

Water quality snapshot: Nullaki (Wilson Inlet) 2021–22

Through Healthy Estuaries WA, the Department of Water and Environmental Regulation monitors water quality in the inlet and the surrounding catchment. This snapshot provides insights from our water quality monitoring during the record-long opening of the sandbar from June 2021 and throughout 2022. By the time the sandbar closed in early January 2023 it had been open for 563 days – the longest continuous opening on record.

The water quality of Wilson Inlet is generally good, with higher concentrations of nitrogen and phosphorus occurring only during high rainfall, caused by inflows from the catchment.

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

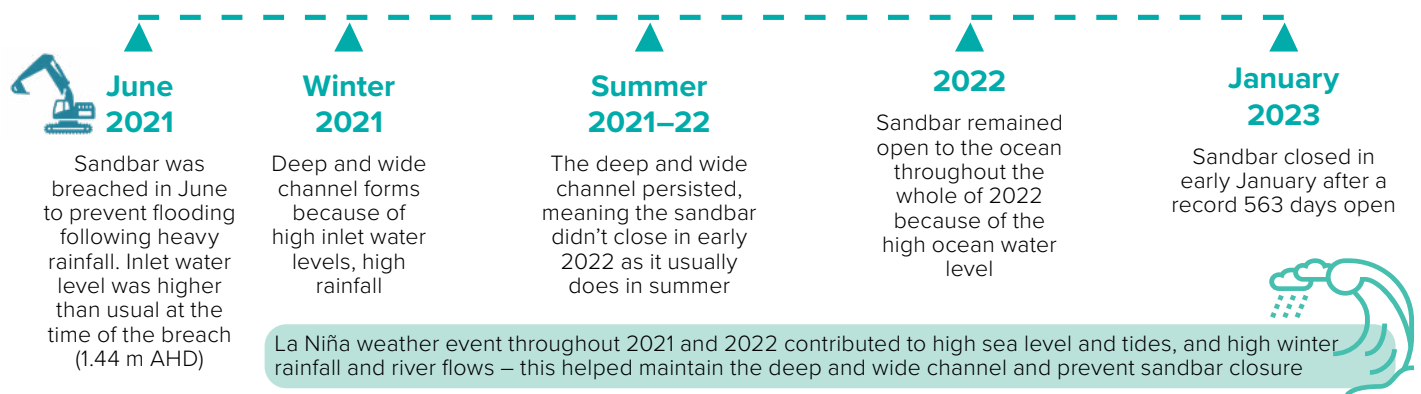
Why did the sandbar remain open for so long?

When the sandbar is ‘open’, there is exchange of water between the estuary and the ocean. When there is no flow from the rivers, sand from the ocean accumulates and eventually closes the channel. The sandbar usually closes in summer.

In June 2021, the sandbar was manually opened (or ‘breached’) following significant rainfall. This was in line with the sandbar protocol to prevent flooding in low-lying areas of the catchment.

The water level at the time of the breach was higher than usual (1.44 metres Australian Height Datum).

A deep and wide channel formed because of the high water level at the time of the breach and high rainfall and river flows during winter 2021. These factors, combined with high ocean levels and tides during the winter because of the La Niña weather event, caused a long-lasting channel.



Nutrients

We monitor nutrient concentrations because excess phosphorus and nitrogen can promote algal growth.¹ While algae are a natural part of aquatic ecosystems, excessive algal growth can make waterways unsightly and smelly, and has the potential to harm fish and pose risks to human health.

