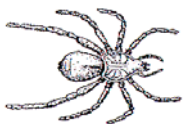


Backyard Biodiversity Study



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1. Background information for teachers

Thank you for participating in our Backyard Biodiversity Study. This ongoing program was developed in the year 2000 to explore the diversity of invertebrates in your area. The study aims to apprentice students into scientific techniques and to introduce them to current Museum research.

Invertebrate biodiversity studies are of great interest to scientists at the Australian Museum *and, if this study is successful, we are hoping to extend them further and incorporate them into research being conducted at the Museum.* Invertebrates make about 99% of all living animal species and are a major component of biodiversity. Despite this overwhelming figure, very little is known about the diversity of invertebrates.

This study will help you find out more about the diversity of invertebrates in your area. With your help we can shed some light on the following questions:

1. **How many different kinds of invertebrates are found in your area?**
2. **What is the most common invertebrate found in your area?**
3. **What different kinds of invertebrates are found in leaf litter compared to lawn areas?**

This experiment will involve putting pitfall traps filled with water in the ground in areas where leaf litter and lawn is found and in lawn in your schoolyard. These are left overnight and collected in the morning. The invertebrates in each sample area will fall into a pitfall trap and quickly drown. Once collected, the invertebrates should then be sorted, identified and counted. If you want to keep the specimens they must be preserved (see instructions in section 2c).

1a. Teachers' notes

What is an invertebrate?

Invertebrates are animals without backbones. While there are about 40,000 species of vertebrates, at least 99% of all animal species are invertebrates. Invertebrates comprise over 30 major animal groups and over 5 million species.

Invertebrates:

- include insects, crustaceans (eg crabs), spiders, coral;
- are found in all aquatic and terrestrial environments;
- are usually smaller than vertebrates but can range in size from microscopic animals to giant squids.

Why are invertebrates important?

Invertebrates affect all other forms of life by sheer weight of numbers. They make up the bulk of biodiversity. Invertebrates are essential for maintaining the function of ecosystems for many reasons. For example:

- they form an integral part of the food web;



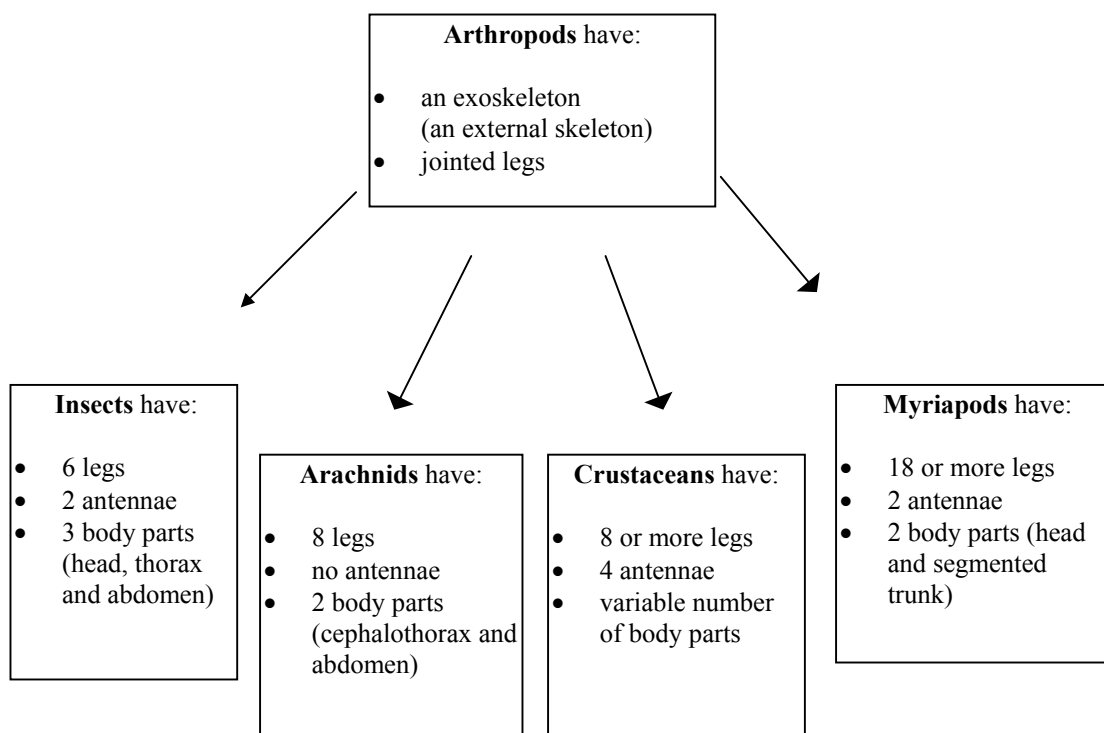
- they recycle organic matter, feeding on faeces or dead plants and animals;
- they make up the bulk of parasite species (along with microorganisms such as bacteria which regulate animal and plant numbers).

