Worms

Curriculum guide

GOVERNMENT OF WESTERN AUSTRALIA

WASTE AUTHORITY
WA...TOO GOOD TO WASTE

WasteSorted Schools

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Contents

Learning to be Waste Wise Activity Guide for Primary Schools

Introduction

The Learning to be Waste Wise Activity Guide is a series of curriculum-linked activity packs written for the Waste Wise Schools Program. Each booklet covers a different topic including a general introduction to waste, the '3Rs' (Reduce, Reuse and Recycle), 'Worms' and 'Compost'. The activities are designed to complement the school's ongoing waste minimisation projects, and to support learning at every stage of a school's Waste Wise journey. In turn, Waste Wise projects provide real life context to curriculum outcomes while directly involving students in their own learning.

By reinforcing Waste Wise principles through the curriculum in an engaging and practical way, teachers will find it easier to incorporate waste reduction practices in their school. In addition, the involvement of students and the modelling of positive behaviours, reinforces the environmental principles and curriculum outcomes.

The activities are designed to be fun; to promote life-long learning; to empower and enable students, teachers and the rest of the school community to take responsibility for their waste minimisation actions; to develop positive environmental values and to promote long term behaviour change.

Waste Wise, Sustainability and the Australian Curriculum

Sustainable patterns of living meet the needs of the present without compromising the ability of future generations to meet their needs. Actions to improve sustainability are both individual and collective endeavours shared across local and global communities. They necessitate a renewed and balanced approach to the way humans interact with each other and the environment.

Sustainability addresses the ongoing capacity of Earth to maintain all life.

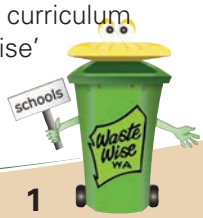
Education for Sustainability (EfS) develops the knowledge, skills, values and worldviews necessary for people to act in ways that contribute to more sustainable patterns of living. It enables individuals and communities to reflect on ways of interpreting and engaging with the world. EfS is futures-oriented, focusing on protecting environments and creating a more ecologically and socially just world through informed action. Actions that support more sustainable patterns of living require consideration of environmental, social, cultural and economic systems and their interdependence (Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)).

Sustainability is one of the cross-curriculum priorities in the Australian Curriculum, developed by ACARA, Australian Curriculum, Assessment and Reporting Authority (http://www.australiancurriculum.edu.au/). Educating students about waste management through the Australian Curriculum learning areas is a great way to develop knowledge, skills, values and worldviews necessary for students to contribute to more sustainable patterns of living.

Waste is a topic that fits easily into every learning area. Waste can easily be integrated into curriculum rather than used as an 'add on'.

All activities in this guide are linked to the Australian Curriculum. Links have been identified in Maths, Science, English and Geography. Detailed links are highlighted at the beginning of each activity. A summary of these learning area links are included in a table before the introduction. The Waste Wise Schools Program is planning to update this guide by adding more Australian Curriculum links as subjects are progressively released (e.g. Art, Civics and Citizenship).

The activities in this guide can also be linked to the existing WA curriculum framework in subjects such as Technology and Enterprise, Physical Education and more. It is up to individual users to identify relevant links to the WA curriculum in this 2013 edition. However you can also refer to the earlier 2010 editions of the 'Learning to be Waste Wise' activity guides for Western Australian Curriculum linked activities.



How to use this booklet

The activities in this booklet have been designed for students in Foundation to Year Six. The majority of the activities are hands-on or interactive and can be completed in order with the subsequent activities building on the knowledge and skills gained in earlier lessons. Ideas for extension and assessment are provided at the end of each activity.

We suggest you begin by reading the 'Teacher introduction' for each guide as it contains important background information on the topic. Key words are in bold throughout the guides and can be found in the glossary at the end of each guide. Our website also includes assessment rubrics for the different year levels as Excel spreadsheets so that you can tailor them to your needs.

Structure of each lesson

Each lesson includes the following information for you:

Aim:	Describes the lesson
Suitable for:	Identifies the year groups the activity is suitable for (e.g. F – Year 6)
Duration:	Outlines the time needed to conduct the lesson. Note that this is a guide only
Prior learning:	Links to previous lessons in the guide that should be completed before attempting the lesson.
General capabilities:	General capabilities in the lesson are identified – the list of symbols is included below.
Cross-curriculum priorities:	Cross-curriculum priorities are identified - the list of symbols is included below.
Background Information:	Provides a link to relevant sections in the Teacher Introduction.
Key words:	Key words identified. Definitions can be found in the glossary.
Resources:	Outlines resources and preparation needed.
Australian Curriculum Links:	Links are grouped in tables for F – Year 2, Years 3 – 4 and Years 5 – 6.
Set the scene:	A brief activity designed to set the scene for the activity.
Activity Instructions:	Full activity instructions.
Extension and assessment ideas:	Activities to extend. The curriculum links for these are also provided where relevant.

Reduced paper use

To reduce paper use, the activities in this booklet have been designed to be 'worksheet-free'. Questions can be written on the board, overhead projector or interactive whiteboard and students should record answers in a notebook. If photocopying is necessary, consider having students work in groups with one set of directions or questions to share.

Equipment to loan

The Waste Wise Schools Program has equipment available to loan schools, including laminated cards for games such as the Compost Relay and the Food Web game. Books, DVDs and other resources are also available to loan. Please contact the Waste Wise Schools Program on wastewise@dwer.wa.gov.au for more information.

Symbols

General Capabilities

- Literacy
- Numeracy
- Information and communication technology (ICT) capability
- Critical and creative thinking
- Personal and social capability
- Ethical understanding
- Intercultural understanding

Cross-curriculum priorities

Please note, only sustainability links have been made in this guide. There may also be opportunities to link to Aboriginal and Torres Strait Islander histories and cultures and Asia and Australia´s engagement with Asia, by examining our waste practices through different perspectives.

- Sustainability
- Aboriginal and Torres Strait Islander histories and cultures
- Asia and Australia's engagement with Asia

Based on Australian Curriculum, Assessment and Reporting Authority (ACARA) materials.

Curriculum links

Learning area	Science										Geography			
Learning area outcomes	Science Understanding			Science as a Human Endeavour		Science Inquiry Skills					Geographical Knowledge and Understanding	Geographical Inquiry Skills		
	Biological sciences	Chemical sciences	Physical sciences	Nature and development of science	Use and influence of science	Questioning and predicting	Planning and conducting	Processing and analysing data and information	Evaluating	Communicating		Collecting, recording, evaluating and representing	Reflecting and responding	Communicating
Worms alive	F-5								1-2	F-6				
Investigation: Worm food	F-1;4	1		1-6	3-6	1-6	1-6	F-6	1-6	F-6	4			
House of worms	4-6				3-6						4;5	3-4; 5,6		3-4; 5,6
Investigation: Grassy heads	F,4			1-6	3-6	1-6	1-6	F-6	1-6	F-6				
Worm loop	F,3,4,6				1-6		F	F-2	1-2	F-4	4		3-4; 5,6	
Investigation: How worms behave	1,5,6		1	3-6	5-6	3-6	3-6	F-6		F-2				
Worm rap	1									1-6	4			
Enterprising worms					3-6						4			
Worm presentations	4-6				1-6					F-6	4		3-4; 5,6	4; 5,6
Worm games	4-6				3-4						4			

Curriculum links

Learning area	Mathematics				English							
	Number and Algebra	Measurement and Geometry		Statistics and probability	Language			Literature	Literacy			
Learning area outcomes	Money and financial mathematics	Using units of measurement	Location and Transformation	Data representation and interpretation	Language for Interaction	Text structure and organisation	Expressing and developing ideas	Examining literature	Texts in context	Interacting with others	Interpreting, analysing, evaluating	Creating texts
Worms alive		2,5										
Investigation: Worm food												
House of worms		3,6		5						3-6	3-6	
Investigation: Grassy heads		4		2-5								
Worm loop												
Investigation: How worms behave				4-5								
Worm rap							4	F-2,3	4	2		2-6
Enterprising worms	5			5		2	6				3-4	
Worm presentations										F-6		
Worm games			3		3					F	4-6	

*Based on Australian Curriculum, Assessment and Reporting Authority (ACARA) materials (9 May, 2013)

Teacher introduction

> **"They are the intestines of the Earth"**
> Charles Darwin

1.0 Why do we have worms?

Worms are often considered to be little 'soil farmers' and by simply living, eating and reproducing they provide a wonderful service to plants and to us.

Worms eat a wide variety of items including old plant material and food scraps. Their **castings** are expelled into the soil and provide nutrients for plants. As the worms move through the soil, their tunnels enable air and water to filter into the ground and loosen up the soil for plant roots, allowing easier absorption of oxygen and water by the plants.

Vermiculture is the cultivating of worms for the purpose of breaking down **organic** waste. Worm farms contain composting worms that eat food scraps and turn them into high quality, natural liquid or **leachate** (worm wiz) and compost (castings) fertiliser for plants. Composting worms thrive in a moist, high nutrient environment, and we create this environment in a worm farm.

Worm farms contribute to environmental sustainability in a number of ways, some of which are:

- decreasing the amount of **organic** waste that is normally put in your school's/home's rubbish bins and sent to landfill
- 'closing the recycling loop' because our organic waste is changed into organic fertiliser for our plants which then produce food for us to eat
- improving and building soil by: improving its physical structure; enriching it with micro-organisms; attracting deep-burrowing earthworms already present in the soil; improving water holding capacity; enhancing germination, plant growth, and crop yield; and improving root growth and structure
- reducing **greenhouse gases**, because in a well-maintained worm farm the **decomposition** process is aerobic (with oxygen) rather than anaerobic (without oxygen).

When organic waste decomposes in landfills, it is usually through anaerobic decomposition which produces **methane** gas. Methane is a harmful **greenhouse gas** with a global warming potential of 25 times that of **carbon dioxide** and is therefore a significant contributor to the warming of the Earth's climate. Currently the waste sector produces about 15 million tonnes of greenhouse gas emissions (or 'carbon pollution') each year, equivalent to three per cent of Australia's emissions (Australian Government, 2013). Aerobic composting (in a worm farm or another compost system) which is done at home, school or on an industrial scale is therefore a more desirable way to process organic waste as it reduces greenhouse gas emissions.

2.0 Description and characteristics of worms

Earth worms are invertebrates, which means they have no back bone. They belong to the **phylum *Annelida,*** which also includes leeches and marine worms. Annelids are different from most other invertebrates because they have long cylindrical shaped bodies made up of many similar segments, and lack appendages, antennae and an obvious head.

In this phylum they are classified as **class *Oligochaeta***. This group is made up of terrestrial earthworms and species that live in freshwater environments. There are many different species of earthworms. Some are just a few centimetres long while others can be up to two to three metres in length, such as the Australian native giant Gippsland earthworm. The earthworms we find in our gardens are often introduced species as our native earthworms are driven away when we clear native vegetation and disturb their habitat.

The earthworms that we use in **worm farms** are a different species to those we find in our garden. The best worms for worm farming are European worms such as the Red wriggler **(***Lumbricus rubellis***)** and the Tiger worm **(***Eisenia fetida*). Another good composting worm is the **Indian blue (***Perionyx excavatus*) that comes from Asia. These species are accustomed to soils high in nutrients. They are used in worm farming because they eat and breed much faster than other earthworms and can quickly transform our waste scraps into worm castings. They can do this in a small amount of space, while other earthworms are better equipped for burrowing and searching for food in our drier, nutrient poor soils.

Most WA schools worm farm with the Tiger worm or the Red wriggler.

The earthworm is blind, but sensitive to light. Their instinct is to move away from light due to their two 'photoreceptors' which are sensitive nerve endings located near the saddle at the anterior (Murphy, 2005). It has three to five hearts depending on the species and breathes through its skin which is a mucous membrane. We can identify its 'head' (anterior) end as it is the end closest to the **clitellum**, a band around the worm near the centre and commonly referred to as the saddle. It feeds by using its mouth or prostomium, and breathes through its skin. It moves through the soil by contracting and expanding its muscles, and using its **setae** (bristles) to grip the soil.

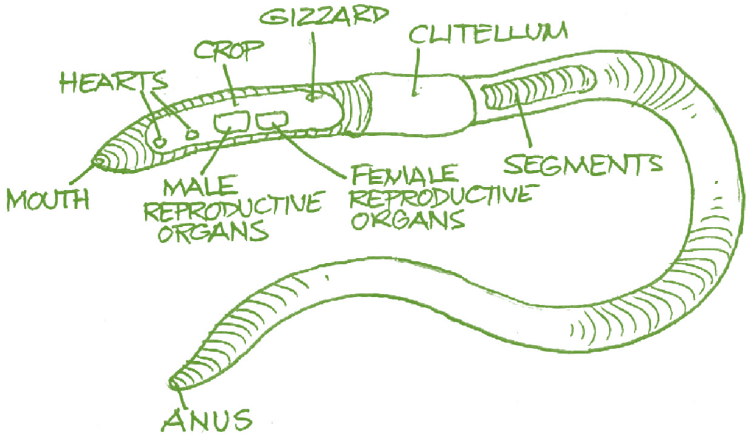


Figure 1: Worm anatomy

3.0 Lifecycle of a worm

Earthworms are **hermaphrodites**, which means they have both male and female sexual organs. The method of reproduction varies between the different species. For tiger worms (common composting worms) two worms are needed for reproduction. During mating, the two worms align their **clitellums** (identified in Figure 1), cover themselves in sticky mucous and exchange sperm. The worms separate and each worm's clitellum produces a thick mucous ring. As the worms wiggle backwards out of this ring, the eggs are picked up and then fertilised by the stored sperm. Ultimately, the mucous ring forms a **capsule** around the fertilised eggs which is deposited in the soil. Each capsule contains four to ten infant worms, which hatch after about two weeks under the right conditions.

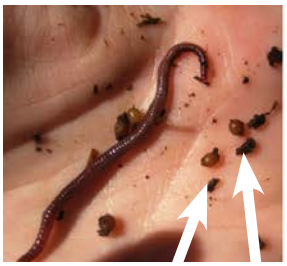


Figure 2: Worm capsules

Figure 3: Adult worms

Figure 4: Worm clitellum

4.0 Worm farming at school

4.1 Living conditions in a worm farm

Ideally **worm farms** should be situated in a cool, shady spot. Worms need cool, moist conditions and a temperature of 25 to 26 degrees Celsius is perfect. They also need a layer of bedding to live in, which can include castings, shredded paper, newspaper, cardboard, brown leaves and straw. As food scraps **decompose**, they will make the worm bedding more and more acidic, therefore it is a good idea to add some garden lime from time to time to maintain the pH as worms prefer a neutral environment.

Your worm farm should be as moist as a wrung out sponge. If there is too much water, the worms will drown, and if there is too little water, they can die. Every day a worm loses about 20 per cent of its body weight in moisture so it is important to keep the worm farm adequately moist (Murphy, 2005).

4.2 School worm farms

A **worm farm** is made from a container that has a drainage hole for water and a lid that keeps out vermin but allows air in. It is normally filled with layers of castings, shredded paper or other types of bedding and composting worms. You can buy worm farm containers, make your own, or have one custom made. Some schools use old bathtubs or construct worm farms out of old pallets, wood (avoid painted or chemically treated wood) or corrugated sheet metal, but most use old fridges that have been safely degassed. Look at the 'How to build a worm farm' fact sheet to find out more. For the amount of waste most schools produce, at least one large worm farm (such as a fridge or a bathtub) is needed.

You can also see how to make a worm farm from a polystyrene box in the following videos: http://www.youtube.com/watch?v=5PbFHFGvoUQ (Ecofaeries) and http://www.youtube.com/watch?v=YykLkvq4148 (Sustainable Gardening Australia).

4.3 Food to put in your worm farm — 'on the menu'

Materials you can put in your worm farm include:

- shredded, moist cardboard, newspaper and paper scraps (avoid shiny magazines)
- coffee grounds and tea bags (with staples removed)
- fruit and vegetable scraps
- leaves
- straw (but not hay with seeds in it)
- coconut fibre
- egg shells (pulverised) or other sources of grit (good to add when the worm farm gets a bit smelly or acidic).

The smaller the pieces of food, the easier it is for the worms to get through. Some schools blend food scraps or chop them up with a metal spade in a bucket or wheelbarrow.

Top tips for worm farming

- water your worm farm one to three times per week, so it is as moist as a wrung out sponge
- add up to four times as much paper as food scraps by volume (this could be wet newspaper or cardboard torn into strips)
- avoid over-feeding your worms because it can make your worm farm smelly and acidic. It is better to underfeed them than feed them too much.
- keep your worm farm in the shade to keep the worms cool
- make sure the worm farm is well drained
- remove mouldy foods if not eaten and put in your compost bin or tumbler.

4.4 Food to keep out of your worm farm —'off the menu'

Anything **organic** will eventually be broken down in a **worm farm**. However, in a small worm farm it is a good idea to omit certain foods such as:

- citrus fruits, pineapple, onions and garlic: can make the worm farm too acidic (pH less than 7) and the worms may even try to move out because of the acidic conditions
- meat and fish: can become smelly as they decompose and attract mice, rats and wasps
- dairy: can become smelly and cause **anaerobic** conditions
- bread: tends to clump up and worm farms can't cope with the amount of bread that schools produce
- oils: smother worms (as they breathe through their skin)
- weeds: as weed seeds are not destroyed in a worm farm.

Did you know that while worms may ingest parts of decaying organic matter, it is the micro-organisms on the organic matter that they are actually interested in.

