FRESHWATER ECOLOGY

Restoring water plants

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NIWA researchers are seeking ways to promote the growth of and protect those plants that have a beneficial role in aquatic habitats.

"WATER WEED" is not always a bad thing! Instead submerged plants have a very necessary role in our waterways – a role that is under threat from deteriorating water quality.

Friend not foe

Many people are aware of the problems caused by exotic water weeds that choke lakes and interfere with recreational pursuits. Few realise that beds of aquatic vegetation can protect and enhance water quality. Plants help to maintain clarity by dampening wave action and preventing the disturbance of bottom sediments. They also groom nutrients and dirt particles from the water (see panel below).

Native vegetation, especially charophytes, play a beneficial role in water bodies.

Despite their guardianship of water clarity, underwater plants can be overwhelmed by inflows of dirty water or by blooms of microscopic algae, both of which can deprive them of essential light. In extreme cases plants can be entirely lost from a lake and fail to re-establish. This is just what has happened in 10 of the shallow lakes in the Waikato region – water bodies that remain highly turbid today. This loss of plants and accompanying deterioration in water quality is an issue facing the managers of shallow lake systems.

NIWA's PGSF research programme "Aquatic Plant Management" aims to identify tools that could help lake managers to restore degraded aquatic habitats through re-establishing and enhancing desirable vegetation. One of the most promising avenues for restoring aquatic vegetation is based on harnessing plants' own strategies for survival.

Sowing seeds for the future

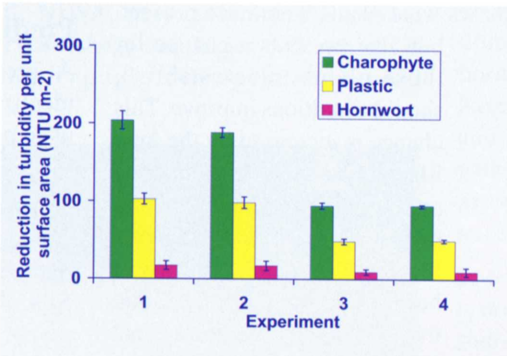
Many native New Zealand water plants invest in a "seed bank" – a deposit of living propagules (seeds and vegetative fragments) laid down in the bed of water bodies. While acting as a reservoir for species and genetic diversity, these seed banks also assist plants to re-establish after catastrophes such as storms. At least 12 native plants form seed banks in lake beds. In some places their propagules are so dense that over 100 can be found in a single teaspoon of mud!

We discovered that the size and diversity of seed banks is shaped by the vegetation history of a lake. As might be expected, lakes that have lost their water plants tend to have few seed species and lower seed numbers in the surface mud. Nevertheless, we found viable seed in lakes that had lost their vegetation over 20 years before. Other vegetation changes also affect the seed bank. In contrast to native water plants, exotic "oxygen weeds" do not produce seed; instead they spread by fragments. When these weeds

Charophytes and clear water – cause or consequence?

NIWA recently hosted Dr Michelle Casanova from Australia, an expert on the ecology of charophytes (macro-algae). Michelle, like us, was interested in a phenomenon noted all over the world – that the clearing of turbid lakes is often linked to the sudden appearance of charophytes. The question was, do these small plants in fact aid in clarifying turbid waters, or do they simply establish when water clarity increases?

We tested the ability of charophytes to clear turbid water. A dose of mud was added to water tanks planted either with charophytes, another plant (hornwort), plastic replica plants, or to tanks without any plants. Water turbidity was then measured over a few days. Turbid water cleared faster in the tanks with plants (including plastic plants), than in the tanks without plants. We then compared the plant types by their surface areas to give an indication of filtering or "dead" spaces for settling particles. Charophytes proved far more effective at reducing turbidity per unit surface area than hornwort or plastic plants.



When compared by surface area, charophytes reduced water turbidity more effectively than hornwort or plastic plants. Each of the four experiments was run over approximately 50 hours. Turbidity was measured as nephelometric turbidity units (NTU).

We also discovered that charophyte "seeds" (technically, oospores rather then true seeds) germinated equally well when placed in shallow water (0.6 m) that was highly turbid (33 NTU, 6% sunlight) as they did under clear water conditions (1 NTU, 20% sunlight). This was despite an estimated three-fold difference in the level of light for germination.

Charophytes have features that make them a particularly desirable plant in lakes (see panel, page 10). Charophytes contribute to keeping lake waters clear – maybe more so than other plants – and added to this is the fact that charophyte seeds can germinate in relatively turbid water. These water plants are a promising ally in the rehabilitation of degraded water bodies.