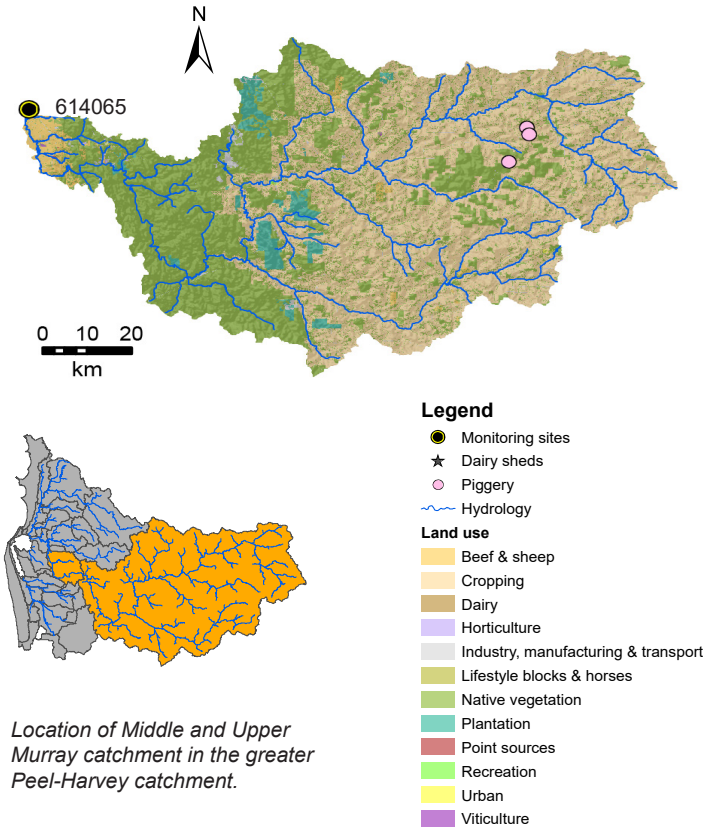
Middle Murray River

This data report provides a summary of the nutrients at the sampling site in the Middle Murray River catchment in 2018 as well as historical data from 2004–18. This report was produced as part of the Regional Estuaries Initiative. Downstream of the site, the river becomes the Lower Murray River and then discharges to the Peel Inlet. Nutrients (nitrogen and phosphorus) are compounds that are important for plants to grow. Excess nutrients entering waterways from effluent, fertilisers and other sources can fuel algal growth, decrease oxygen levels in water and harm fish and other species. Total suspended solids, pH and salinity data are also presented as they help us better understand the processes occurring in the catchment.



Location of Middle and Upper Murray catchment in the greater Peel-Harvey catchment.

About the catchment

The combined Middle and Upper Murray River catchment is presented here as the Upper Murray contributes flow and nutrients to the Middle Murray. The total area of the combined catchments is about 7,044 km^2, over half of which has been cleared for agriculture. On the Darling Scarp a large area of native vegetation remains and on the Swan Coastal Plain, upstream of the sampling site, there are large areas of beef and sheep grazing. There are three piggeries present in the upper portion of the catchment.

The soils in the Darling Scarp portion of the catchment have a high phosphorus-binding capacity, whereas the upper catchment has soils with a moderate phosphorus-binding capacity and the lower catchment soils have a low-phosphorus binding capacity. The phosphorus-binding capacity of these last soils is often so poor that any phosphorus applied to them can be quickly washed into drains and other waterways. Conversely, the Darling Scarp soils tend to bind phosphorus, preventing it from moving into waterways.

Water quality is monitored at site 614065, Pinjarra Road, where the Murray River passes through the town of Pinjarra.

Results summary

Nutrient concentrations were low (total nitrogen) to very low (total phosphorus). Because of the large flow volumes, nutrient loads were moderate (total phosphorus) to large (total nitrogen). This was the saltiest of the monitored sites. The water from the upper catchment is saltier and lower in nutrients than the water from the coastal plain portion of the catchment and it is this water that drives the water quality recorded at the sampling site.

