

# High Frequency Water Quality Monitoring – Fact Sheet

Linking lake restoration with end users for positive environmental outcomes



Figure 1. Lake Waikaremoana monitoring buoy. Photo: Matt Osborne

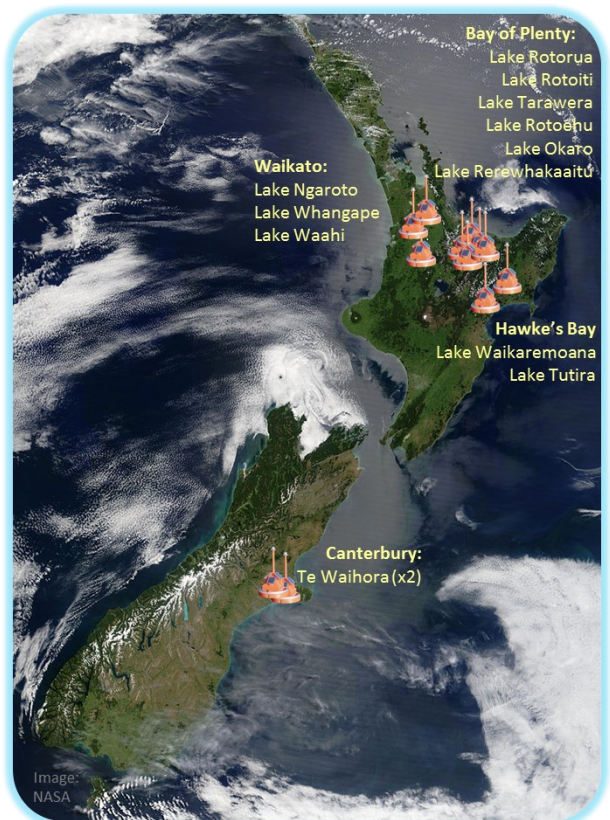


Figure 3. LERNZ lake buoy locations in New Zealand

## High Frequency Lake Monitoring

Comprehensive monitoring is vital for tracking changes in water quality. Key lake processes are often influenced by land-use changes, point-source pollution and changes in climate at time-scales varying from seasons to minutes. Often, these changes may not be adequately described by traditional, infrequent sampling.

High-frequency monitoring buoys (Figure 1) enable better understanding of processes that affect lake health, including temperature stratification patterns, oxygen depletion from bottom waters (Figure 2), algal species succession, sediment resuspension and water clarity. These data help us to evaluate the effectiveness of restoration measures undertaken in lakes and catchments.

LERNZ researchers have developed and deployed a network of 13 solar-powered water quality monitoring buoys around New Zealand (Figure 3). Managed in partnership with stakeholders including Fish and Game, District and Regional Councils, the buoys measure water temperature, chlorophyll and phycocyanin (cyanobacteria) fluorescence, dissolved oxygen, turbidity, pH, and meteorological variables. Data are transmitted to a database and web interface every 15 minutes.

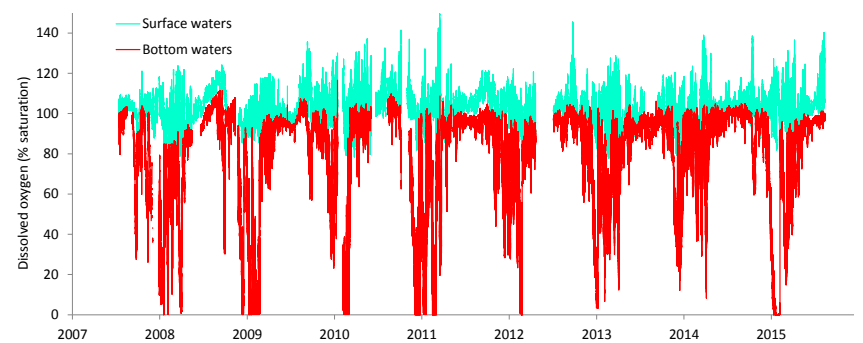


Figure 2. Surface and bottom water dissolved oxygen measurements from the Lake Rotorua monitoring buoy. Frequency, rate (slope) and severity of oxygen depletion from bottom waters during thermal stratification are key indicators of lake ecosystem health.

