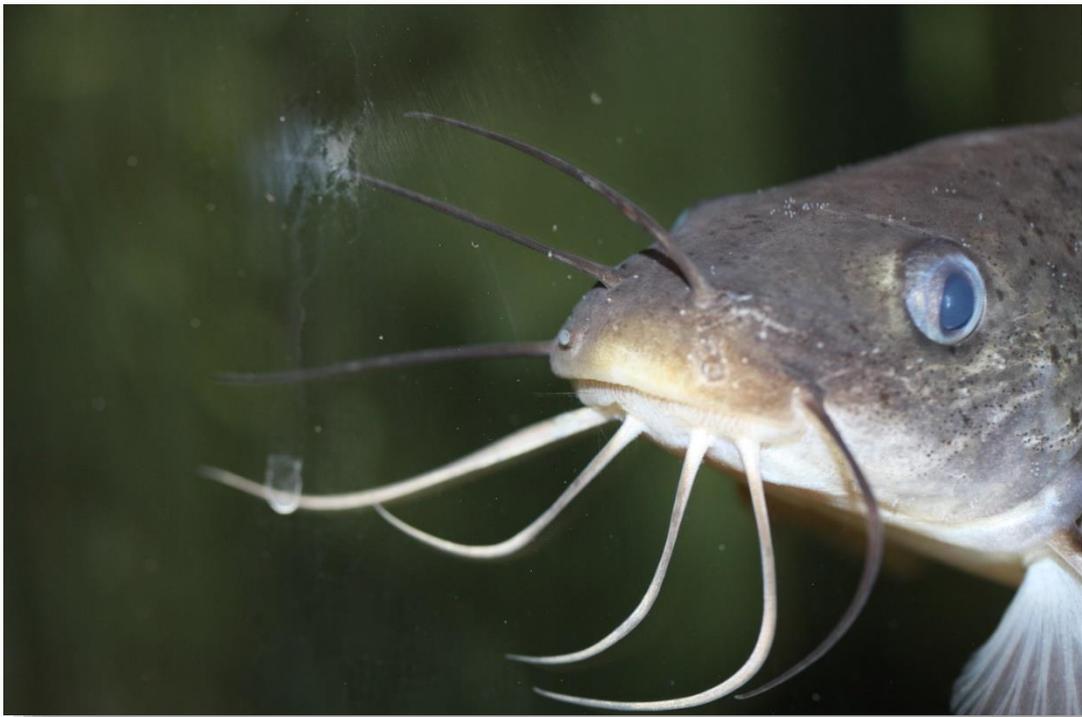


MMCP Collaboration Final Report 2019

Fish Movement

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Overview

The Native Fish Strategy (NFS) followed by the Basin-Wide Watering Strategy (BWS) form probably the largest native fish-community rehabilitation plan in Australia. Fish movement is an essential behavioural component of many species within Murray–Darling Basin native fish communities. Expected outcomes of the BWS, around fish movement, include targets for fish passage.

Fish passage is presently monitored by manual trap-count-and-release activities, and by a more efficient automated Passive Integrated Transponder (PIT) tagged fish monitoring system at fishways. Without continued PIT tagging of fish, there may soon be insufficient tagged-fish in the Murray-Darling Basin (MDB) to effectively use automated monitoring to evaluate the expected outcomes of the BWS. There is presently a large (>6 million data points and growing) dataset of fish detections at fishways, which has the potential to increase our understanding of fish movement behaviour to facilitate improved ecological outcomes from water management.

Objectives

The objective of this project are to:

- Build capacity amongst lock staff along the Murray River by training them to safely and effectively PIT tag fish.

In meeting this objective, we anticipate the following management outcome:

- *Protect and restore water-dependant ecosystems.* By building the capacity to tag fish through the training of Lock staff, and thereby increasing the number of tagged fish in the system. Subsequent data on detections of tagged fish will be available to efficiently provide water resource managers with knowledge on how to effectively manage flows to promote the movement of fish along the length of the Murray River and create lateral connectivity.

Background

The Murray–Darling Basin Authority’s (MDBA) *Native fish Strategy* (NFS) (MDBC 2004) and the Sea to Hume fish passage restoration program within it (Barrett & Mallen-Cooper 2006; Barrett & Mallen-Cooper 2009; MDBC 2008), was a fish-population rehabilitation program on a grand-scale. Originally, a 50-year strategy, the NFS was superseded in 2014 by the more holistic, Basin-Wide Environmental Watering Strategy (BWS) (MDBA 2014). The BWS is an important part of the implementation of the Basin Plan and in addition to fish, considers outcomes for waterbirds, vegetation and hydrology.

