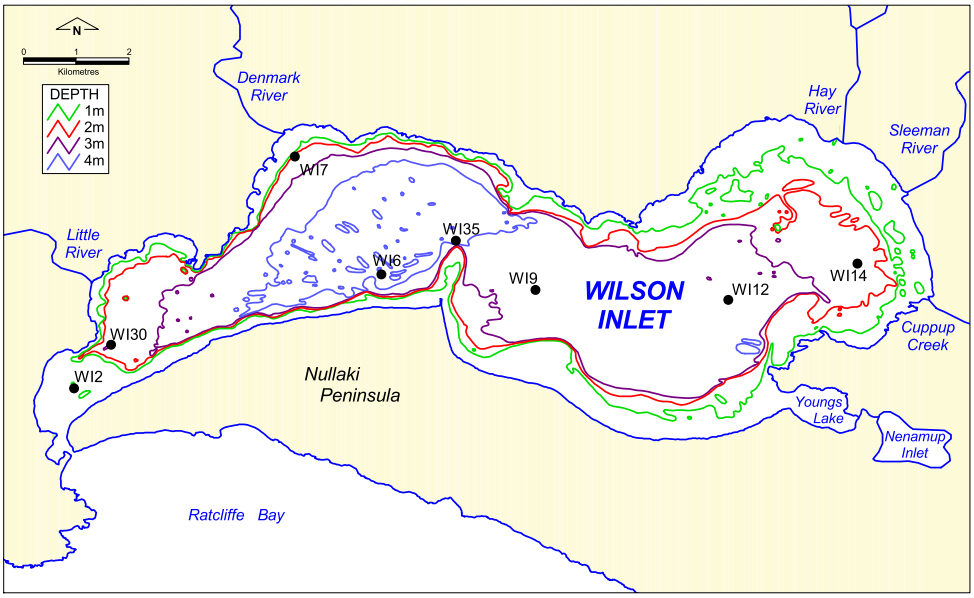
# Wilson Inlet

Wilson Inlet Water Quality Update
November 2002
2002 Bar Opening

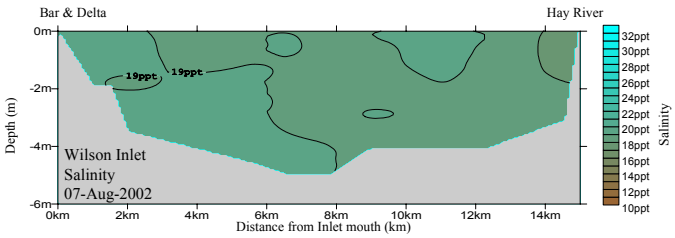
**Introduction:**

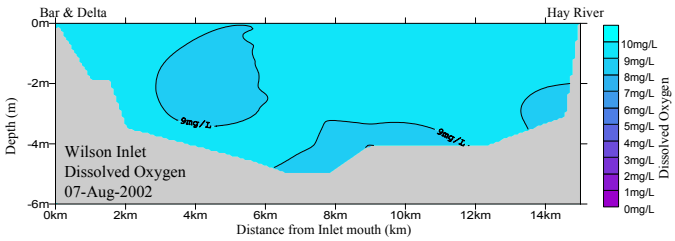
- This document provides an update on the water quality of Wilson Inlet as at 11th November 2002.
- This assessment of the Inlet's water quality is based on monitoring undertaken by the Water and Rivers Commission prior to and following the 2002 bar opening.
- The 2002 Wilson Inlet bar opening took place on the 6th September 2002.
- Water quality sampling had taken place once a month prior to the bar opening and once a fortnight following bar opening. The sampling dates were 11th June 2002, 8th July 2002, 7th August 2002, 4th September 2002, 18th September 2002, 30th September 2002, 14 October 2002, 28th October 2002 and 11th November 2002.
- The water quality parameters measured and reported on here include salinity, temperature, dissolved oxygen, nutrients (phosphorus and nitrogen) and phytoplankton (using chlorophyll A as a proxy).
- The Water and Rivers Commission's "*Wilson Inlet Report to the Community No 5 - Water Quality in Wilson Inlet 1995 to 2002*" is a useful reference when considering the data in this report.
- The map below indicates the locations of sampling sites in the Inlet.



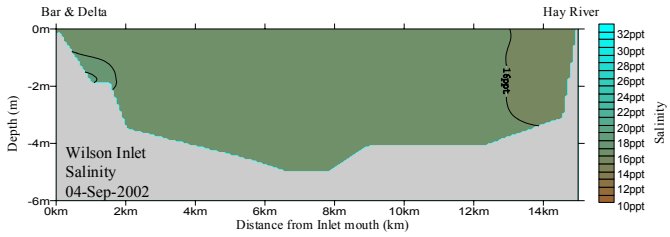

**Surface Plots of Dissolved Oxygen and Salinity:**

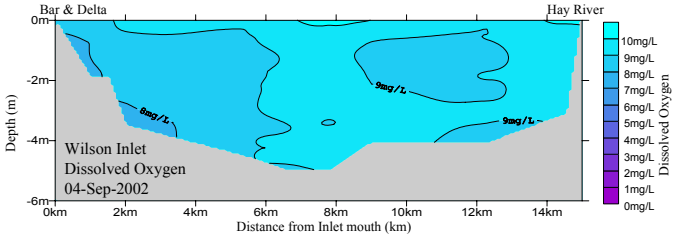
Surface plots of salinity and dissolved oxygen are plotted for the sampling occasions shortly before and after bar opening. These plots represent transects through the Inlet from close to the mouth of the Hay River to the bar.



