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The Executive Officer
Environment, Natural Resources and Regional Development Committee
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Environmental Water Inquiry - Written Submission

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Please find attached a copy of The Murray-Darling Freshwater Research Centre written submission to the Environmental Water Inquiry, requested by the Environment, Natural Resources and Regional Development Committee

Please do not hesitate to contact the office on [redacted] if you require further information

Yours sincerely,

Professor Nick Bond

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Centre Director

The Murray-Darling Freshwater Research Centre

Submission from The Murray-Darling Freshwater Research Centre to the Parliamentary Inquiry in relation to hypoxic blackwater.

What were the key drivers of the hypoxic blackwater events of 2016?

Hypoxic blackwater events have occurred twice in recent years (2010, 2016) in response to large uncontrolled flood events in rivers of the southern Murray-Darling Basin. Large-scale hypoxic blackwater events occur when extensive overbank floods inundate large quantities of accumulated organic matter and nutrients on the floodplain. The greater the concentrations of organic matter and nutrients in floodwater, the larger the magnitude of oxygen depletion in the water column (Hladyz et al. 2011, Whitworth et al. 2012). There has been considerable discussion and speculation as to the underlying causes of these events, including suggestions that environmental watering is a contributing factor.

The Murray-Darling Freshwater Research Centre (MDFRC) and other research organisations have conducted considerable research over the last decade to better understand both the cause of these events, as well as how water managers can act to minimise the risks of hypoxic blackwater and potentially mitigate the impacts if such events do occur.

The key contributing factor in causing blackwater in 2010 and 2016 is the extremely long periods between large-scale flood events, and the associated accumulation of organic matter on floodplains, which normally is removed from (at the very least) low lying areas of floodplains by more regular small and medium-sized floods. Both of these natural and uncontrolled flood events in 2010 and 2016 inundated large areas of floodplain forest and agricultural land that had not been inundated for several decades (since 1993/4). The 2010 event occurred after more than 10 years of drought, and the 2016 event occurred following another 5 years of below average flows, and flooding occurred higher in the Murray and Murrumbidgee catchments than occurred in 2010 (peak flow at Yarrawonga during 2016 reached 180,000 ML/day, a flood peak not observed at that gauge in 23 years). As a consequence (a) the area of floodplain inundated throughout the southern connected basin (SCB) was greater than we have seen in well over a decade; and (b) the accumulations of organic matter on floodplains had built up over this time and were sufficient to fuel large-scale depletion of oxygen, leading to hypoxic blackwater.

What role does environmental watering have in relation to blackwater events?

There is no scientific evidence to suggest environmental watering made a contribution to hypoxic blackwater during either of these events. In fact, relative to rainfall induced runoff, environmental water delivered during 2016 was a minor proportion of total discharge throughout the SCB, being used during floods primarily to try and create local refuge areas with greater oxygen concentrations. As such, the water was delivered via irrigation channels, was of high quality, and is believed to have successfully created local-scale respite from the events (Robyn Watts and Julia Howitt, Charles Sturt University, unpublished data).

We have already seen the successful use of environmental water to create local scale refuges to mitigate the effects of large-scale hypoxic blackwater, but such approaches are likely costly and only partially successful (as evidenced by the large-scale mortality of fishes during these events). There is thus also an important longer-term role for environmental watering in facilitating the recovery of native fish, by focusing on several key goals.

The first of these is to actively target watering actions that help promote successful breeding and recruitment of native fish. This will include the delivery of flows that support not only breeding, but also the production of food resources and food webs that support energy transfer through the food chain. Increasingly it is apparent that floodplains play a key role in the production of this energy, to a large degree by simultaneously removing carbon from the floodplain floor and transferring it into aquatic food webs. Such transfer historically occurred on a very regular basis (on average every 2 years) in rivers such as the Murray.

An ongoing management challenge is therefore determining how to enhance the ecosystem processes that were historically created by these floods, but doing so with less water, while simultaneously minimising impacts to other land users. Meeting these objectives is currently the focus of several large-scale adaptive management programs within Victoria, and across the Murray-Darling Basin, including as part of the Victorian Environmental Flows Monitoring and Assessment Program (VEFMAP; led by DELWP), and the Commonwealth Long-term Intervention Monitoring Program and Environmental Water Knowledge and Research Programs (funded through the Commonwealth Environmental Water Office and led by MDFRC in collaboration with multiple research partners).

While there are potentially beneficial approaches to using environmental water to try and reduce the risk of hypoxic blackwater events, the projected long-term reductions in runoff from climate change coupled with current river-regulation practices to manage land and water, will likely mean that the frequency of more regular small-scale floods remains low. To this extent, the risks from such events will continue in the future. Further work is thus required to identify those areas of the floodplain that are likely to make the greatest contribution to organic matter loads (and hence blackwater), and to implement more regular inundation of those areas to try and reduce organic matter loads. There are also a range of modelling tools available to quantify the extent to which such approaches may reduce the risks given the volume of environmental water that are available, and the influence of any constraints on delivery of that water to floodplains.

We greatly appreciate the opportunity to provide this submission to the inquiry, and welcome any request for further supporting information or advice that might be considered useful to the inquiry.

Supporting literature

Hladyz, S., S. C. Watkins, K. L. Whitworth, and D. S. Baldwin. 2011. Flows and hypoxic blackwater events in managed ephemeral river channels. Journal of Hydrology **401**:117-125.

Whitworth, K. L., D. S. Baldwin, and J. L. Kerr. 2012. Drought, floods and water quality: Drivers of a severe hypoxic blackwater event in a major river system (the southern Murray-Darling Basin, Australia). Journal of Hydrology **450**:190-198.