LakeScience Rotorua

A newsletter about research on the Rotorua Lakes

Produced as an occasional publication by the LakesWater Quality Society, in association with the Royal Society of NZ (Rotorua Branch)

ISSUE 5 October 2002

Welcome to the fifth issue of our email newsletter for those involved in or interested in scientific or management work on the Rotorua Lakes. It is up to **you** to make this informal newsletter a success by providing it with copy – our Society is merely providing the vehicle. We email it free of charge to all those who attended the Rotorua Lakes 2001 Symposium and are on email, and also to anyone else who requests it. If you don't wish to receive future copies, please email us. We will snail mail it on request. The newsletters will also be posted on the Royal Society (Rotorua Branch) website at www.rsnz.govt.nz/clan/rotorua. If you are interested in, or working on lakes, but not the Rotorua Lakes, we are still very happy to receive material from you and to send you newsletters.

The more copy we receive, the more frequently we will be able to send this newsletter out. Electronic copy is preferred but not essential. Only minimal editing is carried out. We hope to send another issue out in December 2002 – given sufficient copy.
Technical content of all contributions is essentially the responsibility of the authors

All material and correspondence relating to *LakeScience Rotorua* to Nick Miller, millern@wave.co.nz, 91 Te Akau Road, R D 4, ROTORUA.

CONTENTS

NEWS

Lakes chair, Waikato University

Dr David Hamilton, the appointee to this position, was given a formal welcome to Rotorua in a very impressive ceremony at Te Aomarama, Ohinemutu, on 7 August 2002. The ceremony and subsequent lunch was co-hosted by Te Arawa and Environment BOP.

A note from Brendon Hicks (University of Waikato).

David Hodges, an MSc student at the Centre for Biodiversity and Ecology Research at the University of Waikato, is about to start a project using stable isotopes to investigate food webs in the Rotorua lakes. This project is supervised by Brendan Hicks, University of Waikato, and Mike van den Heuvel of Forest Research in Rotorua. Rob Pitkethly of Eastern Region Fish and Game will collaborate with the study, which aims to trace carbon and nitrogen flows in lakes of different trophic status, culminating in an examination of the bioenergetics of trout production.

A report on the recent workshop, written by Ian McLean

Rotorua Lakes 2002 - Lakeside Communities and Sewerage was a workshop run by the LakesWater Quality Society Inc. in association with Rotorua District Council, and with support from the Royal Society of New Zealand Rotorua Branch. It was held at the Centra Hotel, Rotorua on Friday 20 September 2002.

The objective of the Workshop was

- To present research results and engineering proposals on sewerage schemes for lakeside communities (especially Okawa Bay/Mourea and Okareka);
- To obtain informed reaction from scientists and engineers;
- To allow interested residents and ratepayers to have their say.

The Workshop comprised eight technical papers, a technical forum, an open forum, and a presentation of RDC policy on charging for lakeside sewerage schemes.

The programme and background papers are available through links from the website http://www.rotorua.rsnz.org .

Research results from NIWA showed that the Okawa Bay exhibits more complex features than previously believed, which are significant for restoration planning. They noted that proposed improvement measures would take some time to show any effects. On Lake Okareka estimates of nutrient inflows from septic tank discharges were a lower proportion of N inflows than Okawa Bay.

Environment BOP reported on action taken, both regarding septic tanks and riparian retirement and other management techniques. Lakes Consulting presented an innovative analysis and management approach based on the balance between N and P.

RDC presented proposals for an SBR treatment plant at Okawa Bay, with land disposal through rapid infiltration. Harrison Grierson reported that these technologies are standard most efficient technologies in appropriate locations, and NIWA reported that limited N removal by spraying effluent on forest was seen at the Whakarewarewa Forest. For Lake Okareka RDC compared the relative economics of reducing N inflows from pasture rather than from septic tank outflows, with the pasture option suggested to be more cost-efficient.

RDC charging policy of operating costs being equalised with other sewered areas, and some local capital contribution, was presented. The capital component was contested from the floor on the basis that all ratepayers had contributed to servicing loans for the existing city sewerage.

The technical session was chaired by Professor David Hamilton and discussed various aspects of the papers that had been delivered.

During the Open Forum several of the scientists gave strong support for a sewerage scheme being necessary for the eventual recovery of Okawa Bay, and none of their colleagues disagreed.

Professor Warwick Silvester summand up the workshop as having significance in several layers including scientific and social.

Full Proceedings are in preparation and may be ordered using the form below (print off and detach):

Please detach and mail to:

LakesWater Quality Society Incorporated
P.O.Box 2008
Rotorua

Name ----------
Postal address ----------
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Email ----------

please complete as appropriate

Copies of summarised proceedings if required (to be posted subsequently)	@	$20	$
I wish to become a member of the LakesWater Quality Society (membership for individuals or families for 2002/03 year)	@	$5	$
Please find enclosed my cheque for:	Total		$

A contribution from Professor David Hamilton, concerning the Lakes Chair and some associated research.

