

WaterShed

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Measuring River Health

by Professor Peter Cullen

One of the questions most frequently asked of the CRC for Fresh Water Ecology is how do we measure river health? Rarely do people want to damage the rivers that they work with or that they are sustained by. However, determining when a river is healthy or when it is changing to an unhealthy state is difficult.

River health is complex, just as human health is complex. If you were to ask your doctor, "Am I healthy?", they would assess a range of indicators and make a judgement. They might look at weight and blood pressure, examine your ears or throat or they might decide on a range of blood tests or X-rays. They would then use these various indicators to determine your health and advise you of the best treatment.

Just like people, unhealthy rivers can be diagnosed by looking at some common symptoms. These are as follows:

- River banks – is the riparian vegetation intact or destroyed? Is there stock damage or signs of

recent unnatural erosion? Are the banks natural or straightened? Do levees isolate the river from its floodplain?

- River bed – has excessive sand from past erosion smothered riverbed habitat, such as deep pools and riffles? Are other habitat present, such as snags?
- The look of the water – are there algal scums, dead fish, litter or other floating rubbish?

Beyond these obvious visual symptoms we, like the human doctor, might want to undertake some diagnostic tests to test our ideas on what might be wrong with a river.

The common diagnostic tests we use include:

- Water quality measurements – there are a range of chemical indicators commonly used including nutrients and salinity. With caution, we may be able to use Water Quality Guidelines to interpret these figures. *continued on page 2*

- Aquatic invertebrates – the levels of nutrients or pollutants in the water and/or changes in flow are significant, however it is the biological consequences of this change that may be of greater concern.

Aquatic invertebrate communities have been widely used in Australia to assess the health of rivers. Invertebrates are good indicators of the biological health of a river. Some species (such as mayflies) are known to be highly sensitive to subtle changes in their environment, while others (such as bloodworms) are very tolerant. Species recorded at a range of damaged or undamaged sites can provide an important insight into what is happening in a river or its catchment. This approach is now used as a predictive tool by river managers.

- Fish – most Australians tend to judge the health of a river by whether or not it supports a healthy population of native fish. However, in cooler mountain streams and/or sections of rivers made artificially cold by water released from dams, introduced species such as trout thrive and are welcomed by many sport fishers. Carp, however, are generally disliked by most people.

Other key elements of a healthy river are:

- The flow regime, which may be influenced by extraction and storage of water. For example, in southern Australia flows may be inverted to create peak flows in summer and low flows in winter.
- Habitat, which is made up of snags, riparian vegetation and bed condition is strongly influenced by flow regime. Adequate flow ensures connection between the river and the flood plain habitat, upstream and downstream of the river.

At the end of the day, communities must choose the level of health they want for their rivers, in a similar way that people make choices about their own health.

‘acceptable change’ will be a tough choice

The choices for either are not easy. With a river, our obligations to downstream users as well as to the environment have to be considered. Setting targets for

flow, salinity, nutrients and riverine health is difficult because it must be done in the context of what



Prof Peter Cullen, Chief Executive of the CRC for Freshwater Ecology. Photo: M Ashkanasy, courtesy of Melbourne Water

level of change is acceptable to society. This is a social choice; all science can and should do is to identify what the consequences of various decisions will be, hopefully identifying long term as well as the short-term changes.

Most people are willing to accept some change in our rivers in exchange for the benefits society gets for their use. Few people are talking about restoring all our rivers to a pristine condition - this is just not possible when we have changed so much in the catchments. We must understand that most rivers are impacted by human activity, many to a great extent. We should certainly seek to identify our few undamaged river systems and protect them.

How much change is acceptable? To answer this question we must first develop a broadly accepted measure of river health. This will ensure that we are all talking about the same thing. The National Land and Water Resources Audit and the Sustainable Rivers Audit being developed by the CRC for Freshwater Ecology for the Murray-Darling Basin address this issue. Deciding where we want a river to be on this scale of ‘acceptable change’ will be a tough choice for communities, but it is a choice that has to be made. In making it, people will want to know what are the limits of change beyond which a river is not likely to recover even if the stress is removed. This is a tough question and remains a challenge for science.

As we move to set targets it is important to remember they are a social choice and we may change them periodically as our views about the sort of rivers we want change and as we better understand the impacts of our decisions and actions.