Middle Murray River

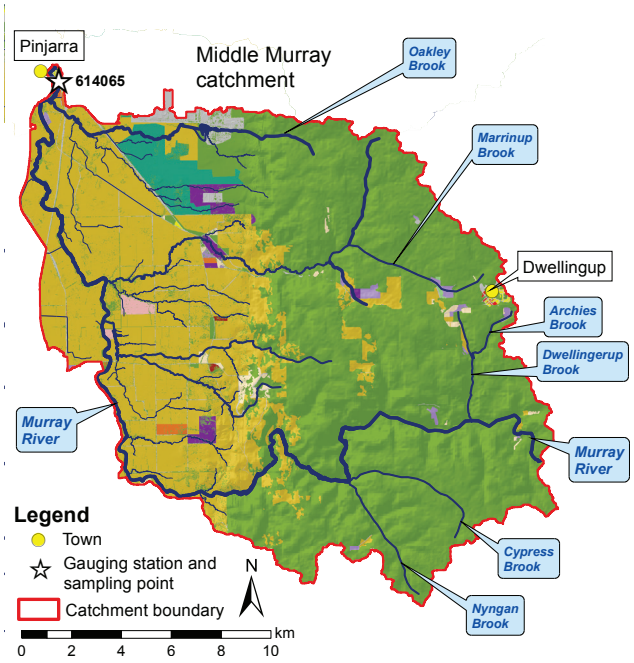
The middle Murray River starts on the Darling Plateau south of Dwellingup and flows towards Pinjarra. The Marrinup and Oakley brooks also start on the plateau north of Dwellingup, both flowing west to join the Murray River.

The sampling site on the Murray River at Pinjarra Road (614065) is one of three long-term monitoring sites within the Peel-Harvey catchment. Nutrients have been monitored at the site since 1983 (except for 1994 and 1995) and flow since 1992. The Murray River flows year-round with river height varying by more than 4 m in some years (e.g. 2009).

Flooding at Pinjarra, highest flow for the year – August 2009

Much of the catchment lies on the Darling Plateau where the soils are mostly ironstone gravel with hard acidic red or yellow soils, although to the west, sandy acidic yellow mottled soils dominate. The catchment is not subject to seasonal inundation and only a small percentage has a high or very high risk of phosphorus leaching to waterways (7.5%).

To the east of the Darling Scarp the catchment is relatively undisturbed. West of the scarp the land has been cleared, mostly for agriculture such as stock grazing, as well as for plantations). Industrial land uses within the catchment include roads, railways and the southern end of Alcoa's alumina refinery. Most of the refinery is located in the lower Murray catchment to the north.



Land use classification (2006)[1]		Area (km²)	Area (%)
Animal keeping – non-farming (horses)		0.76	0.26
Cattle for beef (predominantly)		94	32
Cattle for dairy		0.01	0.01
Conservation and natural		177	60
Cropping		0.10	0.03
Horticulture		1.5	0.52
Industry, manufacturing and transport		6.2	2.1
Intensive animal use		0.14	0.05
Lifestyle block		1.6	0.56
Mixed grazing		2.6	0.89
Offices, commercial and education		0.10	0.03
Plantation		7.0	2.4
Recreation		0.05	0.02
Residential		0.33	0.11
Viticulture		0.92	0.31
Total		**293**	**100**

In 2014 the Murray River had the lowest median TN and TP concentrations of all the 13 sites sampled in the Peel-Harvey catchment.

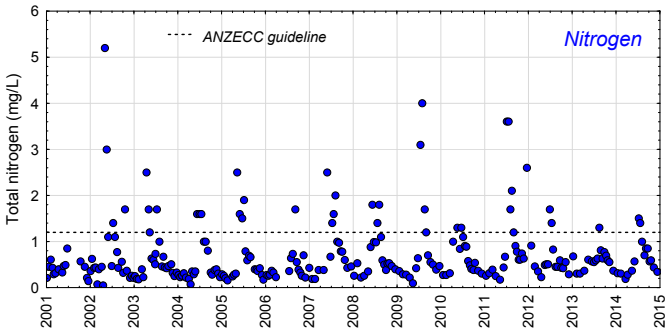
Nutrient summary: median concentrations, loads and status classification at 614065

