

Water quality snapshot: Miaritch (Oyster Harbour) 2023

Through Healthy Estuaries WA, the Department of Water and Environmental Regulation monitors water quality in Miaritch (Oyster Harbour) and its catchment. This snapshot provides some insights from our water quality monitoring during 2022 and 2023.

Understanding estuary condition and monitoring for change helps to guide how we manage our estuaries

Oyster Harbour (the estuary) tends to have healthy nutrient concentrations and oxygen levels. Nutrient concentrations are highest in the wetter months, and in the northern parts of the estuary closest to the rivers.

Rainfall washes nutrients (nitrogen and phosphorus), and organic matter from the surrounding area (catchment) into the rivers and drains, and then to the estuary. When nutrients are applied in the catchment, for example as fertiliser, they wash into the waterways when it rains. Excessive nutrient availability in waterways can fuel potentially harmful algal growth.

In Oyster Harbour and its catchment, 2022 was a relatively dry year, which meant that flows into the estuary were low. After a very dry start in 2023 the winter months were wetter than average. In particular, June 2023 was very wet as there was rainfall on 25 out of 30 days (compared to 20 days with rainfall in an average June). This led to significant flows into the estuary from June onwards.



Salinity and oxygen

Oyster Harbour is permanently open to the ocean at Emu Point, which allows ongoing exchange of water. When the rivers are flowing into the estuary, river and seawater meet but do not easily mix. This causes stratification: a process of layering where fresh water sits on top of denser salty water. This is a natural characteristic of estuaries, but it prevents the mixing of oxygen, and can lead to low oxygen concentrations at depth where the water becomes stagnant.

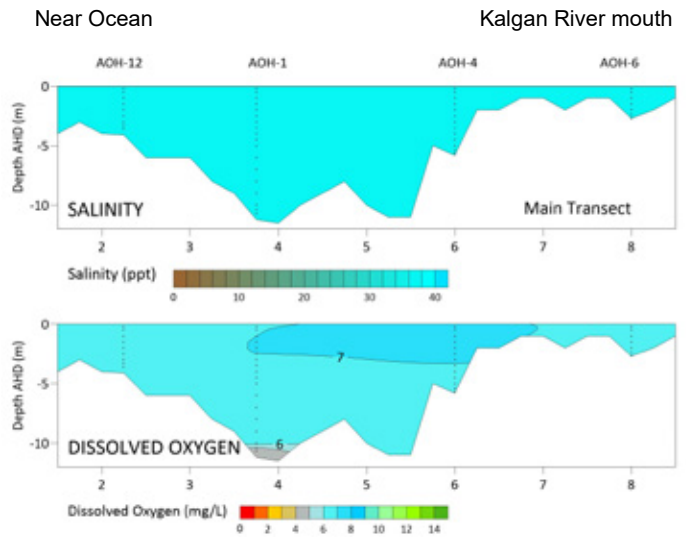
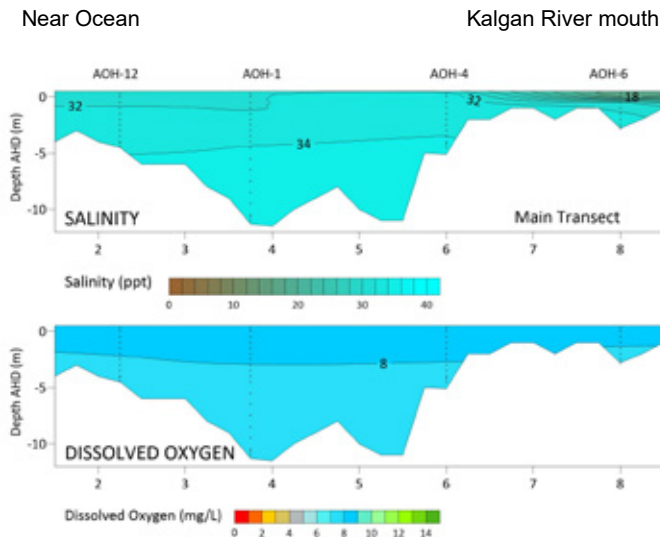
In Oyster Harbour, salinity stratification is mostly weak, and occurs mainly near the rivers at the northern end of the estuary during strong river flows in the wetter months. In very strong flows, the freshwater layer on top of the salty estuarine water can briefly extend all the way to the southern end of the estuary.