Very little is known about the diversity of invertebrates. With so many species yet to be identified, it is impossible to understand their full ecological value. For this reason it is important to conserve and promote invertebrate biodiversity.

1b. Classification

Most of the invertebrates you are likely to collect in this study will probably belong to the phylum Arthropoda. Arthropods and other small invertebrates are sometimes known by the term ‘minibeasts’.

The diagram below shows the scientific criteria used for classifying various ‘minibeasts’ into the large group called arthropods and its smaller sub-groups. The next few pages list some of the minibeasts you might find and indicate the phylum to which they belong.



Examples of animals in each arthropod sub-group:

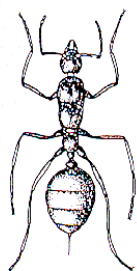
1. **Insects** include bees, butterflies, beetles, ants, moths, praying mantids, cicadas, cockroaches, fleas, wasps and flies.
2. **Arachnids** include spiders, scorpions, pseudoscorpions, ticks and mites.
3. **Crustaceans** include crabs, shrimps, prawns, lobsters, crayfish and slaters.
4. **Myriapods** include centipedes and millipedes.



1c. Invertebrate information sheets

Ants

Phylum: Arthropoda

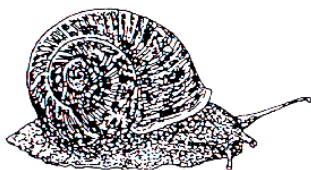


Did you know?

Ants carry their young to various parts of the nest, seeking the right warmth and moisture levels. They feed their young by regurgitating food from their crop (digestive organ), which is sometimes called the 'social stomach'.

Snails and slugs

Phylum: Mollusca



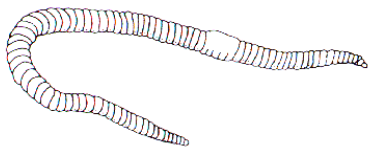
Did you know?

Snails and slugs use a ribbon of teeth (radula) to rasp small pieces of food. They also have an enzyme (a type of chemical) that breaks down the cellulose of plants.



Earthworms

Phylum: Annelida

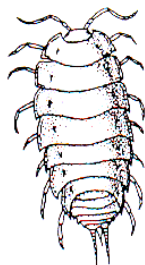


Did you know?

Earthworms burrow using muscular contraction and tunnel by eating through the soil. They also lay eggs in cocoons from which small worms hatch.

Slaters

Phylum: Arthropoda



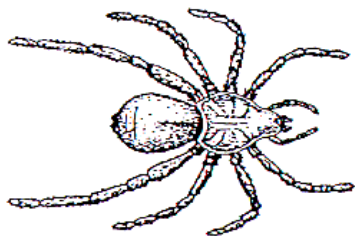
Did you know?

Slaters carry their eggs in a brood pouch on their stomach from which young miniatures of the adult hatch. Some slaters roll themselves into a ball for protection.



Spiders

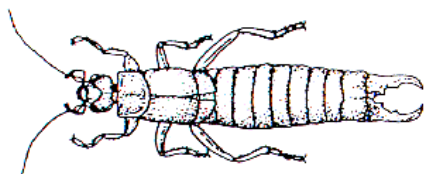
Phylum: Arthropoda

**Did you know?**

Most spiders have eight eyes but, surprisingly, most have poor vision. Most rely on touch and vibration which they sense through the hairs on their legs.

