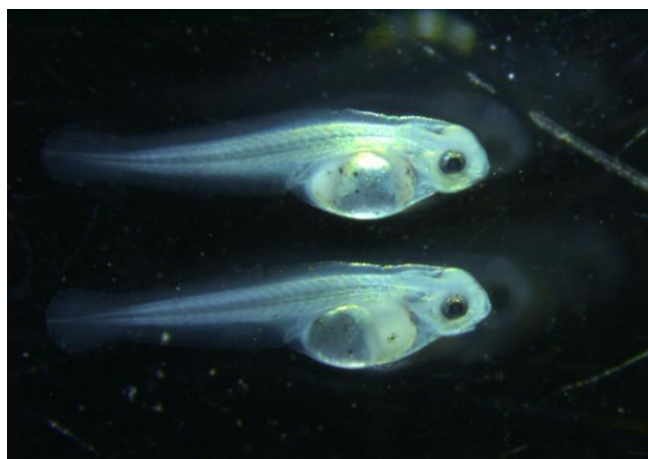


Long Term Intervention Monitoring Project Murrumbidgee System

Selected Area Project Progress Report #3 Report period: 31 December 2014- 31 March 2015



Larval Golden Perch, Mid-Murrumbidgee River

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Ecological responses to Commonwealth environmental water in the Murrumbidgee system as of March 2015

This quarterly report outlines key activities undertaken and preliminary outcomes identified during monitoring of ecosystem responses to the use of Commonwealth environmental water in the Murrumbidgee Catchment undertaken as part of the Murrumbidgee Long-term Intervention Monitoring (LTIM) Project between 31 December 2014 and 31 March 2015. Monitoring includes assessment of ecological outcomes in the Murrumbidgee River and connected wetlands through the mid-Murrumbidgee and Lowbidgee floodplains wetlands as outlined in the Murrumbidgee Monitoring and Evaluation Plan.

In 2014-15, Commonwealth environmental water has been delivered to the North Redbank and South Redbank systems of the Lowbidgee floodplain and Yarradda Lagoon in the mid-Murrumbidgee wetlands (refer to maps at appendix 1). The key objectives of these Commonwealth environmental watering actions are to support:

- native riparian, wetland and floodplain vegetation diversity and condition;
- maintain condition and provide reproduction opportunities for fish, waterbirds and other aquatic vertebrate species, and
- hydrological connectivity and water quality.

Commonwealth environmental water provided to the North Redbank system also includes return flows from wetlands adjacent to the Murrumbidgee River with the objectives of returning carbon and nutrients from the surrounding wetlands to the river in order to support primary productivity and microinvertebrate production which are important for larval fish survival and growth. Dissolved oxygen monitoring of return flows is being undertaken for hypoxic blackwater risk management.

Observations, and recommendations, from monitoring activities undertaken during this period support adaptive management of environmental water.

Preliminary outcomes December 2014 - March 2015

Routine wetland monitoring activities targeting water quality, microinvertebrates, fish, frogs and tadpoles, and waterbirds were completed at the ten Murrumbidgee LTIM wetland sites (refer Appendix 1 and 2) that contained water from 28 January to 2 February 2015. Vegetation diversity was conducted at all 12 LTIM wetlands from 18 January to 2 February 2015.

Vegetation diversity

Vegetation surveys are undertaken to determine the response of vegetation species to environmental watering actions. At wetlands where environmental water has been delivered in spring there was a strong response of aquatic and semi-aquatic species these species continue to be abundant at the LTIM wetlands. Of note is Yarradda Lagoon in the mid-Murrumbidgee which received environmental water in December 2014 resulting in significant increases in the coverage of spiny mud-grass, an important aquatic species that was known to dominate this wetland in the late 1990s. The re-establishment of this species at Yarradda Lagoon is a positive watering outcome.

The Lowbidgee and Nimmie Caira LTIM monitoring sites currently contain a high diversity of aquatic native vegetation species. Spike Rush species are the most dominant group through the Redbank systems, while nardoo and water milfoil are abundant through wetlands in the Nimmie-Caira.



