Investigating Invertebrates in your Backyard

Aims

- Introduction to identifying invertebrates.
- The role of invertebrates in our ecosystems, including their habitats and diet.
- How and why we should monitor invertebrates in our environment.
- Develop action projects around increasing biodiversity in your environment.

Why do Invertebrates matter?

Without invertebrates, terrestrial ecosystems would collapse:

- Plants would fail to reproduce without pollinators.
- Nutrients would remain locked in dead matter without decomposers.
- Soil would lose fertility without engineers like earthworms.
- Food webs would unravel without invertebrates as prey.

In short, invertebrates are the invisible workforce of ecosystems, sustaining biodiversity and human well-being alike.

horizons
REGIONAL COUNCIL

This kit can link to the following NZ Curriculum (2026)

Curriculum	Examples of Activities
Science (2007) *Nature of Science* • Investigating in science - planning and carrying out investigations into invertebrates. • Understanding about science - learning why monitoring invertebrates matters. • Communicating in science - sharing findings from invertebrate surveys. • Participating and contributing - developing biodiversity action projects. *Living World* Levels 1–2: • Recognise that all living things have certain requirements to stay alive. Levels 3–4: • Explore how invertebrates interact with their environment (diet, predators, pollination).	• Observe and describe invertebrates' features (legs, wings, shells) and habitats. • Classify animals into groups (vertebrates vs. invertebrates). • Investigate how ecosystems depend on biodiversity and how invertebrates contribute to soil health, decomposition, and food webs. • Use evidence (monitoring data) to explain how environmental changes affect invertebrate populations.
Maths (2026 Curriculum) – use in addition to maths textbooks as desired Statistics Strand • Students collect, sort, and display data; interpret patterns and trends; critique reliability. *Numbers and Algebra Strand* • Use counting, grouping, ratios, and proportions to describe situations. *Measurement and Geometry* • Apply measurement to length, area, and volume; use spatial reasoning. *Mathematical Modelling* • Apply maths to investigate and solve real-world problems.	• Students tally invertebrates found in different habitats, create graphs (bar charts, pie charts), and interpret biodiversity trends. • Counting invertebrates, calculating percentages of species types, comparing populations across sites, or bush sites verses grasslands for example • Measuring quadrats or transects for monitoring, calculating areas of habitats, mapping invertebrate distribution. • Modelling how changes in habitat (e.g., planting natives) affect invertebrate numbers over time. • Predict how many invertebrates might be in a larger area using proportional reasoning.

English (2026 curriculum) *Oral Language* • Share observations and findings clearly using precise vocabulary (e.g., “habitat,” “adaptation,” “biodiversity”). • Engage in discussions about the role of invertebrates in ecosystems. *Reading* • Read and interpret informational texts about invertebrates, habitats, and diets. • Identify key ideas and supporting details in scientific or environmental texts. *Writing* • Write structured reports and explanations using appropriate language features. • Create persuasive or informative texts for a specific audience.	• Students present findings from monitoring activities. • Group discussions on why invertebrates are important for biodiversity. • Students read DOC or Science Learning Hub resources on invertebrates. • Compare texts on different species and their ecological roles. • Students write a report on invertebrate monitoring results. • Develop a persuasive poster advocating for biodiversity action projects. Examine conservation campaigns for persuasive techniques. • Create multimodal texts (video, infographic) promoting biodiversity enhancement.

