Murray Darling Basin – water quality and dissolved oxygen results

Multiple agencies are undertaking water quality monitoring to review dissolved oxygen conditions across NSW, identify potential risks to ecological communities, and implement mitigating measures. This update provides a summary of information collected up to 8 March 2023.

River levels in the lower Darling River are continuing to recede. As the river level drops, the last of the floodwaters upstream of Pooncarie are draining off the floodplain and back into the main river channel. This results in concentration of large volumes of floodplain nutrients, organic matter, sediment, algae and fish into the river channel. As flows recede, fish can also become stranded in disconnected waterbodies and billabongs on the floodplain where they may suffer from declining water depth, dissolved oxygen depletion (particularly overnight when photosynthetic production of oxygen ceases), higher air and water temperatures and exposure to predators as these waterbodies dry out.

Since mid-February fish deaths have been recorded upstream of Pooncarie, both in the main channel of the river and in off-channel wetlands and depressions, where fish became stranded as water levels dropped. Most of the dead fish are native Bony herring and non-native Carp, although increasing numbers of large-bodied native fish such as Murray cod and Golden perch are being documented. The stranding of substantial numbers of Murray cod and Golden perch during flood recession in this manner is unusual, suggesting fish were avoiding the particularly poor water quality in the river channel during the recession of this flood event. Typically, we expect Murray cod and Golden perch to exit off channel habitats before disconnection. Recent hot weather in the region is also exacerbating the risk of low dissolved oxygen levels in both the river and disconnected floodplain wetlands because warmer water holds less oxygen.

The Bureau of Meteorology has forecast maximum air temperatures at Menindee will increase towards 30°C later this week, which is cooler than the high temperatures experienced last week. Cooler water temperatures assist dissolved oxygen levels to improve which may bring some relief to struggling fish in the lower Darling River.

NSW and Commonwealth agencies will continue to monitor dissolved oxygen levels and assess the risks as low oxygen water makes its way down the lower Darling River. Ongoing monitoring will inform the best operational flow measures to mitigate risks to aquatic life as much as possible.

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To report dead fish, fish struggling or starting to gasp at the water surface, or crayfish exiting the water please call the NSW Department of Primary Industries Fisheries, Fishers Watch Phoneline 1800 043 536 or fill in a fish kill protocol and report form at: www.dpi.nsw.gov.au/fishing/habitat/threats/fish-kills-2019-2020/info-sheet

Dissolved oxygen levels – Menindee Lakes

It was identified that poorer quality water was entering Lake Pamamaroo from Lake Wetherell and was being drawn through the Pamamaroo outlet and discharged into the Darling River upstream from the town of Menindee. This increased the risk of stress to fish. To address this risk, the inlet regulator between lakes Wetherell and Pamamaroo was closed. Monitoring is showing the water quality now being released from Lake Pamamaroo into the Darling River at Menindee is of more suitable quality and is providing some relief for fish. Water is also being released from Lake Menindee to meet flow targets at Weir 32, downstream of Menindee town.

Figure 1 is a satellite-derived Sentinel colour infrared image of lakes Wetherell, Tandure, Pamamaroo and Menindee on 4 March. The image highlights the darker-coloured low oxygen flood water from the upper Barwon- Darling River is being captured in Lake Wetherell and is no longer flowing into Lake Pamamaroo. Some of the darker coloured floodwater from Lake Wetherell is pushing into Lake Tandure. As well as the mixing of floodwater with the more oxygenated water, these large shallow lakes allow the water to be more quickly aerated and provide a refuge area for smaller fish and crustaceans to move into if dissolved oxygen conditions deteriorate in Lake Wetherell.

Figure 1 also shows dissolved oxygen results (in mg/L) collected 8 March. The samples were taken close to the water surface during the day. The lowest results were collected in Lake Wetherell (1.49 mg/L) and upstream of Menindee township (2.55 mg/L). As a general guide, native fish and other large aquatic organisms require at least 2 mg/L of dissolved oxygen to survive, but may begin to suffer if levels are below 4 to 5 mg/L for prolonged periods.