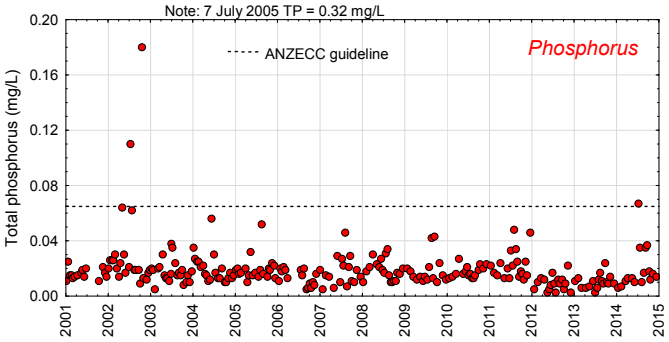
Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Annual flow (GL)	81	184	293	244	334	85	226	237	314	61	189	109	173	153
TN median (mg/L)	0.45	0.45	0.51	0.32	0.39	0.35	0.67	0.53	0.49	0.54	0.74	0.49	0.59	0.57
TP median (mg/L)	0.015	0.021	0.017	0.017	0.019	0.014	0.015	0.019	0.014	0.016	0.022	0.009	0.010	0.014
TN load (t/yr)	50	161	308	255	347	57	229	261	389	34	196	75	159	130
TP load (t/yr)	1.3	4.0	7.5	5.9	8.6	1.4	5.5	6.3	9.1	0.93	4.5	1.8	3.8	3.1

Status classification[2] Low Moderate High Very high

Status reported for three-year period end (i.e. 2012–14 reported in 2014)
TN = total nitrogen TP = total phosphorus

Total nitrogen (TN) and total phosphorus (TP) concentrations (2001–14) at 614065





TN concentration:

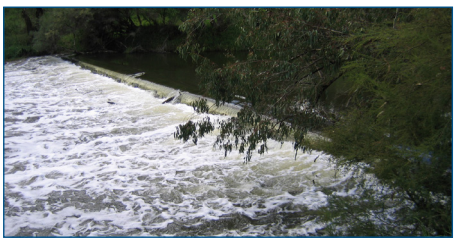
The annual percentage of TN samples that exceeded the ANZECC[3] guideline for lowland rivers (1.2 mg/L) ranged from 0% (2001) to 26% (2011).

Between 2001 and 2014, 14% of samples exceeded the guideline. There was a slight decrease in the percentage of samples exceeding the guideline between 2005 and 2009 (17%) and between 2010 and 2014 (14%).

TN trend:

Trend analysis[2] used data from 2010 to 2014 inclusive.

Once the data were adjusted for flow an emerging decreasing trend (0.034 mg/L/year) was detected.



The weir at Pinjarra – August 2006

TP concentration:

Between 2001 and 2014 only 2% of TP samples exceeded the ANZECC[3] guideline for lowland rivers (0.065 mg/L).

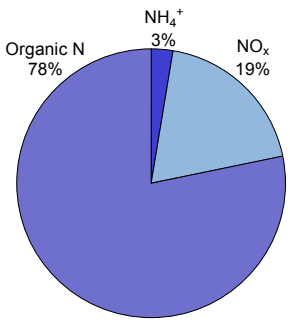
In the years with exceedances (2002, 2005 and 2014), only one or two samples had concentrations greater than 0.065 mg/L.

TP trend:

Trend analysis[2] was not undertaken between 2010 and 2014 as the data appears to show a decrease in concentrations in 2012 before increasing again.

Five years of continuously increasing, decreasing or consistent concentrations are needed to calculate a trend.

Nutrient fractions (2010–14) at 614065



Nitrogen:

Most of the nitrogen (N) was organic in nature. Organic N consists of both dissolved organic and particulate N. It is derived from degrading plant and animal matter and fertilisers. It often needs to be further broken down before it can be used by plants and algae.

The remaining N was dissolved inorganic N (DIN) such as ammonium (NH_4^+) and N oxides (NO_x).

DIN is also derived from animal wastes and fertilisers but is readily available to plants and algae.

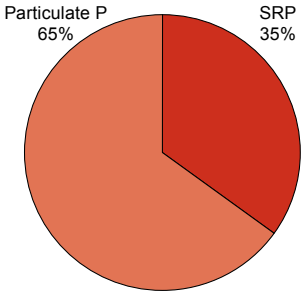
The sampling site on the Murray River had the third-highest percentage of DIN and equal second-highest NO_x of the 13 sites routinely sampled in the Peel-Harvey catchment, and highest of those flowing to the Peel Inlet.

However, in 2014 this site also had the lowest median TN concentration of all the sites sampled.

Phosphorus:

Just under two-thirds of the phosphorus (P) was present as particulate P, which consists of sediment-bound forms of P and organic waste materials.

Particulate P is not readily available for uptake by plants and algae, but may become available over time as organic matter decomposes or soil particles release bound P.

