Ribbons of Blue/Waterwatch WA

Macroinvertebrate Sampling Guidelines

Version 1.1 September 2001

RIBBONS OF BLUE
WATERWATCH WA
Communities Caring for Catchments

Contents

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Introduction

A macroinvertebrate sampling guideline has been developed to define:

- macroinvertebrate sampling methods
- data confidence procedures
- data management protocols

The outcome of the guideline is to ensure consistency and level of data confidence in Ribbons of Blue/Waterwatch WA macroinvertebrate sampling.

Macroinvertebrate sampling can be a once off sample or part of a continued monitoring program. Sampling can be performed solely for awareness purposes to display the diverse creatures that live within our waterways or to ascertain the health of a waterbody.

Therefore, it is pertinent for the protocol to be divided into two general areas of macroinvertebrate sampling.

1. Awareness
2. Project orientated (custom)

Awareness deals with sampling that is a once off sample or as a learning experience for a group. This is especially suited to school groups who just wish to 'discover' and learn. The data confidence procedures are minimal and the data collected is not entered onto the Waterwatch database.

Project orientated involves standardised techniques and produces data of a known quality and is ideal for groups wishing to conduct monitoring projects. The data can be entered onto the Waterwatch database if it meets the minimum data confidence checks.

The guidelines are directed towards sampling in inland waters. The relevance and application in estuarine conditions is limited.

Why sample macroinvertebrates?

Streams, rivers, wetlands, and lakes are home for many small animals called macroinvertebrates. These animals generally include insects, crustaceans, molluscs, arachnids and annelids. The term macroinvertebrate describes those animals that have no backbone and can be seen with the naked eye. Some aquatic macroinvertebrates can be quite large, such as a freshwater crayfish, whilst most are very small. Those invertebrates that are retained on a 0.25 mm mesh net are generally termed macroinvertebrates.

These animals live in the water for all or part of their lives, so their survival is related to the water quality. They are significant within the foodchain of aquatic systems as larger animals such as fish and birds rely on them as a food source. Macroinvertebrates are sensitive to different chemical and physical conditions. If there is a change in the water quality, perhaps because of a pollutant entering the water, or a change in the flow downstream of a dam, then the macroinvertebrate community will also change. Therefore, the richness of macroinvertebrate community composition in a waterbody can be used to provide an estimate of waterbody health.

Macroinvertebrates are sampled in waterbodies because they are useful biological indicators in aquatic systems. The main advantages of using macroinvertebrates is that they are the main secondary producers, many have life span of up to a year and greater, they cannot escape pollution, are sensitive to quite mild pollution or changes in water quality and are easily collected.

However it is very important to emphasise that when assessing macroinvertebrate communities, other physical, chemical and other biological data should be collected to support the waterbody assessment. Other biological measures could include riparian vegetation, fish, algae, frogs, birds and faecal coliforms. Common physical and chemical parameters tested by Ribbons of Blue/Waterwatch WA include temperature, turbidity, conductivity, pH, nutrients and dissolved oxygen.

Safety

Site selection

Safety considerations are paramount. Under no circumstances should sampling be conducted at any site that might be unsafe. Ensure sites have easy access to the waters edge and avoid sites that have steep, slippery or unstable banks, or are adjacent to deep, fast flowing water.

It is important that you are well prepared prior to arriving at the site. If it is a new site, travel to it prior to sampling to overview safety risks. Avoid selecting a site from a map only. If the site lies on private land, ensure that permission to enter the property is granted prior to the sampling session. Never sample alone and notify appropriate people of the sampling location and times. A mobile phone to keep in contact with help and an appropriately stocked first aid kit are two important recommended safety items.

Clothing

Appropriate clothing should be worn that is relevant for the weather conditions. Remember to apply sunscreen and wear a hat in sunny or partly sunny conditions. It is advisable to wear pants and a long sleeve top, particularly if the site is heavily vegetated. Participants should wear thick-soled, fully enclosed shoes when at a sampling site.

