

QUESTIONSHEET 1

- (a) (i) $\frac{84}{100} \times \frac{15}{100} \times 100 =$ and $\frac{16}{100} \times \frac{15}{100} \times 100 =$;
 12.6 ; 2.4 ; 3
- (ii) $\chi^2 = \frac{(78-71.4)^2}{71.4} + \frac{(6-12.6)^2}{12.6} + \frac{(7-13.6)^2}{13.6} + \frac{(9-2.4)^2}{2.4}$;
 (accept later stages of working if correct)
 = 25.42 ; 2
- (iii) $n = 1$; 1
- (iv) reject the null hypothesis;
 because calculated value is greater than the critical value;
 (allow consequential error if value from (ii) is incorrect) 2
- (b) generate random numbers from tables/by computer;
 use them as random coordinates for placing quadrats;
 use 1.0/0.5 metre² quadrats;
 no need to count numbers of plants/% cover, just need to record presence or absence;
 use standard method for recording plants which touch quadrat sides;
 comment on need for many replicates; max 5

TOTAL 13**QUESTIONSHEET 2**

- (a) (i) Total number of voles caught = 64;
 $\frac{64}{8} = 8$; 2
- (ii) $\frac{(7-8)^2}{8} + \frac{(9-8)^2}{8} + \frac{(10-8)^2}{8} + \frac{(10-8)^2}{8} + \frac{(8-8)^2}{8} + \frac{(7-8)^2}{8} + \frac{(2-8)^2}{8} + \frac{(11-8)^2}{8}$;
 (Allow later stages in working if correct)
 $\chi^2 = 7.0$; 2
- (iii) number of degrees of freedom = $8-1 = 7$; ($n-1$) 1
- (iv) accept the null hypothesis;
 since calculated value is less than critical value;
 thus there is a 95% probability that the discrepancy is due to chance alone/any equivalent statement; 3
- (b) use capture-recapture technique;
 mark captured voles with a (harmless) spot of paint and release;
 count number recaptured;
 to avoid counting recaptures twice mark with a second spot of paint before release;
 calculate the population using the formula,
 total population size = $\frac{\text{total number of marked animals} \times \text{total caught in sample}}{\text{number of marked animals recaptured}}$; max 4

TOTAL 12

QUESTIONSHEET 3

- (a) set up coordinate grid/use tapes along 2 sides;
generate random numbers for co-ordinates;
co-ordinate indicates centre of sampling quadrat;

max 2

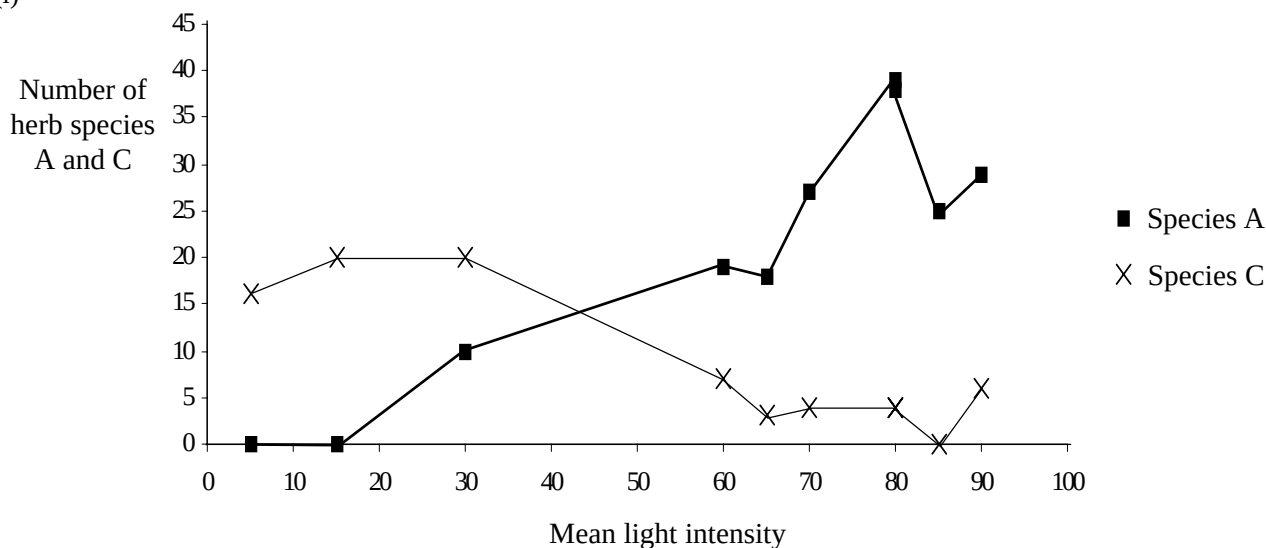
- (b) Advantage:
unbiased/allows statistical testing;

