LA TROBE UNIVERSITY

Centre for Freshwater Ecosystems

Fact Sheet

EWKR
Environmental Water Knowledge & Research

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

Work Summary

Foodweb Theme

The Basin Plan seeks to protect and restore biodiversity in the Basin's aquatic ecosystems. Food Webs are one of a number of critical ecosystem functions believed to be important in sustaining patterns of diversity along with connectivity and nutrient cycling. Improved understanding of the influence of flow on food webs will enable better management of environmental flows within the Basin.

Flow has three major functions in riverine systems; disturbance acting to influence community composition and dynamics, providing cues for major life-history events, and as an influence on energetics through transferring materials longitudinally along the river, laterally between the river and its margins, and vertically between the sediment and the water column.

In the Murray-Darling Basin, the role of flow in disturbance dynamics and as a trigger of life history events is reasonably well known. What is much less clear is the role of flow in generating the resources that are needed to support the growth and survival of key life history stages in order to sustain breeding populations.

There have now been numerous instances where bird breeding, for example, has been triggered by a flow event, but where the birds have either gathered and then not nested, or nested and failed to raise chicks to independence. Similarly, even where fish breeding is initiated by a flow event, we have limited evidence that the fish larvae have access to the food needed to allow them to grow to become adults.

The food web theme has identified the relationship between environmental flows and the provision of food resources across life stages of plants and animals to be a critical knowledge gap in the Murray Darling Basin.

The purpose of the food-web theme is to improve our understanding of the effects of environmental flows on food webs that support waterbird and fish recruitment. In particular, the theme will focus on the base of the food web to clarify the source of organic matter that supports the production of food.

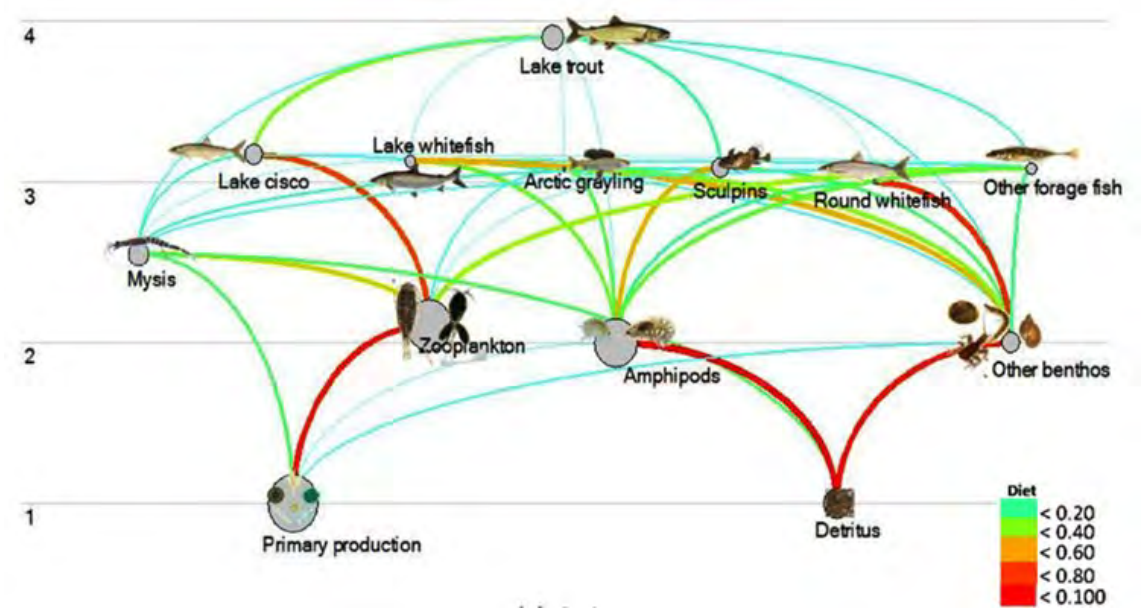
The new knowledge generated will be incorporated into models that will improve manager's capacity to predict food web responses to flows in terms of the amount of food available to target species or life stages.

Contact

Dr Paul McInerney
Theme Coordinator
Centre for Freshwater Ecosystems
La Trobe University
P: + 61 2 60 249690
E: p.mcinerney@latrobe.edu.au

Dr Nikki Thurgate
Project Coordinator
Centre for Freshwater Ecosystems
La Trobe University
P: + 61 2 60 249690
E: n.thurgate@latrobe.edu.au
W: latrobe.edu.au/freshwater-ecosystems

Australian Government
Department of the Environment



A simple model of this type is shown above with species grouped together functionally, with the size of the circles in the figure indicating biomass and the colours of the lines fluxes of energy through the food web to the top consumers.

