

# NEW TOOLS FOR MONITORING THE ROTORUA LAKES

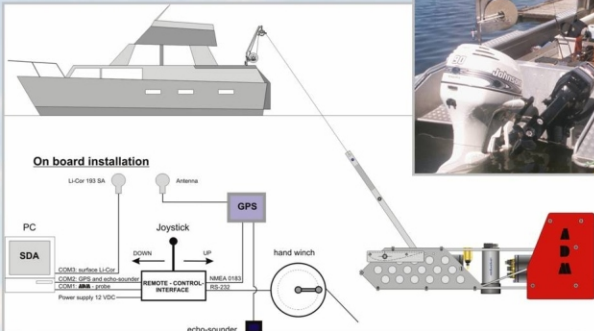
**Toradji Uraoka, Nina von Westernhagen & David Hamilton**

Centre for Biodiversity and Ecology Research,  
University of Waikato, Private Bag 3105, Hamilton, New Zealand.

The University of Waikato has been monitoring physical variables as well as chlorophyll-fluorescence in several Rotorua lakes using specialized limnological equipment - the "BioFish" - that allows excellent spatial discrimination within a lake.

The lakes that are currently being monitored are Rotorua, Rotoiti, Rotoma, Rotoehu and Okareka (see Figure 1).

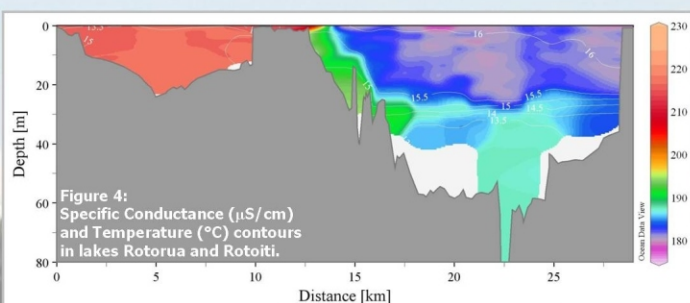
**Figure 2: Complete BioFish set-up used for monitoring lakes.**



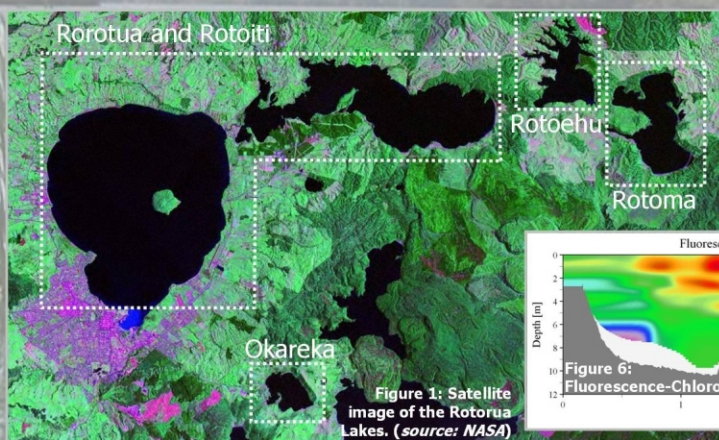
**Figure 3: Above, BioFish set-up ready for monitoring.**



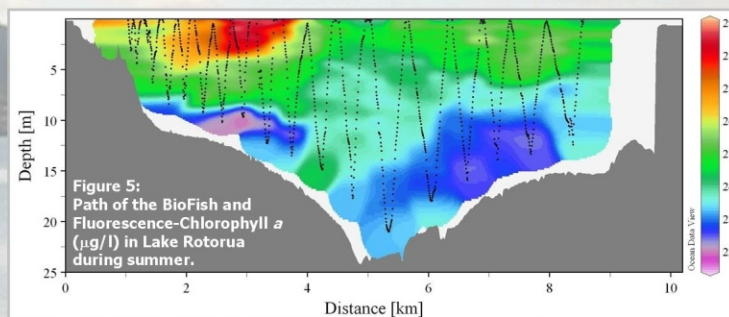
The BioFish is a remote controlled robot able to oscillate from the surface down to 60 m depth, measuring variables such as temperature, conductivity, dissolved oxygen and fluorescence.