Facts and figures

Sampling site code	614065
Catchment area	7,044 km^2
Per cent cleared area (2015)	57 per cent
River flow	Permanent
Annual flow (2018)	327 GL
Main land use (2015)	Cropping and native vegetation

Middle Murray River

Nitrogen over time (2004–18)

Concentrations

Total nitrogen (TN) concentrations fluctuated over the reporting period at the Middle Murray River sampling site. All annual medians, and most of the samples collected, were below the Australian and New Zealand Environment and Conservation Council (ANZECC) trigger value. Median concentrations were generally low, with the 2018 median being the second lowest of the 13 sites sampled in the Peel-Harvey catchment.

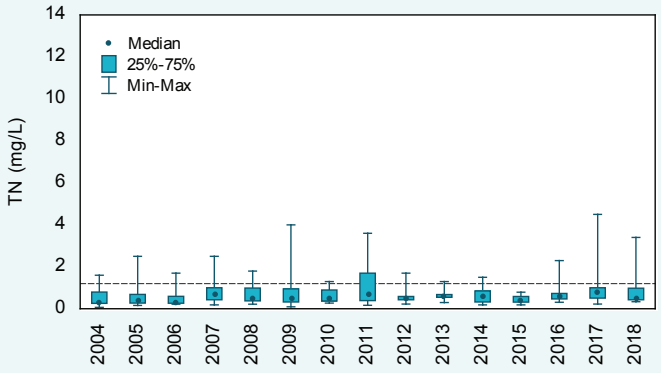
Trends

There was no trend in TN concentrations at the Middle Murray River sampling site over either the short- (2014–18) or long-term (2004–18).

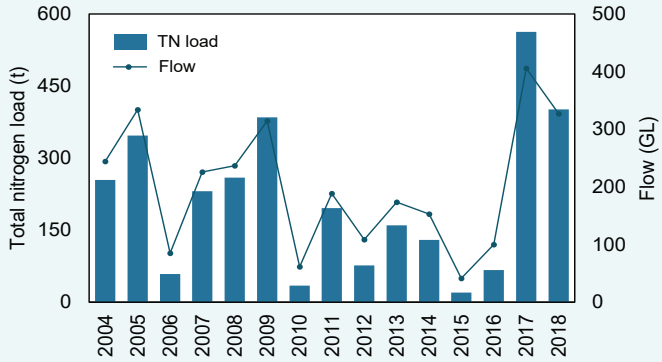
Estimated loads

Estimated TN loads at the Middle Murray River sampling site were large compared with the other sites in the Peel-Harvey catchment. In 2018, the Middle Murray had an estimated TN load of 401 t, the largest of the 10 sites where it was possible to calculate loads. This large load was mostly because of the large flow volume at this site (the Middle Murray had the largest flow volume in 2018 of 327 GL, the Harvey River had the next largest volume of 127 GL). TN concentrations were generally low. Harvey River had the next largest load of 250 t. The load per unit area was small, at 57 kg/km^2, the smallest load per unit area of the Peel-Harvey catchments. TN loads were closely related to flow volume, years with high annual flow having large TN loads and vice versa.

Middle Murray River



Total nitrogen concentrations, 2004–18 at site 614065. The dashed line is the ANZECC trigger value for lowland rivers.



Total nitrogen loads and annual flow, 2004–18 at site 614065.

The weir at the Middle Murray sampling site, November 2018.

Middle Murray River

Nitrogen (2018)

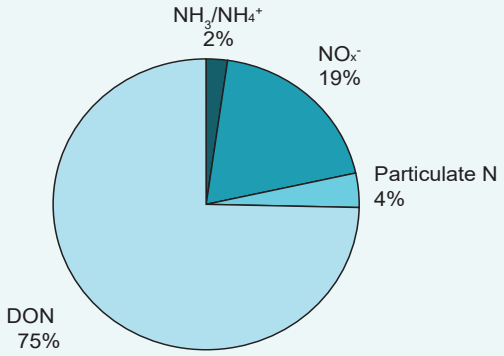
Types of nitrogen

Total N is made up of many different types of N. At the Middle Murray River sampling site, three-quarters of the N was present as dissolved organic N (DON). This type of N consists mainly of degrading plant and animal matter but may also include other forms. The bioavailability of DON varies depending on its form; some are highly bioavailable whereas others, like degrading plant and animal matter, often need to be further broken down to become bioavailable. The remaining N was present as highly bioavailable dissolved inorganic N (DIN—consisting of oxides of N, NO_x^-, and ammonia N, NH_3/NH_4^+). These forms of N are often sourced from animal waste and fertilisers. The proportion of N present as NO_x^- was relatively high compared with the other sites in the Peel-Harvey catchment, with the Middle Murray River having the third highest proportion of N present as NO_x^-.