Appointment of Environment Bay of Plenty Lakes Chair - David Hamilton

Environment Bay of Plenty (EBOP) has made a major commitment to restoration of water quality of the Rotorua Lakes through funding the Chair in Lakes Management and Restoration, based in Biological Sciences at the University of Waikato. The position was taken up in July by David Hamilton. A variety of student and collaborative projects will be supported through the EBOP initiative and through the University of Waikato. Two Ph.D. studies have already commenced. The overall aim of the projects is to provide the scientific basis to support informed management decision making by EBOP, in consultation with iwi, the community and the Rotorua District Council.

David Hamilton is a graduate of Otago University and has spent the past 11 years at the University of Western Australia in Perth, where he was involved in modelling of water quality and examining physical-biological interactions in lakes and estuaries. He returns to New Zealand keen to implement modelling strategies for the Rotorua lakes and to establish greater environmental awareness of lakes and their importance to New Zealand.

Lake Rotorua Ph.D. study

David Burger is examining coupling of the bottom sediments and the water column in Lake Rotorua. It is evident that the continued poor water quality of Lake Rotorua is attributable in large part to nutrients released from the bottom sediments. Unlike most other Rotorua lakes, which maintain strong temperature gradients between the surface and bottom of the water column in summer, Lake Rotorua is periodically mixed. With longer duration between mixing events (i.e. prolonged hot, calm weather) there is greater

depletion of oxygen in bottom waters, with larger release of nutrients sediments. Mixing then transports these nutrients into the light zone where they are used by phytoplankton to potentially form blooms. In Lake Rotorua, mixing is not confined to winter and can therefore create much higher nutrient levels at the water surface at times in summer when light and temperature conditions are ideal for phytoplankton growth. It is likely that Okawa Bay is behaving in a similar fashion. David Burgers's study is supervised by David Hamilton and Conrad Pilditch (University of Waikato) and Max Gibbs (NIWA).

Phytoplankton taxonomy and physiology of North Island lakes Ph.D. study

Eloise Ryan is examining the phytoplankton community structure in 40 lakes of the North Island of New Zealand. One aim of this study is to identify the dominant assemblages of phytoplankton in the lakes. A further aim is to relate the phytoplankton community structure to the prevailing light, temperature, mixing and nutrient conditions in the lakes. This approach is expected to help understand the status of lakes that may not be frequently monitored so that, for example, Environment Bay of Plenty could make rapid assessments about status of the lakes and the impacts of management. The Rotorua lakes provide the focal point for the study. Eloise is supervised by David Hamilton, John Green and Vivienne Cassie Cooper (University of Waikato) and Julie Hall (NIWA).

The continued decline of dissolved oxygen

David Hamilton has been getting familiar with the Rotorua lakes through examining historical data. Previous records put together by Bill Vant, Warwick Vincent and others (e.g. studies by Jolly, Fish and McColl) have been updated with Environment Bay of Plenty data for 2001-2002, and show clearly the continued decline of dissolved oxygen in the bottom waters of many of the lakes in summer. Figure 1 shows the decline of dissolved oxygen (% saturation) in Lake Tikitapu (Blue Lake) as a function of time of year for studies by Jolly in 1955-56 and McColl in 1970-71, as well as data from Environment Bay of Plenty in 2001-2002.

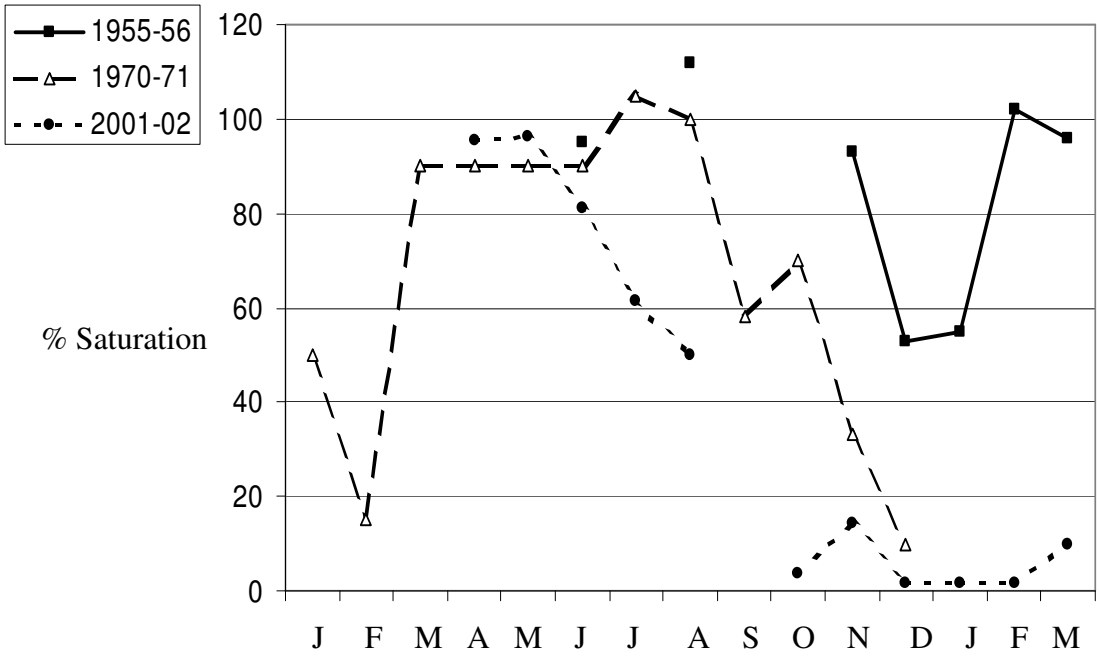


Figure 1. Percent saturation of dissolved oxygen in the bottom (22m depth) waters of Lake Tikitapu as a function of time of year, based on studies for the years 1955-56 (Jolly, 1968), 1970-71 (McColl, 1972) and 2001-02 (Environment Bay of Plenty, unpubl. data)