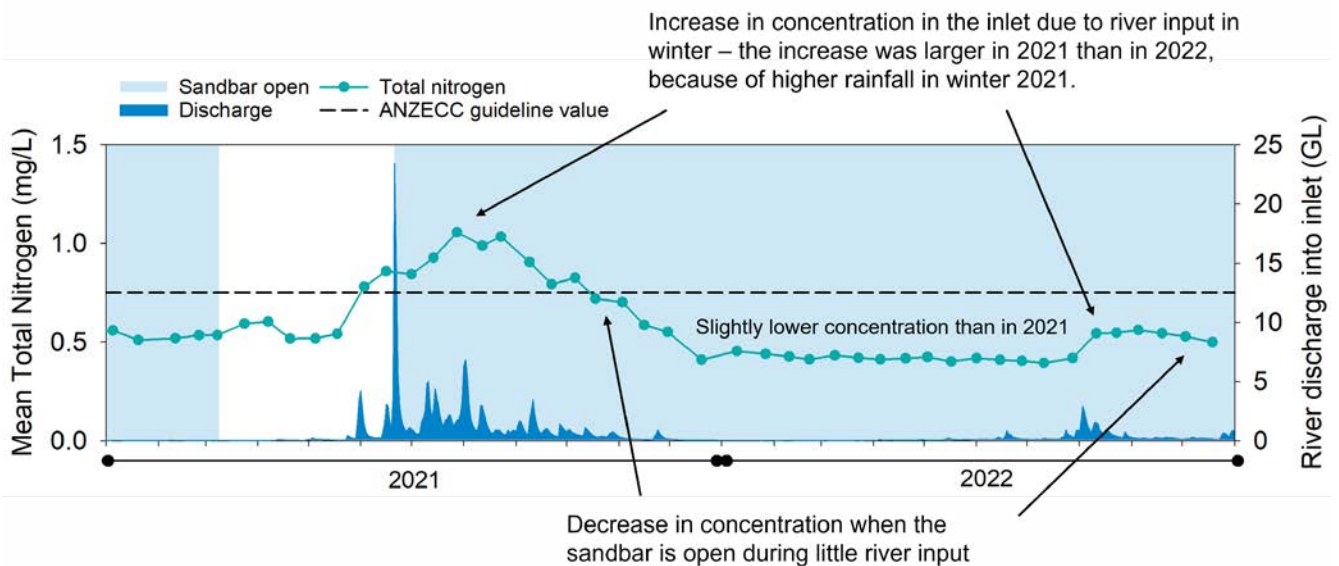
Sandbar dynamics affect nutrient levels. When the sandbar is open, nutrient-rich water from rivers flows to the ocean and is diluted by the inflow of ocean water to the inlet. When the sandbar is closed, these nutrients stay in the inlet.

Rainfall washes nutrients and organic matter from the soil into the rivers so we normally see higher

nutrient concentrations in the rivers and inlet in winter. Nitrogen and phosphorus concentrations increased in the inlet after rainfall generated river flow in both winters (2021 and 2022). The winter nutrient increase in 2021 was larger and more long-lasting than in 2022, because of the much higher rainfall in winter 2021.

During summer 2021–22 through to winter 2022 when the sandbar was open (the time of year when it would typically be closed), we saw slightly better water quality in the inlet than is usual for this time of the year. Nitrogen concentrations were slightly lower than in the previous year, although phosphorus concentrations were similar to usual.

¹ Nutrient concentrations are compared with ANZECC and ARMCANZ (2000) water quality guidelines for estuaries in south-west Australia. Available from www.waterquality.gov.au/anz-guidelines/resources/previous-guidelines/anzecc-armcanz-2000



Oxygen and salinity

When the sandbar is open and the rivers are flowing, 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. The resulting low oxygen conditions in the deeper parts of the water column can lead to fish and other animal deaths and cause the release of even more nutrients from the sediment.

During the long sandbar opening, we observed typical patterns of stratification, where the inlet became stratified during times where ocean exchange and river flow occurred together. Since both ocean exchange and river flow were higher than usual in winter and spring 2021, stratification in the inlet lasted longer than normal.

Once the rivers stopped flowing, ahead of summer 2021–22, the inlet was well mixed, and its salinity levels were near ocean salinity because of the ongoing connection with the ocean. During this period, we saw some brief instances where oxygen levels were slightly lower in the bottom waters compared with the surface waters of the inlet. This was likely because high tides and storms pushed plenty of ocean water, with slightly higher salinity, into the inlet.

Fortunately, the low oxygen conditions were short-lived so were very unlikely to have had a negative impact on the inlet’s ecology. However, these occurrences emphasise that the inlet is vulnerable to occasionally developing low oxygen, even with only small differences in salinity because of the high amount of organic matter accumulated in the estuary bed.

Summary

The longer sandbar opening was caused by a combination of factors including the high water level at the time the sandbar was breached, decent winter rainfall and river flows in 2021, and high ocean water levels and tides because of La Niña.

Overall, the water quality of the inlet is good, though nutrient concentrations tend to increase in winter. In wetter years, the increase is larger than in drier years. The nutrient concentrations during the long opening in 2021–22 were mostly consistent with typical years, though nitrogen concentrations were slightly lower than usual.

The longer opening caused stratification in the inlet, which in turn caused low oxygen levels near the

estuary seabed to last longer than usual. While this was not to an extent or of a duration likely to have harmed inlet health, the inlet remains vulnerable in the face of climate change and extreme weather events. The high nutrient input into the inlet, especially in very wet years, highlights the importance of continuing catchment work to reduce the nutrient loads entering the inlet.

Learn more:

Learn more about the Wilson Inlet sandbar:

estuaries.dwer.wa.gov.au/estuary/wilson-inlet/estuary/the-bar/

Explore the estuary’s salinity and oxygen profiles over time:

estuaries.dwer.wa.gov.au/estuary/wilson-inlet/estuary/condition/physical-profiles/

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