4 LAKES

Overview

- The monitoring of Lake Omapere showed that the algal bloom observed during 2001/2001 has abated and that general water quality improved over winter, but that algal blooms were again experienced during the 2002-03 summer
- Sampling at several lakes throughout Northland has shown that the region's lakes are in variable health

Annual Plan Performance Targets

To continue to develop and implement a prioritised State of the Environment monitoring programme based on the Regional Policy Statement and Regional Plans, by:

- **Operating a region-wide water quality network for the measurement, recording and reporting of lake quality trends**
- **Water quality, weed and algae monitoring of Lake Omapere and associated community liaison and advice, including the development and co-ordination of a Lake Catchment Management Plan**

4.1 Lake Omapere

Sampling at Lake Omapere, which is normally conducted monthly, was disrupted over the 2002/2003 year because of staff changeover. As a result, no data was collected between December 2002 and June 2003, and trend lines in the following graphs have been faded as to indicate that they are only speculative.

Lake Omapere from two different angles

4.1.1 Algae

Chlorophyll a is an indicator of algal growth. At Lake Omapere, chlorophyll a concentration is lowest during winter and highest during summer (Figure 4-1). Because temperature is a major control upon algal growth, this seasonal fluctuation is expected (assuming "normal" conditions).

The cyanobacterial bloom observed during the previous summer ('01/'02) appears to have receded. Although identification of algae collected over the 2002-03 year has yet to be completed, the lake is no longer a bright green colour and visual clarity has improved. However, algal blooms of variable intensities (dependent on weather conditions) are likely to reoccur for several years to come.

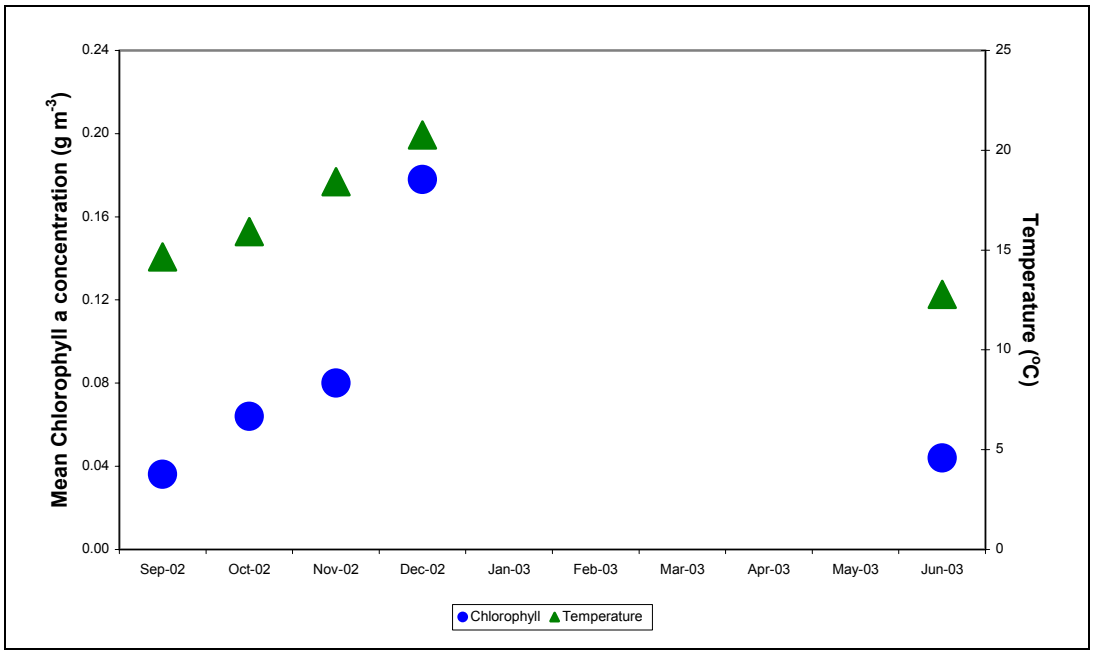

Figure 4-1 Variation in Chlorophyll a concentration at Lake Omapere.

