November 2008

Snowy River flow response monitoring and modelling – physical and water quality response

Following construction of the Snowy Mountains Scheme between 1955 and 1967, flows in the Snowy River have been severely altered. To improve river health, water was released to the Snowy River via the Mowamba River as a result of the de-commissioning of the Mowamba River aqueduct. The Snowy River Flow Response Monitoring and Modelling program was established to assess the changes in river conditions that could be attributed to the new environmental water releases. This summary presents the physical and water quality responses to the first stage Environmental Flow Regime (EFR) to the Snowy River from August 2002.

Physical response

Several aspects of the physical characteristics of the Snowy River were measured before and after the first stage of the environmental flow regime including:

i. habitat area and diversity
ii. channel shape
iii. sediment grain size.

The small increase in base flow in the upper reaches has increased the wetted channel area in the upper reaches. Increases in running water habitat area also occurred. However, no significant change in wetted habitat diversity was recorded in the upper reaches.

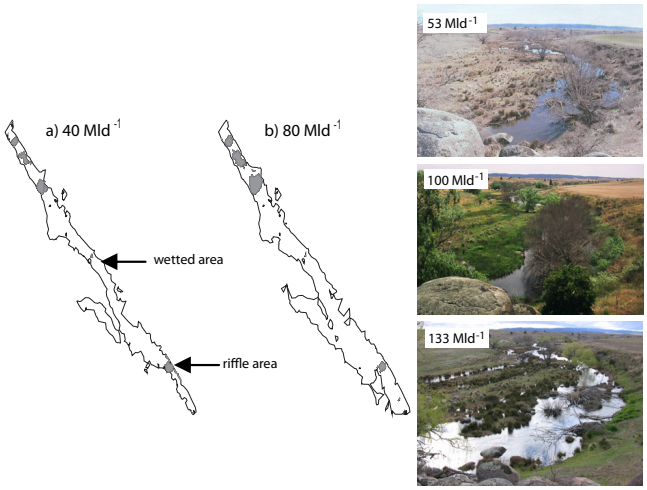

Figure 1 (left): HEC-GeoRAS hydraulic model of Snowy River at Blackburn Creek showing a 50 per cent increase in total wetted area and riffle area at river flows from a) 40 Mld^{-1} (mega litres per day) and b) 80 Mld^{-1}. Photo-point monitoring of the Snowy River at 53, 100 and 133 Mld^{-1}.
Source: Rose (in press).

Localised changes in channel shape have also occurred along the Snowy River, but typically no significant response could be attributable to the new flow regime. At some locations in the upper snowy River, sediment has been deposited in the channel since the 2002-03 wildfires thereby reducing channel depth. The wildfire and the subsequent storm in early 2003 deposited large amounts of sediment and ash into the Snowy River.

In other locations, such as Burnt Hut, sediment has been scoured out making the channel deeper. Scouring occurred at sites where tributary inputs were large enough to induce sediment movement, particularly downstream of the Delegate/Snowy River confluence.

The grain size of the bed sediment changed in the upper Jindabyne Gorge becoming finer rather than the expected coarsening. This localised deposition of fine sediment occurred after a localised storm event post the 2002-03 wildfire that transported ash and sediment into the main river channel.

Results show that the first stage EFR has increased wetted habitat area at sites in the upper Snowy River below Jindabyne Dam, including an increase in running water habitats. However, flows greater than the initial release are required to significantly change channel shape and sediment size.

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Water quality

Water temperature and electrical conductivity (EC) were measured, as these variables will likely reflect the increased mixing of water in the Snowy River as a result of the EFR. The water temperature is likely to be cooler and less variable and EC is expected to reduce as salts become diluted.

Although there was no significant change in mean, maximum or minimum water temperature at Dalgety associated with the environmental flow regime, there was a highly significant negative relationship between mean daily flow and water temperature which suggests that larger EFR would reduce stream water temperatures.

Environmental flow regimes were associated with a significant increase in the diurnal water temperature range at Dalgety by 0.8^{o}C and an increase in the variability of daily fluctuations in the range of water temperatures (Figure 2). These small changes, however, are unlikely to be of ecological significance.

