EWKR
Environmental Water Knowledge & Research

Research to support environmental watering: a collaborative approach in the Murray–Darling Basin

Work Summary

Fish theme
Overview

The distribution and abundance of native fish species within the MDB have declined significantly in the last 50-100 years (MDBC 2004) and as such, are a key target for improvement under a number of basin-wide programs including The Basin Plan and The Living Murray. The Basin-wide environmental watering strategy lists improvements in distribution, abundances, population structure and movement as expected outcomes for fish (MDBA 2014).

In order to appropriately design environmental watering programs to benefit native fish, it is vital that the links between key watering parameters and potential fish responses are clearly understood. This requires an understanding of the biotic processes that maintain fish populations, the key drivers of these processes and the how these are influenced by flow. Research outcomes will assist managers by providing significantly improved predictive and explanatory capacity across a range of species.

Research questions

The overarching question in relation to the MDB EWKR Fish Theme is:

What are the drivers of sustainable populations and diverse communities of native fish?

This is the key question that underpins the fish theme and it seeks to explore the key functional processes that drive outcomes for native fish populations and communities, as well as the situations under which each of these processes become limiting.

The Fish theme will focus on fish recruitment, with research addressing the relative importance of key drivers and their interaction with flow and other variables at multiple spatial scales. The decision to focus on recruitment was based on early consultation with managers who considered recruitment to be the highest priority area. The high level questions for recruitment are:

- What flow regimes best support the recruitment and survival of native fish populations?

  How significant are the individual drivers?

  How do key drivers interact to influence outcomes?

  How should flows be managed to enhance drivers and thereby the fish response?

- How do threats impact on the drivers and recruitment and survival outcomes?

We define recruitment as the process of survival to the end of the first year of life.

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Approach

The Fish Theme will enhance understanding of the key drivers and functional processes of sustainable populations and diverse communities of native fish, as well as the situations under which key processes become limiting. The theme aims to provide improved capacity to predict fish recruitment outcomes in response to different environmental flow conditions.

This will be achieved by synthesis of existing knowledge and data experimental and field studies in key knowledge gap areas in order to better understand the direct and indirect relationships between fish recruitment and flow, and how these are mediated by non-flow related factors.

The proposed approach includes five main research components:

Component F1 – Foundational activities

This component seeks to improve our knowledge of the relationship between flow and fish populations based on both existing knowledge and data, and where this is lacking, the generation of new knowledge. Consequently, this component provides the opportunity to:

1. Improve our conceptual understanding of the relationship between flow and fish recruitment.

2. Test key relationships, particularly those of management relevance in the MDB, identified in the conceptual model by analysing existing data sets and undertaking research to generate new information.

Work undertaken within the Fish Theme will begin with synthesis and conceptualisation activities which will be used to:

- inform the identification of priority focus areas

- generate hypotheses upon which the research undertaken by the theme will be based

- provide a framework for the development of a predictive model

- generate stand-alone, high level scientific and management outputs.

Component F2 – Research activities

This component will focus on addressing key knowledge gas identified through the conceptualisation process relating to the relative importance of key recruitment drivers and their relationship with flow and other variables. The work is comprised of a number of sub-components addressing:

1. The diet of larval fishes.

2. The relationship between larval growth and survival and food density and temperature.

3. The spatial variability in the thermal and nutritional riverscape at multiple spatial scales (patch, riverscape, reach, river segment).

4. The relationship between flow, geomorphic and structural habitat and three key drivers of recruitment: food, temperature and larval dispersal and retention.

5. Basin-scale population dynamics of Golden perch and Murray cod: relating flow to provenance, movement and recruitment in the Murray–Darling Basin.

Component F3 – Swimming capacity, settlement cues and environmental tolerances of the early life stages of

Murray-Darling Basin fishes

This component comprises two student projects. The first student project will investigate the swimming capacity and the effects of the physico-chemical environment (e.g. temperature, dissolved oxygen and turbidity) on the survival and growth of the early life stages of Murray-Darling Basin fishes. This project will be undertaken by an existing PhD student, Dale Campbell who is being supervised by Paul Humphries at CSU.

The second student project will investigate and model the influence of several key mediating recruitment drivers, such as water velocity, flow and habitat availability on the settlement ability of fish larvae with differing reproductive strategies. This project will be undertaken by an existing PhD student, Lorena Noguiera, who is being supervised by Amina Price (MDFRC), Lee Baumgartner (CSU) and Paul Humphries (CSU).

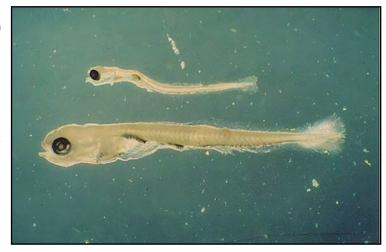***Component F4 - Synthesis and model development and management***

This component will draw together all of the outputs from the conceptualisation and research activities to produce a conceptual model for MDB fish that will describe:

1.   Which recruitment drivers are most important for water managers to consider when managing for recruitment of:

      - different species

      - different seasons

      - different systems and

      - different flow scenarios

2.   How can water managers' best manage delivery of environmental water to target the most appropriate recruitment drivers for the species and system of interest?

3.   What non-flow related factors are likely to impact on the key recruitment drivers and how? What complementary actions can be used to improve recruitment outcomes?

Component F5 – Theme planning, coordination and reporting

This component includes:

•   Theme research planning, including contributions to Annual and Multi-Year Research Plans

•   Theme research coordination, ensuring the research activities are administered effectively and delivered in a coordinated manner to deliver MDB EWKR objectives

•   Theme level reporting, including the Final Research Report for the Fish Theme, and contributions to the Final Research Report and the Overall MDB EWKR Synthesis Report (noting that these reports will build on the specific reports associated with individual research components and activities)

•   Project reporting, including contributions to mid-year and annual progress reporting.

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