4.1.2 Nutrients

At Lake Omapere, nutrients increased from spring through to summer (Figure 4-2). There are a number of possible causes of this increase, from the resuspension of nutrients from the lake floor, to increased use of fertilisers by farmers (and therefore increased nutrient loads in surface run-off). Increased nutrient concentrations greatly amplify the risks of algal blooms occurring during any given year.

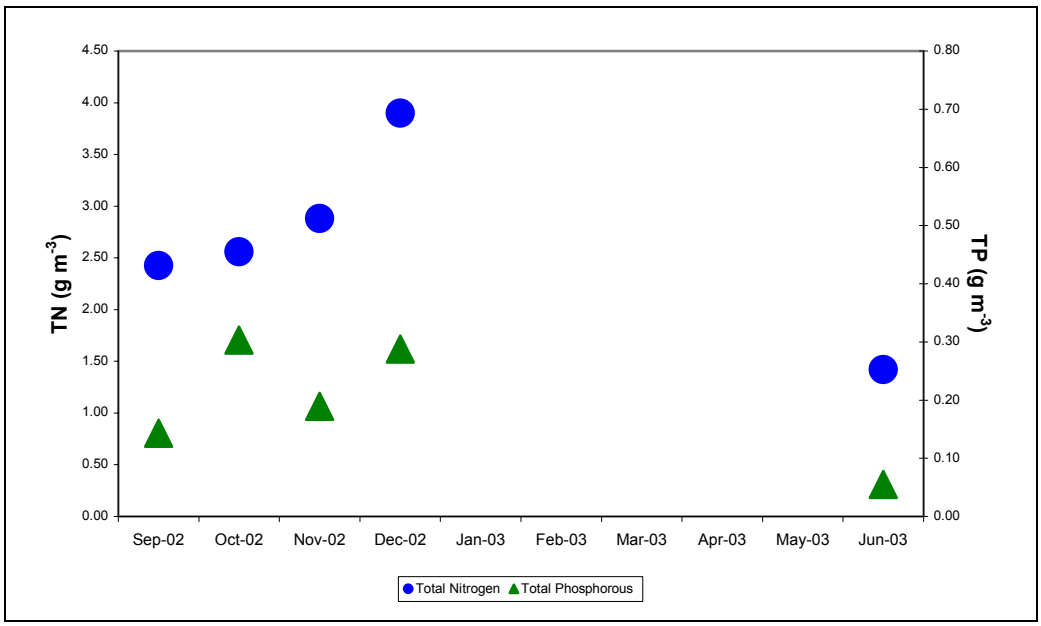

Figure 4-2 Nutrients at Lake Omapere over 2002/2003

4.1.3 Dissolved Oxygen

The death of algae during bloom conditions consumes dissolved oxygen, and can cause serious ecological damage as a result. This possibly explains why Lake Omapere was significantly under-saturated with dissolved oxygen during September of 2002/2003 (Figure 4-3). Following the death and dispersion of the cyanobacterial bloom, dissolved oxygen saturation has increased to levels that should promote ecological stability and health. The low dissolved oxygen levels recorded in September may also be due to the decline in biomass of *Egeria densa* in the Lake. Weed surveys are planned for the end of 2003 to accurately assess the changes in weed biomass.

