LERNZ: Lake Ecosystem Restoration New Zealand – Fact Sheet

Linking lake restoration with end users for positive environmental outcomes

LERNZ
Lake Ecosystem Restoration New Zealand

LERNZ Programme Overview

Based at the University of Waikato (Figure 1), the aim of the LERNZ research programme is to provide end-users such as community groups, regional councils and governmental agencies with practical tools and expertise for restoring indigenous biodiversity and water quality in lakes. The research programme is centred around two main themes:

- New models and technologies to effectively manage harmful algal blooms
- New pest fish management and control technologies

LERNZ is based at the University of Waikato, Hamilton New Zealand, and has established a number of collaborations with domestic and international research organisations since its inception in 2005.

Figure 2. LERNZ High frequency monitoring buoy. Photo: Chris McBride.

High-Frequency Water Quality Monitoring

LERNZ researchers have developed and deployed a network of solar powered monitoring buoys (Figure 2) in lakes around New Zealand, as well as in Singapore and China. These buoys measure water quality every 15 minutes and transmit data to the internet in near-real time. The buoys form part of the 'Global Lake Ecological Observatory Network' (GLEON; www.gleon.org). High frequency monitoring data is important for assessing changes in water quality and predicting impacts of lake restoration techniques.

Lake Restoration

Chemical flocculants such as alum, and the sediment capping material modified zeolite (Aqual P) have been trialled and are being applied at whole-lake scale (Figure 3). These materials lock up plant nutrients such as phosphorus. The aim is to remove nutrients from the water column and/or to reduce their release from the sediments into the lake. Ultimately, the aim is to remove nutrient legacies and re-create a more resilient lake ecosystem.

Figure 3. Application of modified zeolite (Aqual-P) to Lake Okaro. Photo: Andy Bruere.

Figure 1. The LERNZ research programme is based at the University of Waikato campus in Hamilton, New Zealand. Photo: Warrick Powrie

LERNZ: Lake Ecosystem Restoration New Zealand – Fact Sheet Continued

LERNZ
Lake Ecosystem Restoration New Zealand

Lake and Catchment Models

Lake and catchment models (Figure 4) are being used to simulate restoration scenarios such as change of catchment land use, constructed wetlands or reductions of internal nutrient release using chemical flocculants. Discharge and water quality data for the models are collected for the lake and surrounding streams. Nutrient loads are calculated from the land use in the catchment, and weather data is obtained from local meteorological stations. These data are used to provide water quality predictions using a lake model.

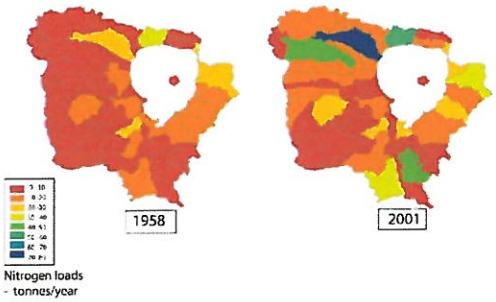

Figure 4. Example of catchment model simulations of nitrogen loads to Lake Rotorua from different sub-catchments.

Remote Sensing

Satellite images can be used for monitoring aspects of water quality that have visible and radiant properties, such as suspended sediments, coloured dissolved organic matter, chlorophyll *a* and temperature (Figure 5). The inferred measurements are ground-truthed against water samples gathered from the lakes.

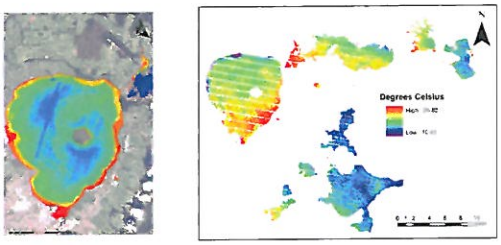

Figure 5. Remote sensing provides wide spatial scale resolution of lake water quality. Shown here as suspended solids for Lake Rotorua (left) and temperature for Rotorua lakes (right).

LERNZdb

The LERNZdb Freshwater Database is a repository for freshwater quality and biodiversity data for lakes, rivers and wetlands in New Zealand. All data in LERNZdb has a Creative Commons Attribution license. This licence allows users to share data openly but still receive credit for it.

Invasive fish

Invasive fish species such as koi carp, rudd and perch displace native fish, disturb sediments, destroy macrophytes and mobilise nutrients, leading to poor water quality. LERNZ has conducted research on the movement and distribution of invasive fish in order to develop efficient methods of removal and exclusion (Figure 6). In addition, models have been developed to determine biomass removal values needed to elicit improvements in water quality.

Figure 6. LERNZ researchers have developed novel pest fish capture and exclusion devices.

Molecular Monitoring Tools

Freshwater species such as fish, zooplankton and caddisflies are being identified, then genetically sequenced and entered into a database. The aim is to be able to detect and identify targeted species quickly using molecular techniques. In addition, pest fish incursions can be rapidly detected using eDNA as it reduces the incidence of non-target bycatch and is considerably cheaper than traditional fish survey methods.

Additional LERNZ Research

Research has also been conducted in the following areas:

- Greenhouse gas emissions from lakes
- Effectiveness of sediment detainment structures
- Social science aspects of lake restoration
- Analysis of trends in high-frequency monitoring data
- Toxic baits for pest fish
- Nutrient excretion by pest fish
- Acoustic lures
- Pest fish effects on lake food web dynamics
- Effect of pest fish mass removals on water quality