Yarradda Lagoon September 2014



Yarradda Lagoon January 2015



Vegetation transect at Avalon Wetland in
Nimmie Caira



Nardoo a native aquatic plant at Avalon
Wetland

Water Quality

Water quality conditions (temperature, conductivity, dissolved oxygen, pH and turbidity) at wetland and river sites were within expected ranges for the time of year sampled. Conductivity (Nap Nap) and turbidity (Eulimbah, Avalon and Nap Nap) have increased across some sites as the wetlands draw down. Low dissolved oxygen (<2 milligrams per litre) was observed overnight at some sites (e.g. Mercedes Swamp and Nap Nap swamps) but again this is not unexpected for the type of wetland and their stage in the hydrological cycle.

Return Flows

The second of three planned return flow events commenced on 4 February 2014. Flows were released as a draw down event by operating the escape structure (drop-boards) at Wynburn without adding top-up flows. Water quality, nutrients, and zooplankton were monitored in the wetland behind the escape regulator and at river sites above and below the release point. Wetland flows drained rapidly, and further drop-boards were removed on 10 and 12 February to maintain the return flow. Monitoring took place on various occasions including 3, 7, 13 and 16 February. Return flow volumes were highly variable, ranging between 3 and approximately 50 ML/day, but would have peaked between 4 and 7 February. River flows (below Redbank Weir) during this period ranged between 244 and 528 ML/day. All data is currently being processed, however analysis of dissolved oxygen loggers data indicates that there was no evidence of adverse water quality impacts associated with the release. No further return flows are planned for the Wynburn escape during the 2014-15 water year.



Return flows leaving the Wynburn Escape on 11 February 2015.

Frogs and tadpoles

As described in previous quarterly reports, southern bell frogs (*Litoria raniformis*, EPBC 1999) have been active through the LTIM monitoring sites in the Nimmie-Caira zone, with adults and tadpoles recorded at all four LTIM sites (Nap Nap, Avalon, Eulimbah and Telephone Creek) in January 2015. Incidental surveys of Suicide Swamp, Warwagee Swamp and Southern Eulimbah also recorded small numbers of calling individuals.



Southern bell frogs can change their colour depending on their surroundings and temperature, with colours ranging from chocolate brown, through to bright green and pale fawn. Southern bell frog from Nap Nap Swamp (January 2015) (Photo J. Ocock).

Waterbird diversity

In total 32 waterbird species were recorded across the surveyed wetland sites, although only two species were confirmed breeding at the LTIM wetland sites with broods observed for pacific black duck and grey teal. The migratory sharp-tailed sandpiper (listed on migratory bird agreements JAMBA, CAMBA and ROKAMBA) was recorded at Avalon Swamp in the Nimmie-Caira Zone. Small flocks of eastern great egret (JAMBA, CAMBA) were recorded at Eulimbah (Nimmie-Caira), Piggery Lake and Two Bridges Swamps (Redbank), these wetlands may be providing important foraging grounds for a small great egret rookery which has established at Tarwillie Swamp in the Redbank system.

The largest counts of waterbirds were recorded at Yarradda Lagoon (in the mid-Murrumbidgee) and Piggery Lake (>350 birds). Large numbers of black swans (50-60 birds) and Eurasian coot (170 birds) were observed at Piggery Lake. The recently inundated Yarradda Lagoon also supported flocks (50-60 birds) of coot, hoary-headed grebe and pink-eared duck. These three species often move to wetlands on re-flooding to exploit temporary peaks in invertebrate prey.