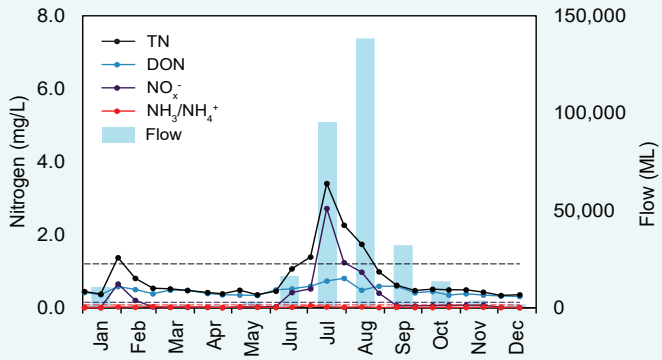
Concentrations

TN, NO_x^- and, to a lesser extent, DON showed a seasonal response at the Middle Murray sampling site. Concentrations began to increase in June as rainfall and flow increased, and peaked in July (for TN and NO_x^-) before slowly falling between July and September. Much of this N was probably the result of mineralisation of organic N in soils and waterways over the summer period, and runoff of high-concentration waters from surrounding agricultural land use. There was also a small peak in TN and NO_x^- concentrations in late January. This followed a peak in flow nine days earlier which would have washed N into the river from surrounding land use as well as mobilising N present in the river. It is likely that much of the N at this site is entering the river via surface runoff from surrounding agricultural land, with groundwater providing proportionally less N. In-stream sources were also contributing N.

Middle Murray River



2018 average nitrogen fractions at site 614065.



2018 nitrogen concentrations and monthly flow at 614065. The dashed lines are the ANZECC trigger values for lowland rivers for the different N species.

The Pinjarra Road Bridge at the Middle Murray sampling site. The rocks along the banks are there to help stop erosion, June 2018.

Middle Murray River

Phosphorus over time (2004–18)

Concentrations

Total phosphorus (TP) concentrations at the Middle Murray River sampling site were low, with all medians and almost all samples below the Peel-Harvey Water Quality Improvement Plan (WQIP) target. The 2018 median TP concentration (0.012 mg/L) was the lowest of the 13 sites sampled in the Peel-Harvey catchment (Mayfield Drain had the next lowest median of 0.022 mg/L).

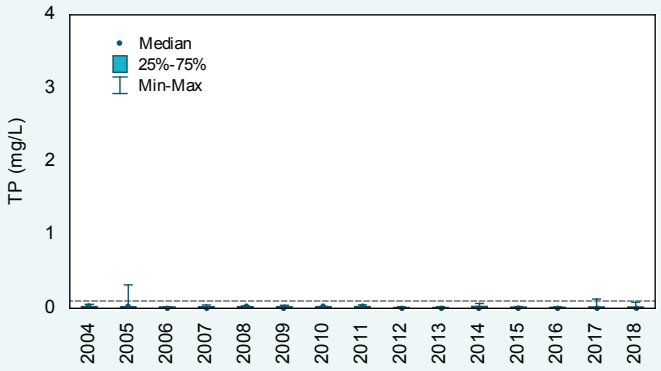
Trends

There was no trend in TP concentrations at the Middle Murray River sampling site over either the short- (2014–18) or long-term (2004–18).

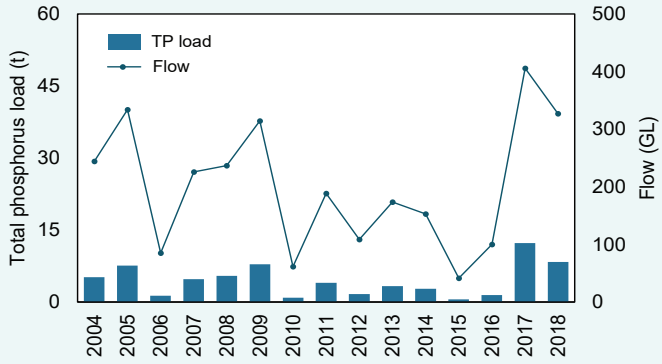
Estimated loads

Estimated TP loads at the Middle Murray River sampling site were moderate compared with the other 10 sites in the Peel-Harvey catchment where it was possible to calculate loads. In 2018, the site had an estimated TP load of 8.3 t, similar to Nambeelup Brook which had a load of 8.6 t. The size of the TP load at the Middle Murray site was a reslt of the large flow volume. TP concentrations were low. In 2018, the Middle Murray had a flow volume of 327 GL compared with Nambeelup Brook with 16 GL, yet they had similar TP loads. The 2018 load per unit area of 1.2 kg/km^2 was the smallest of the Peel-Harvey sites. TP loads were closely related to flow volume; years with high annual flow having large TP loads and vice versa.

