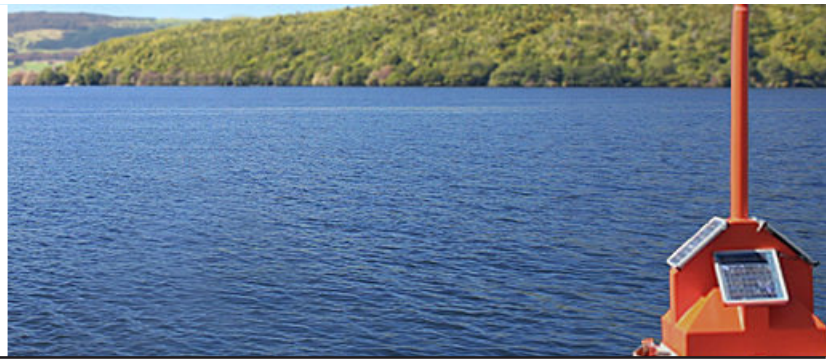


LERNZ

Lake Ecosystem Restoration
New Zealand



University of Waikato

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Ohinewai pest fish removal

Adam Daniel has led the research into mass pest fish removal as a lake restoration measure. At Lake Ohinewai, 3 tonnes of pest fish were removed between January and June this year. Automated baited traps were used to achieve this. Various methods of capture have been tested including a one-way pest fish barrier, electro-fishing boat, fyke nets, a pod trap and a clover trap. The pod trap was found to be the most successful. Adam considers that a maintenance programme would be required to keep numbers down and is aiming to test a trap where heat is used as a lure over winter. A spin-off of the fish removal has been that Rick Muir of Carpai Products has been able to use the fish removed to make berley and liquid fertiliser. DoC, WRC and Aareka Hopkins have supported this project.



Automated bait stations in Lake Ohinewai. Photo: Wendy Paul

A number of our LERNZ team (**Adam Daniel, David Hamilton, Dai Morgan and Brennan Mahoney**) were featured on TV One's Close-up programme recently. Adam talked about the Ohinewai pest fish removal. David talked about the degradation of lake water quality as a result of agricultural intensification, pest fish and invasive weeds. To view the programme follow this link

<http://tvnz.co.nz/close-up/curse-koi-carp-9-06-video-4232144>



Adam and Daniel Hall installing the one-way pest fish barrier over the culvert at the outlet to Lake Ohinewai. The purpose is to let fish out but not allow them to return. The trap can be cleared of debris by lifting the gate. Photo: A. Gray

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

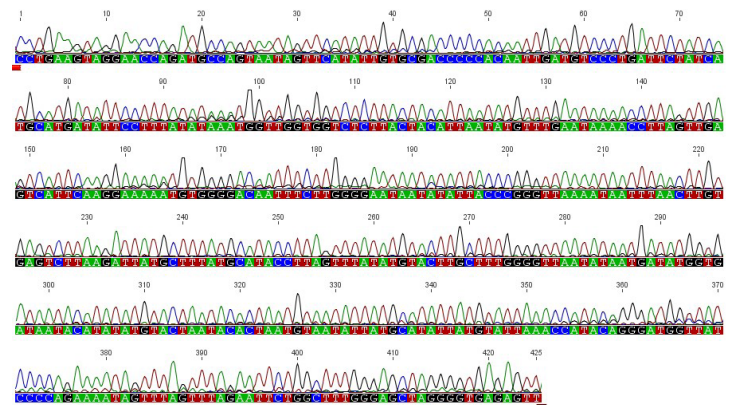
Annual Science Review

On the 30th of June, we had another successful Annual LERNZ Science Review day where we reviewed our successes over the past year. This was a great way to update the research group and our end-users and gain feedback on progress and ideas for our future efforts towards our goals. David Hamilton started by giving an overview of the LERNZ research programme and Deniz Özkundakci and Adam Daniel gave an overview of their own research and progress on IO1 and IO2. Fourteen researchers spoke about their work related to IO1 and nine people spoke about research connected to IO2. Discussion groups included the role of modelling, mechanisms for reaching the community and education outreach pertaining to Maori values and integration and application of monitoring tools for IO1. For IO2, the discussion topics included continuation and usefulness of eDNA, development of an overall package for pest fish removal and alterations to the chemical control milestone including a rotenone rapid assay.

Genetic monitoring

Part of the research work of the Pest Fish intermediate outcome of the University's FRST-funded OBI is to genetically determine presence of pest fish in lakes. The group working on this project, headed by Jonathan Banks, made a significant breakthrough when they extracted and amplified goldfish DNA from Lake Ohinewai.

Environmental DNA (eDNA) is shed by fish when they rub mucus and scales off onto stones from which it can then be extracted. A water sample is taken and specific DNA segments are amplified and sequenced then checked against records in a gene bank to determine which fish species are living in a lake. Eventually these identifications will be used to monitor the effectiveness of pest fish eradication by examining the presence of pest fish without the need for nets or electric fishing and the risk of harm to non-pest fish. Future work aims to customise the DNA amplification technique to quantify the biomass of pest fish in lakes.



Chromatogram showing the DNA sequence of goldfish in Lake Ohinewai.

For more information go to www.lernz.co.nz Centre for Biodiversity and Ecology Research, Department of Biological Sciences, Science and Engineering, The University of Waikato, Private Bag 3105, Hamilton 3240, New Zealand.

