



## Message from LERNZ Science Leader, Professor David Hamilton

It is now less than one year until funding ends for our 10-year programme of research in Lake Biodiversity Restoration, known as LERNZ. We have been the only Outcome Based Investment to persist in a government vision that was originally designed to promote applied research to assist end users with better monitoring tools and finding solutions to some of the hard-to-solve environmental problems.



governance groups as the end of the research programme looms and brings a sharp focus to what we still need to achieve. We are extremely grateful to the members of these committees as they evaluate our last tranche of new initiatives designed to capitalise on the research activities of the previous nine years.

In this time we have drawn heavily on some advantages specific to LERNZ including: (1) capacity to leverage student-based research, often funded from other sources, to add depth to our research programme and to train the next generation of freshwater researchers; (2) a university environment where LERNZ has been used as an exemplar of well-connected applied research, enabling it to attract considerable assistance from the university; and (3) an external governance structure that has worked tirelessly to provide advice and direction, as well as to promote LERNZ. Recently we have been asking a great deal of our external

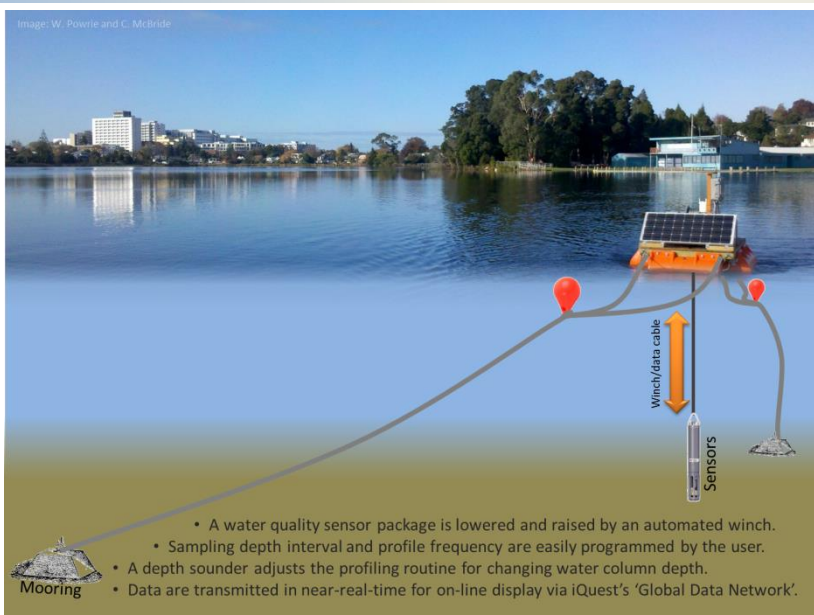
The recent announcement of the amendments of the National Policy Statement for Freshwater Management 2014 (NPS-FM 2014) is likely to provide further incentive for LERNZ to align with national freshwater priorities. There is already a background of techniques that are highly relevant to the NPS-FM and which will be further developed over the remaining months of funding. These include: extension of real-time high-frequency monitoring; a fully functional national lake database of unparalleled depth; national-scale remote sensing of lakes; fully coupled climate-catchment-lake models that can also evaluate the impacts of pest fish. In addition we have tested a range of tools to monitor and manage invasive fish, and better understand their impacts on the environment. We are in a prime position to provide major benefits to our end users through integration of these tools and findings from the research programme into the evolving operational strategies of end users under the NPS-FM 2014.

## Lake monitoring buoys

LERNZ has designed, built and installed many solar powered, high-frequency lake monitoring stations. These systems transmit meteorological and water quality data at 15-minute intervals in near real-time to a web user interface. Monitoring buoys have been placed in lakes around New Zealand and China, and are an integral part of the Global Lake Ecological Observatory Network (GLEON), which monitors anthropogenic effects on lakes worldwide. In 2013 we built and deployed a prototype 'profiler' buoy system, which uses an automated winch to collect various water quality variables throughout the water column.

