River Health in the Flinders Ranges

Dragonfly larva (*Hemicordulia tau*)

Aquatic macroinvertebrates in the Flinders Ranges

The region is biologically very diverse, with more than 420 types of aquatic macroinvertebrates being recorded from 1994–1999. The most common members include chironomid midge larvae (e.g. *Tanytarsus*, *Corynoneura* and *Chironomus* species), oribatid mites, blackfly larvae (*Simulium ornatipes*), caenid mayfly nymphs (*Tasmanocoenis tillyardi*), oligochaetes (worms) and biting midge larvae (*Dasyhelea* species).

A number of rare and uncommon macroinvertebrates are found in the region. They include an undescribed worm (*Insulodrilus* species) from Hookina Creek, a hydrophilid beetle (*Coelostoma fabricii*) from Mt Chambers Creek, a leptocerid caddisfly (*Lectrides varians*) from Mambray and Alligator creeks, and a hydroptilid caddisfly (*Orphninotrichia* species) from Brachina, Oraparinna and Italowie creeks.

The predatory caddisfly *Apsilochorema obliquum* is only found in flowing water habitats from a small number of streams in the region.

Photo: Peter Schultz

Since 1994 scientists from the Environment Protection Authority and Australian Water Quality Centre have been assessing the ecological health of rivers and streams throughout South Australia.

As part of this work, 64 sites in the Flinders Ranges have been assessed. This brochure describes the monitoring methods and the overall condition of the rivers and streams in the Flinders Ranges.

The AUSRIVAS Program

This work is part of the AUStralian RIVer Assessment System (AUSRIVAS), and represents the first national biological assessment of river health to be conducted on a continental scale anywhere in the world. It has involved sampling over 6000 sites across Australia, including about 650 sites in South Australia.

What is river health?

Defining 'river health' is similar to defining human health, as it provides an overall assessment of the health of waterways. It is important to note that the concept of 'health' often has different meanings to different people, and largely depends on each person's values and knowledge. However, for our purposes when we describe river health we are really talking about the ecological condition of a waterway.

It's not just about rivers, but also includes streams, creeks and earthen drains.

How do we measure river health?

We measure river health by comparing the condition of a river to similar rivers of the same type in an undisturbed, unimpacted state (i.e. reference condition). To provide a nationally consistent approach, all States and Territories have used aquatic macroinvertebrates as the major biological indicator group to focus on and model. Our assessments provide a measure of the degree of similarity between the aquatic macroinvertebrates found at each site and those predicted to occur at the site if it were not impacted.

What are macroinvertebrates?

Macroinvertebrates are aquatic animals without backbones that are large enough to be seen with the naked eye. They include insects, crustaceans, snails, worms, mites and sponges. The insects include the larvae of flying insects (e.g. midges, two-winged flies, dragonflies, mayflies, stoneflies and caddisflies) and adults of some groups (e.g. waterbugs, beetles, springtails). The more familiar crustaceans include yabbies, and freshwater shrimps and prawns.

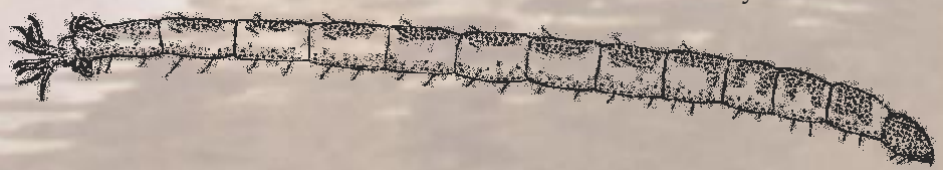
Pupae of biting midges (Ceratopogonidae**) are commonly found in Flinders Ranges streams.**
Photo: M.Marchetti, California State University

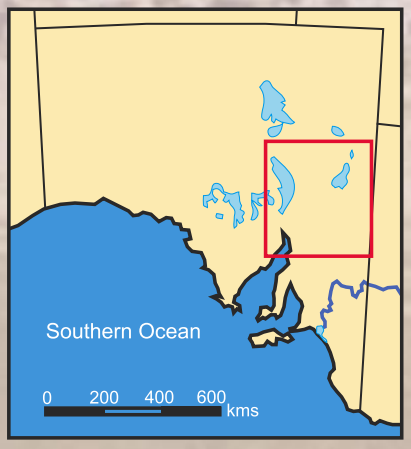
Why use macroinvertebrates?

Macroinvertebrates are most commonly used in biological monitoring studies because they are common, widely distributed, easily sampled and most can be readily identified by experienced biologists.

Why worry about river health?