During low river flows in the drier months, salinity throughout the estuary is the same as in the ocean and is more uniform.

Oyster Harbour usually has very healthy oxygen concentrations in the water throughout the year; however, pockets of lower oxygen concentrations at the deepest monitoring site near Green Island are occasionally present in summer. These small pockets of deep water can become stagnant because of the way water flows through the estuary. These low oxygen levels can cause release of nutrients from the sediment and potentially be harmful to fish. However, because the affected area is small and confined, it is likely that this has limited impact on the overall health of the estuary.

15 August 2022

27 February 2023



Examples of physical profiles in Oyster Harbour showing how salinity and oxygen vary with depth between the mouth of the Kalgan River and near Emu Point

Key takeaways

- The first example from 15 August 2022 (above) shows fresh water on the surface of the Kalgan River where it meets Oyster Harbour. Rainfall has brought fresh water flows to the Kalgan River, which sat on top of the denser, salty estuary water. At this time, the oxygen conditions were healthy at all depths throughout the estuary.
- The example from 27 February 2023 (above) shows a time where there was a pocket of low oxygen conditions in the deepest part of the estuary. At this time, the salinity was high throughout the estuary basin, indicative of very little river flows. In this case, the stagnant conditions in the small, deep pocket of the harbour, not salinity stratification, caused the oxygen to be temporarily depleted.

Nutrients

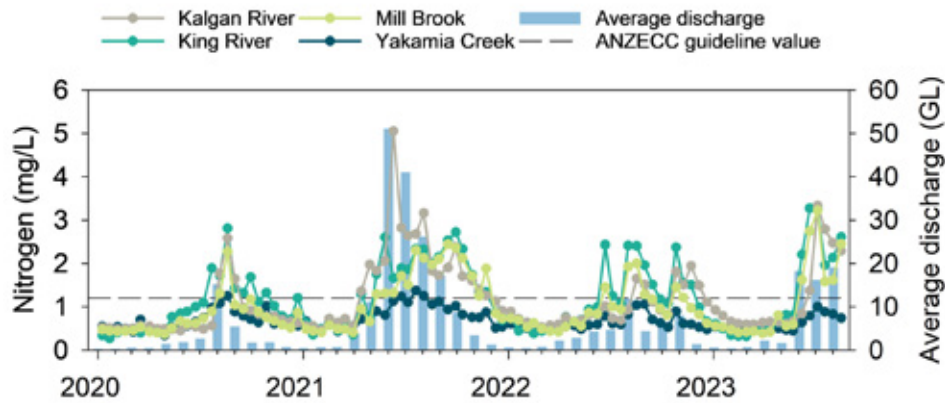
We monitor nutrient concentrations because excess phosphorus and nitrogen can promote algal growth. While algae are a natural part of aquatic ecosystems, excessive algal growth has the potential to harm fish and pose risks to human health and can make waterways unsightly and smelly.

In the catchment

Nitrogen concentrations in Mill Brook and the King and Kalgan rivers were generally above water quality guideline values in the wetter months, an indication of poor water quality.¹ At this time rainfall washes nutrients and organic matter from the soils of the catchments into the rivers. In June 2023, the normal increase in nitrogen concentrations happened more rapidly than usual because of the sudden and prolonged rainfall in June which followed a very dry May. Yakamia Creek had the lowest nitrogen concentrations of the four tributaries, with concentrations only exceeding the water quality guideline value in some winter months of the wetter years. Consistent with previous years, during the drier months, nitrogen concentrations were healthy in Mill Brook and the King and Kalgan rivers.

¹ Nutrient concentrations are compared with [ANZECC and ARM CANZ \(2000\) water quality guidelines for lowland rivers in south-west Australia](#). Guidelines are used to assess risk of adverse effects on water quality.

