Middle Murray River

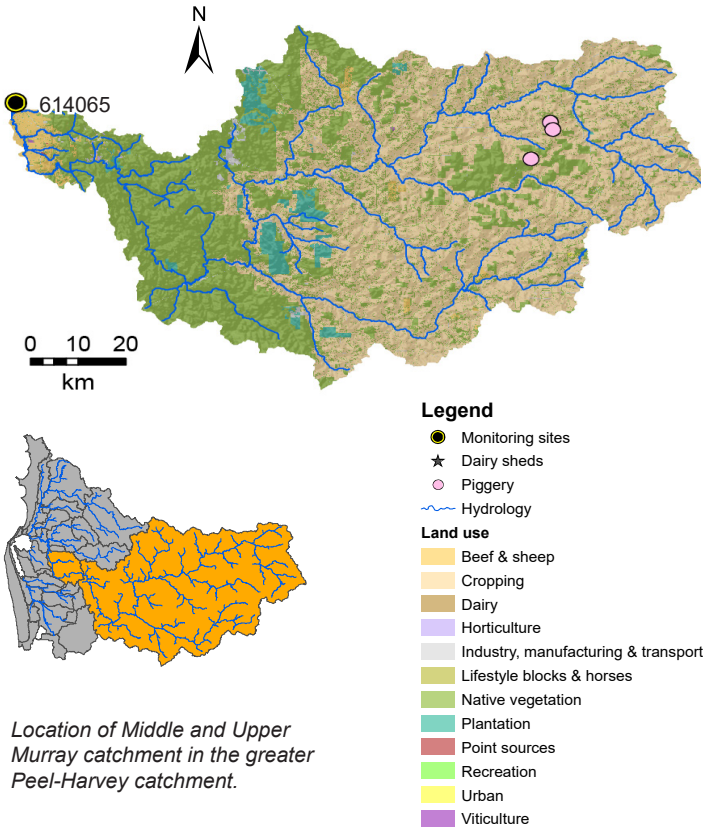
This data report provides a summary of the nutrients at the sampling site in the Middle Murray River catchment in 2019 as well as historical data from 2005–19. This report was produced as part of Healthy Estuaries WA. Downstream of the site, the river becomes the Lower Murray River and then discharges to the Peel Inlet.

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, more than half of which has been cleared for agriculture. On the Darling Scarp a large area of native vegetation remains. 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.

About half of the soils in the coastal plain portion of the catchment have a low phosphorus-binding capacity. The phosphorus-binding capacity of these soils is often so poor that any phosphorous applied to them can be quickly washed or leached into drains and other waterways. The rest of the catchment has soils with a high phosphorus-binding capacity; these 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.



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

Results summary

Nutrient concentrations (total nitrogen and total phosphorus) were classified as low. Because of the large flow volumes, nutrient loads were large compared to the other Peel-Harvey catchment sites. 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
Main land use (2015)	Cropping and native vegetation

Estimated loads and flow at Middle Murray River

614065	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Flow (GL)	334	85	226	237	314	61	189	109	173	153	41	100	405	327	112
TN load (t)	347	59	231	259	385	35	196	76	160	130	20	67	562	401	89
TP load (t)	7.55	1.30	4.73	5.45	7.85	0.86	3.98	1.63	3.28	2.77	0.56	1.47	12.3	8.31	1.96

Middle Murray River

Nitrogen over time (2005–19)

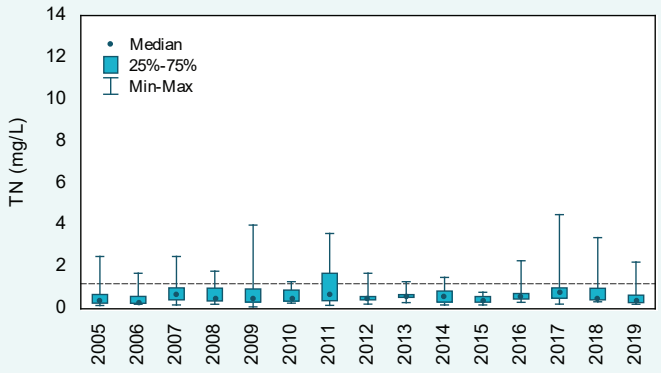
Concentrations

Total nitrogen (TN) concentrations fluctuated over the reporting period at the Middle Murray River sampling site. Using the State Wide River Water Quality Assessment (SWRWQA) methodology, all years were classified as having a low TN concentration. Further, all annual medians, and most of the samples collected, were below the Bindjareb Djilba (Peel-Harvey estuary) Projection Plan water quality target for TN concentrations. Median concentrations were generally low, with the 2019 median being the second lowest of the 13 sites sampled in the Peel-Harvey catchment.