Perhaps less surprising is the decline in dissolved oxygen in the bottom waters of Lake Rotoiti. This decline was clearly evident when Vincent (1984) compared historical data and plotted an exponential curve of the rate of oxygen consumption in deep waters over summer as a function of time, based on several studies over different years up until 1983. An analysis that includes the Environment Bay of Plenty data for 2001-2002 (Figure 2) suggests that the rate of oxygen consumption is still increasing although it may be starting to level off. The oxygen consumption in Figure 2 is given as the 'volumetric hypolimnetic oxygen deficit' (VHOD), representing the rate at which oxygen is consumed in the deeper waters, expressed as oxygen concentration lost per day.

References:

Fish, G.R., 1975. Lakes Rotorua and Rotoiti, North Island, New Zealand: their trophic status and studies for a nutrient budget. *Fisheries Research Bulletin* No. 8, Ministry of Agriculture and Fisheries, 70pp.

Jolly, V.H., 1968. The comparative limnology of some New Zealand lakes. 1. Physical and chemical. *New Zealand Journal of Marine and Freshwater Research* 2(2): 214-259.

McColl, R.H.S., 1972. Chemistry and trophic status of seven New Zealand lakes. *New Zealand Journal of Marine and Freshwater Research* 6(4): 399-447.

Richmond, C.J., 1983. Lake Rotoiti monitoring. Wildlife Service File Report 9/1/2/1, 8pp.

Vincent, W.F., 1984. Accelerated eutrophication in a New Zealand lake: Lake Rotoiti, central North Island. *New Zealand Journal of Marine and Freshwater Research* 18: 431-440.

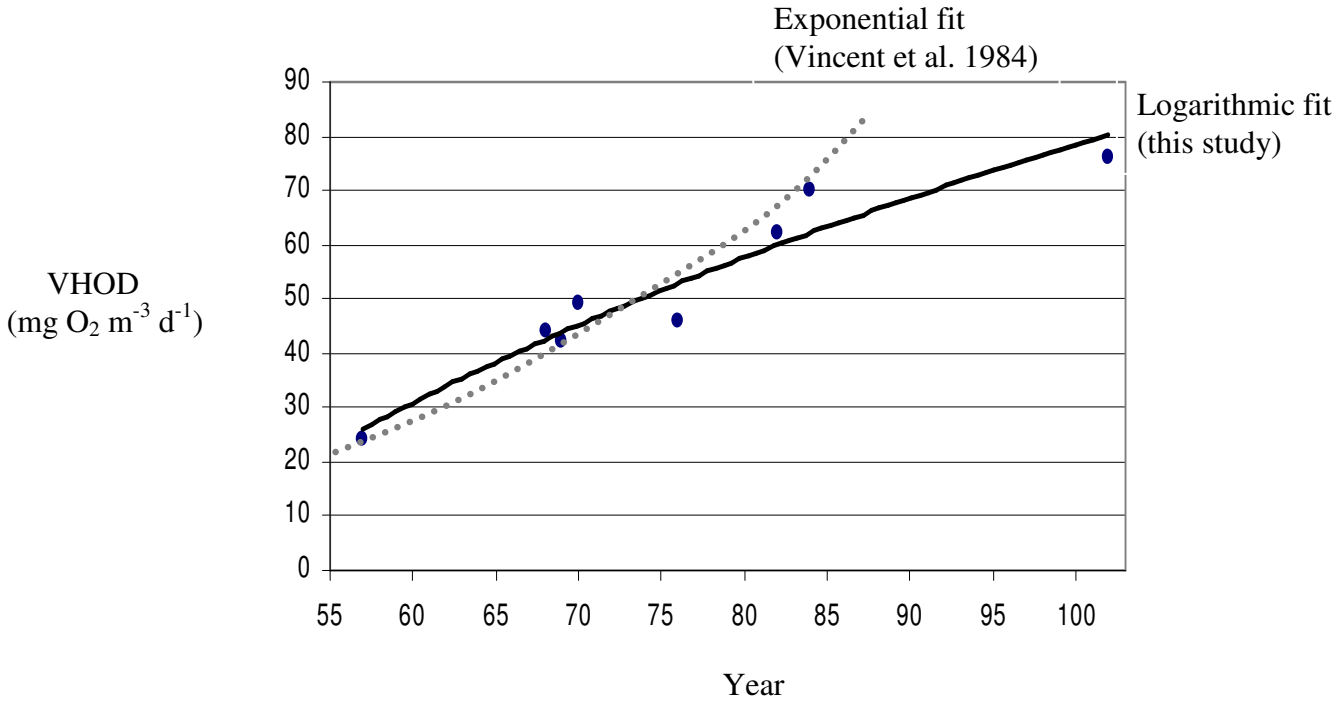


Figure 2. Changes in volmetric hypolimnetic oxygen deficit (Volumetric HOD) as a function of time for Lake Rotoiti. The curve of Vincent et al. (1984) was based on the following data: 1956 (Jolly, 1968), 1970-72 (Fish, 1975), 1976, 1979 (Richmond, 1973) and 1982, 1984 (Vincent, 1984). The curve from this study also includes the 2001-2002 data from Environment Bay of Plenty (unpubl.).