From a Murray–Darling Basin fish perspective, both the NFS and BWS combine to form what is essentially a basin-scale fish-population rehabilitation program for the recovery of native fish communities over a 20-year period spanning 2004–2024. The BWS has expected outcomes for fish that include annual detection and increases in detected fish passage rates between two periods, 2014–2019 and 2019–2024 (MDBA 2014), at ‘key fish passages’ (e.g. Murray River fishways). To be able to evaluate these outcomes, the basin states and the MDBA have collaborated in actively monitoring fish movement through Murray River fishways at 14 weirs built as part of the Sea to Hume fish passage restoration program. This monitoring has been achieved to-date with three types of activity:

1: Tailored research to evaluate fishway performance was appropriately funded during the fishway construction phase and complete by 2008. Fishway performance on the Murray River has been well-described for many fishways in the final report for the Sea to Hume Project (MDBC 2008).

2: Trap-count-and-release at key fishways has occurred at Lock 10 (2010–2017) and at Lock 1 (2014–2016, to remove invasive Carp (*Cyprinus carpio* Linnaeus, 1758)), Lock 11 (2013–2016), Torrumbarry (1991–2017) and Yarrawonga (1999–2016). Trap-count-and-release work is completed by lock staff.

3: An automated PIT tag monitoring system at fishways has been ongoing since 2004 and although early equipment failure due to flooding in 2010–11 caused a break in data-collection, the revised and improved system infrastructure was renewed in 2012 and now effectively logs movements of PIT tagged fish effectively once again. This auto-logging PIT tag detection system was used to inform and evaluate the development phase of fishway construction and by 2008, some 20,000 fish had been tagged and released to be monitored as representative surrogates for the fish population of the Murray River (MDBC 2008). Recognising that a representative population of tagged-fish was essential to the function of this system, the MDBA, and State fisheries agencies continued to fund tagging activities following the conclusion of the construction phase, and today over 75,000¹ fish have been PIT tagged and released into the southern connected basin of the Murray–Darling River. This cumulative total overstates the actual number of tagged fish now present. Once a tagged fish dies, through either natural mortality or harvest, it no longer contributes to the tagged-fish population used to monitor fishways. Examination of the tagging database shows that the annual number of fish tagged has declined strongly since 2011; which is consistent with the declining trend in the number of fish detected at Murray River fishways (Figure 1). While 2010 was a standout year for unique-fish detections that may have been associated with strong fish movement in high river flows, the year was also marked by widespread anoxic conditions and large fish-kills. Since then, the downward trend in fish tagged, and fish-detection data suggests that without continued PIT tagging of fish there will soon be insufficient tagged fish to evaluate the expected outcomes of the BWS.

This projects objective arises from a need to maintain adequate numbers of PIT tagged fish within the Murray River to enable the automated logging of fish passage by a system of PIT detectors at fishways.