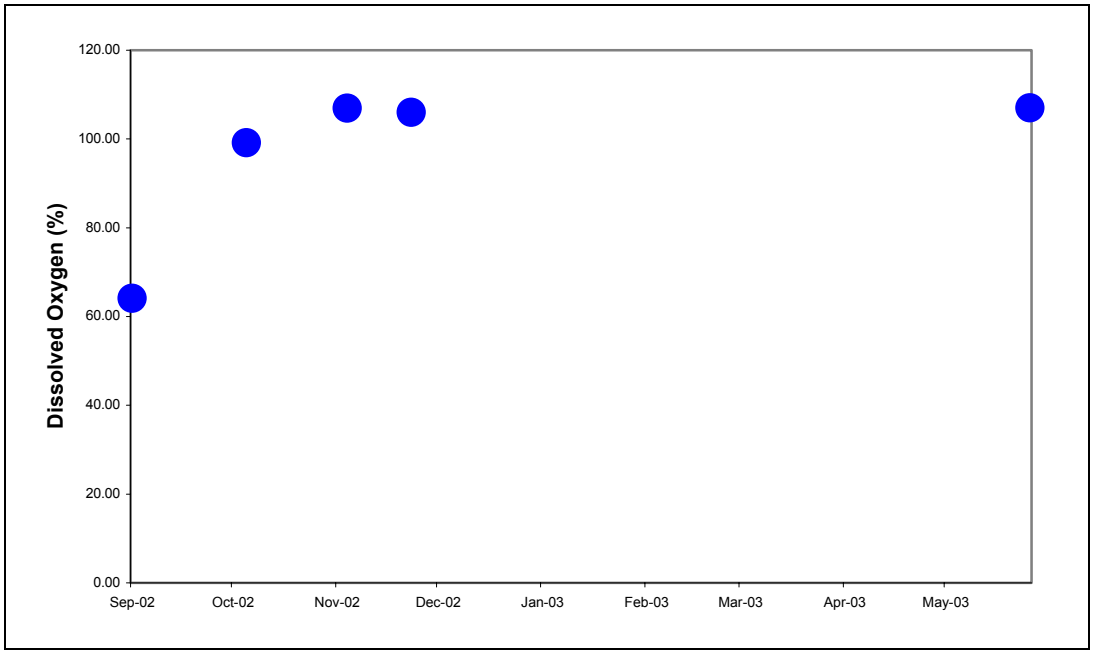

Figure 4-3 Dissolved Oxygen at Lake Omapere. The data gap between December and May makes any interpretation speculative at best.

4.1.4 Future Development

The Council, in partnership with the Lake Omapere Trust, will begin the implementation of the **Lake Omapere Restoration and Management Project**, pending funding from the Ministry for the Environment's **Sustainable Management Fund**. The project has been split into five stages:

1. The development of a **Lake Omapere Management Strategy**, including a report of Kaitiakitanga research and strategy development options, as well as more general consultation
2. The development of a **Weed Management Programme**, focusing on aquatic weeds and introduced Grass Carp
3. The development of an **Integrated Catchment Management Programme**, requiring consultation with farm owners
4. The enhancement of indigenous biodiversity, including a survey and relocation of freshwater mussels and native aquatic plants, and research into the extent of pest fish in the lake
5. Water quality monitoring, to be reported every six months

It is expected that it will take two years to complete the proposed project. There is widespread community support for the project, from iwi, local high schools and the Department of Conservation.

Up-to-date reports regarding Lake Omapere are presented at:

www.nrc.govt.nz/about.us/special_events_issues_projects

4.2 Lake Monitoring Network

The Aupouri Lakes: Ngatu, Waiparera, Wahakari, Rotoroa, Rotokawau and Waimimiha were sampled in early October 2002. Samples from the lakes were analysed for a range of parameters, and the results are discussed below.

4.2.1 Dissolved oxygen, pH and water clarity

All six lakes had good dissolved oxygen levels varying from 8 to 11.7 g m^{-3}, as expected in winter with high water levels, lower temperatures and mixing from the wind (Figure 4-4a).

All of the lakes had pH levels between 6 and 8, except Waimimiha with a mean pH of 8.75, which has been highlighted amber in Figure 4-4b. Studies in freshwater have shown that prolonged pH levels of 9 or greater are lethal for fish and invertebrate biota.

Water clarity, measured using a Secchi Disc, is excellent in Lakes Ngatu, Rotoroa and Rotokawau, moderate in Waiparera and very poor in Waimimiha, shown by red in Figure 4-4c. These water clarity results correspond to the levels of suspended solids (Figure 4-4d) where Lake Waimimiha (shown in amber) averaged 57 g m^{-3} suspended solids.

