Biodiversity and the Environment

7. BIODIVERSITY AND ENVIRONMENT

Candidates should:

(a) use quadrats to investigate the abundance of species e.g. a comparison of different sides of a hedge or mown and unmown grassland.

(b) obtain first hand data to understand how transects can be used to measure changes in the abundance and distribution of species e.g. seashore.

Possible investigations: 'Biodiversity in your backyard'.

(c) understand the principles of sampling, the need to collect sufficient data and use of appropriate statistical analysis. (Details of statistical tests are not required.) Understand the principles of capture/recapture techniques including simple calculations on estimated population size.

(d) understand what is meant by biodiversity, the variety or number of different species in an area, and why it is important. Investigate the ways in which biodiversity and endangered species can be protected including issues surrounding the use of legislation. Understand the need for and issues associated with the collection of reliable data and ongoing environmental monitoring. Appreciate how mathematical modelling can be used to analyse environmental interactions and predict trends.

(e) investigate the use of biological control agents and the introduction of alien species and their effects on local wildlife. Understand the issues surrounding the use of biological control agents and how the approach to using this method of control has changed as requirements for detailed research and scientifically based trials and analysis are now more fully understood.

Possible investigations: evaluating methods of pest control

Counting species

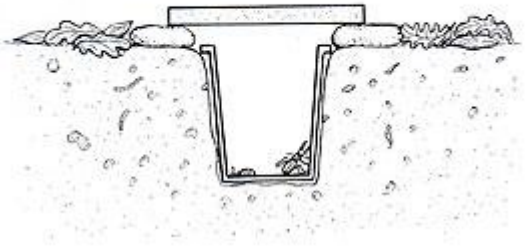
Why do we need to do this?

- Count numbers of species
- Observe changes in numbers of species
- Observe the distribution of a species

How can we count living organisms?

- Nets and pooters
- Pitfall traps
- Quadrats
- Capture / recapture

Pitfall trap



Calculating population sizes

$$\text{Population size} = \frac{\text{Number in first sample} \times \text{number in second sample}}{\text{Number in second sample previously marked}}$$

For example, 10 animals were trapped, marked and released. Two days later, 20 animals were trapped. Of these, 5 were found to be marked.

Population size = $10 \times 20/5 = 200/5 = 40$

Counting a species

- Counting using any of these methods is an estimate only
- The greater the sample size, the more accurate your estimate of the population size will be. Not practical to catch them all.
- Sample area
- A typical quadrat is 1 m × 1 m, or 1 m2. Its area might be small compared to the area of a field.

- When using a quadrat:
- It should be placed randomly so that a representative sample is taken
- The validity and reproductibility of the results increases as the results from more quadrats are analysed

Capture/recapture

Counting a species by capturing it, labelling it, or attaching an electronic device. Then recapturing it to take measurements or simply count the species

Tagging a species may make it more vulnerable to a predator, it could be more visible with a collar / tag / painted marker.

Capture/recapture

You are assuming:

- There is no death, immigration or emigration
- The sampling methods used are identical
- The marking has not affected the survival rate of the animals

Questions

- Why do we need this data?
- *Monitor species numbers – identify at risk endangered species, identify any pollutants or human activity that may be a cause*
- How can we increase the reliability of the data we record?
- *Random sampling, lots of repeats, ensure the technique used is the same and that the technique itself isnt affecting the population*

9. There are several methods of sampling animals or plants in their natural habitats.

(a) State two limitations of random sampling methods. [2]

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(b) During an investigation into numbers of trout in a lake, a method of capturing the trout, marking them with a harmless dye, and then recapturing them was used.

(i) In this investigation, what data would you need to record and how could it be used to estimate the size of the trout population? [4]

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(ii) When using such a capture-recapture technique to estimate population size, what assumptions are being made about

(I) the effect of marking individuals; [1]

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(II) movement of individuals into the area studied? [1]

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9. (a) Does not account for clumping / may miss a species / some areas left unsampled or sampled more than once. (Any 2) [2]

(b) (i) Record: the number of trout captured and marked in the first sample/initially; (x) [1]
the total number of trout caught in the second sample/recaptured;(y) [1]
the number of trout recaptured/in the second sample which were marked. (z) [1]

Appropriate formula for calculating estimate of population – X *x* Y / Z

(ii) (I) Marking does not affect or make animals more conspicuous to predators / does not affect chances or probability of being caught [1]
(II) It assumes that immigration rate is same as/balanced by
emigration rate [1]

9. There are several methods of sampling animals or plants in their natural habitats.

(a) State **two** limitations of random sampling methods. [2]

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(b) During an investigation into numbers of trout in a lake, a method of capturing the trout, marking them with a harmless dye, and then recapturing them was used.

(i) In this investigation, what data would you need to record and how could it be used to estimate the size of the trout population? [4]

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Biodiversity

Variety and number of a species in an area

How can we support Biodiversity?

- Protecting species
- Legislation – use laws to protect a species
- Reliable data and monitoring
- Mathematical modelling using computer programs

Why is Biodiversity important?

- Provides food
- Potential of new food
- Industrial materials
- New medicines

Ecosystems

Help regulate the environment of living organisms

- The atmosphere
- Water supply
- Nutrient cycles
- Provide fertile soil

Factors affecting Biodiversity

- Habitat destruction
- Building
- Quarrying
- Dumping
- agriculture

What measures are in place to ensure Biodiversity

Biodiversity and endangered species are conserved and protected by:

- Convention on International Trade in Endangered Species
- Sites of Special Scientific Interest
- Captive Breeding programmes
- National parks
- Seed banks
- Local biodiversity action plans
- Simulation of environmental interactions using computer programs

Alien species

The accidental or deliberate introduction of a species into an area where is does not naturally occur.

Effects of alien species

- Alien species may grow faster than the native species
- May upset the ecosystem
- Native system may not be able to compete e.g. Japanese knotweed

How we can control a pest

A pest is any living organism that is not deemed useful or hinders the growth of a more desirable or native species

How can we control pests?

- Biological control is the use of one species manage the growth of another species.
- Natural predators exist in nature and this ensure a balanced ecosystem
- Alien species can upset the balance and research exists to address this imbalance

Japanese Knotweed

An example of an alien species

Imported as an ornamental plant

A large and vigorous invasive plant

Has no natural enemies in Britain

How can we tackle Japanese knotweed?

- The use of an insect to control the knotweed?

Before this is implemented:

Detailed research and trials are needed to assess the effects of introducing biological control

The method of pest control must be evaluated thoroughly