Lake Restoration Lags – Fact Sheet

Linking lake restoration with end users for positive environmental outcomes

LERNZ
Lake Ecosystem Restoration New Zealand

Lags in Lake Management Responses

Regulatory responses to declines in lake health have often been characterised by long lag times. Under these circumstances regulation has often failed to prevent declining lake health or to implement successful restoration programmes. For Lake Rotorua, response lags can be seen in the time passing between the recognition of water quality decline (e.g. weed problems and algal blooms), and the effect of regulatory actions to improve water quality (e.g. land use management changes). Research undertaken by Mueller et al. (2015) has shown that lag times of approximately 5 years may occur between significant environmental declines and regulatory responses. Additional lag times relate to the natural environment and may be characterised by long responses of groundwater nitrogen levels, sediments in the bottom of lakes, or natural resilience to management changes. Water quality research and management responses in particular followed periods of decline in water quality and visible occurrences of weed growth and algal blooms (see Figure overleaf).

Policy Responses, Lake Rotorua

The restoration of Lake Rotorua is linked to recent national changes in freshwater management policy. The National Policy Statement for Freshwater Management, effective August 2014, provides direction from central government to regional councils in setting water management objectives and developing a limits-based catchment management approach for water quality. The Bay of Plenty Regional Council (formerly Environment Bay of Plenty, EBOP) operated ahead of the National Policy Statement by developing its own limits-based approach to reduce nutrient inputs to Lake Rotorua. Land use intensification is the main driver of water quality decline in Lake Rotorua and agreement in 2013 between agricultural stakeholders and the regional council established nutrient reduction targets to address this decline. A comprehensive discussion of management and restoration of Lake Rotorua, focusing especially on the role of community action, is detailed in McLean (2014).

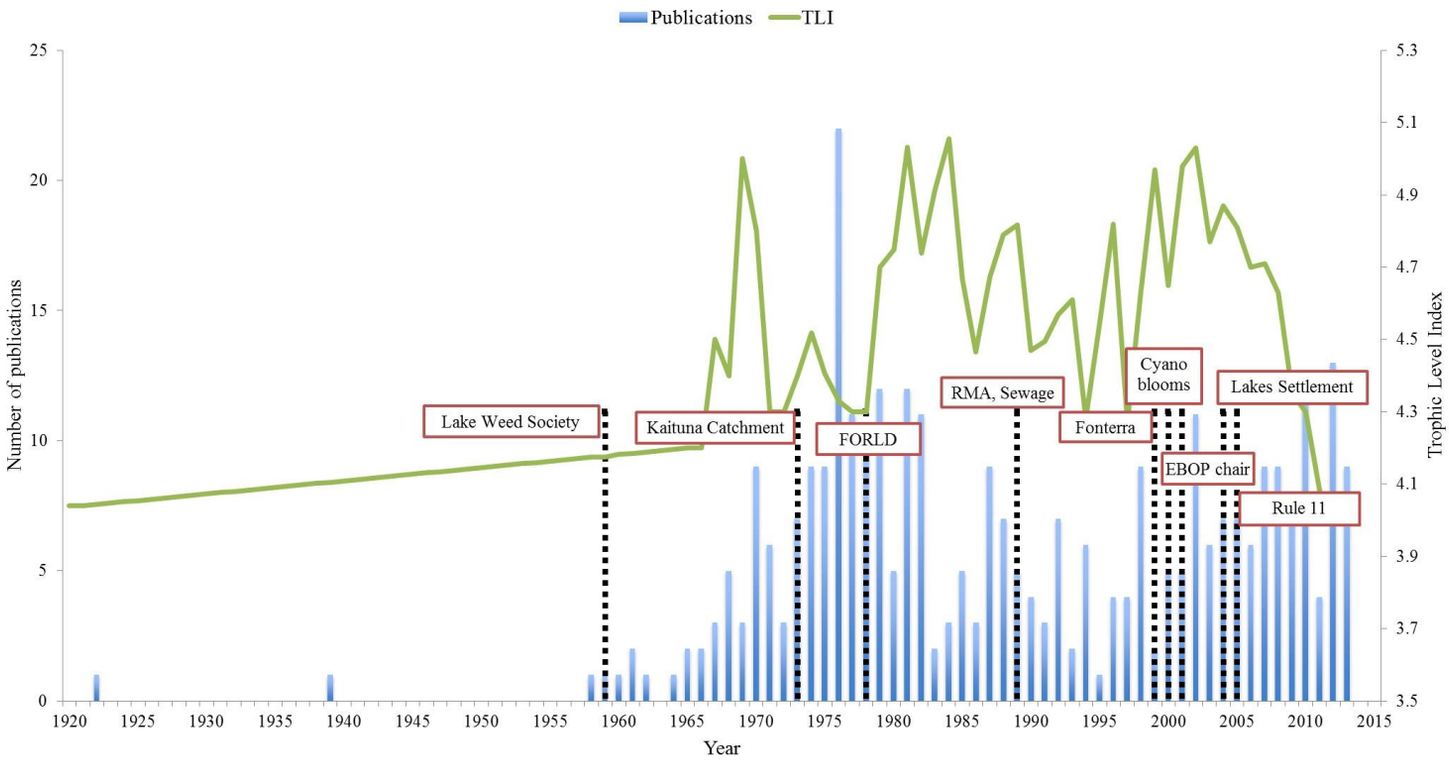
Water quality monitoring buoy on Lake Rotorua.
Photo: Warrick Powrie