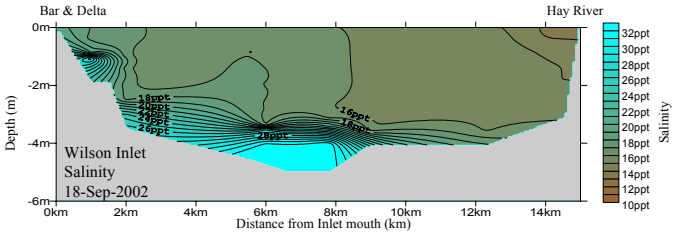



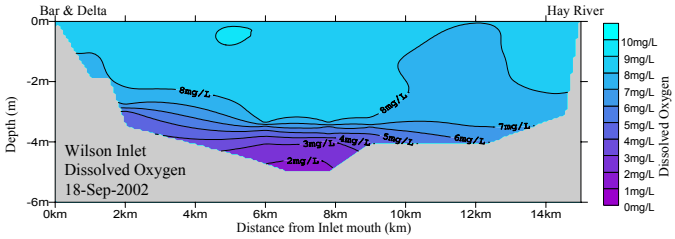

Transects of salinity and dissolved oxygen on August 7th 2002 indicate that the Inlet was relatively well mixed, almost entirely saturated with dissolved oxygen and had a salinity just above half seawater concentrations.



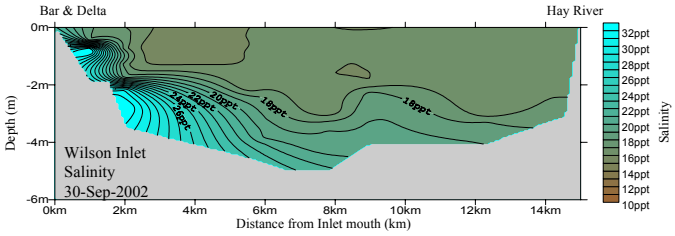



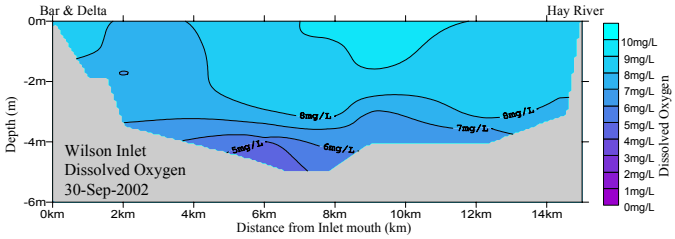

Transects of salinity and dissolved oxygen on September 4th 2002 indicate that the Inlet was very well mixed, almost entirely saturated with dissolved oxygen and had a salinity just below half seawater concentrations – suggesting that inflows in the month of August had been mixed into the Inlet.



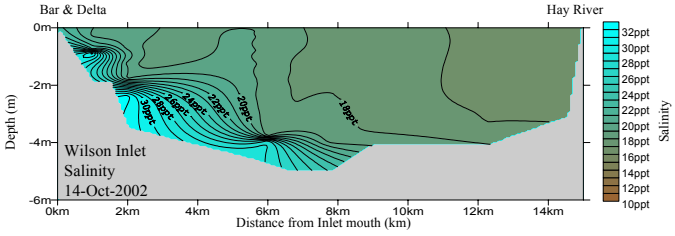



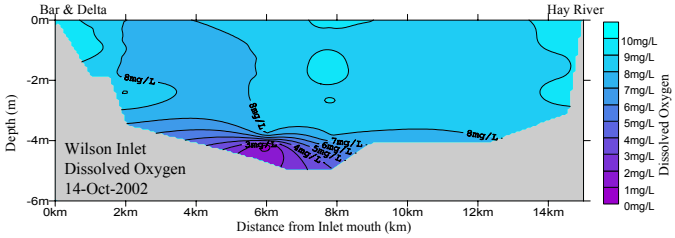

Transects of salinity and dissolved oxygen on September 18th 2002 indicate that the Inlet was strongly stratified. Marine water can clearly be seen intruding into the western basin of the Inlet through the bar opening. Whilst the water above this stratified layer remained close to saturated with dissolved oxygen, the water in the stratified layer was severely deoxygenated.