Fish (wetlands)

Similar to previous surveys, three native fish species (bony herring, carp gudgeon and Murray-Darling rainbow fish) and four invasive fish species (carp, gambusia, goldfish and weather loach) were recorded during the January 2015 surveys. Carp gudgeon continue

to be the most abundant species, and numbers have increased from 2,158 in November to 6,674 in January. The largest proportion of native species (4,428 individuals counted) was recorded at Two Bridges Swamp; however this site remains a refuge for large numbers of invasive species, including carp (582 individuals counted) and weather loach (923 individuals counted). Murray-Darling rainbow fish were recorded at Two Bridges Swamp and Telephone Creek (61 individuals counted in total). Having recently received water, Yarradda and Gooragool lagoons, in the mid-Murrumbidgee, both had significant numbers of fish. Bony herring, a small bodied native, was the most abundant species recorded at Yarradda Lagoon with 120 individuals counted. In contrast, Gooragool Lagoon, which had received drainage water from MIA, consisted of only invasive species (gambusia and carp).



Native Murray rainbowfish surrounded by juvenile carp gudgeon for Telephone Creek

Fish (River)

Sampling of fish communities within the Murrumbidgee River commenced in March 2015 and will be completed by April 2015. Category 1 sites (contributing to the basin wide analysis) were randomly selected from a 100 km reach between Darlington Point and Carrathool (see Figure 2 in Appendix 2), and on-ground mapping of passive gear type locations (for setting small fyke nets within each site) was undertaken at three of the larval fish sites in October 2014 and the remaining seven sites in January 2015. Site maps were post-processed in GIS and maps of the 16 delineated electrofishing units at each site loaded onto GPS units for use during sampling (Figure 1).

Collection of large-bodied equilibrium species (annual spawners) (Murray cod), and periodic species (golden perch and bony herring), was undertaken in February and March 2015 at locations within the focal zone (Darlington Point – Carrathool) although away from annual sampling sites. When sampling at these locations did not yield appropriate sample sizes (particularly for bony herring), sampling locations were extended downstream. Otoliths were removed from samples and will be processed to identify length-at-age data for these species. Existing DPI datasets will also be used to supplement Murray cod and golden perch length-at-age datasets for year 1. Length-at-age relationships will also be established for small bodied opportunistic species (carp gudgeon and Australian smelt) currently being collected from Category 1 annual sampling locations using small fyke nets.

Fish (Larvae)

Larval fish monitoring was undertaken at six sites in the Murrumbidgee River, sampled fortnightly, over six sampling occasions from 20 October 2014 to 2 January 2015. Monitoring sites were distributed between Narrandera and Carrathool. Larval fish are collected from light traps and drift nets which are set overnight at each site. Drift net samples were live-picked in the field and any fish eggs encountered were subsequently hatched in the laboratory to enable species identification, with a subset of these hatched larval samples currently being prepared for genetic analysis to check for the presence of silver perch amongst golden perch samples. Sample processing of larvae is complete and data checks are currently being undertaken. Preliminary results indicate that larval cod (*Maccullochella* spp.) were the most commonly recorded larvae, with 809 individuals collected, followed by the Australian smelt (741 individuals). Few exotic species were recorded and these were in low abundance.



Figure 1 Example of the 16 mapped electrofishing units from a Category 1 fish sampling site on the Murrumbidgee River. Within each unit two shots of 90 seconds electrofishing 'on-time' will be allocated.

Appendix 1 Summary of monitoring activities undertaken between December 2014 and March 2015 as part of the Monitoring and evaluating ecological responses to Commonwealth environmental water use in the Murrumbidgee River Valley