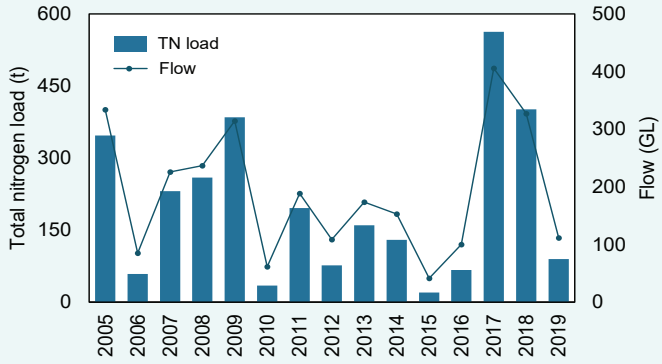
Estimated loads

Estimated TN loads at the Middle Murray River sampling site were very large compared with the other sites in the Peel-Harvey catchment. In 2019, the Middle Murray had an estimated TN load of 89 t, the second largest of the 10 sites where it was possible to calculate loads; only the Harvey River had a larger TN load of 99 t. The large load at the Middle Murray River sampling site was driven by the large flow volume at this site (the Middle Murray had the largest flow volume in 2019 of 112 GL, the Harvey River had the next largest volume of 54 GL); TN concentrations were low. The load per square kilometre was small, at 13 kg/km^2, the smallest load per square kilometre of the Peel-Harvey catchments. TN loads were closely related to flow volume; years with large annual flow volumes had large TN loads and vice versa.

Middle Murray River



Total nitrogen concentrations, 2005–19 at site 614065. The dashed line is the protection plan TN target.



Total nitrogen loads and annual flow, 2005–19 at site 614065.

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

Middle Murray River

Nitrogen (2019)

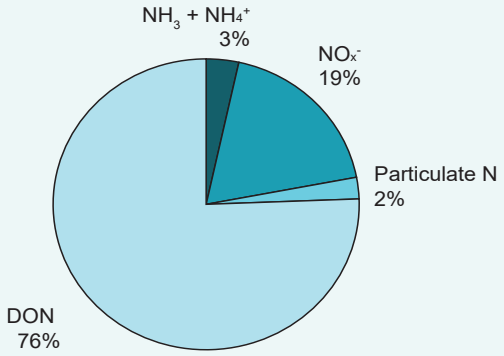
Types of nitrogen

Total N is made up of different types of N. At the Middle Murray River sampling site, about 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 types. The bioavailability of DON varies depending on its type; 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 nitrate, NO_x^-, and total ammonia, $NH_3 + NH_4^+$). These types of N are often sourced from animal waste and fertilisers. The proportion of N present as nitrate was relatively large compared with the other sites in the Peel-Harvey catchment, with the Middle Murray River having the second highest proportion of N present as nitrate.

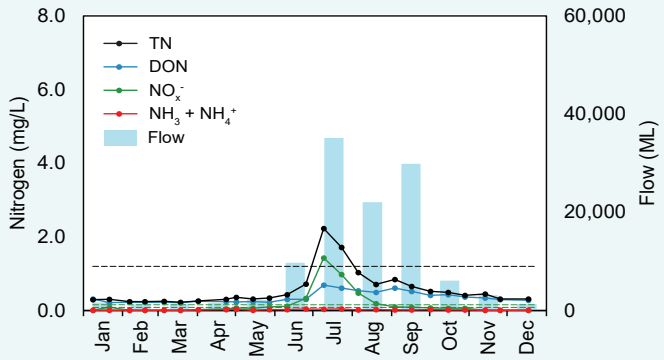
Concentrations

TN, nitrate and 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 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. It is likely that most 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



2019 average nitrogen fractions at site 614065.