Earwigs

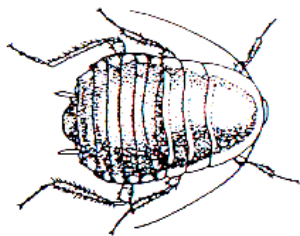
Phylum: Arthropoda

**Did you know?**

Some female earwigs look after their young by licking them regularly to keep them clean. When the young hatch, the females will feed them until they are big enough to leave the nest.

Cockroaches

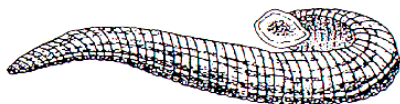
Phylum: Arthropoda

**Did you know?**

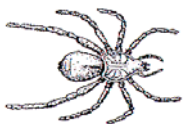
Cockroaches are a very ancient group of animals. Fossil cockroaches dating from before the time of the dinosaurs have been found and look very similar to modern-day cockroaches.

Leeches

Phylum: Annelida

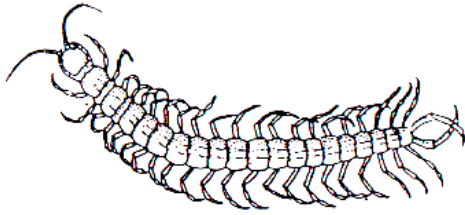
**Did you know?**

Leeches are close relatives of earthworms. Most leeches are parasites while some are predatory and swallow their victims whole. Blood-sucking leeches have three jaws and leave a V-shaped or Y-shaped bite mark.



Centipedes

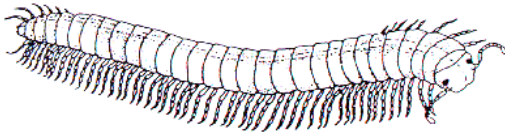
Phylum: Arthropoda

**Did you know?**

The first set of legs of a centipede are modified into poison claws or jaws and are used for attacking prey and inflicting wounds on other animals.

Millipedes

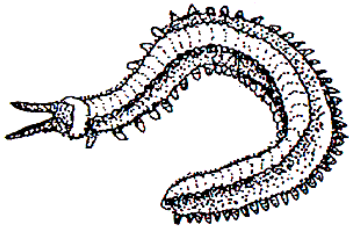
Phylum: Arthropoda

**Did you know?**

The first set of legs of a centipede are modified into poison claws or jaws and are used in attacking prey and inflicting wounds on other animals.

Peripatus

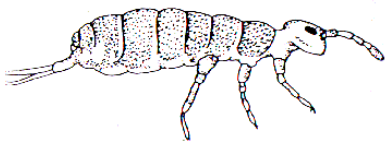
Phylum: Arthropoda

**Did you know?**

Peripatus, or velvet worms, are an ancient group of animals. They are all predators and they catch their prey by squirting it with a sticky slime, making it easy to catch.

Springtails

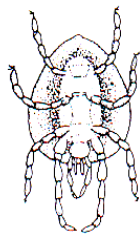
Phylum: Arthropoda

**Did you know?**

Springtails are small insects with a jumping organ located near the base of their tails. This jumping organ allows the springtails to jump long distances. They are often found in large numbers in mould, soil and rotting wood.



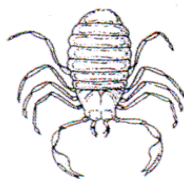
Mites Phylum: Arthropoda



Did you know?

Mites are like ticks in their general appearance. They have one body segment and eight legs. Some are predators, some are scavengers and others feed on plant material.

Pseudoscorpions Phylum: Arthropoda



Did you know?

Pseudoscorpions resemble scorpions. However, they have no tails or stingers. Pseudoscorpions build a silk igloo in which to mate, moult and lay their eggs.

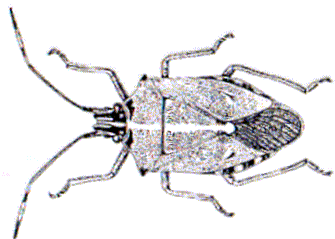
Beetles Phylum: Arthropoda



Did you know?

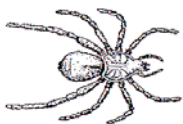
The beetle group includes more species than any other animal group. Some beetles can live for many years and have lichens growing on their backs.