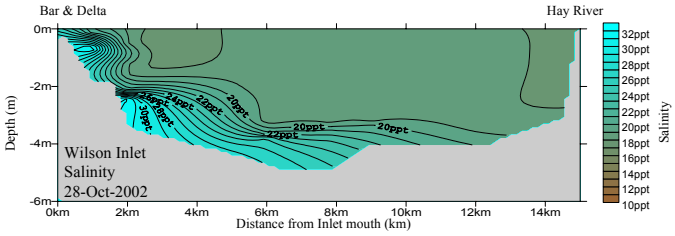



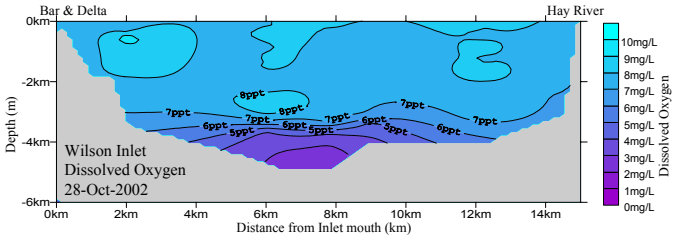

Transects of salinity and dissolved oxygen on September 30th 2002 indicate that while the Inlet remained stratified the stratification was weaker than the two weeks earlier, although stronger stratification appeared to be re-establishing as marine water can clearly be seen intruding into the western basin of the Inlet through the bar opening. Like the stratification, the deoxygenation was not as intense on September 30th as it had been two weeks prior, although the water in the stratified layer was still deoxygenated. The September 30th transect suggests that there must have been some mixing of the stratified layer in the previous two weeks – possibly with weak marine intrusions during this period also.



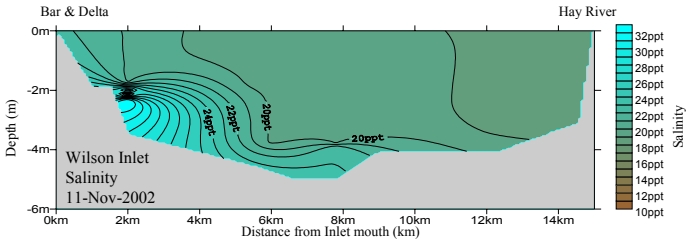



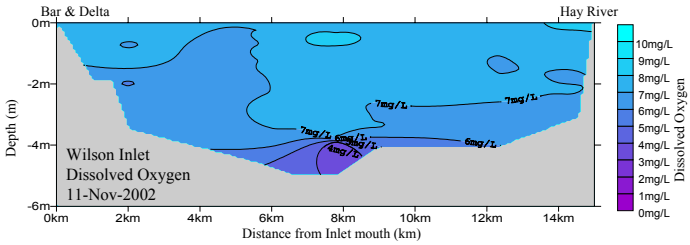

Transects of salinity and dissolved oxygen on October 14th 2002 indicate that the Inlet was strongly stratified. Marine water can clearly be seen intruding into the western basin of the Inlet through the bar opening. Whilst the water above this stratified layer remained close to saturated with dissolved oxygen, the water in the stratified layer was severely deoxygenated. The spatial extent and intensity of the stratification and deoxygenation had increased since the previous sample run two weeks prior but were still confined essentially to the western basin.




Transects of salinity and dissolved oxygen on October 28th 2002 indicate that the Inlet was strongly stratified. Marine water can clearly be seen intruding into the western basin of the Inlet through the bar opening. Whilst the water above this stratified layer remained close to saturated with dissolved oxygen, the water in the stratified layer was severely deoxygenated. The spatial extent and intensity of the stratification and deoxygenation had increased since the previous sample run two weeks prior, the bottom waters of much of the western basin appear deoxygenated with stratification and deoxygenation now extending further east.