Zone	Site name	Status	Water Quality	Microinvertebrates Chlorophyll A	Carbon Nutrients	Larval fish	Tadpoles, fish and turtles	Frogs	Waterbirds	Vegetation	Depth logger	Temperature logger	
mid-Murrumbidgee	Gooragool	Recently inundated	✓	✓	✓		✓	✓	✓	✓	✓	✓	
	Mckennas	Dry								✓	✓	✓	✓
	Sunshower	Dry								✓	✓	✓	✓
	Yarradda	Recently inundated	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
South Redbank	Mercedes	Recently inundated	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
	Two Bridges	Recently inundated	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
	Piggery Lake	Recently inundated	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
	Waugorah Lagoon	Recently inundated	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Nimmie-Caira	Nap Nap	Residual	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
	Avalon	Filling	✓	✓	✓		✓	✓	✓	✓			✓
	Telephone	Recently inundated,	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
	Eulimbah	Recently inundated	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
River sites	Mckennas (Carrathool zone)		✓	✓	✓		Complete for 2014-15						
	Bringagee (Carrathool zone)												
	Yarradda (Carrathool zone)												
	Narrandera (Narrandera zone)		✓	✓	✓								
	Euroley (Narrandera zone)												
	Dairy (Narrandera zone)												
Return Flow # 2	US Wynburn escape 1km *		✓	✓	✓								
	Immediately US Wynburn escape *		✓	✓	✓								
	Wynburn Wetland *		✓	✓	✓								
	DS Wynburn escape 1km *		✓	✓	✓								
	DS Wynburn escape 2km *		✓	✓	✓								
	DS Wynburn escape 3km *		✓	✓	✓								

Appendix 2

About the Murrumbidgee Long-Term Intervention Monitoring Project (LTIM Project)

The Long Term Intervention Monitoring (LTIM) Project for the Murrumbidgee River system is funded by the Commonwealth Environmental Water Holder (\$3.7M 2014-2019) and is being delivered as a collaborative partnership led by Charles Sturt University (Institute for Land, Water and Society) with NSW Department of Primary Industries (Fisheries), University of NSW, NSW Office of Environment and Heritage, and Riverina Local Land Services.

The Murrumbidgee LTIM Project is designed to provide a robust framework to evaluate the ecological outcomes of Commonwealth environmental water within wetland and river systems downstream of Narrandera, NSW. Monitoring activities target multiple taxonomic groups and ecological processes with a focus on indicators of high ecological and community significance, such as large bodied native fish, waterbirds, and endangered species.

Monitoring activities within wetlands are focused on the responses of fish, frogs, tadpoles, turtles, microcrustacea (a component of the zooplankton), waterbirds, vegetation, along with the changes in water quality, carbon and nutrients associated with black water and algal bloom risks, and hydrology measured before, during and after environmental watering. The riverine component includes intensive monitoring of native fish breeding and fish community responses to environmental watering actions, along with microcrustacea, stream metabolism (stream productivity) and water quality associated with black water and algal bloom risks, and hydrology.

The Murrumbidgee LTIM Project is being undertaken across three key ecological regions within the Murrumbidgee, the mid and lower Murrumbidgee River channel and adjacent mid-Murrumbidgee wetlands between Narrandera and Hay, and the Lowbidgee floodplain downstream of Maude, that is further divided into separate monitoring “zones” representing areas with common ecological and hydrological attributes.

The framework includes 12 fixed monitoring sites across three key wetland types, oxbow lagoons of the Mid-Murrumbidgee, lignum-black box wetlands through the Nimmie-Caira system and river red Gum-spike rush wetlands through the Redbank systems and six fixed sites in across the mid and lower the Murrumbidgee River channel.