2019 nitrogen concentrations and monthly flow at 614065. The black dashed line is the protection plan TN target, the red and green lines are the ANZECC trigger values for total ammonia and nitrate.

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 (2005–19)

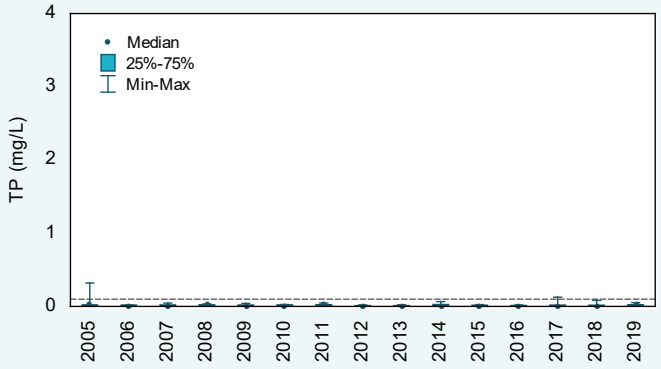
Concentrations

Total phosphorus (TP) concentrations at the Middle Murray River sampling site were low, with all years classified as low using the SWRWQA methodology. Further, all medians and almost all samples were below the protection plan water quality target for TP concentrations. The 2019 median TP concentration (0.018 mg/L) was the lowest of the 13 sites sampled in the Peel-Harvey catchment (Mayfield Drain had the next lowest median of 0.026 mg/L).

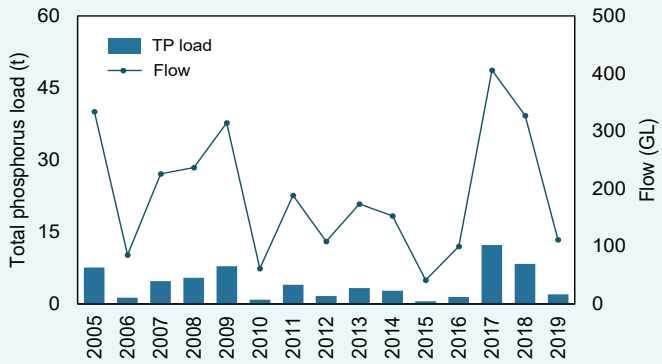
Estimated loads

Estimated TP loads at the Middle Murray River sampling site were large compared with the other 10 sites in the Peel-Harvey catchment where it was possible to calculate loads. In 2019, the site had an estimated TP load of 1.96 t. The size of the TP load at the Middle Murray site was a result of the large flow volume; TP concentrations were low. The 2019 load per square kilometre of 0.3 kg/km^2 was the smallest of the Peel-Harvey sites. TP loads were closely related to flow volume; years with large annual flow volumes had large TP loads and vice versa.

Middle Murray River



Total phosphorus concentrations, 2005–19 at site 614065. The dashed line is the protection plan TP target.



Total phosphorus loads and annual flow, 2005–19 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 (2019)

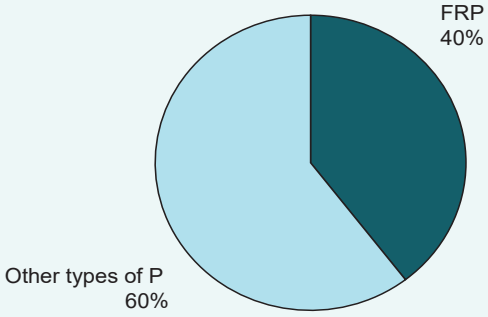
Types of phosphorus

Total P is made up of different types of P. At the Middle Murray River sampling site, just over a third of the P was present as phosphate; measured as filterable reactive phosphorus (FRP), in surface waters this is mainly present as phosphate (PO_4^{3-}) species. Phosphate is generally sourced from animal wastes and fertilisers as well as natural sources. The remainder of the P was present as either particulate P or dissolved organic P (DOP) or both (shown as 'Other types of P' in the chart below). Particulate P generally needs to be broken down before becoming bioavailable. The bioavailability of DOP varies and is poorly understood.

