Wai Care invertebrate field guide

Wai Care Invertebrate Monitoring Protocol (WIMP)

Auckland Council
Te Kaunihera o Tāmaki Makaurau

Habitat identification

Factors influencing habitat quality include watercourse type, catchment land use, bed composition, shade, current speed, microhabitat and bank stability, both at a site and upstream.

Use the habitat information below to identify the general habitat factors of your sampling site.

Watercourse type

Is it a flowing stream, pond/wetland, or does it have tidal influence? Each watercourse type will have its own characteristic invertebrate community.
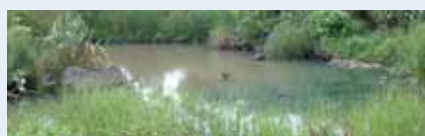
Stream

Description
A freshwater flowing waterway.

Includes
• Perennial streams (flow all year)
• Ephemeral streams (periodically dry)
e.g. small tributaries, streams, rivers.

Pond/wetland

Description
Still or barely flowing water.

Includes
Natural or constructed swamps, bogs, marshes, lakes, ponds and stormwater ponds.

Estuarine

Description
Tidal – mix of fresh and salty water. Often with a muddy band, covered at high tide and exposed at low tide. May have small mud crab holes.

Includes
Mangroves, tidal creeks or rivers.

Catchment land use

What is the predominant land use in the catchment? Is the area upstream of your site mostly bush, pasture or urban? Several different land uses may be present in one catchment, so make a decision about which is the dominant land use in relation to your site.

Bush

Description
Stream is cool and shaded by trees and other vegetation. Has woody debris and leaves in the water.

Includes
Native bush, exotic forestry and any natural landuse where the vegetation has remained intact.

Pasture

Description
Few trees, mainly grassland and may have stock damage around stream banks. Has little woody debris and leaves.

Includes
Farming and grassed parkland.

Urban

Description
Lots of impermeable surfaces such as roads, pavements, roofs and buildings.
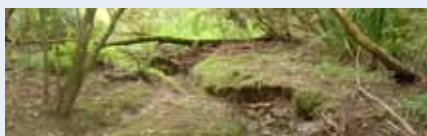
Includes
Industrial (factories etc.), commercial (shops etc.) and residential (houses).

Substrate

What is the bottom of the stream mostly like for your site and immediately upstream? It is likely that there will be more than one type, so concentrate on the main type.

Muddy

Description
Stream channel has soft or compacted muddy substrate. May have woody debris.

Includes
Many of Auckland's lowland streams

Weedy

Description
Stream may have a range of inorganic substrate, but channel has many aquatic plants e.g. oxygen weed, or emergent plants e.g. reeds.

Includes
Many slow flowing and unshaded streams.

Stony

Description
Stony streams usually have a range of bed particle sizes, including gravel, cobbles and larger boulders.

Includes
Many fast flowing streams and bedrock streams. Bedrock streams are not preferred sampling sites because of the difficulty of collecting fine material.

Sandy

Description
Stream channel is largely sand, has little stability and often little food.

Includes
Many estuarine streams.

Gravelly

Description
The stream bed is mainly small stones (1–5cm), which may be less stable than larger stones.

Concrete

Description
Stream is lined with concrete.
Minimal habitat – may support algae or moss, or a thin layer of mud over the concrete.

Includes
Urban streams designed for rapid drainage.

Microhabitat

This is the part of your site where you collect invertebrates. This should be the optimal (or best) habitat for your stream reach. Stones, woody debris, macrophytes and root systems are the most productive microhabitats (in that order). Mud scrapes and open water are less productive, and should only be targeted for sampling if none of the other habitats are present.

Stones

Description
Many aquatic invertebrates live underneath stones in an area of fast flowing water. May have thin layers of algae. To sample, turn stones over and wash debris into the net.

Woody debris

Description
Woody material in the stream. Important in streams with soft substrates. To sample, brush and wash debris into the net.

Macrophytes (large aquatic plants)

Description
Main stream habitat is aquatic plants. To sample, jab and sweep the net though the vegetation.

Root systems

Description
Tree roots growing into the stream channel (common with willows and poplars). To sample, jab and scoop the net up through the root mats.

Mud scrape

Description
Watercourse mainly dried up. To sample, take a scraping of mud where wettest.

Open water

Description
Has little instream cover (includes ponds). To sample, sweep the net through the open water.