True Bugs Phylum: Arthropoda



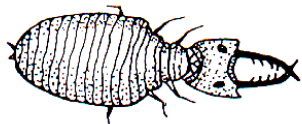
Did you know?

Bugs are divided into two groups depending on the type of wings they have. One group includes shield bugs and the other group includes cicadas.



Antlions

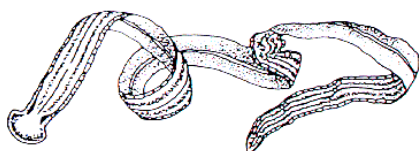
Phylum: Arthropoda

**Did you know?**

Antlions are carnivorous, both as larvae and as adults. They feed solely on ants. Most antlion species dig a conical pit in which to trap ants.

Flatworms

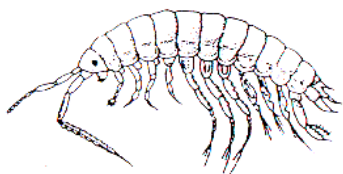
Phylum: Platyhelminthes

**Did you know?**

Terrestrial flatworms are often brightly coloured and either feed on dead animals or capture live prey. Live prey usually gets stuck in the sticky trail left by the flatworm.

Amphipods

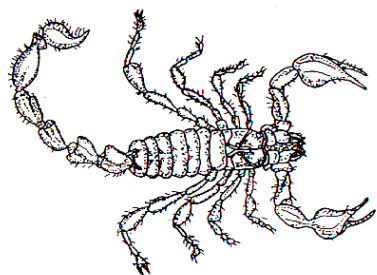
Phylum: Arthropoda

**Did you know?**

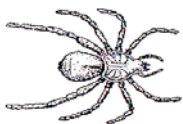
Amphipods are close relatives of slaters and can often be found under leaf litter. They are shiny in appearance and will flick and jump when disturbed.

Scorpions

Phylum: Arthropoda

**Did you know?**

Scorpions have 6 to 12 eyes and yet still have poor vision. They have tiny sensory hairs to make up for this. At birth, scorpions are white and live on their mother's back until they are independent. Their stinger is at the end of their tail and contains two poison sacs.



1d. Classification activities

- Ask each student to collect as many pictures of ‘minibeasts’ as they can. Then divide the students into groups and pool the pictures. Ask each group to decide on ways to sort the animal pictures. Each group could report back to the class on the criteria they used for sorting their pictures.
- Explain that grouping or classifying things is an essential part of the work that scientists do and that over many years, scientists have developed specific criteria for the way they group animals and other things in the world.
- Modify the classificatory key to suit your own requirements and the needs of the students. Make an OHT of it and show it to the class. Discuss the criteria listed with the students. Ask if they had sorted their pictures using any of the criteria mentioned.
- Next, ask the students to mix up their pictures again. Ask them to group the pictures according to the criteria used in the classificatory key. Once the pictures have been checked, the students could paste them onto a large piece of cardboard. Remember to write the criteria on the cardboard as well. Display the posters around the room or collate them into a big book for the class reading area.

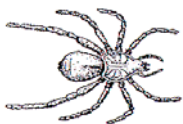
1e. Syllabus links

The information in the following tables has been extracted from the NSW Board of Studies HSIE and Science and Technology K-6 syllabus documents. They show the links between the whole *Biodiversity: life supporting life* exhibition and the syllabuses.

A) Human Society and its Environment

- **Outcomes**

<i>Overview:</i>	<i>Outcomes Stage 3</i>
Patterns of Places and Locations	Demonstrates an understanding of the interconnectedness between Australia and global environments and how individuals and groups can act in an ecologically responsible manner.
Relationships with Places	Explains how various beliefs and practices influence the ways in which people interact with, change and value their environment



Resource Systems	Describes how Australian people, systems and communities are globally interconnected and recognises global responsibilities.
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B) Science and Technology

- **Outcomes**

<i>Content Strands:</i>	<i>Outcomes</i>
	Stage 3
Built Environments	Creates and evaluates built environments demonstrating consideration of sustainability and aesthetic, cultural, safety and function issues.
Living Things	Identifies, describes and evaluates the interaction between living things and their effects on the environment.
Products and Services	Creates and evaluates products and services, demonstrating consideration of sustainability, aesthetic, cultural, safety and function issues.
Earth and its Surroundings	Recognises that the Earth is the source of most materials and resources, and describes phenomena and processes, both natural and human, that form and change the Earth over time.