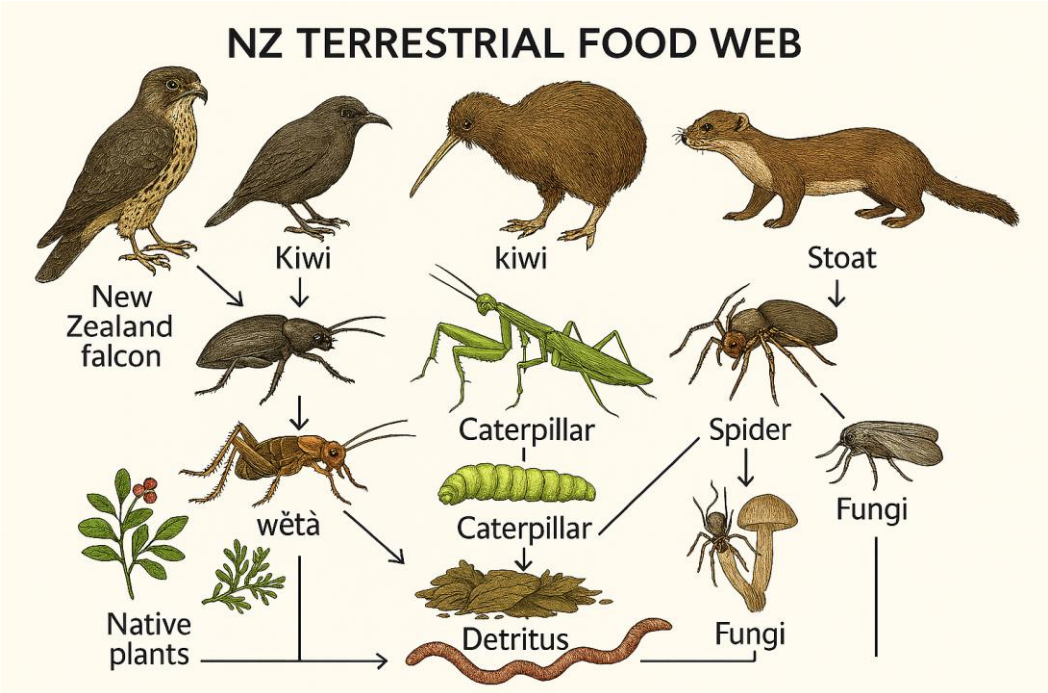
Role of Invertebrates in Ecosystems

Invertebrates are the backbone of ecosystems (ironically, without having one themselves). Broadly, they have jobs in nutrient cycling, pollination, soil formation, and food web stability. In terrestrial ecosystems specifically, they are crucial as pollinators, decomposers, soil engineers, and prey for other animals, making them indispensable for biodiversity and ecosystem health.

If we break this down further:

- **Food Web Foundations**

Invertebrates serve as primary consumers (herbivores feeding on plants) and secondary consumers (predators of other invertebrates). They are a major food source for vertebrates like birds, fish, amphibians, and mammals.



A sample food web

- **Pollination and Plant Reproduction**

Insects such as bees, butterflies, and beetles pollinate flowering plants, enabling reproduction and crop production.

- **Decomposition and Nutrient Cycling**

Detritivores (e.g., earthworms, beetles, millipedes, and fungi-associated invertebrates) breakdown organic matter, recycle leaf litter, dead wood, and animal remains, preventing nutrient lock-up and releasing nutrients back into the soil.

- **Ecosystem Engineers**

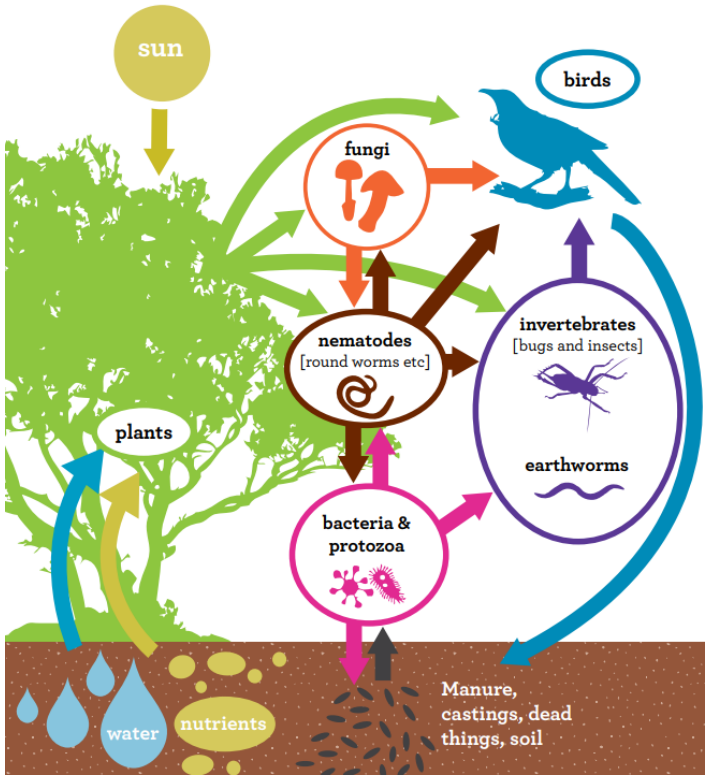
Some invertebrates modify habitats, earthworms and ants aerate soil, improve water infiltration, and enhance nutrient availability.