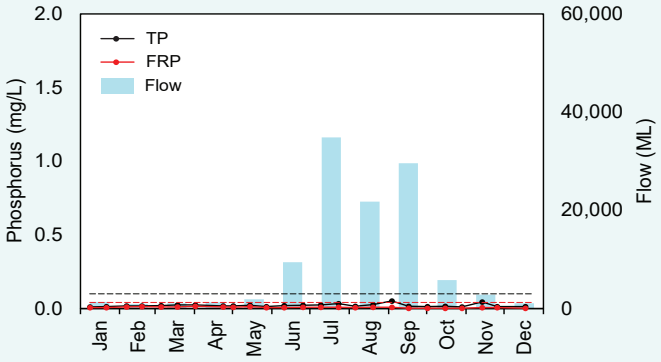
Concentrations

Phosphorus concentrations were low at the Middle Murray River sampling site in 2019, with all samples collected below their respective protection plan water quality target or trigger value (the Australian and New Zealand Environment and Conservation Council [ANZECC] trigger value for phosphate concentrations). Phosphate concentrations were slightly higher in the first six months of the year, when flow was at its lowest. There were a few small peaks in TP concentrations in the second half of the year. It is likely that P was entering the river via surface flow and groundwater, with in-stream sources also contributing some P. It is important to note, however, that P concentrations were consistently low.

Middle Murray River



2019 average phosphorus fractions at 614065.



2019 phosphorus concentrations and monthly flow at 614065. The dashed black line is the protection plan TP target, the red is the ANZECC trigger value for phosphate.

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

Middle Murray River

Dissolved organic carbon over time (2005–19)

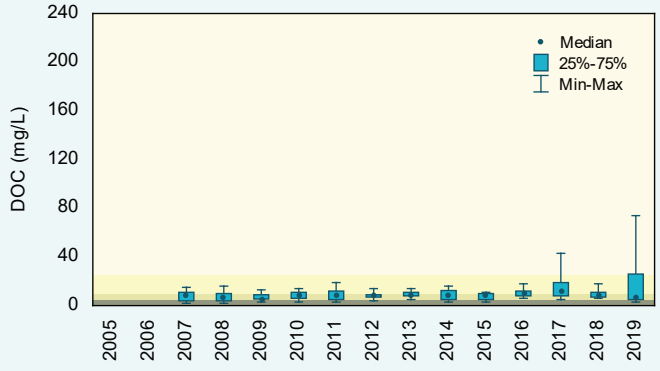
Concentrations

Dissolved organic carbon (DOC) concentrations fluctuated over the reporting period at the Middle Murray River sampling site. Using the SWRWQA methodology, annual DOC concentrations were classified as moderate to 2016 and high from 2017–19. In 2019, the annual range in DOC concentrations was larger than previous years.

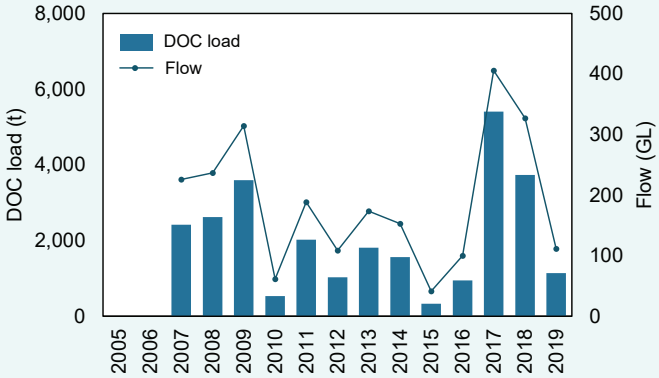
Estimated loads

Estimated DOC loads at the Middle Murray River sampling site were large compared with the other sites in the Peel-Harvey catchment. In 2019, the estimated DOC load was 1,136 t, the largest of the 10 sites in the Peel-Harvey catchment where it was possible to calculate loads. The large DOC load was because of a combination of the large flow volumes and high DOC concentrations at this site. The load per square kilometre of 161 kg/km^2 was small compared with the other Peel-Harvey catchment sites. DOC loads were closely related to flow volume; years with large annual flow volumes had large DOC loads and vice versa.

Middle Murray River



Dissolved organic carbon concentrations, 2005–19 at site 614065. The shading refers to the SWRWQA classification bands.



