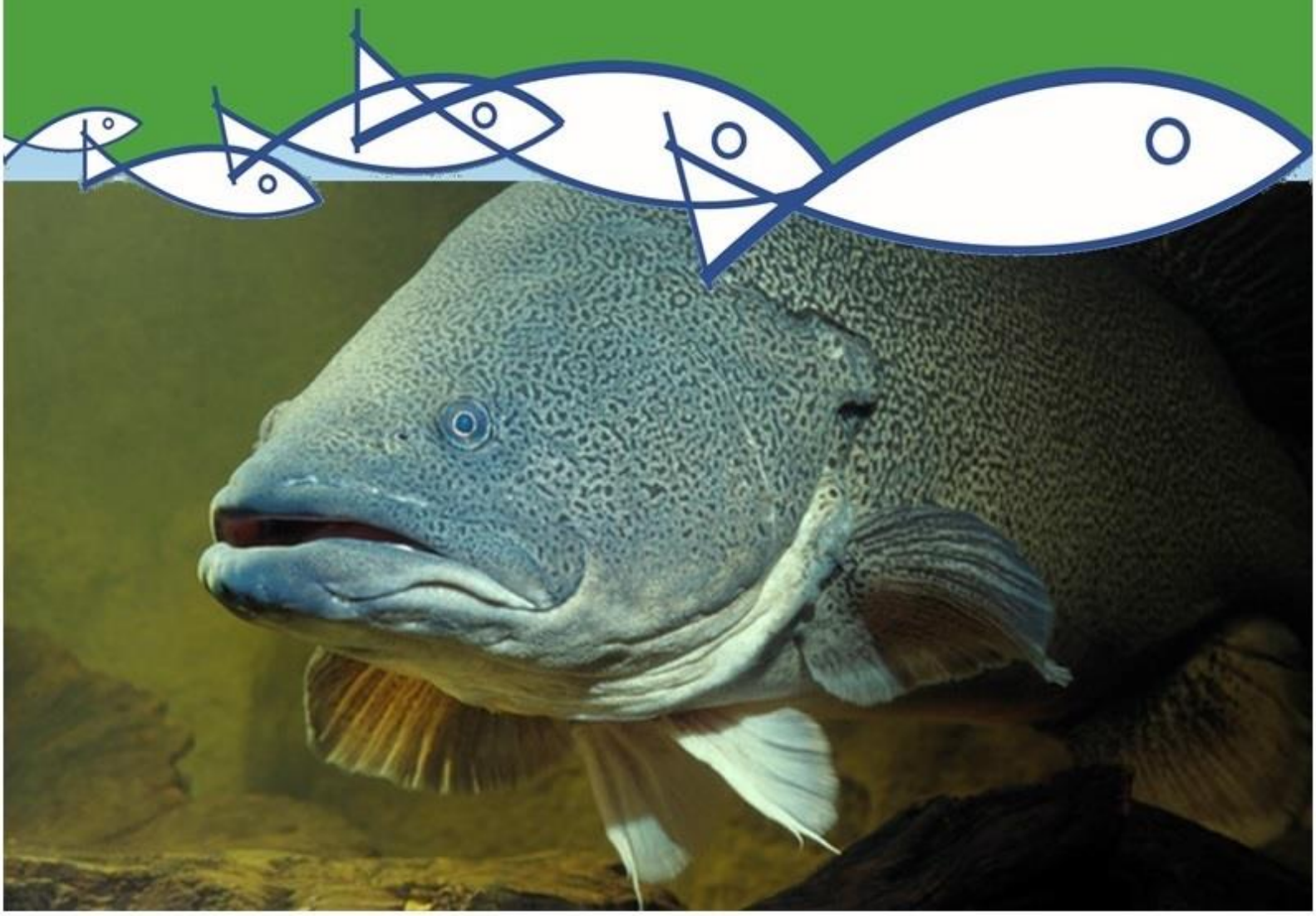
Fish and Flows in the Northern Basin:

responses of fish to changes in flow in the Northern Murray–Darling Basin



Reach Scale Report

prepared for the Murray-Darling Basin Authority

August 2015

NSW GOVERNMENT Department of Primary Industries

Australian Government

MURRAY–DARLING BASIN AUTHORITY

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Front cover image: The threatened Murray Cod, a key native fish species of the Northern Murray-Darling Basin (photo credit – Gunther Schmida).