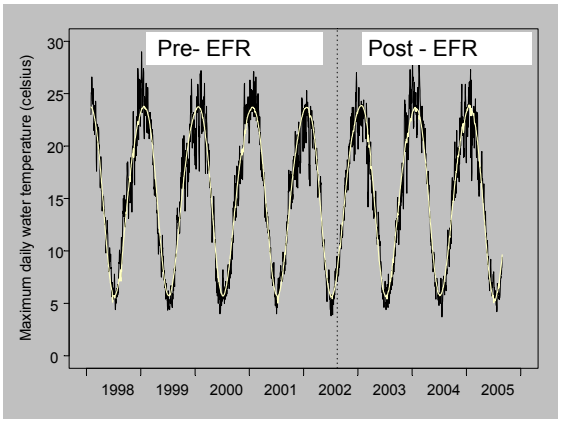
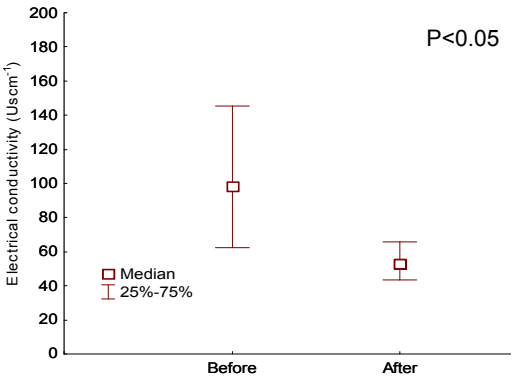


Figure 2 (left): Time series of the mean daily water temperatures for the Snowy River at Dalgety. The fitted line is the prediction from the linear mixed model.
Source: Bevitt and Jones (2008).

There were large and statistically significant decreases in electrical conductivity at all Snowy River sites. This electrical conductivity occurred irrespective of the increased flows from the Mowamba River, and is highly likely to be due to reduced catchment runoff during the drought.

Figure 3 (right): Median electrical conductivity at Dalgety, before and after the EFR in the Snowy River.
Source: Bevitt and Jones (2008).



Preliminary results also indicate that during the warmer months the EFR are sufficient to mix the water column in the smaller, shallower pools (i.e. < 3 metres deep), whereas the deep pools in the Jindabyne Gorge, (i.e. 5 metres deep) remain unmixed and stratified (Figure 4). These locations potentially act as a nutrient source during these periods of stratification.

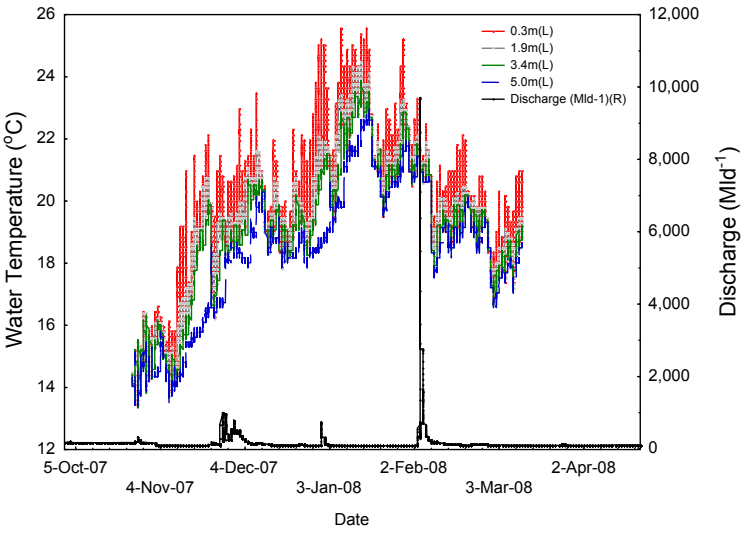


Figure 4 (left): Water temperature profile for the Snowy River downstream of the Mowamba River. Deep pools in the Jindabyne Gorge stratify during the warmer months and the current EFR appears to be insufficient to mix the water column.
Unpublished data.