- **Indicators of Ecosystem Health**

Their abundance and diversity reflect environmental quality. Declines often signal pollution, habitat loss, or climate stress.

- **Pest Control**

Predatory invertebrates (such as ladybugs, spiders, parasitic wasps) regulate populations of herbivorous insects, maintaining balance in plant communities.



Ecosystem connections – without one part an ecosystem will collapse

All insects are invertebrates, but not all invertebrates are insects

An invertebrate is any animal without a backbone/spine. These include insects, spiders, worms, crustaceans, molluscs, jellyfish, corals, etc. Invertebrates make up about 97% of all known animal species.

Invertebrates are classified into different groups typically by their body parts, and number of legs. This helps students to look closely at their bug to see if they can group them, and work out what animal it is.

Invertebrates with legs sit in the taxonomic phylum *Arthropoda*, meaning joint leg. Insects are a subgroup of invertebrates within the phylum Arthropoda.

Insects are the group of arthropods with roughly 5.5million species worldwide. The key characteristics of insects are:

- Three body segments (head, thorax, abdomen)
- Three pairs of jointed legs
- Usually one or two pairs of wings
- Pair of antennae for sensing their environment (smell, touch, vibration)
- Hard outer body covering (exoskeleton)

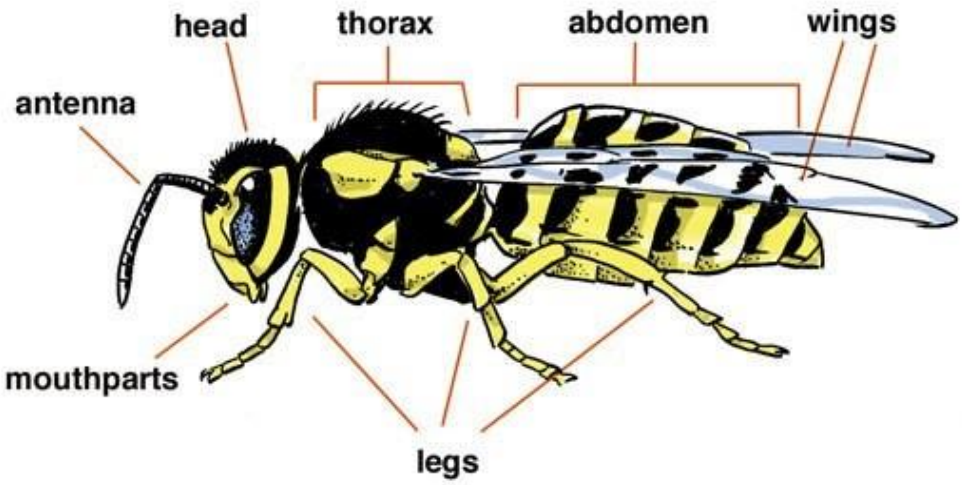


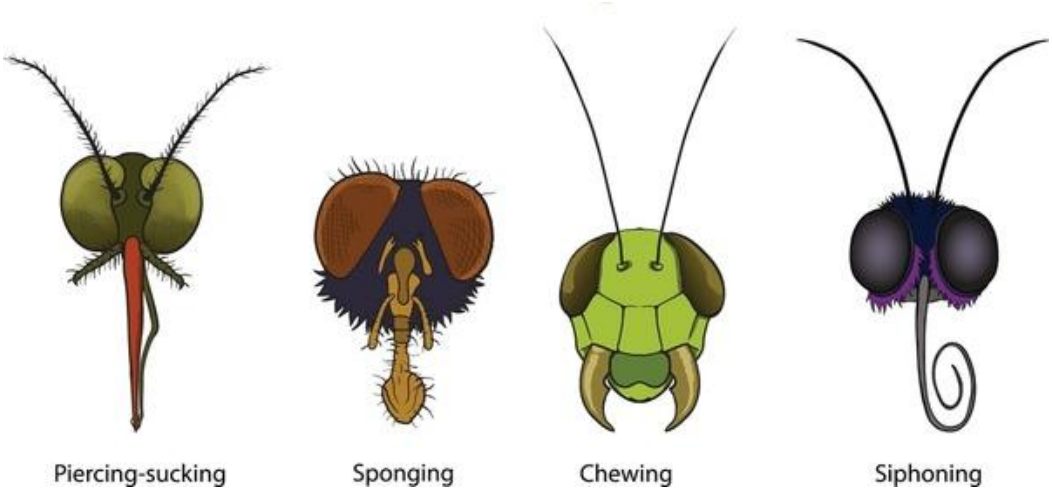
Diagram of an insect's body parts

What do Invertebrates eat?

Invertebrates eat a wide variety of foods depending on their species — some are herbivores feeding on plants and algae, others are carnivores preying on smaller animals, many are omnivores, and quite a few are scavengers or detritivores consuming decaying matter.

Insects as a group eat a wide variety of foods and have adapted their mouthparts to eat different foods:

Type of Mouthpart	**Examples**
Chewing Some insects chew their food just like we do. Their mouthparts are like scissors or a knife. They have strong jaws called mandibles.	Grasshoppers or wētā chew leaves, ants chew bits of plants or other insects, beetles chew plants or wood.
Sucking (siphoning) These insects suck liquid food through a long, straw-like mouth, just like we suck a drink through a straw.	Butterflies suck nectar from flowers, aphids suck sap from plants.