Middle Murray River



Total phosphorus concentrations, 2004–18 at site 614065. The dashed line is the Peel-Harvey WQIP target for winter median TP concentrations.



Total phosphorus loads and annual flow, 2004–18 at site 614065.

Whitewater rafting is popular in the Murray River in winter. This photo was taken near Baden Powell in Dwellingup, August 2005.

Phosphorus (2018)

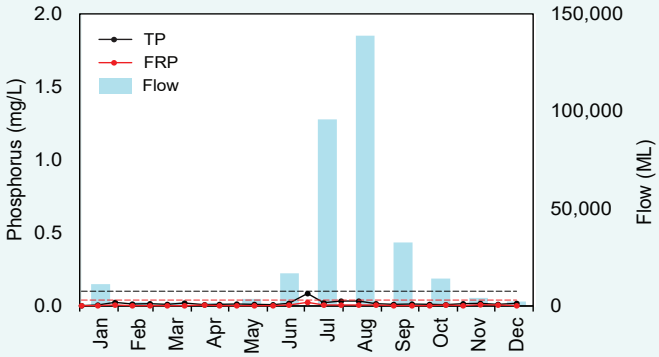
Types of phosphorus

Total P is made up of different types of P. Because a large number of filterable reactive P (FRP) samples were below the laboratory limit of reporting (LOR) in 2018, a phosphorus fraction pie chart was not generated for this site. Fifteen of the 26 FRP samples collected in 2018 were below the LOR (0.005 mg/L).

Concentrations

Phosphorus concentrations were low at the Middle Murray River sampling site in 2018, with all samples collected below their respective target or trigger value. There was a very slight seasonal response in TP concentrations, with a peak recorded in early July and slightly higher concentrations in the remainder of July and August. This suggests that more P was entering the river via surface flow than groundwater, with in-stream sources also contributing some P. It is important to note, however, that P concentrations were consistently low.

Middle Murray River



2018 phosphorus concentrations and monthly flow at 614065. The dashed black line is the Peel-Harvey WQIP target, the red line is the ANZECC trigger values for lowland rivers.

Accessing the gauging station at the Middle Murray sampling site during high flows, May 2015.

Middle Murray River

Dissolved organic carbon over time (2004–18)

Concentrations

Dissolved organic carbon (DOC) concentrations fluctuated over the reporting period at the Middle Murray River sampling site. Using the Statewide River Water Quality Assessment (SWRWQA) classification bands, the annual medians were classified as moderate except for 2016–17 when they were high. With the exception of 2017, the annual range in DOC concentrations at this site was small.

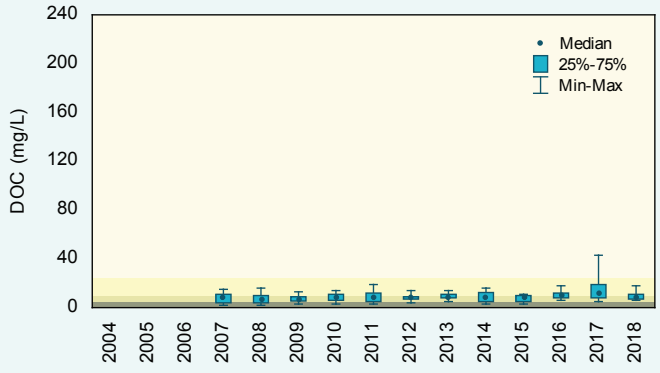
Trends

There was no trend in DOC concentrations at the Middle Murray River sampling site over either the short- (2014–18) or long-term (2007–18).