Persons entering the water for macroinvertebrate sampling should wear waders or rubber boots. Care should be taken when walking in waterbodies for sharp, submerged materials which could pierce the rubber sole. During sampling never go into the water above your knees.

At the end of a sampling session it is recommended that you wash your hands thoroughly before consuming food. It is advisable not to drink the water at the site so instead take with you drinking water.

Schools risk assessment and excursion policy

Prior to sampling a waterbody, schools may need to complete a risk assessment according to the Excursion Guidelines produced by the Department of Education Western Australia (2001). The guidelines provide planning direction for schools to minimise any identified potential risks and to determine the level of supervision required to undertake a safe sampling excursion. Ribbons of Blue/Waterwatch WA Coordinators are able to assist Schools in this regard (refer to Information Statement For Principals And Teachers - Ribbons of Blue Excursions Involving The Participation Of School Students).

Algal Blooms

Algal blooms are a natural part of aquatic environments. An increase in the intensity and frequency of algal blooms, however, is not natural and can cause concern. Apart from the effect a bloom has on the aquatic system, it is possible that the algae might cause human health problems. Some algal blooms can cause allergic skin reactions or dermatitis and if swallowed can cause headaches, stomach cramps, nausea and diarrhoea. All Ribbons of Blue/Waterwatch WA participants should not sample at a site that has a potential algal bloom.

If there is evidence of contaminated water, avoid contact with the water, do not touch any scum around the bank, and do not drink the water. If contact does occur, rinse it off immediately with fresh water and if symptoms develop seek medical advice.

To report algal blooms in Western Australian waterbodies phone the Department of Environment on (08) 9278 0300

Ethics

Ribbons of Blue/Waterwatch WA is an environmental education network which promotes care of the environment. Take care not to leave any rubbish behind, do not damage vegetation and the banks of the waterbody. Use your common sense. If rocks are moved, place them back in the same position.

After the sorting and identification, all animals that are sampled must be returned to the same waterbody that they were collected from. Check to make sure that no animals have been left on equipment such as nets, trays, buckets etc.

Ribbons of Blue/Waterwatch WA do not recommend the keeping of reference collections of macroinvertebrates or holding macroinvertebrates in an artificial environment such as an aquarium.

Minimise disturbance

Macroinvertebrate sampling does disturb macroinvertebrate communities and their habitats. It is important that impact is kept to a minimum. Frequency of sampling should be limited to four times a year, but is site specific. Only allow one or two people at a time to enter the water to sample. Once sampled, macroinvertebrates should be returned to the water unharmed as soon as possible to where they were sampled. If any other animals such as fish and amphibians are caught, they must be returned immediately as they are not the focus of the study. All native fish and amphibians are protected.

Although macroinvertebrates do tolerate this type of investigation quite well they can still be harmed and stressed. It is essential that all samples are kept out of the sunlight (heat) and are well oxygenated. Water in a bucket has less surface area for oxygen diffusion as it is protected from air movement. A sorting tray, however, has a larger surface area but the water temperature can increase more rapidly. Under normal circumstances a sample should be returned to the waterboday that it was collected from within 1 hour. If samples need to be kept for a longer period of time (up to 2 hours) it is recommended that an auxiliary battery operated air pump be used and water temperature is kept constant.

During sorting and identification, care must be taken to avoid damaging the aquatic animals. Most macroinvertebrates cannot live out of the water. Although some freshwater crayfish can be quite robust, under some circumstances following moulting their exoskeletons are very soft and can be damaged if they are handled. Avoid handling any macroinvertebrates, except by a spoon or pipette.

Tweezers of any type should not be used as these easily crush an animal. Utensils such as plastic spoons and plastic pipettes are appropriate to handle macroinvertebrates. Ensure that participants do not use magnifying glasses inappropriately.

Vertebrates

During sampling for macroinvertebrates you may encounter a number of animals higher up in the food chain. Fish, frogs, water rats, tortoises, and birds depend on macroinvertebrates for their survival in some way so their presence is also an indication of health. If any of these animals are caught by accident, they should returned to where they were collected immediately.

