which may increase in intensity, such as rate of turning in response to intensity of a stimulus, for example an increase in chemical gradient.</p> <p>The maggot, in turning its head and comparing the intensity of the stimulus on each side, is responding to the direction of the light stimulus, ensuring that it moves away from the light source. The light source is the stimulus for the directional response.</p> <p>The flatworm responds to a change in chemical gradient. The stimulus has no specific direction, but intensifies. The flatworm response is random, but involves turning, which will increase in frequency as the stimulus intensifies. As the movement is random, it is by chance that it touches the food to start feeding. Increased turning responses in the vicinity of the food are more likely to result in contact.</p> <p>The adaptive advantage for the maggot is that it will move away from light sources, which have the potential to dry out and overheat the maggot. Also, the maggot feeds on organic matter and needs to get inside it. This means its food supply will be in a dark area away from light. The negative phototaxis response is therefore an</p>	<p>Identifies and defines negative phototaxis E.g. a taxis is a movement that has direction, away from or towards a stimulus. (In this case movement of maggots away from light.)</p> <p>Identifies and defines klinokinesis E.g. increased intensity of movement or turning movement that has no specific direction and occurs in response to a non directional / diffuse stimulus. (In this case the rate of turning of the flatworms in response to the meat.)</p> <p>Describes an adaptive advantage of each behaviour: E.g. the maggot is able to move away from harmful light sources or towards food or towards shelter / safety. E.g. the flatworm is more likely to meet up with the food supply.</p>	<p>Explains each named behaviour and why they are different. E.g. the maggot shows a negative phototaxis, which means it is responding to light intensity, and moving directly away from the light stimulus.</p> <p>In comparison, the flatworm senses only the stimulus is present but not the direction of the stimulus. Instead it turns with increased intensity in a random manner, so that it is covering a larger area more thoroughly, instead of just swimming past. Reaching the stimulus is a chance event, unlike the directional movement of the maggot.</p> <p>Explains an adaptive advantage of either named behaviour. E.g. the maggot moves away from light and towards darkness as that is most likely where a food source will be. (Accept alternative explanations if reasonable, such as avoiding dehydration / desiccation / predation.)</p>	<p>Comprehensively explains and discusses the adaptive advantage of the named behaviours. E.g. the maggot shows a negative phototaxis, which means it is responding to light intensity and moving directly away from the light stimulus.</p> <p>The maggot moves away from light and towards darkness, as that is most likely where a food source will be.</p> <p>The adaptive advantages of this behaviour are that the maggot is more likely to encounter a suitable food supply AND find a place to feed that provides some protection from being seen by predators or drying out. (2 or more reasons)</p> <p>E.g. the flatworm shows a (kline) kinesis by turning with greater intensity in the area of the stimulus, but its movements are still random. It is more likely to come in contact with the food source as it is more likely to stay in the vicinity of the food, but it will still be by chance that it makes contact with it. The adaptive advantage is that the chance of encountering food by slowing and turning is increased, &</p>

	<p>advantage to the maggot in identifying potential food sources.</p> <p>When a flatworm senses the meat chemicals, it moves in random circles near to the chemical gradient, which is more likely to bring it into contact with the food source. By altering the direction of movement and covering more of the immediate area where the food supply is, there is a greater chance that it will come into contact with it.</p> <p>Both behaviours are innate responses (genetic) and have persisted because they have provided a selective advantage to the animals displaying them. These animals will be more likely to reproduce and will, in turn, pass on the behaviours and the adaptive advantages.</p>		<p>E.g. the flatworm stops swimming straight through, and the random turning slows it down and enables it to cover a larger area, so contact with food is more likely.</p>	<p>wasted energy not finding food is reduced. Therefore the chance of survival and reproduction increases.</p> <p>Makes comparisons between both behaviours.</p> <p>E.g. both behaviours are genetically determined and provide an adaptive advantage by either removing the organism from potential harm or enhancing the organism's opportunity to feed. Those organisms that display taxis and kinesis responses are more likely to survive and will pass on the behaviours and the adaptive advantages they provide.</p>
--	---	--	--	---

Not Achieved			Achievement		Merit		Excellence	
N0 = no response; no relevant evidence.	N1 = 1 partial point, e.g. one definition.	N2 = 1 point from Achievement.	A3 = 2 points.	A4 = 3 points.	M5 = 1 point.	M6 = 2 points.	E7 = 1 point.	E8 = 2 points.