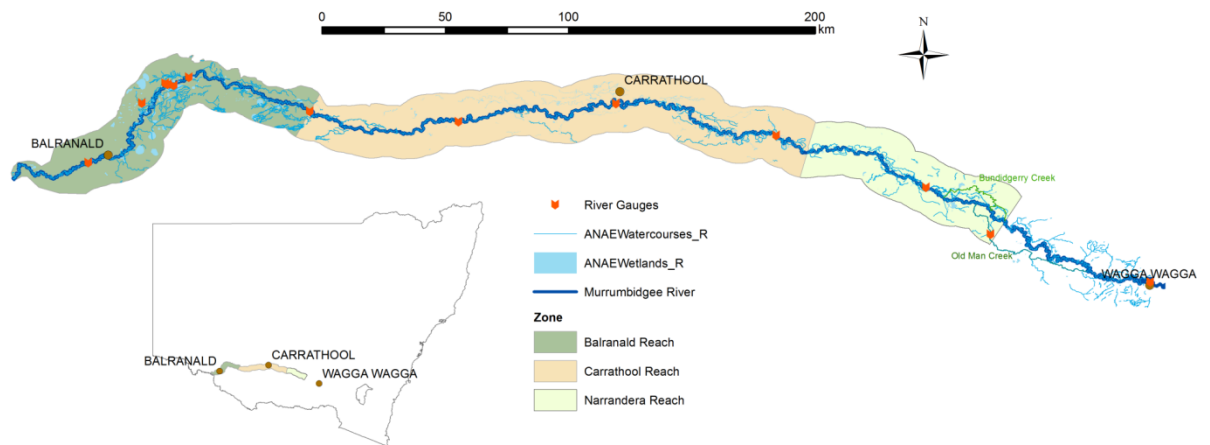


Figure 2 Distribution of riverine zones the Murrumbidgee Selected Area.

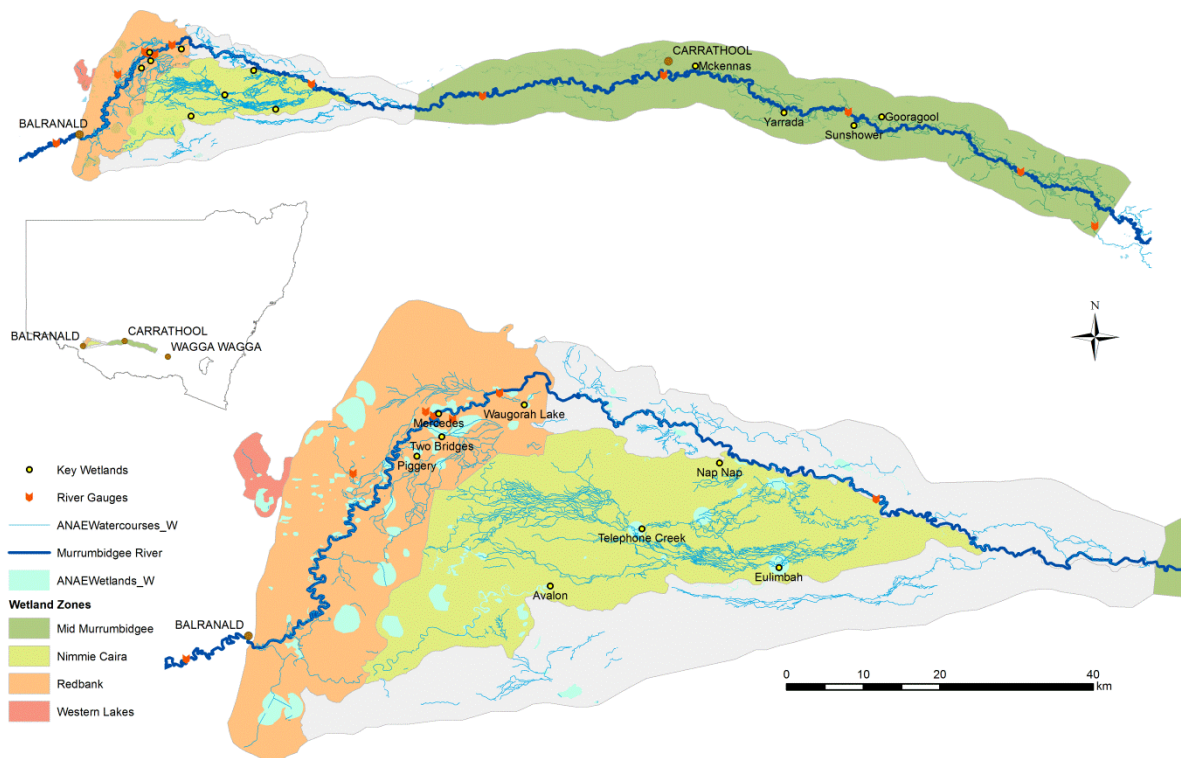


Figure 3 Distribution of wetland zones in the Murrumbidgee Selected Area and locations of key wetlands.