Fish

Fish are very sensitive to handling. Fish that are kept in a bucket can asphyxiate very quickly due to a rapid decrease in dissolved oxygen. Also any physical handling will result in the fish's mucus layer

and scales possibly being removed which leaves the fish open to infection. Freshwater Cobbler (*Tandanus bostocki*), for example, exhibits poisonous spines and are found in macroinvertebrates habitats.

There are common fish species that may be caught, both native and introduced species. All native fish must be returned to the water, however, special considerations apply for introduced species. Introduced fish, such as the Mosquito fish, (*Gambusia holbrooki*), are pests but must be returned to the water if participants are unsure about the identification. If school groups are sampling they must return all fish. Please refer to Education Department Animal Ethics Guidelines.

In other cases where community groups are confident in the positive identification of the fish, action remains at the discretion of the group. Fisheries Department of Western Australia states that introduced pest species should not be returned to the water. Practices such as freezing is a method of humanely disposing of introduced fish. Please refer to the "Feril Peril" pamphlet produced by the Fisheries Department of Western Australia for further information.

Macroinvertebrate Sampling

There are various ways to sample macroinvertebrates depending on your reasons for sampling. Prior to sampling, arrange a consultation meeting with the Ribbons of Blue/Waterwatch WA Coordinator in your region to work through a "How to design a monitoring program" booklet defining your reasons for sampling and further details.

The procedure of sampling is adaptable to whether the desire for the group is purely for awareness or whether the sampling is part of a monitoring program.

Reasons for Monitoring

There are vastly different reasons for undertaking macroinvertebrate sampling. Some broad reasons could include:

- Education and awareness raising
- Collection of baseline data
- Impact of pollution
- Outcomes of restoration activities
- Identify water quality trends

Each registered Ribbons of Blue/Waterwatch WA group must complete a "How to design a monitoring program" booklet. This booklet is designed as a framework to outline the reasons, logistics and outcomes of monitoring. It should be completed in consultation with a Ribbons of Blue/Waterwatch WA Coordinator and other stakeholder such as Local Government, catchment groups, property owners, industry etc. The reasons of monitoring will dictate the level of data confidence required.

Representative Sampling

Representative sampling is sampling in such a manner that the data collected accurately and precisely portrays the actual or true environmental conditions. When at a site, it is essential to conduct a site assessment. This will produce a visual health evaluation of the site and reveal the habitats present. If the habitat composition at a site is 50% channel, 30% riffle, and 20% emergent vegetation, then the sampling effort should involve sampling in the channel 50% of the time, at the riffle 30% of the time and around the emergent vegetation 20% of the time. This method takes into consideration both sampling effort, site habitat variation and allows for the collection of the maximum diversity of macroinvertebrates.

In designing a program it may be apparent to sample each of the habitats individually to ascertain habitat variability of macroinvertebrate communities. In this situation the participants will sample individually at each habitat for the prescribed sampling time of 5 minutes. From the site survey

information already attained, a comparison can be made using the habitat composition and the macroinvertebrates identified in each sample.

Where to sample

You can sample in a whole range of waterbodies such as rivers, streams, creeks, drains, lakes, wetlands and ponds. Choose a site or a number of sites that has easy access and is close by. If the site lies on privately owned land, make sure you have permission to sample. Your choice of sites will depend on your reasons for monitoring eg. awareness, effect of rehabilitation at a site or the effect of a pipe entering a stream. All sites must be registered with Ribbons of Blue/Waterwatch WA by completing a Site Establishment Form.

When to sample

The highest diversity of macroinvertebrate communities is generally when the water levels are beginning to recede and the temperature begins to rise. For rivers this would be in late winter and spring, and for wetlands this would be in spring and early summer. It is different times of the year for rivers and wetlands as rivers generally stop flowing as soon as rainfall stops.

Frequency of sampling

If a group is conducting macroinvertebrate sampling as part of a monitoring program it is recommended that they sample at least twice a year with a maximum of four times a year at one site. It is important that sampling reflects seasonal changes while ensuring that over-sampling does not occur. It is quite possible that some sites are very sensitive to macroinvertebrate sampling, therefore you should take this into account when discussing the design of your monitoring program.