A good rule of thumb is: if **in doubt, leave it out!** A composting system such as heap, bin or tumbler can also help to manage your organic waste and is perfect for composting citrus, onion and garlic scraps that should be left out of your worm farm.

A fermentation system (like a bokashi bin) or chickens can help to deal with excess bread.

4.5 Setting up a school worm farm

a) Select the type of worm farm you want for the school (see the 'House of worms' activity to do this as a class). This may depend on available materials and the size of the worm farm. You will find instructions on how to build a worm farm out of an old fridge on the 'How to build a fridge worm farm' fact sheet, which is available on the Waste Wise website and teacher flashdrive.

b) Cover the bottom of the worm bin to a depth of 10 to 15 centimetres with a mix of dry materials as bedding. Mix two or three of the following materials for good bedding: shredded newspaper or printed paper (not glossy paper), small pieces of corrugated cardboard, straw (not hay with seed in it), coir/coconut fibre, or shredded leaves.

c) Sprinkle the dry materials with water and continue mixing and adding water until the mixture feels like a wrung out sponge (when you squeeze it in the palm of your hand, only a few drops come out).

d) Add composting worms to the container and allow two to three days for the worms to settle in before feeding them, keeping the container moist.

e) Introduce about a quarter to a half kilogram of food scraps per kilogram of worms per week until the worms become accustomed to their new diet. If you maintain a temperature of 25 to 26 degrees Celsius around your worm bin, you can gradually increase food amounts as the worms multiply.

f) To maintain the worm farm, always keep a five centimetre layer of fresh bedding over the worms and food in your bin. Add fresh bedding as needed depending on the season, the activity of your worms, when the old bedding is consumed, or whenever odours or fruit flies become a problem. Do not cover air vents or holes with bedding. Keep the bedding as moist as a wrung out sponge.

A school of about 300 students might need one to three fridge worm farms (with about a two square metre base). To start a fridge worm farm, we recommend having three kilograms of worms.

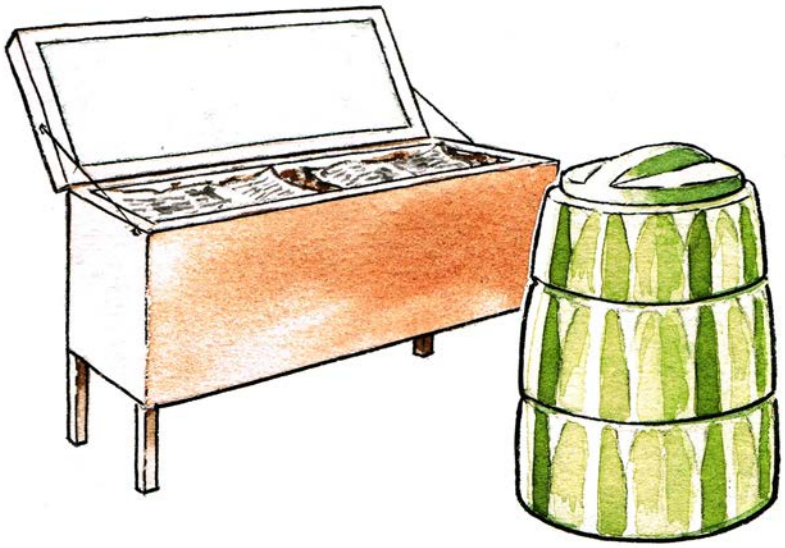
4.6 How many worms?

First, you will need enough worms to manage your **organic** waste. It is a good idea to conduct a waste audit to find out how much organic waste your school produces to work out the size and/or number of worm farms that you'll need (see the 'House of worms' lesson for this activity). As a general guide, one kilogram of worms will eat one kilogram of fruit, vegetable and paper scraps in two to three days. As the quantity of worms needed also depends on the amount of fruit and vegetable waste your school produces, you may need more than one worm farm.

4.7 How much food to feed the worms?

A little trial and error is needed to work out how much to feed your worms. Under the right conditions, worms can eat their own body weight in food every two to three days. To calculate how much food to feed the worms, record the weight of all your worms when you set up your worm farm. This will be the approximate weight you can feed them in two to three days. In the right conditions the worms will multiply so observe their consumption for a few weeks. If the original amount of food begins to disappear at a faster rate, then increase the food.

We recommend having a compost system as well as a worm farm. If you have surplus fruit and vegetable scraps you can then put them in your compost.



4.8 Worm castings and leachate

Worm **castings** and **leachate** are highly nutritious organic foods for plants that can be added to your school garden. They contain a wide variety of nutrients and beneficial microbes necessary for plant growth whilst improving the water retention of soil. Other benefits of using worm castings and leachate on your garden are outlined in section 1.0.

4.8.1 Harvesting of small amounts of castings

Depending on the type of worm farm, there are a couple of ways to harvest the castings, from either the top or from the bottom of the worm farm.
When collecting castings from a bath or fridge worm farm, follow these instructions:

- open the lid or remove the cover of the worm farm
- place the food at one end and replace the lid or cover
- continue to feed the worms this way for about two to three weeks
- harvest the castings from the section they have evacuated (the majority of the worms will have slowly moved toward the food source).

Another technique is to remove the cover of the worm farm to allow light in. The worms will move away from the light, burrowing down to allow you to gently remove the top layer of the castings in the area. Some schools empty the worm farm onto a table and allow the worms to burrow down so that castings from the top can be harvested.

If there is a sliding panel installed, (usually with custom built farms) the castings can be harvested from the base of the worm farm. The advantage of a system such as this is that the worms will not be disturbed when removing the castings (Murphy 2005).

4.8.2 Harvesting all castings

Some sources recommend separating worms from their castings at least twice a year to keep them healthy because at high concentrations, the castings create an unhealthy environment for worms.

One method for doing this ('bait and switch') is particularly suitable for fridge worm farms.
Move the worm bin contents to one side of the bin so it fills about three quarters of the bin's volume. Add fresh bedding and food to the empty section. Let the new section stand for two to four weeks without adding fresh food to the old section. Water and cover only the new side of the bin. The light and lack of moisture will cause the old side to dry out and speed up worm migration. As it dries out, the worms will leave it for the new side. After the worms have moved, harvest the old section. Plan to not feed your worms for at least two weeks before starting this harvest method. That way, you can harvest much sooner.

4.8.3 Harvesting the worm leachate

Many schools collect and bottle the liquid (**leachate**) that filters out of the worm farm and sell it as a plant fertiliser for fundraising. Plastic milk bottles can be collected and reused as containers to store and sell the leachate. Note that the leachate contains living beneficial bacteria so to avoid killing them do not store the leachate for a prolonged period of time (up to two days is okay). Also, avoid exposing the leachate to sunlight as ultra violet (UV) rays kill the bacteria. If there is no smell, it should be ok to use on your garden. Note that it is not good to put a lot of water through your worm farm; regular light watering is ideal. It is better to harvest castings and produce 'worm wiz' by mixing the castings with water than to run a lot of water through your worm farm.

4.9 Trouble shooting

The worms are evacuating!

- This means they aren't comfortable and this could be for a number of reasons. The farm could be too wet or dry, too hot or too acidic (see below).

Too wet

- The worms could drown. Add some shredded newspaper and cardboard to absorb the moisture, check that the drainage is not blocked and that the farm is on a slant.

Too dry

- Add a small amount of water— ideally the castings should have the moisture content of a wrung out sponge.

Too hot

- Add cool water and allow it to drain out. Check that the worm farm is in the shade and has a temperature of around 24 degrees Celsius.
- Freeze fruit and vegetable scraps and then allow them to defrost in the worm farm. Or freeze a plastic bottle of water and place the open bottle in the farm. As it melts, it adds water and cools everything down.

Too acidic

- Add a little garden lime (calcium carbonate) or crushed eggshells to reduce acidity.

Too compacted

- Harvest excess castings. Loosen up the remaining castings to aerate the worms bedding, mix in moist shredded newspaper and cardboard.

Bad smells

- Check the food. Is it mouldy or too large to be consumed? Remove it and compost it or puree it.
- You could be feeding the worms too much. Only feed what they can get through in two to three days.
- The proportion of fruit and vegetables/organics could be too much: add more shredded paper and cardboard. Remember, feed the worms 20 per cent fruit and vegetable scraps and 80 per cent shredded paper and cardboard (that's four times as much paper and cardboard).
- Not enough oxygen. The lack of ventilation can cause the bacteria to become anaerobic, producing sulphurous smells. Check that the farm has air holes, and is not compacted.
- Add some garden lime (calcium carbonate) to reduce acidity and discourage flies.

Nobody at school in the summer holidays

- Set up a roster system for students, parents or teachers to maintain the worms.
- Stock up the worm farm fridge with moist shredded paper and cardboard and set up a drip irrigation system. They will lose mass over the holidays but they should survive.
- Organise the school gardener to maintain it if he or she is working over the holidays.
- Sell or give away the worms and buy a new stock in Term 1.

For other trouble shooting options and ideas on how to be a 'good parent' to your worms watch the video in the following link http://www.youtube.com/watch?v=YykLkvq4148

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Other resources

Make your own worm farming brochure or poster
www.wasteauthority.wa.gov.au/resources/organics-brochure-poster-images

Waste Wise 'Worm farming' and 'How to make a fridge worm farm' fact sheets
education.dec.wa.gov.au/waste-wise/resources/fact-sheets.html

Costa's guide to worm farming and composting for households
http://www.youtube.com/watch?v=eNqRXM2c6L8

For more information go to
www.wastewise.wa.gov.au

Worm activity 1 – Worms alive

Aim:

Students are introduced to the form and function of living things by looking at the features and adaptations that help them to survive. They compare a live worm to a labelled diagram of a worm, create a scientific drawing and record their observations. They also observe worms at different stages of their life cycle.

Suitable for: F – Year 6

Duration: This activity takes up to two 45 minute lessons.

Prior learning: None required

General capabilities:

Cross-curriculum priorities:

Background information:

Before conducting this activity, you might like to read the teacher introduction at the beginning of this guide. The following sections are particularly relevant:

- 2.0 Description and characteristics of worms (includes labelled diagram of a worm)
- 3.0 Lifecycle of a worm.

Adaptations are any behavioural or physical characteristics of an animal that help it survive in its environment.

There are three main categories:

1. behaviours
2. body coverings
3. body parts.

Any or all of these types of adaptations play a critical role in the survival of an animal.

Key words: adaptations, anus, clitellum, invertebrates, mouth, saddle, segments, setae, phylum Annelida

Be kind:

Be sure to treat the worms gently and with respect while observing as they are very fragile. Be sure to release them back into the worm farm after examining them.

Resources:

- a few handfuls of worms and castings from your worm farm, including some juvenile worms and capsules
- water
- one plastic lid per pair (white ice cream container lids are ideal)
- rulers
- magnifying glasses or magnifying cups
- science journal
- pencil
- scales; fine if possible (Years 3-6)
- torch (Years 3-6)
- worm diagram.

Australian Curriculum links for F–Year 2

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science Understanding		
Biological sciences The way objects move depends on a variety of factors, including their size and shape (ACSSU005)	F	Students describe how a worm moves and how this depends on their size and shape.
Living things have a variety of external features (ACSSU017)	1	Students draw a worm and label the head and saddle.
Living things live in different places where their needs are met (ACSSU211)	1	Students discuss where worms live and why they live there.
Living things grow, change and have offspring similar to themselves (ACSSU030)	2	Students observe worms at different stages of life.
Science; Science Inquiry Skills		
Processing and analysing data and information Engage in discussions about observations and use methods such as drawing to represent ideas (ASSIS233)	F	Students discuss how worms move and draw their observations of a worm.
Evaluating Compare observations with those of others (ACSIS213, ACSIS041)	1-2	Students compare observations and drawings of a worm.
Communicating Share observations and ideas (ACSIS012)	F	Students share their observations of a worm with the class.
Represent and communicate observations and ideas in a variety of ways such as oral and written language, drawing and role play (ACSIS029, ACSIS042)	1-2	Students represent their observations of a worm through oral language, drawing and mime.
Mathematics; Measurement and Geometry		
Using units of measurement Compare and order several shapes and objects based on length, area, volume and capacity using appropriate uniform informal measurements(ACMMG037)	2	Students measure a worm using informal methods.

Australian Curriculum links for Years 3–4

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science Understanding		
Biological sciences Living things can be grouped on the basis of observable features and can be distinguished from non-living things (ACSSU044)	3	Students recognise characteristics of living things such as moving and reproducing and answer "How do you know the worm is a living thing?"
Living things have life cycles (ACSSU072)	4	Students observe worms at different stages of their life cycle.
Science; Science Inquiry Skills		
Communicating Represent and communicate ideas and findings in a variety of ways such as diagrams, physical representations and simple reports (ACSIS060, ACSIS071)	3-4	Students use labelled diagrams of a worm to communicate ideas.

Australian Curriculum links for Years 5–6

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science Understanding		
Biological sciences Living things have structural features to survive in their environment (ACSSU043)	5	Students draw a worm and label the head, saddle and segments. Students describe the way a worm moves and answer "Why do you think worms have setae (bristles)?"
Science; Science Inquiry Skills		
Communicating Communicate ideas, explanations and processes in a variety of ways, including multi-modal texts (ACSIS093, ACSIS110)	5-6	Students use labelled diagrams of a worm to communicate ideas.
Mathematics; Measurement and Geometry		
Using units of measurement Choose appropriate units of measurement for length, area volume capacity and mass (ACMMG108)	5	Students accurately measure and record the length, width and weight of a worm.

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Set the scene:

Use a KWL chart to list what students think they know about worms (K) and what they would like to know about worms (W). Ask where worms live and why they live there.

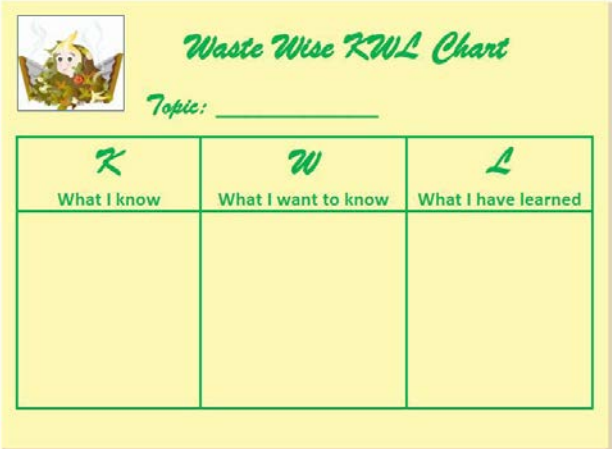
Activity for F–Year 2:

1. Discuss features of a worm (saddle, segments, and head) by showing a diagram. (See section 2.0 in the introduction.)
2. Start by showing the whole class an example of a capsule, a juvenile worm (which is smaller and sometimes lighter in colour than an adult worm) and an adult worm (see section 3.0 in the introduction). Ask students what they think the capsule is and why the juvenile is smaller. You could set up a microscope with your electronic whiteboard to do this.

The letters KWL are an acronym for what students already know (K) about a topic and what they want (W) to know about a topic. It is reviewed after the lesson to see what they have learnt (L). A KWL table is typically divided into three columns titled 'Know', 'Want', 'Learn'. See example image below.

3. Before distributing live worms, explain to students that the worms must be treated gently and touched as little as possible.
4. Give each pair one worm to look at. Place it on the plastic container lid with a drop of water to keep the worm moist.
5. Using a magnifying glass and working in pairs, students observe and draw a picture of a live worm. Highlight some of the features discussed in the beginning of the lesson.
6. Ask students to label the saddle and head on their worm drawing (Year 1 – 2).
7. Instead of measuring the worm with a ruler, students can use informal measurements, such as the width of a pencil (**ACMMG037 – Year 2**). Students record measurements on their worm drawing.
8. Students compare their drawings and observations.

   As a class:
   - ask students how they know worms are living things
   - discuss how worms move and why
   - mime the movement of a worm.
9. Discuss what students have learned (L) about worms and why they have certain features that help them to survive. Complete the KWL chart.



Example of a KWL chart

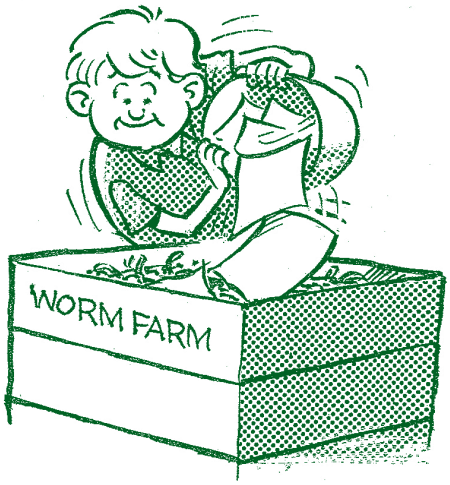
Activity for Years 3–6:

1. Start by showing the whole class pictures of a worm capsule and an adult worm. Ask the students what they think the worm capsule is.
2. Spread the worms and their castings out on a plastic sheet and ask the class to gather around and identify a worm capsule, a juvenile worm (which is smaller and sometimes lighter in colour than an adult worm), and an adult worm.
3. Tell the students they are going to observe a live worm using a magnifying glass and produce a scientific drawing. If students have no prior knowledge of how to do a scientific drawing then this must be explained. (see side box)

4. Provide a detailed drawing of a worm (see figure 1 in the introduction) and have students identify (a) clitellum (b) anus (c) mouth (d) segments. This will provide students with some ideas about where to begin.
5. Before distributing live worms, explain to students that the worms must be treated gently and touched as little as possible.
6. Distribute the worms to the students on a plastic container. Add a drop of water to keep the worm moist.
7. Students first observe and then begin their scientific drawing and labelling of the worm.
8. Observation comments should be recorded separately to the drawing. On a separate piece of paper, record the weight, length and width of the worm, and general observations about the worm:
    - smell
    - colour
    - number of segments
    - can you find the worm's head and tail?
    - does it have eyes, a nose, hair or mouth?
    - is there a difference between the top side of your worm and the bottom?
    - how does the worm's skin feel?
    - do you think the worm has a skeleton?
    - does the worm move and how so? Can the worm move backwards?
    - does the worm have any special features? Describe them.

