

Aggressive interactions and competition for shelter between a recently introduced and an established invasive crayfish: *Orconectes immunis* vs. *O. limosus*

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With 8 figures and 1 table

Abstract: *Orconectes immunis*, a crayfish species from North America, has been recorded first from habitats along the Rhine river (Germany) in the 1990th. Coincidental with the arrival of *O. immunis* resident populations of *O. limosus*, also a non-native crayfish species from North America, declined. We studied in laboratory experiments aggressive interactions and competition for shelter between the two invasive crayfish species as these interactions can result in species replacements. Agonistic behaviour was monitored in heterospecific 1 : 1 combinations of both species in 20-L aquaria. *Orconectes immunis* was strongly aggressively dominant over *O. limosus* when size-matched form I males or females were combined. Even 4 mm smaller *O. immunis* (carapace length) were still dominant over larger *O. limosus* and males of *O. limosus* were not dominant over similar-sized females of *O. immunis*. *Orconectes immunis* was also highly superior in competition for shelter. Shelter occupancy was approximately 6 times higher in *O. immunis* than in *O. limosus*. We conclude that one of the reasons for the observed decline of *O. limosus* coincidental with the arrival of *O. immunis* in some stretches of the Rhine catchment may be the inferiority of the former in aggressive contests. Inferiority in aggressive interactions may force *O. limosus* to leave refuges, making them vulnerable to predators.

Key words: non-indigenous crayfish, interspecific contests, shelter usage, species displacement.

Introduction

The invasion of ecosystems by non-indigenous species (NIS) can pose a threat to the native fauna (Lodge et al. 2000, Sala et al. 2000). In particular native species that overlap in niche with invasives can be threatened or even replaced by the latter. Freshwater crayfish are of great ecological and economic importance. Many crayfish species are kept in aquaculture, used as live food, for bait fishing and, more recently, have become popular in the aquarium trade (e.g. Lodge et al. 2000 and citations therein). Several crayfish species, predominantly from North America, escaped aquacul-

tures or came into European waters by legal or illegal stocking and are now important components of native food webs (cf. Holdich 2002, Machino & Holdich 2006). Crayfish are polytrophic omnivores and prey for a wide array of predators. They often dominate the macro-invertebrate biomass and can have profound effects on freshwater littoral community structure. They are therefore considered keystone species (Momot 1995, Dorn & Wodjak 2004, Rodríguez et al. 2005). Ecological impact and thus, ecosystem functioning can differ significantly with crayfish species identity (cf. Rodríguez et al. 2006). Changes in the crayfish fauna should therefore be monitored carefully.

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