

Invertebrate Collection Manual



A guide to traditional invertebrate collection methods



Introduction

The **Invertebrate Collection Manual** was created by Matthew Bulbert, John Gollan, Andrew Donnelly and Lance Wilkie.

Illustrations were prepared by Lance Wilkie. Images provided by Matthew Bulbert, John Gollan, Gareth Carter. All images, illustrations and text copyrighted to the Australian Museum, 2007.

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Scope of the document:

BugWise Invertebrate Collection Manual has been prepared by Australian Museum staff who work on invertebrate behaviour, taxonomy and ecology. The manual is designed for individuals or groups that wish to collect invertebrates and is an introduction to various collecting techniques. It is hoped the information provided in the guide will aid initial decision making and planning to ensure a successful project. It is important to note that there are many variations on each technique, so it may be necessary to conduct further reading to ensure you meet specific needs of your project.

Each method provides details on:

- the collecting technique;
- a list of the minimum number of items required to execute the technique;
- the groups that are most likely caught by the specific method;
- and some tips on the execution of these techniques, potential problems and a brief statement on approaches needed to standardise your collecting method.

It is important that you read these last sections carefully before commencement as there have been plenty of projects that have failed to meet their goals due to poor planning and a lack of consideration of these issues. Remember invertebrates are animals so it is important to be rigorous in your approach and to make sure the purpose for collecting the invertebrates is justifiable.

If you wish to comment on Invertebrate Collection, please visit our site at www.australianmuseum.net.au/bugwise and either email us or post a comment on the forum.

On the website, you will also find detailed information about other invertebrates and their role in the environment via links on the BugWise resources page.

Happy hunting!

The BugWise Team

Introduction to collecting:

There are two broad categories in which all collecting methods can be placed; passive sampling and active sampling. Passive techniques use sampling devices left in the field to collect material without the collector present. Active sampling involves direct collection of specimens by the collector.

Passive techniques are generally preferred in studies that aim to document the biodiversity in any given area. This is primarily because they maximise return for the minimum amount of effort and secondly because they are easy to standardise. The latter is essential if the data is to be statistically analysed. The most commonly used collection techniques are:

Passive techniques:

- Pitfall trapping
- Leaf litter extraction
- Yellow pan traps
- Flight intercept traps



Active techniques:

- Hand collecting
- Beat sampling
- Sweep sampling
- Chemical knockdown
- Light trapping



1. Pitfall Sampling.

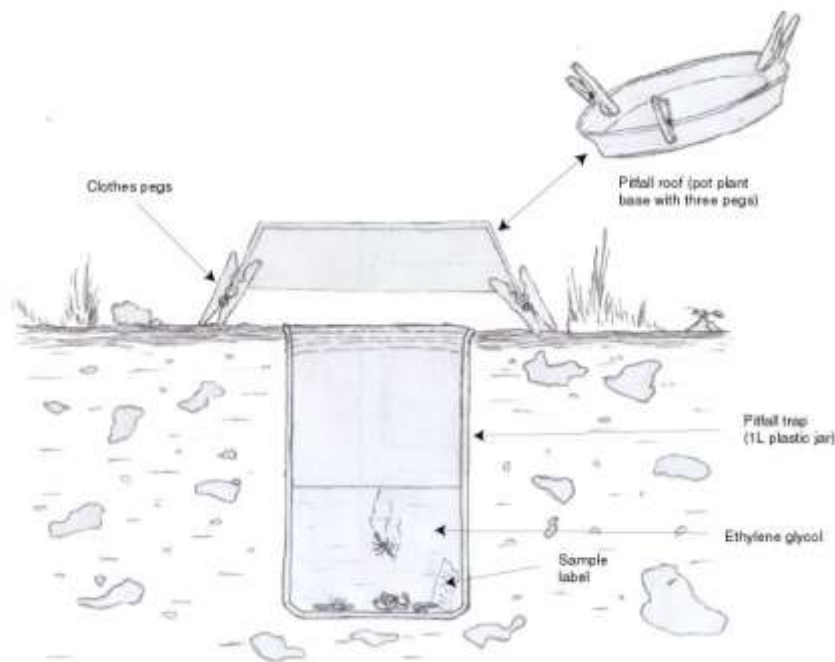
This is the most commonly employed sampling technique in biodiversity inventories. It is used for collecting invertebrates that move along the ground but do not underestimate its ability to collect flying invertebrates especially if the trap is baited.