Equipment used for macroinvertebrate sampling

There are various items of equipment required for the sampling, sorting and identification of aquatic macroinvertebrates.

Sampling net

If the reason for sampling does not require the collection of quality assured data, then the type of net used is not important. A net made out of a stocking or shade cloth is likely to be a cheaper and easier option for some participants. In all other circumstances, however, nets used for the collection of macroinvertebrates should have a mesh size of 250 μm (0.25 mm). This mesh size collects the smallest macroinvertebrates with most debris able to be filtered out. The net should be D-framed and be connected to a large pole. It is advisable that all groups use a D-framed 250 μm net as this demonstrates sound scientific practice and enables the comparison of data between sites and groups.

Nets used for the collection of macro-invertebrate samples should be checked before and after sampling for holes or tears, and repaired or replaced if necessary.

Sorting trays

Sorting trays need to be white and at least 5cm in depth to allow for clean water and sample. If several trays are brought to the site, this can allow for split sampling.

Ice-cube trays

White ice-cube trays allow for a cheap and easy way of placing different macroinvertebrates in separate compartments.

Sorting equipment

Ribbons of Blue/Waterwatch WA recommend plastic desert spoons, paintbrushes and plastic disposable pipettes to handle and sort macroinvertebrates. The ends of pipettes can be cut off at discretion, so larger animals can be collected. Tweezers should not be used as they can harm macroinvertebrates, even for an experienced sampler.

For advanced groups a series of sieves can be used as a rapid and effective sorting technique and allows for the differentiation of macroinvertebrate into size ranges.

General

All equipment used for the collection, sorting and analysis of macroinvertebrate samples needs to be clean and free of organic debris or leftovers from previous sampling sites.

To ensure that the sampling is a success, Figure 1 is a checklist of equipment that you should bring.

Checklist

- ❑ Sampling net
- ❑ Waders/boots
- ❑ Buckets
- ❑ Sorting trays
- ❑ Ice-cube trays
- ❑ Sorting equipment – spoons, pipettes, brushes
- ❑ Magnifying glass
- ❑ Identification keys
- ❑ Clipboards and pencils

Figure 1: Macroinvertebrate equipment checklist

How to take a sample

To conduct macroinvertebrate sampling, someone wearing appropriate clothing (eg., such as waders) will need to enter the water. Water depth should be assessed prior to entering the water. The handle of the dip net can be used to gauge depth and composition of the waterbody. Sampling needs to be conducted for at least 5 minutes. Over-sampling is better than under-sampling to ensure the greatest diversity of macroinvertebrates in the sample.

There are two different methods of sampling macroinvertebrates. A kick sample is used for flowing water with mainly rocky bottoms (riffles). The sediment and stones are disturbed immediately upstream of the net by stirring it up by shuffling and kicking with waders or boots. The animals are dislodged and are swept downstream into the net.

A sweep sample is used in deeper water or muddy bottoms and sampling along banks and amongst vegetation. Bounce the net against vegetation, logs and over the bottom to dislodge any animals that might be attached and stir up the sediment. Use the net in a scooping motion to collect the macroinvertebrates that are dislodged.

How to sort a sample

Sorting should be performed at the site immediately after sampling. Select a location to sort that is flat, and not in direct sunlight. Gently mix the sample in the bucket to ensure that the contents are evenly distributed. Empty some or the entire sample into a white tray, which has about 2cm of clean water from the site. Bear in mind that a large sample containing many organisms and debris might make it difficult to see any of the organisms.

Allow the sample to settle for a few minutes and observe any movement in the water. Using a spoon, brush or pipette, carefully collect any invertebrates that are seen. If you are too vigorous in sorting you may stir up all the material making it difficult to see any of the organisms in the tray. Transfer collected organisms into a white ice-block tray for a closer observation with a magnifying glass. Further examination can be conducted under a microscope.

