LARVAL FISH ASSEMBLAGES IN THE LOWER RIVER MURRAY, AUSTRALIA: EXAMINING THE INFLUENCE OF HYDROLOGY, HABITAT AND FOOD.



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DECLARATION OF AUTHORSHIP

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The Lower River Murray, South Australia (photo courtesy of Kelly Marsland).

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Chowilla (photo courtesy of Lesley Alton).

ABSTRACT

The major assumption of currently accepted fish recruitment hypotheses (e.g. *flood pulse concept* and *flood recruitment model*) is that in the absence of overbank flows the main river channel does not provide adequate food and habitat for larvae and juveniles. However, periods of low flows are common throughout floodplain rivers, and there are a wide diversity of life history strategies exhibited by riverine fish. Therefore, the broad applicability of these assumptions to the management of all fish species and floodplains rivers has been questioned. The *low flow recruitment hypothesis* pioneered the concept that some fishes can successfully spawn and recruit during low flows by utilising main channel habitats. Characteristics of the river channel, flow regime and level of regulation are often distinctly different both within and between rivers, and many of the recruitment models and indeed the life history strategies of fishes, remain untested in alternative floodplain river systems.

River regulation has resulted in altered flow regimes in river systems throughout the world, and in turn, has a range of negative impacts on the fish populations. The Murray-Darling Basin is Australia's largest river catchment and has been severely affected by river regulation. To test some of the assumptions of the previously described recruitment models larval fish and zooplankton sampling was conducted in the main channel environments of the Lower River Murray, South Australia. In comparison to the rest of the Murray-Darling Basin, the Lower River Murray is unique due to the combination of four distinct geomorphologic regions, the absence of significant tributaries, and the high degree of regulation. Extensive river regulation has drastically reduced the natural flow variability of the Lower River Murray. Furthermore, there has been little work on the spawning and larval assemblages within this region.

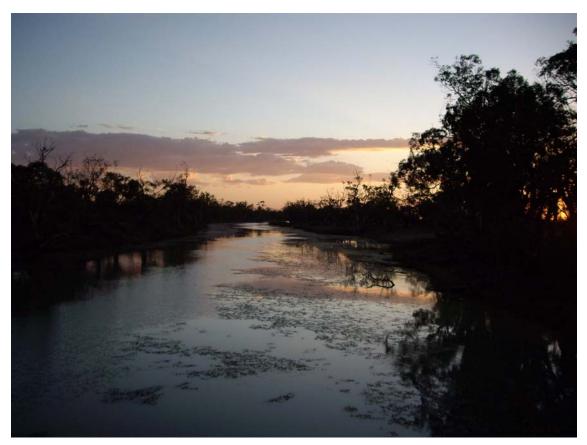
Larval fish sampling is often used for studying the early life history of fishes, but sampling gear and diel timing of sampling can bias results. Pelagic plankton tows were the single most effective method for collection of most species. Diel variation was identified for many species; with most exhibiting higher abundances during the night, although one species occurred in higher abundances during the day. Given these results the sampling regime for this project utilised both day and night pelagic plankton tows.

Annual differences in the larval assemblages in relation to variations in hydrology and environmental variables were investigated across four years, including a year of increased flow and a water level raising, and three years of low regulated flow with stable water levels. The main channel environment of the Lower Murray supported larvae from all life history strategies. The larval assemblage differed between years; the flow pulse year was consistently different from the subsequent three low flow years. Three responses to varying hydrology were identified in the larval assemblage: larvae that were 1) positively correlated to increased flow, 2) negatively correlated to the increased flow and 3) correlated to temperature. The low flow recruitment hypothesis was supported, with a number of small-medium bodied native species spawning under low flow conditions in the river channel. However, golden perch and silver perch (flow cued spawners), were only present during the flow pulse year. Environmental flows are therefore vitally important for the management and restoration of some native fish species.

Strong within year variability was inherent in the data due to the seasonal variation in spawning time of fishes. The timing of peak spawning in the Lower River Murray was compared to other studies throughout the Basin. The broad spawning patterns identified for individual species were similar to seasonal spawning guilds identified for Australian species in previous studies. These spawning guilds were spring/summer and summer spawners. Understanding the timing of spawning of key species within a region will ensure that management actions can be targeted at providing benefits for species of interest.

The key assumption of many recruitment models is that the main river channel is an area of low productivity, and therefore it does not provide adequate food for developing larvae, which is particularly pronounced in years of low flow. Zooplankton sampling was conducted during the spring/summer of 2006 in the pelagic zone of the main river channel in a typical low flow year. Although temporally and spatially restricted, results indicated that during a low flow year an abundant prey source does exist in the main river channel in the Lower River Murray. Furthermore the prey was abundant in the pelagic zone of the open water, where traditionally pelagic zooplankton abundances have been documented to be relatively low. This suggests that in the absence of floodplain inundation developing larvae have adequate access to food in this lowland temperate system.

The inundated floodplain is generally recognised as important habitat for developing, larvae, consequently the importance of the main channel environment is frequently overlooked despite many studies highlighting the importance of shallow, still littoral zones. Larval fish were sampled in three main channel habitats: backwaters, open water and still littoral zones. Larvae of key species successfully spawned and utilised these main channel habitats during a low flow year. Specifically, still littoral zones and backwaters were important main channel habitats for developing fish larvae, providing support for the applicability of the low flow recruitment hypothesis to the Lower River Murray. Some species (namely the small – medium bodied natives were able to spawn and recruit in the Lower River Murray under low flow conditions, but these were also able to spawn under the higher flow conditions. However, during the low flow years there were no larvae golden perch or silver perch collected, suggesting that these species were not spawning under the low flow conditions. This study has highlighted that a number of species will spawn and develop as larvae in the heavily regulated weir pool environment. In addition, adequate food and habitat were available for developing fish larvae in the absence of floodplain inundation in the Lower River Murray. However, for species with specific flow requirements (such as golden perch and silver perch, and potentially Murray cod and freshwater catfish) continued low flow conditions may pose a significant threat. In heavily regulated systems, environmental water allocations should be considered to manage and potentially restore declining fish populations, and the benefit of within channel flow pulses should not be underestimated.



Sunset in Chowilla (photo courtesy of Lesley Alton).