A contribution from John Clayton and Tracey Edwards (NIWA)

Update on LakeSPI – a new concept in ecological assessment

Further to our March 2002 Issue 3, we have an update on this new method that uses aquatic plants to assess the ecological condition of a lake.

LakeSPI is a management tool that uses Submerged Plant Indicators (SPI) for assessing the ecological condition of New Zealand lakes and for monitoring trends in lake ecological condition. This method was introduced in the last newsletter and since this issue, the LakeSPI Technical Report and LakeSPI User Manual have now been released as Version One and are available for download from the NIWA web site: http://www.niwa.co.nz/ncwr/lakespi

The developers of this method were invited to present a paper in France during the recent September 2002 European Weed Research Society Conference. This conference, held only every 4 years, specialises in aquatic plant issues worldwide. The theme of the conference was "use of aquatic plants as indicators". Although the LakeSPI method was developed for NZ lakes it is based on universal ecological principles that make it very relevant for other countries and the method generated considerable interest.

Post conference, also provided an opportunity to dive on one of the 'better' French lakes to view the aquatic vegetation and to consider the potential application of the LakeSPI method to European lakes. After this experience and from viewing a diversity of other French lakes the overall impression was that of just how lucky New Zealanders are with the many high quality lakes we have!

Many of the Rotorua lakes, although still impacted by eutrophication and weed invasion, provide such a contrast to the more highly impacted lakes we observed in France. It emphasised the importance of protecting what we have and for encouraging managers to know what is happening to lakes in their region, so that sound management measures can be implemented before irreversible changes take place. It is very easy to take for granted the value of the lakes we have and its a well known fact that it is so much easier and cost effective to prevent deterioration than to attempt restoration once lake values have been compromised.

With the LakeSPI method now complete, subsequent implementation over the next two years will enable further refinements and improvements to be made to the method. It is anticipated that some assistance will be required during initial implementation of the method and prospective users are asked to contact the authors for advice. A revised version will be prepared with extra features designed to make for easier handling of the data in 2004.

John Clayton & Tracey Edwards

NIWA, Hamilton

Dabchicks and boats

Ashleigh Bright, University of Waikato

Readers may recall an article by Ashleigh , describing the dabchick research study, which appeared in Issue 3. Here is an interim report on the study, which is not yet completed.

The New Zealand dabchick, *Poliocephalus rufopectus*, is a protected endemic grebe, confined to the North Island mainland and classified as endangered because no population exceeds 250 individuals. The North Island populations are apparently stable or increasing and there may be little current

conservation concern. However, there have been very few studies of New Zealand dabchicks and there is no reliable method of capturing and marking the birds. Thus, little is known about life history or population dynamics and the ultimate consequences of human presence and recreational activities on dabchick reproduction and survival. We present findings from three separate studies on the New Zealand dabchick carried out on Lakes Rotoiti, Tarawera and Okareka in the Rotorua Lakes Region.

In the first study, we investigated the effects of motorised boat passes at different speeds and frequencies on the behaviour of dabchicks. In the second study, we determined the effect that human-made structures and boat pass frequency had on the numbers of dabchick pairs, chicks and nests. In the third and final study, we compared the force of wind and boat wave wash at dabchick nesting sites.

The results from our studies suggest that boats do appear to have a negative impact on dabchick behaviour. Disturbance from boats may result in energetic constraints, particularly in winter when daylight hours for feeding are reduced or during times of high requirements (e.g. breeding).

Human-made structures (i.e., jetties, boatsheds and houses) do not appear to be affecting dabchick survival or distribution at present levels. There may even be a positive influence of human-made structures on the number of chicks. Human-made structures may provide suitable cover for chicks from predators, refuges from harassment by other bird species or other benefits.

Boat wash did not generate waves with as much force as waves generated by a "moderate breeze" (11-16 knots). Non-prevailing winds are likely to be a significant factor limiting dabchick nesting success. However, wash from boats may also have a negative impact on dabchick nests particularly if the frequency of boat passes is high and boats are travelling at high speeds close to the shoreline.

At their present levels boating activities and human-made structures do not appear to be affecting dabchick survival or limiting distribution. However, recreational boating activities on the Rotorua lakes have increased in the last 10 years and there is no reason for this trend not to continue. Dabchick populations will not support infinite increases in the numbers of boats on the lakes or the number of human-made structures. We do not know what this threshold level will be. We provide recommendations for further research and management of New Zealand dabchicks.