See video at:

<http://vimeo.com/76822941>



For more information go to [www.lernz.co.nz](http://www.lernz.co.nz)

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## IO1 Leader – Aroon



Aroon Parshotam was appointed IO1 leader in December, 2013, to guide the harmful algal bloom management for lake biodiversity restoration component of the OBI. Until recently, Aroon was a member of NIWA's Water Catchment Modelling team, and undertook research into catchment sediment modelling and water quality modelling.

Aroon's NIWA research had emphasis on sedimentation from land-use change and nutrient loads to lakes as a result of land-use change and agricultural practices. In 2013 he completed a report for the Parliamentary Commissioner for the Environment, preparing Water Quality maps for NZ. For 12 years prior to joining NIWA, Aroon was a scientist at Landcare Research in Palmerston North, where he refined his skills in environmental modelling, focusing on land-use change and soil-climate relationships. Aroon has also held several university positions and has supervised students. The focus for the next 12 months is to create a repository of lake and catchment models used in LERNZ projects. An overview of each model will be created including its purpose, spatial and temporal scales, level of expertise required and hardware requirements needed to run each model. Another focus is to analyse existing high-frequency lake buoy data for relationships to variables relevant to lake biodiversity, and new pieces of instrumentation will be developed to support lake monitoring.

## IO2 Leader – Kevin

Kevin Collier was appointed IO2 leader in February, to guide the invasive fish component to conclusion. Kevin has previously worked for the Department of Conservation, NIWA and most recently the Waikato Regional Council, and combines a background in applied science with experience in managing research programmes.

The focus for IO2 over the next 12 months will be tying together the various strands of work carried out in last nine years and meeting contracted research milestones. Partnership projects have been developed with Waikato Regional Council to identify spawning aggregation sites and migration bottlenecks where control measures can be targeted, building on earlier work by Adam Daniel, and with the Department of Conservation to synthesise current knowledge of invasive fish biology, control and impacts into a management handbook. Work continues on the use of environmental DNA to detect pest fish incursion and the development of molecular methods to monitor zooplankton communities as indicators of invasive fish impacts.

Connected to this work are other projects to understand the food web implications of pest fish invasion and control in lakes, and to identify environmental and social factors associated with invasion risk. Kevin is also continuing his work on large river and floodplain ecology.



## LERNZ Workshops

LERNZ and the University of Waikato are holding a free workshop series on the management of invasive freshwater fish (joint initiative with the Department of Conservation) and catchment water quality modelling.

Registrations close 30 July 2014 and registration is free. The workshops will be held at the University of Waikato over 3-4 September 2014. For more information please contact the Research Manager, Eloise Brown, on [efbrown@waikato.ac.nz](mailto:efbrown@waikato.ac.nz) or (07) 838 4287.

## Workshop Overviews

### Invasive Fish Management

This workshop will comprise a series of invited presentations from management practitioners and researchers covering (i) organisational roles for detection and response, (ii) control and monitoring tools, (iii) invasion prevention and ecological outcomes, and (iv) public perceptions. Each session will be followed by a facilitated discussion.

### Catchment Water Quality Modelling

This workshop will give an overview of available catchment models to quantify the impact of land management practices on flow and water quality. The main focus of the workshops will be on the application of two widely used models, SWAT and INCA. Formal presentations involving students will be given. These presentations will be followed by facilitated discussions on the key issues faced in catchment management and how available models could be utilized.

## Eloise Brown – Research Manager

Eloise Brown is the new Research Manager for LERNZ and provides support to the LERNZ governance members (the Governance Group, External Science Review Committee and End User Advisory Group). Eloise graduated from the University of Waikato with a BSc, MSc and PhD before spending eight years with Genesis as an Environmental Manager.





## LERNZ data base

LERNZdb (Lake Ecosystem Restoration New Zealand Freshwater Database) is a data repository supporting the storage and retrieval of water quality and biodiversity measurement data for lakes, rivers and wetlands in New Zealand. LERNZdb provides freshwater data in a consistent way made available under a Creative Commons Attribution licence. This way the data is shared openly and available to scientists and the public alike assisting in implementing LERNZ's mission statement of "linking lake restoration research with end users to achieve outcomes". Recent developments of LERNZdb include adding a machine interface to submit data, quality rating scores for datasets, and processes for reviewing submissions by domain experts to ensure consistent quality standards.