To maintain an oxygenated flow in the Darling River through Menindee township and reduce the risk of further fish deaths, releases from the Pamamaroo outlet will continue during the recession of flows back to regulated conditions. Releases from Lake Menindee have also been reduced to assist in the flow of water from Lake Pamamarooo past Menindee town and through to the lower Darling River, but is still delivering good flows at Weir 32.

Lower dissolved oxygen results are being recorded overnight and early in the morning in some areas. Dissolved oxygen levels drop overnight when respiration (microbes and animals breathing oxygen) outpaces oxygen replenishment (photosynthesis from aquatic plants and algae) that occurs during the day.

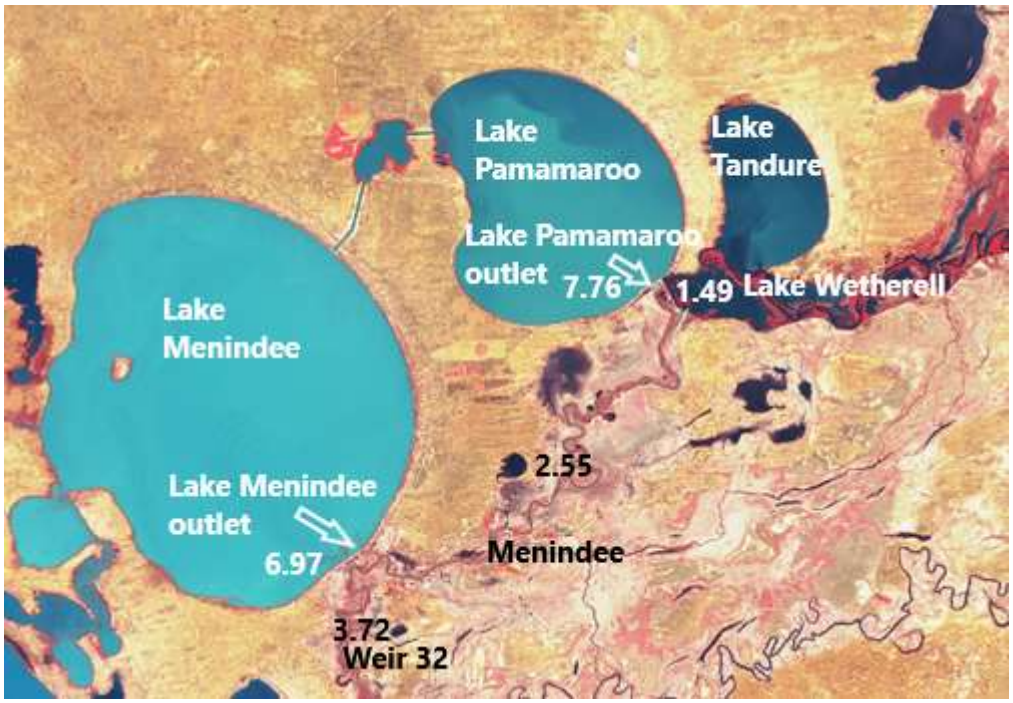

Figure 1: Satellite derived Sentinel colour infrared image – Image 4 March. Data collected 8 March (mg/L)

Dissolved oxygen in the Darling River downstream of Menindee at Weir 32 had been low, decreasing to less than 2 mg/L on 25 February. These levels have now improved above 2 mg/L in response to the operational measures implemented and are continuing to increase toward the safer level for fish health of 4 mg/L (Figure 2).

