

WetMAP – Victoria’s Wetland Monitoring and Assessment Program for environmental water

Project Update – 2019

Fish Theme



Background

WetMAP is a state-wide monitoring program designed to assess the ecological responses of vegetation, waterbirds, frogs and fish to the delivery of water for the environment in Victorian wetlands. Monitoring for the current stage of WetMAP (2016–2020) is coordinated by the Arthur Rylah Institute (ARI) and funded through the Victorian government’s \$222 million investment over four years to improve catchment and waterway health.

Program Objectives

WetMAP aims to:

- enable DELWP (Department of Environment, Land, Water and Planning) and its water delivery partners to clearly demonstrate ecological outcomes of environmental water management to the community and water industry stakeholders.
- fill knowledge gaps to enable adaptive management – improving planning, delivery and evaluation of environmental water management in rivers and wetlands across Victoria.
- identify ecosystem outcomes from environmental water to help meet Victoria’s obligations under the Murray-Darling Basin Plan.

Ultimately, WetMAP seeks to inform the development of an environmental water planning tool for Catchment Management Authorities (CMAs) and the Victorian Environmental Water Holder.

Program Design

The design of WetMAP is based on:

- conceptual models of the responses of wetland biota to environmental water delivery and natural flooding
- watering objectives defined in state and regional water management plans, and

- Key Evaluation Questions (KEQs) and indicators.

Fish monitoring

Fish monitoring for 2018-19 was conducted in 19 northern Victorian wetlands (Fig 1 – see next page). Monitoring was also conducted in connecting channels during watering events, to examine movement of fish into and out of wetlands during watering. The current phase of fish monitoring for WetMAP has been designed to examine the mechanisms driving fish productivity and is focussed on two distinct areas of interest:

- a) **small-bodied generalist fishes** that dominate native fish abundance and biomass across wetlands (Fig 2), supporting broad-scale ecosystem functions (e.g. fish production contributing to food webs) and biodiversity values, and
- b) **threatened** small-bodied freshwater fishes, with a focus on Murray Hardyhead *Craterocephalus fluviatilis* a wetland specialist species with high biodiversity value.



Fig 2 - Small bodied generalist fish (Photo: ARI).

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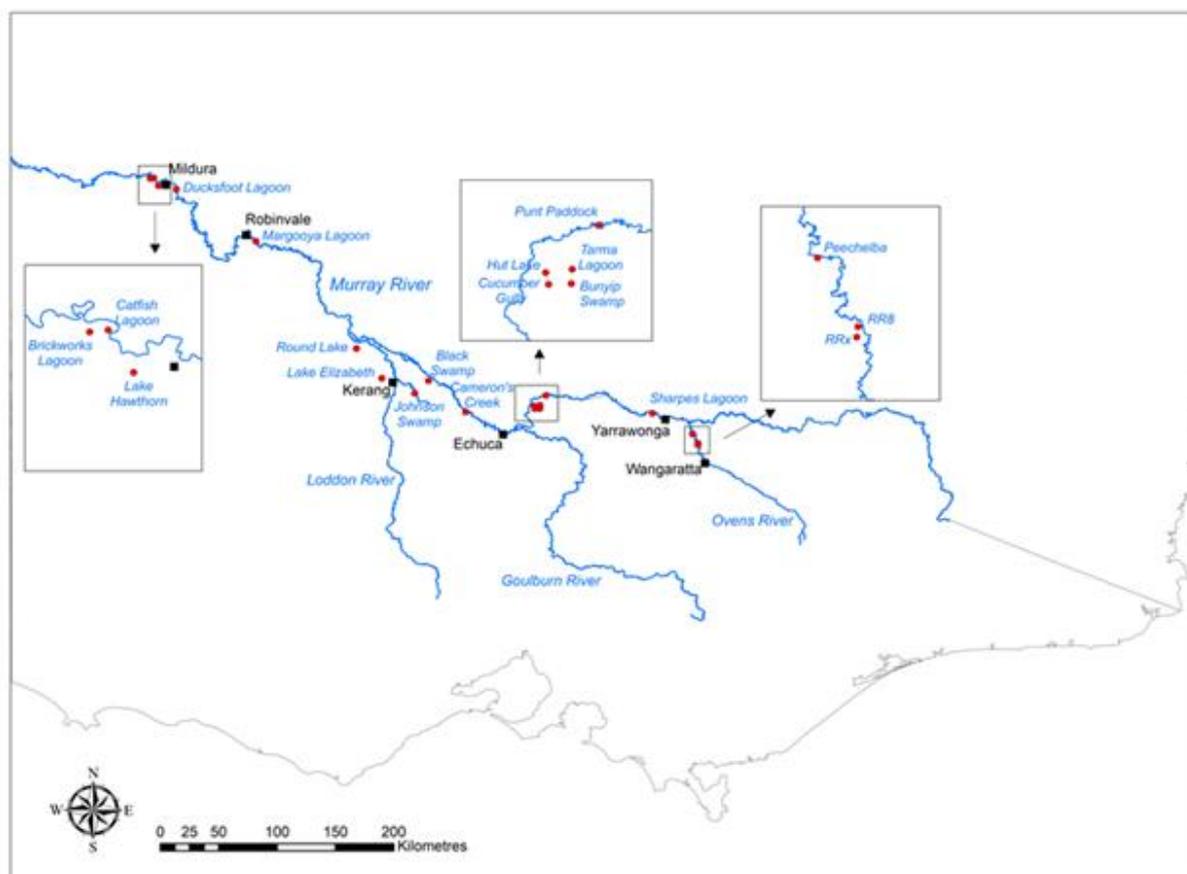