Future developments will include on-demand generation of custom datasets, each with a persistent identifier, by selectively combining data points from multiple publicly available datasets.

LERNZdb recently went live and is available to the public at <http://lernzdb.its.waikato.ac.nz/>

In connection with LERNZdb, LERNZ has been working with Wairoa Pacific Limited to develop software to visualise data from the 3,900 New Zealand lakes > 1 ha in area.

## Completed postgraduate studies

**Dylan Clarke (MSc)** (photo right)

The performance of Detainment Bunds (DBs) for attenuating phosphorus and sediment loss from pastoral farmland.

<http://hdl.handle.net/10289/7993>

**Michael Pingram (PhD)**

Food webs in the lower Waikato River and the role of hydrogeomorphic complexity.

<http://hdl.handle.net/10289/8529>

**Mat Allan (PhD)** (photo right)

Remote sensing, numerical modelling and ground truthing for analysis of lake water quality and temperature

<http://hdl.handle.net/10289/8513>

**Jonathan Abell (PhD)** (photo right)

Variability in nutrient loading to lake ecosystems and associated impacts on water quality.

<http://hdl.handle.net/10289/7698>

**Jonathan Puddick (PhD)** (photo right)

Spectroscopic investigations of oligopeptides from aquatic Cyanobacteria: Characterisation of new oligopeptides, development of microcystin quantification tools and investigations into microcystin production

<http://hdl.handle.net/10289/7289>



## Recent Publications\*

- Abell, J. M., & Hamilton, D. P. (2013). Bioavailability of phosphorus transported during storm flow to a eutrophic, polymictic lake. *New Zealand Journal of Marine and Freshwater Research*, 47(4), 481-489.
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- Brookes, J. D., Carey, C. C., Hamilton, D. P., Ho, L., van der Linden, L., Renner, R. & Rogosi, A. (2014). Emerging Challenges for the Drinking Water Industry. *Environmental Science & Technology*, 48(4), 2099-2101.
- Brookes, J. D., O'Brien, K. R., Burford, M. A., Bruesewitz, D. A., Hodges, B. R., McBride, C. & Hamilton, D. P. (2013). Effects of diurnal vertical mixing and stratification on phytoplankton productivity in geothermal Lake Rotowhero, New Zealand. *Inland Waters*, 3(3), 369-376.
- Cary, S. C., Coyne, K. J., Rueckert, A., Wood, S. A., Kelly, S., Gemmill, C. E., Vieglais, C., & Hicks, B. J. (2014). Development and validation of a quantitative PCR assay for the early detection and monitoring of the invasive diatom *Didymosphenia geminata*. *Harmful Algae*, 36, 63-70.
- Cirés, S., Roa, C. A., Wood, S. A., Puddick, J., Loza, V., & Heimann, K. (2014). First report of microcystin-producing *Fischerella* sp. (Stigonematales, Cyanobacteria) in tropical Australia. *Toxicon*, 88: 62-66

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- Collier, K.J., Hamer, M. P., & Moore, S.C. (In press). Littoral and benthic macroinvertebrate community responses to contrasting stressors in a large New Zealand river. *New Zealand Journal of Marine and Freshwater Research*.
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- Eaton-Rye, J. J., Packer, M. A., Summerfield, T. C., & Wood, S. A. (2014). Algal and cyanobacterial bioenergy and diversity. *New Zealand Journal of Botany*, 52(1), 1-5.
- Górski, K., Collier, K., Hamilton, D. P. & Hicks, B. J. (2014). Effects of flow on lateral interactions of fish and shrimps with off-channel habitats in a large river-floodplain system. *Hydrobiologia*, 729(1), 161-174.
- Hamilton, D. P., Wood, S. A., Dietrich, D. R., & Puddick, J. (2014). Costs of harmful blooms of freshwater cyanobacteria. In N. K. Sharma, A. K. Rai and L. J. Stal (Eds.) *Cyanobacteria* (pp. 245-256): John Wiley & Sons, Ltd.