Shade

How much shade does the site have? Shade is provided mainly by overhanging plants. The amount of shade at a site affects factors such as water temperature, which in turn will affect the amount of oxygen held in the water. This will influence the invertebrate species able to live in the area. Choose the site category that best describes the general area you are sampling in.

Shaded site

Description
Site mostly shaded at all times of the day. Trees upstream also shade stream.

Includes
Native bush streams.

Some trees/some shade

Description
Some trees at site and upstream, but not completely shaded. Stream may be in a deep channel with banks providing shade, with or without trees.

Includes
Newly re-planted sites, but the trees are not yet tall enough to provide complete shade.

Unshaded site

Description
Few or no trees at sampling site, upstream or in the catchment.

Includes
Pasture streams with no riparian vegetation.

Current

How is the water moving? Is it fast, or slow and stagnant? Is there a series of pools and riffles, or is the current flowing at the same rate for the whole reach of your site? Many streams have a variety of currents, so look for the fastest zone. The most productive streams tend to have a variety of flows.

Fast

Description
Water has fast current.
Includes
Riffles, pools and runs.

Slow

Description
Water flows at a moderate to slow pace and has little variation along the stream reach.
Includes
Slow flowing and run habitats in flat countryside.

Stagnant

Description
Very little or no flow.
Includes
Pools or ponds with little or no inflow or outflow.

Bank stability

How stable is the stream bank? When banks are unstable and erosion prone, more sediment enters the water, reducing its clarity and changing the type of invertebrate community that can live there.

Stable

Description
Stream banks stable and safe to stand on. May be old erosion scars from major floods now overgrown with vegetation.
Includes
Most mature bush streams.

Some erosion

Description
Has some recent erosion scars, but reasonably stable. One side of stream may be stable, while the other erodes.
Includes
Many farmland streams.

Very unstable

Description
Bank is very unstable, with bare earth eroding into stream. May be difficult/ dangerous to stand on bank.
Includes
Poor quality farmland or urban streams.

Invertebrate identification

The invertebrates on these pages are grouped according to the 40 "WIMP" taxa. In some cases the WIMP group shown includes more than one species e.g. there are several species of swimming mayflies but only one spiny gill mayfly. For more information see www.waicare.org.nz

Caddisfly

Grub-like body, some in protective case

Phylum: Arthropoda
Class: Insecta
Order: Trichoptera

Spiral-cased caddisfly `10`
(common in high quality streams)

- Small caddis larvae with spiral, snail-like cases
- Case made of fine sand grains
- During pupation case firmly attached to stream bed
- Small size and slow movement make them hard to spot
- Case usually under 3mm across

Scale ⊢—⊣ 3mm

Smooth-cased caddisfly `9`
(common in high quality streams)

- Caddis larvae with smooth secreted portable cases
- Angle of case opening varies between species
- Larvae crawl around with case
- During pupation case attached to stream bed
- Case length up to 14mm (larger species)

Scale ⊢———⊣ 14mm

Stony-cased caddisfly `6`
(common in medium to high quality streams)

- Caddis larvae with portable cases
- Case made of sand grains and small stones
- During pupation case attached to stream bed
- Larvae crawl around with case
- Case length up to 15mm (some species)

Scale ⊢———⊣ 15mm

Woody-cased caddisfly `5`
(common in medium to high quality streams)

- Caddis larvae sheltering in stick or plant cases
- Abdomen may have small tentacle-like gills
- Long stripy legs visible outside the woody case
- Larvae crawl around with case
- Body length up to 20mm

Scale ⊢———⊣ 20mm

Free-living caddisfly `5`
(common in medium to high quality streams)

- Grub-like larvae with soft abdomen and no portable case
- May or may not have gills under the abdomen
- Pupae may be protected by a stony shelter
- Crawls rather than swims
- Body length up to 15mm (some species)

Scale ⊢———⊣ 15mm

Key Types of habitats that these invertebrates commonly live in.

