A-Level Biology

Biodiversity

Mark Scheme

Time available: 75 minutes
Marks available: 54 marks

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Mark schemes

1. (a) Correct answer for 2 marks = 2.7;;
Accept for 1 mark,

$79 \times 78/6162$ in numerator (value of $N(N-1)$)

OR

2286 in denominator (value of $\Sigma n(n-1)$)

OR

22, 41, 14, 2 (correct readings of bar chart for all species)

OR

0.37 – 0.38 (correct calculation using correct numerator and incorrect figures
from bar chart: 22, 63, 77, 79)

2

(b) 1. Same number of (different) species (in both plots)

 OR

 (Both plots) have 4 species;

1

(c) 1. Determine the area of plot 1.

 2. Calculate (total) area of meadow;

 3. Divide area of meadow by area of plot;

 4. Multiply by number of beetles (per plot)/41;
 Accept multiply by incorrect figure taken from figure (eg 43)

4

[7]

2. (a) (Number of species and) number of individuals in each species (in each habitat)
OR
(Number of species and) population of each species (in each habitat);
 Accept organisms for individuals
 Ignore frequency.
 Accept abundance of each species.

1

(b) 1.   Random samples;

     2.   Large number (of samples)
           OR
           (Continue sampling) until stable running mean;

                    Both marks can be awarded on one line.

                    Ignore other answers unless they contradict mark points.

                    Accept many/multiple. Ignore several.

                    If a specified number is given, it must be 10 or more.

                    Accept 'large sample (size)'.

                    Accept organisms for individuals

                                                                              2

(c) (Larger fields have relatively)

     More centre
     OR
     Less edge
     OR
     Less hedge
     OR
     Fewer species;

                    Ignore removal of hedge (as given in stem).

                                                                              1

(d)   Advantage -

1.   Greater (bio)diversity **so** increase in predators of pests
OR
Increase in predators of pests **so** more yield/income/less pesticides/less damage to crops
OR
Increase in pollinators **so** more yield/income
OR
May attract more tourists/subsidies to their farm **so** more income (from diversification);

Disadvantage -

2.   Reduced land area **for** crop growth/income
OR
Greater (bio)diversity **so** increase pest population
OR
Increase pest population **so** less yield/less income/(more) need for pesticides/(more) damage to crops
OR
Increased (interspecific) competition **so** less yield/income
OR
More difficult to farm **so** less income;

Accept description of yield eg crop growth.

For 'crop' accept 'plant'.

*Accept other valid suggestions **with** explanation that will affect the farm as a whole.*

Examples of 'more difficult to farm' – can't use large machinery, more difficult to plough/seed/harvest.

2

[6]

3.   (a)   (A measure of) the number of (different) species in a community;

For 'community' accept 'habitat/ecosystem/one area/environment'

Reject 'in a population'.

1

(b) **Yes, natural best, because**

1.   Peak of (mean) bee numbers in natural habitat is highest;
        For accept description for 'peak'.

2.   The (mean) number of bees was higher in the natural habitat until day 200;
        2. For 'day 200' accept any day between 190 and 210.
        2. For 'until day 200' accept 'for 200 days'.

3.   (Mean) species richness in natural habitat higher at all times;

No, natural not best, because

4.   Lowest (mean) number of bees after day 220;
        4. For 'day 220' accept any day between 210 and 230.

Yes, town worst, because

5.   Peak of species richness higher in <u>both</u> natural and farmland

OR

Species richness lowest in town from day 125;
        For 'day 125' accept any day between 115 and 135.

No, town not worst, because

(Mean) species richness is lower in farmland until day 125;
        For 'day 125' accept any day between 115 and 135.
        For 'until day 125' accept 'for 125 days'.

7.   Similar (mean) number of bees to farmland;

OR

(Mean) number of bees lower in farmland until day 140;
        For 'day 140' accept any day between day 130 and 150.
        For 'until day 140' accept 'for 140 days'

General, no, because

8.   Index of diversity of bees not measured

OR

The number of bees of each species is not known;

4 max

(c) 1. Must not harm the bees
OR
Must allow the bee to be released unchanged;

2. Must allow close examination
OR
Use a key (to identify the species);

Accept method that allows close examination

Ignore references to DNA sequencing

Accept 'use photographs/specimens (to identify species)'

2

(d) 1. Collect at more times of the year **so** more points on graph/better line (of best fit) on graph;

Both suggestion and explanation is required for each mark point.

The explanation must relate to the graph.

2. Counted number of individuals in each species **so** that they could calculate index of diversity;

3. Collected from more sites/more years **to** increase accuracy of (mean) data;

For 'accuracy' accept 'representative'.

2 max

(e) 1. *A. chlorogaster* and *A. piperi* are more closely related (to each other than to *P. pruinosa*);

Must be a comparative statement.

Accept A. chlorogaster and A. piperi share a more recent/closer common ancestor (than they do with P. pruinosa);

Ignore references to A. chlorogaster and A. piperi not being related to P. pruinosa or not having a common ancestor with P. pruinosa.

2. Because they are in the same genus;

2

[11]

4. (a) 1. Only cleared and abandoned and introduction of non-native species make (significant) difference;

2. Because only (means of) these ± 2 SDs from zero / no change;

3. About same number / 4 to 3 increase or decrease (species) richness / biodiversity;

Accept converse for others

3

(b) 1. Non-native species out-competes / kills / eats / is a disease of native plants;

2. Some (populations of) native species become extinct (in the community);

2

(c) 1. Set up grid system with coordinates;

2. Place large number of quadrats (at coordinates) selected at random;

3. Count number of / estimate percentage cover of native plant in quadrats;

3. Repeat at same time each year (for many years);

3 max

(d) 1. Correct answer two marks – 0.0599;

1 mark for writing $\dfrac{\log e\,(SR2\,/\,SR1)}{Time\ in\ decades}$

Award 1 mark for answer of – 5.985 or 0.290

2

[10]

5. (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]

6. (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]

7. (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 sour<u>ces</u> / less variety of food.

Q Neutral: less food

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

3

[7]