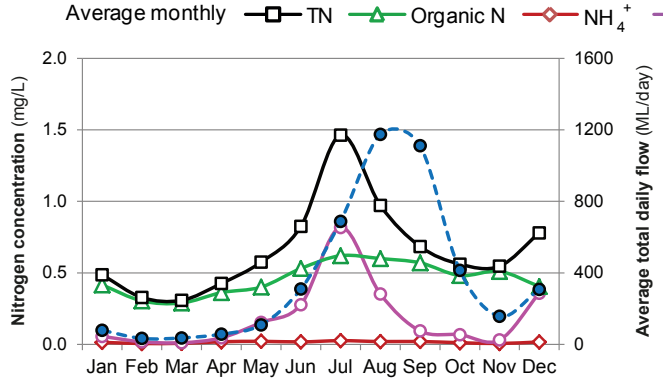


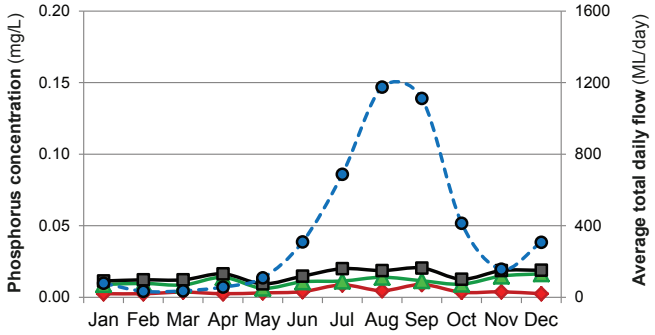
The remaining P was present as soluble reactive phosphorus (SRP). SRP is derived from fertilisers and animal wastes and is readily available for uptake by plants and algae.

The sampling site had the second-lowest percentage of SRP of the seven routine sampling sites flowing to the Peel Inlet. It also had the lowest median TP concentration of the 13 sites sampled in the Peel-Harvey catchment in 2014.

Upstream view at Pinjarra – December 2005

Seasonal variations in nutrient concentrations and riverine flow (2010–14) at 614065





Nitrogen:

Average monthly nitrogen concentrations were highest in winter.

NO_x concentrations increased with flow, possibly due to excess fertilisers and animal wastes being mobilised and flushed into the system.

TN concentrations exceeded ANZECC[3] guidelines during July. NH_4^+ did not exceed guideline concentrations.

NO_x concentrations exceeded the guideline from the first flush in May, throughout winter (June–August) and in December with an increase in flow.

View of the gauging station at Pinjarra – December 2005

Phosphorus:

Average monthly phosphorus concentrations were low throughout the year with average particulate P concentrations being greater than SRP each month.

View of the gauging station at Pinjarra – August 2009

Average monthly TP and SRP concentrations did not exceed ANZECC[3] guideline values.

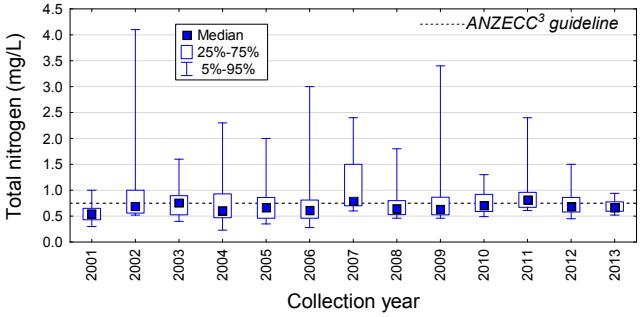
	ANZECC 2000[3]	Months exceeded
TN	1.2 mg/L	Jul
NH_4^+	0.08 mg/L	None
NO_x	0.15 mg/L	May–Aug, Dec
TP	0.065 mg/L	None
SRP	0.04 mg/L	None

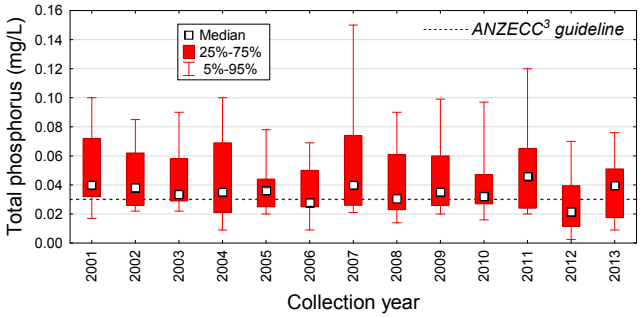
Murray River – estuarine water quality

Water quality along the estuarine section of the Murray River was monitored at three sites between 2001 and 2014.

