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)

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Welcome to the tenth 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 or the 2002 workshop, 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.rotorua.rsnz.org . 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 March 2004 – given 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.

We wish all our readers a Merry Christmas and a pleasant holiday break.

CONTENTS

NEWS

The Rotorua Lakes 2003 Symposium was held in early October, and attracted 247 registrants. A good variety of speakers presented on a wide range of topics. A number of poster presentations dealt with ongoing research on the Rotorua Lakes. The Proceedings are at an advanced stage of preparation and we expect to send them out in January. If you have not ordered a copy, but wish to do so, please email Nick Miller (millern@wave.co.nz).

The first cyanobacterial blooms of the summer have been making themselves noticed in lakes Rotorua and Rotoiti. Local residents are hoping that this summer will be better than the last, but the signs are not promising. At the time of writing, Te Weta Bay (Rotoiti) has a distinctly unhealthy hue. One side-effect of the cyanobacterial summer has been the number of large rainwater tanks that have been delivered into the area. Many households have abandoned a reliable (but now unsafe) lake water supply for a somewhat safer (but unreliable) rainwater supply. There is talk of a municipal supply but the urgency of the water supply situation has led to many individuals taking their own action.

Contribution from the University of Waikato

Report on Lake Rotoiti and Rotorua

David Hamilton, Will Alexander and David Burger recently submitted a report to the Lakes Water Quality Society on lakes Rotoiti and Rotorua. The main findings for Lake Rotoiti are that internal loads (i.e. inputs from the bottom sediments) are extremely high in phosphorus, moderate in ammonium, and that there is substantial loss of nitrate through denitrification when the bottom waters become anoxic. These factors have contributed to low ratios of inorganic and total nitrogen to phosphorus, which could be expected to contribute to favour dominance of blue-green algae. Compared with 1981-82, ratios of inorganic and total nitrogen to phosphorus declined in 2002-3, especially in bottom waters, and nitrate has declined from moderate levels (about 20-50 mg/m^3) to around detection limits (< 5 mg/m^3) in surface waters. The conditions that existed in 2002-3 provide strong circumstantial evidence that the anoxic conditions in Lake Rotoiti favour dominance of phosphorus over nitrogen, and that blue-green algae would be favoured under these conditions. Evidence of nitrogen fixation of blue-green algae in Okawa Bay and the main basin of Lake Rotoiti provides further strong evidence that blue-green algae are taking advantage of the low nitrogen conditions to out-compete other species of phytoplankton.,

For Lake Rotorua, the report is a brief synopsis of David Burger's water column measurements of nitrogen and phosphorus for his Ph.D. research. Short-term stratification events in summer induce temporary declines in oxygen levels in bottom waters which lead to release of phosphorus and nitrogen from the bottom sediments into the water column. Two of these events in early 2003 were estimated to have released >20 tonnes of phosphorus and > 300 tonnes of nitrogen.

Conference presentation - Eloise Ryan

Eloise Ryan recently attended the combined Australia-New Zealand Limnology Society conference in Warrnambool, Victoria. An abstract of her presentation is given here:

Factors controlling phytoplankton composition and biomass in the Rotorua lakes, by E. F. Ryan, D. P. Hamilton, J. A. Hall and U. V. Cassie Cooper

The objective of this study is to investigate the role of mixing, light and nutrients in the vertical distribution of phytoplankton in Lakes Tarawera, Tikitapu and Okareka. Each of these three lakes has a deep chlorophyll maximum (DCM). These DCMs are situated at depths between 15-19 m in Lakes Tikitapu and Okareka and 29 – 32 m in Lake Tarawera. Differences between the surface and subsurface communities are also being described in each lake. Different species contribute to the DCM. In Lakes Tikitapu and Okareka the DCM is composed mostly of dinoflagellates (*Peridinium* spp.). Continuous profiling over each day was necessary to capture vertical migrations by *Peridinium* in response to vertical variations in nutrients and light. The DCM in Lake Tarawera was comprised mostly of diatoms, which suggests that it was formed by physical factors (i.e. sinking of diatoms cells interacting with lake mixing) rather than biological factors (i.e. vertical migration) as was found in Lakes Tikitapu and Okareka. Carbon-13 uptake and nutrient spiking experiments have been carried out *in-situ* to determine phytoplankton growth rates and nutrient requirements. The results indicate that phytoplankton in the DCM from Lake Tarawera are primarily light limited and have adequate supply of nutrients, while those from the DCM in Lakes Okareka and Tikitapu are primarily nutrient limited. Our study is continuing with an investigation of the hypothesis that the breakdown of the winter DCM in Lake Tarawera leads to the annual peak phytoplankton biomass as found in large lakes during winter. The classical paradigm of phytoplankton seasonality in temperate monomictic lakes suggests that light, temperature and mixing regimes cannot support net phytoplankton growth in winter. We

hypothesise that the deepening of the thermocline as has been observed in Lake Taupo during winter, with entrainment of nutrients from depth, may lead to the large winter phytoplankton biomass.

