The potential for inferring trophic state of Lake Wairarapa using zooplankton community composition

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by

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INTRODUCTION

The use of biotic responses to infer lake trophic state (i.e., the bioindicator approach) is commonly neglected in favour of chemical and physical methods. Duggan et al. (2001a, 2001b, 2002) found that trophic state was the main determinant of rotifer distribution among North Island, New Zealand, lakes. Based on these responses developed a quantitative bioindicator index, using rotifer community composition, to infer Trophic Lake Index (TLI) values (*sensu* Burns et al. 1999). This approach was recently used successfully to infer trophic state changes in lakes of the Auckland region (Duggan & Barnes 2006). In this report I evaluate whether Lake Wairarapa would be a suitable candidate for monitoring trophic state using zooplankton during Wellington Regional Council's regular quarterly sampling, and what the number of net samples would be required during monitoring (i.e., to collect greater than 300 individual zooplankton).

METHODS

Four samples were collected from Lake Wairarapa on December 12, 2005; one from each of Wellington Regional Council's regular sampling sites. Sites 2 and 4 were sampled using a 40 µm mesh plankton net hauled vertically through the water column (~ 2 m). Each of these sites was sampled by 13 vertical net hauls (Table 1). As sites 1 and 3 were shallower, these were sampled by throwing the plankton net horizontally and towing to the boat over approximately 5 m. Samples were preserved in 70% isopropanol. Sample 2 was examined as it would be during regular monitoring (until >300 individual rotifers had been counted). Small subsamples for the remaining sites were counted to determine the abundances of zooplankton in those samples;

subsamples were counted until greater than 200 individuals were recorded in sites 3 and 4, and more than 100 in site 1.

RESULTS AND DISCUSSION

The minimum number of hauls required to achieve a sample with a minimum of 300 individuals varied between sites, but in all cases a combined sample from 3 hauls or tows would have been adequate on this date (Table 1). This result may rely to some extent on environmental conditions at this time, but sample size required may vary seasonally. For example, New Zealand rotifer abundances are generally greatest in summer and autumn, and lowest in winter and spring (Duggan 1999); samples may potentially have been collected when populations were high. Three hauls or tows will therefore be adequate during summer, but it is suggested that a minimum of six hauls be taken throughout the year to insure reasonable populations are collected.

The aim of this report is not to compare rotifer inferred trophic state with that recorded by other methods in the lake. However, the rotifer inferred TLI values from these single samples, ranging between 6.2 and 6.6, do not seem unreasonable for this lake (Table 1). Although these are calculated based on single samples, it is

Table 1. Method and results of zooplankton sampling from Lake Wairarapa in December 2005, and inferred trophic state from rotifer community composition.

	Site 2	Site 1	Site 3	Site 4
How sampled	13 hauls	6 horizontal tows	6 horizontal tows	13 hauls
Total rotifers in sample	3140	666	3996	7704
Minimum hauls or tows required	2	3	1	1
Inferred TLI	6.54	6.23	6.62	6.37

recommended that four samples from different seasons be used to more accurately assess TLI from rotifer composition (Duggan et al. 2001b). Lake Waiararapa is sampled quarterly by Wellington Regional Council, while for most physical and chemical variables monthly sampling is typically recommended due to variability through time. As biota (e.g., zooplankton community composition) integrate environmental conditions through time, and as quarterly samples were found to accurately reflect observed TLI in its development, this method of assessment may be well worthwhile to complement traditional monitoring in this system. Additionally, during the development of the rotifer inferred TLI scheme, Duggan et al. (2001b) found measured and rotifer inferred TLI to be well matched for Lake Wairarapa, and may thus provide a good lake for monitoring using this method.

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Appendix 1. Rotifer taxa recorded from Lake Wairarapa

A. Rotifer taxa recorded from Lake Wairarapa December 12, 2005.

Keratella cochlearis
Keratella tecta
Keratella tropica
Pompholyx complanata
Synchaeta oblonga

B. Additional known taxa from Lake Wairarapa recorded by Duggan et al. (2002)

Brachionus caudatus
Brachionus cf. *lyratus*
Hexarthra intermedia
Polyarthre dolichoptera
Synchaeta stylata