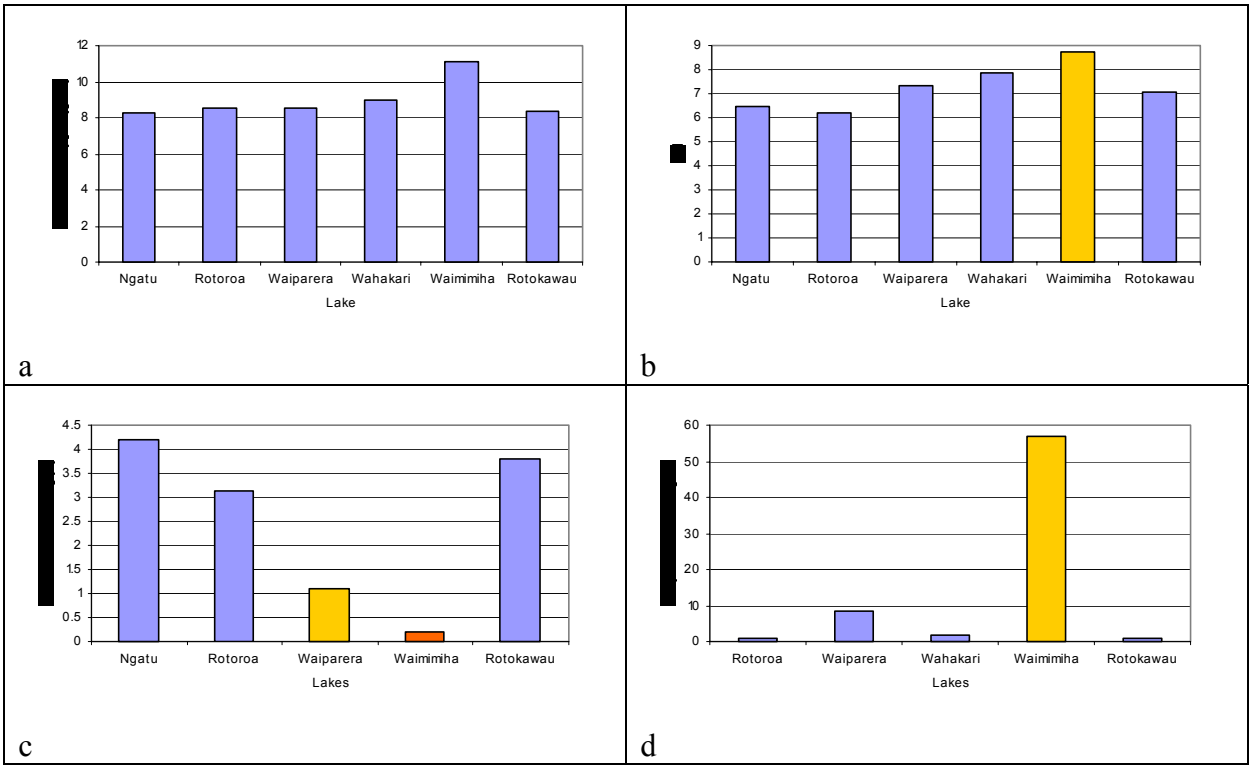

Figure 4-4 Dissolved Oxygen (a), pH (b), water clarity measured using a Secchi Disc (c) and total suspended solids (d) for the six Aupouri Lakes sampled on the 1st October 2002. Red bars indicate poor water quality/highly impacted lakes, amber is indicative of moderate water quality/impacted lakes. NB: some of these results are an average of 2 or 4 readings while others are based on a single reading.