¹ <http://fishnet.karltek.com.au/FishNet/> , accessed June 2017

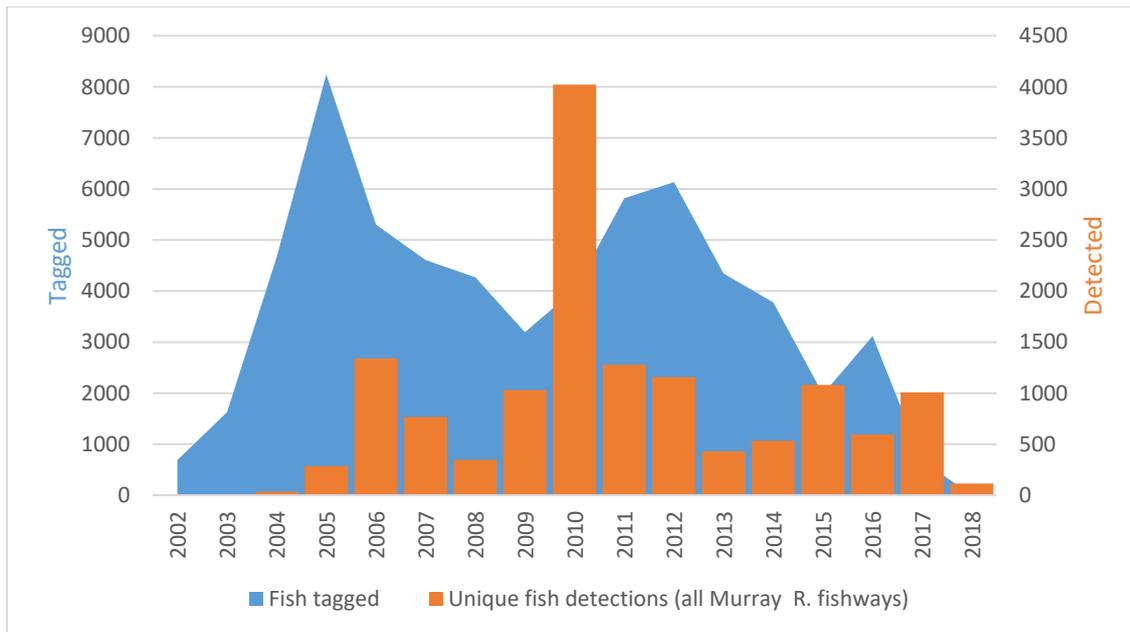


Figure 1. Counts of all fish tagged with PIT tags registered in the FishNet database by year (<https://PITtags.com.au/FishNet/>, accessed July 2018) (curve) and annual counts of unique-fish detections in all Murray River fishways from 2002–2018 (bars).

Methods

Permits for lock staff to tag

The MDBA coordinated the process of obtaining permission under the NSW Animal Research regulations (2010) of the NSW Animal Research Act 1985, for WaterNSW employees (e.g. lock staff at locks 10 and 15, etc.) to trap and PIT tag fish once training is complete and they are tagging ‘operationally’ rather than under-training. New South Wales Department of Primary Industry (NSW DPI) has granted approval, under section 37 of the Fisheries Act, to enable trapping and tagging at Murray River fishways on the condition that Animal Care and Ethics approval is obtained under the Australian Code for the Care and Use of Animals for Scientific Purposes.

Advice from NSW DPI in November 2016 was that MDBA or the state constructing authorities for the relevant fishways (e.g. WaterNSW) should submit applications (i.e. as ‘the applicant’) to the NSW DPI Animal Care and Ethics Committee (ACEC) for external applicants. To enable the ACEC to review and approve the application from WaterNSW, an MOU between the two agencies was signed in May 2018. The application, presently in review, should be viewed as an extension of existing fish-trapping and counting — where the animal-ethics risk has been tested in recent years. Once approved, Lock 10 staff will be able to commence tagging.

Capacity building – training Lock staff

Training for WaterNSW staff was structured around practical tagging followed by data-entry and uploading to the *FishNet* database (<https://PITtags.com.au/FishNet/>); following procedures in the training course developed earlier in the project by the Centre for Freshwater Ecosystems (CFE), ‘Lock keeper’s Guide to PIT Tagging Fish at Lock 10’ (Huntley & Brown 2016).

Results and discussion

Since 2015–16, staff at Lock 10 have been trained to a standard suitable for them to commence tagging, subject to animal care and ethics approval being granted by the NSW DPI ACEC committee. Ongoing training in 2017 included a ‘refresher course’ for staff at Lock-10 and some staff from Lock-15, with sign-off competencies occurring by CFE trainers.

Training has concentrated on developing safe practices and competency in tagging fish rather than achieving any objective count of tagged fish. However, for completeness, the numbers of fish tagged during training are presented by species and year in Table 1.

Table 1. Count of fish PIT tagged by species during training sessions with Lock 10 staff.

Fish tagged	2015	2016	2017	Species totals
Silver perch	11	5	1	17
Carp	35			35
Golden perch	134	64	90	288
Murray cod	1			1
Bony herring	1			1
Annual totals	182	69	91	342

Capacity building

Progress towards equipping lock staff with the necessary experience and skills to undertake PIT tagging of large-bodied fish occurred after some delays in permitting and caused by high-flows in 2016. Staff at Lock 10 now show competency in performing the task and are ready to commence a tagging program as described in this report and in more detail in the MDBA’s Pilot Program Proposal (MDBA 2016).

Animal care and ethics (ACE) permission for regular PIT tagging activities has not yet been secured by WaterNSW, but is imperative if the MDBA’s pilot program is to succeed in the River Murray upstream of Lock 9. Without implementing a plan to continue PIT tagging fish in the Murray River valley it will not be possible to evaluate whether many of the expected outcomes for fish passage and connectivity have been met for the Basin-Wide Environmental Watering Strategy (MDBA 2015).

If ACE permission in NSW cannot be achieved, immediate alternative strategies to consider, in consultation with MDBA include:

- Commencing training for SAWater staff at locks under South Australian control (locks 1–9).
- Arranging alternative funding for tagging activities with researchers having existing ACE permission that can work cost-effectively alongside lock staff to achieve PIT tagging targets.

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