Make sure that the ice-cube tray also has clean water from the site in the compartments. The sorting process should take a minimum of 20 minutes as some macroinvertebrates are quite hard to find, particularly to an inexperienced eye. Remember some organisms can be very large and others can be smaller than 1mm and may look like a grain of sand. It is recommended that when you believe you have found all the taxa continue looking for a further 10 minutes. It is important that all types of organisms are found, as this is the information that is entered on data sheets and used to evaluate the health of the waterbody.

Classification

The level of classification depends on what data and resources the participants have available and must be outlined in the "How to design a monitoring program" booklet. Classification is generally a combination of order and family level.

How to classify macroinvertebrates

Prior to identification it is important to understand how living things are classified. There is a huge variety of life on earth and it can be quite confusing, so biologists have developed a system that assembles all the living things into groups. The basic groupings are Kingdom, Phylum, Class, Order, Family, Genus and Species.

The groups are arranged in a hierarchical system. Within a kingdom are groups called phyla, within a phylum there are groups called classes, within a class there are groups called orders, and so on. A kingdom is a large and broad division such as whether the living thing is a plant or an animal, whilst on the other end of the system, species is a finite division with members sharing very similar attributes.

Marron are a very well known invertebrate inhabiting the waterbodies of the south west of Western Australia. Here is an example of the classification of this animal.

Classification of a Marron

Kingdom	Animalia
Phylum	Arthropoda
Class	Crustacea
Order	Decapoda
Family	Parastacidae
Genus	*Cherax*
Species	*Cherax tenuimanus*

Therefore, scientists would refer to the Marron as *Cherax tenuimanus*. This naming system is called a binomial system and consists of two parts. The first part is the generic name which has the first letter as a capital and then is followed by the specific name which is all lower case. The name should also be written in italics as above or underlined eg. Cherax tenuimanus.

How to identify macroinvertebrates

Identification can be conducted concurrently with sorting or at the end as long as participants spend the times prescribed above for the sorting process. Ribbons of Blue/Waterwatch WA have a wide range of resources to assist in the identification process. They range from identification keys, computer software and reference books.

The level of sampling performed by the group determines the selection of the resources and the use of several resources is recommended to confirm identification. Generally, macroinvertebrates are large enough to make an accurate identification, however, where possible a field microscope should be used to identify smaller organisms. Otherwise, try taking a photo or drawing a sketch with a description so it can be identified later. Once the macroinvertebrates have been sorted and classified

they need to be returned back to the water that they were collected from as soon as possible and not removed from the site.

Recording

After sorting and identification, mark down on the Macroinvertebrate Data Sheet (refer to Appendix 1) what you have found. Count each type of organism only once. Also make notes about abundance and any other observations in the comments column.

Interpretation

A macroinvertebrate is either present or not present at a site for a combination of reasons. Take into account lifecycle, seasons, water flow, riparian vegetation, habitats etc to try to explain why each animal is living at a site and how it is interacting with its environment and other organisms. Some organisms can be classed as either sensitive or tolerant depending on its response to specific changes in the water conditions.

With further monitoring and more data, it may be possible to calculate sensitivity ratings for each animal. Also participants should compare their data at a site at different times of the year, or with different sites in the same catchment or stream, or with different waterbodies.

Supporting Data

It is recommended that aquatic macroinvertebrate sampling should be sampled in conjunction with other parameters for a comprehensive evaluation of waterbody health. Essential water quality parameters and a site assessment should also be taken to support the macroinvertebrate data, and indeed portray a clearer picture of the health of the waterbody.

There are a wide variety of water quality tests that groups can perform. As mentioned previously temperature, turbidity, conductivity, pH, nutrients and dissolved oxygen are parameters commonly measured by Ribbons of Blue/Waterwatch WA groups. This data collected should be correlated with macroinvertebrate data to investigate any significance. For example, water temperature may need to be at a certain a level for adult insects to lay eggs in the water. Examination of a macroinvertebrate dataset may help you deduce the approximate time or cues for reproduction of taxa at a site.

