Gippsland Coastal Board

Gippsland Lakes Environmental Study - Fact Sheet No. 2

Estimating nutrient loads to the Lakes – How?

Nutrients and the Gippsland Lakes

Nutrients in aquatic environments comprise chemicals that provide nourishment for growth of water-based plants and associated animals. The most common plant nutrients consist of the various chemical forms of nitrogen (N) and phosphorus (P). Additionally organic carbon compounds can be used as a nutrient by some bacteria.

Tambo River at Bruthen, March 1999

Land-use and other changes have altered, amongst other things, the quantity and composition of nutrients reaching the Gippsland Lakes. A transformation in the Lakes ecology has accompanied these changes including increased periods of oxygen deficiency in deeper water areas and an apparent increase in the frequency and extent of algal blooms, particularly those of toxic blue-green algae, which have human health implications.

Such events have had and will continue to have the potential for profound social, economic and environmental consequences should they continue to increase in frequency and extent.

The Gippsland Lakes Water Quality Modelling Project was established to better understand the functioning and potential future responses of the Lakes to altered loads of nutrients and other potential changes. A critical component of the project required accurate prediction of the timing and general locations of primary inputs of nutrients to the Lakes from the catchment, which is 20,600 km^2.

There are numerous approaches to calculating nutrient and sediment loads. A common approach is to simply multiply the volume of water (based on gauged flows) by the average concentration of specific nutrients. This may provide a reasonable estimate of total volumes over longer periods, but for the water quality modelling project, daily loads for each of the major basins within the Lakes were required, and the detail of data was not sufficient to use this approach. The concentration of nutrients also displays significant variation over short-periods of time, corresponding with the nature of rainfall events, volumes of run-off and the catchments drained. These issues combined make estimating loads a complex task.

Accordingly, the Centre for Environmental Applied Hydrology at the University of Melbourne was commissioned to derive relationships between specific riverine inflows to the Lakes and their associated nutrient concentrations. Based on this work they then calculated daily loads of nutrients for use in the water quality models.

Method of Analysis

Information on nutrient concentrations in rivers flowing to the Gippsland Lakes was obtained from various sources including the Victorian Water Quality Monitoring Network, Waterwatch, Catchment Management Authorities, Water Authorities and EPA Victoria.

The available data provided a consistent data set for the derivation of relationships between nutrient concentrations and variables including discharge, time of year and measures of flow over the previous months. The nutrient concentration data consisted of weekly to monthly fixed period sampling, with additional measurement during storms. The six sampling stations selected for nutrient input estimations were located on the lower reaches of the Tambo, Nicholson, Mitchell, Avon, Thomson/Macalister and LaTrobe rivers. Suitably adjusted data from nearby sites was used, where necessary, to complement the available data sets.

The method employed consisted of regressions to determine the relationship between the measured nutrient concentrations and mean daily flows, seasonality, baseflow and antecedent discharge. At some sites, data was separated into high and low flows to account for different regression relationships for different types of flow. The resultant regressions were tested to determine that the relationships were statistically significant and unbiased. They were also compared to data not used in their derivation, illustrating that they were unbiased and optimal. These relationships enabled development of equations for each river predicting daily loads of suspended solids and nutrients (total phosphorus and total nitrogen) entering the Lakes from each of those sources according to flow. An extension of the models enabled load estimates to be generated for other ungauged areas (approximately 20% of the total catchment) draining to the Lakes and separate estimates of nutrient runoff from the Macalister Irrigation District, were integrated to provide total load inputs to the Lakes system.

The table below provides the average annual loads to each of the main Lakes for three key parameters.

Summary of the long-term estimated annual riverine loads into the Gippsland Lakes based on the period 1977 to 1999

	Total Suspended Solids (tonnes/year)	Total Phosphorous (tonnes/year)	Total Nitrogen (tonnes/year)
Lake King	45,270	70	730
Lake Victoria	8,490	10	125
Lake Wellington	165,870	220	1,940
Total	219,630	300	2,800

The Lakes display a large range of diversity in terms of their physical attributes and the pressures placed on them by the catchments that drain to them. This fact sheet is part of a series aimed at informing the community on the results of the project. More detailed information is provided in the technical and final reports, which are available on the Gippsland Coastal Board website (http://www.vcc.vic.gov.au/gcboard).

For further information contact:

Gippsland Coastal Board, 7 Service Street, (PO Box 476), Bairnsdale Vic 3875
phone: (03) 5152 0451, fax: (03) 5152 0444, or e-mail: gcb@net-tech.com.au