Love Our Lakes

Gippsland Lakes Environment Report 2024

Water Quality Key Facts

Salinity and dissolved oxygen

What is salinity and why is it important?

Salinity is a measure of the dissolved salts in water, with the most common salts in natural waters being sodium and chloride. It has a strong influence over ecology of aquatic systems, with species having different salinity tolerances and optimum salinities for growth and reproduction. For example, the salinity regime in the Gippsland Lakes influences:

- the distribution and condition of vegetation communities such as seagrass, swamp paperbark, saltmarsh, reeds, sedges and rushes and submerged freshwater plants
- fish populations and recruitment, particularly for estuarine fish such as black bream, that have specific salinity requirements for successful breeding and recruitment
- the health of Burrunan dolphins
- abundance and diversity of invertebrates, fish and waterbirds through habitat provisions and food chain interactions
- the condition and reproduction of frog species
- the type of phytoplankton that dominate and the incidence and severity of algal blooms.

What is dissolved oxygen and how is it related to salinity?

Dissolved oxygen is the amount of oxygen held in water and available to aquatic organisms. Fish, aquatic invertebrates and submerged aquatic plants such as seagrass all require oxygen that they extract from the water column. Dissolved oxygen is absorbed from the air at the water's surface and produced by plants and algae as a by-product of photosynthesis. The salinity regime effects dissolved oxygen in a number of ways, but most significantly in the Gippsland Lakes stratification is a key feature.

Stratification occurs in Lakes Victoria and King during periods of high to moderate freshwater inflows. The water column becomes divided into two separate layers that do not mix. A surface layer of freshwater overlaying a bottom layer of more dense, saline water. As the bottom layer is not in contact with the air, dissolved oxygen can become reduced (Figure 1).

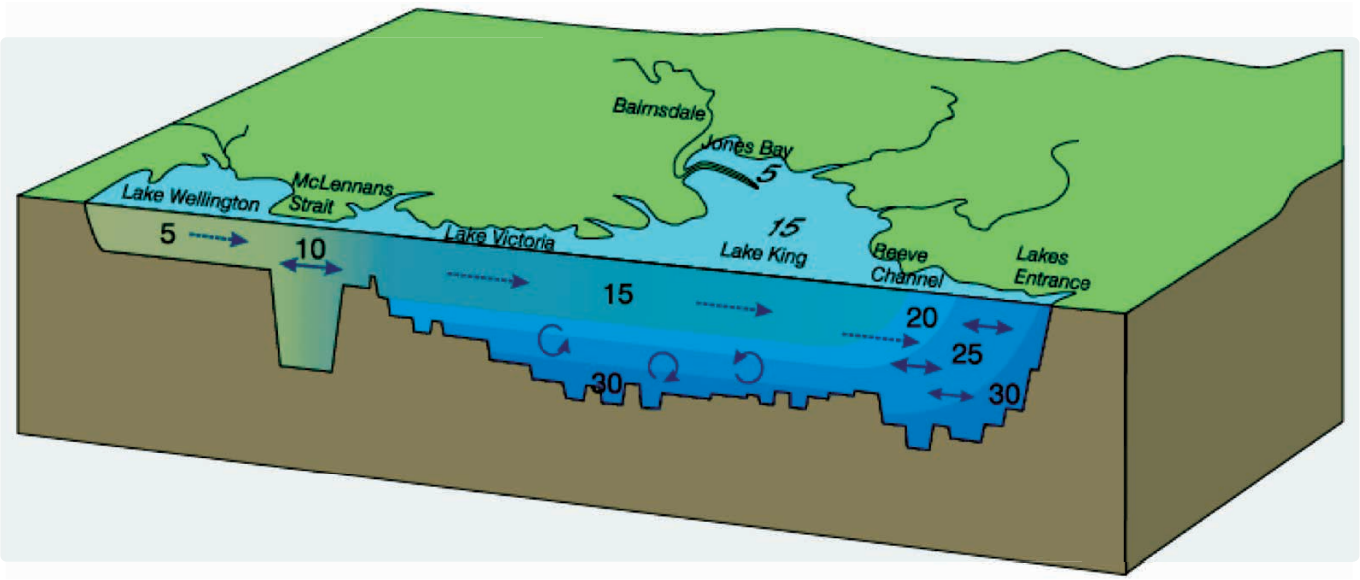


Figure 1 Conceptual model of salinity and stratification in the Gippsland Lakes (Webster et al. 2001). Showing fresher water towards the surface and more saline conditions towards the bottom of the lake.

How do we measure dissolved oxygen and salinity?

Dissolved oxygen and salinity are both measured "in situ" that is measures are taken using water quality meters directly on site. Salinity is measured by passing an electrical current through the water and reported in EC units. Salinity and dissolved oxygen are measured by automatic loggers every 15 minutes in Sale Common, Heart Morass, Macleod Morass and Dowd Morass. The data can be accessed through the Victorian Water Measurement information system (https://data.water.vic.gov.au/).

Environmental Protection Authority (EPA) Victoria also monitors water quality by boat in the main lakes at five sites in Lakes Wellington, Victoria and Lake King. This includes salinity and dissolved oxygen in surface and bottom waters.

What influences salinity in the Gippsland Lakes?

Salinity is influenced by rainfall, river flows and tidal exchange and under average climatic conditions a predictable pattern of salinity occurs across the lakes. The majority of freshwater flows into the Gippsland Lakes come from the western rivers into Lake Wellington. This, together with the tidal exchange from the Entrance, creates a salinity gradient from fresher at Lake Wellington, to more saline at Lake King. There is also a variability in salinity seasonally in both the main lakes and fringing wetlands, with higher winter and spring river flows / rainfall resulting in decreased salinity, and lower river flows in summer and autumn resulting in increases in salinity.