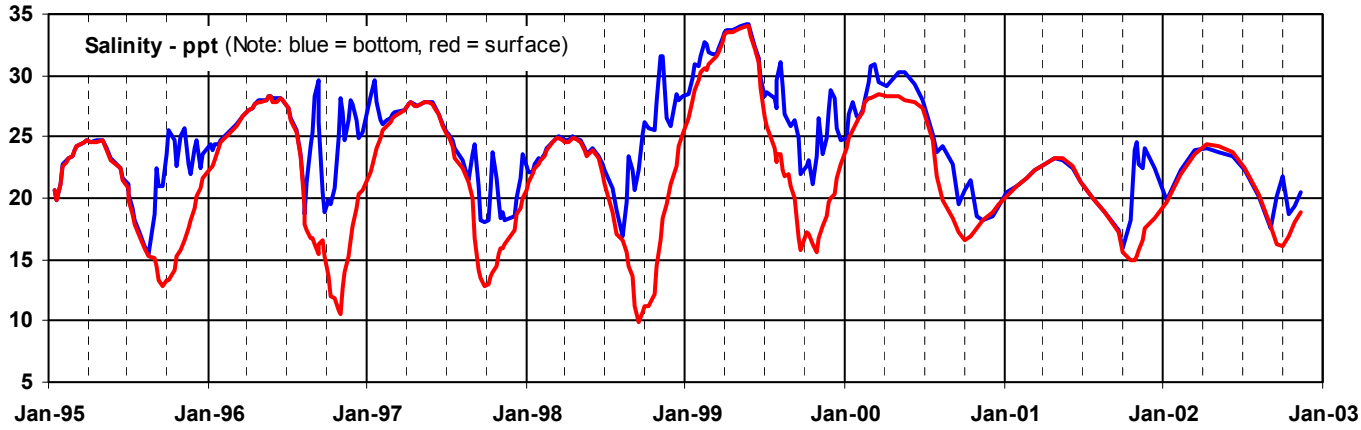


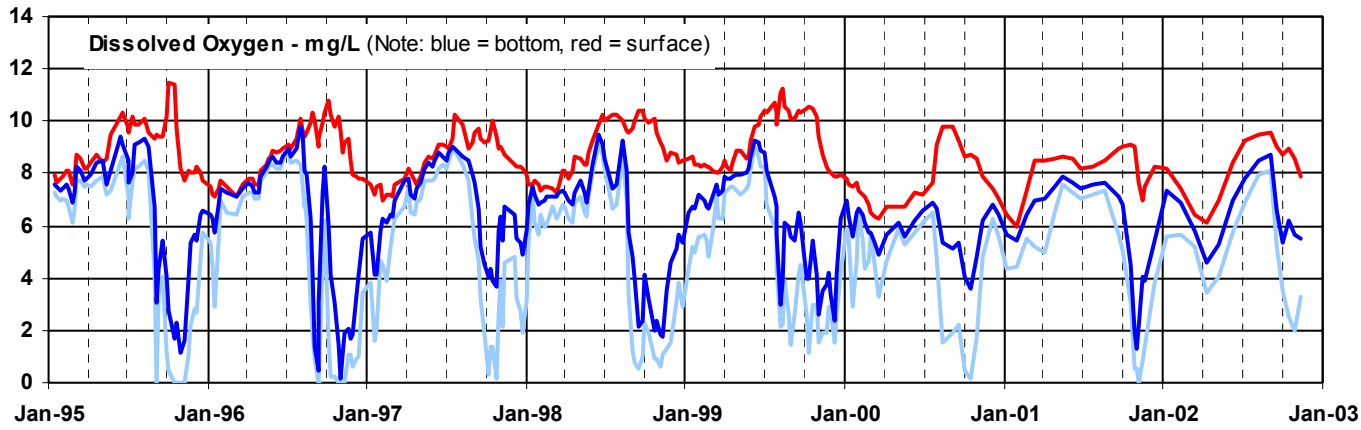

Transects of salinity and dissolved oxygen on November 11th 2002 indicate that while the Inlet remained stratified the stratification was weaker than the two weeks earlier. Similarly the extent an intensity of deoxygenation was reduced compared to the previous fortnight's sample run, and the salinity of the Inlet had on average risen slightly. This suggests that there had been substantial mixing in the fortnight between November 11 and October 28.

**Time-Series Plots of Dissolved Oxygen and Salinity:**

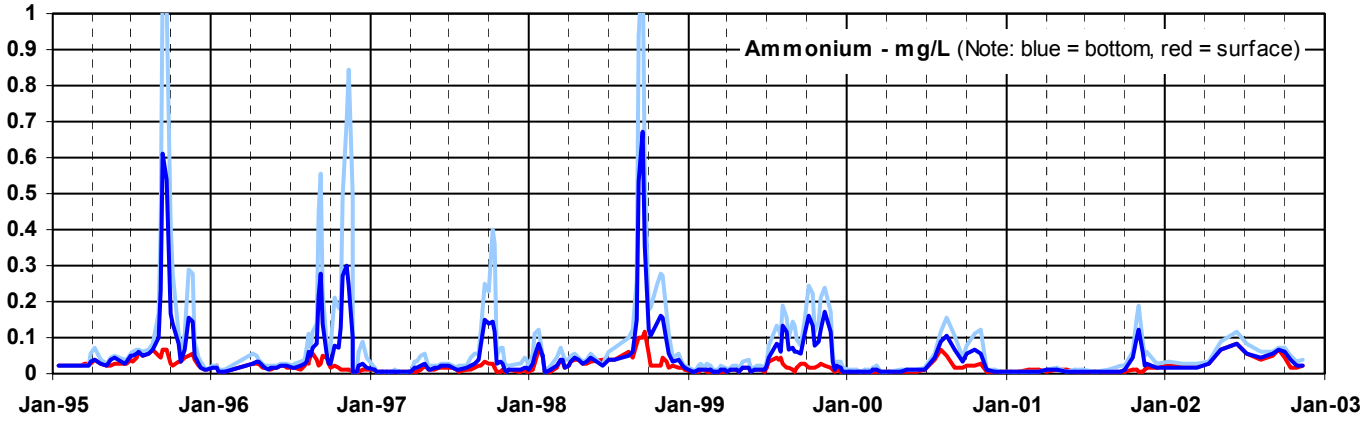
Time-series plots of salinity and dissolved oxygen are plotted for all sampling occasions from January 1995 to put the current data in context. These plots represent the average value of the parameter of interest for the main basin sampling sites in the Inlet: WI12, WI6, WI9 and WI35. The red lines on the plots represent the averages of surface data and the blue lines the averages of bottom data.



