Mark schemes

Q1.

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

79 × 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]

Q2.

(a) 3.8;
Accept figures that round down to 3.8 ie (3.81 to 3.84)
Ignore: number of decimal places.

1

(b) 1. (Index of diversity also) measures abundance / number /
population (size) of **each** species;
Ignore "total number of species" unqualified
Accept: every species for each species.

2.   (So useful because) may be many of some species
OR
(So useful because) may be few of other species;

2

(c) 1.   Movement of (floating) object over known distance **and** over
given time
OR
Time to fill container of known volume
OR
Use of data logging device;
Accept: digital device eg (digital) flow meter

1

(d)

Mark in paired statements.

Accept converse statements in context of site 2.

1.   Less food/prey at site 1;
More food/prey in site 2.

2.   (So more) mayfly starve;
(So) mayfly grow/ survive/reproduce.
OR
3.   Less oxygen at site 1;

4.   (So) less respiration/ATP/energy (for mayflies);
OR
5.   More predators/Anglers' Curse at site 1;

6.   (So more) mayfly killed/eaten/removed;
OR
7.   More competition at site 1;

8.   (So more) mayfly starve;

2

(e) Same size of area (sampled)
OR
Same size net/mesh
OR
Same sampling time
OR
Samples taken at same time of day/on same day;
Accept use of quadrat
Accept any other valid reason

1

[7]

Q3.

(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]

Q4.

(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]

Q5.

(a) 1.   Species = (A group of) organisms that are able to produce fertile offspring;

      2.   Species richness = the number of (different) species in a community;

          2.   Accept in a habitat / ecosystem / area

          2.   Reject in a population

          2.   Ignore 'types' unqualified

2

(b) 5;

1

(c) 1.   Number of individuals of each species not known;

      2.   **Almost** all (of sample A / the 68%) could be of the <u>same</u> species;

      3.   Two / other samples have a hig<u>her</u> number of species / hig<u>her</u> species richness but a low<u>er</u> number of individuals / fish;

      4.   Other samples may have more individuals of each species;

          2.   If not stated otherwise, assume MP2 relates to sample A / 68%

3 max

[6]

Q6.

(a) Correct answer of 4.92, 2 marks;

If N(N-1) = 3540, **OR** ∑n(n-1) = 720, then award 1 mark

      Accept 4.916 / 4.917 / 4.9

2

(b) 1.   A method of selecting sampling sites at random;

      2.   Use of quadrat;

      3.   Identify (plant) species (at site / in each quadrat)
OR
Count number of (different plant) species (at site / in each quadrat);

          1.   E.g. grid with coordinates selected using random number table

          2.   Frame or point

          3.   Reject refs to % cover, or counting individuals

3

(c) 1.   Significant increase in species richness on Islay and Colonsay

and (significant) fall on Harris;

2.   Change in diversity on Islay not significant;

3.   Greater than 0.05 / 5% probability of getting this change /
       difference by chance (on Islay)
       OR
       (For other differences) less than 0.001 / 0.1% probability of
       getting this change / difference by chance (for species richness
       on Colonsay, Harris, Islay)
       OR
       Less than 0.01/1% probability of getting this change/difference
       by chance (for diversity index on Colonsay, Harris);

       2.   *Accept converse about significance of*
            differences in other cases

       3.   *Reject **results** are due / not due to chance*

       3.   *Ignore refs to P unqualified*

                 3

[8]

Q7.

(a)

3	6	9
152	211	167

                 2

(b)   2.45

          Use of the correct denominator = 1 mark

                 2

(c)   1.   More plant species;

     2.   More food sources / variety of food;

     3.   More habitats / niches;
            Allow converse for barley field
            More food = neutral

                 3

[7]

Q8.

(a)   Any **two** valid reasons;

e.g.

1.   Increase in plant diversity leads to more <u>types</u> of food for animals;

2.   Increase in variety of animals leads to increase in predator species;

3.   Increase in niche / habitat

                 2 max

(b)　1.　Repeat soil sorting for different times and record number of species collected;

　　　2.　Find optimum time / time beyond which further sorting does not lead to increase in animal species found

2

(c)　1.　No data on number of individuals in each

species / diversity index $\quad = \dfrac{N\,(N-1)}{\sum n\,(n-1)}$

1

(d)　Principle:

　　　1.　Overlap of 2 × SD shows probability of differences (in means) being due to chance is greater than 0.95;
　　　　　　Allow converse of MP1
　　　　　　Credit MP1 wherever it appears

　　Agree:

　　　2.　No difference in number of earthworms and millipedes (per m^2)

　　　3.　No difference in number of species of centipedes or millipedes.

　　Disagree:

　　　4.　More beetles and woodlice in grassy strips;

　　　5.　More species of beetles, earthworms, woodlice in grassy strips.

4 max

[9]

Q9.

(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;

$$\frac{\log_e(SR2/SR1)}{\text{Time in decades}}$$

1 mark for writing

Award 1 mark for answer of – 5.985 or 0.290

2

[10]

Q10.

(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]

Q11.

(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]