LERNZ TEBNS

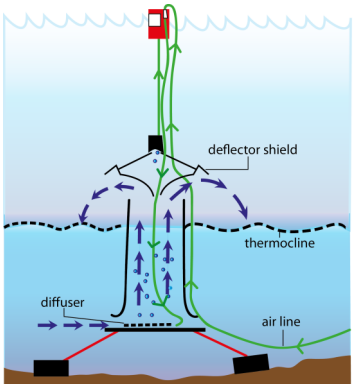
Lake Ecosystem Restoration New Zealand

University of Waikato

Issue 18 Jan-Mar 2011

Rotoehu destratification

The depletion of dissolved oxygen in the bottom waters of stratified eutrophic lakes can exacerbate declining water quality by both increasing nutrient releases from bottom sediments and reducing the usable habitat for aquatic biota. Lake Rotoehu, one of the Rotorua lakes, is such a lake which has anoxic periods during temporary stratification in summer months. The Bay of Plenty Regional Council is now considering an in-lake restoration method by which the entire water column of Lake Rotoehu will be artificially mixed with a goal of improvement in water quality in the lake. LERNZ researchers have reunited with former student Dennis Trolle (now at National Environment Research Institute, Denmark) and are collaborating with the Bay of Plenty Regional Council and Hans Burggraaf (Page Macrae Engineering) to carry out a lake ecosystem modelling study in Lake Rotoehu. This study aims to provide information on the design of an artificial destratification system for the lake, including appropriate sizing and power requirements, as well as the expected change in water quality with operating the system.



Concept diagram of a destratifier. The aim of a destratifier is to remove the thermocline so that the bottom waters do not become deoxygenated. In this image, the green hose represents an air line pumping air from a compressor on shore. The air is pumped into a diffuser near the base, forcing air bubbles and displaced water upwards to a deflection shield which maximises circulation. The air bubbles are captured to minimise surface effects.

Lake buoy and optical properties

Kevin Rose, visiting PhD student from Miami University (Ohio, USA) worked with **Chris McBride** to develop methods to improve estimates of buoy-based chlorophyll sensors used on New Zealand lakes.

Kevin, Chris and **David Hamilton** gathered data on the optical properties of lakes in the MacKenzie Basin in a recent trip.

Sensors below the lake buoy. Photo: Kevin Rose.

The **LERNZ** group is now on **Facebook** if you would like to join. Type **LERNZ** into the search box.

Karori fish removal

Karori Sanctuary lower reservoir has problematic algal blooms and the resident fish population is almost entirely European perch. There have now been five fish removals from the reservoir. The aim of the removals is to reduce the small zooplanktivorous perch to levels that allow the zooplankton population to increase and thus reduce the algal population. Using the electro-fishing boat and gill nets, about 2000 European perch were removed in February this year. It is estimated that about 10% of the fish stock and 20% of the biomass have been removed on each occasion. To have a significant effect, about 80% of the small perch in the reservoir would need to be removed. After each fish removal, there has been an increase in the zooplankton population and a decline in the phytoplankton population but last year when no fish removal was carried out the same pattern was still observed. Thus, it is considered that use of the electro-fishing is not an effective means to remove the pest fish in this case and a mass poisoning operation may be what is required. For more information, listen to an interview on RadioNZ: http://www.lernz.co.nz/gallery/lakekarori.html

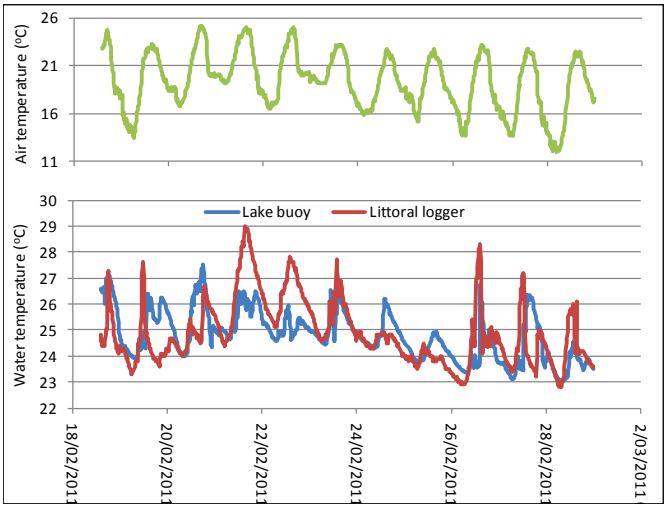
Floating, palatable pest fish baits

It is logistically difficult to reduce populations of pest fish in large water bodies and there are currently few viable methods available to wildlife managers. Toxic baits have been trialled in the past but not developed further since they are highly unpalatable to fish (carp) and they can result in unacceptable non-target by-catches. However, the use of such baits is potentially desirable because pest fish can be trained to feed on the baits. They may be used in different types of water bodies, and the amount of toxin (rotenone) that would enter the system would be small and localised. We plan to develop a bait that is structurally robust, floats so that it maintains its integrity and can be easily recovered. This will reduce the possibility of non-target by-catch and the amount of toxin that could potentially find its way into the ecosystem. In addition, we will attempt to mask the flavour of the toxin to improve its palatability and investigate the use of audio lures to increase visitations by pest fish to bait stations.