Lapping/sponging Some insects lap up their food, almost like using a tiny tongue, like we use a spoon or a sponge.	Bees lap nectar, houseflies lap up liquids and dissolved food.
Piercing These insects pierce plants or animals to get the liquid inside just like using a needle.	Mosquitoes pierce skin, stink bugs pierce plants.



Insect mouthparts

Shedding (moulting) or metamorphosis?

A hard body covering gives invertebrates' protection and provides support for their internal organs. But this hard exoskeleton does not grow with them. So they need to shed (moult) their skin periodically.

Shedding can happen multiple times in an animal's life. Shedding allows them to replace the rigid outer covering with a new, larger one, enabling growth, and repair.

However, there is a big difference between shedding (moulting) and metamorphosis. Metamorphosis is the biological **transformation of body form and function** during development which often involves distinct stages of life.

Cicada shedding its exoskeleton

Metamorphosis is a big part of being an invertebrate

Animals undergo metamorphosis because it helps them survive and thrive by reducing competition, adapting to different environments, and preparing for reproduction.

- **Avoiding Competition**

Insects like butterflies have caterpillars that eat leaves, while adults drink nectar. This means the young and adults don't fight over the same food. The benefit is more efficient use of resources as there is no competition for both stages of life.

- **Adapting to Different Environments**

Many invertebrates start life in one environment and move to another. Example: Dragonflies live as aquatic nymphs, then become flying adults. The result is that they can use two habitats, increasing survival chances.

- **Protection During Growth**

The pupa stage (like a chrysalis) is a safe “resting” phase. Inside, the animal reorganises its body without needing to move or eat. This result in a secure way to transform into a stronger adult.

- **Specialised Roles at Each Stage**

Larva/Nymph stages have a focus on eating and growing. Pupal stage is the transformation stage, the reorganisation of body parts. Finally, the adult has a focus on reproduction and spreading to new areas. The benefit of this is that each stage has a clear job that supports survival of the species.

