

Impact of willows on aquatic invertebrate communities



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Cover image: A sudden influx of willow leaves during autumn creating a flush of organic pollution – Sixth Creek, Mt. Lofty Ranges, South Australia.

Photo: Wahizatul A. Azmi

DECLARATION

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Dated: June 2011

*I dedicate this thesis to my beloved husband, Md. Yuzeiry Md. Yasin
and my sons, Erfan Kheiry and Ezlan Kheiry.*

ABSTRACT

Exotic willows (*Salix* spp.) have invaded the riparian zones of many Australian streams, but the impact of willows and their removal on aquatic invertebrate communities are poorly understood. In the Mount Lofty Ranges, South Australia, willows have aggressively invaded riparian zones of many freshwater streams, often affect stream morphology and erosion, leading to water quality problems and suppress growth of native vegetation. We hypothesized that aquatic invertebrate diversity and abundance would be reduced in streams with willows present and after they have been removed. We also investigated whether willow leaves could provide a useful food source by comparing feeding preference, growth rates and survivorship of five dominant aquatic invertebrates. Also, we investigated the potential habitat value created by willow roots for aquatic invertebrates and whether shade (willow canopies) can influence the invertebrate assemblages.

Our findings suggest that the presence of willows was clearly associated with a reduction in taxon diversity. However, the abundance of invertebrates was significantly higher in sites with willows due to the high abundance of the introduced hydrobiid snail (*Potamopyrgus antipodarum*). The establishment of this snail under willows should be considered a serious threat as it may be in resource competition with native invertebrates. Lower invertebrate diversity and taxa numbers were observed where willows were removed and the site not revegetated. This reduction in diversity and change in composition of aquatic invertebrate communities may be due to loss of habitat, changes in water quality, or may depend on the prior history of willow invasion. Taxa responsible for the significant differences among sites when riparian vegetation is changed from the original vegetation to willows, or when willows are removed, were also identified. We found that changes in the pattern of invertebrate assemblages seemed to be influenced by differences in season, habitat quality, food availability and water quality.

Feeding preference experiments where eucalypt and willow leaves were compared revealed that willow leaves are a source of food for some native invertebrates [e.g., *Dinotoperla evansi* (Plecoptera: Gripopterygidae), *Tasmanocoenis tillyardi* (Ephemeroptera: Caenidae) and *Lingora aurata* (Trichoptera: Conoesucidae)], and may influence their growth rates and survivorships. In habitat preference experiments, we found willow roots supported significantly higher and more diverse aquatic invertebrate assemblages than an artificial substrate of aluminium wire mesh of different sizes. These findings revealed that willow roots provide a better habitat and a variety of microhabitats

for invertebrate colonisation. However, the introduced hydrobiid snails were strongly associated with willow root habitats compared with other invertebrates. In experiments of the effect of shade, we found that increased light as a result of willow removal and revegetation resulted in lower invertebrate abundance, although there were higher taxa numbers and diversity. This increase in sites lacking a riparian canopy (i.e., open canopy), may be due to an increase in the availability of quality food through reduced shading, which in turn increases the long term invertebrate community diversity, productivity and abundance.

Careful management of restoration programs to remove willows and to revegetate the sites is highly recommended, particularly in small streams such as those in this study. Many aspects need to be considered before willows are removed and revegetation programs carried out. These include: the impact of willows including their canopies and root masses, and that of the revegetation to replace willows. Aquatic invertebrates are potential bioindicators in the ecological success of willow control and revegetation programs, and should be considered as an important component during monitoring of such programs.