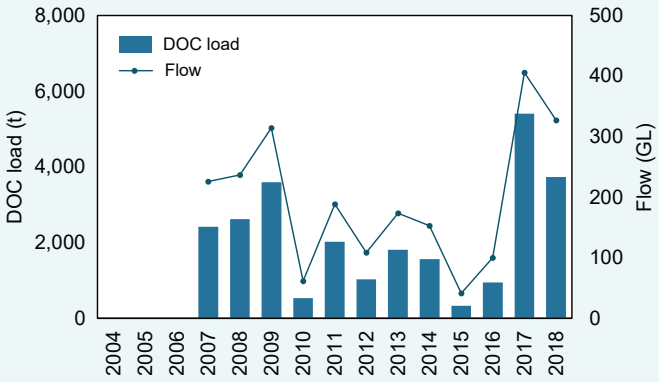
Estimated loads

Estimated DOC loads at the Middle Murray River sampling site were large compared with the other sites in the Peel-Harvey catchment. In 2018, the estimated DOC load was 3731 t, the largest of the 10 sites in the Peel-Harvey catchment where it was possible to calculate loads. Like for TN and TP loads, the large DOC load was because of the large flow volumes at this site compared with the other sites in the Peel-Harvey catchment. DOC concentrations were low. The load per unit area of 530 kg/km^2 was small compared with the other Peel-Harvey catchment sites. DOC loads were closely related to flow volume, years with high annual flow having large DOC loads and vice versa.

Middle Murray River



Dissolved organic carbon concentrations, 2004–18 at site 614065. The shading refers to the SWRWQA classification bands.



Dissolved organic carbon loads and annual flow, 2004–18 at site 614065.

very high high moderate low

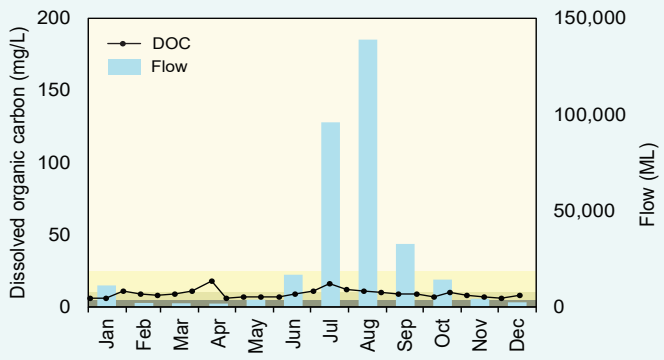
Houseboats are popular on the Middle Murray River. This one is at the Pinjarra boat ramp, May 2006.

Dissolved organic carbon (2018)

Concentrations

Dissolved organic carbon concentrations varied throughout 2018 at the Middle Murray River sampling site. There was a small peak in DOC concentrations in July, driven by the increase in rainfall and flow which flushed DOC into the river from surrounding land use at this time. The reason for the peak in April is unknown. DOC was entering the Middle Murray River via surface and groundwater flows as well as coming from in-stream sources. DOC is sourced mainly from degrading plant and animal matter, including natural organic matter in soils and wetlands, with many wetlands on deep sands typically generating high DOC concentrations. It varies widely in its bioavailability.

Middle Murray River



2018 dissolved organic carbon concentrations and monthly flow at 614065. The shading refers to the SWRWQA classification bands.

very high high moderate low

Releasing cobbler (a native fish) caught as part of a river health assessment in the Murray River, near the confluence with Marrinup Brook, December 2017.

Middle Murray River

Total suspended solids over time (2004–18)

Concentrations

Total suspended solids (TSS) concentrations were low at the Middle Murray River sampling site. All annual medians were classified as low using the SWRWQA bands, though most years had some samples classified as high and a few years had samples classified as very high. The 2018 median (2 mg/L) was the equal second lowest of the three sites sampled in the Peel-Harvey catchment (along with Mayfield Drain).

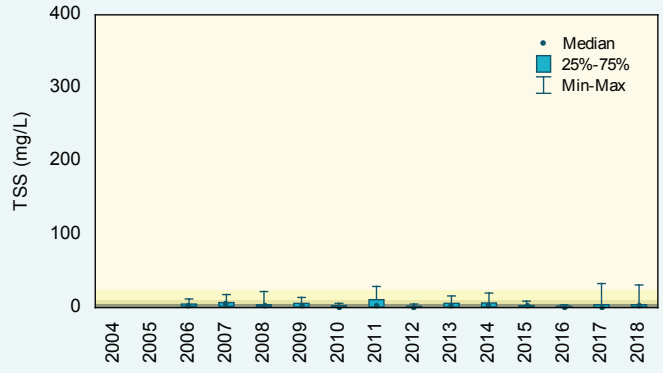
Trends

There was no trend in TSS concentrations at the Middle Murray River sampling site over either the short- (2014–18) or long-term (2006–18).