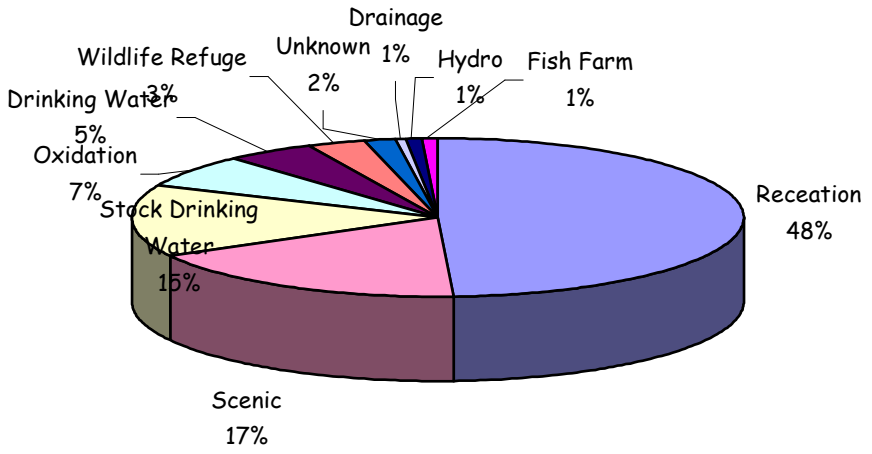
Toxic Cyanobacteria in New Zealand – PhD – Susie Wood
A 6-monthly report for the Lakes Water Quality Society

Summary of Summer 2001/2 work

Methods:

To raise interest in my project, an advertising campaign that involved speaking at conferences and a large mailout was initiated. From November 2001 to April 2002 over 130 water samples were received or collected. Some of these samples were gathered during field trips but the large majority were sent in by people and organisations around New Zealand. Initially waterbodies experiencing algal blooms or with known problems were targeted but samples were not restricted to these as even when not visible, toxic cyanobacterial may still be present. The samples came from a large variety of water use categories as shown in Figure 1.

Figure 1: Primary Water Use of Waterbodies Sampled

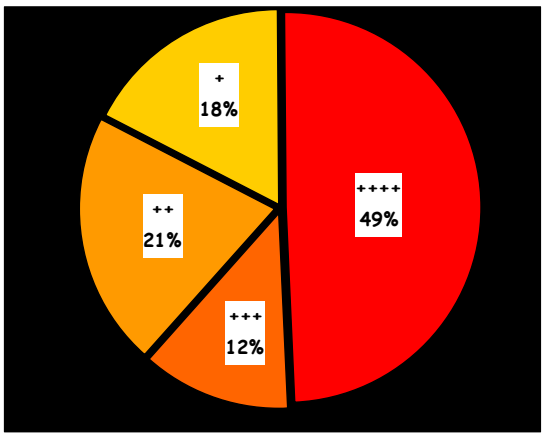


When received the water samples were stored at 4°C and divided into three portions; a small amount was preserved, a second portion frozen for later toxin analysis and a third portion analysed immediately under a light microscope for species identification. If cyanobacterial were present they were quantified according to a contamination index; at 100x magnification + = 1colony or greater per 10 optical fields, ++++ = more than five colonies per field etc. All samples were tested for the cyanotoxin microcystin using an ELIZA developed by AgResearch in Ruakura. This gives the total amount of microcystin present in a sample.

Okawa Bay – Jan 2002

Results:
44% of samples contained cyanobacteria. The percentage of samples in each of the contamination indices is shown in Figure 2.

Figure 2: Percentage of samples in each contamination index.



The following 10 potentially toxic cyanobacterial species were observed in the samples. The number of samples the species were observed in, is given in brackets following the species name.

- *Microcystis aerogenosa* (23)
- *Microcytis sp.?* (2)
- *Anabaena solitaria* (6)
- *Anabaena circinalis* (11)
- *Anabaena flos-aquae* (2)
- *Anabaena spirodies* (2)
- *Anabaena sp.* ? (7)
- *Planktothrix mougeotii* (8)
- *Planktothrix peronata* (6)
- *Planktothrix sp.?* (2)

Microcystin in samples:
In the samples in which cyanobacteria was observed, 51% of them contained microcystin, 16% contained traces of microcystin and 33% contained no microcystin.

56% of the samples contained no visible cyanobacteria, however 15% of these contained microcystin, 25% contained traces of microcystin and 60% contained no microcystin.

A sample from Lake Horowhenua in February contained over 9000mg/ml of microcystin. This was the highest level of microcystin detected in a sample.

An excel sheet with full results is attached to this report.

Future Work:

During the months of June and July 2002 I was traveling in North America competing in international road cycling races. I have now restarted work on this project.

All samples collected last summer are currently being analysed for saxitoxins using an ELSIA.

Work planned for this summer includes further sample collection and analyses, and in depth studies of several lakes. Possible study lakes are Lake Horowhenua and Lake Rotoehu. Studies may include looking

at changing levels of toxins during a bloom, different detection methods and an experimental study looking at accumulation of toxins in freshwater bivalves.