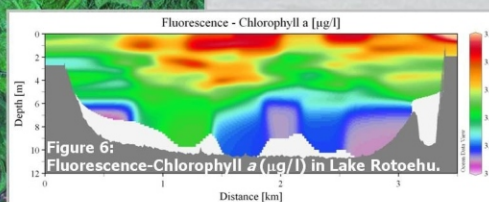
**Figure 4: Specific Conductance ( $\mu\text{S}/\text{cm}$ ) and Temperature ( $^{\circ}\text{C}$ ) contours in lakes Rotorua and Rotoiti.**



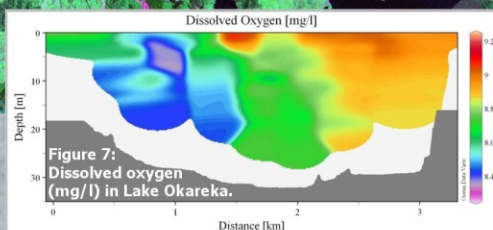
**Figure 1: Satellite image of the Rotorua Lakes. (source: NASA)**



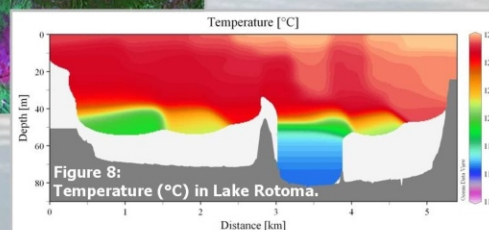
**Figure 5: Path of the BioFish and Fluorescence-Chlorophyll  $a$  ( $\mu\text{g}/\text{l}$ ) in Lake Rotorua during summer.**



**Figure 6: Fluorescence-Chlorophyll  $a$  ( $\mu\text{g}/\text{l}$ ) in Lake Rotoehu.**



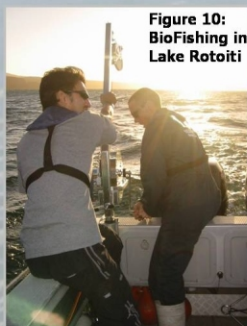
**Figure 7: Dissolved oxygen ( $\text{mg}/\text{l}$ ) in Lake Okareka.**



**Figure 8: Temperature ( $^{\circ}\text{C}$ ) in Lake Rotoma.**

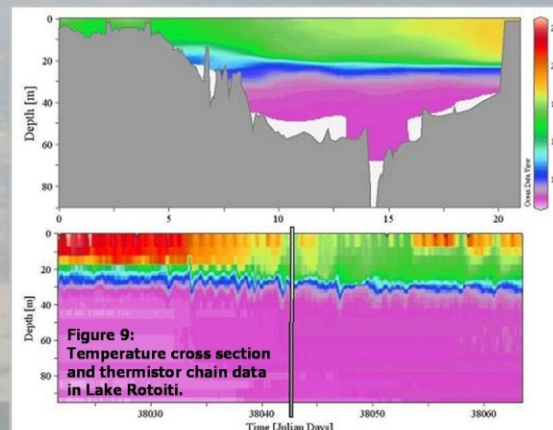
The data measured by sensors travels from the BioFish to the onboard computer system (see Figures 2 and 3), recording in real time at a rate of 4 measurements per second.

This towed system enables measurements in lengths of 10 km or more across a lake (see Figures 4 to 8), in a period of around 1 to 2 hours.



**Figure 10: BioFishing in Lake Rotoiti**

Complementary measurements are being carried out with thermistor chains (see Figure 9), which continuously record the temperature in a vertical profile in the lake. A CTD, which is multi-parameter probe, is also used to resolve depth profiles in the lakes and make comparisons with BioFish measurements.



**Figure 9: Temperature cross section and thermistor chain data in Lake Rotoiti.**

**Acknowledgments:** Environment Bay of Plenty is acknowledged for field assistance and funding. ASD Sensortechnik GmbH (Germany) and Peter Jarman (University of Waikato) are thanked for technical support.