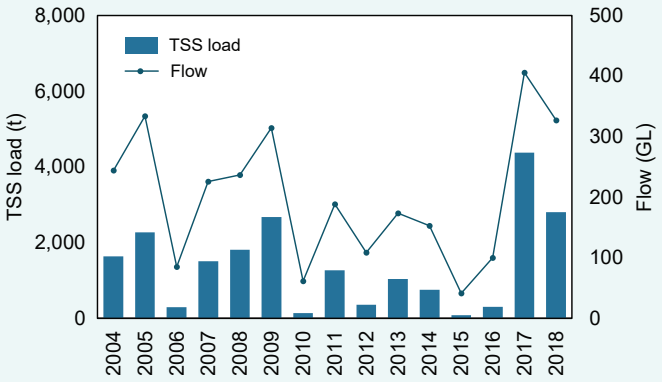
Estimated loads

Estimated TSS loads at the Middle Murray sampling site were large compared with the other sites in the Peel-Harvey catchment. In 2018, the estimated TSS load at this site was 2,803 t, the second largest of the 10 sites in the Peel-Harvey catchment where it was possible to calculate loads. Only the Harvey River had a larger TSS load of 4,288 t. The relatively large TSS loads at the Middle Murray site was because of the large flow volumes. TSS concentrations were low. The load per unit area of 398 kg/km^2 was small to moderate compared with the other Peel-Harvey catchment sites. TSS loads were closely related to flow volume, years with high annual flow having large TSS loads and vice versa.

Middle Murray River



Total suspended solids concentrations, 2004–18 at site 614065. The shading refers to the SWRWQA classification bands.



Total suspended solids loads and annual flow, 2004–18 at site 614065.

very high high moderate low

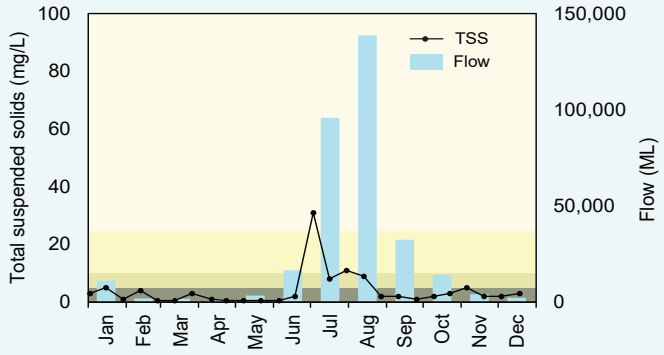
Rapids at Dwaarlindjirraap in Dwellingup, August 2016.

Total suspended solids (2018)

Concentrations

Total suspended solids (TSS) concentrations showed a seasonal pattern at the Middle Murray River sampling site, peaking in early July before falling again over the remainder of July and August. This peak is likely because of a first-flush effect where heavy rainfall washed particulate matter into the river from surrounding land use. In-stream sources such as erosion were also likely to be contributing TSS at this time. For most of the rest of the year, TSS concentrations were low.

Middle Murray River



2018 total suspended solids concentrations and monthly flow at 614065. The shading refers to the SWRWQA classification bands.

very high high moderate low

The Murray River near Dwaarlindjiraap in Dwellingup. The river is in good condition here with intact fringing vegetation, reflecting a more natural state, July 2017.

Middle Murray River

pH over time (2004–18)

pH values

pH at the Middle Murray River sampling site fluctuated over the reporting period. Most of the samples collected fell within the upper and lower ANZECC trigger value.

