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Fine scale spatial behaviour of indigenous riverine fish in a small New Zealand stream



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Abstract

The substrate and flow characteristics of a 100m reach of a small, North Island, New Zealand stream were mapped and drawn to a 0.25m² grid scale. One hundred and thirty four individual fish, representing five native and one introduced species were PIT tagged and then monitored with a portable transceiver over 41 occasions during day and night in autumn to winter of 2008, then on 3 occasions in January 2009. Redfin bullies (*Gobiomorphus huttoni*), shortjaw kokopu (*Galaxias postvectis*) and koaro (*Galaxias brevipinnis*) were most commonly represented and redetected in the 100m reach (75%, 73%, and 83% detection rates respectively). Redfin bullies with a lower condition factor than conspecifics were less likely to be redetected and gravid fish were considered more at risk of infection or death associated with PIT tagging. Shortjaw kokopu were less likely to be redetected but more likely to retain tags in the longer term than both redfin bullies and koaro. No difference was found in tag detection rates at a range of flow levels, nor between day and night surveying, although a small decline in detection rates occurred as water temperature decreased.

Four hundred and twelve locations of untagged fish were collected during 14 night samples and added to the dataset of 557 locations of PIT tagged fish. A total of 1112 (82% of the reach) 0.25m² grid squares were inventoried for microhabitat characteristics using 16 physical variables which, together with fish locations, enabled the microhabitat characteristics of the grid squares where fish were found to be compared with those where fish were not found. Redfin bullies and shortjaw kokopu showed strong associations with large substrates and large interstitial refuge spaces and both species showed marked diel differences in microhabitat utilisation. Koaro were more dependent on velocity and surface turbulence and used similar microhabitat types regardless of diel period. No size-based or seasonal differences were found regarding microhabitat use. Potential segregation was observed between shortjaw kokopu and koaro but no other biotic influences on habitat utilisation were apparent.

Three floods occurred during the 2008 sampling period which facilitated the collection of fish behavioural data in relation to high flows. A total of 31 individuals were detected during flood conditions and these were found either within 0.5 metres of the base flow stream bed edge or inside the base flow stream bed in areas with large boulder substrates. A subset of the population was found returning to the same locations during multiple floods. Individual fish detected during high flows were significantly less familiar (see pages 68-69 for a detailed description of the term “familiar” in this context) in comparison to the subset of individuals that were commonly resident in the study reach during base flow conditions, showing that tagged fish made larger scale movements during flood conditions. While small changes in community composition occurred that were able to be attributed to flood-induced microhabitat changes, overall a remarkable level of persistence was observed in the tagged community, with over half of all individuals remaining in or returning to the same 100m section of stream following each flood.

Explanation of text

This thesis is a combination of four individual papers. This format has resulted in some repetition in introductions and methods sections between chapters, however a number of chapter and page references have been included to aid the reader. Chapters two, three and four are currently in preparation to be submitted to scientific journals for publication. The appendix contains a reviewed manuscript that was submitted to the New Zealand Journal of Marine and Freshwater Research in December 2008. Reviewers comments were received in late March 2009, specified changes were made and the manuscript was resubmitted on 25th May 2009.

The experimental manipulations and fish sampling methods have been sanctioned by the Massey University Animal Ethics Committee (protocol No. 07/30 and 07/106)

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