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TABLE OF CONTENTS

| | |
|--|-----------|
| DECLARATION | 3 |
| ABSTRACT | 5 |
| ACKNOWLEDGEMENTS | 7 |
| TABLE OF CONTENTS | 9 |
| LIST OF FIGURES | 12 |
| LIST OF TABLES | 14 |
| | |
| CHAPTER 1: General Introduction | 17 |
| 1.1 Introduction..... | 18 |
| 1.2 Effect of willows on aquatic invertebrate communities | 19 |
| 1.3 Aquatic invertebrates as bioindicators..... | 22 |
| 1.4 Thesis outline..... | 23 |
| | |
| CHAPTER 2: Exotic willows and their impact on the diversity and abundance of aquatic invertebrate communities | 27 |
| 2.0 Abstract..... | 28 |
| 2.1 Introduction..... | 29 |
| 2.2 Materials and Methods..... | 31 |
| 2.2.1 <i>Study site</i> | 31 |
| 2.2.2 <i>Sampling methodology</i> | 35 |
| 2.2.3 <i>Data analysis</i> | 36 |
| 2.3 Results..... | 38 |
| 2.3.1 <i>Effect of treatments</i> | 38 |
| 2.3.2 <i>Seasonal patterns</i> | 43 |
| 2.3.3 <i>Effect of habitats</i> | 45 |
| 2.3.4 <i>Influences of physico-chemical parameters</i> | 47 |
| 2.4 Discussion..... | 52 |

| | |
|--|-----------|
| CHAPTER 3: Feeding preference, survival and growth of aquatic invertebrates on crack willow (<i>Salix fragilis</i>) and white gum (<i>Eucalyptus viminalis</i>) leaves..... | 61 |
| 3.0 Abstract..... | 62 |
| 3.1 Introduction..... | 62 |
| 3.2 Materials and Methods..... | 66 |
| 3.2.1 <i>Study sites and species studied</i> | 66 |
| 3.2.2 <i>Feeding preference experiments</i> | 67 |
| 3.2.3 <i>Survival and growth experiments</i> | 69 |
| 3.2.4 <i>Total carbon and nitrogen analyses</i> | 69 |
| 3.3 Results..... | 70 |
| 3.3.1 <i>Feeding preference</i> | 70 |
| 3.3.2 <i>Survival and growth</i> | 73 |
| 3.3.3 <i>Nutritional value of leaves</i> | 75 |
| 3.4 Discussion..... | 77 |

| | |
|---|-----------|
| CHAPTER 4: Comparison of willow roots and artificial substrates as habitat for aquatic invertebrate communities..... | 81 |
| 4.0 Abstract..... | 82 |
| 4.1 Introduction..... | 83 |
| 4.2 Materials and Methods..... | 86 |
| 4.2.1 <i>Site description</i> | 86 |
| 4.2.2 <i>Experimental designs</i> | 86 |
| 4.2.3 <i>Analysis of findings</i> | 88 |
| 4.3 Results..... | 90 |
| 4.3.1 <i>Effect of substrate type</i> | 90 |
| 4.3.2 <i>Effect of habitat complexity</i> | 98 |
| 4.3.3 <i>Effect of periods of colonisation</i> | 102 |
| 4.4 Discussion..... | 105 |

| | |
|--|------------|
| CHAPTER 5: Effect of shades on aquatic invertebrate communities..... | 114 |
| 5.0 Abstract..... | 115 |
| 5.1 Introduction..... | 116 |
| 5.2 Materials and Methods..... | 118 |
| 5.2.1 <i>Impact of natural willow shade on aquatic invertebrates</i> | 119 |
| 5.2.2 <i>Impact of artificial shade on aquatic invertebrates</i> | 119 |
| 5.2.3 <i>Water temperature and light intensity measurement</i> | 121 |
| 5.2.4 <i>Analysis of findings</i> | 122 |
| 5.3 Results..... | 123 |
| 5.3.1 <i>Impact of natural willow shade on aquatic invertebrates</i> | 123 |
| 5.3.2 <i>Impact of artificial shade on aquatic invertebrates</i> | 130 |
| 5.4 Discussion..... | 136 |
| | |
| CHAPTER 6: General Discussion and Conclusions..... | 143 |
| 6.1 Impact of willows and their removal on aquatic invertebrate communities..... | 144 |
| 6.2 Conclusions and Further Research..... | 152 |
| | |
| REFERENCES..... | 154 |
| | |
| APPENDIX I List of taxa of aquatic invertebrates collected from Sixth and Deep Creeks..... | 166–167 |
| APPENDIX II List of taxa of aquatic invertebrates recorded at each treatment in Sixth and Deep Creeks..... | 168–170 |
| APPENDIX III Raw physico-chemical data for each sampling event in Sixth and Deep Creeks..... | 171–180 |
| APPENDIX IV Monte Carlo test of significance of observed maximum indicator value for taxon abundance on willow roots and aluminium wire mesh substrate..... | 181 |
| APPENDIX V Taxa abundances in relation to the types of substrate and substrate complexity..... | 182–183 |
| APPENDIX VI Trial experiments comparing willow roots and four artificial substrates as habitat for aquatic invertebrate communities..... | 184–187 |