Dissolved organic carbon loads and annual flow, 2005–19 at site 614065.

low moderate high very high

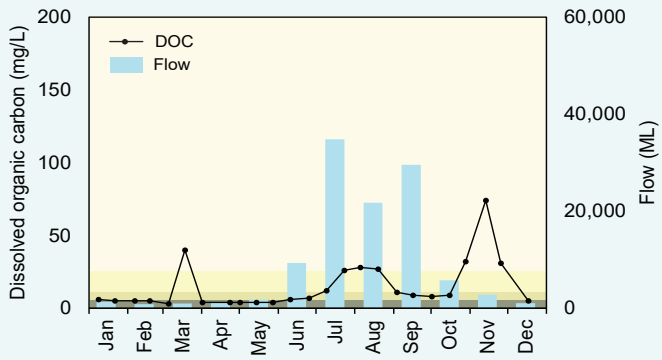
Houseboats are popular on the Middle Murray River. This one is at the Pinjarra boat ramp, May 2006.

Dissolved organic carbon (2019)

Concentrations

DOC concentrations varied throughout 2019 at the Middle Murray River sampling site. There was a peak in DOC concentrations in July and August, 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 March and November 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 from agricultural land and natural organic matter in soils and wetlands. It varies widely in its bioavailability.

Middle Murray River



2019 dissolved organic carbon concentrations and monthly flow at 614065. The shading refers to the SWRWQA classification bands.

low moderate high very high

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 (2005–19)

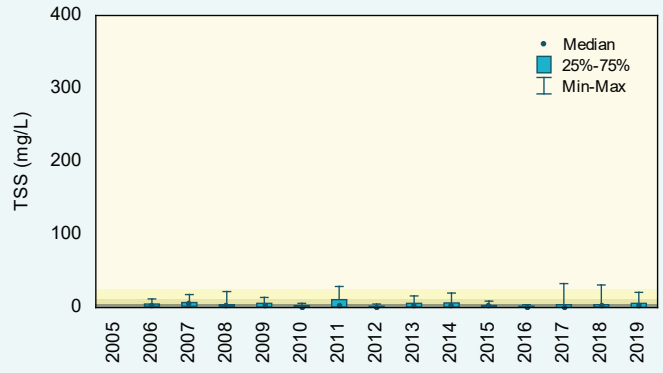
Concentrations

Total suspended solids (TSS) concentrations fluctuated over the reporting period at the Middle Murray River sampling site. Using the SWRWQA methodology, all years were classified as having low TSS concentrations. The 2019 median (3 mg/L) was the third lowest of the 13 sites sampled in the Peel-Harvey catchment.

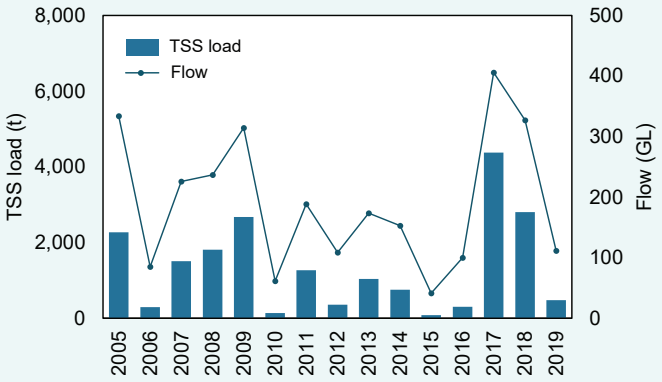
Estimated loads

Estimated TSS loads at the Middle Murray sampling site were large compared with the other sites in the Peel-Harvey catchment. In 2019, the estimated TSS load at this site was 481 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 1,420 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 square kilometre of 68 kg/km^2 was small to moderate compared with the other Peel-Harvey catchment sites, only Gull Road Drain had a smaller load per square kilometre of 8 kg/km^2. TSS loads were closely related to flow volume; years with large annual flow volumes had large TSS loads and vice versa.

Middle Murray River



Total suspended solids concentrations, 2005–19 at site 614065. The shading refers to the SWRWQA classification bands.