If nutrient testing indicates high levels of nutrients, those taxa able to cope and in some instances flourish in eutrophic conditions, such as water fleas and water boatmen, can be predicted to be present in high abundance. Alternatively, if macroinvertebrate sampling indicates a high abundance of water fleas and waterboatmen, nutrient testing is appropriate to gauge the extent of the eutrophic conditions and change over time.

A better understanding of a site will inevitably lead to a better understanding of our macroinvertebrate communities and water quality. Prior to sampling at a new site it is essential to take observations of the waterbody and identify any input and outputs, different habitats, potential pollution threats, wildlife, safety and ethical issues etc.

Record keeping

The Waterwatch database contains various information about groups, sites and importantly water quality data that has been validated. Each Ribbons of Blue/Waterwatch WA Coordinator maintain it. Data can only be entered onto the database if the data has successfully passed the quality control checks. Any data that fails the check still has value as supporting data or perhaps to show an indication that re-training is required.

The Waterwatch database does not use the same terms that Ribbons of Blue/Waterwatch WA uses to name its macroinvertebrates and has organisms or fields that are not relevant for our purposes. Table 1 lists what fields are on the Waterwatch database and how they compare to Ribbons of Blue/Waterwatch WA.

Table 1: Waterwatch database macroinvertebrate fields

Test No.	Test Name	Ribbons of Blue/Waterwatch WA Name
98	Macroinvertebrate Rating	*Not relevant*
99	Macroinvertebrate Diversity	Macroinvertebrate Diversity (Total)
100	----------	----------
101	Stonefly larvae	Stonefly larvae
102	Mayfly larvae	Mayfly nymph
103	Freshwater shrimp	*Not relevant*
104	Dobsonflies/alder-flies	*Not relevant*
105	Riffle Beetles	Riffle beetle and larvae
106	Freshwater Prawn	Freshwater prawn
107	Diving Beetles	Predacious diving beetle adult/larvae
108	Yabbies/Marron/Gilgie	Freshwater crayfish
109	Dragonflies	Dragonfly larvae
110	Damselflies	Damselfly larvae
111	Caddis-fly larvae	Caddisfly larvae
112	Water mites	Water mites
113	Water-scavenger beetles	Water scavenger beetle adult/larvae
114	Whirligig beetles	Whirligig beetle/larvae
115	Leeches	Leeches
116	Snails	Freshwater snails
117	Flatworms	Flatworms
118	Black-fly larvae	Blackfly larvae
119	Mosquitos	Mosquito larvae and pupae
120	Water-pennies	*Not relevant*
121	Chironomids	Non-biting midge larvae
122	Beetle larvae	*Not relevant*
123	Water-boatmen	Water boatmen
124	Water scorpions	Water scorpions
125	Water-measurers	Water measurers
126	Water striders	Water striders
127	Small-water-striders	*Not relevant*
128	Biting-midges	Biting midge larvae
129	Springtail	Springtails
130	Freshwater crab	*Not relevant*
131	Side-swimmers	Amphipods
132	Freshwater slater	Isopods
133	Segmented worms	Segmented worms
134	Limpets	*Not relevant*
135	Bivalves	Freshwater mussels
136	Roundworms	Roundworms
137	Hydra	*Not relevant*
138	Crane-flies	*Not relevant*
139	----------	----------
140	Beetles	*Not relevant*
141	Beetle larvae	*Not relevant*
142	True Bugs	*Not relevant*
143	Water flea	Water fleas
144	Clam shrimps	Ostracods
145	Bristleworm	*Not relevant*

The Macroinvertebrate Diversity field should be entered and is total number of taxa found from the macroinvertebrate data sheet. The Waterwatch database does not have the facility to enter all the taxa found on the new data sheet. Therefore, it is important to be stringent in storing and managing hard

copy data. Ribbons of Blue/Waterwatch WA Coordinators should consult with the State Environmental Officer to develop regional databases in the future.