## GLEON

The Global Lake Ecological Observatory Network (GLEON) is a worldwide network of instrumented lake buoys, and an international community of scientists, educators, policy makers, and citizens invested in the future of fresh waters. GLEON conducts innovative science by sharing and interpreting high-resolution sensor data to understand, predict and communicate the role and response of lakes in a changing global environment. Data from LERNZ buoys in New Zealand have contributed to a number of GLEON research projects analysing responses of lake processes to environmental pressures at a global scale ([www.gleon.org](http://www.gleon.org)).

## Quality Control of Data

Comprehensive quality assurance and quality control (QA/QC) are vital for effective and appropriate use of high frequency sensor data. LERNZ have developed 'B3', a freeware application specifically for QA/QC of environmental sensor datasets. Its aim is to provide an intuitive working environment based on a visual interface for semi-automated editing of outlying data and erroneous measurements, including sensor thresholds, rapid error detection, and mathematical transformation. B3 keeps a detailed log of data modifications, and raw data are stored as a separate layer so that unmodified data can be retrieved at any time. B3 has found international usage through the GLEON network. (<http://www.lernz.co.nz/tools-and-resources/b3>).

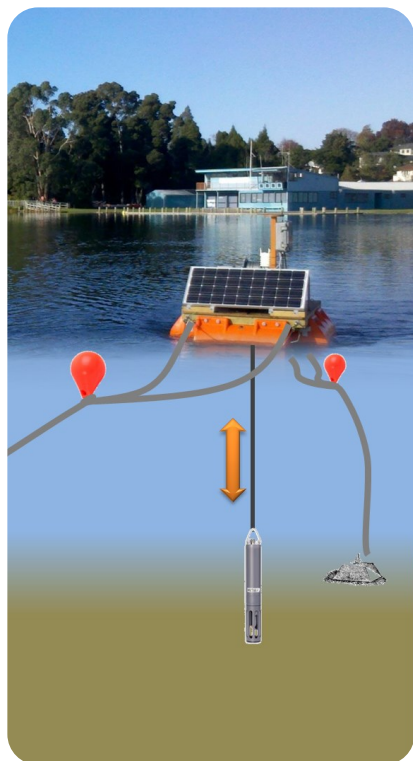


Figure 4. Schematic diagram of the LERNZ autonomous water column profiler monitoring buoy.

## The Next Generation: Autonomous Profiling Buoys

In 2013 LERNZ designed, built and deployed a prototype 'profiler' monitoring buoy in Lake Rotoehu (Figure 4). This system utilises a custom winch to raise and lower a water quality sensor package through the water column. The winch is controlled by a datalogger (with telemetry) and the sampling routine can be easily modified by the user. This technology yields a great deal more information and insight than fixed-sensor buoys, by measuring all water quality variables at multiple depths in the lake (e.g. Figure 5). It is also cost-effective because it avoids the need for sensor replication. Because of these advantages, future buoy deployments are likely to be vertical profilers.

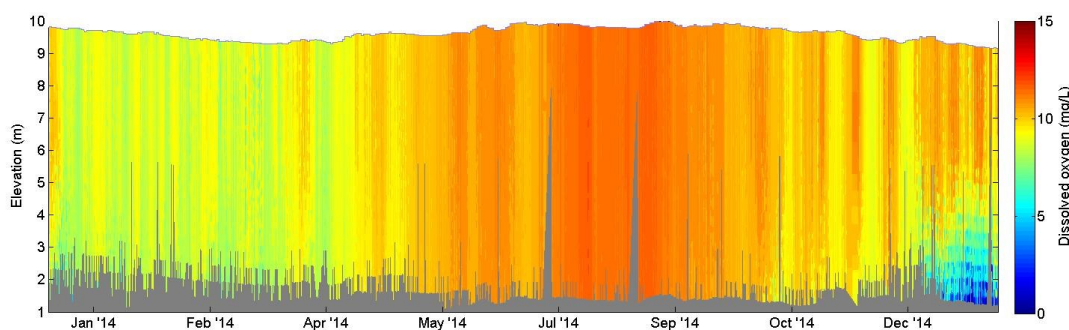


Figure 5. Dissolved oxygen data from the LERNZ profiler buoy located at Lake Rotoehu.