- **Evolutionary Advantage**

Metamorphosis allows animals to change their body structure dramatically. This makes them more flexible in adapting to challenges like predators, food sources, or climate changes.

Metamorphosis is a big change in body shape and lifestyle that some animals go through as they grow up. It’s like having a totally different "before" and "after" version of yourself!

Two Main Types of Metamorphosis

Complete Metamorphosis

Animals go through four stages: egg → larva → pupa → adult. Each stage looks very different.

Example: Butterflies

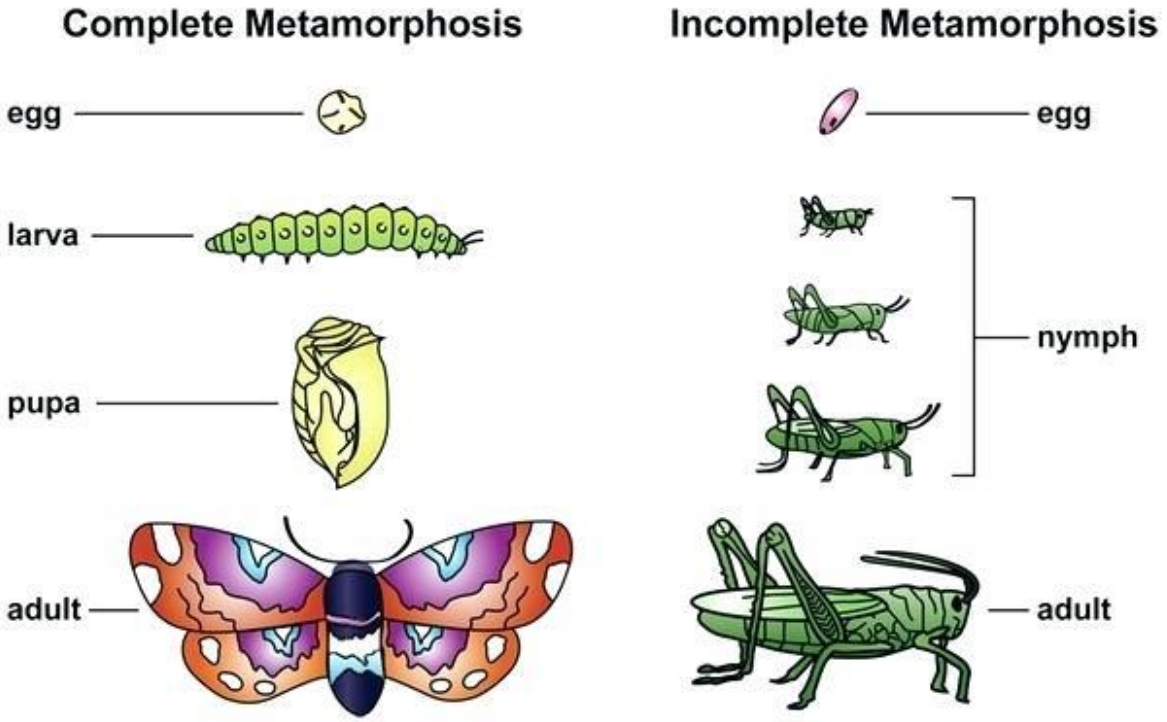
- **Egg**: tiny and stuck to a leaf.
- **Larva** (caterpillar): eats a lot to grow big.
- **Pupa** (chrysalis): resting stage where the body changes.
- **Adult** butterfly: totally new creature with wings.

Incomplete Metamorphosis

Animals go through three stages: egg → nymph → adult. The young (nymph) looks like a smaller version of the adult (a mini-me), but without wings or full features.

Example: Grasshoppers

- **Egg**: laid in soil or on leaves.
- **Nymph**: looks like a mini grasshopper but can’t fly yet.
- **Adult**: grows wings and can reproduce.