Constructed wetlands, silt traps and infiltration filters

Ph D student, Rebecca Eivers is researching end-of-drain treatment systems (constructed wetlands, silt traps and infiltration filters) as management tools to reduce sediment and nutrient inputs into peat lakes and provide habitat for aquatic communities. She has surveyed eight drains and twenty-six treatment systems on six shallow peat lakes within the Waikato region, measuring a range of physico-chemical parameters and aquatic communities. Preliminary results indicate sediment and nutrient loads frequently exceed treatment capacity based on treatment system volume to subcatchment size ratio. However, total suspended solids, total nitrogen and total phosphorus were reduced in a number of systems, suggesting some benefits despite suboptimal sizes. Aquatic communities vary across sites. Three native fish species (short fin eel, common bully and black mudfish), three exotic fish species (gambusia, goldfish, and koi carp), as well as tadpoles of the green and golden bell frog were caught within treatment systems. Lakes Kaituna, Komakorau, Kainui and the Rotopiko lakes also support pest fish populations including rudd, perch and brown bullhead catfish. Aquatic macroinvertebrates comprise nine orders. Sixty-six zooplankton species were identified and preliminary analyses indicate community composition is significantly driven by pH, macrophyte cover and connectivity with the lake ecosystem. Further analyses aim to determine environmental drivers shaping other aquatic communities within these systems.



Silt trap at Lake Komakorau. Photo: Rebecca Eivers

Conferences

Kevin Collier, Konrad Górski and Michael Pingram attended the inaugural *International Conference on the Status and Future of the World's Large Rivers* (Vienna, Austria). Their poster presentations can be viewed on www.lernz.co.nz

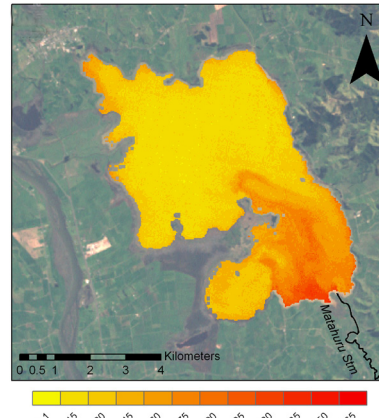
Mat Allan attended the *International Association for Great Lakes Research* (Duluth, USA) where he presented research on atmospheric correction of Landsat 7 thermal imagery for lake water temperature retrieval and validation of a three dimensional hydrodynamic model.

Jonathan Abell and Deniz Özkundakci attended the *2011 International Symposium of the International Association for Sediment and Water Science* (Devon, England). Jonathan presented his research into the bioavailability of nutrients transported in storm-flow. Deniz presented work that he did with **Tjorben Posch** on characterisation of colloidal-bound nutrients in pore water of sediments of nutrient-enriched lakes.

Deniz Özkundakci also attended the *2011 International SWAT Conference* (Toledo, Spain). He presented a paper entitled "A coupled catchment-lake model to simulate historical, contemporary and future water quality of a eutrophic, polymictic lake".

Nick Ling attended the *Murray Darling Basin Authority Workshop on Gambusia eradication and control* (Melbourne, Australia) and presented papers on "Gambusia in New Zealand - impacts on native fish" and "Habitat and attempts to improve trapping success".

GIS tools automate lake water remote sensing



Estimated total suspended solids (mg/L) in Lake Waikare, 09 September 2001, using Landsat7 ETM+ data.

Remote sensing is a source of lake water quality information providing data, spatial variation within lakes that may be missed by routine point sampling. Increasing availability of remotely sensed data and image swaths mean remote sensing is becoming a cost effective monitoring tool. Using Landsat 7 ETM+, data for the Waikato region from online data archives, Glen Stichbury, Brendan Hicks, and Lars Brabyn have developed Geographic Information System (GIS) tools to automate estimation of water quality variables. This 10-

year data set provided the means to hind cast water quality in the region's lakes and fill in gaps in data over the past decade. Spatio-temporal effects of pest fish and runoff can also be examined. The image above shows the variability of suspended sediment that in Lake Waikare.

The tools developed by Glen are, available for ArcGIS10x and ArcInfo Workstation, and use computer scripts to pre-process the data, estimate the requested water quality variables and produce maps and statistical tables for the results. They will enable end users with limited GIS or remote sensing knowledge to quickly and easily analyse remote sensing data and add another dimension to their water quality monitoring capabilities.

Recent Publications

Daniel, A.J., Hicks, B.J., Ling, N., and David, B.O. 2011. Movements of radio and acoustic-tagged adult koi carp in the Waikato River, New Zealand. *North American Journal of Fisheries Management*, 31: 352—362.

<http://www.tandfonline.com/doi/abs/10.1080/02755947.2011.576205>

Lucena-Moya, P. and Duggan, I.C. 2011. Macrophyte architecture affects the abundance and diversity of littoral microfauna. *Aquatic Ecology*, 45: 279-287.

<http://www.springerlink.com/content/m12378u1qu314351/>

Özkundakci, D., Hamilton, D.P. and Trolle, D. 2011. Modelling the response of a highly eutrophic lake to reductions in external and internal nutrient loading. *New Zealand Journal of Marine and Freshwater Research*, 45: 165-185.

<http://www.tandfonline.com/doi/abs/10.1080/00288330.2010.548072>

Muraoka, K. 2011. A modelling study of the physical dynamics of Lake Rotoiti, North Island, New Zealand. BSc(Hons) thesis, the University of Waikato, Hamilton, New Zealand.

Peters, N.E., Böhlke, J.K., Brooks, P.D., Burt, T.P., Gooseff, M.N., Hamilton, D.P., Mulholland, P.J., Roulet, N.T. and Turner, J.V. 2011. *Hydrology and Biogeochemistry Linkages*. In: Peter Wilderer (ed.) *Treatise on Water Science*, vol. 2, pp. 271– 304 Oxford: Academic Press.

Factsheets: Lake Models; Flocculation for Managing Lake Water Quality http://www.lernz.co.nz/education/fact_sheets.html