Acknowledgments

Many thanks to my supervisors Dr Bob Wear (Victoria University) & Dr John Ruck (Massey University, Wellington) for their help and ideas. The LakesWater Quality Society for their generous financial support and AgResearch (Ruakura) & ESR for help with cyanotoxin detection methods.

Lake Horowhenua –January 2002

The results spreadsheet mentioned in this report is shown on the following pages as a Word table, in landscape format. Much of the data refers to waterways elsewhere in the country, but we have left all the data in, to provide an interesting comparison and background.

No.	Sample Location	Date	Water Use	*Cyanobacteria Sp. 1*	Qty.	*Cyanobacteria Sp. 2*	Qty.	*Cyanobacteria Sp. 3*	Qty.	Microcystins	Notes
05002	Oxidation Ponds - Western Taupo	10/01/02	Oxidation	*Planktothrix mougeotii*	*++++*	*Microcystis aerogenosa*	*++++*			yes - too high	retest
08002	Lake Horowhenua	17/02/02	Recreational	*Microcystis aerogenosa*	*++++*					positive- data pending	
07502	Horowhenua - Domain	29/01/02	Recreation	*Microcystis aerogenosa*	*++++*					positive- data pending	
00801	Horowhenua (Domain)	25/11/01	Recreation	*Microcystis aerogenosa*	*++++*					positive- data pending	
00701	Horowhenua (middle)	7/11/01	Recreation	*Microcystis aerogenosa*	*++++*					positive- data pending	
06902	Lake Rotoheu	28/01/02	Recreation	*Microcystis aerogenosa*	*++++*					25	
11402	Masterton - oxidation pond #1	25/03/02	Oxidation	*Planktothrix mougeotii*	*++++*	*Microcystis aerogenosa*	*+++*			20	
09102	Masterton Oxidation Ponds - 3	13/03/02	Oxidation	*Planktothrix mougeotii*	*++++*					17	
093A02	Lake Omapere A	2/03/02	Recreation	*Microcystis aerogenosa*	*++++*					8.3	RETEST
01201	Rotoehu	26/11/01	Recreation	*Microcystis aerogenosa*	*++++*					5	
05502	Lake Orakai (Napier)	18/01/02	Stock DW?	*Anabaena spirodies*	*+++*	*Anabaena sp?*	*+++*			4	
00601	A.Richardson (Northland)	29/11/01	Human & Stock Drinking Water	*Microcystis sp.*	*++++*					3.5	Sludge Samlpe
092B02	Kaitaia Oxdation Ponds - 2	3/03/02	Oxidation	*Planktothrix mougeotii*	*++++*					2	
05102	Henly - Masterton	19/01/01	Recreation	*Anabaena circinalis*	*++*					2	
092C02	Kaitaia Oxdation Ponds - 3	13/03/02	Oxidation	*Planktothrix mougeotii*	*++++*	*Arthrospira cf.maxima*	*+*			1.5	
092A02	Kaitaia Oxdation Ponds - 1	13/03/02	Oxidation	*Planktothrix mougeotii*	*++++*					0.9	
08102	Lake Papaitonga	17/02/02	Scenic	*Planktothrix peronata*	*++*					0.9	
05902	Rototiti - Ohau Channel (Rotorua)	28/01/02	Receation	*Anabaena solitaria*	*++++*	*Microcystis aerogenosa*	*+*			0.6	
03201	Sth Oxidation Pond - Bleheim	1/01/01	Oxidation	*Planktothrix mougeotii*	*++++*					0.5	
05802	Rototiti - Te Weta Bay (Rotorua)	28/01/02	Receation	*Anabaena solitaria*	*+++*	*Microcystis aerogenosa*	*+*			0.4	
04002	Henly - Masterton	6/01/01	Recreation	*Anabaena circinalis*	*+*					0.4	
077A02	Rototiti - Okawa Bay	30/01/02	Recreation	*Anabaena circinalis*	*++*	*Microcystis aerogenosa*	*+*			0.35	
077B02	Rototiti - Okawa Bay	30/01/02	Recreation	*Anabaena circinalis*	*++*	*Microcystis aerogenosa*	*+*			0.35	
06302	Rototiti - Okawa Bay, Marina (Rotorua)	28/01/02	Receation	*Anabaena solitaria*	*+++*	*Microcystis aerogenosa*	*+*			0.27	
05702	Rototiti - Okawa Bay (Rotorua)	28/01/02	Receation	*Anabaena solitaria*	*+++*	*Microcystis aerogenosa*	*+*			0.25	
06002	Rototiti - Okawa Bay (Rotorua)	28/01/02	Receation	*Anabaena solitaria*	*+++*	*Microcystis aerogenosa*	*+*	*Anabaena circinalis*	*+*	0.25	
07302	Lake Ngahewa - Rotorua	28/01/02	Recreation	*Anabaena solitaria*	*+++*	*Microcystis aerogenosa*	*+*			0.15	
06702	Lake Okaro	29/01/02	Recreation	*Anabaena flos-aquae*	*++*					0.15	
08602	Lake Pauri	22/02/02	Recreation ?	*Planktothrix peronata*	*+++*					trace	retest
10902	Southland Stream ??	?	Stock DW??	*Planktothrix peronata*	*+++*					Trace	
11202	Lake Omapere	26/03/02	Recreation	*Microcystis aerogenosa*	*++*	*Anabaena solitaria*	*++*			trace	retest
04502	Torrington - Upper Dam (Wainui)	11/01/01	Stock DW	*Coelosharerium sp ?*	*++*					Trace	
09702	Lake Henly - Masterton	18/03/02	Recreation	*Anabaena circinalis*	*++*					trace	retest
06202	Lake Rotorua - Beach Front	28/01/02	Receation	*Planktothrix sp.*	*+*					Trace	
07602	Riverton - Creek	5/02/01	Stock DW	*Planktothrix sp.*	*+*					Trace	
083C02	Waimanu Lagoons - Nth	17/02/02	Recreation	*Planktothrix peronata*	*+*					Trace	
00601a	A.Richardson (Northland)	30/11/01	Human & Stock Drinking	*Microcystis sp.*	*+*					Trace	Water Sample