Different types of metamorphosis

Where to find invertebrates

Terrestrial invertebrates are incredibly diverse and occupy nearly every habitat type:

Forests and Native Bush

- Wētā (giant, tree, and cave species) are found in forest undergrowth, tree holes, and caves.
- *Powelliphanta* snails live in broadleaf forest and scrub.
- Peripatus (velvet worms) hide in damp leaf litter and rotting logs.

Soil and Leaf Litter

- Soil invertebrates include mites, springtails, millipedes, centipedes, earthworms, and nematodes.
- These organisms are essential for decomposition and nutrient cycling.

Grasslands and Farmland

- Ants, beetles, and spiders thrive in open habitats.
- Many species are important for pest control and soil aeration.

Wetlands and Coastal Areas

- Slaters, amphipods (land hoppers), and snails are common in damp environments.
- Some species are adapted to sandy soils and dune systems.

Urban and Garden Environments

- Towns and cities are also a haven for invertebrates such as slaters, spiders, and beetles.
- Gardens often host pollinators like native bees and hoverflies.

How to Find them

Most invertebrates like dark, damp environments. Tamariki will already know good places to find bugs. Ask them where in your backyard are good bug spots.

- Look out for bugs living in the soil, leaf litter (the dead leaves and things under trees and plants), in compost heaps, in trees or on bushes. Also, many shelter under logs and stones.
- Lift a pile of leaf litter and put it in the tray or bowl. Then use a spoon to lift bugs up carefully to look them, or put them in a separate pot to look at later.

- Lift logs and stones use the spoon to lift bugs into a pot
- Night walks are great to spot other bugs such as wētā and peripatus which are nocturnal.
- Pitfall traps & light traps are used by ecologists to survey beetles, moths, and other insects. See below for details of how to make your own.

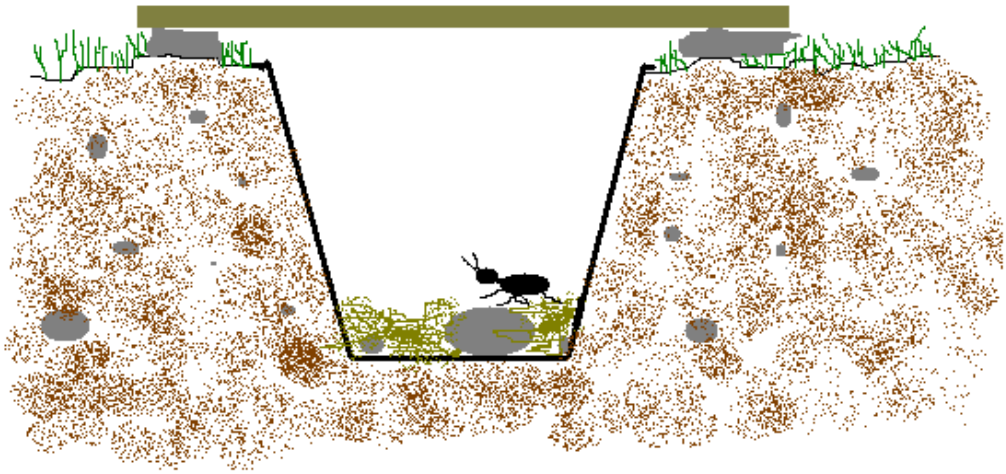
Making your own bug traps

There are instructions online to build your own traps, here are just a few examples.

Pitfall traps

Students can make simple pitfall traps by burying a cup or container flush with the ground so crawling insects fall in. Covering the trap with a raised lid (to keep rain out) and checking it regularly ensures safe collection and release of invertebrates.

Typically, the materials you will need are; small container (plastic cup, yoghurt pot, or jar), trowel or spoon for digging a hole in the ground, a flat cover (cardboard, tile, or plastic lid), small stones or sticks to support the cover. Finally, a notebook or bug ID guide for recording observations.



Pit fall trap

Berlese Trap

A Berlese trap (or Berlese funnel) is a device used to extract small invertebrates from soil or leaf litter by driving them downward into a collecting container. It works by applying heat and light to dry the sample, forcing organisms to move away. Remember invertebrates have a preference for dark, damp habitats.