    NB: Scales may not be able to record the weight of one worm if they are not fine scales. Have students record the weight of 20 average sized worms and calculate the average weight of one worm.

When making scientific drawings, they must be clear, well labelled (head, tail, segments etc), and with as much detail as a simple observation will allow. It should be titled and enclosed in a simple border using a ruler and pencil.



9. When students have completed their scientific drawings and observations, allow a short period of time for class discussion on findings and return worms to the worm farm.
10. Discuss animal features and adaptations compared to humans. For example, humans need arms and legs to move around, worms do not because they have a long slender body ideal for moving through soil. Humans wear sunglasses to protect their eyes from the glare of the sun but worms do not because they spend most of their time underground in the dark and do not have eyes. (**ACSSU043 – Year 5**).
11. Discuss what students have learned (L) about worms. Complete the KWL chart.

Extension or assessment ideas:

- Create a class table for recording the measurements of the worms. F-Year 2 can focus on length, where Years 3-6 could focus on length, width and mass. Students can then create charts using this information (numeracy).
- Students can create posters or Power Point presentations on the lifecycle of a worm. (**ACELY 1689-Year 4**)
- Start a term's work on worms by introducing the worms through reading 'A Diary of a worm' by Doreen Cronin then explain students will be completing their own diary or journal of worm work in the term. (**ACELT1601 – Year 3; ACELT1607 – Year 4**)
- Write a story on what it would be like if you woke up tomorrow as a worm. (**ACELT 1582- Year 1; ACELY1671 – Year 2; ACELY1682- Year 3; ACELY1694 –Year 4**)
- Have students do research on specific animal features and adaptations. (**ACSSU043 – Year 5**)

Worm activity 2 – Investigation: Worm food

Aim:

Students will build a mini worm farm and investigate the factors that affect the rate at which worms consume food. They will observe changes in the mini worm farm and record their information in a table format to show how the needs of the worms are best met.

Suitable for: F – Year 6

Duration: The initial lesson and investigation set up will take about one hour with ongoing 10 minute observations two to three times per week over three weeks, followed by another full lesson to discuss final observations and (for years 3–6) to create reports.

Prior learning: This activity is best done after the students have completed other activities about worms such as Worm activity 1–Worms alive.

General capabilities:

Cross-curriculum priorities:

Background information:

Before conducting this activity, you might like to read the teacher introduction at the beginning of this guide. The following sections are particularly relevant:

- 4. Worm farming at school, particularly sub sections
  - 4.3 Food to put in your worm farm – 'on the menu'
  - 4.4 Food to keep out of your worm farm – 'off the menu'

Key words: castings, decompose, pH level.

Resources:

- one two litre clear plastic drink bottle (with the top cut off, see diagram) per pair
- moist worm castings
- water
- compost worms
- newspaper
- large and small vegetable and fruit scraps
- hard and soft vegetable and fruit scraps (i.e. carrots vs. banana, pre-prepared for F-2 only) – chopped into similar sized long strips so that you can place them up against the edge of the bottle
- digital kitchen scales (for Years 3–6)
- knives for preparing food scraps (for Years 3–6)
- fork/mortar and pestle/blender(optional) for pureeing and a grater for grating food scraps as available (for Years 3–6).

Australian Curriculum links for F–2

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science Understanding		
Biological sciences Living things have basic needs including food and water (ACSSU002)	F	Students observe worms eating food over a period of weeks.
Living things live in different places where their needs are met (ACSSU211)	1	Students discuss where worms live and what food they need.
Chemical sciences Everyday materials can be physically changed in a variety of ways (ACSSU018)	1	Students observe how a variety of foods are broken down by worms.
Science; Science as a Human Endeavour		
Nature and development of science Science involves asking questions about, and describing changes in, objects and events (ACSHE021, ACSHE034)	1-2	Students ask questions about what will happen in the investigation and describe changes in food over time in a mini worm farm.
Science; Science Inquiry Skills		
Questioning and predicting Respond to and pose questions and make predictions about familiar objects and events (ACSIS 024 and ACSIS037)	1-2	Students pose questions about what will happen to the food in the worm farms over time and make predictions.
Planning and conducting Participate in different types of guided investigations to explore and answer questions, such as manipulating materials, testing ideas and accessing information sources (ACSIS025, ACSIS038)	1-2	Students investigate what happens to food in a worm farm over time.
Processing and analysing data and information Engage in discussions about observations and use methods such as drawing to represent ideas (ASSIS233)	F	Students discuss the food types and draw a picture of their mini worm farm
Through discussion compare observations with predictions. (ACSIS212, ACSIS038)	1-2	Students compare which food broke down the fastest with their predictions.
Evaluating Compare observations with those of others (ACSIS213, ACSIS041)	1-2	Students compare their observations of food decomposition with others.
Communicating Share observations and ideas (ACSIS012)	F	Students share what they observe happening to the food in their worm farm with the class.
Represent and communicate observations and ideas in a variety of ways such as oral and written language, drawing and role play (ACSIS029, ACSIS042)	1-2	Students represent and communicate observations of the investigation through oral and written language and drawing.

Australian Curriculum links for Years 3–4

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science Understanding		
Biological sciences Living things, including plants and animals, depend on each other and the environment to survive (ACSSU072)	4	Students discuss what worms need to survive.
Science; Science as a Human Endeavour		
Nature and development of science Science involves making predictions and describing patterns and relationships (ACSHE050, ACSHE061)	3-4	Students understand they can make and test predictions and describe relationships.
Use and influence of science Science knowledge helps people understand the effect of their actions (ACSHE051 and ACSHE062)	3-4	Students discuss the effect of having a worm farm at their school.
Science; Science Inquiry Skills		
Questioning and predicting With guidance, identify questions in familiar contexts that can be investigated scientifically and predict what might happen based on prior knowledge (ACSIS053, ACSIS064)	3-4	Students create investigative questions about food in worm farms.
Planning and conducting Suggest ways to plan and conduct investigations to find answers to questions (ACSIS054, ACSIS065)	3-4	Students discuss ways to find out which foods will break down the fastest in a worm farm.
Safely use appropriate materials, tools or equipment to make and record observations, using formal measurements and digital technologies as appropriate (ACSIS055, ACSIS066)	3-4	Students discuss safety rules and conduct the investigation.
Processing and analysing data and information Compare results with predictions, suggesting possible reasons for findings (ACSIS215, ACSIS216)	3-4	Students compare results of rates of food types breaking down with predictions and suggest reasons.
Evaluating Reflect on the investigation, including whether a test was fair or not (ACSIS058, ACSIS069)	3-4	Students discuss whether the investigation was fair.
Communicating Represent and communicate ideas and findings in a variety of ways such as diagrams, physical representations and simple reports (ACSIS060, ACSIS071).	3-4	Students create a report of their findings including written observations, drawings and photos.
Geography; Geographical Knowledge and Understanding		
The sustainable management of waste from production and consumption (ACHGK025)	4	Students discuss how organic waste can be managed sustainably by using worm farms.

Australian Curriculum links for Years 5–6

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science as a Human Endeavour		
Nature and development of science Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena (ACSHE098, ACSHE081)	5-6	Students understand they can make and test predictions and use evidence to make explanations.
Use and influence of science Scientific knowledge is used to inform personal and community decisions (ACSHS217 and ACSHS220)	5-6	Students discuss why individuals and schools choose to have worm farms.
Science; Science Inquiry Skills		
Questioning and predicting With guidance, pose questions to clarify practical problems or inform a scientific investigation, and predict what the findings of an investigation might be (ACSIS231, ACSIS232)	5-6	Students create investigative questions about food in worm farms and predict what their findings will be.
Planning and conducting Decide which variable should be changed and measured in fair tests and accurately observe, measure and record data, using digital technologies as appropriate (ACSIS087, ACSIS104)	5-6	Students choose the variable to change to determine how to prepare food for the experiment. Students observe and record this data.
Use equipment and materials safely, identifying potential risks (ACSIS088, ACSIS105)	5-6	Students identify hazards and discuss safety rules.
Processing and analysing data and information Compare data with predictions and use as evidence in developing explanations (ACSIS218, ACSIS221)	5-6	Students compare the predictions on the rates of food breaking down to the results of their investigation and develop explanations.
Evaluating Suggest improvements to the methods used to investigate a question or solve a problem (ACSIS091, ACSIS108)	5-6	Students suggest improvements to the methods used in the investigation.
Communicating Communicate ideas, explanations and processes in a variety of ways, including multi-modal texts (ACSIS093, ACSIS110)	5-6	Students create a report of their findings including written observations, drawings, photos and explanations.

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Set the scene:

Ask the students what compost worms need to survive, and discuss where their food comes from.

Activity for F–Year 2 :

Demonstrate the set up of a mini worm farm to the students. This activity could be carried out as a whole class or students could work in pairs to then create their own mini worm farm with one of the food types. Ensure that all of the food types (large, small, hard and soft) are included so that students can compare their farm with three others containing different food types.

Investigation instructions

1. To make a mini worm farm place about five centimetres of castings in each bottle and add a small handful of worms. Add about five centimetres more of castings.
2. Carefully dig a small hole right next to the side of the container and bury one type of food item (large, small, hard or soft) in the bottle. Make sure that you can see the food through the side of the bottle and that the food is completely covered with castings.
3. Add a small amount of water to moisten the worm farm. Wrap the outside of the bottle with a piece of newspaper and place a damp newspaper 'plug' on top.

Predictions

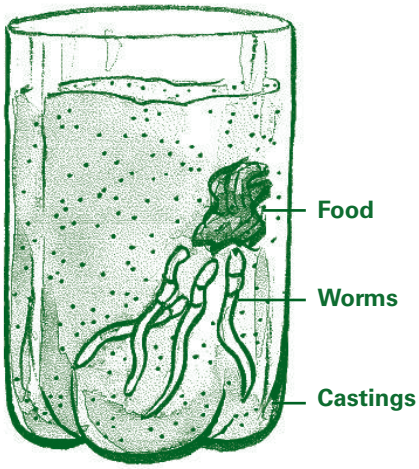
1. Ask students to complete a question like:

   'Will the small pieces of fruit _____ __ _____ than the large fruit?' or

   'Which fruit will _____ the fastest?'
2. Ask students to predict which food types they think will be broken down the fastest.

Observations

1. Check the mini worm farms every few days and add a little water if required. Represent and communicate observations in the following ways:
   - Students orally compare observations of their worm farm with other students.
   - Record observations on a chart as a class, and students write in their science journals. Use the table below as a guide to record observations (e.g. fruit is smaller, many worms around the fruit; fruit is gone etc).
   - Students can draw a picture of their worm farm on the first day and then again once each week. They could also take a photo.
2. Observations should continue until all the food scraps have been converted into castings.



Food	Day 1 observations	Day 2	Day 3	Day...
Small pieces of fruit/vegetable				
Large pieces of fruit/vegetable				
Soft fruit/vegetable				
Hard fruit/vegetable				

Discussion

1. Discuss which food was eaten the quickest and compare with original predictions. Discuss what happens to the school food scraps when they go into the school worm farm and how worms turn organic matter into castings.
2. Discuss the questions: What living conditions do worms like? Why is the school worm farm a suitable place for worms to live?
3. Once the experiment is finished, return the worms to their regular home in the school worm farm.

Activity for Years 3–6:

Investigation instructions

1. Tell the students they will investigate why and how different foods will break down in a mini worm farm. Students in Years 3 and 4 will work as a class create questions about food in worm farms. Students in Years 5 and 6 will create questions in pairs.

   For example:

   - Which food types are eaten the fastest by worms?
   - How should food be prepared to optimise the amount of scraps that can be recycled in the school worm farm?

If you wish to create a more student-led experiment, you may choose to change the question to 'What conditions are optimal for efficient processing of the school's food scraps in the worm farm?' and allow the students to change different variables, such as moisture levels.

1. Ask students how they could find out which foods will break down the fastest in a worm farm.
2. Ask the students which variables are relevant to worms eating food scraps. Answers could include:
   - moisture
   - temperature
   - pH level
   - quantities of food, worms and castings.
3. Students discuss in pairs which variables should be changed and which should be kept constant. Then as a class agree to keep all constant except for the food.
4. In their pairs students brainstorm different ways to prepare the food, (for example, pureeing, chopping, grating or leaving food items whole) and share with the class. Decide on a list of food and discuss ways to prepare the different foods.
5. Identify possible hazards in this experiment (Years 5 and 6) and discuss any safety rules (Years 3 and 4).
6. Each pair is given a food type and prepares the food accordingly. Students should use the same mass of food in each bottle and clearly label the food type. Students follow steps 1–3 in the F–Year 2 activity above to set up their mini worm farms.

Predictions

1. Students predict which food types will be consumed the fastest.

Observations

1. Students produce their own tables for recording information for all the different food types, with plenty of space to record information.
2. Students monitor and record observations over a period of three weeks in the following ways:
   - fill out their tables with their observations
   - draw pictures and/or take photographs on the first day and then each week afterwards.

3. After three weeks, if any food remains, students can weigh and record the amount of food.
4. Students create a scientific report of their findings (see example image below), including their table, drawings and photographs (you may choose to do this after the discussion questions).

Discussion

Based on the data collected, ask the students to discuss the following questions in pairs:

- Which food was consumed the fastest and which was the slowest? Why?
- How did the results compare to your predictions?
- Do you think this was a fair test to find out which food break down the fastest in a worm farm? (**ACSIS058** and **ACSIS069 – Year 3 and 4**)
- Can you think of any improvements to the methods used to investigate this question? (**ACSIS091** and **ACSIS108 – Year 5 and 6**).

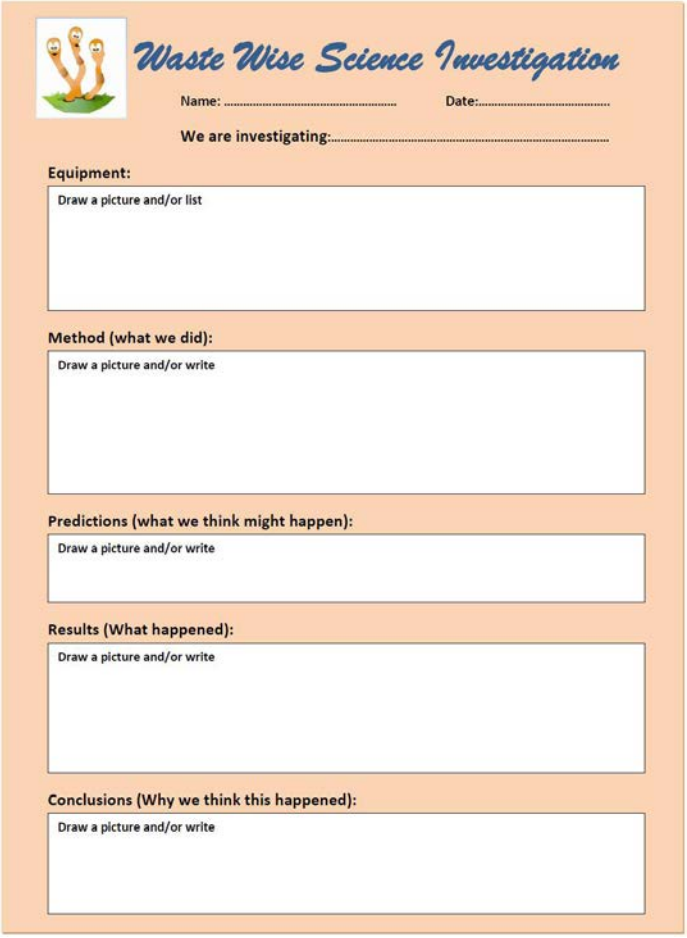
Application questions

Students discuss the following questions:

- (For schools with an existing worm farm) Why does our school have a worm farm? Should we be doing anything different with the way we deal with food scraps at our school?
- (For schools without a worm farm) Should we get a worm farm for our school? Why? When we set up a worm farm for our school, how should we deal with food scraps?
- Do you have a worm farm at home? Why would you choose to get a worm farm at home? (**ACSHS217** and **ACSHS220 – Year 5 and 6**)
- How can the use of a worm farm contribute to the sustainable management of waste? (**ACHGK025 – Year 4**)

Extension or assessment ideas

- Create a 'How to Feed' manual or an 'off/on the menu' card or poster for a worm farm.
- Imagine you own a worm restaurant and write a menu for the compost worms (**ACELY1671 – Year 2** and **ACELY1682 – Year 3**).



Waste Wise Science Investigation

Name: ..... Date:.....

We are investigating:.....