You will need:

- Equal size jars or plastic containers (diameter 5-10cm) with screw on lids, the tighter the seal the better.
- A spade, trowel or auger
- Preservative e.g. propylene glycol
- Gloves
- Detergent (break up surface tension)
- Plant pot base 'roof'
- Clothes pegs

Method

Partially fill a jar with a form of preservative fluid (e.g. propylene glycol) sink it into the ground so that its rim is flush with the surface of the ground. Invertebrates that are active on the ground fall into the trap are killed and preserved by the fluid. Place a 'roof' over pitfall, to protect the trap from rain or debris. The pitfalls may also be baited to attract particular groups of invertebrates for example dung to attract dung beetles.



Most likely to catch

Ants, spiders, beetles

Tips

Put out more than one pitfall trap at each site. Mark location of each pitfall with flagging tape so you can find the trap. Make sure the rim of the pitfall is flush with the ground; some walking invertebrates have aversions to walking down or up a slope. When digging the holes transfer the dirt onto pot plant base (used for making roof) as this dirt will be later used to fill around the pitfall. If the ground is rocky it may be necessary to fill around the pitfall with stones before replacing the dirt.

Pitfall Trap

Problems

Pitfall traps may catch small vertebrates (referred to as by-catch) including, lizards, frogs and mice. Small pitfall traps (diameter 5-10cm) or grids placed across pitfalls can be used to minimize the amount of by-catch. Send any caught to local museum.

Possible strategies to standardize technique

Use the same number and size of pitfall traps at each location and make sure the traps are out for the same period of time. The museum commonly used a Quincunx pattern when arranging the pitfalls.

2. Yellow pan traps.

Yellow pan traps are essentially similar in concept to pitfall traps, but are mainly used to catch flying insects. The collection fluid attracts insects in search of water but more specifically many wasps and certain flies are attracted to the colour yellow, which is essential for the method.

This is an example of a pan trap. It is a common yellow picnic bowl secured to the ground with a skewer and partially filled with saline. It has caught a number of flying insects attracted to the colour and the liquid.



Yellow pan Trap

Method

Partially fill a yellow coloured plastic bowl or lipped tray with collecting fluid. The pan is then placed on the ground. It's important you add one or two drops of detergent to reduce water tension. After the collecting period sieve the catch to remove the liquid and then transfer the contents to a long-term storage preservative such as ethanol. A fine nylon mesh placed in a pasta strainer or tea strainer is good for transferring the catch to the preservation fluid.

Most likely to catch

Flies, small wasps, and certain groups of flying beetles.

Tips

It is advisable the trap be left for no more than 24 hours. This is because they are generally easy to disturb and secondly the saline water will evaporate, especially in hot conditions.

If the pan is light weight it may be necessary to stake it to the ground with skewers or anchor it with a rock if the conditions prevent the use of skewers.

Avoid using yellow pans near obvious burrows as rabbits and wombats enjoy destroying yellow pans.

Problems

Pan traps can attract other animals that investigate the water.

Possible strategies to standardize technique

Use the same number and size of pan traps at each location and make sure the traps are out for the same period. Yellow pans often arranged in lines equally spaced.

You will need:

- Yellow coloured plastic pans e.g. plastic picnic bowls or any kind of tray with high sides e.g. baking tray, making sure that all trays used for the one sample are the same size.
- Collection fluid for pan – ideally salty water
- Detergent (break up surface tension)
- Preservative for catch e.g. 80% ethanol (preferably in a squeeze bottle)
- Collecting jars or sample vials
- Sample labels – including date, collectors name, location (locality name and latitude and longitude co-ordinates if possible)
- Flat-headed tweezers
- Sieve e.g. pasta strainer, tea strainer, nylon mesh

3. Flight Intercept Traps.

A variety of intercept traps have been designed to catch flying insects but all work on the same principle, that is an insect's flight is impeded and in the process the insect is channelled into a container with preservative.

You will need:

- Flight intercept trap
- Preservative for collecting container or trough eg propylene glycol or saline water
- Detergent (break up surface tension)
- Collecting jars or sample vials
- Sample labels – including date, collectors name, location (locality name and latitude and longitude coordinates if possible)
- Flat-headed tweezers

Method

Flight intercept traps can be erected or hung anywhere. To maximise your catch though they are usually placed along probable insect flight paths. Likely flight paths include locations such as forest edges, riverbanks, trails in forests, and little open gullies. Simple flight intercept traps are made of a rectangular screen of fine mesh or clear plastic, suspended in likely "flight paths" of insects. Flying insects encounter this obstacle and those that drop towards the ground are collected in a trough containing preservative.

There are more sophisticated flight intercept traps such as the Malaise trap. It is basically a three-sided tent made of a fine mesh that is black on the walls and white on the roof. The roof is sloped upwards from the front to the back and comes to a funnel-like apex. At the apex is a sample vial containing preservative. Flying insects strike the walls and move up (this is aided by the black walls and white roof - many flying insects move instinctively towards light). They are gradually funnelled into the sample vial.