Q2	Evidence	Achievement	Merit	Excellence
	<p>The gannet is a seasonal visitor, arriving to breed from August to March. At this time, birds re-establish pair bonds and cooperative behavior and claim territories on which to build nests.</p> <p>There will be intra-specific competition between gannets for nesting sites, and these will be defended by territorial behavior. They will bring food for their young, when hatched, and care for them over an extended period of time.</p> <p>The gannets will respond to an endogenous rhythm to migrate, usually triggered by a zeitgeber, which may be change in photoperiod or temperature. Day length is usually more reliable, as there are fluctuations in the temperature, and day-length is a more consistent cue. The birds prepare for migration by feeding well, storing fat layers (stored energy), and building up strength by flying. The day-length is detected by the pineal gland through the skin and feathers, which triggers a characteristic behaviour called a zugunruhe, migratory restlessness showing a readiness to fly, and flies for longer periods of time. The gannets must have a way of navigating the journey, such as magnetic navigation and or stellar navigation and solar navigation, to ensure that they make their journey and reach the destination. By navigating, the birds will leave an environment where seasonal conditions may mean that their food source is decreasing, and in the nesting sites the parasites are increasing, as well as the temperature, and climate is deteriorating and becoming less favourable. By migrating, the gannet will have to spend a large amount of energy, and the cost of migrating must be outweighed by the benefits.</p> <p>Because gannets have a low number of offspring and a</p>	<p>Migration behaviour described</p> <p>The mass movement of (organisms) gannets between New Zealand and Australia on a seasonal basis usually from breeding to non-breeding areas and back again, usually over long distances.</p> <p>Territoriality described</p> <p>Gannets actively defend their nesting sites by displays and vocalisations.</p> <p>E.g. intraspecific competition between gannets during the breeding season.</p> <p>Ensures a safe protected nest for the young.</p> <p>A place to breed.</p> <p>The gannet now has an area with which it can become familiar. It can learn where resources are (fish + water) and protection from predators.</p> <p>Pair bond described</p> <p>A pair bond is a stable relationship between animals of the opposite sex that ensures cooperative behaviour in mating and the rearing of young.</p> <p>Parental care described</p> <p>Only one chick is produced, but the parents invest considerable effort</p>	<p>Explanation of how identified behaviours are controlled or maintained.</p> <p>AND / OR</p> <p>explain the costs and benefits of the behaviours .</p> <p>Migration behaviour explained</p> <p>E.g. nesting gannets display migratory behaviour, where they respond to an endogenous rhythm that triggers their arrival in New Zealand for the breeding season and their return to Australia for the summer. Their migratory behaviour will be triggered by the action of zeitgebers, such as change in photoperiod or temperature.</p> <p>Costs and benefits explained</p> <p>Explains that:</p> <ul style="list-style-type: none"> • Benefits must outweigh the costs. • High cost of energy for migration, however the old site had low food resources (seasonal), parasites are high, and predators are high, which is a high cost of staying. • The new site is warmer and has a rich source of food; this provides a higher chance for 	<p>Discussion of how the combination of behaviours provides adaptive value to the gannets (links are made).</p> <p>E.g. There is intraspecific competition between the gannets as they seek the best possible nesting sites; and they are most likely territorial, defending their nest site against other gannets. This helps to ensure their breeding attempts are successful.</p> <p>Links between changing biological and environmental factors due to the migratory nature of nesting gannets and / or climate changes.</p> <p>Links to the seasonal food supply being able to support the energy required for parents and offspring as well as the reduction of parasites by migrating.</p> <p>Links formation of a pair bond in caring for the young, which reduces the amount of energy either parent would have to spend on their own, and this greatly increases survivorship of the parents and the offspring. This means that while one parent is off feeding, the other is looking after and protecting the young. Then returns and feeds the young, while the other parent then flies off to do the same. Links to greater parent care and therefore greater chance of survival of the young.</p> <p>This links to the resources that are found in the new site to be able to support the growth of the population.</p>

