

# Temperatures drop in New Zealand's rivers

David Smith

After six years of data collection, the National River Water Quality Network is revealing some interesting trends.

THE NATIONAL River Water Quality Network was set up six years ago by NIWA (then DSIR) with two objectives:

- to improve understanding of our water resources and hence to assist their management;
- to detect significant trends in water quality.

The Network was designed so that after five years any trends of practical significance would be revealed.

Findings from the first two years of data collection have already been published (see Smith and Maasdam 1994; Maasdam and Smith 1994). However, only now is the record long enough to allow us to begin to report on trends.

The Network has 77 river and stream sites (see map) which are sampled monthly by staff from NIWA's 14 field survey teams. Flow, dissolved oxygen, temperature and water clarity are measured at the site, and water samples collected for later, more detailed, analysis. All samples are analysed in NIWA's Hamilton laboratories. Rigorous data quality assurance techniques are employed. For a brief description of the Network, refer to Smith and McBride 1990.

For trend assessment, the "raw" data are first adjusted to take account of seasonal fluctuations. This reduces predictable "noise" in the data and makes trend detection more sensitive, and analysis provides a relatively simple initial trend assessment. The data also have noise removed by a process called "flow-adjustment". This first examines how values change with river flow, and then removes any predictability in these values which is due to flow. The data are then re-examined for trends, again taking account of seasonal fluctuations.

Some interesting findings have emerged from the study. For example, river flows in the northern half of the North Island have tended to decrease over the years 1989 to 1993, whereas in the south-eastern South Island some sites show an upward trend in flow.

One of the most interesting results is for river temperature. At almost half the sites, the measurements over 1987-93 show a strong trend downwards. There are no significant up-trends. The figure shows trends for flow-adjusted data. The median change is  $-0.28^{\circ}\text{C}$  per year. This trend parallels similar findings for water temperature in the Manukau Harbour, Auckland, during 1990-93, and in the coastal waters of the Auckland region (Rhodes *et al.* 1993).

Dr Jim Salinger, NIWA's climate expert, suggests that these temperature reductions follow a trend in the Southern Oscillation Index which signals the El Niño/La Niña changes of the tropical Pacific Ocean. He believes that another contributing factor was probably the eruption of Mount Pinatubo in June 1991. The massive quantities of volcanic ash released into the atmosphere have reduced insolation, leading to lower temperatures in New Zealand. ■

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## Further reading

Auckland Regional Council 1994. Water quality survey of the Manukau Harbour. Sixth Annual Report. ARC Environment Technical Publication No. 37. Auckland Regional Council.

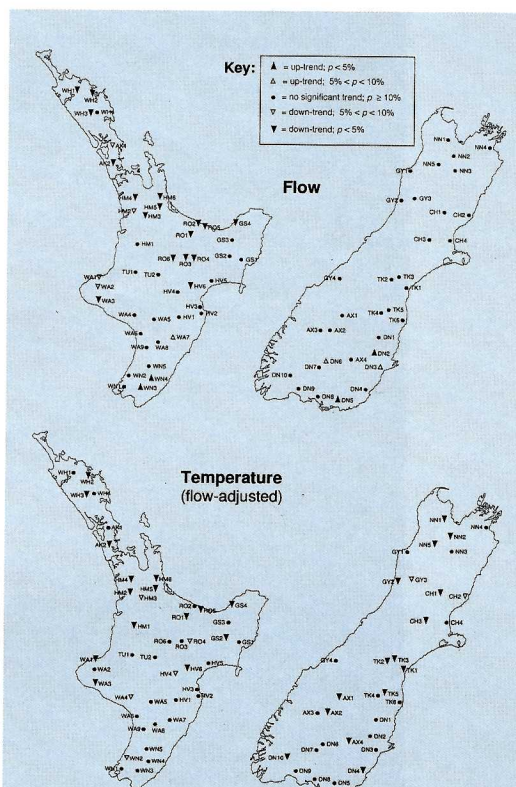
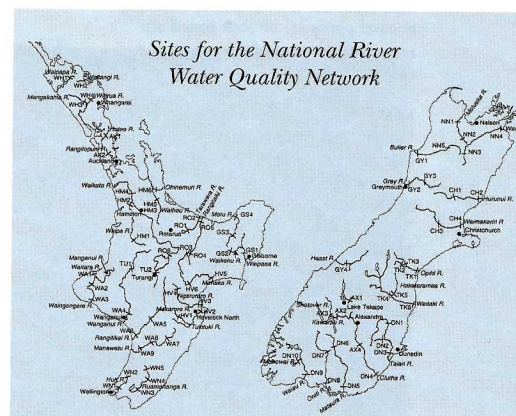
Maasdam, R. and Smith, D.G. 1994. New Zealand's National River Water Quality Network. 2. Relationships between physico-chemical data and environmental factors. *NZ Journal of Marine and Freshwater Research* 28: 37-54.

Rhodes, L.L., Haywood, A.J., Ballantine, W.J. and

MacKenzie, A.L. 1993. Algal blooms and climate anomalies in north-east New Zealand, August December 1992. *NZ Journal of Marine and Freshwater Research* 27: 419-430.

Smith, D.G. and McBride, G.B. 1990. New Zealand's national water quality monitoring network design and first year's operation. *Water Resources Bulletin* 26: 767-775.

Smith, D. G. and Maasdam, R. 1994. New Zealand's National River Water Quality Network. 1. Design and physico-chemical characterisation. *NZ Journal of Marine and Freshwater Research* 28: 19-35.



Flow and temperature trend maps showing sites and significance of trends at each.

(p is the probability of inferring that a trend has occurred when it has not. p values < 5% are highly significant.)