The puzzle of the Tooma River fish-kills

Since the late 1980s, landowners have been reporting spasmodic fish-kills in the Tooma River, alpine NSW. Coincidentally, a team of scientists sampled fish and macroinvertebrate faunas of the Tooma River during a 1998 study of the environmental-flow requirements of rivers in the Snowy Mountains region, and found, to their surprise, that the river's aquatic ecology was in poorer condition than could be expected from the impacts of river regulation alone, and despite good-quality habitats in some areas.

An investigation by the science team was unable to define the causes of the fish-kills or the reduced ecological condition.

The puzzle remains unsolved.

The landowners reported that fish-kills were associated with brief, high river-flows in summer, accompanied by visible bluish colouration in the water. They had observed that the dead fish had been bleeding from the gills. Fish had disappeared from the main river channel, then eventually recolonised. No formal records or investigations were made of the events at the time.

The science team considered that the available evidence was consistent with episodic releases of contaminants. After helicopter and ground searches of the catchment, the team concluded that the likely source of contamination was the Deep Creek waste-rock dump left after 1950s tunnelling. An alternative possibility was that sediment flushed from the Tooma Dam during periodic maintenance operations might contain contaminants. The sediment was also likely to deplete downstream dissolved oxygen levels.

But investigation during 1998–2001 produced insufficient evidence to either incriminate or exonerate the Deep Creek waste-rock dump. Also, the maintenance schedule at Tooma Dam showed no relationship to the occurrence of fish kills.

The investigation

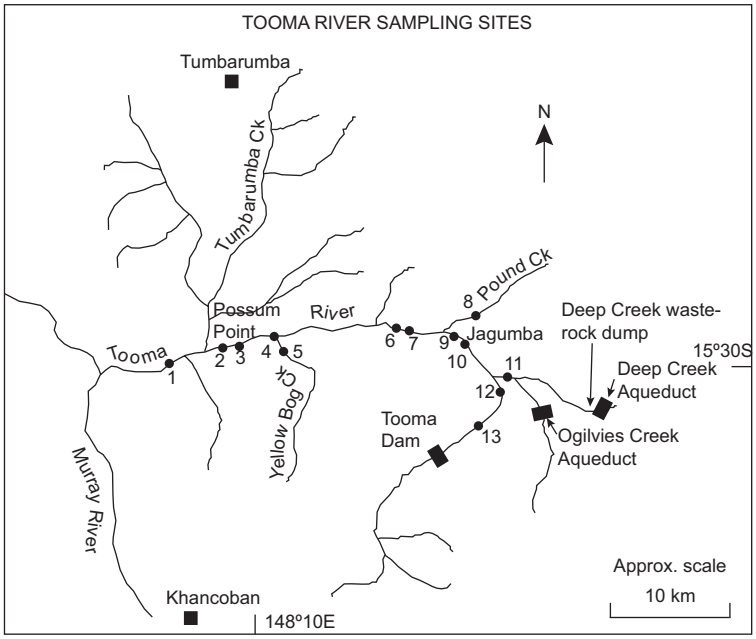
In April 2001 the team used irrigation to simulate intense rainfall on two separate areas of the Deep Creek waste-rock dump, each equivalent to 8% of the dump's surface area. The irrigations were equivalent to 484 mm and 394 mm of rain falling directly onto the areas. Two natural rainfall events also occurred during the experiment. In case the experiment produced contaminants, the team guarded against ill-effects in the Tooma River by arranging to have water released from Tooma Dam at the same time, at approximately 20 megalitres per day — a dilution factor of 20–40.

The species of macroinvertebrates (insect larvae and crustacea) and fish (mountain galaxias) in Deep Creek were typical of streams in the Australian alpine area, and the irrigations of the waste-rock dump were not followed by any decrease in the downstream macroinvertebrate communities, nor any detectable effect on the galaxiid populations.

At most sampling sites the water was near neutral in acidity (pH 6.5–7.6). At the toe of the dump, pH was slightly more acid than upstream. Small increases in salinity and in the concentrations of several dissolved elements were observed downstream after one of the irrigations and following the rainfall, indicating some flushing of dissolved elements from the dump. Dissolved oxygen in the river varied in a typical daily pattern. Aluminium, copper and cadmium — elements that could be of concern according to the national guidelines for freshwater quality — were present, but not in particularly high concentrations.

To test the effects of the dilution releases from the Tooma Dam, the team also sampled macroinvertebrates, fish and water quality near the dam wall and downstream, before and after releases from the dam. No effects were detected.

Unrelated to the irrigation experiment, chemical analyses of sediments and yabbies did not reveal clear evidence of toxic materials. The gills and liver of a dead fish collected after a fish-kill event were analysed for pesticides and metals and examined for histo-pathological changes, but also did not provide useful evidence.



Not exhaustive — implications so far

With the resources and time available, the team irrigated only 16% of the dump — leaving 84% untested. A hydrologic budget showed that the experiment had applied more water than was measured as extra outflow into the Tooma River. For these and other reasons, it is quite possible that contaminants could still be in the waste-rock dump but undetected, and further exposure, redistribution and oxidation of rocks in the area could possibly trigger their release.

The project has highlighted the difficulty of assessing rare and unpredictable contamination events, but the science team considers that further investigation is warranted to find reasons for the fish kills and biotic disturbance.

In this isolated location and with such infrequent and unpredictable fish-kills, remote sensing could be an effective next step. Also, local rural communities would be in the best position to investigate similar situations in future, provided that they are given suitable support, training and facilities.

Footnote

This study is reported in full in 'The Tooma River Project: Interdisciplinary probes into ill-defined and unpredictable contamination', by John Harris, Lee Bowling, Reuben Keller, Robert Keller, Jessica Kress, P.S. (Sam) Lake and D.C. (Bear) McPhail, published by the CRC for Freshwater Ecology, Canberra, ACT. The report is available in hard copy from eWater CRC and as a PDF file on the Web at <http://freshwater.canberra.edu.au>, under Publications, Technical reports, 2006. With the PDF file is a separate spreadsheet file, with notes on waste-rock dumps across the Murray-Darling Basin, from a survey made in association with this study.

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Photographs: John Harris (landscape, dump, investigation); Gunther Schmida (mountain galaxias), courtesy of Murray-Darling Basin Commission