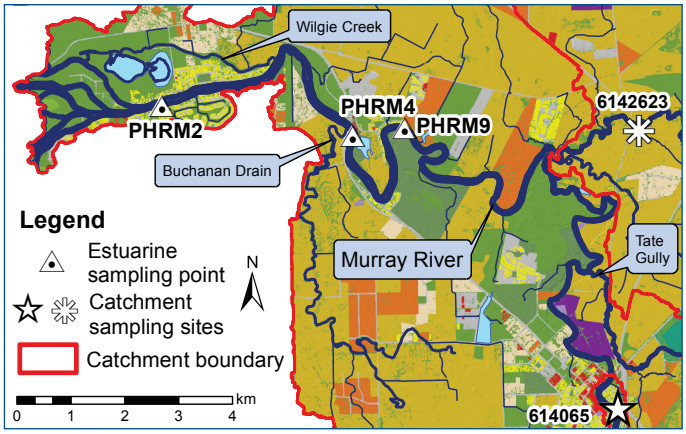
Annual surface median TN concentrations rarely exceeded the ANZECC[3] guidelines for estuarine waters (0.75 mg/L). However, annual surface median TP concentrations rarely fell below the guidelines (0.03 mg/L).

Most of the nitrogen present was organic however DIN concentrations increased substantially with winter flows.





Phosphorus was present mostly as particulate P throughout the year with a slight increase in SRP during winter.

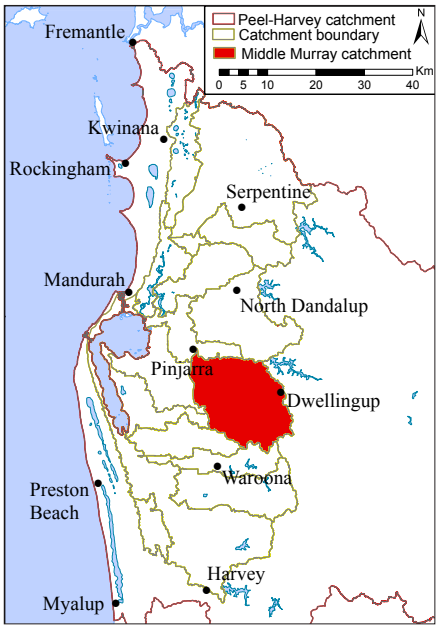


Fish deaths

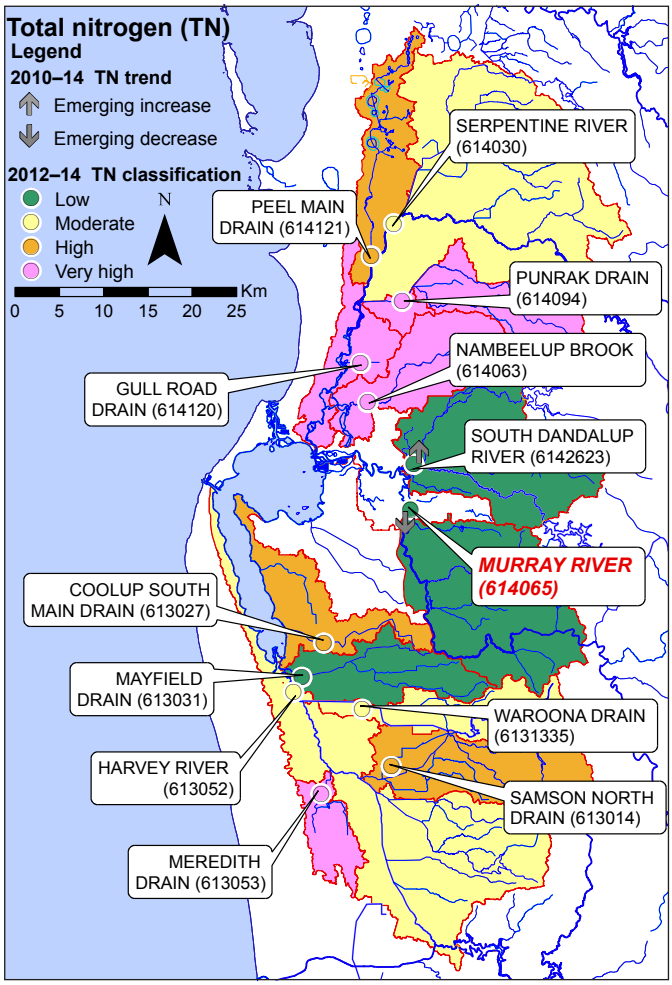
Between 2001 and 2014, 17 fish death incidents were reported in the Murray River's estuarine reaches. One event involved 2000 bream (2010). Most deaths were attributed to algal blooms, scum events or low oxygen conditions following storms. On a few occasions ichthyotoxic dinoflagellates were responsible for the deaths.