A sophisticated flight intercept trap called a Malaise trap. The insects fly into the dark mesh and move up towards the light mesh which eventually tapers to a collection container seen at the top left.

Most likely to catch

Flying insect groups such as beetles, bugs, flies, wasps, bees, moths and butterflies, dragonflies.

Tips

Use in conjunction with yellow pan traps and pitfall traps to achieve the most comprehensive survey.

It is advisable to put a dash of detergent in collecting device to reduce surface water tension.

Problems

Malaise traps tend to be quite expensive. They also catch many, many insects so post catch processing issues need to be addressed.

Possible strategies to standardize technique

Ensure the time each trap is left out is similar, use multiple traps at each location.

4. Hand collecting.

This is the simplest (and most active) sampling technique for collecting invertebrates.



Hand collecting can be done anywhere; here the collector is scooping water bugs into a vial.

You will need:

- Collecting jars or sample vials
- Preservative (preferably in a squeeze bottle) e.g. 80% ethanol.
- Sample labels – including date, collectors name, location (locality name, and co-ordinates if possible)
- Forceps or Flat-headed tweezers
- Artists paintbrush
- Head torch (if collecting at night).
- Anything to aid collection such as an aspirator.

Method

Look for and collect invertebrates by hand (using forceps or flat-headed tweezers). Hold invertebrates in a sampling jar for identification. Depending on their mobility, some species will be easier to catch than others. Slow-moving invertebrates may simply be grasped with the forceps, or brushed into the sample vial with a paintbrush. More active species can be caught by placing the sample vial over them. Once the specimen(s) have been transferred to a vial, preservative and a sample label are added.

Most likely to catch

Possibly any invertebrate.

Tips

Good areas for collecting invertebrates include: under logs and rocks, tree trunks (above and beneath bark) and on leafy vegetation. Sampling at night will often produce a very different suite of species than if you only sample during the day. Try to avoid using your hands as there are many invertebrate mimics, with some potentially providing nasty stings.

Problems

It is very difficult to compare sites using this method, as collection effort will vary among different collectors. Inherent differences in habitats will also make it easier or harder to collect.

Possible strategies to standardize technique

Standardize effort by having a set 'total search time' for each site. Being consistent about the type of habitats searched (e.g. only under logs) will also standardize surveys (these all depend on your question).

5. Beat sampling.

This is the most widely used technique for collecting invertebrates associated with plants. It may be used to sample any part of the plant including branches, leaves, flower heads and even dead wood.

You will need:

- Collecting jars or sample vials
- Preservative e.g. 80% ethanol (preferably in a squeeze bottle)
- Sample labels – including date, collectors name, location (locality name and co-ordinates if possible)
- Artists paintbrush
- Sturdy stick for beating vegetation.
- A beating net / tray.
- An aspirator/pooter



An apparatus used to collect insects from a beating tray called a 'Pooter' or an aspirator (above). A collector, beat sampling a small shrub with a sturdy stick and a beating tray (left).



Method

Hold a beating tray underneath the plant part under investigation, knock it firmly with a sturdy stick, and collect the invertebrates that fall into the tray using a 'pooter'. After all specimens have been transferred to the sample vial, a sample label is added and the vial sealed.

Most likely to catch

Beetles, bugs, ants and spiders

Tips

It is a good idea to have a collecting jar handy to capture invertebrates too big for the pooter. Spiders have a tendency to spin webs in the pooter so it is advisable to transfer the specimens to the preservation fluid as soon as possible after collecting.

Invertebrates that can fly or jump will quickly disappear from the beating tray so a very keen eye and a quick hand is required. It is also a good idea to start using the pooter around the upper edges of beating tray as these invertebrates are likely to escape first.

Problems

Impossible to do when it is windy or foliage is wet. It can be difficult to transfer specimens from the pooter to the collecting jar. Inconsistencies in sampling effort among collectors can be a problem. For example, tall people may beat regions of a plant that a shorter person cannot reach. If the technique is to be used to compare sites, care must be taken to 'standardize' samples.

Possible strategies to standardize technique

Decide on how many times each branch should be struck, the time taken per plant and the sites targeted on a plant (these all depend on your question).

6. Chemical Knockdown.

This technique is used for collecting invertebrates from plants.