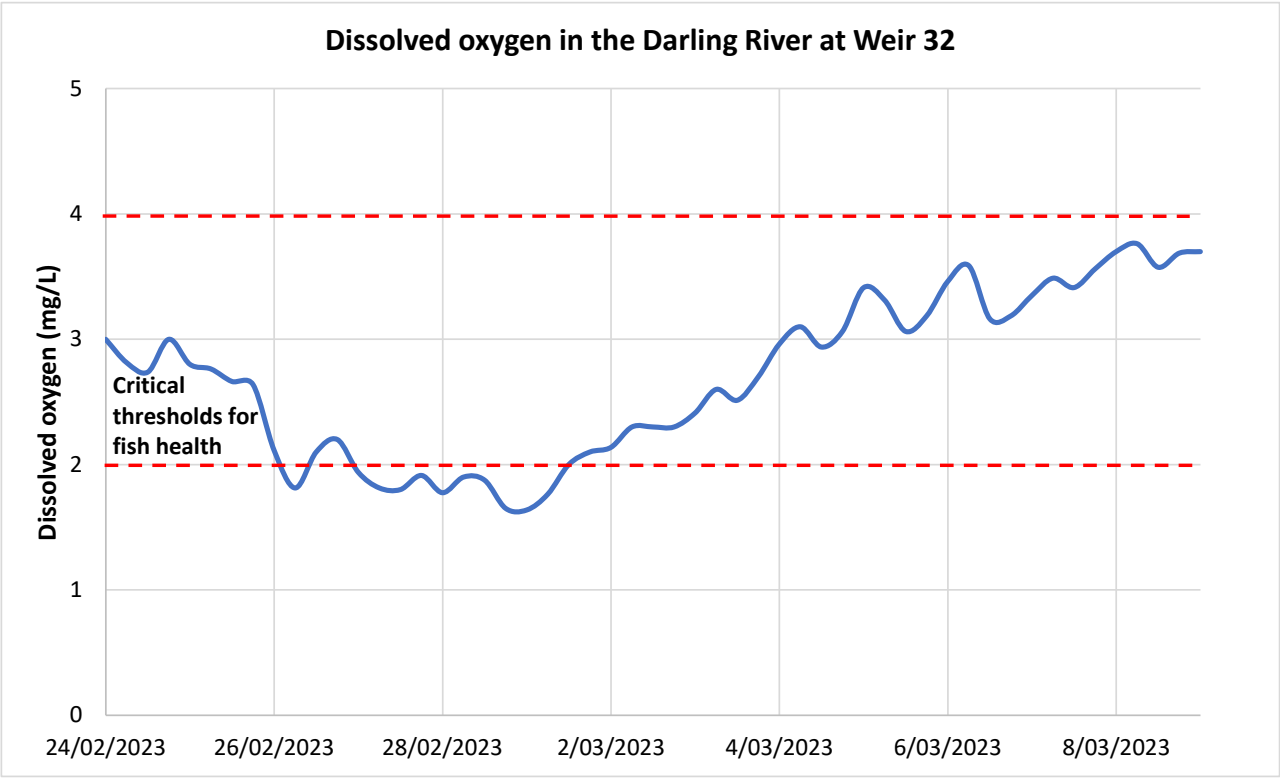

Figure 2: Dissolved oxygen (mg/L) in the Darling River at Weir 32 – 24 February to 8 March 2023

NSW and Commonwealth agencies will continue to work together and monitor dissolved oxygen levels in this area and advise the best operational measures to mitigate risks to aquatic life as much as possible. This can involve adjusting the timing, size and location of releases from the Lakes into the lower Darling River to maintain the quality of the water in the river.

Dissolved oxygen levels – lower Darling River

Figure 3 is a series of satellite derived Sentinel colour infrared images. The image on the left was taken on 22 February 2023 during minor flooding at Pooncarie. The centre image (27 February) shows, as river levels drop, floodwater is draining back into the main channel. By 4 March (right) the majority of the floodwater had returned to the channel with some water remaining in billabongs and depressions.

As mentioned above, poor quality water returning from the floodplain containing large volumes of nutrients, organic matter, sediment and fish biomass is being concentrated in the river channel. The nutrient-rich return flows combined with warm, still water provide ideal conditions for the growth of algae and this increases the risk of large oxygen fluctuations, with high oxygen concentrations during the day from photosynthetic activity then very low oxygen concentrations overnight when photosynthesis ceases.