1

- Disadvantage:
coverage may be uneven/unrepresentative/large areas may be missed;

1

- (c) (i)



- correct axes (light intensity on x-axis);
suitable scale;
accurate plotting;
joining points with a ruled straight line; (IOB recommendations)
key/curves labelled;

5

- (ii) number increases as average light intensity decreases/converse; **1**
- (iii) shade tolerant/loving plant/able to photosynthesise efficiently at low light intensities/low compensation point; **1**
- (d) thinner epidermis;
large/many chloroplasts;
chloroplasts concentrated towards upper/adaxial surface;
high chlorophyll concentration;
larger leaves;

max 2**TOTAL 13**

QUESTIONSHEET 4

- (a) as pH increases, so does number of species/increase in acidity reduces number of species/converse; 1
- (b) stream pH may be influenced by point sources of acids/may change over short distances;
need to obtain representative value/minimise effect of anomalous values; 2
- (c) may influence ion activity eg $\text{Ca}^{2+}/\text{Al}^{3+}$;
may influence solubility of toxins/metals;
may effect physiology/named process in a species/enzyme action may be inhibited/enhanced; max 2
- (d) temperature;
light intensity;
concentrations of metals;
oxygen concentration; max 2
- TOTAL 7**
-

QUESTIONSHEET 5

- (a) (i) random sampling/random quadrats; 1
- (ii) line transect/line sampling; 1
- (b) (i) effectively increases length of growing season;
greater photosynthesis;
increased growth/yield/profit; max 2
- (ii) inhibits branches/encourages apical growth;
reduces light reaching ground/reduces growth of ground flora/competition; 2
- TOTAL 6**
-

QUESTIONSHEET 6

- (a) the number of organisms of a species in one area at one time; 1
- (b) $N = \frac{66 \times 54}{16}$; = 222.75; (accept 222 - 223) 2
- (c) marking does not affect probability of recapture;
marking persists over trapping period/marks do not wear/wash off;
the population remains constant over the sampling period;
the samples constitute an accurate cross section of the population/sexes/ages etc; max 3
- TOTAL 6**

QUESTIONSHEET 7

- (a) will not provide a random sample;
because of 'handedness'/subjectivity/bias/differences between samplers' throwing ability; 2
- (b) set up grid using tapes at right angles/along two sides of lawn;
generate random/numbers for use as co-ordinates;
using accurate technique e.g. computer/tables;
place quadrat at intersection;
count number of dandelions in the quadrat;
repeat at least 10 times and calculate the mean density per quadrat area;
calculate daisy population in total lawn area; max 5
- (c) (i) total area = $25 \times 30 = 750 \text{ m}^2$;
1 % sample = 7.5 m^2 ;
area of quadrat = $0.50 \times 0.50 = 0.25 \text{ m}^2$;
number of quadrats required = $\frac{7.5}{0.25} = 30$; max 3
- TOTAL 10**
-

QUESTIONSHEET 8

- (a) 39.1; 1
- (b) collect more leaves at each height/point;
collect equal number of leaves at each height/point;
use more than one tree;
measure light intensity at each point;
repeat at different times of day/different days; max 3
- (c) lay leaf flat on graph paper and draw round margin;
count up total number of squares included;
count up total number of $\frac{1}{2}$ squares included and add into total;
multiply by two to get total surface area (both sides of leaf); max 3
- TOTAL 7**
-