			Water								
01001	Waihola	17/11/01	Recreation	*Anabaena flos-aqua*	+					?	RETEST
09002	Waihola	14/03/02	Recreation	*Anabaena sp??*	++++					0	
08502	Waihola	12/03/02	Recreation	*Anabaena flos-aquae*	++++					0	
078A02	Karori - Lower Lake - Nth	6/02/02	Wildlife Refuge	*Anabaena circinalis*	++++					0	
02401	Lake Rotehu - Te Pohue Bay	6/11/01	Recreation	*Anabaena sp??*	+++					0	
08402	Lindale Pond	17/02/02	Recreation	*Anabaena circinalis*	+++	*Anabaena Sp?*	+			0	
078B02	Karori - Lower Lake - Mid	7/02/02	Wildlife Refuge	*Anabaena circinalis*	+++					0	
078C02	Karori - Lower Lake - Sth	8/02/02	Wildlife Refuge	*Anabaena circinalis*	+++					0	
083A02	Waikanae Estuary - Nth	17/02/02	Recreation	*Planktothrix peronata*	++					0	
11302	Lake Forsyth	27/03/02	Recreation, Stock DW	*Nodularia spumigena*	++					0	retest
093B02	Lake Omapere B	2/03/02	Recreation	*Microcystis aerogenosa*	++					0	RETEST
093C02	Lake Omapere C	2/03/02	Recreation	*Microcystis aerogenosa*	++					0	RETEST
2901	Lake Opuri	10/12/01	Recreation	*Anabaena sp??*	++					0	
089B02	Mrs D Ellis - Paparoa - Northland	??	??	*Anabaena sp??*	++					0	
10602	Lake Horseshoe	16/03/02	Scenic	*Planktothrix peronata*	+					0	
11002	Whakaipo Bay - Lake Taupo	27/03/02	Recreation	*Microcystis aerogenosa*	+	*Anabaena circinalis*	+			0	
00501	Horowhenua	21/10/01	Recreation	*Microcystis aerogenosa*	+					0	
09402	Lake Rotoroa (Hamilton)	10/03/02	Recreation	*Microcystis aerogenosa*	+					0	RETEST
08702	Richardson Rd (Wanganui)	22/02/02	Recreation ?	*Anabaena sp??*	+					0	
03101	Nth Oxidation Pond - Bleheim	1/01/01	Oxidation	*NO*						4.6-6.6ng/ml	
10702	Taylors Dam - SW end	17/03/02	Scenic	*NO*						3.2ng/ml	
04702	Torrington - Lower Dam(Wainui)	11/01/01	Stock DW	*NO*						1-4ng/ml	
00901	Papaitonga	25/11/01	Scenic	*NO*						100ng/ml + ??	RETEST
01101	Small Lake near Cromwell	17/11/01	? Recreation	*NO*						1.5ng/ml+	RETEST
05202	Lake Hatuma (Waipukurau)	19/01/02	Recreation	*NO*						1.3-2.7ng/ml	
025A01	Wincester - Farm Pond- Rotorua	4/12/02	Human & Stock Drinking Water	*NO*						0.8ng/ml	
04102	Queen Elizabeth Park - Masternton	6/01/01	Scenic	*NO*						0.33-0.45	
03001	Pond near Oxidation pond - Bleheim	1/01/01	No Use	*NO*						0.3-0.4ng/ml	
03401	Waihopa Cemmetry Pond	1/01/01	Scenic ??	*NO*						0.2ng/ml	
03901	Small pond Nelson??	1/01/01	Scenic	*NO*						.2-.3ng/ml	
01601	Boundary Dam (COXE4 - Waiotira)	29/11/01	Stock DW	*NO*						Trace	
01701	Kahakatra (COXE5 - Waiotira)	29/11/01	Stock DW	*NO*						Trace	
02201	S.Mcintosh - Farm Dam - Scum	16/12/01	Scenic	*NO*						Trace	
03301	Lrg Pond Golf Course - Bleheim	1/01/01	Scenic	*NO*						Trace	
03501	Taylors Dam - West Bank	1/01/01	Scenic	*NO*						Trace	
03601	Taylors Dam - Sth East Bank	1/01/01	Scenic	*NO*						Trace	
03701	Pond Sth Eastof Taylors Dam	1/01/01	Stock DW	*NO*						Trace	
03801	Pond West of Taylors Dam	1/01/01	Scenic	*NO*						Trace	