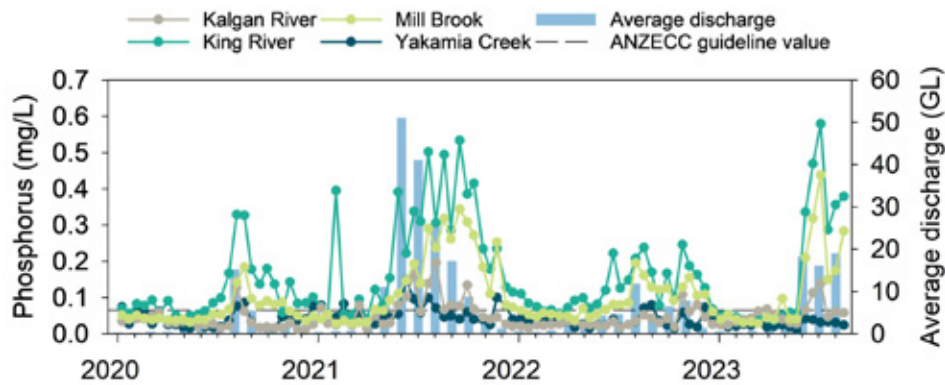




Nitrogen concentrations and average discharge (flow) into Oyster Harbour, showing concentrations increasing with higher river flows during the wetter months of each year

Phosphorus concentrations in the King River and Mill Brook are usually also above water quality guideline values in the wetter months. Similar to nitrogen, in 2023 there was a sharper than normal increase in phosphorus concentrations with the start of the rainfall in June at these two sites. In the Kalgan River, however, phosphorus concentrations are usually lower and vary less across the year, only becoming elevated

under high-flow conditions, as it was in the wet year of 2021. This is because the soils in the Kalgan River’s catchment tend to have better phosphorus retention capacity than those in the King River and Mill Brook catchments. Phosphorus concentrations in Yakamia Creek vary little over time and are mostly at healthy levels.



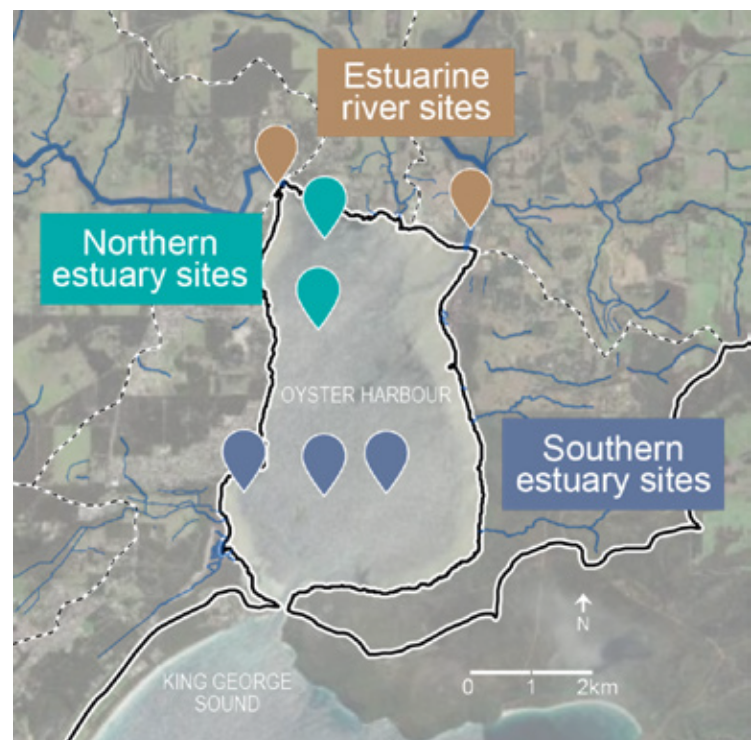
Phosphorus concentrations and average discharge (flow) into Oyster Harbour