Fig 1 - Map of the study areas, showing selected town centres (black circles) and wetlands sampled (red circles)

The following four KEQs have been developed to guide the monitoring design for the WetMAP fish theme:

KEQs

- 1 Are increases in fish abundance (production) greater in wetlands that receive environmental water than in wetlands that do not?
- 2 Do environmental water events increase the native fish species richness in wetlands?
- 3 Do environmental water events provide opportunities for fish to move between wetlands and rivers?
- 4 Do Murray Hardyhead persist in saline wetlands where environmental water is effectively used to maintain wetland salinity levels within the range required for successful spawning and recruitment?

Supplementary questions have also been developed to investigate the specific, underlying processes that drive fish responses to environmental watering.

SQs

- 1 How does wetland watering history influence native species richness and abundance in wetlands?
- 2 How does the spatial extent of wetland inundation during watering events affect food resources, fish recruitment and abundance in wetlands?
- 3 Does connectivity of wetlands with their source water facilitate the immigration or adult fish or dispersal of juvenile fish?

For analysis and evaluation purposes, wetlands included in 2018-19 fish surveys have been classified according to their recent watering history (up to five years prior to surveys being conducted):

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- *Natural wetting*: these wetlands occur in the Ovens River floodplain and have frequent (several times per year) wetting and drying periods.
- *Annual wetting*: these wetlands occur in Barmah and Gunbower forests and have occasional (twice per year to every second year) wetting and drying periods.
- *Stable water levels*: these wetlands occur close to the Murray River, with regulated or unregulated connecting channels, and have relatively stable water levels.

Survey methods

Generalist species

Fifteen wetlands were sampled between October 2018 and June 2019. Survey sites included:

- a) seven wetlands that receive environmental water and were sampled multiple times from spring through autumn.
- b) fifteen wetlands (including the seven mentioned above) with a broad range of watering regimes were sampled during autumn, including wetlands that are largely unregulated.
- c) connecting channels of three wetlands, which were sampled to catch fish moving in and out of the wetlands during watering events (Fig 3).
- d) three flood runners off the Murray River in Barmah Forest, which were sampled during a watering event.

Fine and coarse mesh single-wing fyke nets and fine mesh seine nets were used to sample fish within wetlands (including larval fish), and fine and coarse mesh double-wing fyke nets were used to monitor the number of fish moving in and out of wetlands. Water quality parameters (dissolved oxygen, conductivity, temperature, turbidity, pH), and zooplankton and Chlorophyll α (as measures of productivity) were also measured.