\* Publications can be obtained by contacting Dr Eloise Brown ([efbrown@waikato.ac.nz](mailto:efbrown@waikato.ac.nz)), the author, or through the journal's web site or URL (where the DOI is given).

- Hicks, B.J., Bell, D.G., Duggan, I., Wood, S. & Tempero, G. (2013) *Aquatic ecology of Lake Rotokare, Taranaki, and options for restoration*. ERI Report No. 14. Prepared for the Rotokare Scenic Reserve Trust. Environmental Research Institute, University of Waikato, Hamilton, New Zealand.
- Hicks, B. J., Stichbury, G. A., Brabyn, L. K., Allan, M. G., & Ashraf, S. (2013). Hindcasting water clarity from Landsat satellite images of unmonitored shallow lakes in the Waikato region, New Zealand. *Environmental Monitoring and Assessment*, 185(9), 7245-7261.
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- Jones, H. F. E., Hamilton D. P., 2014. Lake Whangape and Lake Waahi hydrodynamic modelling. ERI Report No. 31. Client report prepared for Waikato Regional Council. Environmental Research Institute, University of Waikato, Hamilton, New Zealand.
- Jones, H. F. E., Özkundakci, D., Kochendoerfer, S., McBride, C., and Hamilton, D. 2014. Lake Rotokakahi water quality modelling (ERI Report No. 32). Client report prepared for Bay of Plenty Regional Council. Environmental Research Institute, University of Waikato, Hamilton, New Zealand.
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- Morgan, D., Kumar, H., Ling, N., & Hicks, B. (2014). Toxicity effects of oral gavage of aqueous solutions of cube-root powder and sodium nitrite in common carp. *Wildlife Research*, 40, 647-653.
- Mulling, B., Wood, S., & Hamilton, D. (2014). Intra-colony motility of *Microcystis wessenbergii* cells. *New Zealand Journal of Botany*, 52(1), 153-159.
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- Pingram, M. A., Collier, K. J., Hamilton, D. P., & David, B. O. (In press). High intensity data survey and multivariate statistics reveal ecological zones along the longitudinal profile of a large, temperate, lowland river. *River Systems*.
- Pingram, M., Collier, K., Hamilton, D., Hicks, B., & David, B. (2014). Spatial and temporal patterns of carbon flow in a temperate, large river food web. *Hydrobiologia*, 729(1), 107-131.
- Puddick, J., Prinsep, M. R., Wood, S. A., Cary, S. C., Hamilton, D. P., & Wilkins, A. L. (2013). Isolation and structure determination of two new hydrophobic microcystins from *Microcystis* sp.(CAWBG11). *Phytochemistry Letters*, 6(4), 575-581.
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- Tana, R. & Tempero, G. (2013). *Life-history of Lake Horowhenua common smelt: analysis of otolith chemistry and vertebral counts*. ERI Report No. 16. Client report prepared for Horizons Regional Council. Environmental Research Institute, University of Waikato, Hamilton, New Zealand.
- Tempero, G. (2013) *Assessment of fish populations in Lake Horowhenua, Levin*. (ERI Report No. 15) Client report prepared for Horizons Regional Council. Environmental Research Institute, University of Waikato, Hamilton, New Zealand.
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- Watson, N.T.N., Duggan, I.C., Collins, G.E., Beet, C.R., Woods, S.M., Banks, J.C., & Hogg, I.D. (2014) A Molecular-Based Assessment Tool for Characterising New Zealand Freshwater Zooplankton Communities (ERI Report No. 39). Client report prepared for LERNZ. Environmental Research Institute, University of Waikato, Hamilton, New Zealand.
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- Wu, N., Daniel, A. & Tempero, G. (2013). *Fish biomass and gonad development in the Rotopiko (Serpentine) lakes*. ERI Report No. 20. Client report prepared for Department of Conservation. Environmental Research Institute, University of Waikato, Hamilton, New Zealand.