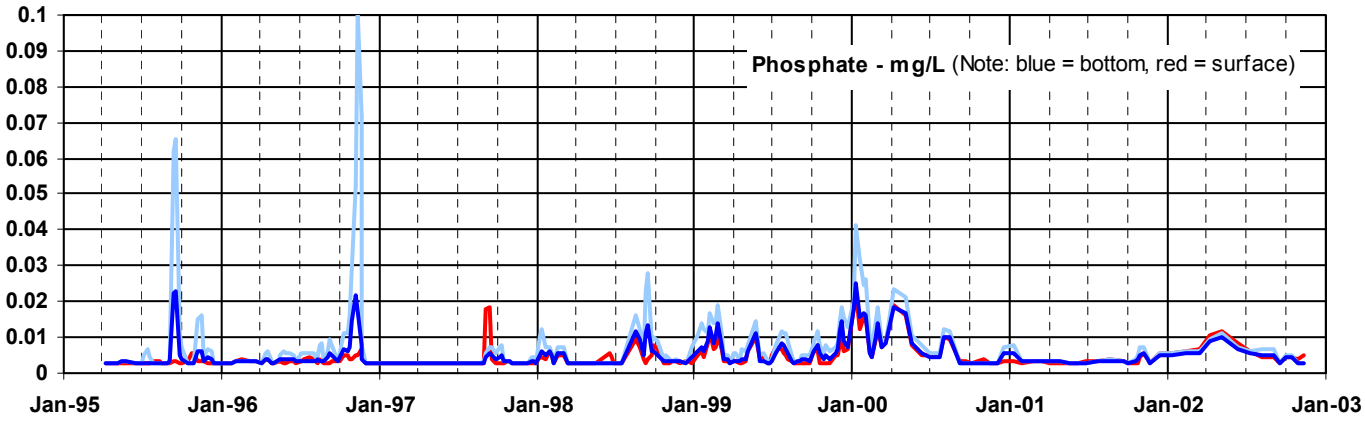

This figure presents salinity data for surface and bottom waters (average of sites WI6, WI12, WI35, WI14 and WI9) for the period January 1995 to present. Where the lines indicating bottom and surface water salinities diverge, stratification is occurring. It is clear from this plot that, to date, the 2002 bar opening has resulted in little stratification compared to previous years. A preliminary inspection suggests that this is due to low river flow over the winter and spring resulting in a higher than average salinity in the Inlet at the time of bar opening. It also appears that marine intrusions and marine exchange have been less than in previous years, and that wind energised mixing may have been greater – although these last two assertions are only guesstimates and are yet to be quantified by analysis of the relevant data. Nonetheless we may yet see stronger stratification in the November and December period.