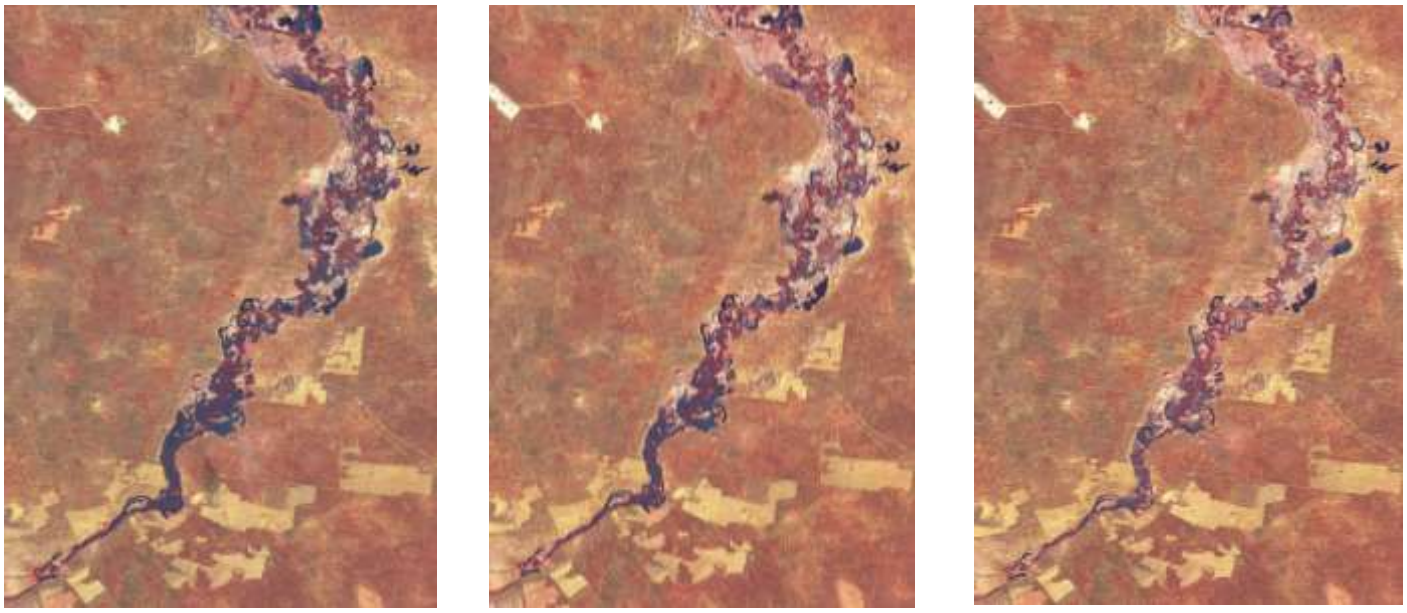

Figure 3: Series of satellite derived Sentinel colour infrared images of the lower Darling River including Pooncarie and Burtundy. Images 22 February (left), 27 February (middle) and 4 March (right)

As the low oxygen floodwaters continue downstream, dissolved oxygen levels in the Darling River downstream of Pooncarie at Burtundy has decreased to less than 2 mg/L (Figure 4). Oxygenated water is being released from Menindee Lakes, but it will be some weeks before it reaches Burtundy. There may be some improvement in dissolved oxygen with lower air temperatures expected this week.