LIST OF FIGURES

| | |
|--|----|
| Fig. 2.1 Location of study sites in the Mount Lofty Ranges catchment area, South Australia..... | 32 |
| Fig. 2.2 Photos of each treatment in Sixth and Deep Creeks..... | 34 |
| Fig. 2.3 Total abundance (a) and mean number of taxa (b) of aquatic invertebrate communities in four different treatments in Sixth and Deep Creeks..... | 40 |
| Fig. 2.4 Principal component analysis (PCA) case scores showing taxa assemblages associated with treatments in each habitat..... | 41 |
| Fig. 2.5 Total abundance of functional feeding groups of aquatic invertebrates in four different treatments in Sixth and Deep Creeks..... | 43 |
| Fig. 2.6 Seasonal abundances of major groups of aquatic invertebrates in (a) Sixth and (b) Deep Creeks..... | 45 |
| Fig. 2.7 Dendrogram using Sorensen's Coefficient method for two-way clustering analysis of generic composition in pool, riffle and edge habitats in each treatment..... | 47 |
| Fig. 2.8 Partial regression plots between densities of two dominant taxa and two water quality parameters..... | 50 |
| Fig. 2.9 Detrended correspondence analysis (DCA) plots showing taxa assemblage ordinations which related to some environmental variables..... | 51 |
| Fig. 3.1 Feeding preference experiments were conducted in plastic feeding trays (44.45 cm long x 20.9 cm wide x 2.54 cm depth), partially filled with freshly collected stream water..... | 67 |
| Fig. 3.2 Feeding preference for the different leaf types of five dominant invertebrates as indicated by the Chesson-Manly index..... | 71 |
| Fig. 3.3 Growth rates (mean \pm SE) of five dominant invertebrates fed with four different food types for 28 days..... | 75 |
| Fig. 3.4 Total carbon (a), nitrogen (b) and C/N ratios (c) for each leaf species and leaf states..... | 76 |
| Fig. 4.1 Willow roots (a) and aluminium wire mesh (b) bundles in onion bags..... | 88 |
| Fig. 4.2 Total abundance of aquatic invertebrate communities in different substrates, habitat complexity and periods of colonisation..... | 91 |
| Fig. 4.3 Mean number of taxa of aquatic invertebrate communities in different substrates, habitat complexity and periods of colonisation..... | 92 |