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Executive Summary

Alteration of the natural flow regime across the majority of valleys in the Northern Murray-Darling Basin has had significant impacts on the hydrological, hydraulic and ecological conditions that native fish rely on for recruitment success and survival. The degradation of instream processes and habitat features across most major systems has resulted in the majority of fish communities of the Northern Basin being in poor to moderate condition.

Current activities across the Murray-Darling Basin, especially those related to water management, provide opportunities for fish communities to recover from impacts associated with river regulation. To achieve this, management actions need to be developed based on best available science and knowledge. The *Fish and Flows in the Northern Basin* project has contributed to the consolidation and improvement of science and knowledge in the Northern Basin.

The *Fish and Flows in the Northern Basin* project was commissioned by the Murray-Darling Basin Authority in November 2014 to improve the understanding of Environmental Water Requirements (EWRs) for fish in the Northern Basin as part of the Northern Basin Review. Earlier stages of the project included an extensive literature review, where over 150 sources of information were considered (Stage 1), a Northern Basin Expert Panel workshop of university and government experts (Stage 2), and further work to consider available information for the wider Northern Basin (Stage 2).

The information assessed in Stage 2 was used to determine the fish communities present in the Northern Basin and their condition; specify functional groups based on similarities in flow requirements, and; develop conceptual flow models that can be applied to reaches through the use of site-specific information.

The Northern Basin Expert Panel workshop enabled a group of fish experts from across the Murray-Darling Basin to meet and discuss the latest thinking and research available to define flow requirements of fish in the Northern Basin. The Expert Panel were instrumental in identifying all available literature and informing functional groups for fish and the flows that would benefit spawning, recruitment, movement and migrations, maintenance and condition. Following the workshop, five functional groups were identified, including:

1. Flow Dependent Specialists (e.g. Golden Perch and Silver Perch)
2. In-channel Specialists
   A Flow Dependent (e.g. Murray Cod)
   B Flow Independent (e.g. Freshwater Catfish)
3. Floodplain Specialists (e.g. Olive Perchlet and Rendahl's Tandan)
4. Generalists (e.g. Bony Bream)
5. Generalists (alien species) (e.g. Carp)

This report presents Stage 3 of the project, which has used the information from the first two stages to focus on determining EWRs for fishes in the Barwon-Darling where there is available information to apply the conceptual flow models.

Information related to fish and flow interactions and requirements in the Barwon-Darling River has been considered in the context of water management, habitat condition and fish community status for the system. This analysis has been significantly enhanced by the collection of new instream habitat information for the 1,100 km reach of the Barwon-Darling between Walgett and Wilcannia, as well as the interrogation of detailed hydrological information and fish related research findings to progress EWRs for fish in the Barwon-Darling River.

Seven site-specific flow indicators have been developed to represent the EWRs of the Barwon-Darling at three representative sites as part of the *Fish and Flows in the Northern Basin* project (**Table i**). These flow indicators aim to provide longitudinal connectivity, cues for life-cycle responses, improved habitat availability, increased primary productivity, and enhanced fish condition in the

Barwon-Darling River. These flow indicators are based on fish eco-hydrology information considered during the project, and were tested against without development and baseline (i.e. pre Basin Plan conditions) hydrology modelling to ensure the requirements are consistent with the natural hydrology of the system.

The implementation of these EWRs would achieve significant native fish outcomes. The outcomes are especially tailored to the species of the fish community that are reliant on flow events for specific life-cycle requirements (i.e. the Flow Dependent Specialists and In-channel Specialists), by providing improved spawning and recruitment opportunities. These EWRs will also enhance spawning and recruitment opportunities for the Generalist functional group and the In-channel Specialists that are less reliant on flows, and will enhance the maintenance and condition of all native fish functional groups.

