Steps in Biological Investigations

By this stage, you will have completed many of the early stages of your investigation. Now is a good time to review what you have done and reflect on the biological significance of what you are investigating. Review the first page of this flow chart in light of your findings so far. You are now ready to begin a more in-depth analysis of your results. Never under-estimate the value of plotting your data, even at a very early stage. This will help you decide on the best type of data analysis (see opposite).

Photos courtesy of Pasco

Observation

Something ...

- Changes or affects something else.
- Is more abundant, etc. along a transect, at one site, temperature, concentration, etc. than others.
- Is bigger, taller, or grows more quickly.

Pilot study

Lets you check ...

- Equipment, sampling sites, sampling interval.
- How long it takes to collect data.
- Problems with identification or other unforeseen issues.

Research

To find out ...

- Basic biology and properties.
- What other biotic or abiotic factors may have an effect.
- Its place within the broader biological context.

Analysis

Are you looking for a ...

- **Difference**.
- **Trend** or relationship.
- **Goodness of fit** (to a theoretical outcome).

Be prepared to revise your study design in the light of the results from your pilot study

Variables

Next you need to ...

- Identify the key variables likely to cause the effect.
- Identify variables to be controlled in order to give the best chance of showing the effect that you want to study.

Hypothesis

Must be ...

- Testable
- Able to generate predictions

so that in the end you can say whether your data supports or allows you to reject your hypothesis.

START HERE

What kind of data are you recording?

Measurements or counts

Calculate **mean** and 95% **CI** from replicates

What kind of test?

Testing for a **relationship** between variables

Trend

Plot a **scatter** graph

Finding how one factor affects another

Regression

Linear: The data plot in a straight line (uncommon biologically). **Example**: clutch size vs body size in *Daphnia*.

Non-Linear: The data do not plot in a straight line (i.e. curved). **Example**: oxygen consumption at different temperatures.

Testing for a correlation

Normal data

Pearson correlation coefficient

Example: Wing length vs tail length in birds.

Non-normal data

Spearman correlation coefficient

Example: Frequency of occurrence of different species at two sites.

Testing for a **difference** between groups (e.g. habitats or treatments)

Difference

Plot a **bar** graph

More than two groups of data

ANOVA (Analysis of variance)

Example: Survival of weevils in different pasture types.

Two groups of data

Normal data

Same individuals

Paired *t*-test

Example: Comparison of ratios of arm to leg length in chimpanzees and gorillas.

Different individuals

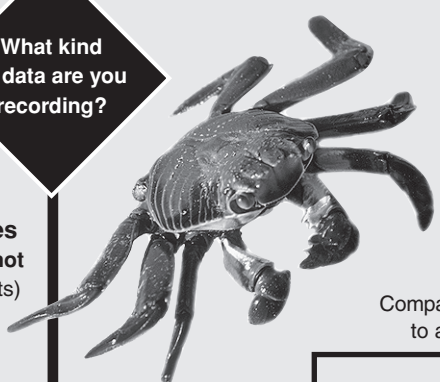
Unpaired *t*-test

Example: Suitability of clay pots and plastic pots for plant growth.

Non-normal data

Mann-Whitney *U*-test

Data must be **ranked** in order of increasing size. **Example**: Size of fruit from a plant species grown in two different habitats.



Frequencies (counts only, **not** measurements)

Test for goodness of fit

Comparing observed counts to an expected count

Chi-squared test

Example: An expected genetic ratio, or preference for different habitats.

Testing an association between groups of counts

Chi-squared test for association

Example: Association of one plant with another in an area.

Key to Abbreviations:

CI = confidence interval