| | |
|---|-----|
| Fig. 4.4 Relative abundance of major aquatic invertebrate groups collected from willow roots (a) and aluminium wire mesh substrates (b)..... | 93 |
| Fig. 4.5 Total abundance of functional feeding groups of aquatic invertebrates in six different habitat complexity..... | 97 |
| Fig. 4.6 Detrended correspondence analysis (DCA) plots showing taxa assemblage ordinations which related to the types of substrate..... | 101 |
| Fig. 4.7 Dendrograms using UPGMA Sorensen's Coefficient method for one-way (a) and two-way (b) clustering analysis of individuals and generic composition in different substrates, habitat complexity and periods of colonisation..... | 103 |
| Fig. 5.1 Shade cloth of different mesh sizes; 70% (a) and 30% (b), representing artificial shade for fully and partly shaded treatments, and (c) typical section without a canopy at Deep Creek representing an open canopy..... | 121 |
| Fig. 5.2 Total abundance (a) and mean number of taxa (b) of aquatic invertebrate communities in three different willow shade levels at Sixth Creek..... | 124 |
| Fig. 5.3 Relative abundance of major aquatic invertebrate groups collected from three different willow shade levels..... | 127 |
| Fig. 5.4 Total abundance of functional feeding groups of aquatic invertebrates in three different willow shade levels..... | 128 |
| Fig. 5.5 Dendrograms using UPGMA Sorensen's Coefficient method for two-way clustering analysis of individuals and generic composition in different willow shade levels..... | 129 |
| Fig. 5.6 Total abundance (a) and mean number of taxa (b) of aquatic invertebrate communities in three different artificial shade levels at Deep Creek..... | 130 |
| Fig. 5.7 Relative abundance of major aquatic invertebrate groups collected from three different artificial shade levels..... | 133 |
| Fig. 5.8 Total abundance of functional feeding groups of aquatic invertebrates in three different artificial shade levels..... | 134 |
| Fig. 5.9 Dendrograms using UPGMA Sorensen's Coefficient method for two-way clustering analysis of individuals and generic composition in different artificial shade levels..... | 155 |

LIST OF TABLES

| | |
|---|-----------|
| Table 2.1 Summary of description and physico-chemical characteristics of each treatment in Sixth and Deep Creeks..... | 33 |
| Table 2.2 Results of two-way ANOVAs on total abundance and taxon richness of aquatic invertebrates collected from Sixth and Deep Creeks..... | 39 |
| Table 2.3 Results of two-way factorial PerMANOVAs on aquatic invertebrate community assemblages collected from Sixth and Deep Creeks..... | 39 |
| Table 2.4 Spearman's-rho correlation analysis between physico-chemical variables, total abundance, taxon richness and five dominant aquatic invertebrate species in Sixth and Deep Creeks..... | 49 |
| Table 3.1 F values for one-way ANOVAs on the effect of leaf species and leaf structures on food consumption, survival and growth of each invertebrate species..... | 72 |
| Table 3.2 Survival (%) of each invertebrate species fed on leached and senescent leaves of willows and eucalypts..... | 73 |
| Table 4.1 Results of two-way ANOVAs on total abundance and taxon richness of aquatic invertebrates at different substrate type, habitat complexity and periods of colonisation..... | 90 |
| Table 4.2 Results of two-way factorial PerMANOVAs on aquatic invertebrate community assemblages at different types of substrate, substrate complexity and periods of colonisation..... | 94 |
| Table 4.3 List of aquatic invertebrates, their functional feeding groups and taxon abundance in relation to the type of substrate and substrate complexity..... | 95 |
| Table 4.4 Results of two-way ANOVAs on functional feeding groups of aquatic invertebrates at different types of habitat complexity and periods of colonisation..... | 99 |
| Table 5.1 Results of one-way ANOVAs on total abundance and taxon richness of aquatic invertebrates at different willow shade levels (at Sixth Creek)..... | 124 |
| Table 5.2 Summary statistics for mean total abundance and mean number of taxa under three different willow shade levels..... | 125 |
| Table 5.3 Composition of aquatic invertebrates in different willow shade level treatments..... | 126 & 127 |
| Table 5.4 Summary statistics for mean total abundance and mean number of taxa under three different artificial shade levels..... | 131 |

Table 5.5 Results of one-way ANOVAs on total abundance and taxon richness of aquatic invertebrates at different artificial shade levels (at Deep Creek)..... 131

Table 5.6 Composition of aquatic invertebrates in different artificial shade level treatments..... 132 & 133

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