Equipment:

Draw a picture and/or list

Method (what we did):

Draw a picture and/or write

Predictions (what we think might happen):

Draw a picture and/or write

Results (What happened):

Draw a picture and/or write

Conclusions (Why we think this happened):

Draw a picture and/or write

Example of a Scientific report

Worm activity 3 – House of worms

Aim:
Students will learn how to set up and care for a worm farm by researching worm farming (vermiculture) techniques, designing a worm farm for the school, and presenting their findings and design.

Suitable for: Years 3-6, particularly Years 5-6.

Duration: This activity takes two to four 45 minute lessons, depending on whether the students produce a map, a poster, or both.

Prior learning: This activity is best done after the students have completed other activities about worms. Some useful activities include: Worm activity 1-Worms alive and Worm activity 2-Investigation: Worm food.

General capabilities:

Cross-curriculum priorities:

Background information:

Ideally, this project will coincide with the installation of a worm farm in your school and will be initiated by an upper primary class. As ecological sustainability becomes a focal point in schools, students can be empowered to act by engaging them in the setting up and running of a worm farm and educating fellow students and their community about this topic. When students raise and care for worms in a school environment to reduce the amount of organic waste going to landfill, worm farming can become part of a sustainable school culture.

Before conducting this activity, you might like to read the teacher introduction at the beginning of this guide. The following sections are particularly relevant:

- Section 4.1: Living conditions in a worm farm
- Section 4.2: School worm farms
- Section 4.6: How many worms?

It would also be helpful to watch the following link to see how Ecofaeries make a worm farm from a polystyrene box:
http://www.youtube.com/watch?v=5PbFHFGvoUQ

Sustainable Gardening Australia also has a video which shows how to make a worm farm from a polystyrene box, as well as how to look after worms and become 'good parents'
http://www.youtube.com/watch?v=YykLkvq4148:

Key words: decompose, organic, worm castings, worm leachate, vermiculture.

Resources:

- Waste Wise fact sheets (available on the Waste Wise website): 'Worms' and 'How to make a fridge worm farm'
- cardboard to make posters
- pencils and pens
- internet access (see links in 'Sources' and 'Other Resources' in the Teacher Introduction, as well as the two links above)
- books about worms.

Australian Curriculum links for Years 3–4

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science Understanding		
Biological sciences Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073)	4	Students research what worms need to survive.
Science; Science as a Human Endeavour		
Use and influence of science Science knowledge helps people to understand the effect of their actions (ACSHE051, ACSHE062)	3-4	Students research worm needs and use this knowledge to decide on the location and design of a worm farm for the school.
Geography; Geographical Knowledge and Understanding		
The sustainable management of waste from production and consumption (ACHGK025)	4	Students research how having a worm farm contributes to the sustainable management of organic waste.
Geography; Geographical Inquiry Skills		
Collecting, recording, evaluating and representing Represent the location of places and their features by constructing large scale maps that conform to cartographic conventions using scale, legend, title and north point and describe their location using simple grid references, compass direction and distance (ACHGS022, ACHGS029)	3-4	Students make a map of where to locate their worm farm in the school.
Communicating Present findings in a range of communication forms, for example written, oral, digital, graphic, tabular and visual and use geographical terminology (ACHGS024, ACHGS031)	3-4	Students present their recommendations about what kind of worm farm the school should have and where to place it in the school.
Mathematics; Measurement and Geometry		
Using units of measurement Measure, order and compare objects using familiar metric units of length, mass and capacity (ACMMG061)	3	Students use scales to measure the weight of organic waste (optional).

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
English: Literacy		
Using units of measurement Plan and deliver short presentations, providing some key details in logical sequence. (ACELY1677)	3	Students plan and deliver a short presentation about worms and/or worm farms (eg. oral / multimodal / storyboard etc.)
Plan, rehearse and deliver presentations incorporating learned content and taking into account the particular purposes and audiences (ACELY1689)	4	Students plan, rehearse and deliver a short presentation about worms and worm farms
Interpreting, analysing, evaluating Read an increasing range of different types of texts by combining contextual, semantic, grammatical and phonic knowledge, using text processing strategies, for example, monitoring, predicting, confirming, re-reading, reading on and self-correcting. (ACELY1679)	3	Students read a range of texts on the topic of worm farming
Read different types of texts by combining contextual, semantic, grammatical and phonic knowledge using text processing strategies, for example monitoring meaning, cross checking and reviewing. (ACELY1691)	4	Students read a range of texts on the topic of worm farming

Australian Curriculum links for Years 5–6

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science Understanding		
Biological sciences Living things have structural features and adaptations that help them survive in their environment (ACSSU043)	5	Students research the features and adaptations of worms and how this relates to what they need to survive in a worm farm
The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094)	6	Students research what worms need to survive and how this relates to designing a worm farm
Science; Science as a Human Endeavour		
Use and influence of science Scientific knowledge is used to inform personal and community decisions (ACSHS217 and ACSHS220).	5-6	Students research worm needs and use this knowledge to decide on the location and design of a worm farm for the school
Geography; Geographical Knowledge and Understanding		
The influence people have on the human characteristics of places and the management of spaces within them (ACHGK029)	5	Students use their research to determine where to locate a worm farm in the school, and explain why this is a good location

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Geography; Geographical Inquiry Skills		
Collecting, recording, evaluating and representing Represent the location and features of places and different types of geographical information by constructing large-scale and small-scale maps that conform to cartographic conventions, including border, source, scale, legend, title and north point, using spatial technologies as appropriate (ACHGS036, ACHGS043)	5-6	Students make a map of where to locate their worm farm in the school.
Communicating Present findings and ideas in a range of communication forms, for example, written, oral, graphic, tabular, visual and maps; using geographic terminology and digital technologies as appropriate (ACHGS038, ACHGS045)	5-6	Students present their recommendations about what kind of worm farm the school should have and where to place it in the school.
Mathematics; Measurement and Geometry		
Using units of measurement Solve problems involving the comparison of lengths and areas using appropriate units (ACMMG137)	6	Students determine what size worm farms are needed to process all of the school's organic waste
Mathematics; Statistics and Probability		
Data representation and interpretation Pose questions and collect categorical or numerical data by observation or survey (ACMSP118)	5	Students collect numerical data about the school's organic waste by carrying out a waste audit (optional)
English: Literacy		
Interacting with others Plan, rehearse and deliver presentations for defined audiences and purposes incorporating accurate and sequenced content and multimodal elements (ACELY1700)	5	Students plan, rehearse and deliver a short sequenced presentation about worms and worm farms for a lower year level
Plan, rehearse and deliver presentations, selecting and sequencing appropriate content and multimodal elements for defined audiences and purposes, making appropriate choices for modality and emphasis (ACELY1710)	6	Students plan, rehearse and deliver a short sequenced presentation about worms and worm farms for a lower year level
Interpreting, analysing, evaluating Use comprehension strategies to analyse information, integrating and linking ideas from a variety of print and digital sources (ACELY1703)	5	Students research worm farming and choose appropriate information to use to design a worm farm
Use comprehension strategies to interpret and analyse information and ideas, comparing content from a variety of textual sources including media and digital texts (ACELY1713)	6	Students research worm farming and choose appropriate information to design a worm farm

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Set the scene

Ask the students what they know about the kind of environments worms like to live in, and write their ideas on the board.

Optional pre-activity

Collect and weigh the school's organic waste for a day (if you have not recently done a waste audit at the school). Waste Wise can provide you with a Waste Audit kit - this includes a print out of our Waste Audit Toolkit (available on our website) with signs for your audit, a black plastic sheet to empty your waste onto, and a set of disposable gloves (or better yet, use reusable gloves). (**ACMMG061 – Year 3, ACMMG084 – Year 4, ACMSP118 – Year 5**)

Activity for Years 3–6

1. Students research worms and worm farming using the worm fact sheet, how to make a fridge worm farm fact sheet, the Internet and any other relevant resources. Students should determine:
    - how worms can help reduce the amount of waste people throw away (**ACHGK025 – Year 4**)
    - what worms need to survive
    - the features and adaptations of worms and how this relates to what they need to survive in a worm farm (**Year 5 – ACSSU043**)
    - where to best locate a worm farm
    - what worms should and shouldn't be fed
    - the uses of worm castings and worm leachate.
2. Encourage the students to think about the different kinds of containers that could be used for worm farming (e.g. plastic worm farm container; old fridge; old bathtub; container made of reuse materials; polystyrene box).
3. In pairs, students will use their knowledge to design a worm farm for the school. Each pair chooses which kind of container they will use for their design. You may like to ensure that a range of containers are chosen so that there is different content if students deliver presentations.
4. Students decide on:
    - what materials to use
    - what bedding to use
    - where to locate the worm farm in the school, and why this is a good location
    - other materials the school will need to take care of the worms
    - how to collect, store and use the worm leachate
    - disposal of excess food collected (composted / given to chickens etc)
    - how many worms to start with (one kilogram of worms will eat one kilogram of fruit, vegetable and paper scraps in two to three days) see section 4.6 in the introduction. The teacher will need to guide the calculation or alternatively offer this question as an extension activity. (For Years 5–6 only)
    - what size worm farm (or farms) is (or are) needed to process all of the school's organic waste—length, width and surface area. Note that worms mostly feed on the surface. (**Year 6 – ACMMG137**)
5. Students do one or more of the following: make a map of the area where the worm farm is to be located that conforms to cartographic conventions; make a poster of their design; and/or make a poster about what they have learnt about worms.
6. In pairs students plan, rehearse and deliver a short presentation about their findings and recommendations to the class using their map and/or poster.
7. Students in Years 5 and 6 present their findings and recommendations to a lower year level to inform them about worms, using their map, poster or other elements as another communication mode.
8. (Optional): Each pair presents their findings to a different class in the school

   and/or one presentation may be chosen to be showcased at the school assembly to inform the school community about worm farms.

Extension or assessment ideas

1. Set up the school worm farm as a class:
   a) Refer to the introduction section 4.5 'Setting up a school worm farm' for the steps required to set up a worm farm. To start with, you may like to set up one or two small-scale worm farms in polystyrene boxes that are near the classroom.
   b) Students use their knowledge from their research and experience setting up the worm farm to develop instructions for other classes on how to feed and care for the worms. (**ACELY1671–Year 2, ACELY1682–Year 3, ACELY1694–Year 4**).
2. Measure food quantities, worm leachate and castings collected, and worms according to mass, capacity and volume. (**ACMMG084–Year 4**).
3. Calculate the area of the surface of the worm farm (as worms mostly feed on the surface) and numbers of worms in each square metre. (**ACMMG109–Year 5**).
4. Develop schedules for classes for the collection of food scraps, feeding and maintenance of worms.

Worm activity 4 – Investigation: Grassy heads

Aim:

Students conduct a controlled experiment to test the benefits of worm castings and leachate on plant growth. Students will learn about the relationships that assist the survival of living things by investigating the benefits of worm castings (and worm leachate for Years 3–6) by making grassy heads from old stockings.

Suitable for: F- Year 2 and Years 3-6

Duration: The initial lesson and experimental set up will take about one hour with ongoing observations over one week, followed by up to two 45 minute lessons to review the observations through discussion, drawing, creating graphs and writing.

Prior learning: It would be useful to have completed other activities about worms. These include: Worm activity 1 – Worms alive and Worm activity 2 – Investigation: Worm food.

General capabilities:

Cross-curriculum priorities:

Background information:

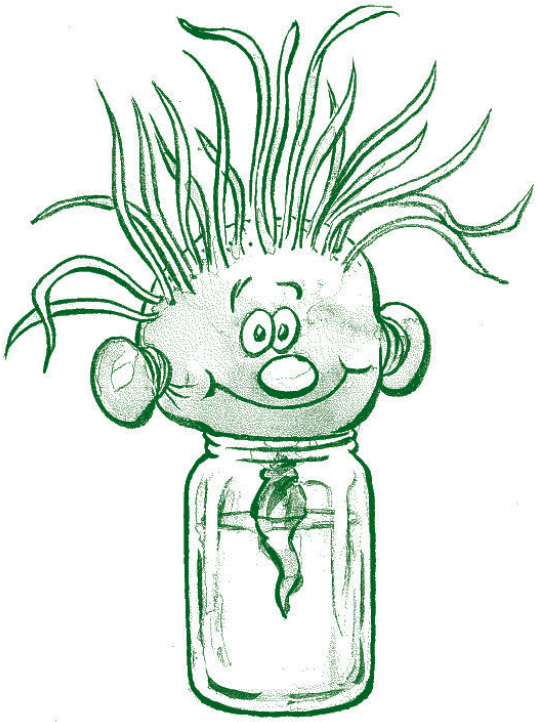
Before conducting this activity, you might like to read the teacher introduction at the beginning of this guide. The following sections are particularly relevant:

- Section 4.8: Worm castings and leachate
- Section 4.9: Trouble shooting

Key words: decompose, microbes, organic, worm castings, worm leachate, vermiculture

Resources

- old stockings/knee highs -two per group F–Year 2,or four per group Years 3–6
- grass seeds or other fast growing varieties such as wheat grass
- coffee cups or jars-two per group F–Year 2, four per group Years 3–6
- worm leachate (diluted to the colour of weak tea)
- plain water
- worm castings
- plain soil from the garden (do not use potting mix as this contains additives which may skew the results)
- newspaper
- ruler (Years 4–6)
- elastic bands (optional)
- decorations: buttons or squiggly eyes (optional).



Australian Curriculum links for F–2

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science Understanding		
Biological sciences Living things have basic needs including food and water (ACSSU002)	F	Students explore the relationship between worms and plants.
Science; Science as a Human Endeavour		
Nature and development of science Science involves asking questions about, and describing changes in, objects and events (ACSHE021, ACSHE021)	1-2	Students can ask questions about and describe changes in the growth of grass in worm castings.
Science; Science Inquiry Skills		
Questioning and predicting Respond to and pose questions and make predictions about familiar objects and events (ACSIS 024 and ACSIS037)	1-2	Students make predictions about which grassy head they think will grow the fastest.
Planning and conducting Participate in different types of guided investigations to explore and answer questions, such as manipulating materials, testing ideas and accessing information sources (ACSIS025, ACSIS038)	1-2	Students make grassy heads to investigate the effect of worm casting on plant growth.
Nature and development of science Use informal measurements in the collection and recording of observations, with the assistance of digital technologies as appropriate (ACSIS026 and ACSIS039)	1-2	Students use informal measurements to record the growth of grass in the experiment
Processing and analysing data and information Engage in discussions about observations and use methods such as drawing to represent ideas (ASSIS233)	F	Students discuss the growth of the seeds and draw a picture of their grassy heads.
Through discussion compare observations with predictions. (ACSIS212, ACSIS038)	1-2	Students compare the results of the investigation with their predictions.
Evaluating Compare observations with those of others (ACSIS213, ACSIS041)	1-2	Students compare their results with other students.
Communicating Share observations and ideas (ACSIS012)	F	Students share what they observe happening to the grassy heads.
Represent and communicate observations and ideas in a variety of ways such as oral and written language, drawing and role play (ACSIS029, ACSIS042)	1 -2	Students represent and communicate observations of the investigation through oral and written language and drawing.

Australian Curriculum links for Years 3–4

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science Understanding		
Biological sciences Living things, including plants and animals, depend on each other and the environment to survive (ACSSU072)	4	Students discuss what worms need to survive.
Science; Science as a Human Endeavour		
Nature and development of science Science involves making predictions and describing patterns and relationships (ACSHE050, ACSHE061)	3-4	Students understand they can make and test predictions and describe relationships.
Use and influence of science Science knowledge helps people understand the effect of their actions (ACSHE051 and ACSHE062)	3-4	Students discuss the effect of having a worm farm at their school.
Science; Science Inquiry Skills		
Questioning and predicting With guidance, identify questions in familiar contexts that can be investigated scientifically and predict what might happen based on prior knowledge (ACSIS053, ACSIS064)	3-4	Students create investigative questions about food in worm farms.
Planning and conducting Suggest ways to plan and conduct investigations to find answers to questions (ACSIS054, ACSIS065)	3-4	Students discuss ways to find out which foods will break down the fastest in a worm farm.
Safely use appropriate materials, tools or equipment to make and record observations, using formal measurements and digital technologies as appropriate (ACSIS055, ACSIS066)	3-4	Students discuss safety rules and conduct the investigation.
Processing and analysing data and information Compare results with predictions, suggesting possible reasons for findings (ACSIS215, ACSIS216)	3-4	Students compare results of rates of food types breaking down with predictions and suggest reasons.
Evaluating Reflect on the investigation, including whether a test was fair or not (ACSIS058, ACSIS069)	3-4	Students discuss whether the investigation was fair.
Communicating Represent and communicate ideas and findings in a variety of ways such as diagrams, physical representations and simple reports (ACSIS060, ACSIS071).	3-4	Students create a report of their findings including written observations, drawings and photos.

Mathematics, Statistics and Probability		
Data representation and interpretation Collect data, organise into categories and create displays using lists, tables, picture graphs and simple column graphs, with and without the use of digital technologies (ACMSP069)	3	Students collect data on the effects of worm leachate, record into a table and graph the results.
Interpret and compare data displays	3	Students interpret tables and graphs that they have generated.
Select and trial methods for data collection, including survey questions and recording sheets (ACMSP095)	4	Students decide on the most effective way to collect data for this investigation
Mathematics, Measurement and Geometry		
Using units of measurement Use scaled instruments to measure and compare lengths, masses, capacities and temperatures (ACMMG084)	4	Students use a ruler to compare lengths of grass grown

Australian Curriculum links for Years 5–6

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science as a Human Endeavour		
Nature and development of science Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena (ACSHE098, ACSHE081)	5-6	Students understand they can make and test predictions and use evidence to make explanations.
Use and influence of science Scientific knowledge is used to inform personal and community decisions (ACSHS217 and ACSHS220)	5-6	Students discuss why individuals and schools choose to have worm farms.