2. The Backyard Biodiversity Study

The Backyard Biodiversity Study consists of five stages (a-e).

2a. Before completing your study

- Introduce your students to the study by talking about different invertebrates. You could try the activity below:
- Give each student one ‘**minibeast**’ to investigate. Ask them to find out where their minibeast lives, what it does during the day and night, how it reproduces, its life cycle and what it eats. Ask them to report back to the group or class to compare minibeasts.
- Discuss which areas in the school would be suitable to put pitfall traps. **Leaf litter** is found under trees/shrubs in forests or garden beds. It is usually made up of a variety of organic material such as decaying leaves, twigs and flowers. **Lawn** is a grassed area with little other organic matter.

Prepare the equipment for the study (eg labelling the pitfall trap cups or jars).

2b. Completing your study

What you need:

- A small shovel
- Two plastic cups or small glass jars
- Enough water to half-fill your cup or jar
- A few drops of detergent
- Two small sheets of cardboard to cover the pitfall trap cups or jars
- Labels for each pitfall trap cup or jar
- A waterproof pen or a pencil
- One bottle of methylated spirits

What to do:

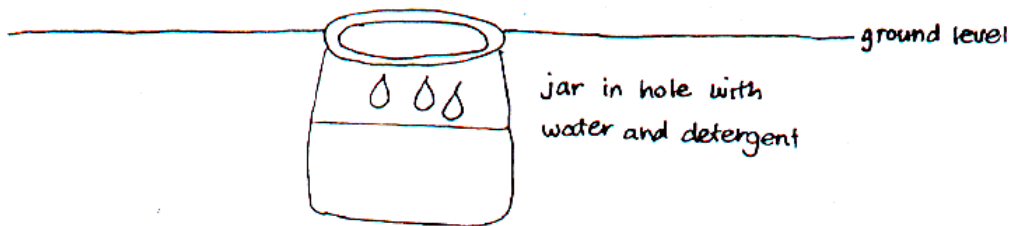
1. **Select** your sites - three in lawn and three in leaf litter - and **write down** what each site is called (eg ‘Leaf litter 1’).



2. Label all cups or jars with the name of the site (eg lawn 2). You can put the label on the outside of your jar or place it in the bottom of the jar.
3. **Bury** a small jar up to its neck, or a plastic cup up to its rim, in the ground at your selected site.



4. **Half-fill** the jar or cup with water and **add** a drop of detergent to break the surface tension of the water.



5. **Place** a piece of cardboard over the jar, slightly raised on some pebbles. Invertebrates will scuttle under the board for shelter and fall into your pitfall trap.



6. **Leave** the traps in place for 24 hours then go back and **collect** them, keeping careful note of which traps were in lawn and which were in leaf litter.
7. **Measure** the air temperature.



2c. What have you found?

NB: Only sort and identify animals larger than 3mm in length.

1. Process each pitfall trap individually. Have six copies of **Activity Sheet 1** (Raw Data Sheet) photocopied and ready to tally the animals found in each pitfall trap.
2. Pour the contents of the trap into a sorting tray (eg a plate or base where you can look at the animals easily) and, using the information in this pack, sort and classify the animals.
3. Put all like animals in the same container. Use one of the specimen vials provided. Fill the vial with a mixture of half methylated spirits, half water. (This step is only necessary if you want to keep the specimens for future reference. Without methylated spirits the animals will decompose and start to smell!)

2d. Writing the results of your study

1. Record your findings on **Activity Sheet 2** (Backyard Biodiversity Results Sheet).
2. Collate the results from each of the three like sites and average them.
3. Chart your results on **Activity Sheet 3** (the Backyard Biodiversity Graph).
4. Send it back to the Museum as a class poster.

If you have any difficulty in filling out the data sheet, or with any part of the study, please call (02) 9320 6295.

2e. Poster

During Science Week we will display the findings of your study at the Australian Museum. Please send us your findings as a poster (see our ideas page for possible layouts). Your poster could include the following things:

- Graphs
- Results table from Activity Sheet 2
- Photos
- Pictures
- Name of school and class
- Map of the school grounds including pitfall trap sites (optional)
- Poems/stories (optional)



Activity Sheet 1

Raw Data Sheet

Photocopy for each pitfall trap.

