

# A Global Overview of the Conservation of Freshwater Decapod Crustaceans



The white-clawed crayfish, *Austropotamobius pallipes* complex

Tadashi Kawai · Neil Cumberlidge  
Editors

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 Springer

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*This book is dedicated to the late Professor Michael Türkay, who was a truly inspiring leader in the fields of crustacean biology and conservation*

# Foreword

More than 10 % of all described species on earth are concentrated in freshwater ecosystems. The fact that freshwaters are teeming with life but only occupy less than one per cent of the earth's surface makes these ecosystems the ultimate biodiversity hotspot. What's more, the beneficial services provided by freshwater ecosystems have been estimated to be worth more than \$29 trillion US a year.

Despite the immense value of these ecosystems, we are losing them at a rapid pace, and it is estimated that more than 64 % of the world's wetlands on which freshwater species depend have been destroyed since 1900. Population monitoring of freshwater species dating back to 1976 indicates that the rate of species loss in freshwater ecosystems is double that seen in either terrestrial or marine ecosystems. The 2015 version of the IUCN Red List of Threatened Species confirms this trend is continuing in freshwaters, with an alarmingly high number of these species (one in three) assessed as threatened with extinction. The accelerating decline of freshwater species worldwide means that many will be lost forever before we have even had a chance to add them to the biodiversity literature.

Human actions are largely to blame for this catastrophic loss of natural capital. Pressures on freshwater resources everywhere are growing daily as the increasing world population adds to the demand for drinking water, improved sanitation, food, energy, and industrial products. However, questionable environmental accounting methods in use for development projects fail to factor in the benefits of the valuable ecosystem services provided by freshwater systems and often undercount the true costs of the detrimental impact of development. Too often the increasing exploitation of freshwaters for human use fails to recognise the needs of the species that live there, and equally does not recognise the valuable services that these species collectively provide to ensure the sustainable functioning of these ecosystems.

Freshwater decapod crustaceans are a key component of the biodiversity found in freshwater ecosystems around the world. As this volume clearly shows, these conspicuous and valuable macroinvertebrates are also falling victim to the ever-increasing threats to global biodiversity. Species extinction represents a tragic

loss in itself, as well as being a tangible sign of the erosion of the natural resources upon which many people depend for their livelihood. The impact of this on human populations is felt through such things as a reduction in the number of species offered for direct consumption, or through a breakdown of ecosystem functions to the point where these wetlands fail to provide basic services (such as clean, abundant drinking water). In addition, research in Africa has demonstrated that healthy populations of freshwater crabs are critical for both nutrient recycling in freshwater ecosystems and for the continued survival of river otters and other predators of crustaceans.

Up-to-date information is a critical tool for addressing the urgent global challenge to conserve and sustainably manage the world's freshwater biodiversity. Knowledge of exactly where threatened species are located and the precise nature and origins of the threats that they face is invaluable for informing conservation actions aimed at avoiding or minimizing adverse impacts on freshwater biodiversity. Without current and comprehensive information, progress towards the conservation of our freshwater biodiversity is sure to continue to lag far behind that for other better known, and equally threatened, taxa.

This volume compiles for the first time the significant progress that has been made over the last 10 years to fill gaps in our knowledge of freshwater decapod crustacean conservation. It does this by providing specific examples of how this information can be applied in our efforts to conserve this important but rarely appreciated component of global biodiversity. I highly commend this volume and recognize the tremendous efforts of the many people who have worked tirelessly to make this information available in a single work. This book represents a truly valuable body of knowledge that is sure to make a significant contribution to help ensure the long-term future of freshwater decapod crustaceans around the world.

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# Preface

Freshwater ecosystems worldwide, from high latitudes to the tropics, host highly diverse communities of aquatic invertebrates that are often dominated by large-bodied decapod crustaceans such as freshwater crabs, aeglids, crayfish, and shrimps. These conspicuous macroinvertebrates excite interest because of their large size, a characteristic that also makes them an attractive food source. As a consequence, the populations of these crustaceans are under increasingly heavy pressure. Moreover, the alteration of global ecosystems by humans has happened more in the past one hundred years than in any comparative period of time in history. Freshwater habitats, and the animals that depend on them, are now under imminent threat from a number of different sources, a fact that is reflected in the high rates of biodiversity loss in freshwater ecosystems in all parts of the world.

We became aware of the continuing demand for the latest information on the threats to freshwater ecosystems following the publication in 2014 of “Advances in Freshwater Decapod Systematics and Biology”, edited by Darren C.J. Yeo (National University of Singapore, Singapore), Sebastian Klaus (University of Heidelberg, Germany), and Neil Cumberlidge (Northern Michigan University, USA). This was the first multi-author English language book to be produced on the freshwater decapods, and it has become a much sought-after source of reference material for researchers, students, conservationists, citizen scientists, and regional managers. This realization is what motivated us to produce a book written by specialists in freshwater decapod conservation that highlights the scale of the problems facing all of us. We are especially aware of the importance of this message reaching the next generation of scientists and managers because they will be the ones facing the consequences of severe environmental disruption in their lifetimes.