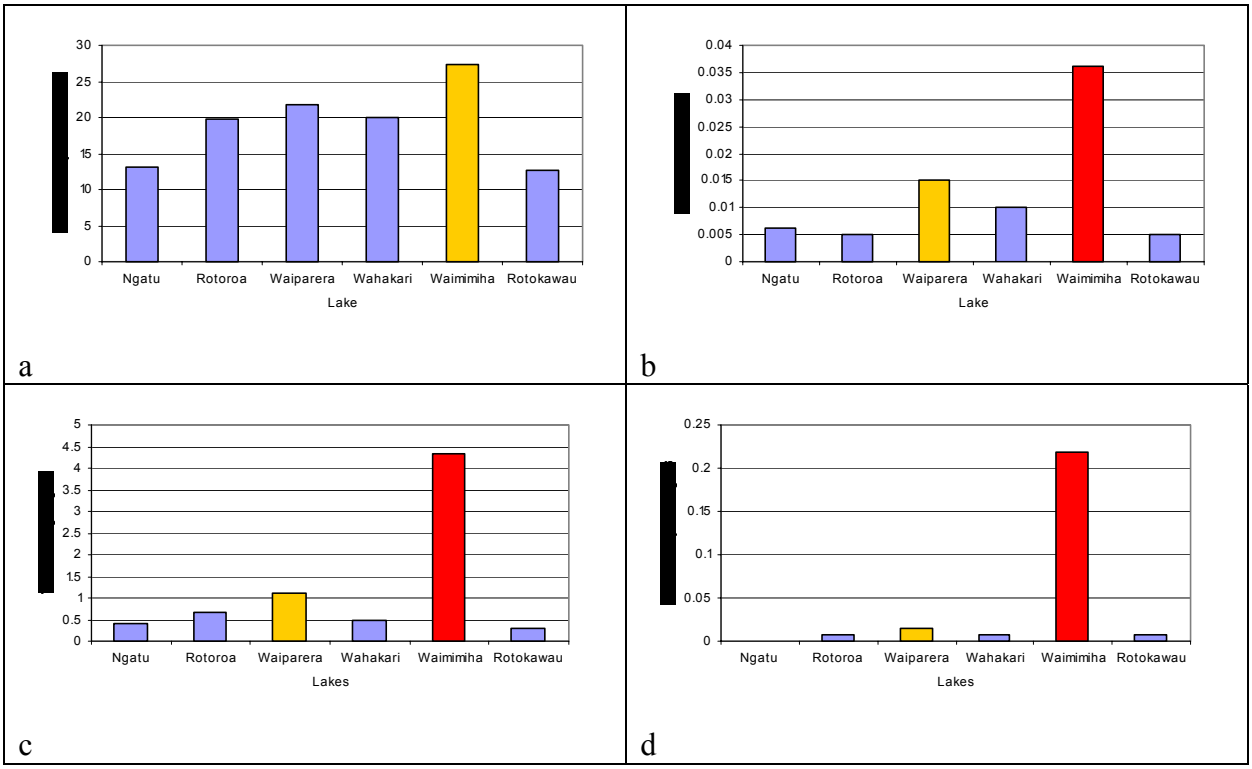

Figure 4-5 Conductivity (a), Chlorophyll α (b), total nitrogen (c) and total phosphorus (d) for the Aupouri Lakes sampled on the 1st October 2002. Red bars indicate poor water quality/highly impacted lakes, while amber is indicative of moderate water quality/impacted lakes. Note: some of these results are averages of 2 or 4 readings, while others are single readings.

4.2.2 Conductivity, chlorophyll, nitrogen and phosphorus levels

Waimimiha had an average conductivity of 27 mS m^{-1} adjusted to 25°C, indicating poor to moderate water quality (Figure 4-5a). The other 5 lakes all had a conductivity of less than 22 mS m^{-1}.

Chlorophyll α was not detected or very low in all the lakes, which is to be expected at this time of year, except Waimimiha and Waiparera (Figure 4-5b). One of the four chlorophyll α measurements recorded for Waimimiha was 0.13 g m^{-3}, which is similar to the levels of chlorophyll found in Lake Omapere in summer 2002-03.

Both total nitrogen and phosphorus concentrations were very high in Lake Waimimiha, (shown in red in Figures 4-5c and 4-5d) and at high levels in Lake Waiparera (shown in amber in Figures 4-5c and 4-5d). At the other lakes, nutrient levels were relatively low.

Overall, the state of the major Aupouri Lakes is as follows:

Excellent lake health – none or mildly impacted

- Lake Ngatu
- Lake Rotoroa
- Lake Wahakari
- Lake Rotokawau

Moderate lake health – moderately impacted

- Lake Waiparera

Poor Lake Health – Severely impacted/degraded

- Lake Waimimiha

4.2.3 Future Development

The Lake Monitoring Network will now be established in 2003/2004 and will include selected lakes throughout the region deemed significant either due to their size, location, use, as well as their cultural or ecological importance. A wide range of parameters will be sampled twice a year to determine the overall state of lakes throughout the region. Lakes identified as critical will be sampled monthly, in a similar manner to the River Water Quality Monitoring Network, as discussed in Chapter Two.

The other major project associated with lakes planned for the forthcoming year 2003/2004 is development of the Northland Lake Management Strategy. With new staff appointments in the biosecurity, land operations and water quality teams, the survey work for the Strategy will be progressing early in 2004.