Nutrient loads

Indicators and thresholds

Loads of nitrogen and phosphorus entering the Gippsland Lakes are a recognised important driver of algal blooms (Cook et al. 2008, Holland et al. 2009, Cook and Holland 2012). Loads are linked closely to the volume of river inflows, which in turn is linked to rainfall. In high flow (high rainfall) years, loads of nutrients entering the Lakes are generally higher, and in low rainfall years, loads are lower. The relationship between loads and flows has been established by Cook (2011) and thresholds for condition ratings have been derived based on a deviation from these relationships as follows:

- Good = load / flow is lower than long term median
- Fair = load / flow is within long term median (+/- 20%).
- Poor = load / flow is higher than long term median

Consistent with Cook and Holland (2012) loads were calculated using flows and nutrient concentrations from the gauged catchments of the Tambo, Nicholson, Mitchell, Avon, Thomson and Latrobe Rivers (Victorian Water Measurement Information System). Loads were calculated using the Kendal Ratio method (Kendall et al. 1983) stratified for flow using a spreadsheet routine (Tan et al. 2005).

Results

Summary

Indicator	Status and trends				Summary
	Unknown	Poor	Fair	Good	
Nutrient loads					Loads of nutrients entering into the Gippsland Lakes are strongly driven by rainfall in the catchment and river flows. In wet years, more water flows into the lakes, bringing with it more nutrients and sediments. Conversely, dry years bring only small amounts of nutrients into the Gippsland Lakes system. This relationship between loads and flows is complex, and this indicator has been assessed by considering both the amount of nitrogen and phosphorus and the volume of inflowing water. Over the past five years these relative loads of both nitrogen and phosphorus largely been below the long-term average, with the exception of 2014. Flows and loads vary substantially over time, but there appears to be a decreasing trend (improving condition) in nutrients loads following the peaks of 2007.

Data quality:

Good

Data custodian:

Victorian Water Measurement Information System
data.water.vic.gov.au/monitoring.htm

Status

Total nitrogen loads entering the Gippsland Lakes from the six major rivers from 2015 to 2020 ranged between 494 tonnes in 2018 to 1691 tonnes in 2020. Similarly, total phosphorus loads ranged from 23 tonnes in 2019 to 102 tonnes in 2016. While at face value loads are tightly coupled to flows, with higher loads in high rainfall years; condition is assessed by looking at the ratio of nutrients to volume. That is, are more nutrients entering the system per unit volume of water? The flow averaged nutrient concentrations are presented in Figure 1 from 1977 to 2020. This illustrates that in the past five years, which have included mostly low rainfall years, with the exception of 2016/17, the inflow of nitrogen and phosphorus has been largely below the long-term median. The long-term median of the flow averaged total nitrogen and phosphorus concentrations have been 0.69 and 0.07, respectively. In the past five years, the median ratios have been 0.61 and 0.03 respectively, indicating “good” condition.