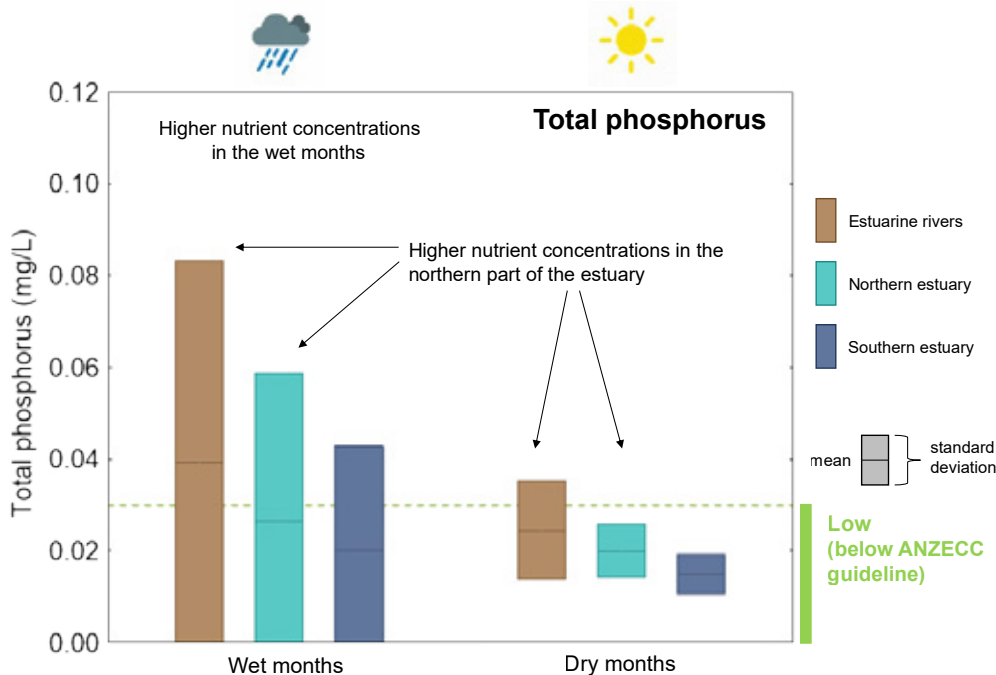
In the estuary

The estuary followed a similar pattern to the catchment, with higher concentrations in winter, especially in wetter years. The relatively low rainfall in winter 2022 meant that nutrient concentrations in the estuary were lower than in the wetter winter of 2023.

The main input of nutrients into the estuary is from river discharge which transports nutrients from the land uses in the catchment. We generally find higher nutrient concentrations at our monitoring sites closest to the rivers compared with those closer to the ocean. This difference is especially pronounced in the winter months. The permanent opening in the south of Oyster Harbour allows ongoing exchange with ocean water, also diluting nutrient concentrations in the estuary.

The occasional low oxygen concentrations in the deepest parts of the estuary would likely cause some release of nutrients from the sediment in the dry months. This is a small nutrient source compared with the amount of nutrients input from catchment land uses.





Microalgae in the estuary

Microalgae are a naturally occurring and important part of estuary ecosystems. They can sometimes be harmful if present at high densities ('algal blooms'), or if they are toxic.

In Oyster Harbour, microalgal activity is generally low. Although nutrient concentrations are higher in the wet

months, microalgal activity is highest in the summer months. This is because microalgae grow faster under well-lit and warm conditions, which prevail in the drier months, when nutrient availability is still sufficient. Microalgae activity was slightly higher in summer 2022–23 than 2021–22, but was still at healthy levels compared with guideline values.

Summary

While occasional low oxygen concentrations in the sediment likely caused some localised nutrient release from the sediment, most of the nutrient inputs come from the catchment's land uses, for example fertiliser or livestock waste.

Microalgal activity is highest in summer, when warmer water temperatures and increased light availability allow algae to grow and take advantage of the available nutrients.

Catchment work continues to be important to ensure the resilience of Oyster Harbour in a changing climate. Reducing nutrient inputs to the estuary from the King River and Mill Brook catchments is particularly important, as these rivers both have high phosphorus concentrations during winter flows.

Healthy Estuaries WA is supporting work in the catchment to reduce nutrient inputs to Oyster Harbour. For example, the program works with farmers on best practice fertiliser and nutrient management, and in keeping livestock out of waterways.