You will need:

- Safety equipment used to avoid contact with chemicals and inhalation.
- Collecting jars or sample vials
- Knockdown chemical – usually a spray
- Preservative eg 80% ethanol (preferably in a squeeze bottle)
- Sample labels – including date, collectors name, location (locality name and latitude and longitude co-ordinates if possible)
- Artists paintbrush
- Sturdy stick for beating plant.
- Collecting trays (we used 400mm pot plant bases), plastic groundsheets, common sheets (white generally the best) or beating tray
- Clear plastic sheets to place over plant area to be treated

Method

Cover or wrap all or part of the plant under investigation. Then apply a knockdown chemical to the plant. Collect the invertebrates as they fall by placing a sheet or tray under or around the area that is to be treated. After initial collection, it is a good idea to beat or shake the plant to dislodge any remaining invertebrates. There are many variations on this basic method with varying levels of sophistication, labour and expense. Simple 'knock down' techniques use household insecticide spray, while the more complex methods used for sampling whole trees require 'mistifiers' or 'foggers'.

Most likely to catch

Beetles, bugs, spiders, mantids.

Tips

Carry out early in the morning when flying invertebrates are more sluggish. Chemical knockdown is a very productive technique in terms of the number of specimens retrieved from a single plant.

Be sure to obtain the appropriate knockdown chemical as some are much healthier for the environment and us than others.

Problems

Very weather dependent, and is unsuitable in wind and rain. Can be difficult and time consuming to collect specimens by hand from tray or drop sheet.

7. Sweeping.

This is a technique for collecting flying invertebrates. It may be employed to catch insects "on the wing", but it is generally more effective when used to catch them at rest on the ground, on rocks, or on plants. It is particularly good for collecting insects from grass or low-lying herbs and shrubs.

You will need:

- Collecting vials
- Preservative (preferably in a squeeze bottle) e.g. 80% ethanol
- A sweep net - net with tough, fine mesh and moderate length handle. It is not recommended to use nets designed for capturing butterflies for collecting insects off plants as the sweeping action can cause these nets to tear.



Researcher sweeping foliage of a mangrove.

Method

Sweep a net to catch insects in flight, across vegetation or onto the ground. Transfer insects in the net to a vial.

Most likely to catch

Any

Tips

For invertebrates collected in the air or on vegetation, half twist the sweep net back on its self so the net part flips on itself effectively closing off the exit to the invertebrates. For insects collected on the ground pinch the net around them so they do not escape.

If debris has not accumulated in the net, funnel the invertebrates into the corner of the net. Then wiggle the collecting jar through the open end of the net transferring invertebrates into jar as you push it towards the corner (make sure jar has preservative). If debris has accumulated in the net, it may be necessary to use a pooter to collect the catch.

Problems

Can be difficult and time consuming transferring specimens from net to collecting jar especially if debris has been collected with catch eg. if sweeping grass, flower heads and burrs maybe collected in the process of sweeping. This procedure is also difficult to standardize.

Possible strategies to standardize technique

Walk a transect of a fixed length at each site and make a fixed number of sweeps over the vegetation on the transect or fix the search time.

8. Light trapping.

Light trapping operates on the principle that at night, insects of many groups are attracted to light.



Researcher collecting insects during light trapping.

You will need:

- Collecting jars or sample vials. Jars with tissue paper laced with fingernail polish remover are very useful for collecting moths. Moths' wings are damaged by liquids and abrasive surfaces, and are pinned dry after collection. Other more commercial products are more effective but have many more hazards associated with using them.
- Preservative e.g. 80% ethanol (preferably in a squeeze bottle)
- Sample labels – incl. date, collectors name, location (locality name and co-ordinates if possible)
- Large white sheets. Not needed if free standing or hanging light traps are used.
- Rope or a frame of some sort to suspend the sheet.
- A lamp and power supply. A variety of light sources may be used, but generally the brighter the better. The best of all is a mercury vapour lamp, available from specialist suppliers.
- A torch, preferably a head torch.
- Flathead tweezers.

Method

At night, arrange a light source so it is suspended behind a white sheet hung over rope tied to trees at about head height. Turn on the light and collect insects by hand as they land on the sheet. A period of two to four hours is recommended. There are other light trap designs such as free-standing models that can be used where there are no trees, or models that hang from trees. These latter two designs can be left unattended if they are funnelled into a collecting device such as an enclosed base, filled with refuges eg. egg cartons or into a jar filled with preservative.

Most likely groups caught

Moths, beetles, bugs, wasps, flies, mayflies and lacewings.

Tips

Arrange the sheet (or sheets) so they reach the ground. Use a sheet on the ground and collect insects that land in the vicinity. Light trapping is particularly effective close to tall trees and next to watercourses.

Problems

Light traps attract insects from a wide area, which means they cannot be used to sample a particular habitat.

Possible strategies to standardize technique

Leave the light on for the same period each time, collect for the same periods during this time, and collect at the same moon phase. (These depend on your question).