Estuaries accumulate many of the chemicals washed from coastal urban areas. (Photo: B. Williamson)

more and more built-up. Biological surveys in two of these estuaries indicate that present effects on ecosystems are slight. However, in 20–50 years, the predicted concentrations of zinc are likely to cause widespread biological effects unless steps are taken to minimise contaminant inputs to these estuaries.

The standard method for testing sediment toxicity involves exposing animals to artificially contaminated sediments. In the past, however, many of these tests failed because the animals responded to artefacts introduced by the physical and chemical modifications used to produce the contaminated sediments.

Our research involves developing procedures for producing contaminated sediments that don't have these artefacts and yet still retain their natural physical and other chemical characteristics. When we have achieved this, we will then be able to realistically predict the future effects of contaminated sediments on New Zealand estuarine animals.

As our SWAT research progresses we will gradually build up a full picture of how contamination from transport and other activities affects aquatic ecosystems in urban areas and how we can go about reducing these effects. The models and methods we develop will help in the quest for "natural" stream and estuarine habitats in our towns and cities. ■

Mike Timperley and Gerda Kuschel are based at NIWA in Auckland.

WATER QUALITY

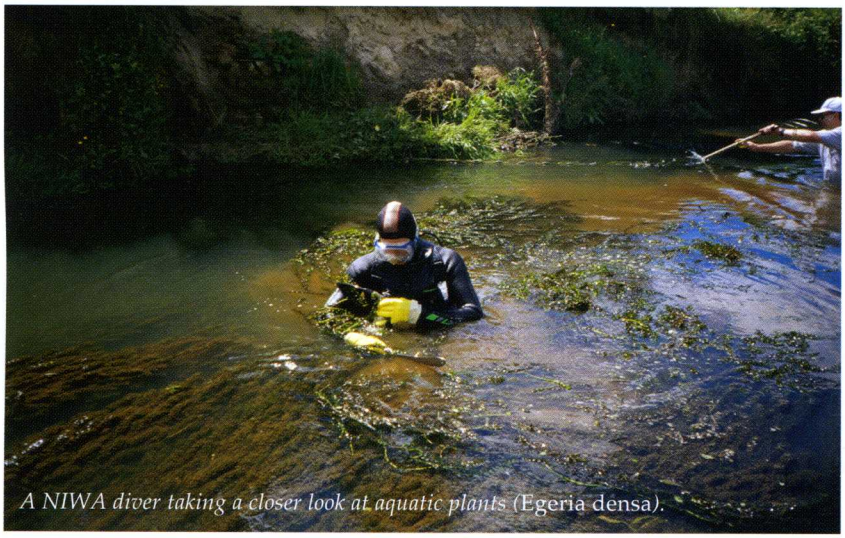
Predicting stream-water pH from changes in dissolved oxygen produced by aquatic plants

Bob Wilcock

Steve Chapra

Measure dissolved oxygen – and get pH thrown in for nothing! A model being tested at NIWA aims to make this possible.

DURING SUMMER AND AUTUMN in lowland, agriculturally developed areas you'll often see small streams choked with luxuriant growths of water weeds (macrophytes) and filamentous algae. These streams usually don't have much shading because most of the indigenous riparian shrubs and trees have been replaced with pasture. The water and sediment also contain extra nutrients from runoff and point-source discharges from agriculture. In fact, conditions are ideal for the growth of aquatic plants.



A NIWA diver taking a closer look at aquatic plants (Egeria densa).

Research in NIWA's PGSF programme "Pollution Control and Remediation for Rural Waterways" has shown that the presence of macrophytes makes an enormous difference to the physical and chemical properties of these streams and hence to the aquatic ecosystem. Compared to streams in more natural catchments, pasture streams are deeper and slower and, over any 24-hour period, they will exhibit wide swings in the concentration of dissolved oxygen (DO) and the water temperature and pH.

Dissolved oxygen and pH

There is plenty of literature on the use of graphs of dissolved oxygen measured over 24-hour periods (known as "diurnal oxygen curves") to estimate stream productivity, respiration and reaeration. A model – DOFLO – that uses field data to calculate parameters for describing these processes was described in *Water & Atmosphere* 3(1): 17–18. But in streams where DO changes throughout the day, you also see parallel changes in pH that are associated with the uptake and release of carbon dioxide during photosynthesis. The mechanism, roughly, is this: during the day photosynthesis by aquatic