Recent International Union for Conservation of Nature (IUCN) Red List assessments of the freshwater decapods from all parts of the world have revealed unexpectedly high numbers of species threatened with extinction and have specified the source of threats to each species. The majority of threatened species of decapods are restricted-range endemics living in habitats subjected to deforestation, alteration of drainage patterns, and pollution, and many species are over-harvested for human



consumption. The stability of freshwater ecosystems is being seriously altered by the introduction of non-native species, urbanization, logging, and overexploitation of native species, and these negative impacts are increasing with globalization and human encroachment. In addition, the rate of global climate change in the coming century is projected to increase, and this will further impact all ecosystems more rapidly than any changes that have occurred in the last 10,000 years. It is clear that we are rapidly losing a good part of the biodiversity of the freshwater realm worldwide, and trends indicate that this situation is becoming increasingly serious. The locations of threatened species of decapods and the nature of their extinction threats are now better understood, and our global conservation efforts can now be focused on those species and habitats that are in most need.

Here, we review the current strategies aimed at monitoring and quantifying the decline of the world's threatened freshwater decapod species and highlight the efforts being taken to develop conservation measures to prevent further losses. Strategies for the sustainable management of inland aquatic resources depend heavily on baseline data on diversity, conservation status, and distribution patterns of the freshwater decapod faunas, all of which are now available on a global scale. The growing pressures on freshwater habitats and their species make it a priority to understand the effectiveness of current conservation strategies at the global and national levels in protecting freshwater systems and their inhabitants.

Future challenges include the increasing human population that is placing additional pressures on freshwater resources as demands for food, energy, transport, and water supply grow. In addition, there are significant emerging threats to freshwater ecosystems from future global climate change. However, the scale of the impact of these threats on freshwater ecosystems is still not well understood by the public, policymakers, and politicians, and there is a need to raise awareness of the urgent need for conservation action before it is too late. The limited resources available for conservation mean that we need to prioritize conservation interventions for those species that are on the edge of extinction based on their conservation status and the extinction threats that they face. Conservation action plans now need to be developed that are aimed at developing measures to prevent further losses, and these plans depend on cooperation between scientists, conservation managers, educators, funding agencies, and policymakers, as well as conservation agencies such as the IUCN.

Finally, the idea for the present volume arose at the 2013 summer meeting of The Crustacean Society in San Jose, Costa Rica, when we [Tadashi Kawai (TK) and Neil Cumberlidge (NC)] shared our common concerns for the urgent need to protect the hundreds of species of threatened decapod crustaceans that depend on freshwater habitats for their survival. As a result, we developed a proposal to Springer Publishers for a multi-authored invited volume that was based on two symposia on decapod conservation held at conferences in Germany and Japan. The first of these symposia was "Conservation and Biology of Freshwater Decapoda" held at the 2014 International Crustacean Congress 9 (ICC9) in Frankfurt, Germany, that included presentations by many of the authors who have contributed a chapter to this book. In addition, one of the editors (NC) was also an invited

plenary speaker at ICC9 who presented a talk on “Developing Conservation Strategies for Threatened Freshwater Decapods Worldwide”. The second symposium was “Conservation of Freshwater Decapods” at the “International Association of Astacology (IAA) and Carcinological Society of Japan (CSJ) Joint international Conference on Crustacea, IAA 20” held later in 2014 in Sapporo, Japan. This conference was organized by TK and included presentations on decapod conservation by several authors of the present volume, and by NC, who gave a talk in the plenary session on “Freshwater Crabs and the Biodiversity Crisis: Meeting the Conservation Challenges”. These three meetings formed the core of the 15 chapters in the present volume that have been authored by 38 leading specialists from all parts of the world. In this way, we were able to obtain global coverage that provided us with global coverage of the latest information on the biology and conservation of freshwater decapods.

In organizing and editing this book, we have enjoyed the support and input from active specialists in decapod biology and conservation from around the world. We would especially like to acknowledge the following individuals and organizations for their help: Dr. Hanamura Yukio (Japan), Dr. Elena Tricarico (Italy), Ms. Heide Türkay (Germany), the International Association of Astacology, The Crustacean Society, The Carcinological Society of Japan, and Zarigani Kenkyukai (Japan). We are especially grateful for the capable support of Judith Terpos and Alexandrine Cheronet of Springer Publishers who have guided us expertly throughout all of the steps in this long and complex process.

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May 2016

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