Restoration Measures, Lake Rotorua

A number of restoration measures have been undertaken to address water quality decline and ecosystem degradation. Invasions by exotic submerged plants and periodic algal blooms led to a number of in-lake interventions such as herbicide spraying. From 2007, management of the lake has included the treatment of an inflowing stream (Utuhina) with alum to reduce the concentration of phosphorus in the lake. Alum treatment of an additional stream inflow (Puarenga) commenced in 2010. Through measures such as voluntary land management agreements, attempts have been made to reduce nutrient run-off from the catchment. The target water quality level (a Trophic Level Index of 4.2) was met for the first time in 2012-2013, after 5 years of alum dosing.

What Leads to Failure in Restoration Efforts?

Management responses to water quality declines in Lake Rotorua have mostly been reactive. There has been a disconnection between land-use intensification and the effects that the intensification has had on lake water quality. Management responses often occurred after water quality degradation was visible in the public sphere (such as proliferation of lake weed and algal blooms) and delays in of management responses have allowed water quality to further degrade.



Numbers of publications on water quality of Lake Rotorua, 1922—2013, alongside water quality changes (represented by TLI), and important environmental and regulatory events in the same time period (text boxes). Water quality is indicated by the Trophic Level Index, which uses the parameters of Secchi depth for clarity, and concentrations of total nitrogen, total phosphorus and chlorophyll *a*. (Modified from Mueller et al. 2015).

Science can better inform management decision making when it can provide a comprehensive framework that integrates all relevant ecological knowledge, taking account of economic interests and societal constraints. Models can be then be used to create scenarios to visualise economic as well as environmental impacts of planning decisions. The integration of ecological and economic models for catchment management studies offers the opportunity to reduce response lags and to expose stakeholders to a wide range of possible scenarios.

A working example for this type of analysis and management approach can be seen in the concept of Integrated Catchment Management. This has been attempted, for example, in the Motueka River catchment (Bowden et al. 2004). This project encompasses multiple disciplines and stakeholder research to inform improved management of land, freshwater and coastal environments, thereby aiming at the most effective management strategies and aiming to resolve potential conflicts in land uses.

References

Bowden, W.B., Fenemor, A., and Deans, N (2004). Integrated water and catchment research for the public good: The Motueka River–Tasman Bay initiative, New Zealand. *International Journal of Water Resources Development*