Research Questions

The food-web theme has identified the following key questions. Within each of the main questions, a set of subsidiary questions have been generated based on existing knowledge of likely sources of variation in energy flow.

1. **What flow regimes best support food-webs that transfer energy to support recruitment of native fish and waterbirds?**

   1A What are the main energy sources contributing to larval fish biomass and waterbird recruitment in the field?

   1B Are there clear spatial patterns in the importance of different energy sources?

   1C Are there clear temporal patterns in the importance of different energy sources?

   1D Is there evidence of 'energy bottlenecks' preventing passage of energy to higher trophic levels?

   1E How does provision of flow affect any patterns detected in 1.1A-D?

2. **How do other stressors (e.g. land-use change, invasive species) impact on food-web processes and the achievement of native fish and waterbirds outcomes?**

   2A Is there evidence for energy being diverted away from native fish and waterbirds (e.g. by carp)?

   2B Is there evidence that productivity in the channel is limited by other factors (e.g. water turbidity, availability of productive substrates)?

Environmental flows directly impact on energy flow via a number of mechanisms including patterns of productivity and movement of nutrients, organic matter and food among habitats. There are likely to be spaces in the landscape that are disproportionally important in space and time for primary and/or secondary production with their location and productivity being influenced by flow.

Numerous studies of large systems around the world and in Australia have shown that the movements of energy associated with flow are a critical factor influencing fish and waterbird recruitment.

The food web theme represents a critical link between the work being carried out across other themes. The proposed research plan is therefore structured in such a way that there is clear line of sight between the outputs of the Food Web theme and those of the fish and birds themes.

Approach

Given the gaps in current empirical understanding of food web dynamics in the Murray-Darling Basin, we propose to approach the theme in four stages.

1. Review and conceptualisation. This stage identified our current knowledge status and critical knowledge gaps. This stage has been completed.

2. Identifying critical basal resources. Understanding the basal resources underpinning fish and waterbird recruitment is essential to understanding the way that flow may influence fish and waterbird recruitment through its influence on food resources. This component will have both a field and experimental component.

3. Identifying important sites of production. This stage will seek to identify areas that are disproportionally more important in delivering and/or transforming basal resources.

4. Modelling bioenergetics within identified production sites. This activity will take the outcomes of the other work and existing knowledge to improve our capacity to predict the outcomes of environmental flows in terms of their influence on food webs.

Activity 1: Identifying Critical Basal Resources Supporting Fish Recruitment

Understanding the basal resources underpinning fish recruitment is essential to understanding the way that flow may influence fish recruitment through its influence on food resources.

The fish theme is seeking to evaluate the fundamental triad concept that proposes that fish recruitment is dependent on habitats that provide nutrient enrichment, concentration and retention of both food and fish larvae.

The project's capacity to test this model depends on understanding the basal resources that support larval recruitment as these are the enriching resources that will be concentrated.

To address this question in conjunction with the fish theme we will undertake a field sampling program starting with a pilot study targeting larval and juvenile cod, yellowbelly and carp, in addition to quantitatively sample 8 basal resources (e.g. dead plant material, algae etc).

Fish and basal resources will be analysed for bulk ^{13}C and ^{15}N composition, fatty acid distribution amino acid distribution and calorific value. In addition it is anticipated that zooplankton samples will be taken and analysed for calorific value only.

Activity 2: Identifying Critical Basal Resources Supporting Waterbird Recruitment

The Waterbirds Theme has summarised existing information on diets of waterbirds, including some gut content data, and most waterbirds have been allocated to a feeding guild (e.g piscivorous, herbivorous).

While useful, this data does not currently identify the basal resources on which the waterbirds rely or changes in prey type that may be associated with changes in available habitat. Improved understanding of these issues will help identify ways in which managers can better target environmental flows to those habitats critical to the provision of food for waterbird chicks.

The study will focus on Straw-necked ibis with the Waterbird theme intending to collect regurgitate from about 40 individuals and visually identify the prey items in the regurgitate at Barmah-Milewa Forest.

Keep in touch with MDB EWKR

* EWKR Story space ewkr.com.au
* latrobe.edu.au/centre-for-freshwater-ecosystems