New Students

Wendy Paul has been sampling Lake Okaro to do a before and after evaluation of chemical flocculants in the lead-in to her Masters study. Environment Bay of Plenty is evaluating the use of these flocculants for the control of nutrient levels at a whole lake scale.

Nina Van Westernhagen recently started a Ph.D. to examine Lake Rotoiti in detail, particularly the effects of the Ohau Channel and anoxia.

GLEANINGS – some interesting papers seen recently (other contributions to this section are welcome.)

Mycorrhizal fungi can dominate phosphate supply to plants irrespective of growth responses.

Smith, S.E.; Smith, F.A.; Jakobsen, I. *Plant Physiology*, September 2003, Vol. 133, pp 16-20.

Arbuscular mycorrhizal (AM) fungi are vital components of nearly all terrestrial ecosystems, forming mutually beneficial (mutualistic) symbioses with the roots of around 80% of vascular plants and often increasing phosphate uptake and growth. The authors present novel data showing that AM fungi can provide the dominant route for plant P supply, even when overall growth or P uptake remains unaffected. The results will change our understanding of the roles of AM fungi in agricultural and natural ecosystems: they also predict that mycorrhiza-specific plant P transporters must pay a major role in plant P uptake regardless of whether the plants respond to AM colonization by taking up more P per plant or by increased dry weight, compared with non-mycorrhizal control plants.

This work might well have some relevance to agricultural practices in lake catchments.

As a Christmas bonus we have included this whimsical piece which may appeal to those readers who are bemused by popular views of chemistry.

A popular chemical glossary

David Jones

Additive: A chemical maliciously added to an otherwise natural product. See Pure.

Animal: Creature with rights. See Pest.

Atom: Highly explosive and radioactive constituent of bombs, atomic power plants. and nuclear waste. See Nuclear-free zone.

Cancer: Terminal disease brought on by chemicals.

Chemical: Synthetic substance that is bad for you or the environment.

Chemical Industry: A large and wicked enterprise dedicated to the production and dispersal of pollutants.

Chemist: (a) A friendly figure in a white coat who dispenses drugs. (b) A sinister figure in a white coat who synthesizes chemicals

Cosmetic: Chemical tested on human beings to avoid risk to animals.

Drug: (a) A chemical with redeeming features. (b) A chemical with no redeeming features.

Ecology: A discipline for classifying activities, substances, objects, and technical operations into their due degrees of goodness or wickedness. See Green.

Environment: Recently discovered territory in urgent need of protection from pollutants.

Environmental regulations: Bureaucratic form of exorcism for. warding off chemicals. See Permitted level.

Free: (as in lead-, chlorine-, CFC-, etc.) (of a product). Uncontaminated by lead, etc., owing to great self-restraint on the part of the manufacturer.

Friendly: (as in dolphin-, ozone-, environment-, etc.). (of a product) Less harmful to dolphins, etc., than the previous formulation:.'

Gas: A chemical in vapor form. Requires the adjectives "poisonous" or "deadly."

Green: (of a product) Containing fewer chemicals than it might (general) conducive to feelings of ecological. virtue or self-satisfaction..

Harmless: approved, nonpolluting, safe, etc.: (of a chemical), insufficiently investigated.

Homeopathic remedy: Medicine containing just enough chemicals.

Incinerator: Device for increasing the toxicity of waste before dispersing it in the environment.

Insecticide: Chemical deadly to vertebrates and higher forms of life.

Junk food: A mixture of additives.

Natural: Extracted from the environment without the use of chemicals. See Synthetic.

Nuclear-free zone: Municipal region containing no atoms.

Part per million, part per billion, etc.: (of a chemical) Dangerously excessive concentration.

Permitted level: (of a chemical) Dangerously excessive concentration resulting. from insufficiently rigorous environmental regulations.

Pest: Creature without rights..

Plastic: Subtle chemical that pollutes the environment simply by cluttering it up.

Pollutant: Any chemical loose in the environment. See Chemical Industry.

Radiation: Form of invisible evil that goes through everything. Requires the adjectives "dangerous" or "hazardous." Given off by atoms and some other technological products.

Radon: Form of radiation resulting from atoms getting into houses.

Recycling: Expensive but virtuous process for taking waste that nobody wants and turning it into raw material that nobody wants.

Synthetic: A nasty substitution for something natural.

Vitamin: Benevolent nonchemical substance found in natural foodstuffs. Destroyed by boiling.

Waste: Mixture of pollutants. Requires the adjective "toxic." In. a perfectly green world, no activity would produce any waste.

Zinc, selenium, copper gluconate, beta-carotene, chromium, etc.: (a) Benevolent ingredients of natural foodstuffs and diet supplements, conducive to health. (b) Poisonous synthetic chemicals.

David Jones is at the University of Newcastle upon Tyne in England. He writes the "Daedalus" column in *Nature*, but is most widely known for identifying arsenic in Napoleon's wallpaper.

(From *Chemtech* December 1993.)