The proposed EWRs are an improvement compared to the in-channel EWRs for the Barwon-Darling that were developed to inform the Basin Plan, as an expanded evidence base on the eco-hydrology requirements of fish in the Northern Basin has been used. The new set of site-specific flow indicators continue to primarily focus on in-channel environmental outcomes for fish, which will benefit all of the functional groups of native fish; however, based on the expanded evidence base, there have been refinements to elements of the flow indicators including the seasonal timing, duration, flow threshold, number of events in a season and frequency. As part of the Northern Basin Review, the MDBA will subsequently use these flow indicators and others developed in other projects to model water recovery options.

In addition to the in-channel outcomes, significant native fish responses would be expected from overbank flows. The information presented about the requirements of the Floodplain Specialist functional group should be taken into consideration when determining EWRs for floodplain environmental outcomes in the Barwon-Darling as additional new information is available, such as the floodplain inundation information and vegetation distribution data. In addition, the conceptual flow models developed as part of this project could be applied in other Northern Basin catchments as part of future management actions using site-specific data. This work cannot be achieved within the timeframe of the Northern Basin Review but could be considered as part of any longer term research program.

The proposed EWRs seek to reinstate flows needed to sustain healthy and resilient populations of native fish. However, it is important to acknowledge that whilst flow restoration is critical for delivering native fish outcomes in the Northern Basin, a range of other factors will also influence outcomes, including aquatic habitat, riparian management, water quality issues, extraction, and fish passage. The information collected for this project, especially the habitat mapping data, can be used to target future work related to these factors. To ensure the most efficient and effective use of environmental water, coordinated and targeted complementary actions also need to be considered in an adaptive management framework that incorporates rigorous scientific monitoring and evaluation. Water requirements and management actions for fish can continue to be progressed through the new information compiled through this project, and a commitment to further developing knowledge and management actions in the Northern Basin.

Table i: Proposed site-specific flow indicators and associated ecological targets for the Barwon-Darling River based on outcomes from the *Fish and Flows in the Northern Basin* project.

Site	Site-specific ecological targets	Site-specific flow indicators
Barwon-Darling River at Bourke	To improve the inundation and availability of key habitat features along the Barwon-Darling River, particularly for large woody debris. To improve the longitudinal connectivity along the Barwon-Darling River, enhancing upstream and downstream migration and movement opportunities for native fish. Providing flow regimes that enhance spawning and recruitment opportunities for Flow dependent specialist native fish species.	Minimum of 1 flow event of 6,000 ML/day for a minimum of 14 consecutive days from July to June for 80% of years (low and high uncertainty). Minimum of 1 flow event of 10,000 ML/day for a minimum of 14 consecutive days from August to May for 60% (high uncertainty) to 80% (low uncertainty) of years. Minimum of 2 flow events of 10,000 ML/day for 20 consecutive days from August to May, with a minimum peak event of 15,000 ML/day for five days incorporated for 25% (high uncertainty) to 34% (low uncertainty) of years.
Darling River at Louth	To improve the inundation and availability of key habitat features along the Barwon-Darling River, particularly for large woody debris, providing flow regimes that enhance spawning and recruitment opportunities for In-channel Specialist native fish species. To improve the longitudinal connectivity along the Barwon-Darling River, enhancing upstream and downstream migration and movement opportunities for native fish.	Minimum of 1 flow event of 6,000 ML/day for 20 consecutive days from August to May for 70% (low and high uncertainty). Minimum of 1 flow events of 21,000 ML/day for 20 consecutive days from August to May for 40% of years (low and high uncertainty.
Darling River at Wilcannia	To improve the inundation of key habitat features that contribute to primary productivity along the Barwon-Darling River, enhancing opportunities to improve food supply and body condition for native fish. To improve the system wide connectivity along the Barwon-Darling River, enhancing upstream and downstream migration and movement opportunities for native fish.	Minimum of 2 flow events of 6,000 ML/day for 8 consecutive days from August to May for 44% (high uncertainty) to 59% (low uncertainty) of years. Minimum of 1 flow event of 20,000 ML/day for 5 consecutive days from July to June for 44% (high uncertainty) to 58% (low uncertainty) of years.