Total suspended solids loads and annual flow, 2005–19 at site 614065.

low moderate high very high

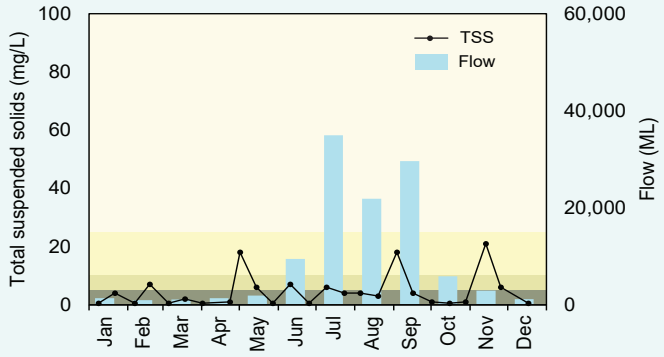
Rapids at Dwaarlindjirraap in Dwellingup, August 2016.

Total suspended solids (2019)

Concentrations

In 2018, TSS concentrations showed a seasonal pattern at the Middle Murray River sampling site. This was not evident in 2019, where concentrations fluctuated during the year. It is likely that particulate matter was entering the river via surface runoff from surrounding land use as well as coming from in-stream sources such as erosion.

Middle Murray River



2019 total suspended solids concentrations and monthly flow at 614065. The shading refers to the SWRWQA classification bands.

low moderate high very high

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 (2005–19)

pH values

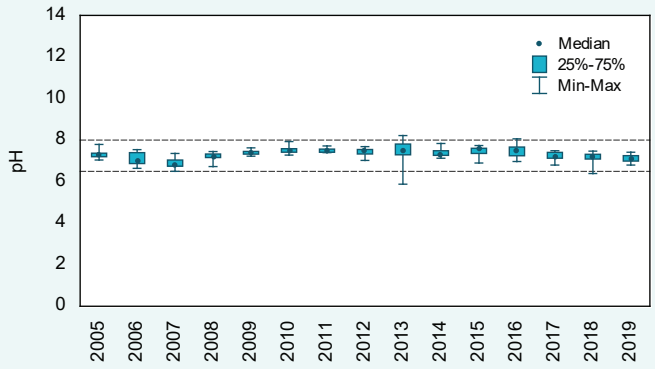
pH at the Middle Murray River sampling site fluctuated over the reporting period. Most of the samples collected fell within the upper and lower ANZECC trigger value.

pH (2019)

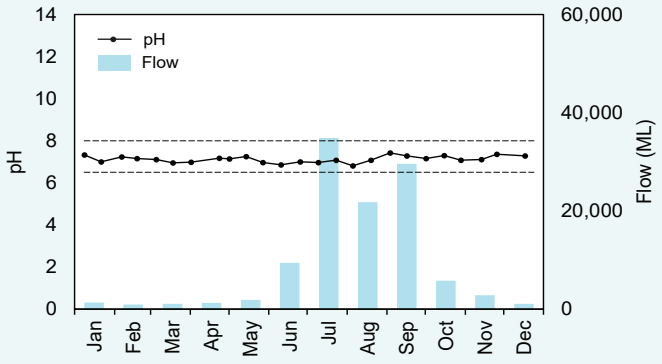
pH values

pH values fluctuated during 2019, with no clear evidence of a seasonal pattern. All samples collected fell within the upper and lower ANZECC trigger values.

Middle Murray River



pH levels, 2005–19 at site 614065. The dashed lines are the upper and lower ANZECC trigger values.



2019 pH levels and monthly flow at 614065. The dashed lines are the upper and lower ANZECC trigger values.

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

Middle Murray River

Salinity over time (2005–19)

Concentrations

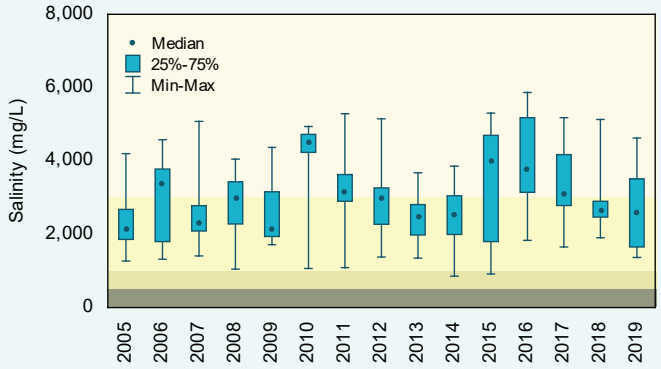
Salinity at the Middle Murray River sampling site fluctuated over the reporting period. Using the Water Resources Inventory 2014 salinity bands, 2010–13 and 2016–18 were classified as saline and the remaining years as brackish (note, that in 2018, the SWRWQA classification bands were used). Salts were entering the river via both surface flows (especially in the upper catchment) and groundwater.