Science; Science Inquiry Skills		
Questioning and predicting With guidance, pose questions to clarify practical problems or inform a scientific investigation, and predict what the findings of an investigation might be (ACSIS231, ACSIS232)	5-6	Students create investigative questions about food in worm farms and predict what their findings will be.
Planning and conducting Decide which variable should be changed and measured in fair tests and accurately observe, measure and record data, using digital technologies as appropriate (ACSIS087, ACSIS104)	5-6	Students choose the variable to change to determine how to prepare food for the experiment. Students observe and record this data.
Use equipment and materials safely, identifying potential risks (ACSIS088, ACSIS105)	5-6	Students identify hazards and discuss safety rules.
Processing and analysing data and information Compare data with predictions and use as evidence in developing explanations (ACSIS218, ACSIS221)	5-6	Students compare the predictions on the rates of food breaking down to the results of their investigation and develop explanations.
Evaluating Suggest improvements to the methods used to investigate a question or solve a problem (ACSIS091, ACSIS108)	5-6	Students suggest improvements to the methods used in the investigation.
Communicating Communicate ideas, explanations and processes in a variety of ways, including multi-modal texts (ACSIS093, ACSIS110)	5-6	Students create a report of their findings including written observations, drawings, photos and explanations.
Mathematics, Statistics and Probability		
Data representation and interpretation Pose questions and collect categorical or numerical data by observation or survey (ACMSP118)	5	Students pose questions about the outcomes of a worm leachate investigation and collect data by observation.
Construct displays, including column graphs, dot plots and tables, appropriate for data type, with and without the use of digital technologies (ACMSP119)	5	Students construct tables andcolumn graphs of the results of their worm leachate investigation.

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

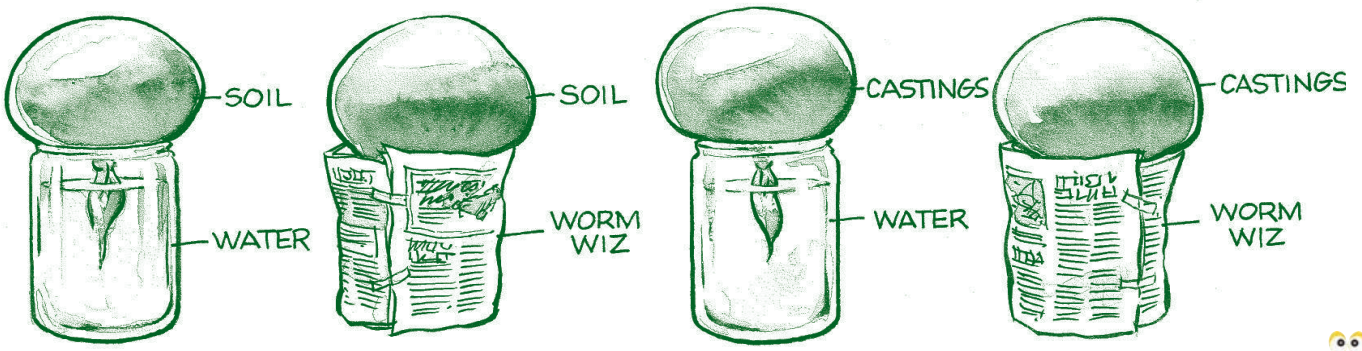
Activity for Years 3–6:

Tell the students they will be investigating the relationship between worms and plants by growing grassy heads and creating different living conditions for the grass to grow in.

Investigation instructions

1. For Years 3 and 4, ask the students to choose which questions they think they will be investigating the answers to:
   a) What is the effect of worm leachate on growing grass?
   b) Do worms eat grass?
   c) Do worm castings help plants to grow?
   d) Can people eat worms?
2. For Years 5 and 6, ask the students to formulate a question about what they would like to investigate about the effect of worm castings and leachate on plants.
   - Ask the students how they could test this relationship using the worm castings and leachate (you can give the students the equipment or the list of equipment).
3. Discuss the different designs and suggest improvements.
4. Demonstrate the experiment set up and elicit the variables (garden soil, castings, water, leachate) in the experiment from the students. Ask them which variable should be kept constant for all grassy heads (e.g. amount of grass seeds should be kept constant).
5. Divide the class into groups and distribute four stockings and jars to each group. One stocking will be the 'control' —with no leachate or castings, and three the 'experimental' grassy heads (just leachate, just castings, both leachate and castings).
6. Ask students to label the variables to be investigated. Each group will observe the effects of worm leachate and worm castings in comparison to water and local soil. Alternatively have the students work in pairs and divide the variables amongst the class.
7. Using the feet, place one tablespoon of grass seed in the toe section of each stocking.
8. To create the 'control' Grassy Head (1) add a cup of plain garden soil. Tie a knot and cut off any excess stocking but leave a smallish 'tail'. Turn it upside down and place the 'control' stocking knot on a jar filled with water, with the 'tail' in the water.
9. Repeat this process for the remaining three stockings:
   - Grassy head 2: add plain garden soil to the stocking and add leachate to the jar instead of water
   - Grassy head 3: add a mixture of half soil and castings to the stocking and plain water in the jar
   - Grassy head 4: add a mixture of half soil and castings to the stocking and leachate to the jar instead of water.
10. Make sure the whole grassy head is moist (or watered) with the same liquid that is in the jar and that the 'tail' is immersed. The beneficial microbes in worm leachate can be harmed by light, so wrap the jar with newspaper.
11. Place all the grassy heads in a sunny spot. Add water or leachate regularly to make sure they don't dry out.

Predictions



1. Ask students to come up with a prediction about what will happen with each of the four grassy heads. Students can write their predictions in their science journals.

Observations

1. Ask students to decide on the most effective way to collect data for this investigation i.e. decide what to measure and how often and how to record it. (**ACMSP095 – Year 4**)
2. Students create an observation table (see example – table 2).
3. Students observe, measure and record any changes in grass height, colour, and amount of seeds that have germinated for one week or longer if desired.

Table 2

		Observations						
	Grassy Head	**Day 1**	**Day 2**	**Day 3**	**Day 4**	**Day 5**	**Day 6**	**Day 7**
1	Soil + water (control) - Grass height - Colour - Amount of seeds germinated							
2	Soil + worm leachate - Grass height - Colour - Amount of seeds germinated							
3	Castings + water - Grass height - Colour - Amount of seeds germinated							
4	Castings + worm leachate - Grass height - Colour - Amount of seeds germinated							

4. Students create graphs of their results. Then they compare their graphs and tables with students from another group, describing their similarities and differences and the usefulness of each representation for comparing data.
5. Students create a scientific report of their findings, including their table, graphs, drawings and photographs (you may also choose to ask students to record some of their discussion questions in the report).

Discussion

Based on the data collected, students discuss the following questions in pairs:

- Which stocking head grows the 'hair' the fastest?
- Why do you think this is the case?
- How do the results compare with the predictions?
- What conclusions can you make about the effect of worm leachate and worm castings on plants?
- Do you think this was a fair test to find out about the effect of worm leachate and castings on plants (**ACSIS058** and **ACSIS069 – Year 3 and 4**)?
- Can you think of any improvements to the methods used to investigate this question? (**ACSIS091** and **ACSIS108 – Year 5 and 6**).

Application questions

Students discuss the following questions in pairs and then as a class:

- Why are worms beneficial to have in gardens?
- How do you think we should use worm castings and or leachate in the school garden?
- If you had your own garden would you use worm leachate or castings on it? Why?

Extension or assessment ideas

- Calculate the average increase in growth of the grass when using worm castings or leachate (**ACMMG137 – Year 6**). This statistic can then be used in the 'Enterprising worms' lesson to convince people to purchase the worm castings or leachate. (For example, "Tests prove that using worm leachate helps grass grow 'x' per cent faster than the control").
- Students adapt the variables and come up with their own predictions according to what they would like to test. Students can test different concentrations of worm leachate. Is worm leachate more effective when it isn't diluted? Is there an optimal dilution that should be used? Students will plan and conduct the experiment, collect, record and present their data. What conclusions can be made about the relationship between the amount of worm leachate used and the grassy heads? (**ACSIS065 – Year 4** and **ACSIS091 – Year 5**, **ACSIS108 –Year 6**).

Worm activity 5 – Worm loop

Aim:
Students will use their sense of touch and smell to identify the contents of six boxes. The items in the boxes demonstrate a 'closed loop' of organic recycling.

Suitable for: F – Year 6

Duration: One lesson (plus preparation time)

Prior learning: This activity is best done after the students have experience with maintaining a worm farm, particularly for F to Year 2. It would also be useful to have completed other activities about worms, such as Worm activity 1- Worms alive and Worm activity 2 - Investigation: Worm food.

General capabilities:

Cross-curriculum priorities:

Background information:

Before conducting this activity, you might like to read the teacher introduction at the beginning of this guide. The following sections are particularly relevant:

- 1.0 Why have a worm farm?
- 4.8: Worm castings and leachate.

An organic recycling loop –This activity demonstrates a loop of organic recycling. Fruit and vegetable scraps (box 1) are placed in a worm farm (box 2), castings (box 3) are produced by the worms, seeds (box 4) are planted in the garden with the castings and fruit and/or vegetables are produced (box 5). Box 6 (Years 3–6 only) is the odd one out, as its contents are inorganic and not part of the cycle.

Key words: inorganic, organic, worm castings

Resources

For the shoeboxes:

- Six shoeboxes with lids ; fiveboxes for F to Year 2
- Five rectangular shaped pieces of material; four for F to Year 2
- Sticky tape
- Labels for boxes - for Years 3–6 only.

Items to go in the shoeboxes:

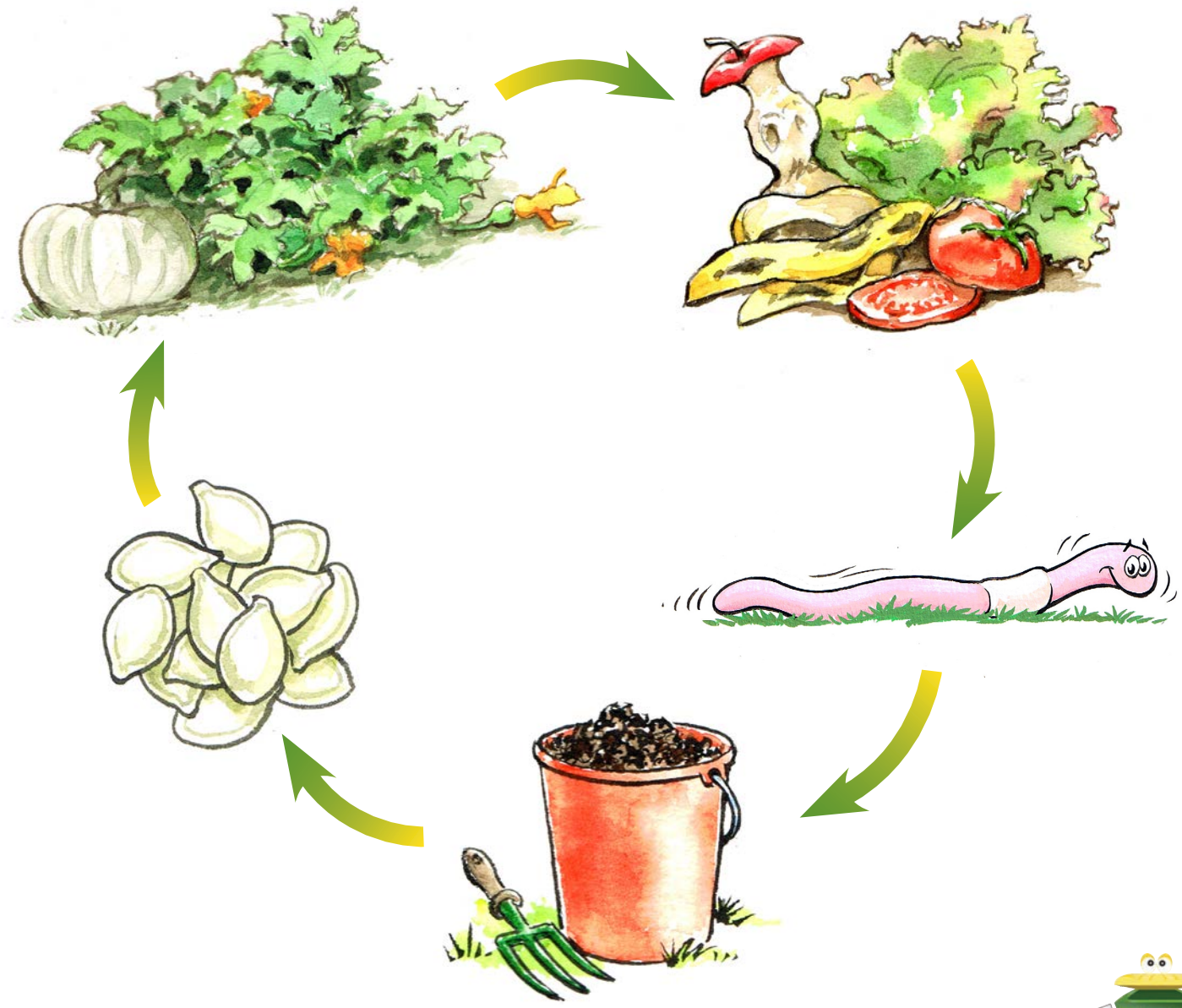
- apple core and or banana skin or any fruit or vegetable scraps
- some worms from your worm farm
- about five cups of worm castings (or soil if no castings available)
- some vegetable seeds (beans, peas and pumpkin are a suitable choice)
- any whole fruit or vegetable (not scraps)
- an inorganic item (e.g. plastic or metal) — for Years 3–6 only.

Activity preparation

NB. Check whether your students have any food handling sensitivities before doing this activity.

- Cut a hole in each of the shoebox lids large enough for a child's hand to fit through.
- Cover each hole with a flap of material large enough that the contents of the box can't be seen and tape it to the lid, except for box 2 which the students will look through.
- Label the boxes 1-6 / 1-5
- Place the following in each box:
  - Box 1: fruit and/or vegetable scraps
  - Box 2: worms
  - Box 3: worm castings or soil
  - Box 4: seeds
  - Box 5: whole piece of fruit or vegetable
  - Box 6: An inorganic item such as plastic or metal (for Year 3-6 only).

Cycle of organic recycling



Australian Curriculum links for F–Year 2

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science Understanding		
Biological sciences Living things have basic needs, including food and water (ACSSU002)	F	Students learn about worms needing food as part of the organic recycling loop
Science; Science as a Human Endeavour		
Use and influence of science People use science in their daily lives, including when caring for their environment and living things. (ACSHE022, ACSHE035)	1-2	Students discuss how they cared for worms by not touching them in this activity
Science; Science Inquiry Skills		
Planning and conducting Explore and make observations by using the senses (ACSIS233)	F	Students explore with their senses of touch and smell to identify objects they can't see
Processing and analysing data and information Engage in discussions about observations and use methods such as drawing to represent ideas (ACSIS233)	F	Students discuss their observations as a class, and draw an organic recycling cycle
Use a range of methods to sort information, including drawings and tables (ACSIS027, ACSIS040)	1-2	As a class, students sort the items in the boxes into a graphic organiser, representing the cycle of organic recycling
Evaluating Compare observations with those of others (ACSIS213, ACSIS041)	1-2	Students share their observations and ideas about the objects in the boxes
Communicating Share observations and ideas (ACSIS012)	F	Students share their observations and ideas about the objects in the boxes
Represent and communicate observations and ideas in a variety of ways such as oral and written language, drawing and role play (ACSIS029, ACSIS042)	1-2	Students discuss their ideas as a class and draw the loop of organic recycling

Australian Curriculum links for Years 3–4

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science Understanding		
Biological sciences Living things can be grouped on the basis of observable features and can be distinguished from non-living things (ACSSU044) Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073)	3 4	Students explore differences between worms, once living things and products of worms (castings) Students explore how worms are part of organic recycling loops
Science; Science as a Human Endeavour		
Use and influence of science Science knowledge helps people to understand the effect of their actions (ACSHE051, ACSHE062)	3-4	Students discuss what happens to waste that goes in a worm farm and that goes into a regular bin
Science; Science Inquiry Skills		
Communicating Represent and communicate ideas and findings in a variety of ways such as diagrams, physical representations and simple reports (ACSIS060, ACSIS071)	3-4	Students draw a diagram of an organic recycling loop
Geography; Geographical Knowledge and Understanding		
The natural resources provided by the environment, and different views on how they could be used sustainably (ACHGK024) The sustainable management of waste from production and consumption (ACHGK025)	4 4	Students discuss different views on how food waste can be used sustainably Students discuss the sustainable management of food waste through the loop of organic recycling
Geography; Geographical Inquiry Skills		
Reflecting and responding Reflect on their learning to propose individual action in response to a contemporary geographical challenge and identify the expected effects of the proposal (ACHGS025, ACHGS032)	3-4	Students reflect on their learning about worm farming to propose individual actions that can address the issue of landfill sites becoming full

Australian Curriculum links for Years 5–6

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science Understanding		
Biological sciences The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094)	6	Students consider the physical conditions of worm farms
Science; Science as a Human Endeavour		
Use and influence of science Scientific understandings, discoveries and inventions are used to solve problems that directly affect people's lives (ACSHE083, ACSHE 100)	5-6	Students consider how knowledge of organic recycling loops solves problems and contributes to sustainability
Scientific knowledge is used to inform personal and community decisions (ACSHS217, ACSHS220)	5-6	Students consider how knowledge of organic recycling loops informs decisions about what to do with waste and how to use this knowledge in gardening
Geography; Geographical Inquiry Skills		
Reflecting and responding Reflect on their learning to propose individual and collective action in response to a contemporary geographical challenge and describe the expected effects of their proposal on different groups of people (ACHGS039, ACHGS046)	5-6	Students reflect on their learning about worm farming to propose individual and collective actions that can address the issue of landfill sites becoming full and describe the expected effects on different groups of people

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Set the scene

Ask the students to list the senses they use other than sight. Let them know they'll be using some of these senses in this activity.