1. Site name and number: _____ (eg Lawn 2)
2. The temperature on the day of your sampling: _____ Degrees Celsius
3. Using the key, tally the animals you find in the table below

Animals	Tally	Total
Amphipods		
Springtails		
Spiders		
Snails		
Slaters		
Centipedes		
Millipedes		
Beetles		
Flies		
Larvae		
Ants		



Activity Sheet 2

Backyard Biodiversity Results Sheet

1. Study Date: _____

2. Please write your name(s) and the school's address in the space below.

Name(s)	Address of School

3. The temperature on the day of your sampling: _____ Degrees Celsius

4. Fill in the results table below.

(To work out the average number of animal types in the three like sites, simply divide each total by three. Round the answers to one decimal place.)

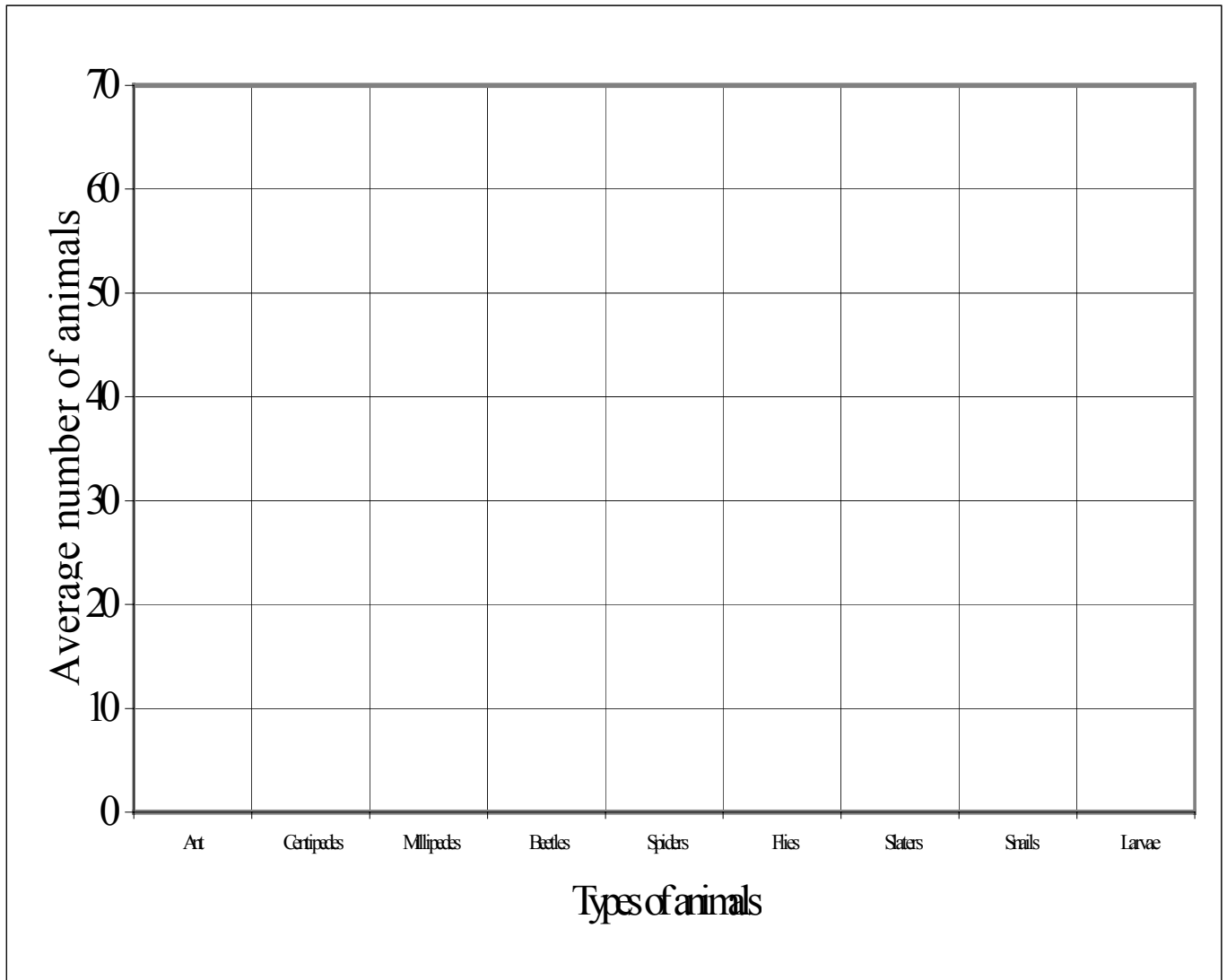
Animal	Lawn					Leaf litter				
	1	2	3	Total	Average	1	2	3	Total	Average
Ants										
Centipedes										
Millipedes										
Beetles										
Spiders										
Flies										
Slaters										
Snails										
Larvae										



