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MASSEY UNIVERSITY
GRADUATE RESEARCH SCHOOL

**THE EFFECTS OF
HYDROLOGICAL AND NUTRIENT DISTURBANCE ON
STREAM INVERTEBRATE COMMUNITIES
USING A TRAIT-BASED APPROACH**

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Abstract

Anthropogenic altered flow regimes and nutrient enrichment can cause significant impacts on stream biota and may lead to species loss if characteristics of the local fauna are not compatible with the new environmental conditions. I used fourth corner models, Bayesian ordination, and regression analysis to assess those potential effects on trait and species composition of invertebrate communities in UK, New Zealand (NZ) and Vietnamese streams.

NZ temperate mountain streams with greater substrate disturbance increased the abundance of plastron- respirers, but not those having two aquatic life stages or who were filter feeders. UK temperate rivers with predictable multiple high flows per year supported individuals having highly synchronized life history strategy; rivers with one prolonged rising limb and strong groundwater influence were better for those having a high reproduction strategy, and rivers with a steep peak flow supported both strategies.

Nutrients affect functional feeding and life history traits via promoting algal overgrowth in NZ streams. Both periphyton biomass and nutrients increased the abundance of algae piercers, collectors and those having two aquatic life stages, being long-lived and having hermaphroditic ability; but decreased the abundance of shredders, scrapers, and those having univoltine life cycles.

The post-flood recovery of invertebrate communities depended on the recovery of the food base of the food web that was, in turn, determined by the presence of a forest canopy cover and nutrient levels in a stream. Within the forest canopy stream, communities in the low nutrient site recovered by week 9 after a 1-in-50-year flood in Wellington, NZ. Without the forest canopy, the recovery of communities in nutrient-

impacted streams (by 25 weeks) was probably associated with a quicker regrowth of periphyton while communities in the low nutrient site had not recovered even after 40 weeks.

Hydrological disturbances, nutrients, and their combination had strong effects on invertebrate communities in temperate streams. Taxa that survive in a site have trait characteristics that are highly compatible with both the hydrological and nutrient conditions at a site. In contrast to temperate invertebrate communities, Vietnamese tropical highland community structure was influenced more by elevation than disturbance. Further studies are required to clarify how flow disturbance may effect invertebrate communities in tropical streams.

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Preface

The thesis was written up in the format of a paper-based thesis, therefore, each chapter was presented as a standalone manuscript. Consequently, information in methodology in each chapter may be repeated. Chapter 1-8 are primarily my work with input from my chief supervisor, Professor Russell Death.

Professor Russell Death provides critical contribution on manuscript development and editing. Therefore, he is a co-author on all manuscripts prepared. Wendy Monk and Paul Wood are co-authors on Chapter Two because they supplied the hydrological and raw invertebrate data for analysis. Hieu Quang Nguyen is a co-author on Chapter Five because he identified invertebrate samples.

Statement of Author contribution can be found in Appendix A.

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