## DOCTORAATSVERDEDIGING

<table>
<thead>
<tr>
<th><strong>Naam doctoraatstudent</strong></th>
<th>Natalie Beenaerts</th>
</tr>
</thead>
</table>
| **Titel doctoraatsproefschrift** | **Nederlands:**
Moleculaire fylogenie en biogeografie van de echte zoetwaterkrabben van de Oude Wereld, met bijzondere aandacht voor de fauna van Sri Lanka

**Engels:**
Molecular phylogenetics and biogeography of the Old World true fresh water crabs, with emphasis on the fauna of Sri Lanka |
| **Onderzoeksgroep** | Dierkunde: Biodiversiteit & Toxicologie |
| **Promotor(en)** | Prof. Dr. Tom Artois  
Prof Dr. Franky Bossuyt (co-promotor) |
| **Datum verdediging** | 22 december 2009 |
ABSTRACT

With about 6,800 species described, the Brachyura or true crabs are the most species-rich group of Decapoda (lobsters, crabs, shrimps, etc...) (Ng et al. 2008; De Grave et al. 2009). An astonishing one fifth (~1280 species) of those crabs are true freshwater crabs, belonging to four superfamilies: Gecarcinucoidea, Potamoidea, Pseudothelphusoidea and Trichodactyloidea (Cumberlidge et al., 2008).

During the past twenty years, freshwater crab taxonomy and systematics have undergone major changes, with many new species described. Diagnostic morphological characters are re-weighted at all levels (from superfamily to species). The scant fossil record and the unresolved marine sistergroup(s) and ancestors hamper the reconstruction of freshwater crab relationships. The growth of molecular tools is of great importance for evolutionary biology, including freshwater crab evolutionary history. In this study, I contribute to the elucidation of the phylogeny and past biogeographical events of the true freshwater crabs, at least for the Old World and more specifically for Sri Lanka. These freshwater crabs of Sri Lanka also became the focus of biodiversity issues with implications for conservation. Before dropping the reader into that world, I briefly introduce the faunal group, its distribution, past global geological events, the concept of biodiversity hotspots (chapter one) and some methods used (chapter two).

In chapter three, I compile a multi-locus data set of 229 specimens of freshwater crabs mainly from the Old World. After a preliminary analysis on this data set, we selected a data set of 107 species, of which 102 were Old World freshwater crab species. This chapter provides a comprehensive phylogenetic framework and explains within a temporal framework the freshwater crab diversification and contemporary distribution. The phylogenetic results of this study infer the monophyly of the three major Old World freshwater crab families. Moreover, this study demonstrates that the contemporary freshwater crab distribution is most probably a consequence of post-Gondwanan diversification with frequent marine dispersals and clear influences of major geographical events.

In chapter four of this study I focus on the apparent similarities between the Sri Lanka fauna and the fauna of the Western Ghats, Indian peninsula. The regular land connections between Sri Lanka and the Indian peninsula in the Pleistocene have been used to explain these biological similarities, because during periods of low stand, migration to and from the mainland was possible. I use molecular phylogenies of two vertebrate and four invertebrate groups, and demonstrate that dispersal between mainland India and Sri Lanka has been much more limited than was assumed. Despite several periods in which Sri Lanka was connected by a land bridge to the Indian Subcontinent, it maintained a fauna that is largely distinct from that of the Indian mainland. Due to the striking morphological resemblance between the mainland and Sri Lankan faunas, the substantial genetic differentiation has escaped the attention of biologists and conservation managers. Our findings highlight the importance of less conspicuous intrinsic and extrinsic factors as significant barriers to animal dispersal and prompt recognition of Sri Lanka as a unique biodiversity hotspot.

In chapter five, I focus on the freshwater crabs as possible important indicators for biodiversity conservation on Sri Lanka. I assess the biodiversity of these crabs in relation to the different elevational zones (lowland, upland and highland) based on both species richness and phylogenetic diversity. The extensive radiation of freshwater crabs on Sri Lanka, i.e., 51 species (50 of them endemic), successfully colonized most moist habitats and all climatic and elevational zones in Sri Lanka. Three different lineages appear to have radiated simultaneously, each within a specific elevational zone, with little interchange thereafter. The lowland and upland zones show a higher species richness than the highland zone while—unexpectedly—phylogenetic diversity is highest in the lowland zone, illustrating the importance of considering both these measures in conservation planning. The diversity indices for the species in the various IUCN Red List categories in each of the three zones suggest that extinction risk may be related to elevational zone. Our results also show that overall more than 50% of Sri Lanka’s freshwater crab species (including several as yet undescribed ones), or approximately 72 million years of evolutionary history, are threatened with extinction. In my efforts to unravel the above questions, I evidently stumbled on new questions, which would be interesting to tackle in the future. Some of those are mentioned at a glance in the last chapter (chapter six).

It was only possible to cover this large set of faunal groups through collaboration with other research groups. I covered the freshwater crabs and the freshwater shrimps.