Activity for F – Year 2

In this activity, students will use their sense of touch and smell to identify the contents of five of the boxes, and will use sight to identify the worms in box 2.

1. Place the boxes around the room.
2. Put students into five groups and allocate each group to one box. Groups will rotate around the boxes. Hand out scrap paper for students to draw or write down what they think is in each box.
3. Students need to do the next part of this activity without any talking.
4. Ask students to take turns to feel and smell their allocated box without looking inside. Remember, no talking! You might like to have a timer or a bell handy to ensure each team member has a turn.
5. Once everyone has had a turn, rotate groups to the next box and repeat the activity so all students get to look in or feel all five boxes.
6. Gather back as a group and brainstorm what they thought was in each box and why. Focus on what they touched and smelled.
7. Ask students: How are the contents of the box connected? What do we do with food scraps? What do the worms do with them? What can we do with worm castings?
8. Draw the cycle of organic recycling on the board and then ask students to draw the cycle in their books. They can also label and describe each step on their diagram.
9. Ask the class why they think that they were asked to only look at box 2 rather than touch the contents (A: to care for living things) (**ACSHE022 – Year 1, ACSHE035 – Year 2**).

Activity for Year 3 – 6

Follow the same procedure as above but mix up the items so that the items are not in the order of the organic recycling loop e.g. put the worms in Box 1 instead of the fruit scraps. Mix up all the other boxes too.

1. Ask the students to do the first part of this activity without any talking.
2. Let the students look in the box with the worms, and to feel and smell the contents of the other boxes as described above. Students should write down or draw what they think is in the box (use scrap paper)
3. Rotate so that all students feel all six boxes.
4. After students have been to the final box, ask the students to discuss with their group what they thought was in each box.
5. Get each group to look in their final box and report back on what is actually in there. Label the boxes and list the correct answers on the board. Discuss in their group whether they were right.
6. Ask each group to work out how the boxes are connected. Let them know that one box does not belong in the group at all. Ask: Which one is the odd one out? How are the other boxes connected in a cycle? As a class put the boxes into the right order.
7. Ask the students to draw a diagram of this organic recycling loop.
8. Ask the students what worms need other than food to grow and survive (**ACSSU073 – Year 4, ACSSU094 – Year 6**).

9. Discuss the characteristics of the contents of each box in pairs and then as a class. Ask:
    - what do you know or can you observe about each of the parts of the cycle? (**ACSSU044 – Year 3**)
    - why do you think that you were asked to only look at the box with the worms in it, rather than feel them (to care for the worms).
10. Discuss the loop of organic recycling as a class (**ACHGK025 – Year 4**). Ask:
    - what happens to food waste that goes into a regular bin? (It goes to landfill)
    - why is using a worm farm part of being environmentally sustainable? (Some reasons why include: reducing waste to landfill, improving depleted soils without relying on chemical fertilisers, and saving water due to improved water retention of soil) (**ACSHE083 – Year 5, ACSHE 100 – Year 6**)
    - can you think of any sustainable alternatives to putting food in a worm farm? (composting, using a fermentation system (like a bokashi bin) or giving the scraps to chickens)
    - how could learning about organic recycling loops influence decisions you make in your life? (**ACSHS217 – Year 5, ACSHS220 – Year 6**)
    - for Years 3-4: Many municipal landfill sites are predicted to be full within the next 10 years. What can you do in your life to address this challenge, with the knowledge that you have about worm farming? What could the effects of this be? (**ACHGS025 – Year 3, ACHGS032 – Year 4**)
    - for Years 5-6: Many municipal landfill sites are predicted to be full within the next 10 years. What can you do in your life to address this challenge, with the knowledge that you have about worm farming? What could your town/city do to address this challenge? What would the expected effects of your proposal be on different groups of people (eg. school children, people working in offices, the elderly etc) (**ACHGS039 – Year 5, ACHGS046 – Year 6**)

Extension or assessment ideas

- Use a magnifying glass to look at the worms. Observe and describe how they move (**ACSSU017 – Year 1**). Draw and label a worm.

Worm activity 6 – Investigation: How worms behave

Aim:
Students will use worms from the school worm farm to investigate how worms move around and react to various light conditions. They will test predictions by gathering data and analyse how the features of living things enables them to function in their environment.

Suitable for: Years F-6, particularly for Years 3-6

Duration: This activity takes approximately three 45 minute lessons, including writing up the report.

Prior learning: This activity is best done after the students have completed other activities about worms. Some useful activities include: Worm activity 1-Worms alive and Worm activity 2-Investigation: Worm food.

General capabilities:

Cross-curriculum priorities:

Background information:

Before conducting this activity, you might like to read the teacher introduction at the beginning of this guide. The following section is particularly relevant:

- 2.0 Description and characteristics of worms.

Be kind

Be sure to treat the worms gently and with respect while observing as they are very fragile. Be sure to release them back into the worm farm after examining them.

Key words: adaptations, compost worms, castings, clitellum, invertebrates, photoreceptors, saddle, segments, setae, phylum Annelida.

Resources

- compost worms from the school worm farm
- worm castings
- tray (the plastic desk drawers are perfect for this)
- exercise book
- stopwatches/ student watches (one for each pair) or the classroom wall clock
- magnifying glasses (one for each pair)
- optional: Bottle cap e.g. from a soft drink bottle (one for each pair for Years 3-6; one lamp for F-2).

Australian Curriculum links for F–2

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science Understanding		
Biological sciences Living things have a variety of external features (ACSSU017)	1	Students observe how a worm moves as it moves away from a light source.
Living things live in different places where their needs are met (ACSSU211)	1	Students discuss why worms are sensitive to light in relation to living underground.
Physical sciences Light and sound are produced by a range of sources and can be sensed (ACSSU020)	1	Students observe the effect of light on worms.
Science; Science Inquiry Skills		
Processing and analysing data and information Engage in discussions about observations and use methods such as drawing to represent ideas (ASSIS233)	F	Students discuss how worms move and draw their observations of a worm.
Through discussion compare observations with predictions. (ACSIS212, ACSIS038)	1-2	Students predict what might happen in the investigation and then compare these to their observations as a class activity.
Communicating Share observations and ideas (ACSIS012)	F	Students share their observations of a worm with the class.
Represent and communicate observations and ideas in a variety of ways such as oral and written language, drawing and role play (ACSIS029, ACSIS042)	1 -2	Students represent their observations of a worm investigation through drawing and writing.

Australian Curriculum links for Years 3–4

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science as a Human Endeavour		
Nature and development of science Science involves making predictions and describing patterns and relationships (ACSHE050, ACSHE061)	3-4	Students understand they can make and test predictions and describe relationships.
Science; Science Inquiry Skills		
Questioning and predicting With guidance, identify questions in familiar contexts that can be investigated scientifically and predict what might happen based on prior knowledge (ACSIS053, ACSIS064)	3-4	Students identify a question they will investigate about worms and light sources and make predictions about how worms will respond.
Planning and conducting Suggest ways to plan and conduct investigations to find answers to questions (ACSIS054, ACSIS065)	3-4	Students suggest ways to plan and conduct an investigation about how worms respond to light sources.
Processing and analysing data and information Use a range of methods including tables and simple column graphs to represent data and identify patterns and trends (ACSIS057, ACSIS068)	3-4	Students record results of their investigation in a table and graph the results.
Compare results with predictions, suggesting possible reasons for findings (ACSIS215, ACSIS216)	3-4	Students compare results of their investigation with their predictions and suggest reasons why.
Mathematics; Statistics and Probability		
Data representation and interpretation Construct suitable data displays, with and without the use of digital technologies, from given or collected data. Include tables, column graphs and picture graphs where one picture can represent many data values (ACMSP096)	4	Students construct a table and graph results

Australian Curriculum links for Years 5–6

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science Understanding		
Biological sciences Living things have structural features and adaptations that help them to survive in their environment (ACSSU043)	5	Students can discuss how worms are adapted to live in the soil and avoid light.
The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094)	6	Students gather evidence to prove that worms avoid light in their environment.
Living things have structural features to survive in their environment (ACSSU043)	5	Students can discuss how worms are adapted to live in the soil and avoid light.
Science; Science as a Human Endeavour		
Nature and development of science Science involves testing predictions by gathering data and using evidence to develop explanations of events and phenomena (ACSHE081, ACSHE098)	5-6	Students understand they can make and test predictions and use evidence to make explanations.
Use and influence of science Scientific understandings, discoveries and inventions are used to solve problems that directly affect people's lives (ACSHE083, ACSHE100)	5-6	Students apply their knowledge about worms and light to plan how they could harvest the castings from the school worm farm.
Science; Science Inquiry Skills		
Questioning and predicting With guidance, pose questions to clarify practical problems or inform a scientific investigation, and predict what the findings of an investigation might be (ACSIS231, ACSIS232)	5-6	Students pose questions they will investigate about worms and light sources and make predictions about how worms will respond.
Planning and conducting With guidance plan appropriate investigation methods to answer questions or solve problems (ACSIS231, ACSIS232)	5-6	Students suggest ways to plan and conduct an investigation about how worms respond to light sources.
Processing and analysing data and information Construct and use a range of representations, including tables and graphs to represent and describe observations, patterns or relationships in data using digital technologies as appropriate (ACSIS090, ACSIS107)	5-6	Students record results of their investigation in a table, graph the results, and describe the pattern represented in the graph.
Compare data with predictions and use as evidence in developing explanations (ACSIS218, ACSIS221)	5-6	Students compare results of their investigation with their predictions and use as evidence in developing explanations.
Mathematics, Statistics and Probability		
Data representation and interpretation Pose questions and collect categorical or numerical data by observation or survey (ACMSP118)	5	Students pose a question about worms and collect numerical data
Construct displays, including column graphs, dot plots and tables, appropriate for data type, with and without the use of digital technologies (ACMSP119)	5	Students construct a table and graph results.

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Set the scene

Review the students' prior knowledge about worms. Ask what kinds of light sources worms might be exposed to.

Activity for F – Year 2

Investigation instructions

1. Ask the students how they think the worms will respond to a light source. Set up the activity described in the Activity for Years 3–6 'Investigation instructions' (below) as a demonstration for the whole class.

Predictions

1. Ask the students to predict what will happen when worms are exposed to light.

Observations

1. Ask the students to create a booklet to record the investigation steps and their observations in with pictures and writing.
2. Every five minutes invite the class to observe what the worms are doing. Record the students' observations to go in the booklet.

Discussion

As a class discuss:

- the students initial predictions compared to their observations
- why worms are sensitive to light in relation to living underground.

Activity for Year 3 – 6

Investigation planning

1. Students will begin by thinking about a scientific question to investigate the effect of light on worms.
   - Year 3–4: Students will choose which question best describes what they will be investigating:
     a) What do worms like to eat?
     b) How do worms respond to light sources?
     c) How much water do worms need?
   - Year 5–6: Students will write their own question about what they would like to investigate about worms and light sources. Discuss the investigation questions as a class.
2. Ask students how they could investigate the answer to the question they posed or chose. You may like to give the students the equipment or the list of equipment for this.
   - Year 3–4: Discuss in pairs and then as a class.
   - Year 5–6: Write the steps for a plan to investigate the question in pairs.
3. Discuss the different designs and suggest improvements.

Investigation instructions

1. This activity will be conducted in pairs. Have students set up their investigation, either as they suggested or as follows.
2. Take the class outside or ensure that there is plenty of light in the space you are using for this investigation.

3. Ask each pair to:
   - cover a tray with a thin layer of worm castings and half without
   - place an exercise book (or tea towel) over half of the tray to cover the castings
   - tell the students about this next step, but first ask them to make their predictions (below). Students will gently place about 10 worms on the side of the tray that is uncovered and give the worms some time to settle down. Use only 10 worms, because if there is more than that number they will tend to bunch together rather than move around. You can put 10 worms in each of the bottle tops for easy distribution to the groups.

Predictions

1. Have students make predictions about how the worms will respond to the light and record their ideas in their science journals.

Observations

1. Observe the worms for 15 to 20 minutes. During the investigation, carefully watch the worms to make sure they aren't drying out. If this is the case, return them immediately to the worm farm.
2. Students observe whether the worms head directly for the shelter of the castings. Students count and tally how many worms there are on each side of the tray every three to five minutes and record in a table. You might like to discuss with the class what the table could look like to record the data. (**ACMSP095 – Year 4**)
3. Students use a magnifying glass to closely observe worm mobility and body segmentation. Record all observations.
4. Students graph the results of their investigation (number of worms versus time).
5. Students describe the pattern represented in the graph. (**Year 5 and 6 – ACSIS090 and ACSIS107**)
6. Students create a report of their findings, including the graph, diagrams or photos. You could also ask them to include and answers to discussion questions below:

Discussion

Students discuss in pairs:

- How did your results compare with your predictions?
- How do the worms respond to the light?
- Why do you think worms responded the way they did?
- Did you gain enough evidence to demonstrate how worms respond to light? Was the test fair? (**ACSIS058, ACSIS069 – Year 3 and 4**)
- How could you improve the experiment and what further experiments can you complete to get further evidence? (**ACSIS091, ACSIS108 –Year 5 and 6**)

Application question

Ask the students to apply their new knowledge about worms and light to plan how they could harvest the castings from the school worm farm (**ACSHE083, ACSHE100 – Year 5 and 6**).

Extension or assessment ideas

- Students research what features a worm has to sense the light and why they react the way they do.
- Students design an investigation to see how worms respond to heat, to cold or to moisture. Students make predictions, gather data and record their observations. Based on the evidence they have found from conducting their experiment, students design a survival guide for worms, which includes what conditions they thrive in and what conditions they try to avoid (**ACSIS23, ACSIS232 – Year 5 and 6**).
- Design a worm farm for worms to reflect the conditions in which worms like to live.
- Write a survival guide for worms with particular emphasis on how to protect the worms from light sources. Publish this as a Power Point presentation, brochure or poster (**ACELY1671 – Year 2; ACELY1682 – Year 3** and **ACELY1694 – Year 4**).

Worm activity 7 – Worm rap

Aim:
Students will demonstrate their knowledge of the characteristics of worms in a creative way by writing and performing their own rap about worms.

Suitable for: F–Year 6

Duration: This activity takes between 45 and 60 minutes with an additional lesson to practice and present raps or poems to an audience.

Prior learning: This activity is best done after the students have completed other activities about worms. Some useful activities include: Worm activity 1-Worms alive, Worm activity 2-Investigation: Worm food and Worm activity 5: Worm loop.

General capabilities:

Cross-curriculum priorities:

Background information:

Before conducting this activity, you might like to read the teacher introduction at the beginning of this guide. The following sections are particularly relevant:

- Section 2: Description and characteristics of worms.

Key words: adaptations, castings, clitellum, compost worms, invertebrates, photoreceptors, phylum *Annelida*, saddle, segments, setae,

Resources

- Examples of worm literature such as poems, plays or stories about worms
- Worm rap! by Caroline Haviland, from Science and Children, January 1993 http://mypages.iit.edu/~smile/bi9409.html
- Waste Wise CDs to lend (contact the Waste Wise team to organize a loan)
  - Captain Cleanup: 'Wiggly Worm'
  - Billy B: 'A Worm Song', Nobody likes me', 'The Inch Worm', and
  - Fay White: 'Earthworm'
- The littlest worm (an echo song that can be sung to the tune of 'My Highland Goat') www.traditionalmusic.co.uk/childrens-songs/Littlest_Worm.htm

Australian Curriculum links for F–2

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science Understanding		
Biological sciences Living things have a variety of external features (ACSSU017)	1	Students revise the physical features of worms by reading or writing a worm rap or rhyme.
Science; Science Inquiry Skills		
Communicating Represent and communicate observations and ideas in a variety of ways such as oral and written language, drawing and role play (ACSIS029, ACSIS042)	2	Students present what they have learned about worms through a rap or poem.
English; Literature		
Examining literature Replicate the rhythms and sound patterns in stories, rhymes, songs and poems from a range of cultures (ACELT 1579)	F	Students replicate a 'worm rap' or worm song.
Listen to, recite and perform poems, chants, rhymes and songs, imitating and inventing sound patterns including alliteration and rhyme (ACELT 1585)	1	Students replicate a 'worm rap' or worm song.
Identify, reproduce, and experiment with rhythmic, sound and word poems, chants, rhymes and songs (ACEL1592)	2	Students replicate a 'worm rap' or worm song.
English; Literacy		
Interacting with others Rehearse and deliver short presentations on familiar and new topics (ACELY1667)	2	Students rehearse and deliver their worm rap or rhyme to the class or at an assembly.
Creating texts Create short imaginative, informative and persuasive texts using growing knowledge of text structures and language features for familiar and some less familiar audiences, selecting print and multimodal elements appropriate to the audience and purpose. (ACELY 1671)	2	Students create their own raps or poem about worms.