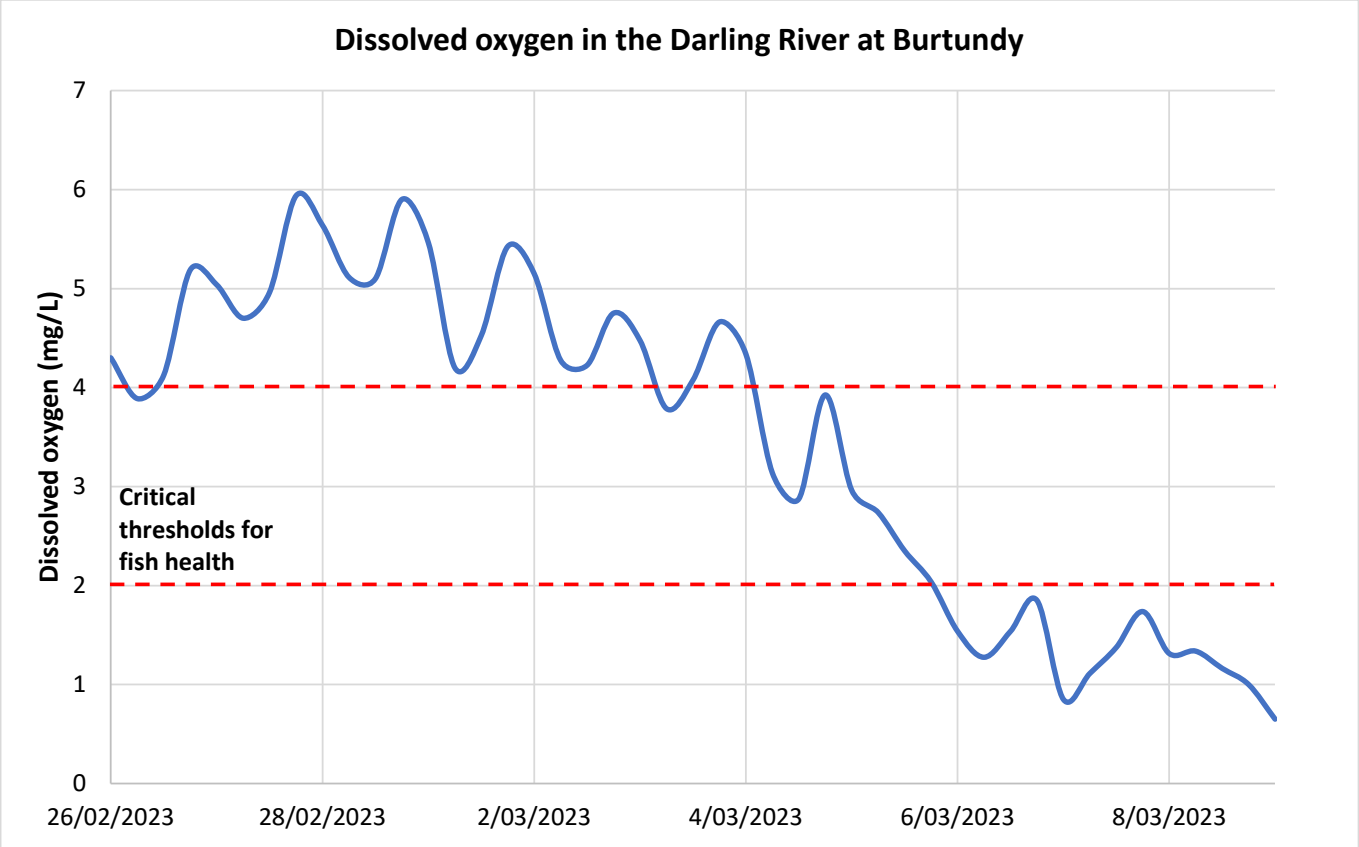

Figure 4: Dissolved oxygen (mg/L) in the Darling River at Burtundy – 26 February to 8 March 2023

Hypoxic blackwater fish death summary

In recent months NSW DPI Fisheries has received reports of fish deaths, fish struggling and crustaceans leaving the water across a broad area in the Murray-Darling Basin, including in the Murray, Kolety/Edward, Wakool, Murrumbidgee, Lachlan, Gwydir, Darling, Barwon, Namoi and Macquarie rivers and Yanco-Billabong Creek system. High air temperatures increase the risk of further reductions in dissolved oxygen in some areas and the potential for further fish death events.

In the last few weeks there have been confirmed fish deaths in the Darling River upstream of Pooncarie related to poor quality floodplain return water and the stranding of fish in off-channel wetlands as the river disconnected. Large numbers of Bony herring and Carp have been affected with increasing numbers of large-bodied native fish, such as Murray cod and Golden perch, also dying. The speed of the recession of floodwater is typical of floods in the lower Darling River, which makes the stranding of these native species in this manner somewhat unusual, as the fish appear to have avoided returning to the river channel, presumably because the quality of the water in the channel at the time was poorer relative to that on the floodplain.