Training

Ribbons of Blue/Waterwatch WA Coordinators conduct training for participants. If macroinvertebrate sampling is part of a monitoring program, the Regional Coordinator should ensure as part of the training that at least one member of the sampling group should be skilled in macroinvertebrate identification. Re-training of groups should be conducted at least every 12 months or earlier as required.

Minimum and Additional Quality Control Checks

If data is collected as part of a monitoring program then the data can be entered onto the Waterwatch database. The data must be able to pass the minimum control checks prior to entering onto the database.

Minimum Checks

- Group is registered with Ribbons of Blue/Waterwatch WA
- Site code matches the site registered with Ribbons of Blue/Waterwatch WA
- Data is entered on a recognised Ribbons of Blue/Waterwatch WA data sheet
- Date and time recorded
- Training conducted in the past 12 months
- A D-framed 0.25 mm mesh net used
- Sampling time at least 5 minutes
- Sorting time at least 30 minutes
- Regional Coordinator is confident that at least one group member has adequate identification ability
- Results make sense

Additional Control Checks

- Identification confirmed by Ribbons of Blue/Waterwatch WA Coordinator, aquatic biologist or stereomicroscope.

Useful References

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Ribbons of Blue/Waterwatch WA
Macroinvertebrate Data Sheet

RIBBONS OF BLUE
WATERWATCH WA
Communities Caring for Catchments

School/Group: _____ Date: _____ Time: _____

Teacher/Contact : _____ Sampling Net: _____

Class: _____ Site Code: _____ Sampling Time: _____ *mins* Sorting Time: _____ *mins*

Macroinvertebrate	Classification	Present (✓)	Comments
PHYLUM ARTHROPODA – CLASS INSECTA			
Stonefly larvae	Plecoptera (order)		
Mayfly nymph	Ephemeroptera (order)		
Caddisfly larvae	Trichoptera (order)		
Dragonfly larvae	Odonata (order)		
Damselfly larvae	Odonata (order)		
Water boatmen	Corixidae (family)		
Backswimmers	Notonectidae (family)		
Water scorpion	Nepidae (family)		
Water measurer	Hydrometridae (family)		
Water strider	Gerridae (family)		
Riffle beetle adult/larvae	Elmidae (family)		
Predacious diving beetle adult/larvae	Dytiscidae (family)		
Water scavenger beetle adult/larvae	Hydrophilidae (family)		
Whirligig beetle adult/larvae	Gyrinidae (family)		
Mosquito pupae/larvae	Culicidae (family)		
Blackfly larvae	Simuliidae (family)		
Soldier fly larvae	Stratiomyidae (family)		
Biting midge larvae	Ceratopogonidae (family)		
Non-biting midge larvae	Chironomidae (family)		
Springtails	Collembola (order)		
PHYLUM ARTHROPODA - CLASS CRUSTACEA			
Freshwater crayfish	Parastacidae (family)		
Freshwater prawn	Decapoda (order)		
Water flea	Cladocera (suborder)		
Clam shrimp	Conchostraca (suborder)		
Amphipod	Amphipoda (order)		
Ostracod	Ostracoda (subclass)		
Copepod	Copepoda (subclass)		
Shield shrimp	Notostraca (order)		
Fairy shrimp	Anostraca (order)		
Isopod	Isopoda (order)		
PHYLUM ARTHROPODA - CLASS ARACHNIDA			
Water mite	Acarina (order)		
Water spider	Araneae (order)		
PHYLUM MOLLUSCA			
Freshwater mussel	Bivalvia (class)		
Freshwater snail	Gastropoda (class)		
PHYLUM ANNELIDA			
Segmented worm	Oligochaeta (class)		
Leeches	Hirudinea (class)		
PHYLUM NEMATODA			
Roundworms	Nematoda (phylum)		
PHYLUM PLATYHELMINTHES			
Flatworms	Turbellaria (class)		
MACROINVERTEBRATE DIVERSITY (TOTAL) *			

* Add up the number of ✓'s to determine the total number of different macroinvertebrates found. The presence of various freshwater macroinvertebrates may vary according to season, lifecycle, water flow, habitat and water quality.