**M1.**(a) 1. Females are (generally) longer / larger / bigger / up to 115(mm) / males are (generally) shorter / smaller / up to 100(mm);

*Ignore: tall*

*Accept: females have a larger / 90 modal / peak / most common value <u>and</u> males have a smaller / 80 modal / peak / most common value*

*Accept mean length of females greater / mean length of males shorter*

*Reject: use of mean in relation to 80 mm or 90 mm*

*Reject: Most of the females are 90 mm long / most of the males are 80 mm long*

2. Females show a greater range / variation / males show a narrower range / variation.

*Accept: correct use of figures from the graph: the range of males is 50 to 100 <u>and</u> of females is 50 to 115 / the spread is 50 for males <u>and</u> 65 for females*

**2**

(b) (i) **2.6** to **2.7** = 2 marks;
Incorrect answer but evidence of a numerator of **24180 OR 156 × 155** <u>or</u> denominator of **9014** = 1 mark;

**2**

(ii) (Fewer plant species) − no mark

1. (So) few(er) habitats / niches;

*Ignore habitat size*

***Q** Neutral: fewer homes*

2. (So) lower diversity of <u>insects</u> / fewer <u>insect</u> species / fewer <u>insect</u> types;

***Q** Neutral: fewer <u>insects</u>*

*Accept less variety of <u>insects</u>*

3. (So) fewer food source<u>s</u> / less variety of food.

***Q** Neutral: less food*

*Ignore references to pesticides, farmers' actions, competition between lizards and evolution*

**3**

**[7]**

**M2.**(a) 4:

**1**

(b) 2.68(6).

*If answer incorrect:*
*Σn(n-1) = 242 = 1 mark*
*N(N-1) = 650 = 1 mark*

**2**

(c) 1. Take more samples and find mean;
2. Method for randomised samples described.

*Allow larger area = 1 mark*

**2**

**[5]**

**M3.**(a) Species richness measures only number of (different) species / does not measure number of individuals.

**1**

(b) Trees vary in height.

**1**

(c) 1. Index for canopy is 3.73;
2. Index for understorey is 3.30;
3. Index in canopy is 1.13 times bigger;

*If either or both indices incorrect, allow correct calculation from student's values.*

**3**

(d) 1. For *Zaretis itys*, difference in distribution is probably due to chance / probability of being due to chance is more than 5%;
2. For all species other than *Zaretis itys*, difference in distribution is (highly) unlikely to be due to chance;
3. Because P < 0.001 which is highly significant / is much lower than 5%.

**3**

**[8]**

**M4.**(a) 1. Draw grid over (map of) area;
2. Select squares / coordinates at random.

**2**

(b) 1. No emigration / immigration;
2. No losses to predation;
3. Marking does not affect survival;
4. Birth rate and death rate equal;
5. (In this case) all belong to one population.

**2 max**

(c) 1. Only glows brightly with UV, so doesn't make insects more visible;
2. So doesn't affect / increase predation;

***OR***

1. Glows brightly with UV marking visible;
2. So makes it easy to pick out labelled insects.

**2**

(d) 10 130.
Tolerance of ±1

$$N = \frac{M \times C}{R}$$ *= 1 marks*

**2**

(e) 1. Scientists removed large numbers of insects (which were not returned) from same area / same population;
2. Affecting ratio of marked to unmarked.

**2**

**[10]**

**M5.**(a) 1. Number of (individuals of) each species;
*Accept: 'population' for 'number'*

2. Total number of individuals / number of species;

*Accept: 'species richness'*

*MP2 allows for other types of diversity index*

**2**

(b) (i) (Shows) results are due to the herbicide / are not due to another factor / (to) compare the effect of using and not using the herbicide / shows the effect of adding the herbicide;

*Neutral: allows a comparison*

*Neutral: ensures results are due to the independent variable*

*Reject: 'insecticide'*

*Accept: 'pesticide'*

**1**

(ii) 1. (More) weeds killed **so** more crops / plants survive / higher yield / less competition;

2. High concentrations (of herbicide) harm / damage / kill / are toxic to crops / plants;

*Accept: 'pesticide'*

*Neutral: 'insecticide'*

*Accept: use of figures (eg 400+)*

**2**

(iii) 1. Reduced plant diversity / fewer plant species / fewer varieties of plant;

*Accept: 'weed' for 'plant'*

*Neutral: fewer plants*

*Accept: only one crop species remains*

2. Fewer habitats / niches;

***Q** Neutral: fewer homes / shelters*

3. Fewer food sources / varieties of food;

*Neutral: less food*

**3**

**[8]**

**M6.**(a) 1. No interbreeding / gene pools are separate / <u>geographic(al)</u> isolation;

*Accept: all marks if answer written in context of producing increased diversity of plants*

*1 Do not award this mark in context of new species being formed and then not interbreeding*

*1 Accept reproductive isolation as an alternative to no interbreeding*

2. Mutation;

*2 Accept: genetic variation*

3. Different selection pressures / different foods / niches / habitats;

*3 Accept: different environment / biotic / abiotic conditions or named condition*

*3 Neutral: different climates*

4. Adapted organisms survive and breed / differential reproductive success;

5. Change / increase in allele frequency / frequencies;

**5**

(b) Similar / same environmental / abiotic / biotic factors / similar / same selection pressures / no isolation / gene flow can occur (within a species);

*Accept: same environment*

**1**

**[6]**