QUESTIONSHEET 9

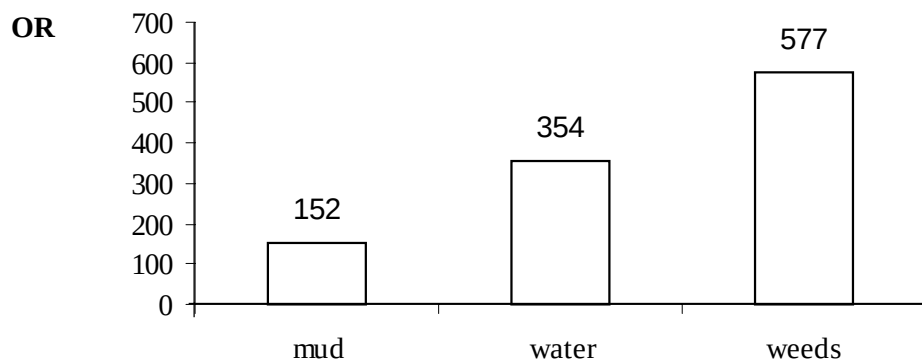
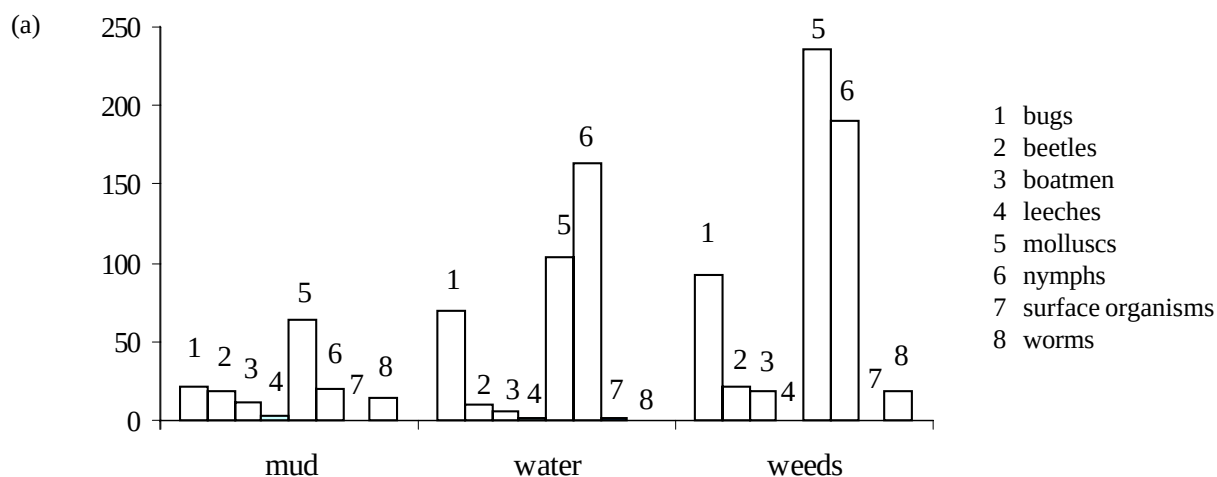
- (a) (i) Any three of:
insufficient seeds/
lack of replicates/
uneven spacing/
growth confused with germination/
only used one acid/
use of tissue paper rather than soil/
only one watering;;; 3
- (b) unsuitable pH may inhibit enzyme action;
ref diastase which mobilises starch reserves/proteases which mobilise protein reserves;
may inhibit gibberellin secretion (and so enzymes are not activated); max 2
- TOTAL 5**

QUESTIONSHEET 10

- (a) relative abundance/population density; 1
- (b) Biotic: max 2
 predators; food supply; human activity;
- Abiotic: max 2
 temperature changes; inundation/tidal covering; exposure/wave action/turbulence; varying salinity/dehydration;
- (c) (i) L. neritoides can withstand dessication/exposure to air/temperature change; 2
 L. littoralis requires constant cover by seawater/spray/cannot withstand dessication;
- (ii) Nucella lapillus is found all over the shore since it can feed on all species of periwinkle/limpet; 2
 particular Littorina sps. only found on specific areas of the shore;
- TOTAL 9**
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QUESTIONSHEET 11

- (a) Advantage: 1
 allows (parametric) statistical treatment/unbiased;
- Disadvantage: 1
 may give unrepresentative/clumped/sample/large areas may be missed;
- (b) select defined area/population; max 5
 description of measurement of Pleurococcus e.g. grid on transparent acetate/plastic;
 suitable grid size/1 cm² grid squares;
 random selection of sampling area on trees;
 record of percentage cover (green colouration);
 elimination of other variables e.g. age/species/condition of trees or equivalent;
 calculation of mean values/need for sufficiently large sample;
- (c) more sunlight so more photosynthesis; 2
 thus more growth/cell division;
 higher temperatures mean faster enzyme action/more photosynthesis;
- TOTAL 9**

QUESTIONSHEET 12

axes labelled;
suitable scale;
correct plotting;
key;

4

(b) Any two of:
unequal sampling intensity/unequal sample sizes/only part of microhabitat sampled;

2

(c) weeds provide cover/place to hide from predators;
weeds provide food for herbivores;
higher O₂ tension around weeds;

max 2**TOTAL 8**