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■ High ■ Moderate
■ Low

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Oxyethira and *Paroxyethira* caddisfly   **2**

(common in medium to poor quality streams)

- Tiny caddis larvae occupying cases
- Larva may be visible inside the often transparent case
- Easily overlooked because of small size
- Crawls around stones or plants
- Case length up to 5mm

Scale   5mm

Beetle

Six legs, biting mouthparts, adults with hard covers over wings, larvae with hard body (compared with caddisfly larvae)

Phylum: Arthropoda
Class: Insecta
Order: Coleoptera

Beetle   **6**

(stream quality and type varies between species)

- Several beetle families have freshwater species
- Beetle adults are armoured with a hard exoskeleton
- Have chewing mouthparts
- Some swim in pools (e.g. dytiscids)
- Some burrow in stream beds (e.g. elmids)
- Body length mostly under 10mm

Scale   10mm

Bug

Pointed, sucking mouthparts

Phylum: Arthropoda
Class: Insecta
Order: Hemiptera

Pond skater   **5**

(common in ponds or slow flowing streams)

- Pond skaters are tiny bugs found on the water surface
- May look like little black floating seeds
- Swarms of them attack insects trapped on surface of still water
- Body length up to 2mm

Scale   2mm

Backswimmer and water boatman   **5**

(common in ponds or slow flowing streams)

- Backswimmers hover "belly-up" in open water and have oar-like legs
- Water boatmen often swim rapidly between bed and water surface with their "belly" facing downwards
- Body length of both up to 6mm

Scale   6mm

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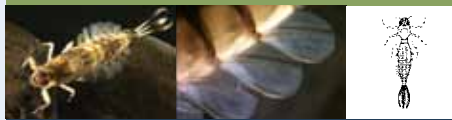
Mayfly

Three tails, gills along the sides of the body

Phylum: Arthropoda
Class: Insecta
Order: Ephemeroptera

Swimming mayfly `9`

(common in high quality streams)

- Streamlined, fish-like nymph
- Tail has three feathered filaments
- Leaf-like gills along the body
- Fast swimmers but mostly rest on the stream bed
- Body length up to 20mm

Scale | 20mm

Spiny gill mayfly `9`

(common in high quality streams)

- Large, chunky nymph
- Tail has three filaments – middle one is very short
- Top of the abdomen has large cactus-like gills
- Often stationary, but also swims with clumsy motion
- Body length up to 18mm

Scale | 18mm

Flat mayfly `8`

(common in high quality streams)

- Nymph with a flat body shape
- Tail has three slender filaments (though can break off)
- Sides of the abdomen have gills
- Usually hugs stream bed but also swims awkwardly
- Body length up to 20mm

Scale | 20mm

Dobsonfly

Leg-like gills along the body

Phylum: Arthropoda
Class: Insecta
Order: Megaloptera

Archichauliodes dobsonfly `7`

(common in medium to high quality streams)

- Our largest stream insect
- Abdomen has "leg like" gills
- Prominent powerful jaws hence the common name "toe biter"
- Can crawl quickly around stream bed
- Body length up to 30mm

Scale | 30mm

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Stonefly

Two tails, most lack gills along the side of the body

Phylum: Arthropoda
Class: Insecta
Order: Plecoptera

Stenoperla stonefly

10

(common in high quality streams)

- Large nymph with a green body
- Tail has two prominent filaments
- Abdomen has slender gills (unusual in NZ stoneflies)
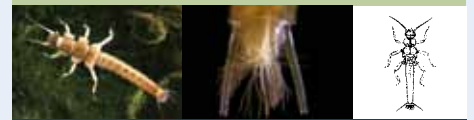- Crawls quickly, in or out of water
- Body length up to 30mm

| Scale | 30mm |

Tail gill stonefly

5

(common in high quality streams)

- Several species with gill tufts or tubular gills between two tails (cerci)
- Most have a uniform brown body
- No gills along the side of the abdomen
- Crawls along, lifting (rather than dragging) its body
- Body length up to 18mm (some species)

| Scale | 18mm |

Spotty stonefly

5

(common in high quality streams)

- Nymphs have pale spots on body and legs, unlike most other tail gill stoneflies
- No gills along the side of the abdomen
- Active crawlers like other stoneflies
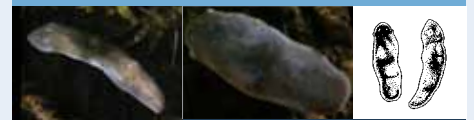- Body length less than 10mm

| Scale | 10mm |

Flatworm

Phylum: Platyhelminthes

Flatworm

3

(common in high, medium or low quality streams)

- Very common but often overlooked
- Usually dark coloured and roughly oval
- Moves with a gliding motion, but very flexible
- Body length typically 6mm

| Scale | 6mm |

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Crustacean

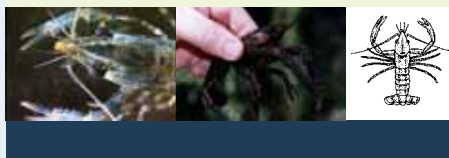Hard exoskeleton, many specialised legs

Phylum: Arthropoda
Sub phylum: Crustacea

Crayfish (Koura)