The decline of water quality, blooms of blue-green algae, contamination with pesticides, nutrients and sediment, microbes that threaten drinking water supplies, fish deaths, and the threats posed by increasing salinity are some of the widespread issues that affect many waterways in Australia. This often leads to questions about the overall health of rivers and streams and the actions we should take to improve the environmental condition of our waterways.





Site Description

- More biologically diverse than reference sites (needs detailed investigation) (X)
- Reference site
- Reference condition (A)
- Significantly impaired (B)
- Severely impaired (C)
- Beyond the capacity of current AUSRIVAS models (?)

A / B - Site that varies in condition from one year to the next

Land Type

- Lake
- Land
- Ocean
- River
- Towns
- Streams

N

0 10 20 30 40 kms

Riverine environments in the Flinders Ranges

The Flinders Ranges extend about 450 km, and riverine environments range from small streams in the Warnertown to Wilmington area in the south to ephemeral springs in the Gammon Ranges in the north. The general landscape consists of a complex of parallel ridges and valleys with remnant plateaus and plains preserved high in the relief of the region. Parts of the region originated 500–1000 million years ago. Geological activity, erosion and deposition have resulted in the current landscape.

The general climate of the region is highly variable due to the interaction of air movement and rainfall patterns with mountain ridges throughout the ranges. Rainfall is higher in the uplands than on the adjacent plains, and increases southwards across the region. Average annual rainfall ranges from less than 200 mm in the most northerly ridges and plains to more than 600 mm in the Mt Remarkable area to the south.

Water boatmen (e.g. *Sigara* species) are common in the still-water margins of streams and waterholes in the region.
Photo: Prof. E. Wachmann, Berlin

Rivers and creeks in the region tend to flow episodically in response to occasional and irregular rains. There are three basic types of stream habitat in the Flinders Ranges: those fed by springs which are generally permanent; those that flow for a considerable length of time following winter rains and are thus seasonal in nature; and those which flow only briefly after rain and are therefore ephemeral.

Many streams have springs that discharge near permanent water in their upper reaches but are temporary in their lower reaches.

It is important to note that there is also considerable underground flow in many streams in the Flinders Ranges. This sub-surface habitat is called the hyporheos (from the Greek for 'under' and 'flow') and, at times of low rainfall, is an important refuge for many aquatic insects and crustaceans.

The major drainage patterns include streams that flow into the upper Spencer Gulf from Port Pirie to Port Augusta, and streams that discharge into Lake Torrens and Lake Frome. The coastal streams include Back, Baroota and Mambray creeks. The Willochra Creek is the major stream that drains into Lake Torrens, and the Siccus River and Wilpena Creek are the largest waterways that flow into Lake Frome.

River health in the Flinders Ranges

The map provides an overall assessment of the health of individual sites in the region.
Most waterways were in good condition, including sites from Baroota, Coonatto, Bunyeroo, Yadnapunda and Oratunga creeks and Baratta Springs. There was a biodiverse site at Pekina Creek, although other creeks also had high numbers of species on some occasions, particularly from some of the reference sites (e.g. Brachina, Parachilna, Bunyeroo and Spring creeks).

The major impacts associated with streams in the region relate to nutrient enrichment and erosion by stock; tracks and roads; land clearance; in-stream reservoirs; and discharges from disused mines and saline groundwater systems.

The Willochra Creek is the major drainage system in the region. The tributary streams in the upper reaches were in good condition, with diverse biological communities. As flows extended onto the Willochra Plain, the creek rated poorly due to the low numbers of invertebrates that are able to tolerate the very high salinity of water in the lower reaches.

Other waterways that showed moderate to severe impacts included Wilpena (possible tourism impacts, water quality), Aroona (dam, flow and water quality), Arcoona (stock, water quality), Crows Nest (high nitrogen concentrations and turbidity) and Arkaroola (limited habitat, high nutrients) creeks. Sites from Paralana Hot Springs and Nilpena Creek were so unusual that they were unable to be assessed by the AUSRIVAS models.

Peter Goonan is the Project Manager for S.A. and can be contacted at the Environment Protection Authority on (08) 8204 2044.
Chris Madden, Paul McEvoy and Daria Taylor provided technical input to this project and can be contacted at the Australian Water Quality Centre on (08) 8259 0336.
Bruce Gray from Environment Australia administered this national program and can be contacted on (02) 6274 2526.

Additional details are available at
http://ausrivas.canberra.edu.au
http://www.ea.gov.au/water/rivers/nrhp/index.html

Government of South Australia

EPA South Australia

Environment Australia
Department of the Environment and Heritage

EGI Environmental and Geographic Information

Australian Water Quality Centre