Activity Sheet 3

Backyard Biodiversity Graph

This graph compares the average number of invertebrates found in leaf litter and lawn. Using the **average** values from the table on **Activity Sheet 2**, fill in the graph below. Use a different colour to chart the numbers for the two sites and colour in the key to match.



Example only

Activity Sheet 2

Backyard Biodiversity Results Sheet

1. Study Date: 08/03/04
2. Please write your name(s) and the school's address in the space below.

Name	Address of School
Kelly Bughouse	Cicada Road Teatree NSW 2034

3. The temperature on the day of your sampling: 25 Degrees Celsius

5. Fill in the results table below.

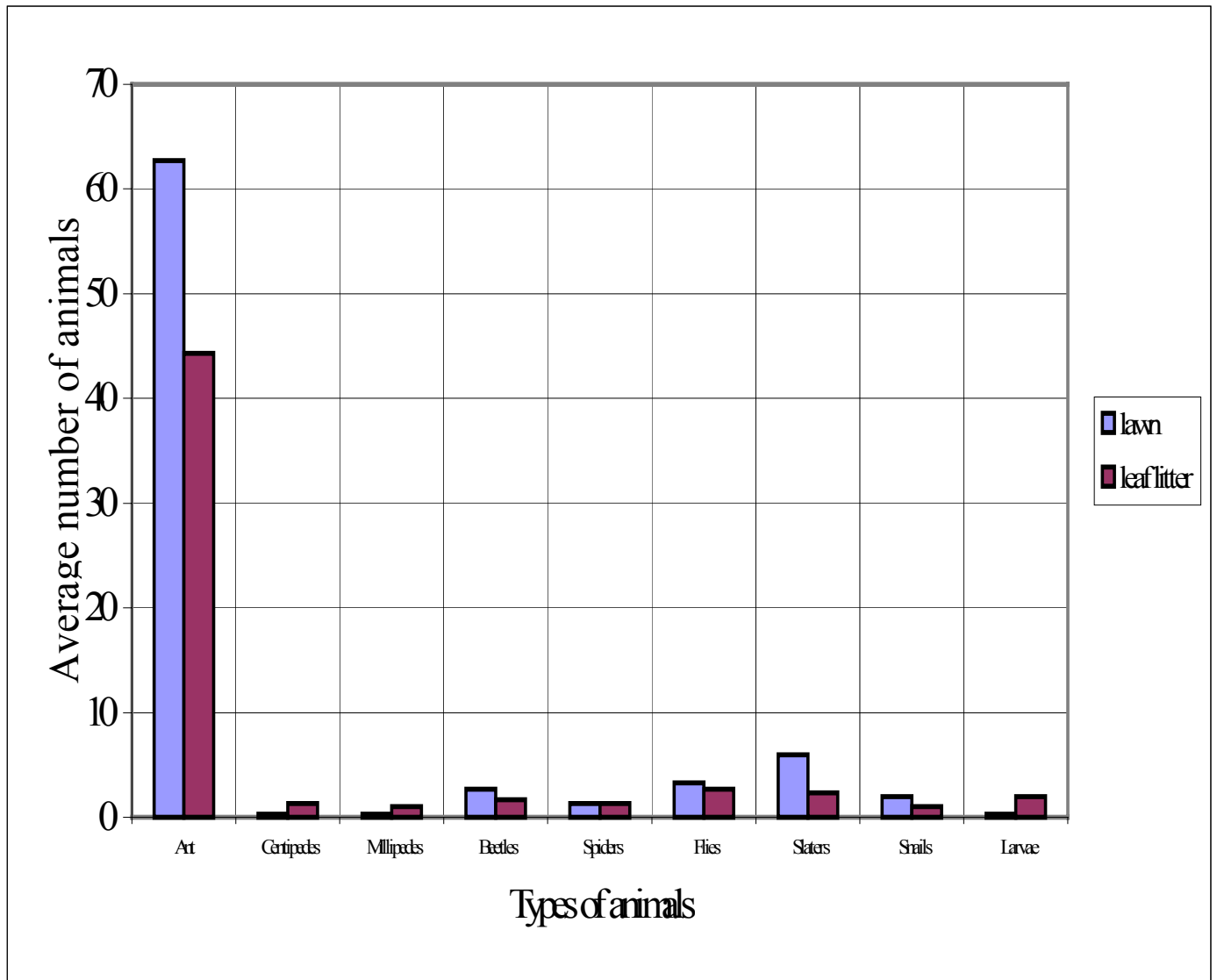
(To work out the average number of animal types in the three sites, simply divide each total by three. Round the answers to one decimal place.)

