NORTH CENTRAL
Catchment Management Authority

Freshwater Macroinvertebrates

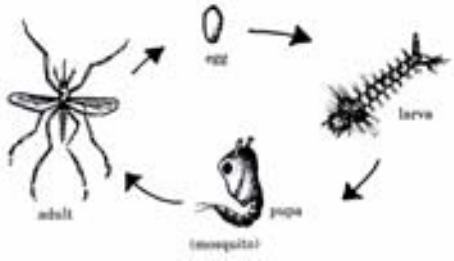
DESCRIPTION AND CHARACTERISTICS

Freshwater macroinvertebrates can be found in all types of water bodies across Australia, even swimming pools! They are quite small but most can be seen with the naked eye. They are extremely diverse and range in appearance and size. For instance, they can have no legs to numerous legs, be round or oblong, with or without visible eyes, antennae and mouthparts. Some animals breathe through tubes which they push up through the water surface into the air, others have gills located on various segments of their body and some even take small bubbles of air under water like little scuba tanks!

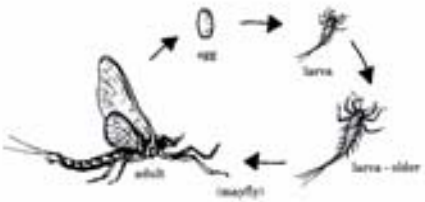
A pair of damselfly nymphs © 2002 John Gooderham and Edward Tsyrlin

BIOLOGY AND LIFE CYCLE

Most macroinvertebrates follow a simple lifecycle: they hatch from eggs then develop straight into a nymph or into a larval stage. Nymphs develop straight into adults whereas larvae transform into pupae before developing into adults. Many of these adults are sexually reproductive and have the ability for flight. The dragonfly nymph, for instance, climbs out of the water onto a reed or rock, sheds it outer skin (exoskeleton) and the adult emerges. It lets it's wings and body unfold and flies off to carry out the rest of its cycle above the water surface. It will then drop eggs into the water after it has mated. Many of the true bugs and water beetles remain in the water body for their entire life, however they do possess wings that allow them to fly to a different area if they find their current habitat unsuitable.



WITH A PUPAL STAGE



WITHOUT A PUPAL STAGE

Some animals can reproduce asexually by splitting into multiple individuals voluntarily. Some snails and leeches undergo hermaphroditic reproduction where one individual has both male and female organs so both individuals involved in mating can produce eggs.

Aquatic environments comprise complex food webs. Feeding methods of macroinvertebrates include scrapers (graze the layer of algae from rocks, logs etc) such as snails, shredders (breakdown coarse debris into smaller pieces while feeding), collectors (or filter feeders), predators and detritivores (feed on dead material). Basically, they play a vital role in processing organic matter in our waterways as well as being a major food source for animals such as platypus, fish, frogs, and birds.

Mayfly nymph © 2002 John Gooderham and Edward Tsyrlin

For macroinvertebrates there are several broad habitat types including riffles and pools which contain multiple microhabitats. In faster flowing waters animals are adapted to live attached to or under rocks. They fasten themselves onto the stream substrate to avoid being washed downstream. In pools, the animals can be free swimming or attached to substrate and vegetation and occupy most of the water column. Areas with aquatic vegetation, leaf litter and woody habitat provide for a diverse range of macroinvertebrates.

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INDICATORS OF RIVER HEALTH

Macroinvertebrates are useful indicators of river health because they occupy a central role in the food chain, many live for over a year, they cannot easily escape pollution and they can be quite sensitive to even mild cases of pollution or water quality changes. Because some are more tolerant to pollution than others, sampling macroinvertebrates within a waterway can provide us with an indication of its health. There are many guides that can be used to assess water quality. While there are many surveying and analysis methodologies, for Waterwatch purposes the Stream Invertebrate Grade Number - Average Level (SIGNAL) is used. The process involves following standardised sampling and sorting procedures and identification to the level of order or family (sorting to family level is most accurate but can be difficult for individuals with little training in identification). Each type of macroinvertebrate group has a grade from 1-10 based on its sensitivity. The higher the number, the more sensitive the animal is. The assessment technique provides an overall score by taking into consideration the sensitivity of the macroinvertebrates present and their abundance.

Micro caddis—this little caddis fly is less than 5mm long! This species has a moderate sensitivity rating © 2002 John Gooderham and Edward Tsyrlin

Freshwater shrimp can tolerate reasonably poor water quality © 2002 John Gooderham and Edward Tsyrlin

Macroinvertebrates respond to the presence of longer term pollution or changes in water quality as compared to water quality testing which only assesses health, or presence of pollution for that point in time and is highly specific (test for pH, phosphorus etc). For instance, stonefly nymphs are very sensitive to organic pollution such as turbidity, if you have had reoccurring events that cause turbidity, but only sample turbidity once and an event hasn't occurred that day, you may not know about the usually high turbidity. The absence of stoneflies in a waterway where they usually occur may help you determine that something more long term has been going on. For another example, a higher than normal presence of bloodworms and a drop in other species occurrence could indicate low dissolved oxygen levels as blood worms are very tolerant to low oxygen conditions.

For information on how to conduct your own macroinvertebrate survey, please visit the Waterwatch Australia national technical manual at: www.waterwatch.org.au/publications/module3/macroinvertebrates.html or contact your regional Waterwatch facilitator.