Typically, homemade Berlese traps use a soft drinks bottle, plastic catching pottle, and a piece of mesh. Many people place a lamp over the top of the trap to provide that heat and light source to encourage the bugs to move downwards. They then get trapped in the pottle at the bottom.

Berlese Trap

DIY Moth Trapping

The easiest method for looking for moths at night is simple hang up a white sheet and place a light source nearby. Moths are lured to the light and rest on the sheet. The best conditions for trapping moths is around the new moon, when it is nice and dark. A calm, humid and warm night helps also.

Moth trapping with a sheet and lamp

Identifying Invertebrates

To help students identify invertebrates, focus on observable features like body structure, number of legs, presence of wings or shells, and habitat.

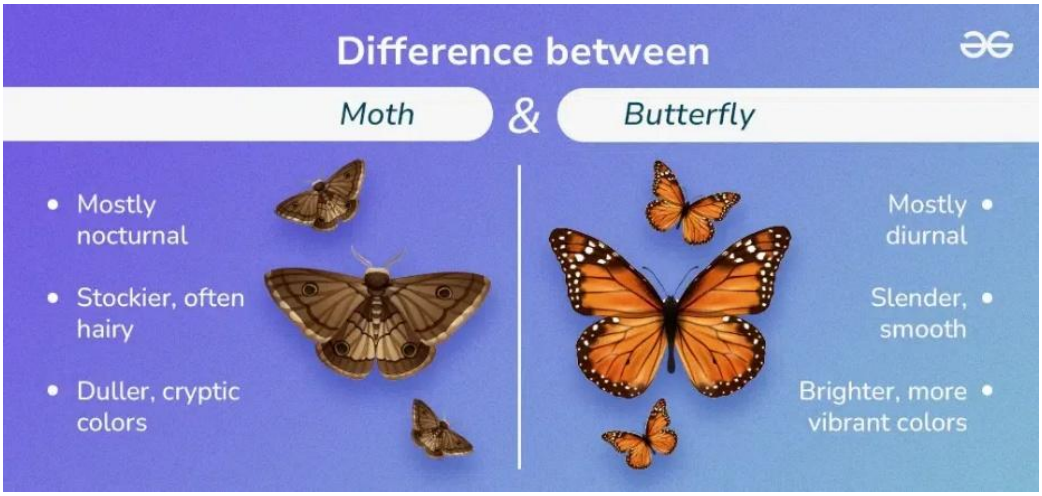
One of the easiest ways is to count the number of legs.

	Invertebrates without Legs		**Invertebrates with 6 legs**	**Invertebrates with 8 legs**	**Invertebrate with more than 8 legs**
Group	Worms	Snails and slugs	Insects	Spiders and other arachnids	Crustaceans
Features of this group	No legs No shell Long thin body	No legs Slimy body Some have shells	6 legs 2 antennae 3 body parts (body, thorax, abdomen	8 legs	More than 8 legs
Examples	Earthworms Other worms	Snails and slugs	Butterfly, cicada, beetle, ant, wētā, stick insect, cockroach	Spiders Harvestmen	Slaters Hoppers

Moth or Butterfly?

Butterflies and moths are both members of the insect order *Lepidoptera*, which means ‘scaley wing’. This refers to their tiny overlapping scales that cover the wings and bodies of butterflies and moths. They typically differ in behaviour, anatomy, and life cycle.

Butterflies are typically diurnal (active during the day) with slender bodies and clubbed antennae, while moths are mostly nocturnal (active at night) with thicker bodies and feathery antennae.



Moths verses Butterflies

You can use the ID chart below for easy identification.

24 hour freephone 0508 800 800 | **email** help@horizons.govt.nz
Private Bag 11025, Manawatū Mail Centre, Palmerston North 4442

NZ Invertebrates: ID guide for students

How many legs does the invertebrate have?