Australian Curriculum links for Years 3–4

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science Inquiry Skills		
Communicating Represent and communicate ideas and findings in a variety of ways such as diagrams, physical representations and simple reports (ACSIS060, ACSIS071)	3-4	Students present what they have learned about worms through a rap or poem.
Geography; Geographical Knowledge and Understanding		
The sustainable management of waste from production and consumption (ACHGK025)	4	Students review their knowledge about worms, including their role in dealing with organic waste
English; Language		
Expressing and developing ideas Incorporate new vocabulary from a range of sources into students' own texts including vocabulary encountered in research (ACELA1498)	4	Students use their learned worm vocabulary to create a rap or poem.
English; Literature		
Examining literature Discuss the nature and effects of some language devices used to enhance meaning and shape the reader's reaction, including rhythm and onomatopoeia in poetry and prose (ACELT1600)	3	Students discuss the use of rhyme and rhythm in the worm rap.
English; Literacy		
Texts in context Plan, rehearse and deliver presentations incorporating learned content and taking into account the particular purposes and audience (ACELY1689)	4	Students write their own rap, Haiku or play about worms for a specific purpose such as a school assembly.
Creating texts Plan, draft and publish imaginative, informative and persuasive texts demonstrating increasing control over text structures and language features and selecting print, and multimodal elements appropriate to the audience and purpose. (ACELY 1682)	3	Students create their own raps or poem about worms.
Plan, draft and publish imaginative, informative and persuasive texts containing key information and supporting details for a widening range of audiences demonstrating increasing control over text and language features (ACELY1694)	4	Students write their own rap about worms or present the information that they have learnt in a creative form to demonstrate their knowledge of worms.

Australian Curriculum links for Years 5–6

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science Inquiry Skills		
Communicating Communicate ideas, explanations and processes in a variety of ways, including multi-modal texts (ACSIS093, ACSIS110)	5-6	Students present what they have learned about worms through a rap or poem.
English; Literacy		
Creating texts Plan, draft and publish imaginative, informative and persuasive print and multimodal texts, choosing text structures, language features, images and sound appropriate to purpose and audience (ACELY1704)	5	Students write their own rap about worms or present the information that they have learnt in a creative form to demonstrate their knowledge of worms.
Plan, draft and publish imaginative, informative and persuasive texts choosing and experimenting with text structures, language features, images and digital resources appropriate to purpose and audience (ACELY1714)	6	Students write their own rap, Haiku or play to demonstrate their knowledge of worms

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Set the scene

Play the worm songs and discuss with students the rhyming words in the verses.

Activity for F – 2

Investigation instructions

1. Read the Waste Wise worm rap below or 'Worm rap!' by Caroline Haviland (available at http://mypages.iit.edu/~smile/bi9409.html) and have students perform it for the class to experiment with rhythmic sound.

WASTE WISE WORM RAP

Pleased to meet you,
I'm a worm as you can see
And I'm here today to tell you,
About my family

We've got no eyes to see you
But we move away from light
And no ears to hear you
But your tremors give us fright

We're nifty little critters
We help the soil grow plants
To help your growing bodies
Get good food in balance

We've got no legs or arms
Not needed underground
'cos we wriggle and make tunnels
As we spread our charm around

Those green thumbed ones among you
They know the good we do
If a soil's got worms inside it
It grows more veg for you!

2. Brainstorm the key words about compost worms with the class and create a 'worm word wall'.
3. Year 2 students could create their own raps or poems about worms, using their knowledge of chants, rhymes and songs.
4. The rap or a student's work can be learnt for a whole school presentation informing the school on what they have learnt about worms.

Activity for Years 3–6

1. Students review their knowledge about worms, including worm features, worm farms and their role in dealing with organic waste.
2. As a class, create a 'worm word wall' using the vocabulary reviewed.
3. Students write their own rap about worms or present the information that they have learnt in a creative form (e.g. they could write a haiku poem or perform a worm play to demonstrate their knowledge of worms).
4. Students perform the worm plays/raps/songs for another class or at assembly.

Ideas for extension or assessment

- Students in lower primary can demonstrate their knowledge of the features worms have to help them to survive by naming the correct body parts in their raps, songs and poems. This can be linked to what they learned about worms in the 'Worms Alive' activity at the beginning of this guide.
- Read 'Diary of a Worm', see the website for English teaching ideas: www.readwritethink.org/lessons/lesson_view.asp?id=778 and have students write their own children's book. (**ACELY1651 – F; ACELY1662 – Year 1; ACELY1671 – Year 2; ACELY1682 – Year 3; ACEL1694 – Year 4**)
- Sew a worm character to make a puppet to perform with at assembly or a draught stopper (which can then be reused at home) by filling it with sawdust or rice.

Worm activity 8 – Enterprising Worms

Aim:

Students will design a Waste Wise marketing plan to sell worm leachate (or castings), including collecting, packaging and labeling their product to raise money for their school. Tasks will be assigned to different year levels, the younger students will design the product labels while the older students devise the business plan. All students can work together to collect and market the product.

Suitable for: Years 2–6

Duration: For Years 2–4, this activity takes 45 to 60 minutes.

For Years 5–6, this activity takes two to three lessons.

Prior learning: This activity is best done after the students have completed several other lessons about worms and/or have practical experience of using worm leachate on the school garden. Worm activity 4 -Grassy Heads is particularly useful.

General capabilities:

Cross-curriculum priorities:

Background information:

It is recommended that this activity is done once a sizeable and successful worm farm has been set up at the school.

Before conducting this activity, you might like to read the teacher introduction at the beginning of this guide. The following sections are particularly relevant:

- 1.0 Why have a worm farm?
- 4.0: Worm farming at school
- 4.8: Worm castings and leachate.

People pay a lot of money for fertilisers for their home gardens and are continuously looking for more sustainable ways to garden. Selling worm castings and worm leachate produced at school is a good enterprise introduction for students. It can provide funds to enable the school to expand the worm farm area into an organic recycling centre complete with garden beds full of sustainable and healthy fruit and vegetables, grown on compost and fertilised by worm castings of course!

It is not good to put a lot of water through your worm farm; regular light watering is ideal. It is better to harvest castings and produce 'worm wiz' by mixing the castings with water than to run a lot of water through your worm farm.

Worm leachate contains live microbes that require oxygen to survive and are sensitive to light, so leachate should be stored away from the sun. Leachate should not be stored for long periods as the microbes will die.

Key words: decompose, organic, worm castings, worm leachate

Resources

- school worm farm
- one, two or three litre containers (clean and empty) —milk bottles work well
- labels designed by the students
- empty packaging samples from a selection of products (e.g. milk carton, soft drink bottle, egg carton, Seasol garden fertiliser, toy packaging)
- product advertisements.

Australian Curriculum links for Year 2

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
English; Language		
Text structure and organisation Understanding that different types of text have identifiable text structures and language features that help the text serve its purpose (ACELA1463)	2	Students create labels to encourage people to purchase worm leachate

Australian Curriculum links for Years 3–4

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science as a Human Endeavour		
Use and influence of science Science knowledge helps people to understand the effect of their actions (ACSHE051, ACSHE062)	3-4	Students use their knowledge about worm castings and leachate to show why people should buy it
Geography; Geographical Knowledge and Understanding		
The sustainable management of waste from production and consumption (ACHGK025)	4	Students discuss how having a worm farm contributes to sustainability
English; Literacy		
Interpreting, analysing, evaluating Identify the audience and purpose of imaginative, informative and persuasive texts (ACELY1678)	3	Students identify the audience for their worm enterprise and write a persuasive worm leachate label
Identify characteristic features used in imaginative, informative and persuasive texts to meet the purpose of the text. (ACELY1691)	4	Students analyse advertising and labels for different products to identify persuasive techniques

Australian Curriculum links for Years 5–6

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science as a Human Endeavour		
Use and influence of science Scientific knowledge is used to inform personal and community decisions (ASSHE217)	5-6	Students' knowledge about the benefits of worm leachate and castings is used to plan sales for a worm enterprise
Mathematics; Number and Algebra		
Money and financial mathematics Create simple financial plans (ACMNA106)	5	Students create a simple plan for their business and calculate costs and potential profits
Mathematics; Statistics and Probability		
Data representation and interpretation Construct displays including column graphs, dot plots and tables, appropriate for data type with and without the use of digital technologies (ACMSP119)	5	Students produce graphs and diagrams to show the sales of worm leachate or castings
English: Language		
Expressing and developing ideas Identify and explain how analytical images like figures, tables, diagrams maps and graphs contribute to our understanding of verbal information in factual and persuasive texts (ACELA1524)	6	Students present a flow chart of the worm enterprise to the principal or at a school assembly

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Set the scene

1. Review the benefits of having a worm farm and using organic worm fertiliser (leachate and castings) in gardens, from the practical experience that students have had, and/or what they learnt from the 'Grassy Heads' investigation. For at least Year 4 and up, we suggest framing this in the context of sustainability (reducing waste to landfill improving soil organically, etc). (**ACHGK025 – Year 4**)
2. Depending on your students' level, provide some product packaging and/or advertising pictures for students to discuss different advertising methods, language and labelling of products to appeal to certain audiences.

Activity for Years 2–4

1. Have students design a label for selling the worm leachate and/or castings to the school community, using language and pictures that show why the worm leachate is good for gardens and why people should buy it.
2. Share the ideas about labels with the upper primary classes so they can use them in their business plans to sell the worm leachate to the school community.

Activity for Years 5–6

Before the activity

Make sure that the school policy allows the students to conduct a fundraising initiative and that any requirements are taken care of.

Activity instructions

1. Explain to the students that they are going to create a plan to sell their worm leachate and/or castings to raise funds for the school. Divide the students into pairs or groups.
2. Think of a name for the product.

   Students decide on a method of packaging for their worm castings or worm leachate focusing on reusing materials, using the empty packaging samples from a selection of products.
3. Ask the students to devise a simple plan for selling worm castings or worm leachate by answering the following questions:
   - Who will buy the product?
   - How much will you charge?
   - Where and when will you sell it and how often?
   - How will you advertise this?
   - Who will look after the money?
   - What will you do with the money for the school?
   - What safety issues should be considered? (such as students wearing hats and gloves, getting permission from parents, that the leachate might be mistaken for something else).
   - Calculate any possible costs and work out how much profit the school can make each week in relation to the number of bottles they fill with leachate (without over-watering the worms of course!).
4. This plan could then be implemented as a project. The class could decide which plan to continue with (see extension ideas).

Follow-up activity (optional)

If the worm leachate fundraising project is implemented, develop a way to assess the success of fundraising and show how the fundraising process works as a system using a diagram.

1. Students tally the amount of bottles sold per day.
2. Students calculate the funds they raise over time.
3. Students graph this data.
4. A flow diagram can be used to show how the worm leachate and/or castings are produced, sold and the funds from this put back into various school projects.
5. The students can present this to the principal or at an assembly.

Ideas for extension or assessment

- Following on from the plan, produce an organised, efficient process for the collection and sale of worm products and address any safety issues.
- Decide how best to advertise the worm castings/leachate. For example, create a slogan or jingle to catch the buyer's attention, and/or use persuasive language and figures to convince them to buy the product. If the percentage improvement in growth of grass when using worm leachate or castings was calculated in the 'Grassy Heads' lesson students can use this figure for advertising. (**ACELY1682 – Year 3; ACELY1694 – Year 4; ACELY1704 – Year 5; ACELY1714 – Year 6**)
- Present the students' advertising campaign at assembly for Drama. (English links as above)

Worm activity 9 – Worm Presentations

Aim:

Students demonstrate their knowledge about worms by producing a product (an album, a dance, a performance, an essay, a guidebook) using the RAFT concept (Role, Audience, Format and Topic) that they present to other students or members of the school community.

Suitable for: F–Year 6

Duration: For F-Year 2, this activity takes one lesson. For Years 3-6, it takes approximately one lesson for presentation preparation, and another two to three lessons for presentation practice and delivery, depending on the length of presentation time you set for your students.

Prior learning: This activity is best done after the students have completed several other lessons about worms and/or have experience with maintaining the school worm farm. Some useful activities include: Worm activity 1– Worms Alive and Worm activity 2– 'Investigation: Worm Food'.

General capabilities:

Cross-curriculum priorities:

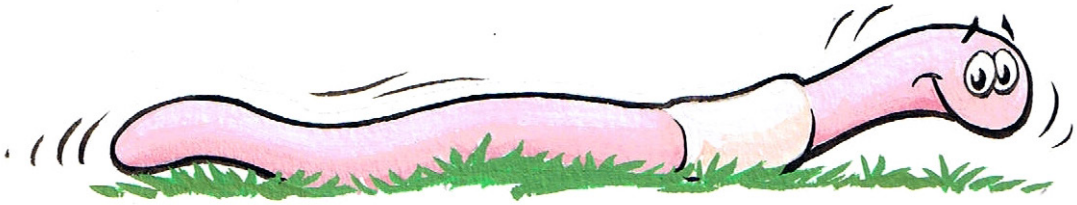
Background information:

Before conducting this activity, you might like to read the teacher introduction at the beginning of this guide.

Key words: any vocabulary in the teacher introduction and glossary that you have previously covered with your students.

Resources

- Art supplies as needed



Australian Curriculum links for F–2

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science as a Human Endeavour		
Use and influence of science People use science in their daily lives, including when caring for their environment and living things (ACSHE022, ACSHE035)	1-2	Students share what they know about worms from their prior experience
Science; Science Inquiry Skills		
Communicating Share observations and ideas (ACSIS012)	F	Students share what foods they have observed being put in the school worm farm
Represent and communicate observations and ideas in a variety of ways such as oral and written language, drawing and role play (ACSIS029, ACSIS042)	1-2	Students use oral language to communicate what they have learnt about worms
English; Literacy		
Interacting with others Deliver short oral presentations to peers (ACELY1647)	F	Students make a short presentation about food to put in and leave out of a worm farm
Make short presentations using some introduced text structures and language, for example opening statements (ACELY1657)	1	Students make a short presentation about food to put in and leave out of a worm farm
Rehearse and deliver short presentations on familiar and new topics (ACELY1667)	2	Students make a short presentation on what they know about worms.

Australian Curriculum links for Years 3–4

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science Understanding		
Biological sciences Living things have life cycles (ACSSU072)	4	Students compile their knowledge about the life cycles of worms
Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073)	4	Students compile their knowledge about what worms need to survive
Science; Science as a Human Endeavour		
Use and influence of science Science knowledge helps people to understand the effect of their actions (ACSHE051, ACSHE062)	3-4	Students reflect on the reasons for and effects of having a worm farm
Science; Science Inquiry Skills		
Communicating Represent and communicate ideas and findings in a variety of ways such as diagrams, physical representations and simple reports (ACSIS060, ACSIS071)	3-4	Students represent their ideas and findings in a concept map, and deliver a presentation about them.
Geography; Geographical Knowledge and Understanding		
The sustainable management of waste from production and consumption (ACHGK025)	4	Students present on how worms contribute to the sustainable management of waste
Geography; Geographical Inquiry Skills		
Communicating Present finding in a range of communication forms, for example written, oral, digital, graphic, tabular and visual and use geographical terminology (ACHGS031)	4	Students present their knowledge and ideas on how worm farms contribute to sustainable waste management
Reflecting and responding Reflect on their learning to propose individual action in response to a contemporary geographical challenge and identify the expected effects of the proposal (ACHGS025, ACHGS032)	3-4	Students propose individual actions to address sustainable waste management
English; Literacy		
Interacting with others Plan and deliver short presentations, providing some key details in logical sequence. (ACELY1677)	3	Students make a short presentation on what they know about worms.
Plan, rehearse and deliver presentations incorporating learned content and taking into account the particular purposes and audiences (ACELY1689)	4	Students plan, rehearse and deliver a short presentation about worms based on what they have learnt in previous lessons.

Australian Curriculum links for Years 5–6

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science Understanding		
Biological sciences Living things have structural features and adaptations that help them to survive in their environment (ACSSU043)	5	Students compile knowledge about the structural features and adaptations of worms that help them survive
The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094)	6	Students compile knowledge about how worms are affected by the physical conditions of their environment
Science; Science as a Human Endeavour		
Use and influence of science Scientific understandings, discoveries and inventions are used to solve problems that directly affect people's lives (ACSHE083, ACSHE100)	5-6	Students reflect on their understandings about worms and how they solve problems
Scientific knowledge is used to inform personal and community decisions (ACSHE217, ACSHE220)	5-6	Students reflect on why the school community choose to have a worm farm
Science; Science Inquiry Skills		
Communicating Communicate ideas, explanations and processes in a variety of ways, including multi-modal texts (ACSIS093, ACSIS110)	5-6	Students represent ideas, explanations and processes about worms in a concept map, and deliver a presentation about them
Geography; Geographical Inquiry Skills		
Communicating Present findings and ideas in a range of communication forms, for example, written, oral, graphic, tabular, visual and maps; using geographical terminology and digital technologies as appropriate (ACHGS038, ACGHS046)	5-6	Students present their knowledge and ideas on how worm farms contribute to reducing waste going to landfill
Reflecting and responding Reflect on their learning to propose individual and collective action in response to a contemporary geographical challenge and describe the expected effects of their proposal on different groups of people (ACHGS039, ACHGS046)	5-6	Students propose individual and collective actions to address reducing waste going to landfill

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science Understanding		
Interacting with others Plan, rehearse and deliver presentations for defined audiences and purposes incorporating accurate and sequenced content and multimodal elements (ACELY1700)	5	Students plan, rehearse and deliver a short sequenced presentation about worms and worm farms for an audience of their choice
Plan, rehearse and deliver presentations, selecting and sequencing appropriate content and multimodal elements for defined audiences and purposes, making appropriate choices for modality and emphasis (ACELY1710)	6	Students plan, rehearse and deliver a short sequenced presentation about worms and worm farms for an audience of their choice
Use interaction skills, for example paraphrasing, questioning and interpreting non-verbal cues and choose vocabulary and vocal effects appropriate for different audiences and purposes (ACELY1796)	5	Students create a product and present it to an audience of their choice, adapting their language to meet the perceived audience needs
Use interaction skills, varying conventions of spoken interactions such as voice volume, tone, pitch and pace according to group size, formality of interaction and needs and expertise of audience (ACELY18160)	6	Students create a product and present it to an audience of their choice, adapting their language to meet the perceived audience needs

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Set the scene for F–Year 2

Create a concept map as a class with all the information they know about worms, including topics such as: why worms farms are useful (1.0 in the introduction); worm menu (4.3 and 4.4); and how to set up a worm farm (4.5). For Foundation students you might just like to focus on food to put in your worm farm and food to keep out.