Trends

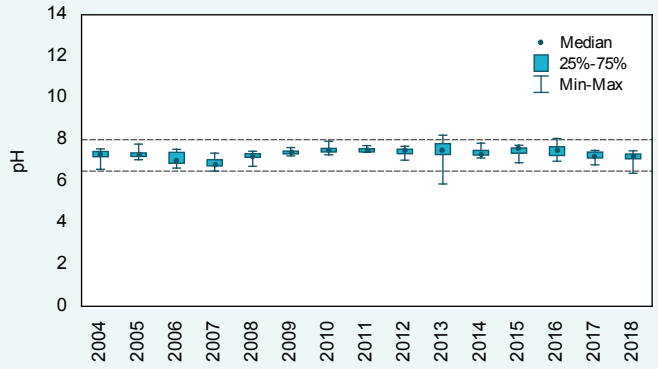
There was no trend in pH at the Middle Murray River sampling site over either the short- (2014–18) or long-term (2004–18).

pH (2018)

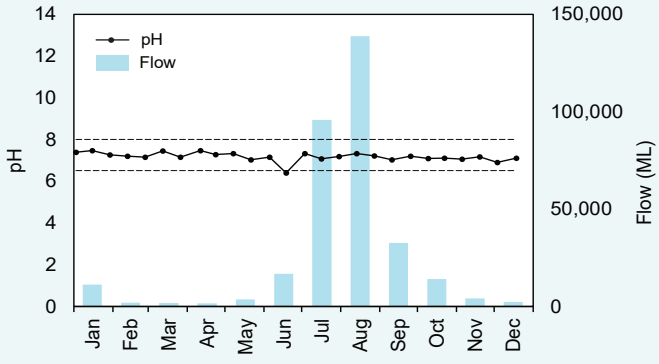
pH values

pH values fluctuated over 2018, with no clear evidence of a seasonal pattern. All samples collected fell within the upper and lower ANZECC trigger values, with the exception of the mid-June sample which was below the lower ANZECC trigger value. Why there was a dip in pH at this time is unclear, though it coincided with a peak in salinity on the same sampling day which suggests it was saltier, lower pH waters running off from salt seeps and flats in the upper catchment.

Middle Murray River



pH levels, 2004–18 at site 614065. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.



2018 pH levels and monthly flow at 614065. The dashed lines are the upper and lower ANZECC trigger values for lowland rivers.

Marrinup Brook, a tributary of the Middle Murray river, September 2017.

Middle Murray River

Salinity over time (2004–18)

Concentrations

Salinity at the Middle Murray River sampling site fluctuated over the reporting period; however, all annual medians and almost all samples were classified as brackish using the SWRWQA bands. Salts were entering the river via both surface flows (especially in the upper catchment) and groundwater.

Trends

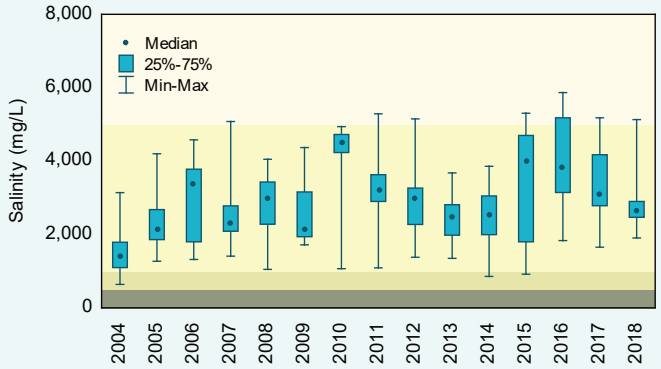
There was a long-term (2004–18) increasing trend in salinity of 60 mg/L/yr. There was no short-term (2014–18) trend present. The long-term trend is likely because of the drying climate.

Salinity (2018)

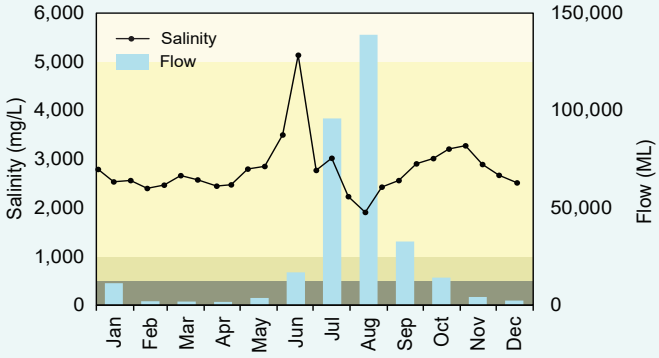
Concentrations

Salinity showed a seasonal pattern at the Middle Murray River sampling site. Salinity peaked in mid-June, when rainfall and flow were increasing. This peak was likely because of salts that had accumulated over the drier months being washed into the river from surrounding land use. After this peak, concentrations decreased, being at their lowest in August when flow was at its highest. It is likely that salt was entering the river via both surface and groundwater flows.