5

(common in medium to high quality streams)

- Small crayfish (compared to our marine species)
- Pincers are powerful and pointed – beware!
- Can walk slowly forwards or shoot quickly backwards with a tail flick
- Body length usually less than 150mm

Shrimp

5

(common in lowland, weedy streams)

- Five pairs of walking legs
- Semi-transparent body
- No large claws or pincers
- Can walk, hover or flick backwards
- Length up to 30mm

Scale ├────────┤ 30mm

Amphipod and isopod

5

(common in slow flowing streams)

Small crustaceans:

- Amphipods; appear to be compressed sideways
- Isopods (less common) resemble wood lice (slaters)
- Amphipods and estuarine isopod species are fast swimmers
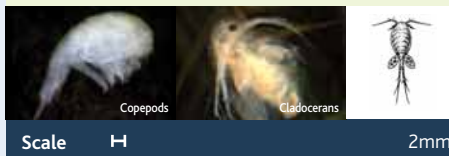- Body length usually less than 5mm

Isopod   Amphipod

Scale ├─┤ 5mm

Water flea

5

(common in ponds or slow flowing streams)

Tiny crustaceans:

- Copepods – typically comma-shaped or tear-shaped and may be fast swimmers
- Cladocerans – usually more rounded and swims with a jerky motion
- Body length usually only 1–2mm

Copepods   Cladocerans

Scale ├┤ 2mm

Crab

5

(common in slow flowing, lowland streams)

Freshwater and estuarine species included:

- Freshwater *Halicarcinus/Amarinus*: rounded body, spindly legs, hides amongst debris
- Estuarine *Helice*: sturdier with thicker legs, burrows
- Length up to 35mm across (including their 8 legs)

Scale ├────────┤ 30mm

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Seed shrimp   3

(common in ponds or slow flowing streams)

- Small blue-white, brown or green crustaceans that look like seeds or tiny bivalves (two parts to shell)
- Ability to swim is often the reason they are seen
- Tiny legs may be seen protruding between the shells
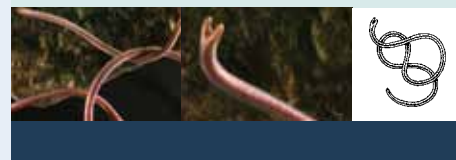- Length usually only 1mm
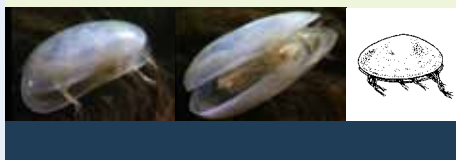
Horsehair worm

Long wiry, unsegmented worm

Phylum: Nematomorphs

Horsehair worm   6

(occasional in medium to high quality streams)

- Long, wire-like brown coloured worms
- Surface texture is smooth and shiny
- Easily overlooked until slow movement is noticed
- Body length up to 200mm

Dragonfly and damselfly

Nymphs with extendable grasping mouthparts

Phylum: Arthropoda
Class: Insecta
Order: Odonata

Dragonfly   6

(common in medium to high quality wetlands and ponds)

- Chunky aquatic nymphs with spider-like legs
- Prey are ambushed using extendable gin-trap-like mouthparts
- Some can propel themselves forwards by squirting a jet of water backwards
- Otherwise they are usually stationary
- Body length up to 30mm

Scale |———————————| 30mm

Damselfly   5

(common in medium to high quality streams and wetlands)

- Damselfly nymphs have slender bodies
- Tail has three leaf-like gills at its tip
- Prey are ambushed using extendable gin-trap-like mouthparts
- May wave their abdomen to circulate water past tail gills
- Crawls slowly but usually stationary
- Body length up to 25mm

Scale |———————————| 25mm

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- High (green)
- Moderate (orange)
- Low (red)

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Mollusc

Living inside calcified shells – includes snails, limpets and bivalves

Phylum: Mollusca

Class: Gastropoda and Bivalvia

Freshwater mussel `6`

(common in medium to high quality streams)

- Dark brown mussels found in sandy bottom streams
- Bivalves (two parts to shell)
- Difficult to see shell as mostly buried in sand
- Shell length up to 120mm length

Latia limpet `6`

(common in medium to high quality streams)