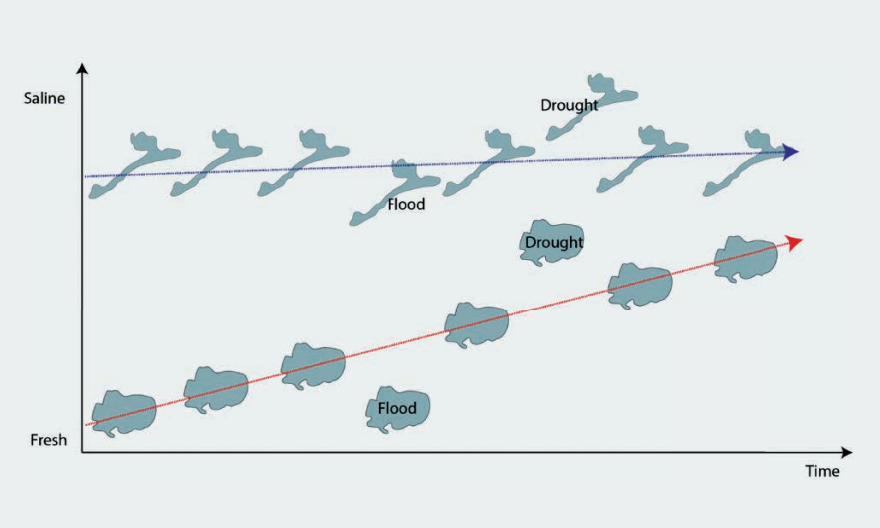
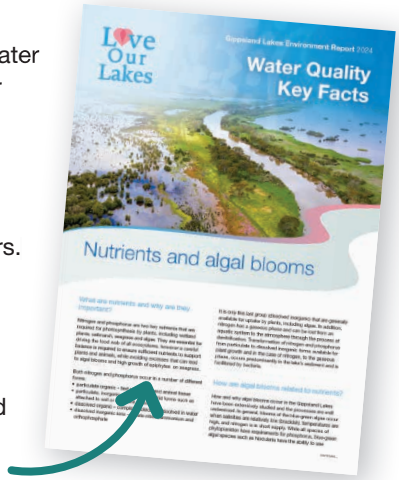


Figure 2 Conceptual diagram showing long term trends in salinity in Lake Wellington (bottom) and Lakes Victoria and King (top) and the periodic effects of events like floods and droughts.

Sustained change and events

Climate change and water resource use have a sustained effect on salinity across the Gippsland Lakes. Decreased freshwater inflows from a drier climate and increased water demand, together with rising sea levels, act to increase salinity in the system. There is clear evidence of a trend of rising salinity in Lake Wellington. The proximity of Lake King and eastern Lake Victoria to the Entrance, means they are more influenced by tidal exchange and to date there is no trend of rising salinity in this part of the Gippsland Lakes since it was listed as a Ramsar site in 1982 (Figure 2).

Events such as king tides, prolonged drought and floods result in large, but relatively short-term changes to salinity regimes. For example, during periods of prolonged low rainfall, there are increases in salinity in the fringing wetlands and Lake Wellington (for example during 2018 – 2019). During floods or in years with very high rainfall, salinity declines, and this occurred in 2020 – 2023, again more markedly in the west, at the greatest distance from the entrance and marine influences. High inflows of freshwater also increase the extent and severity of stratification, with a fresher layer of water sitting on top of a saltier layer at the bottom. As a consequence, there are drops in dissolved oxygen in the bottom waters during flood years. High rainfall years also influence the extent and severity of algal blooms as well as the dominant algal species (as outlined in '**Water Quality Key Facts - Nutrients and algal blooms**').



Salinity levels and dissolved oxygen are monitored regularly at key locations.

What are we doing to manage salinity and dissolved oxygen?

Environmental water is provided to several of the fringing wetlands to maintain hydrology and salinity regimes. The delivery of environmental water has been improved by several regulators that allow freshwater to enter the wetlands during low river flows. This environmental water management has insured that to date Sale Common has remained a freshwater wetland supporting freshwater biota.

There are gates at the southern end of Macleod Morass, where it is connected to Lake King. These prevent the intrusion of saline water from Lake King into the morass while allowing for the discharge of freshwater during high flow events. This helps to maintain the salinity in the wetland and keep the upper parts of the morass predominantly fresh.

There are few management options for managing salinity in the main lakes as it is so highly influenced by weather and climate. What is being done is to ensure that freshwater inflows are not further eroded by extraction in the catchment. Already 20 - 50 % of river flows to Lake Wellington are extracted for consumptive use (including the diversion of drinking water to Melbourne). The Central and Gippsland Region Sustainable Water Strategy contains provisions to not only ensure that flows to the Gippsland Lakes are maintained, but to recover further water for the environment to increase freshwater flows to the system and maintain ecological character.

Love Our Lakes

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Acknowledgement of Country: We acknowledge the Gunaikurnai people, Traditional Owners and custodians of the land and waters of the Gippsland Lakes region, and pay our respects to their Elders past and present. In particular, we pay tribute to the Brayakaulung, Brabralung and Tatungalung clans, whose custodianship is a vital part of the heritage, knowledge and future management of the Gippsland Lakes.