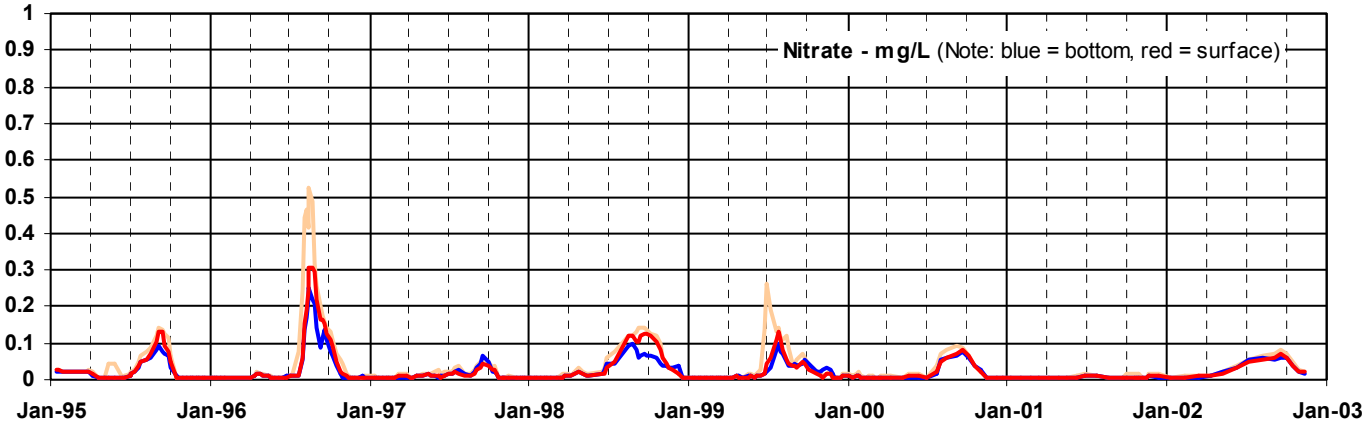

This figure presents dissolved oxygen data for surface and bottom waters (average of sites WI6, WI12, WI35, WI14 and WI9) for the period January 1995 to present (dark blue is the average of bottom water dissolved oxygen concentrations and light blue is the minimum). Where the lines indicating bottom and surface water dissolved oxygen concentrations diverge, in most cases deoxygenation of bottom waters is occurring (in some cases, such as spring 1995, there is also a small amount of surface water photosynthesis and oxygen production occurring). It is clear from this plot that to date, the 2002 bar opening has resulted in less deoxygenation than in previous years; this is probably a result of the less intense and less persistent stratification to date.



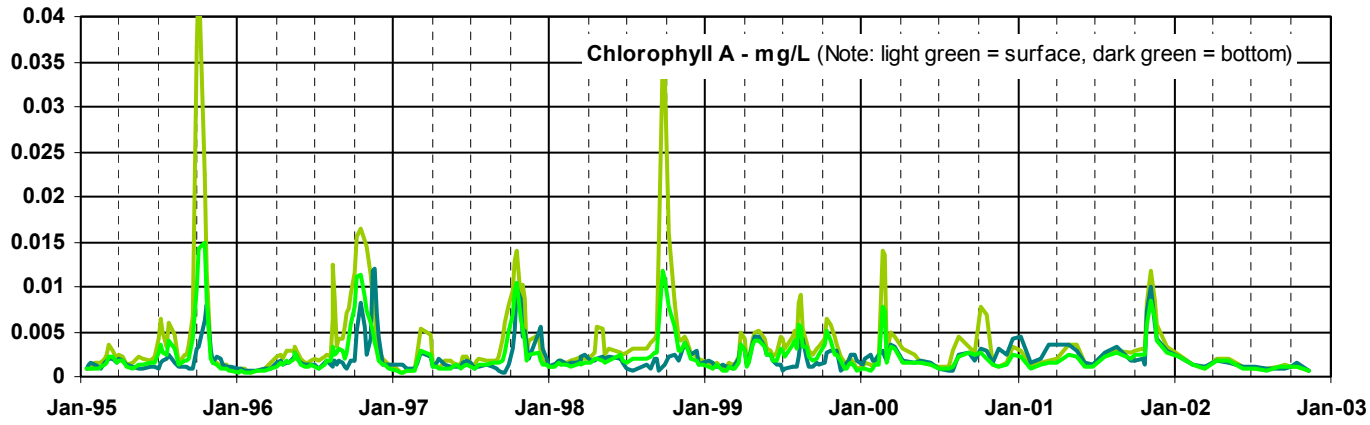

This figure presents ammonium data for surface and bottom waters (average of sites WI6, WI12, WI35, WI14 and WI9) for the period January 1995 to present (dark blue is the average of bottom water ammonium concentrations and light blue is the maximum). The plots clearly demonstrates, that unlike in previous years, to date there has not been a large amount of ammonium recycled from bottom sediments into the water column – this is because of the lack of persistent stratification and deoxygenation. Notably though ammonium concentrations were higher about April 2002 onwards than usual. This could be related to different river flow patterns than usual or due to recycling of nutrients from decaying biomass in the Inlet – the source of these nutrients can hopefully be quantified once flow and meteorological data for the Inlet are processed.



