

First record of the spiny-cheek crayfish *Orconectes limosus* (Rafinesque, 1817) introduced to the Iberian Peninsula

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Abstract

This is the first record of the spiny-cheek crayfish, *Orconectes limosus* (Rafinesque, 1817), introduced into the Iberian Peninsula. Sixteen individuals of this crayfish species were detected in the Muga River, near to the Boadella Reservoir (Catalonia, NE Iberian Peninsula) on October 9, 2010. This reservoir is only 14 km away from France, where the spiny-cheek crayfish was introduced during the 20th century. The presence of this non-native crayfish is a pressure on the conservation of native crayfish populations of this area and a problem for the whole aquatic ecosystem.

Key words: spiny-cheek crayfish, *Orconectes limosus*, Iberian Peninsula, Muga River, Boadella Reservoir

Introduction

The spiny-cheek crayfish, *Orconectes limosus* (Rafinesque, 1817) [Crustacea: Decapoda: Cambaridae], is a crayfish native of North America, widely distributed on the Atlantic watersheds. The spiny-cheek crayfish was the first non-native crayfish to be intentionally introduced into Europe from the United States (Hamr 2002; Holdich 2002). After its first European introduction into Germany in 1890, secondary introductions were made, and nowadays it is widely present in many European countries, from England to Hungary and from France to Lithuania (Hamr 2002; Holdich and Black 2007; Holdich et al. 2009). However, until now, the species had not been detected in the Iberian Peninsula (García-Berthou et al. 2007; Holdich and Black 2007; Adams et al. 2010). The presence of this invasive species might be a further problem to the native white-clawed crayfish (*Austropotamobius italicus*), because the spiny-cheek crayfish may live in a wide range of habitats and acts as a vector of crayfish plague (*Aphanomyces astaci*), like other North American crayfish (Souty-Grosset et al. 2006).

Material and methods

During a nocturnal survey with flashlights to detect individuals of white-clawed crayfish in the Muga River (Catalonia, NE Iberian Peninsula) on October 9th 2010, 16 individuals of spiny-cheek crayfish were detected along a 150 m river stretch (Figure 1). The location of these individuals was the connection between River Muga and Boadella Reservoir (Figure 2). Some of these individuals were captured and fixed with alcohol. The mustelid faeces around this site were full of crayfish remains. Some of these faeces were also collected. Unfortunately, after this survey the level of reservoir went up quickly due to a strong rain. For this reason, it was not possible to conduct a second survey to study the population with more details.

Results and discussion

The spiny-cheek crayfish individuals detected in Muga River had varying lengths with a maximum of 9 cm from the end of the rostrum to the end of the telson. The fact that the mustelid faeces around this site were full of crayfish remains might indicate a high abundance of



Figure 1. *Orconectes limosus* specimen from the Muga River (Iberian Peninsula) collected on 9 October 2010. Photographs by Lluís Benejam.

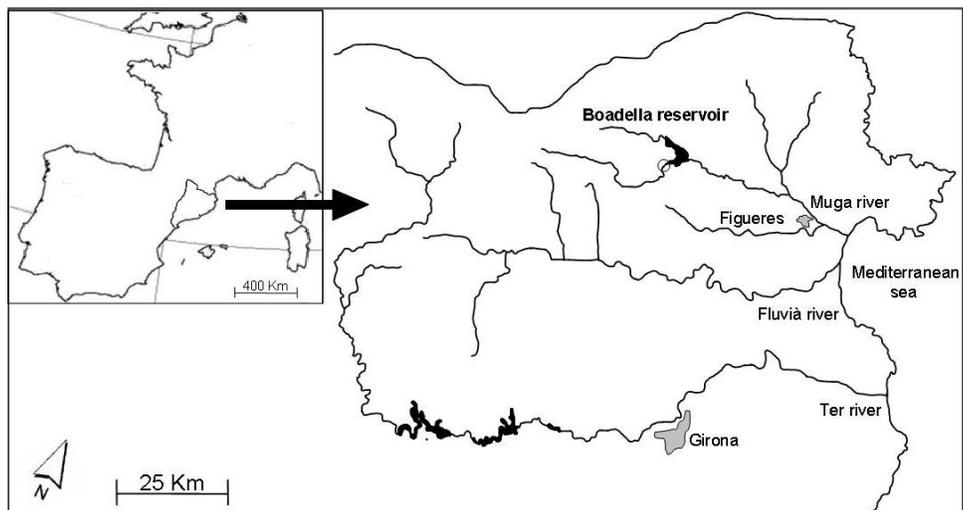


Figure 2. Map of the study area with a circle showing the site location of *Orconectes limosus* in the Muga River basin, near to the Boadella Reservoir (42°20'N, 2°49'E). The main towns and other rivers in the vicinity are also shown.

spiny-cheek crayfish in this area. Therefore, it is possible that this species was introduced in this point some years ago and they have been reproducing resulting in their current abundance.

