

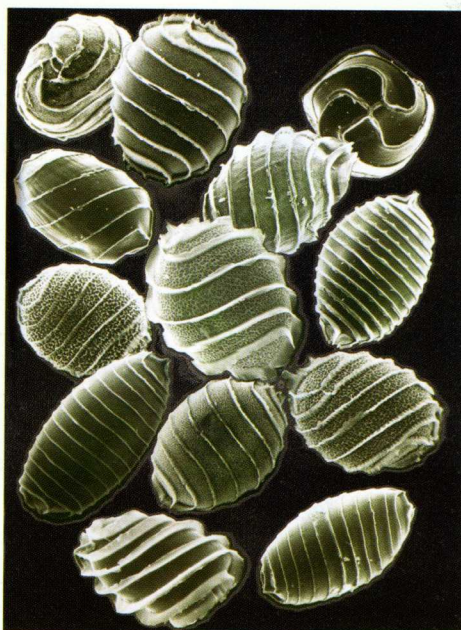
shallowest (youngest) sediments. Another question is the effect of season. Many terrestrial seeds germinate according to seasonal cues. We need to establish if water plants have such strategies and if seedling establishment is more successful at one particular time of the year.

Future research will focus on establishment responses of key seed bank species and assessment of the techniques and requirements for restoration of vegetation resources in our water bodies. ■

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Further reading

de Winton, M.D. and Clayton, J.S. 1996. The impact of invasive submerged weed species on seed banks in lake sediments. *Aquatic Botany* 53: 31-45.

de Winton, M.D., Clayton, J.S. and Champion, P.D. in press. Seedling emergence from seed banks of 15 New Zealand lakes with contrasting vegetation histories. *Aquatic Botany*.

left: The unique size and appearance of plant propagules help to identify the species in the seed bank.

FRESHWATER ECOLOGY

Are rudd a threat to water plants?

Rohan Wells

The coarse fish, rudd, is one of several factors that could hamper programmes to restore submerged vegetation to many water bodies in New Zealand.

RUDD (*Scardinius erythrophthalmus*) are freshwater fish that feed mainly on aquatic plants. They look like large goldfish, except that they have red fins. These fish were illegally imported into New Zealand in the 1960s, bred up in numbers and then released in the Waikato, Auckland and Northland regions. The offender wanted to establish a popular game fish in warmer nutrient-rich waters unsuitable for trout (*Auckland Star*, 5 June 1971).

Rudd are now well established, forming large populations in many water bodies from the Waikato northwards. They usually grow to 200–300 mm long but can exceed 600 mm (B. Chisnall, NIWA, pers. comm.). Their main predators are shags and larger eels, which, if numerous enough, can decimate a rudd population.



High densities of rudd in lakes may cause negative “top-down” effects on the ecosystem, especially on other organisms that depend on aquatic plants. Other freshwater fish are also known to be capable of severe impacts. For example, European carp in Australia and the UK have turned lakes and rivers permanently muddy as their foraging activities stir up bottom sediments and uproot plants.

Lake degradation and aquatic plants

In the Waikato region of New Zealand, most water bodies have been degraded over the last two decades by a loss of plant and animal diversity. Many hydro-electric lakes are now dominated by the introduced pond plant, hornwort (*Ceratophyllum demersum*). Others have lost all their submerged aquatic vegetation and become dominated by algae. Both these paths of degradation are undesirable, but “weed” growths are usually preferred to an algal nuisance.

Excessive plant growth may interfere with recreational activities, accumulate on lake shores, block water intakes, or cause overnight oxygen depletion. On the other hand, the switch from a plant-dominated water body to a murky, algal-dominated or muddy-water lake has consequences for many other organisms. Invertebrates associated with aquatic plants may decline or disappear and this can affect some