- Limpet/dome shaped snails usually with dark brown shells
- Releases a glow-in-the-dark mucus when disturbed
- Movement is slow and hard to detect
- Shell length up to 11mm

Scale 11mm

Fingernail clam `5`

(common in ponds or slow flowing streams)

- Small bivalves (two parts to shell)
- Shell is rounded and usually white or brown
- Difficult to see movement (and probably won't after capture)
- Shell diameter up to 4mm

Scale 4mm

Rounded snail `3`

(common in high, medium or low quality streams)

Very common group, includes:
Potamopyrgus:
- Dark, thick-shelled and the most common

Physella:
- More delicate shell and common in polluted sites
- Movement and trails in sample trays are easy to observe
- Shell length less than 10mm in most species

Scale 10mm

Flat spiral snail `3`

(common in ponds or slow flowing streams)

- Small, easily overlooked snails
- Thin, flat spiral shell is often translucent
- Difficult to spot but often found attached to aquatic plants
- Shell up to 2.5mm across

Scale 2.5mm

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Worm

(segmented)

Phylum: Annelida
Class: Hirudinea and Oligochaeta

Leech   **3**

(common in high, medium or low quality streams)

- Extremely flexible flattened or rounded body
- Common species usually pale or light grey
- Posterior end has a suction disc
- Moves with a looping, caterpillar-like motion
- Body length of most species less than 7mm

Scale		7mm

Oligochaete worm   **1**

(common in medium or low quality streams)

- Segmented worms that look like miniature garden worms
- Some bright red (especially in low oxygen environments)
- Are very stretchy but also coil into tight, tangled bundles
- Body length mostly under 30mm

Scale		30mm

Spider and mite

Eight legs, body divided into two segments (spider) or only one segment (mite)

Phylum: Arthropoda
Class: Arachnida

Dolomedes spider   **5**

(common in medium to high quality streams)

- Large semi-aquatic spider
- Abdomen has white stripes on the sides
- Runs on water surface and can dive under
- Leg span commonly 60mm

Scale		60mm

Mite   **5**

(common in ponds or slow flowing streams)

- Tiny spider-like invertebrates with eight legs
- Round bodies not broken into segments
- Some mites swim using swimming hairs on the legs
- Coloured red/orange or brown
- Diameter usually only 1–2mm

Scale		2mm

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Watercourse
Stream
Pond/wetland
Estuarine

Land use
Bush
Pasture
Urban

Substrate
Muddy/sandy
Weedy
Stony

Shade
Shaded site
Some shade/shaded
Unshaded/some shade/shaded

Current
Fast
Slow/fast
Stagnant/slow/fast

Bank stability
Stable
Some erosion/stable
Very unstable/some erosion/stable

Invertebrate identification

The invertebrates on these pages are grouped according to the 40 "WIMP" taxa. In some cases the WIMP group shown includes more than one species e.g. there are several species of swimming mayflies but only one spiny gill mayfly. For more information see www.waicare.org.nz

True fly

Maggot-like larvae, without legs

Phylum: Arthropoda
Class: Insecta
Order: Diptera

Cranefly   **5**

(common in high, medium or low quality streams)

• Worm-like larvae
• Some have caterpillar-like creeping welts (most don't)
• At the tail end a star-like breathing structure may be visible
• Head is often withdrawn into the body
• Move in a thrashing, chaotic manner when disturbed
• Body length up to 30mm

Scale |————| 30mm

Other maggot-like flies   **3**

(common in high, medium or low quality streams)

• Many fly species have maggot-like larvae
• May have no visible head, some have creeping welts
• Head end of the body is often pointed
• Most show little movement other than maggot-like wriggling
• Body length mostly less than 15mm

Scale |————| 15mm

Sandflies or blackfly   **3**
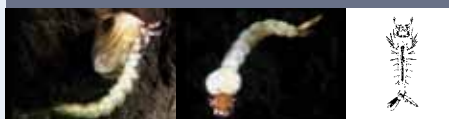
(common in high, medium or low quality streams)

• Small larvae with swollen abdomen (larger than head)
• Attaches to surfaces with tiny hooks at end of abdomen
• Fan-like feeding structures attached to head
• Body may sway and stretch when abdomen is fixed in place
• Body length up to 5mm

Scale |—| 5mm
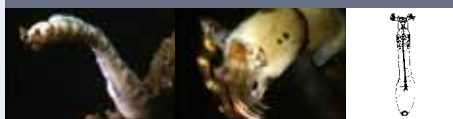
Mosquito   **3**

(common in ponds and slow flowing streams)

• Small swimming larvae
• Breathing tube attached to the tail end
• Segment behind head is wider than the head
• Larvae swim in a wriggling motion
• Pupae swim in a tumbling motion
• Body length usually less than 4mm

Scale |—| 4mm

Midge   **2**

(common in high, medium or low quality streams)

• Small worm-like larvae with small head (distinguishes them from worms)
• Some bright red (especially in low oxygen environments)
• Tail end has tiny prolegs used for attachment
• Some larvae swim using a thrashing motion
• Body length up to 20mm (most less than 10mm)

Scale |————| 20mm

Key Types of habitats that these invertebrates commonly live in.