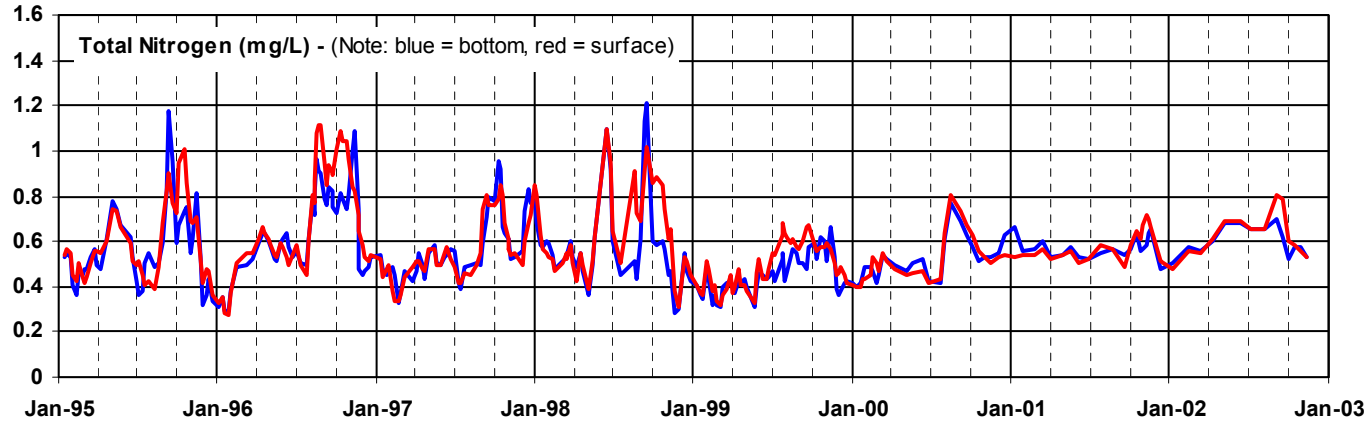

This figure presents phosphate data for surface and bottom waters (average of sites WI6, WI12, WI35, WI14 and WI9) for the period January 1995 to present (dark blue is the average of bottom water phosphate concentrations and light blue is the maximum). Like the ammonium, plotted above, the phosphate demonstrates little evidence of increased sediment recycling in the post bar open period but was elevated, almost certainly through the same process of recycling or river flow as the ammonium was, in the late autumn period.



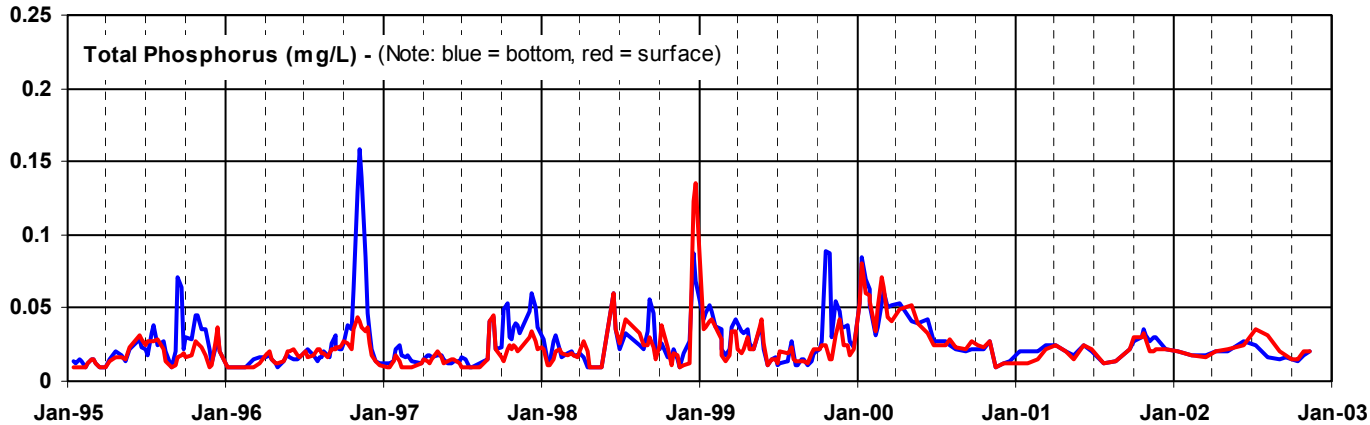

This figure presents nitrate data for surface and bottom waters (average of sites WI6, WI12, WI35, WI14 and WI9) for the period January 1995 to present (red is the average of surface water nitrate concentrations and orange is the maximum). Nitrate concentrations in the winter and spring of 2002 elevated slightly, again until catchment data are processed it is difficult to determine whether this represents nitrate from river flow or from the nitrification of ammonium that has accumulated in the Inlet from recycling of biomass. Suffice as to say, like other years, by the beginning of summer this nitrate had been run down to detection limits either due to denitrification or uptake by *Ruppia* and algae.