Unfortunately, this is not the only non-native species in this area. The red swamp crayfish (*Procambarus clarkii*) is also present in Boadella Reservoir at least since the 1990s (Benejam and Saura-Mas 2010). The fish assemblage of Boadella Reservoir, and the inflowing rivers, is mainly composed of non-native species (Benejam et al. 2005; Carol et al. 2006). Because of a high frequency of anglers and due to its proximity to the French border, the Boadella Reservoir, together with Lake Banyoles (Clavero and García-Berthou 2006), are among the most important geographical entryways of freshwater alien species to the Iberian Peninsula. In this reservoir, there are at least eight non-native fish species (some of them native to France) and it has been one of the first localities of introduction for other species still not widespread in the Iberian Peninsula, such as the common bream *Abramis brama* (Linnaeus, 1758), perch *Perca fluviatilis* (Linnaeus, 1758), roach *Rutilus rutilus* (Linnaeus, 1758), pikeperch *Sander lucioperca* (Linnaeus, 1758), or rudd *Scardinius erythrophthalmus* (Linnaeus, 1758) (Benejam et al. 2005; Carol et al. 2006).

Some headwater streams that flow into Boadella Reservoir have very important populations of the native white-clawed crayfish. This is important due to its good conservation status, compared to the precarious status of other populations of this species around the Iberian Peninsula, and to its high variability and genetic specificities (Benejam and Saura-Mas 2010; Pedraza-Lara et al. 2010). So, the new presence of the spiny-cheek crayfish is another pressure on the conservation of native crayfish populations of this area and a problem for the whole aquatic ecosystem. This non-native species has been shown to have had an adverse impact on many native crayfish populations in Europe (Holdich et al. 2009). Prevention measures should therefore be taken to avoid the spread of *Orconectes limosus* to the Iberian Peninsula since it could negatively affect the conservation of native species such as the white-clawed crayfish, that is currently threatened in many Iberian Peninsula localities.

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References

- Adams S, Schuster GA, Taylor CA (2010) *Orconectes limosus*. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010.4. <http://www.iucnredlist.org> (Accessed 17 March 2011)
- Benejam L, Carol J, Alcaraz C, García-Berthou E (2005) First record of the common bream (*Abramis brama*) introduced to the Iberian Peninsula. *Limnetica* 24: 273–274
- Benejam L, Saura-Mas S (2010) Conservation plan of native crayfish population (*Austropotamobius italicus*) of Arnera stream (Muga river basin). Catalan Government, Environmental Department. Technical report, 52 pp
- Carol J, Benejam L, Alcaraz C, Vila-Gispert A, Zamora L, Navarro E, Armengol J, García-Berthou E (2006) The effects of limnological features on fish assemblages in fourteen Spanish reservoirs. *Ecology of Freshwater Fish* 15: 66–77, <http://dx.doi.org/10.1111/j.1600-0633.2005.0123.x>
- Clavero M, García-Berthou E (2006) Homogenization dynamics and introduction routes of invasive freshwater fish in the Iberian Peninsula. *Ecological Applications* 16: 2313–2324, [http://dx.doi.org/10.1890/1051-0761\(2006\)016\[2313:HDAR OJ\]2.0.CO;2](http://dx.doi.org/10.1890/1051-0761(2006)016[2313:HDAR OJ]2.0.CO;2)
- García-Berthou E, Boix D, Clavero M (2007) Non-indigenous animal species naturalized in Iberian inland waters. In: Gherardi F (ed), Biological invaders in inland waters: profiles, distribution, and threats. *Invading Nature: Springer Series in Invasion Ecology*. Springer, Dordrecht, Netherlands, pp 123–140
- Hamr P (2002) *Orconectes*. In: Holdich DM (ed) Biology of freshwater crayfish. Blackwell Science, Oxford, pp 585–608
- Holdich DM (2002) Distribution of crayfish in Europe and some adjoining countries. *Bulletin Français de la Pêche et de la Pisciculture* 367: 611–650
- Holdich D, Black J (2007) The spiny-cheek crayfish, *Orconectes limosus* (Rafinesque, 1817) [Crustacea: Decapoda: Cambaridae], digs into the UK. *Aquatic Invasions* 2: 1–15, <http://dx.doi.org/10.3391/ai.2007.2.1.1>
- Holdich DM, Reynolds JD, Souty-Grosset C, Sibley PJ (2009) A review of the ever increasing threat to European crayfish from non-indigenous crayfish species. *Knowledge and Management of Aquatic Ecosystems* 394–395:11, <http://dx.doi.org/10.1051/kmae/2009025>
- Pedraza-Lara C, Alda F, Carranza S, Doadrio I (2010) Mitochondrial DNA structure of the Iberian populations of the white-clawed crayfish *Austropotamobius italicus italicus* (Faxon, 1914). *Molecular Phylogenetics and Evolution* 57: 327–342, <http://dx.doi.org/10.1016/j.ympev.010.06.007>
- Souty-Grosset C, Holdich DM, Noël PY, Reynolds JD, Haffner P (eds) (2006) Atlas of Crayfish in Europe. Muséum national d'Histoire naturelle, Paris, (Patrimoines naturels, 64). ISBN: 2–85653–579–8