Koi carp and floating fish bait (Photo, Dai Morgan)

Littoral logger

On 17 November 2010 an iQuest temperature sensor was launched in the littoral zone of Lake Ngaroto. The objective of this sensor is to collect data as part of the assessment of habitat suitability for pest fish spawning and the effects of climate change, including determination of heat transfer for predictive modelling of carp spawning habitat. Water temperatures in the shallow littoral zone, suitable for pest fish spawning, will be compared with water temperatures recorded mid-lake by the lake buoy. When the littoral sensor recorded a maximum of 30°C on 30 November, the 0.3-m lake buoy sensor recorded 26°C. These data will be used to link the harmful algal blooms programme with pest fish research. The littoral logger has a camera for checking the position of the temperature sensor. **Chris McBride** helped **Brendan Hicks** and **Dudley Bell** with this sensor deployment.



Temperature from the littoral logger and the lake buoy at Lake Ngaroto.

Lake Rotomahana

David Hamilton, Chris Hendy and **Ilia Ostrovsky**, visiting scientist from Kinneret Limnological Laboratory (IOLR) in Israel, were amongst the University of Waikato scientists that visited Lake Rotomahana, as part of a joint project with GNS. They gathered dissolved oxygen, temperature, fluorescence and conductivity data and observed the response of smelt around gas seeps.

Large numbers of smelt gathered in the plume of the gas bubbles observed at the lake surface. Photos: Ilia Ostrovsky

Visitors

Assoc Prof David Shively from the University of Montana, USA, gave a lecture on Montana's (USA) Clark Fork River Basin Task Force as a vehicle for integrated water resources management.

Prof Ken Whelan from the University College Dublin, Ireland presented work of the Irish Marine Institute including managing diadromous fish stocks in a changing climate, and long-term monitoring in freshwater and the ocean.

Assoc Prof Euan Harvey from the University of Western Australia presented his work on the use of stereo-video for collecting data on the length and abundance of fish.

Recent Publications

Abell, J.M., Özkundakci, D., Hamilton, D.P., and Miller, S.D. 2011. Relationships between land use and nitrogen and phosphorus in New Zealand lakes. Marine and Freshwater Research 62: 162-175.

Bruesewitz, D., Hamilton, D.P., and Schipper, L.A. 2011. Denitrification potential in lake sediment increases across a gradient of catchment agriculture. Ecosystems 14: 341-352.

Collier, K.J. and Clements, B.L. 2011. Influences of catchment and corridor imperviousness on urban stream macroinvertebrate communities at multiple spatial scales. Hydrobiologia 664: 35-50.

Duggan, I.C. 2011. Aquaria. In: Encyclopedia of Biological Invasions. D. Simberloff and M. Rejmanek (Eds.) University of California Press, pp. 32-35.

Hamilton, D.P. and Landman, M.J., 2011. Lake restoration: An experimental ecosystem approach for eutrophication control. Hydrobiologia 661(1): 1-3. (Special section on Lake Restoration).

Nishri, A. and Hamilton, D.P. 2010. A mass balance evaluation of the ecological significance of historical nitrogen fluxes in Lake Kinneret. Hydrobiologia 655: 109 – 119.

Özkundakci, D., Duggan, I.C. and Hamilton, D.P. 2011. Does sediment capping have post-application effects on zooplankton and phytoplankton? Hydrobiologia 661: 55-64.

Özkundakci, D., Hamilton, D.P. and Gibbs, M. 2011. Hypolimnetic phosphorus and nitrogen dynamics in a small, eutrophic lake with a seasonally anoxic hypolimnion. Hydrobiologia 661: 5-20.

Parparov, A., Gal, G., Hamilton, D.P., Kasprzak, P. and Ostapenia, A. 2010. Water quality assessment, trophic classification and water resources management. Journal of Water Resources Protection 2:907-915.

Wood, S.A., Prentice, M.J., Smith, K and D.P. Hamilton. 2010. Low dissolved inorganic nitrogen and increased heterocyte frequency: precursors to *Anabaena planktonica* blooms in a temperate, eutrophic reservoir. Journal of Plankton Research 32: 1315-1325.

Congratulations

Congratulations to the following students who have submitted their theses or dissertations.

Grant Tempero (PhD)
Abundance and function of multiple haemoglobin isomorphs from rainbow trout (*Oncorhynchus mykiss*).

Salman Ashraf (PhD)
Enhancing spatial resolution of remotely sensed data for mapping freshwater environments.

Melany Ginders (MSc)
Influence of connectivity on the functioning role of the natural and reconstructed side-arm in the Lower Waikato River.

Toni Johnston (MSc)
Comparison of riparian willows and riprap as habitat for fish and invertebrates in the Waikato River.

Chrystal Kelly (MSc)
Charophyte responses to herbicide and mycoherbicide technologies.

Kohji Muraoka (BSc Hons)
A modelling study of the physical dynamics of Lake Rotoiti, North Island, New Zealand.

Principal Funders: FRST Contract UOWX0505 and BOPRC

Edited by Wendy Paul