Middle Murray River



Salinity concentrations, 2004–18 at site 614065. The shading refers to the SWRWQA classification bands.



2018 salinity concentrations and monthly flow at site 614065. The shading refers to the SWRWQA classification bands.

saline brackish marginal fresh

The Middle Murray river during high flows in Pinjarra, August 2009.

Middle Murray River

Background

The Regional Estuaries Initiative is a State Government program to improve the health of waterways and estuaries in the south-west of Western Australia. Healthy Estuaries WA is a Royalties for Regions program launched in 2020 and will build on the work of the Regional Estuaries Initiative. Collecting and reporting water quality data, such as in this report, helps build understanding of the whole system. By understanding the whole system, we can direct investment towards the most effective actions in the catchments to protect and restore the health of our waterways.

You can find the latest data on the condition of Peel-Harvey estuary at estuaries.dwer.wa.gov.au/estuary/peel-harvey-estuary/

The Regional Estuaries Initiative partners with the Peel-Harvey Catchment Council to fund best-practice fertilisers, dairy effluent and watercourse management on farms.

- To find out how you can be involved visit estuaries.dwer.wa.gov.au/participate
- To find out more about the Peel-Harvey Catchment Council go to peel-harvey.org.au
- To find out more about the health of the rivers in the Peel-Harvey Catchment go to rivers.dwer.wa.gov.au/assessments/results

Methods

Total phosphorus concentrations were compared with the Peel-Harvey WQIP target. This target represents the median winter concentration that is required for each of the subcatchments to meet their load reduction target. Where possible, other parameters were compared with the ANZECC trigger values for lowland rivers in south-west Australia. These values provide a value above which there may be a risk of adverse effect. For pH there is both an upper and lower trigger value which represent the acceptable pH range. Where there were no ANZECC trigger values available (for DOC, TSS and salinity) the SWRWQA classification bands were used to allow samples and sites to be classified and compared.

Trend testing was carried out using either the Mann or Seasonal Kendall tests as appropriate. Where there were flow data available and there was a flow-concentration relationship, the data were flow-adjusted before trend analysis.

Annual loads were calculated by multiplying daily flow with daily nutrient concentrations and aggregating over the year. Measured daily concentrations were not available as samples were collected fortnightly at best, so daily concentration data were calculated using the locally estimated scatterplot smoothing algorithm (LOESS).

Glossary

Bioavailable: bioavailable nutrients refers to those nutrients which plants and algae can take up from the water and use straight away for growth.

Concentration: the amount of a substance present in the water.

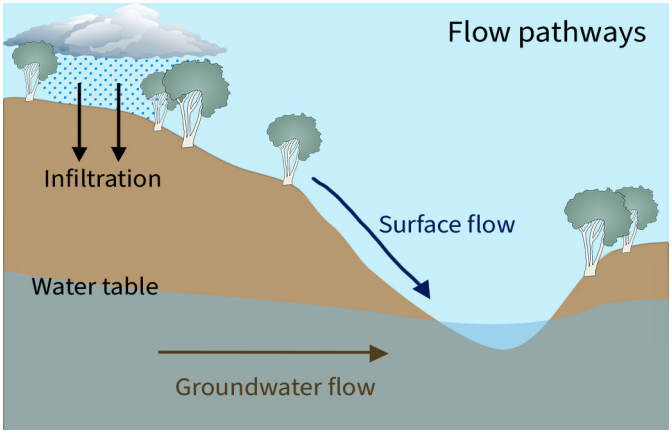
Evapoconcentration: the increase in concentration of a substance dissolved in water because of water being lost by evaporation.

Laboratory limit of reporting: this is the lowest concentration (or amount) of an analyte that can be reported by a laboratory.

Load: the total mass of a substance passing a certain point.

Load per unit area: the load at the sampling site divided by the entire catchment area upstream of the sampling site.

The schematic below shows the main flow pathways which may contribute nutrients, particulates and salts to the waterways. Connection between surface water and groundwater depends on the location in the catchment, geology and the time of year.



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