	<p>high investment of parental care, there is a greater chance of survival of the young. The young are often different colours from parents, which identifies them as a non-threat to other gannets and reduces aggression towards the young in terms of hierarchy.</p>	<p>and food reserves to increase the chances of survival of the young. Examples from migration may include:</p> <p>Benefits:</p> <ul style="list-style-type: none"> • favourable climate (especially temperature) and habitat (nest sites for breeding) • abundant food resources • reduces parasitism/predation • better breeding conditions • greater genetic mixing. <p>Costs:</p> <ul style="list-style-type: none"> • high demand of energy • could be blown off course in heavy winds • could get eaten by predator • become exhausted by using too much energy during the migration. • might get there and no food is available • might starve. 	<p>survival of the young. Etc.</p> <p>Territoriality explained</p> <p>This is an innate response that is genetically programmed and is a form of intraspecific competition. E.g. There is intraspecific competition between the gannets as they seek the best possible nesting sites, and they are most likely territorial, defending their nest site against other gannets. This helps to ensure their breeding attempts are successful. More healthy individuals better suited to the environment maintain the better sites, ensuring greater reproductive success. Birds that do not hold a territory will fail to form a pair bond and mate.</p> <p>Costs and benefits explained</p> <p>Better territories provide a higher chance of mating success, however the cost of maintaining a prime territory is a high cost of energy. Having a better nesting site may ensure higher chance of survival of young, as they are protected by all the surrounding nesting sites.</p> <p>Pair bond explained</p> <p>Displays that lower aggression of the gannet, which defends its territory and allows cooperation between opposite sexes for the raising and rearing of the young.</p>	
--	---	---	--	--

			<p>It is a way of communication and species recognition, and courtship displays and nest build may trigger ovulation.</p> <p>Costs and benefits explained</p> <p>Sharing in feeding and raising the young reduces the amount of energy required by either parent working alone. Higher chance of survival of the young.</p>	
--	--	--	--	--

Not Achieved			Achievement		Merit		Excellence	
NØ = no response; no relevant evidence.	N1 = 1 partial point, e.g. one definition.	N2 = 1 point from Achievement.	A3 = 2 points.	A4 = 3 points.	M5 = 1 point.	M6 = 2 points.	E7 = 1 point.	E8 = 2 points.