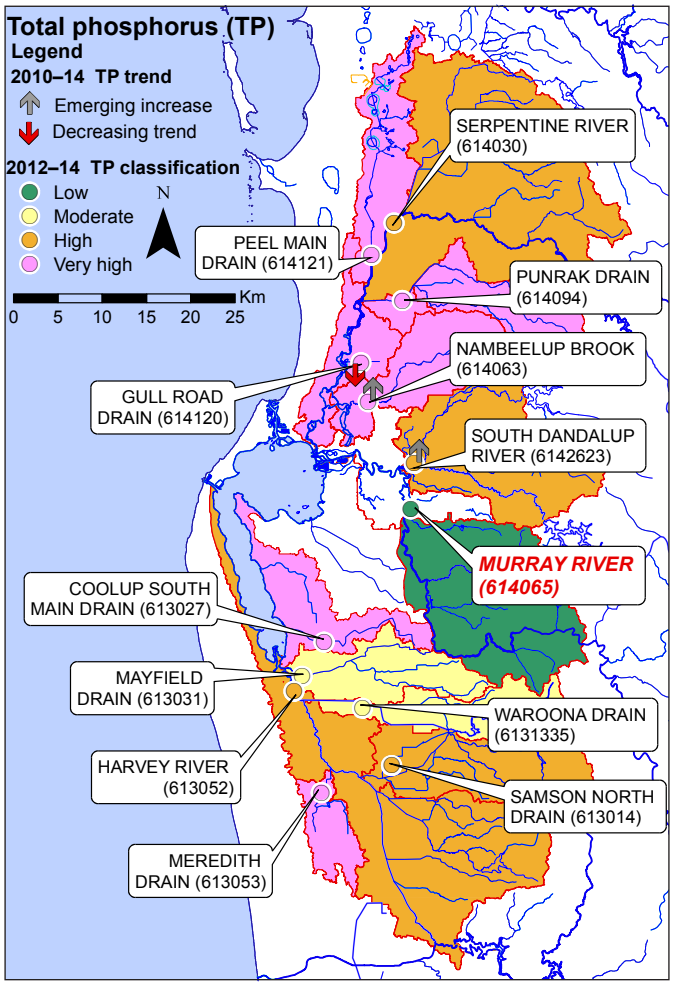
Dead fish in surface scum, lower reaches of the Murray River – January 2002

How the Middle Murray River fits within the Peel-Harvey catchment: location and statistics



Catchment	Receiving waterbody	Sample site (AWRC)	Area (km²)	2014 Flow (GL)	2014 TN median (mg/L)	2014 TP median (mg/L)
Peel Main Drain	Serpentine River	614121	120	5.0	1.7	0.19
Upper Serpentine River	Serpentine River	614030	502	28	0.79	0.13
Dirk Brook – Punrak Drain	Serpentine River	614094	134	9.6	1.9	0.21
Nambeelup Brook	Serpentine River	614063	143	9.7	3.7	0.60
Lower Serpentine River - Gull Road Drain	Peel Inlet	614120	94	-	4.4	0.93
South Dandalup River	Murray River	6142623	243	-	1.1	0.11
Middle Murray River	**Murray River**	**614065**	**293**	**153**	**0.57**	**0.01**
Coolup South Main Drain	Harvey Estuary	613027	113	2.1	2.1	0.31
Mayfield Drain	Harvey Estuary	613031	119	15	0.73	0.03
Harvey River	Harvey Estuary	613052	408	98	1.4	0.15
Drakes Brook – Waroona Drain	Harvey River	6131335	107	-	0.99	0.07
Samson North Drain	Harvey River	613014	195	-	1.5	0.18
Meredith Drain	Harvey River	613053	56	-	2.8	0.38





References

[1] Kelsey, P, Hall, J, Kretschmer, P, Quinton, B & Shakya, D 2010, *Hydrological and nutrient modelling of the Peel-Harvey catchment*, Water Science Technical Series, Report no. 33, Department of Water, Western Australia.

[2] Department of Water 2015, *Catchment nutrient reports* (methods for the analysis of status classification, loads and trends), <http://www.water.wa.gov.au/water-topics/waterways/assessing-waterway-health/catchment-nutirent-reports>.

[3] ANZECC & ARMCANZ 2000, *Australian guidelines for water quality monitoring and reporting,* National Water Quality Management Strategy, Paper no. 7, Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

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