04202	Wairapara	6/01/01	Recreation	*NO*						Trace		
043A02	Lyndon	8/01/01	Recreation	*NO*						Trace		
04802	Torrington - Sth Pond(Wainui)	11/01/01	Stock DW	*NO*						Trace		
05302	Lake Tutira (Napier)	18/01/02	Recreation	*NO*						Trace		
05402	Lake Waikopiro (Napier)	18/01/02	Recreation	*NO*						Trace		
06102	Rototiti - Mid Lake (Rotorua)	28/01/02	Receation	*NO*						Trace		
06502	Te Whaiau Lake	29/01/02	Recreation/Hydro	*NO*						Trace		
07202	Georges Dr - Pond - Napier	27/01/02	Scenic	*NO*						Trace		
10202	Onamalutu Domain Stream	17/03/02	Recreation	*NO*						trace		
10802	Taylors Dam - NE end	17/03/02	Scenic	*NO*						trace		
11102	***									0		
00101	Wiritoa	21/10/01	Recreation	*NO*						0		
00201	Virginia	21/10/01	Scenic	*NO*						0		
00301	Mangamahoe	21/10/01	Hydro	*NO*						0		
00401	Rotokare	21/10/01	Recreation	*NO*						0		
01301	Woolshed (COXE1 - Waiotira)	29/11/01	Stock DW/Irrigation	*NO*						0		
01401	Middle Dam (COXE2 - Waiotira)	29/11/01	Stock DW	*NO*						0		
01501	Big Dam (COXE3 - Waiotira)	29/11/01	Stock DW	*NO*						0		
01801	Labonte (Waipu)	29/11/01	Fish Farm	*NO*						0		
01901	J.Simons - Farm, Pukeohe - Little	10/12/01	Stock DW	*NO*						0		
02001	J.Simons - Farm, Pukeohe - Big	10/12/01	Stock DW	*NO*						0		
02101	S.Mcintosh - Farm Dam - Bottom	16/12/01	Scenic	*NO*						0		
02301	S.Mcintosh - Farm Dam - Culvet	16/12/01	Scenic	*NO*						0		
025B01	Wincester - Farm River - Rotorua	4/12/02	Human & Stock Drinking Water	*NO*						0		
02601	Lake Brunner	18/12/01	Recreation	*NO*						0		
02701	Lake Pearson	18/12/01	Recreation	*NO*						0		
02801	Lake Kaniere	18/12/01	Recreation	*NO*						0		
043B02	Lyndon	8/01/01	Recreation	*NO*						0		
04402	Coleridge	8/01/01	Recreation	*NO*						0		
04602	Torrington - Stream(Wainui)	11/01/01	Stock DW	*NO*						0		
04902	Torrington - West Pond(Wainui)	11/01/01	Stock DW	*NO*						0		
05602	Lake Rotokawa (Rotorua)	28/01/02	Scenic	*NO*						0		
06402	Lake Rotoaira	29/01/02	Recreation	*NO*						0		
06602	Lake Rotopounamu	29/01/02	Scenic	*NO*						0		
06802	Lake Rotowhero	28/01/02	Thermal	*NO*						0		
07002	ToRepatutaki Swamp - Near Taupo	28/01/02	Stock DW	*NO*						0		
07102	Otamangakau	29/01/02	Recreation/Hydro	*NO*						0		
07402	Private Lake - Rotorua/Taupo Rd	29/01/02	Scenic	*NO*						0		
078D02	Karori - Upper Lake	9/02/02	Wildlife Refuge	*NO*						0		
07902	Belmont Park - Pond	9/02/02	Stock DW	*NO*						0		

08202	Ngaumanu	17/02/02	Recreation	*NO*							0	
083B02	Waimanu Lagoons - Sth	17/02/02	Recreation	*NO*							0	
08802	Wiritoa	22/02/02	Recreation	*NO*							0	
089A02	Mrs D Ellis - Paparoa - Northland	??	??	*NO*							0	
095A02	Helensville Dam # 1	13/03/02	Drinking Water	*NO*							0	
095B02	Helensville Dam # 3	13/03/02	Drinking Water	*NO*							0	
09602	Elizabeth Park - Masterton	18/03/02	Recreation/scenic	*NO*							0	
09802	Lake Rotoroa - Nelson Lakes	16/03/02	Recreation	*NO*							0	
09902	Lake Rotoiti - Nelson Lakes	16/03/02	Recreation	*NO*							0	
10002	Farmers Pond - St Arnaud	17/03/02	Stock DW	*NO*							0	
10102	Lake Mahinapua	14/03/02	Recreation	*NO*							0	
10302	Lake Kaniere	13/03/02	Recreation	*NO*							0	
10402	Lake Chalice	17/03/02	Scenic	*NO*							0	
10502	Gravel Pit - Wairau River	17/03/02	-	*NO*							0	
15502	Glen Innis Pond	1/04/02	Recreation	*NO*							0	