On 1 March there was a report of five (5) dead Murray cod in the lower Lachlan River near Hunthawang. The cause of the deaths is unknown, however; spot measurements showed dissolved oxygen levels were above concern levels for fish, so the deaths are likely unrelated to low oxygen. The fish may have been in poor overall condition and infection by the parasitic Lernea was observed on the dead fish.

On 3 March, there was a report of a low number (in the tens) of dead Golden perch, Spangled perch, Carp, Bony herring in the Bogan River, Nyngan Weir Pool. Cause was unclear, however; it is suspected that low flow, combined with very warm temperatures, resulted in low dissolved oxygen levels.

On 6 March there was a report of a large number of dead Redfin perch (hundreds) in Carcoar Dam, with no other species appearing affected. The Redfin were mostly small fish. Investigation into the cause is ongoing.

NSW agencies are working together to investigate and determine if any other native fish have been affected. There may be other fish death incidents that have not yet been reported directly to NSW Department of Primary Industries Fisheries.

Programs to benefit native fish, such as improving fish passage and habitat restoration to provide conditions conducive to fish breeding and population growth, are ongoing. These works are vital and provide an environment where fish populations can bounce back from low oxygen events.

What is being done?

To maintain an oxygenated flow in the Darling River through Menindee township and reduce the risk of further fish deaths, releases from the Pamamaroo outlet will continue. Releases from Lake Menindee have also been reduced (currently at 3 gigalitres/day) to assist in the flow of water from Lake Pamamaroo, past Menindee town and through to the lower Darling River. Utilising the lower Darling Water Quality Allowance is providing a flushing flow of oxygenated water to the Darling River through Menindee town. The discharge will also maintain flow velocity that research has shown provides conditions that are less favourable for harmful algal bloom formation. Ongoing monitoring will identify if the operations continue to achieve the desired results. Discharge from Pamamaroo is slowly decreasing at a slower rate than normal operational requirements, as monitoring of water quality suggests that there are improvements in the reach downstream of Lake Pamamaroo.

There are no operational measures available to reduce the current risk of further fish deaths in the lower Darling River downstream of the Menindee Lakes. Oxygenated water is being released from Menindee Lakes, but this will take some weeks to pass along the system. The volume of water being released will not be sufficient to reconnect billabongs on the floodplain to allow any remaining stranded fish to return to the main river channel.

Weather outlook

The Bureau of Meteorology has forecast median maximum air temperatures will remain close to average to slightly higher for March, with a higher chance of exceeding the median maximum temperature for March to May across most of NSW. The forecast is that rainfall figures for March through to May will be lower than historic averages for the majority of NSW. Refer to the Bureau of Meteorology website for the latest forecasts.

Additional information

To notify the NSW Department of Planning and Environment – Water of potential blackwater events email: waterqualitydata@dpie.nsw.gov.au

To report dead fish, fish struggling or gasping at the water surface, or crayfish leaving the water please call the NSW DPI Fisheries Phoneline 1800 043 536 or fill in a fish kill protocol and report form at: www.dpi.nsw.gov.au/fishing/habitat/threats/fish-kills-2019-2020/info-sheet

Information on recent fish deaths is available at: Fish kills in NSW. When reporting, please include the name of the river/waterbody, location and date of your observation. If possible, please also record what species are affected and an estimate of number of each species observed.

Further information on blackwater events can be found at the DPE Water website at: www.industry.nsw.gov.au/water/allocations-availability/droughts-floods/drought-update/managing-drought-recovery/blackwater

Additional information is also available on the Murray-Darling Basin Authority website at: www.mdba.gov.au/publications/mdba-reports/water-management-101-factsheets

Operational updates are available at: WaterInsights - WaterNSW

Flood updates can be found on the Environment Protection Authority web page at: www.epa.nsw.gov.au/news/news/2022/nsw-storm-and-flood-updates-2022

To report suspected algal blooms see the WaterNSW website.