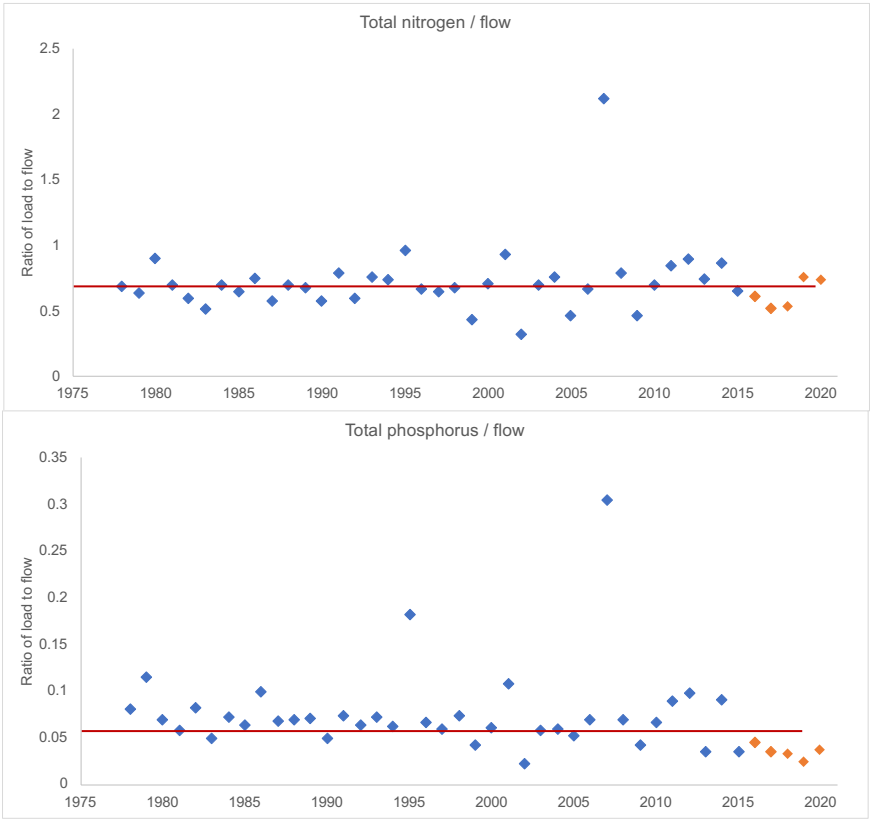

Figure 1: Ratio of total nitrogen (top) and total phosphorus (bottom) loads to flow in the Gippsland Lakes, past five years shown in orange (data 1978 – 2009 provided by Perran Cook, data from 2010 – 2020 calculated from stream flow and nutrient data from the Victorian Water Measurement Information System data.water.vic.gov.au/monitoring.htm)

Trend

Exponentially Weighted Moving Averages of the ratio of total nitrogen and phosphorus loads to flow (Figure 2) indicates that following the peak in 2007 (in the year of the flood following bushfires) there was an increase in loads, but that loads are now returning to more usual levels. There is a clear trend of continued decreasing phosphorus loads into the Gippsland Lakes.

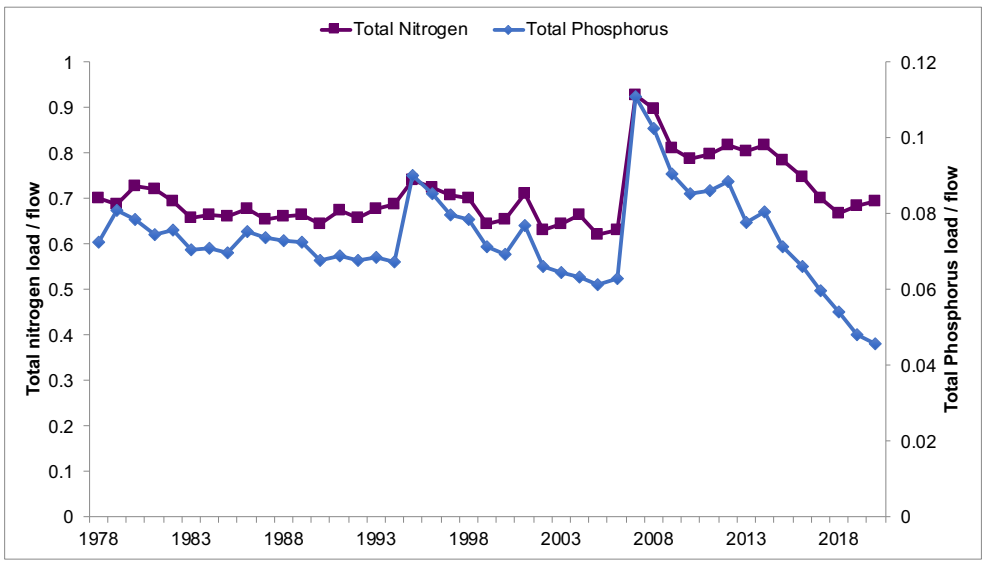

Figure 2: Exponentially weighted moving averages (EWMA) of the ratio of total nitrogen and phosphorous loads to flows.

References

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