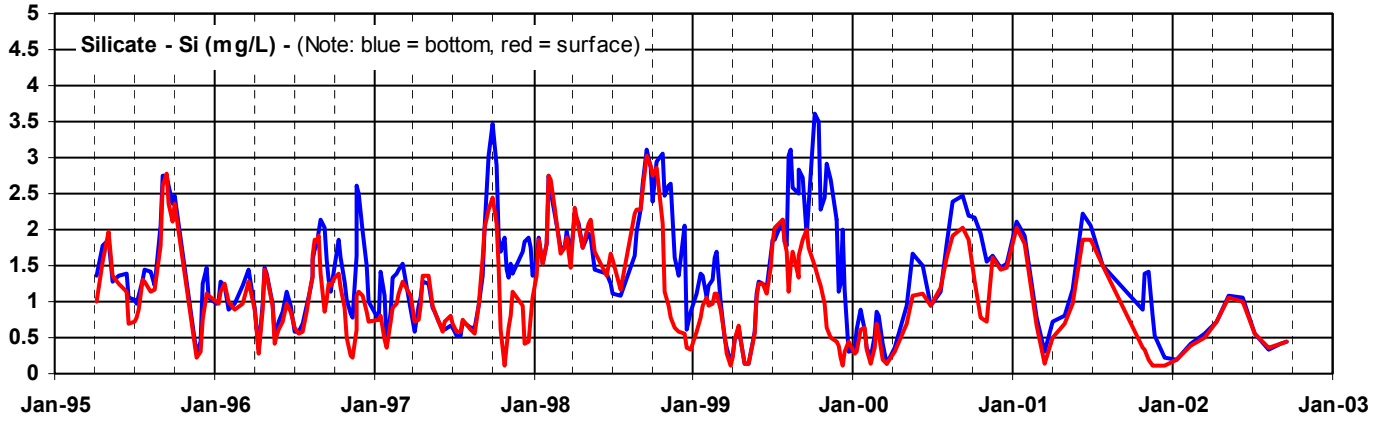

This figure presents chlorophyll A data for surface and bottom waters (average of sites WI6, WI12, WI35, WI14 and WI9) for the period January 1995 to present (light green is the average of surface water chlorophyll A concentrations and khaki is the maximum). To date the phytoplankton activity in Wilson Inlet in 2002 has been minimal. However, if significant marine exchange and stratification were to occur in the coming weeks we may yet see phytoplankton bloom activity in the Inlet in 2002.



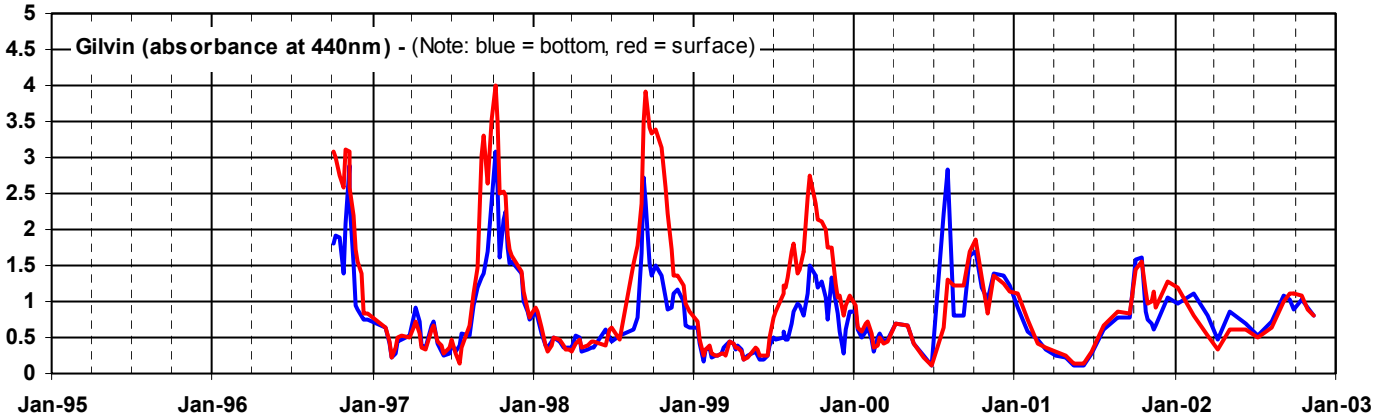

This figure presents total nitrogen data for surface and bottom waters (average of sites WI6, WI12, WI35, WI14 and WI9) for the period January 1995 to present.




This figure presents total phosphorus data for surface and bottom waters (average of sites WI6, WI12, WI35, WI14 and WI9) for the period January 1995 to present.




This figure presents silicate data for surface and bottom waters (average of sites WI6, WI12, WI35, WI14 and WI9) for the period January 1995 to present.




This figure presents gilvin (ie water colour) data for surface and bottom waters (average of sites WI6, WI12, WI35, WI14 and WI9) for the period January 1995 to present. Given that gilvin is a measure of the yellow-brown colour of the water that comes from catchment derived tannins and humic compounds, the most striking feature of this plot is that in 2001 and 2002 there was considerably less gilvin present than in previous years – indicating that river flow was exceptionally low.

**Summary:**

To date stratification in the post 2002 bar opening period has either been weak or strong but transient. This may be due to a combination of factors including low river flow, potentially stronger or more persistent winds, and a small volume of marine exchange to date (these factors remained to be confirmed and quantified). As a consequence deoxygenation has been intermittent and less intense than in previous years. This in turn has meant that the increased fluxes of ammonium (and to a lesser degree phosphorus) from the sediments, which usually follow extended periods of deoxygenation and fuel subsequent phytoplankton blooms, have not occurred. Therefore, to date, there have been no phytoplankton blooms (ie blooms of floating microalgae) in the Inlet following the 2002 bar opening.

If marine exchange and subsequent stratification increase in the coming weeks then the possibility for blooms still exists.

The fact that river flow and presumably nutrient delivery to the catchment were low over the winter and spring of 2002 also suggests that there may have been fewer nutrients available for the growth of *Ruppia* in the Inlet this year. However, there appears to have been some increase in nutrients in the water column in late autumn (the source is yet to be determined) and the likely sink for those nutrients was probably the *Ruppia* so this may compensate for the reduced catchment nutrient load in winter and spring.

A more thorough analysis of this water quality data may be made in the future when river flow, meteorological, water level and tide data are collated and analysed.