Salinity (2019)

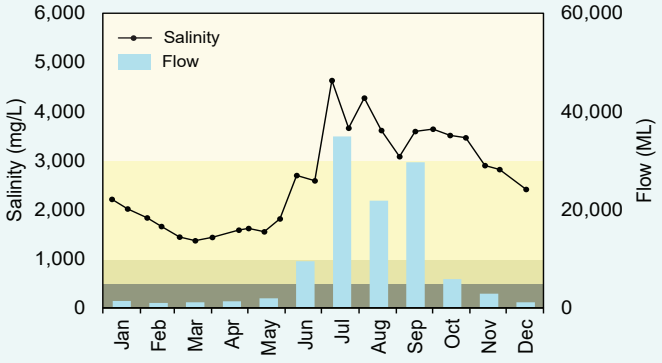
Concentrations

Salinity showed a seasonal pattern at the Middle Murray River sampling site. Salinity peaked in July, when rainfall and flow were increasing. This peak was likely the result of salts that had accumulated over the drier months being washed into the river from surrounding land use. After this peak, concentrations decreased. It is likely that salts were entering the river via both surface flows and groundwater, with surface flows generally saltier than the groundwater.

Middle Murray River



Salinity concentrations, 2005–19 at site 614065. The shading refers to the Water Resources Inventory 2014 salinity ranges.



2019 salinity concentrations and monthly flow at site 614065. The shading refers to the Water Resources Inventory 2014 salinity ranges.

fresh marginal brackish saline

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

Middle Murray River

Background

Healthy Estuaries WA is a State Government program launched in 2020 and builds 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.

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 the water and harm fish and other species. Total suspended solids, pH and salinity data are also presented as these help us better understand the processes occurring in the catchment.

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

Healthy Estuaries WA partners with the Peel-Harvey Catchment Council to fund best-practice managment of fertiliser, dairy effluent and watercourses 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

Variables were compared with the Bindjareb Djilba (Peel-Harvey estuary) Protection Plan concentration targets or ANZECC trigger values where available, or the SWRWQA bands or the 2014 Water Resources Inventory ranges. They were classified using the SWRWQA methodology. Standard statistical tests were used to calculate trends and loads. For further information on the methods visit estuaries.dwer.wa.gov.au/nutrient-reports/data-analysis

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 per volume of water.

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

First flush: material washed into a waterway by the first rainfall after an extended dry period. The first flush is often associated with high concentrations of nutrients and particulate matter.

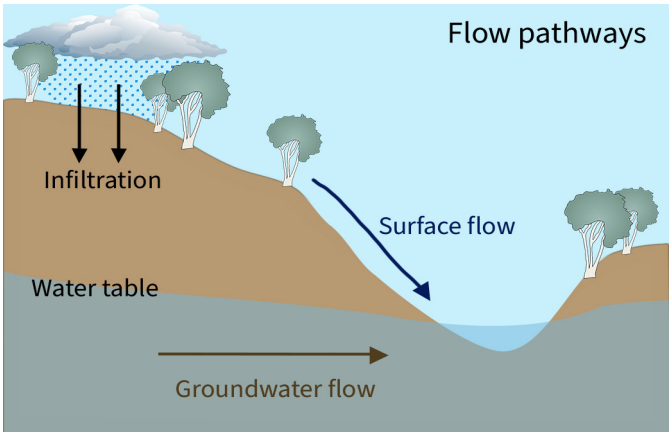
Laboratory limit of reporting: (LOR) this is the lowest concentration of an analyte that can be reported by a laboratory.

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

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

Nitrate: The measurement for the nutrient nitrate actually measures both nitrate (NO_3^-) and nitrite (NO_2^-), which is reported as NO_x^-. We still refer to this as nitrate as in most surface waters nitrite is present in very low concentrations.

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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