Animal	Lawn					Leaf litter				
	1	2	3	Total	Average	1	2	3	Total	Average
Ants	78	65	45	188	62.7	12	45	76	133	44.3
Centipedes			1	1	0.3	2	2		4	1.3
Millipedes		1		1	0.3	2	1		3	1
Beetles	3	3	2	8	2.7	1	2	2	5	1.7
Spiders	2		2	4	1.3	1	2	1	4	1.3
Flies	3	2	5	10	3.3	5	2	1	8	2.7
Slaters	12	1	5	18	6	1	4	2	7	2.3
Snails		1	5	6	2	3			3	1
Larvae	1			1	0.3	1	3	2		2



Example only Activity Sheet 3

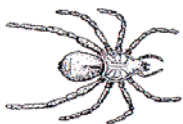
Backyard Biodiversity Graph



4. Extra resources

4a. Glossary

Adaptation	The process an organism undergoes to fit into its surroundings.
Arid zone	An area where less than 250 mm of rain falls per year.
Biodiversity	The rich variety of life on earth.
Biota	All living organisms.
Classification	The process of dividing organisms into like groups.
Ecology	The study of organisms, their behaviour, modes of life and their relationships with their surroundings.
Ecosystem	A community of organisms interacting with each other and their surroundings.
Endemic	A term used to describe organisms that occur only in specific geographic locations.
Environment	The conditions in which an organism lives.
Extinction	The termination of a lineage of organisms.
Fauna	A Latin term for animals.
Flora	A Latin term for plants.
Habitat	A place or environment in which specific organisms live.
Isopods	A group of crustaceans similar to sealice and woodlice.
Megadiversity	Very high levels of biodiversity in a certain area.
Organism	A life form.



4b. References/Further reading

Books

Allen, J. 1977, *Exciting Things to Do with Nature*, Marshall Cavendish, United Kingdom.

A book with interesting craft and science experiments for younger children.

Burnie, D. 1993, *How Nature Works*, RD Press, Australia.

A very interesting book with many hands-on experiments that help to explain the forces of nature.

Frauca, H. 1991 *What Animal is that?* The Currawong Press, Australia.

An illustrated survey of Australian fauna with more than 650 species described.

Haddington, P. & Johnston, J. 1987, *An Introduction to Australian Insects*, NSW University Press, Australia

This book has colour photos, diagrams and keys, suitable for high school students.

Harlow, R. & Morgan, G. 1991, *175 Amazing Nature Experiments*, Random House, New York.

This book compiles a number of experiments to try at home or in the classroom.

Zborowski, P. & Storey, R. 1998, *A Field Guide to Insects in Australia*, New Holland Publishers Pty Ltd, Sydney, London, Cape Town.

This is a basic guide to insects of Australia which is well illustrated.

Websites

Australian Museum

www.amonline.net.au

ABC

www.abc.net.au/science/

Exploratorium (USA)

www.exploratorium.edu/

The Gould League

www.gould.edu.au