Some invertebrates are sensitive to pollutants and habitat degradation, while other invertebrates are tolerant and can be found in a range of conditions.

Sensitivity
High (green)   Moderate (orange)
Low (red)

Sensitivity Score
10 = Highest sensitivity
1 = Lowest sensitivity

Some invertebrates are able to live in a range of habitat types, while others have a limited range.

Watercourse	Land use	Substrate	Shade	Current	Bank stability
Stream	Bush	Muddy/sandy	Shaded site	Fast	Stable
Pond/wetland	Pasture	Weedy	Some shade/shaded	Slow/fast	Some erosion/stable
Estuarine	Urban	Stony	Unshaded/some shade/shaded	Stagnant/slow/fast	Very unstable/some erosion/stable

12

Identify your invertebrate

There are a number of features that are used to distinguish between types of invertebrates. Take a few moments to look at your invertebrate.

How big is it?

Common invertebrates can range from 120mm e.g. freshwater mussel, to less than 1mm e.g. water flea

Observe how it moves

Does it swim through the water, walk along the surface, crawl around the tray, glide over smooth surfaces?

What does its body look like?

The key features to look at are:

Legs
Any? How many?

Tails
Any? How many?

Gills
Any? Where are they (along the abdomen, between tail filaments)?
Are they beating?

Shell
Like a snail?
A dome-shaped shell, sticking to rocks?
Two shells (bivalve), like a mussel or pipi?

Case
What is it made of (wood, stones, sand)?

Grub-like (soft) body
Does it have legs?
Does it have an obvious head?

Worm-like body
Long and skinny?
Wiry, like a horsehair?
Flattened?

Invertebrate classification

Invertebrates are part of the animal kingdom. This table summarises their biological classification, which is a method used to categorise species of organisms.

Arthropods (jointed legs)	Insects	Ephemeroptera	Mayflies
		Plecoptera	Stoneflies
		Trichoptera	Caddisflies
		Odonata	Dragonflies and damselflies
		Megaloptera	Dobsonflies
		Hemiptera	Bugs (water boatmen, backswimmers, pondskaters)
		Coleoptera	Beetles
		Diptera	True flies (craneflies, midges, mosquitos, sandflies)
	Crustaceans	Malacostraca	Crayfish, shrimps, crabs, amphipods, isopods
		Ostracoda	Seed shrimps
		Copepoda	Water fleas
	Arachnids		Spiders and mites
Molluscs		Gastropoda	Snails, latia limpets
		Bivalvia	Mussels, fingernail clams
Annelids (segmented worms)		Oligochaeta	Worms
		Hirudinea	Leeches
Platyhelminthes			Flatworms
Nematomorphs			Horsehair worms

The type of invertebrates found at a stream can tell us a lot about its health. The Wai Care Invertebrate Monitoring Protocol (WIMP) relates the type of invertebrate communities found back to the habitat these came from.

This helps to give a clearer picture of stream health in any habitat.

Useful links and resources

- A guide to the freshwater invertebrates of New Zealand www.landcareresearch.co.nz/research/biocons/freshwater
- Landcare Research Microscope Images (CD)
- Winterbourn, M., Gregson, K., and Dolphin, C. (2006). *Guide to the Aquatic Insects of New Zealand (4th Edition)*. New Zealand: Entomological Society of New Zealand
- www.waicare.org.nz

Field protocols

- Keep your macroinvertebrate sample in the shade so the bugs don't overheat.
- Always return your macroinvertebrates alive to the site you took them from.
- Rinse out your sample gear between sites, just in case you transfer some unwanted germs!
- Always leave your site in a better condition than when you arrived.

Manaaki Whenua
Landcare Research

Wai Care
Together for healthy waterways
www.waicare.org.nz

Auckland Council
Te Kaunihera o Tāmaki Makaurau