No legs

Snails, slugs and worms

Molluscs

Snails
Soft, slimy bodies
Hard shell

Slugs
Soft, slimy bodies
No shell

Annelids

Earthworms
Long, thin bodies
No shell
Rings/ segments around body

Other worms

Do not have segments and can be different shapes (e.g. flatworms and round worms)

6 legs

Insects [ALL insects have 6 legs, 2 antennae/ feelers and a 3 -part body (head- thorax- and abdomen)]. Some insect groups:

Beetles

Bees and wasps

Bees

Wasps

Wētā

Cock-roaches

Stick insects

Crickets & grasshop-pers

Ants

Dragon-flies

Butterflies and moths

Flies

Mosquitoes

Cicadas

8 legs

Arachnids (Spiders, harvestmen, mites and ticks)

Spiders

Harvest-men

Mites and ticks

Mite photo: Alastair Robertson and Maria Minor, Massey University

Not sure about which bug you found? This guide only covers some of our thousands of invertebrate species in New Zealand.

More than 8 legs

Myriapods, crustaceans and other

Myriapods

Centipedes

Millipedes

Crustaceans

Isopods: Slaters

Amphipods: Hoppers

Other

Caterpillars & larvae

Although caterpillars have many legs (if you look closely) they are insects not myriapods or crustaceans. Being a caterpillar is just one part of their life cycle. As adults they will only have 6 legs.

EXPERIENCING INVERTEBRATES IN YOUR GREEN SPACE

Department of Conservation
Te Papa Atawhai

Unique Terrestrial Invertebrates of New Zealand

- **Wētā**
    - Types: Tree wētā, cave wētā, giant wētā, ground wētā.
    - Where to find: Forests (inside tree holes, under logs, leaf litter). Caves and rocky crevices.
    - Best time: Night (they're nocturnal).

Tip: Look for chewed leaves or listen for rustling in leaf litter.

- **Peripatus (Velvet Worms, ngaokeoke)**
    - Where to find: Damp leaf litter, rotting logs, and mossy forest floors.
    - Best time: Night, after rain.

Tip: They're secretive—move slowly and carefully when lifting logs.

- ***Powelliphanta* Snails**
    - Where to find: Moist forests.
    - Best time: After rain.

Tip: Some species are large and beautifully patterned—look under leaves and logs.

Please note that it's against the law to take or hold *Powelliphanta* shells without a DOC permit. So if you find one, simply photograph it and leave it where it is.

- **Native Earthworms**
    - Where to find: Soil across farmland, forests, and gardens.

Tip: Dig gently in moist soil; NZ has giant native species up to 1.5 m long in Southland!

- **Stick Insects (Rō)**
    - Where to find: Shrubs and trees, especially mānuka and kānuka.
    - Best time: Daytime, though they camouflage extremely well.

Tip: Look for “moving twigs” on branches.

- **Native Beetles**
    - Examples: Huhu beetle (largest NZ beetle), ground beetles, stag beetles.
    - Where to find: Forests, gardens, and farmland.
    - Best time: Huhu beetles are often seen flying at night in summer.

Tip: Check around lights at night—they’re attracted to them.

Other Activities to Explore Invertebrates

There are many different activities you can do to explore invertebrates in your backyard. Here are a few examples:

- **Ahi Pepe MothNet** is a citizen science project that aims to engage teachers, students and whānau with moths, and through moths with nature and science.
- **Create a butterfly garden:** Plant some swan plants to attract Monarch Butterflies and then watch their lifecycle. Students can keep journals, sketch each stage, and note changes.
- **Life Cycle Art:** Draw or paint the stages of metamorphosis (egg, larva, pupa, adult). Students can make flipbooks or comic strips showing the transformation.
- **Food Chain Connections:** Create a food web to show connections between invertebrates and other animals.
- **Animal preferences:** create a choice chambers experiment to show what habitat slaters prefer – dark or light, damp or dry.
- **Finding bugs in winter:** try bug hunting in winter, do you find more or less? Why?

Take Action for Invertebrates

Once students have investigated what lives in the backyard, think about what could be done to provide more habitat to our bugs. Do some research on the internet.

Ideas could be to:

- build a bug hotel
- plant more trees/bushes to encourage more bugs