Q3	Evidence	Achievement	Merit	Excellence
	<p>Mutualism is the relationship between species where there is inter-dependence. They benefit each other.</p> <p>Predation is where one species feeds off another so that one benefits and the other is harmed.</p> <p>Interspecific competition is where two species compete for the same resource.</p> <p>Formation of fruit occurs after pollination and is an important survival process for <i>Fuchsia excorticata</i>, as it contains the seed until it is ready for germination. Seeds are produced from sexual reproduction and depend on pollination. Seed formation is important for the fuchsia, as it provides genetic variation and therefore adaptive advantages in changing environmental conditions. If the formation of fruit is low, then the formation of new seeds and new plants will also be low. Hermaphroditic (self-pollinated) plants do not provide genetic variation and have lower survival chances / fitness. For the birds, pollination is a consequence of their feeding from honey nectre.</p> <p>Visitation of pollinating birds is greater in the predator free forest, with 75 more s / 100 flowers / hour.</p> <p>Within the predator free forest, bellbird and tui visits are approximately equal, at approximately 40 s / 100 flowers / hour, whereas in forests with predator presence, only tui were observed and no bellbirds. Bellbirds may be more affected by predation. Similarly hihi are found in lower numbers visiting the fuchsias in the predator free forests (less than 20 s / 100 flowers / hour), but are absent from the other forest. Silvereye, however, are found visiting the fuchsia in the forest with predators but not in the predator free forest. Their numbers are very low however, at only approximately 18 s / 100 flowers / hour. They may therefore be</p>	<p>Defines the terms mutualism, predation, interspecific competition</p> <p>E.g.:</p> <ul style="list-style-type: none"> • Mutualism is the relationship between species where there is inter-dependence. They benefit each other. • Predation is where one species feeds off another so that one benefits and the other is harmed. • Interspecific competition is where two species compete for the same resource. <p>Describes a difference between the forests.</p> <p>E.g.:</p> <ul style="list-style-type: none"> • Pollination is higher in the pest free environment • Pollination reaches formation of fruit levels more frequently in the pest free environment • More bellbirds and tuis present in the pest free environment <p>(allow alternatives)</p> <p>Describes two key relationships</p> <p>E.g.:</p> <ul style="list-style-type: none"> • Tui and bellbirds receive nectar whilst the fuchsias are being 	<p>Explains the importance of formation of fruit in female fuchsias.</p> <p>E.g.:</p> <ul style="list-style-type: none"> • Pollination must result in formation of seeds or fruit for germination of seeds to happen. The female trees will produce seeds with greater genetic variety and through increased variation, better survival within a changing environment. <p>Compares outcomes for <i>Fuchsia excorticata</i> and native birds at the two sites.</p> <p>E.g.:</p> <ul style="list-style-type: none"> • Within the predator free site pollen scores are higher for female fuchsia with pollen scores of 2-3 for females and 2 for hermaphrodites. This means the female trees, which have greater variation, have greater success with seed formation. In the predated site, mean pollen scores are much lower at approximately 0.5 for females and 0.8 for hermaphrodites. Neither score is reaching the critical value, where pollination results in successful fruit formation. <p>OR</p>	<p>Comprehensively compares relationships between birds and birds and fuchsias, using relevant data.</p> <p>E.g.:</p> <ul style="list-style-type: none"> • When bird activity is recorded in a predator free forest environment and compared with that of a forest where predators are present, there is a significant difference between bird visits. In the case of <i>Fuchsia excorticata</i> this could affect survival in its forest environment. Visitation of pollinating birds is greater in the predator free forest, with 75 more s / 100 flowers / hour. <p>Within the predator free forest, bellbird and tui visits are approximately equal, at approximately 40 s / 100 flowers / hour, whereas in forests with predator presence, only tui were observed and no bellbirds. Bellbirds may be more affected by predation. Similarly hihi are found in lower numbers visiting the Fuchsias in the predator free forests (less than 20 s / 100 flowers / hour), but are absent from the other forest. Silvereye, however, are found visiting the fuchsia in the forest with predators but not in the predator free forest. Their numbers are very low</p>