Threatened species - case study: Murray Hardyhead

Four saline wetlands (Lake Elizabeth, Round Lake, Lake Hawthorn, Brickworks Billabong) were surveyed in May and June 2019 (two in the North Central and two in the Mallee region) where Murray Hardyhead were recently reintroduced or known to be present. Environmental water delivery to the wetlands in the North Central region (Lake Elizabeth, Round Lake) occurred during spring to decrease salinity concentrations to allow for successful recruitment to the population, based on new findings regarding the species’ salinity tolerance. Wetlands in the Mallee region were watered differently to those in the North Central, with one, Lake Hawthorn, watered consistently during spring and summer, and the other, Brickworks Billabong, filled in the spring and autumn.

A large fine-mesh seine was used to sample Murray Hardyhead in each wetland. If fewer than 20 fish were caught, then fine mesh double-wing fyke nets were

deployed. Sampling was kept to a minimum to reduce disturbance to the population.

Results and Key Observations

WetMAP fish monitoring to date, although in its early stages, indicates environmental water plays an important role in facilitating the management of native fish production and persistence in wetlands, and acts as a conduit for the movement of fish into and out of wetlands.

Generalist species

A total of 221,840 fish were captured in surveys undertaken within wetlands in 2018-19. In total, nine native and four exotic species were captured, with the catch dominated numerically by the native Carp Gudgeon *Hypseleotris* spp (78%).

Native fish species richness and abundance

- Wetlands on unregulated river floodplains (Ovens River) had moderate richness and abundance.
- Wetlands in relatively isolated areas of forest (Barmah Forest) had lower species richness and abundance.
- Wetlands with a direct connection to the Murray River (Mallee region) had low abundance but higher species richness.

Fish movement

- There was clear directionality in fish movement, with fish actively moving between wetlands and the river. This included large numbers of juvenile fish that were dispersing to the Murray River.
- 185,691 fish (six native and four exotic species) were caught moving between wetlands and the Murray River at Margooya and Ducksfoot lagoons, and between the irrigation channel and Johnson Swamp. This included 156,219 Carp Gudgeon caught in a single net at Margooya Lagoon in February, which were trying to move out of the wetland (Table 1).



Fig 3 - Fyke net set in a channel (right) (Photos: ARI).

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Table 1. Number of fish caught moving in and out of Margooya Lagoon on four sampling occasions in 2018 and 2019.

Species	16/10/2018		22-23/10/2018		19-20/11/2018		11/02/2019	
	IN	OUT	IN	OUT	IN	OUT	IN	OUT
Native								
Carp Gudgeon	123		1277	1127	365	664	115	156,219
Australian Smelt	26		64	35	13	8751	0	0
Bony Bream	0		0	0	14	0		0
Un-specked Hardhead	0		0	1	0	0	0	0
Exotic								
Goldfish	0		3	3	0	0	3	0
Carp	0		0	0	92	1413	9	2
Gambusia	0		0	0	0	0	1	44

Murray Hardyhead

Surveys conducted in the two North Central Victorian wetlands (Lake Elizabeth, Round Lake) showed reduced salinity concentrations and considerable recruitment of Murray Hardyhead, with over 800 fish captured in Lake Elizabeth and 28 fish captured in Round Lake. In contrast, the species was not found following reintroduction in Lake Hawthorn in the Mallee region, possibly as a result of delivery infrastructure being insufficient to provide an adequate volume of water to reduce salinity to an appropriate level to allow spawning and recruitment. Only two fish were captured at Brickworks Billabong; while this number is relatively low, it does indicate persistence of the species, which is promising. These results highlight the importance of understanding the ecology and tolerance of native fish species. This information in turn can inform the management of environmental water to benefit threatened wetland specialist fish species.

What’s Next

The results of surveys undertaken 2018-19 are encouraging. Based on project findings and team discussions to date, a similar monitoring program is proposed for 2019-20. Specific details on the proposed approach can be found in the WetMAP Fish Theme proposal for 2019-20 monitoring, which can be obtained from the DELWP Environmental Water team or ARI.

Further information

See www.ari.vic.gov.au for further information on WetMAP.

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ISBN 978-1-76105-028-2 (pdf/online/MS word)

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