Maintaining in-stream values of small streams given the increasing demand for water: lessons from the Top of the South

Roger Young, John Hayes, Anna Crowe, Rowan Strickland
Cawthron Institute, Private Bag 2, Nelson

Peter Hamill
Marlborough District Council, P.O. Box 443, Blenheim

Throughout the country regional and district councils are being asked to balance abstractive demands against flows required for maintenance of in-stream values in small streams. In many cases these streams do not have flow data and there is limited information on the in-stream values to be protected. Unfortunately, the in-stream values of small streams are often perceived to be relatively low, despite the fact that they are often important habitat for native fish and key spawning and rearing areas for sports fish.

Technical methods to assess flow requirements in larger streams and rivers are relatively well developed. However, these methods are not necessarily applicable to small streams because most research on the flow requirements of aquatic life has been carried out on larger rivers and the equations used in hydraulic models work poorly in small turbulent streams. These techniques are also time consuming and expensive and often can not be justified on a small stream. In most cases, decisions on water allocation and environmental flows in small streams currently are based on historic flow methods (e.g. minimum flow at the 1 in 5-year low flow) and thus require transfer of flow records from the nearest flow recorder, which is usually on a nearby larger stream or river and thus not necessarily a good predictor of flows in the small stream of interest.

Abstractions from groundwater and seepage galleries have the potential to drop ground water levels causing springs and nearby small streams to recede or dry up. These concerns led to two small stream studies in Marlborough and Tasman. The first study was of the values and threats across a range of spring-fed waterways on the Wairau Plain in conjunction with the Marlborough District Council. The second was an assessment of some techniques to guide management of water abstraction in a small headwater stream in the Motueka River catchment as part of the Motueka integrated catchment management (ICM) project (see http://icm.landcareresearch.co.nz).

Water quality and biological surveys of 34 spring-fed waterways on the Wairau Plain indicated four separate groups of sites: contaminated waterways with little ecological value, waterways with tidal influence, waterways with weak connection to the aquifer, and waterways with strong connections with the aquifer. All three of these latter groups have potentially high ecological value. For example, our observations of giant kokopu in two of these waterways were the first officially recorded sightings of this native fish in the Wairau Plain area since 1973.

Relatively simple relationships between flow and habitat availability were not applicable in these streams because water levels are related to flow, the biomass of aquatic plants, and in some cases tidal fluctuation. Historical records of spring drying were useful in determining which waterways are under threat from increases in groundwater abstraction. Trigger levels controlling groundwater abstraction in the future are probably best based on water levels in representative streams where aquatic plant growth is controlled, or directly on groundwater levels near threatened streams.

In a small tributary of the Motueka River a quick hydraulic method (Jowett 1998) of assessing changes in habitat with flow was compared with a simplified in-stream flow incremental methodology (IFIM) based method, which was used as the standard for comparison. Problems with bias in the field measurements using the quick hydraulic method were identified but could be resolved with small changes in field protocols. Once these problems were addressed the two methods predicted reasonably similar mean depth, mean width and mean velocity over a range of flows, although there was some divergence as flow approached zero. The quick hydraulic method predicts only the response of mean depth, width and velocity, rather than the distribution of depths and velocities. Therefore, it was not possible to directly relate the results with habitat preferences for any particular species, which is possible and a particular strength of the IFIM based method. Nevertheless, the quick hydraulic method allows considerable time savings over the IFIM method and enables likely changes in width, depth and velocity with flow to be quantified, thus enabling more informed decisions on water allocation management.

Reference

Jowett, I. G. 1998: Hydraulic geometry of New Zealand rivers and its use as a preliminary method of habitat assessment. *Regulated Rivers: Research & Management 14*: 451-466.