	<p>affected by predation due to mammals or loss of habitat. They may be present in the predator free forests, but may not visit the fuchsia due to interspecific competition with the tui and bellbird.</p> <p>In the forest where predators are present, the hermaphrodite / self-pollinating trees show lower levels of pollination. (Pollen score of approximately 1.25 compared with 1.5) and below the index of 1.5 needed for successful formation of fruit. This suggests that the trees themselves are being predated or their pollen is being damaged, which will impact on mutualistic relationships with any birds.</p> <p>Tui and bellbirds show similar rates of activity around <i>F. excorticata</i> in the predator free forest, so that they are potentially competing for nectar and possibly nest sites. There will probably be some separation of their niches to reduce interspecific competition. This means that they might visit the fuchsia at different times or different areas and nest in different places.</p> <p>The relationship between the female <i>F. excorticata</i> and the tui and bellbird is mutualistic, where the birds obtain nectar as a food supply and the female trees are pollinated. This is of greater benefit to the fuchsia in the predator free forest where formation of fruit in female trees is higher and therefore more successful, resulting in higher seed production.</p>	<p>pollinated.</p> <ul style="list-style-type: none"> • There is interspecific competition between the tui and the bellbirds / hihi / silvereyes for nectar. • Birds are being lost from the Pirongia forest due to predation. 	<ul style="list-style-type: none"> • Tui and bellbirds have similar presence and visitations to fuchsia in the predator free area, but are far less commonly seen in the predated area. (40 s / 100 flowers / hr in the predator free area compared with 10s / 100 flowers / hr for tui, and no visits recorded for bellbirds in the predated area). The presence of predators appears to have a strong effect on their presence. Tui and bellbirds would compete for resources in the predator free forest, whereas the tui would face competition from silvereyes in the predated forest. Bellbirds and hihi appear to be most affected by predation, as there are no recorded visits to fuchsia in the predated forest. <p>Explains the relationship between Fuchsias and the birds</p> <p>E.g.:</p> <ul style="list-style-type: none"> • Mutualism between the fuchsia and the tui and bellbird provides pollination and increased survival chances for the fuchsia and food supplies (nectar) for the birds, enabling them to raise young. In predated forest areas, where bird numbers are reduced, reproduction of fuchsia will also reduce and so will the genetic variability of the trees. 	<p>however, at only approximately 18 s / 100 flowers / hour. They may therefore be affected by predation due to mammals or loss of habitat. They may be present in the predator free forests, but may not visit the fuchsia due to interspecific competition with the tui and bellbird.</p> <ul style="list-style-type: none"> • Female trees suffer from low pollination levels and low formation of fruit where there are low bird numbers. In the Pirongia forest, visits by tui and silvereyes are below 20 s / 100 flowers / hr. Visits by bellbirds and hihi were not recorded at all. Pollination levels are also very low, reaching a pollen score of only 0.5, which is well below the level of 1.5 needed for successful formation of fruit. The mutualistic relationship between bird pollinators and the fuchsia has broken down and fuchsia must rely on self-pollination of hermaphrodites, which will result in reduced variation and reduced fitness, threatening survival. <p>In the forest where predators are present, the hermaphrodite / self-pollinating trees show lower levels of formation of fruit (approximately 1.25 compared with 1.5) and below the pollen score index of 1.5 needed for successful formation of fruit. This suggests that the trees themselves are being predated or their pollen is being damaged, which</p>
--	---	--	---	---

				<p>will further impact on mutualistic relationships with any birds.</p> <ul style="list-style-type: none"> As well as mutualistic relationships between the bird pollinators and the fuchsias, there will also be interspecific competition between the birds themselves within the predator free forest. Bellbirds and tui visit the fuchsia in similar numbers (approx. 40 s / 100 flowers / hour). In order to co-exist there must be factors reducing competition between them and the birds are likely to feed in different ways, possibly at different levels and different times. The hihi will also be competing with bellbirds and tui, although its numbers are much lower, which suggests it does not compete as successfully as the others, and may have more specialised niches. Competition between silvereyes and tui within the Pirongia, where predators are present, may be less intense due to the numbers of bird visits recorded being very low, at under 20s / 100flowers / hour and the absence of other competitors.
--	--	--	--	---

Not Achieved			Achievement		Merit		Excellence	
NØ = no response; no relevant evidence.	N1 = 1 partial point, e.g. one definition.	N2 = 1 point from Achievement.	A3 = 2 points.	A4 = 3 points.	M5 = 1 point.	M6 = 2 points.	E7 = 1 point.	E8 = 2 points.

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 12	13 – 18	19 – 24