Activity for F–Year 2

1. Ask the students to prepare a short oral presentation to perform for their class. They can choose one of the following characters to role play:
   - a worm from the worm farm
   - a food scrap
   - a student at the school.
2. Review the information from the concept map that is relevant to each character.
3. Remind students that their opening sentences communicate who their character is and give an example (e.g. "I am a worm from the school worm farm and I like to eat…").
4. Students rehearse and deliver their presentation to the class.

Set the scene for Years 3–6

Ask students what are some of the most interesting things they know about worms.

Activity for Years 3–6

1. Tell the students that in groups, they will create a presentation to help educate the school community about vermiculture in a format of their choice. Presentations will include role play to demonstrate a variety of perspectives.

2. Put the students in groups of three to four. In their groups, students compile all their research and practical knowledge on vermiculture and complete a concept map so that all ideas and information are presented. We recommend you invite your students to include think about worm farming in the context of sustainability.
3. Refer to the Australian Curriculum links at the beginning of this activity for topics and ideas. Some examples include:
   - life cycles of worms and what they need to survive (Years 3 and 4)
   - structural features and adaptations(Year 5)
   - how worms are affected by the physical conditions of the environment (Year 6)
   - what problems can be addressed by keeping worms and why the school has a worm farm (Years 4, 5 and 6)
   - how worm farms contribute to the sustainable management of waste (Year 4) (or include this with the above topic)
   - propose individual actions to meet the challenge of reducing waste going to landfill, and identify the expected effects of this (Year 3 and 4)
   - propose individual and collective actions to meet the challenge of reducing waste going to landfill, and identify the effects of this on different groups of people (eg. school children, office workers, the elderly, etc) (Year 5 and 6)
4. Students:
   a. choose a **Role**: this is the perspective from which they will make their presentation from. (e.g. the point of view of a worm, a food scrap, a student or a worm farmer)
   b. decide on an **Audience**: for example, another class, teachers, or parents
   c. decide on a **Format**: for example, a play, a documentary, an ICT presentation, a fairy tale, a song, etc. Encourage students to be creative
   d. decide on the **Topic**: Students can cover worms broadly, or focus on one area of vermiculture, for example, the worm menu, how to set up a worm farm (if activity 6, 'House of Worms' has not been completed), or troubleshooting problems. If this is going to be presented to the whole school then it could be coordinated so that all topics within vermiculture can be represented.
5. Students prepare and rehearse their presentation in the format of their choice.
6. Students deliver their presentation to the chosen audience (e.g.to different classes or at a sustainability fair).

Ideas for extension or assessment

This project can be adapted to suit any sustainability project and would be a good way to produce work, displays or presentations for a sustainability fair at the school.

Worm activity 10 – Worm games

Aim:

This game provides students with a fun way to demonstrate their knowledge of worms and to learn from one another. This activity can be used to revise some curriculum links previously covered in the class on the topic of worms.

Suitable for: Year 2 - Year 6, particularly 5-6.

Duration: If the students have already completed research on worms (Years 3-6), this activity takes approximately 45 minutes to prepare the game and 45 minutes to play.

For the research component, add at least another two lessons.

Prior learning: This activity is best done after the students have completed several other lessons about worms and/or have experience with maintaining the school worm farm. Some useful activities include: Worm activity 1-Worms Alive and Worm activity 2-Investigation: Worm Food. If the students have already completed Worm activity 3 -House of Worms, the research component of the activity may not be necessary.

General capabilities:

Cross-curriculum priorities:

Background information:

Before conducting this activity, you might like to read the teacher introduction at the beginning of this guide. For years 4–6 all sections may be useful to refer to.
For years 2–3 the following sections are particularly relevant:

- 4.3 Food to put in your worm farm— 'on the menu'
- 4.4 Food to keep out of your worm farm— 'off the menu'

Key words: any vocabulary in the teacher introduction and glossary that you have previously covered with your students, or that you would like the students to learn.

Resources for research component (if applicable)

- Waste Wise fact sheets (available on the website): 'Worms' and 'How to make a fridge worm farm'
- cardboard to make posters
- pencils and pens
- internet access
- books.

Resources for game

- cardboard (recycled e.g. cereal boxes) to make fact or picture cards
- photocopied grids, graph paper or paper for students to make grids (the flip side of an already used piece of paper)
- a hard back book for each pair large enough to prevent students from seeing each other's grid, or some other object to use as a barrier

Australian Curriculum links for Years 3–4

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science Understanding		
Biological sciences Living things, including plants and animals, depend on each other and the environment to survive (ACSSU073)	4	Students research or review what worms need to survive
Science; Science as a Human Endeavour		
Use and influence of science Science knowledge helps people to understand the effect of their actions (ACSHE051, ACSHE062)	3-4	Students review the reasons for and effects of having a worm farm
Geography; Geographical Knowledge and Understanding		
The sustainable management of waste from production and consumption (ACHGK025)	4	Students research or review how worm farms contribute to sustainable waste management
Mathematics; Measurement and geometry		
Location and Transformation Create and interpret simple grid maps to show position and pathway (ACMMG065)	3	Students create a grid map, draw objects and identify the location of objects in the grid in a worm game.
English; Language		
Language for interaction Understand that successful cooperation with others depends on the shared use of social conventions, including turn taking patterns and forms of addresses that vary according to the degree of formality in social situations (ACELA1476)	3	Students play a worm game in pairs.
English; Literacy		
Interpreting, analysing, evaluating Use comprehension strategies to build literal and inferred meaning to expand content knowledge, integrating and linking ideas and analysing and evaluating texts (ACELY1692)	4	Students research worms and choose appropriate information to use in a game.

Australian Curriculum links for Years 5-6

Subject; Strand		
Sub-strand Content description (code)	**Year**	**Lesson outcome**
Science; Science Understanding		
Biological Sciences Living things have structural features and adaptations that help them survive in their environment (ACSSU043)	5	Students research or review the features and adaptations of worms
The growth and survival of living things are affected by the physical conditions of their environment (ACSSU094)	6	Students research or review what worms need to survive
Science; Science as a Human Endeavour		
Use and influence of science People use science in their daily lives, including when caring for their environment and living things (ACSHE022, ACSHE035)	5-6	Students discuss why the school community chose to have a worm farm
English; Literacy		
Interpreting, analysing, evaluating Use comprehension strategies to analyse information, integrating and linking ideas from a variety of print and digital sources (ACELY1703)	5	Students research worms and choose appropriate information to use in a game (if research component included)
Use comprehension strategies to interpret and analyse information and ideas, comparing content from a variety of textual sources including media and digital texts (ACELY1713)	6	Students research worms and choose appropriate information to use in a game (if research component included)

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA)

Set the scene

Ask the students why the school has a worm farm. Encourage them to think about different aspects of sustainability (e.g. Reducing waste to landfill, conserving water as worm castings improve water retention soils, using organic fertilisers which are not harmful to waterways).

Activity for Years 2–6

Research component

1. If applicable, students research in books, on the Internet, from the Waste Wise worm fact sheets and poster, on the topics of: worms and waste; biology; living conditions; worms and sustainability and what can and can't be put in a worm farm.

Game preparation

2. Based on the students' research or drawn from students' previous knowledge and experience, students work in pairs to create 20 fact cards on the cardboard and write the answers on the reverse side of the cards.
3. Each student draws a grid play board with 80 squares on scrap paper or graph paper. Students should rule 10 vertical lines, and 10 horizontal lines. They then write 1 to 8 in the squares on the top row (skipping the top left square) and then, the letters 'a' to 'h' down the first column (see illustration). This grid represents a worm farm (alternatively provide the students with a photocopy of the grid below).

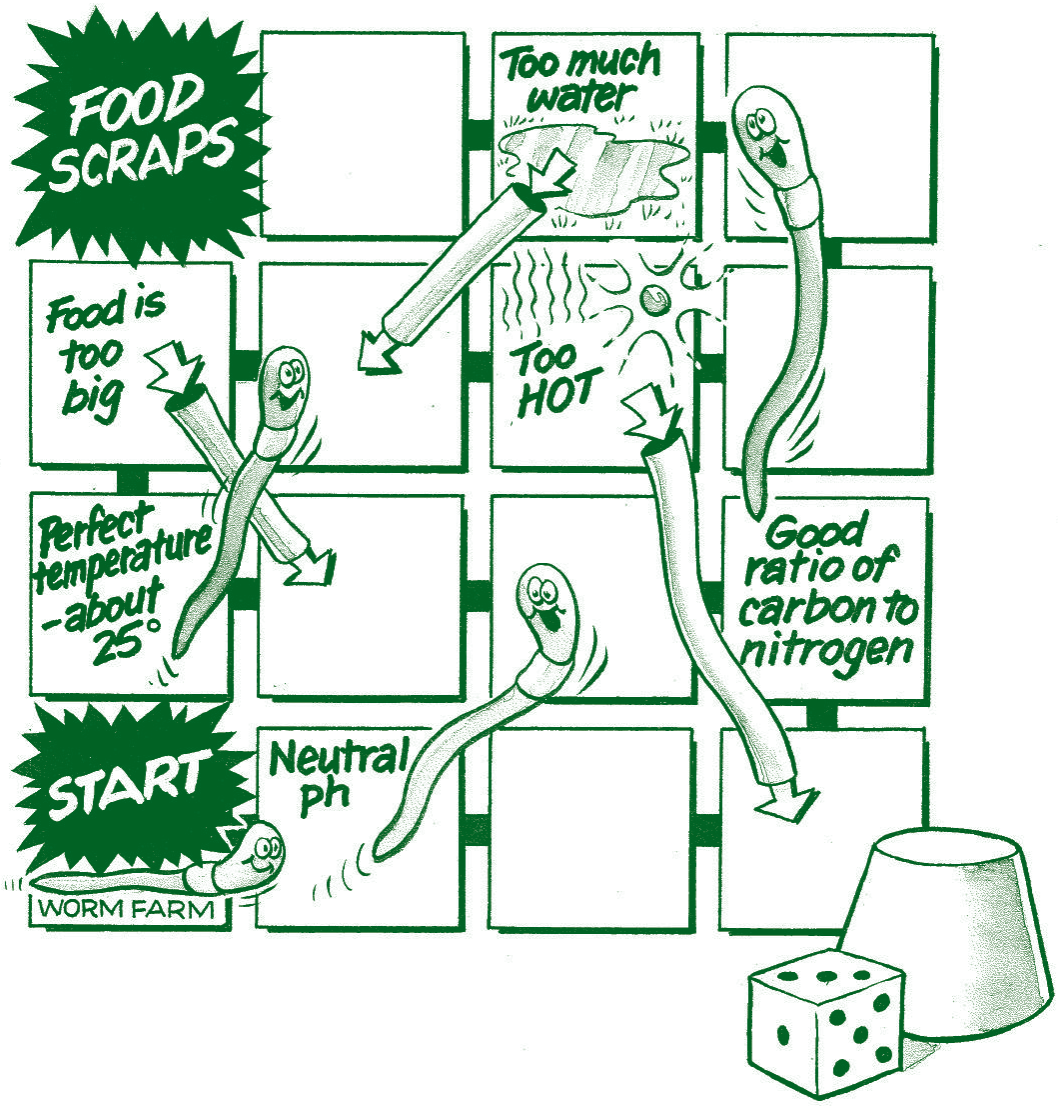
	1	2	3	4	5	6	7	8
A								
B								
C								
D								
E								
F								
G								
H								

Game instructions (similar to the game Battleship)

1. Place a barrier (hard back book or other) between the students who sit facing each other so that neither student can see the other's grid.
2. Without showing their partner each student then draws worms in their grid. They have two adult worms (five squares long) and two baby worms (two squares long) to hide in their worm farm, running vertically or horizontally)
3. To have a chance to guess the worm position, the students first have to answer a worm fact question. If the question is answered incorrectly or they do not know the answer, they must be told the correct answer so that they can answer it correctly next time. A correct response means a player can take a turn to guess where the worms are. They call out their guess by calling the reference for the grid, e.g. B7 etc. If they have guessed a square correctly the person whose worm was found has to say 'hit', and if not 'miss'. The player marks the box on their game grid with an X if it is a miss, and a W, if it is a hit. Then it is the other player's turn.
4. The players continue until they have dug up a whole worm. When a worm is 'dug up', the player whose worm it is has to say 'It's your worm'. The other player then wins this worm as a point. The game continues until one player has unearthed all of the other player's worms.

Ideas for extension or assessment

Students can create their own 'Worm and tunnels' game using their knowledge of worms. This game concept is adapted from the Snakes and ladders game.



Glossary

Adaptations: Any behavioural or physical characteristics of an animal that help it to survive in its environment.

Aerobic decomposition: Organic matter being broken down in the presence of oxygen.

Anaerobic decomposition: Organic matter being broken down without the presence of oxygen.

Annelida: Alarge phylum of segmented worms including earthworms and leeches. They are also less-formally known as annelids, the name coming from the Latin 'annelus', meaning 'little ring'.

Capsule: Formed from a mucous ring and containing the fertilised egg to be deposited in the soil. The capsule on average will produce four baby worms and these can hatch after about two weeks in the right conditions.

Carbon dioxide (CO_2): An odourless, colourless gas produced during respiration. It is a greenhouse gas.

Castings/vermicast: See worm castings.

Class: A taxa (group) that collectively describes organisms which are similar in the international biological classification system. In this system, 'kingdom' is the highest level, followed by 'phylum', 'class', 'order', 'family', 'genus', and finally, 'species'. The table below shows how humans and tiger worms (red wriggler worms) are classified in this system.

Common name	Kingdom	Phylum	Class	Order	Family	Genus	Species
Human	Animalia	Chordata	Mammalia	Primate	Hominidae	Homo	sapiens
Tiger worm	Animalia	Annelida	Clitellata	Haplotaxida	Lumbricidae	Eisenia	foetida

Clitellum: A clitellum is part of the reproductive system of an annelid (a worm with small rings or segments). The clitellum is a thick, saddle-like ring found in the epidermis (skin) of the worm.

Decomposition: The process of organic matter being broken down physically and chemically by bacterial or fungal action; the rotting process; decomposition can be aerobic (with oxygen) or anaerobic (without oxygen).

Greenhouse gases: Any of the gases whose absorption of solar radiation is responsible for the greenhouse effect, including carbon dioxide and methane.

Hermaphrodites: Organisms having both male and female reproductive organs.

Inorganic: Not organic, that is, matter that has not come from a living thing. (e.g. plastic, glass, metal, synthetic fertilisers).

Invertebrates: An animal without a backbone.

Leachate: see worm leachate

Methane (CH_4): A colourless, odourless, flammable gas produced during anaerobic composting.

Microbes: Micro-organisms such as bacteria and actinomycetes. In the case of worm leachate and castings these are the beneficial micro-organisms that accelerate decomposition (Murphy, 2009).

Oligochaete: *Oligochaeta*, collectively, is a subclass in the biological phylum Annelida and includes various earthworms.

Organic: Matter that has come from a once-living organism and is capable of decay or is the product of decay (e.g. plants, leaves, food scraps, paper, straw etc).

pH level: Measured level of acidity (>7) or alkalinity (<7) of soil/water etc. In this instance the worm farm contents.

Photoreceptors: Nerve endings that are extremely sensitive to light.

Phylum: A taxa (group) that collectively describes organisms which are similar in the international biological classification system. In this system, 'kingdom' is the highest level, followed by 'phylum'/'division', 'class', 'order', 'family', 'genus', and finally, 'species'. See entry for '**class**' above.

Saddle: see clitellum.

Segmented: The body is divided into successive segments, as in earthworms or lobsters.

Seta (plural-setae): Stiff hair made of solid keratin that worms have on each segment of their bodies and use them for grip and as sensors.

Worm castings/vermicast: Organic material that has been digested by worms and passed through their digestive system (i.e. faeces). Both worm leachate and castings contain a wide variety of nutrients and beneficial microbes necessary for plant growth. Castings also assist in improving the water retention of soil.

Worm farm: A bought or constructed home for worms put in place to convert organic matter into worm castings and 'worm wiz'.

Worm leachate ('worm wiz'): A highly nutritious organic liquid plant food produced by the worms and collected from a worm farm.

Vermiculture: The raising and production of earthworms and their by-products.