

Revision of the distribution of *Corbicula fluminea* (Müller 1744) in the Iberian Peninsula

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Abstract

This paper presents an overview of the chronology of Asian clam *Corbicula fluminea* invasions in the Iberian Peninsula and additionally presents the distribution of all relevant records published from 1981 (first record in the Peninsula) until 2008 in two geographic formats with references to invaded basins. In short, a total of six great basins and thirteen UTM 100x100 squares showed the presence of the species.

Key words: Asian clam, *Corbicula fluminea*, distribution, Iberian Peninsula, invasive species

Freshwater ecosystems are the most severely impacted in the world and are experiencing a decline in biodiversity and modifications by human activity worldwide (Revenga and Kura 2003). In terms of biological perspective, these global changes include the homogenization of Earth's biota by means of invasive species (Ricciardi and Rasmussen 1998). In terms of both abundance and biomass, invasive bivalves of the genus *Corbicula* (Asian clam) are one of the most widespread species. The actual distribution of the Asian clam includes south-eastern and eastern Asia, Australia and Africa (McMahon 1983). The species *Corbicula fluminea* (Müller 1744) and *Corbicula fluminalis* (Müller 1744) are among the most "efficient" freshwater invaders worldwide, appearing as

exogenous species in watercourses of both North and South-America, Japan and Europe (Araujo et al. 1993). The IUCN Global Invasive Species Database considers the second species as synonym of the first, so hereafter both species will be considered as *Corbicula fluminea*.

At least eight alien freshwater molluscan species have been introduced into the Iberian Peninsula in the last century (the gastropods *Melanoides tuberculata* (Müller 1774), *Potamopyrgus antipodarum* (J.E. Gray 1843), *Physella* (*Costatella*) *acuta* (Draparnaud 1805) and *Gyraulus chinensis* (Dunker 1848), and the bivalves *Dreissena polymorpha* (Pallas 1771), *Mytilopsis leucophaeta* (Conrad 1831) and *Corbicula fluminea* (Müller 1774)) and most are widespread in this area (García-Berthou et al.

2007). The first Iberian Peninsula record for the genus *Corbicula* was in the Tajo River basin at the beginning of the 1980's (Mouthon 1981), since this time distribution data for the Asian clam have experienced an exponential increase until 2008 (Figure 1). *Corbicula fluminea* is present, at least, in more than six great Iberian basins (Figure 2 and Annex 1), and comprises

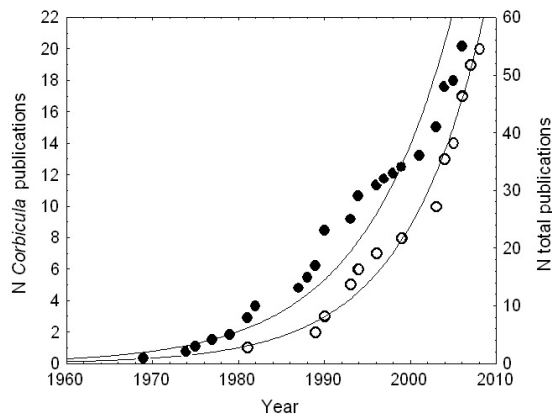


Figure 1. Cumulative number of publications referring to the distribution of freshwater invasive molluscan species (filled circles) and to *Corbicula* species (empty circles) in the Iberian Peninsula, since the first species record in the twenty century. References for *Corbicula* publications appear in Annex 1, references to freshwater invasive molluscan species are from Table 1, Vidal-Abarca and Suárez 1985, García-Berthou et al. 2007 and author's database

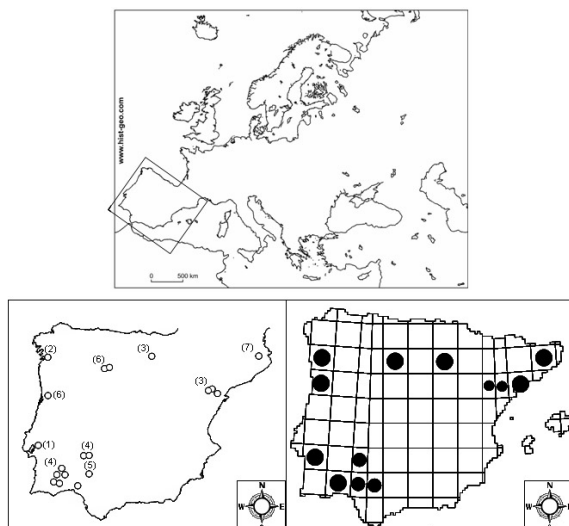


Figure 2. Distribution of *Corbicula* species across the Iberian Peninsula. Left: localities in which the species have been detected, with numbers inside brackets referring to river basins named in Table 1; right: UTM sites with presence of the Asian clam

14.6% of the 100x100 km UTM (Universal Transverse Mercator coordinates) web of the Iberian Peninsula. This figure indicates that this species remains undetected or unreported only in the centre and south-eastern Iberian water-courses.

As a general rule introduced species can become more easily established in altered ecosystems (Clavero et al. 2004; Pérez-Quintero 2007). In highly variable Mediterranean-semiarid freshwater habitats, like those of the Iberian Peninsula, small rivers with low flow rates are strongly influenced by two annual and predictable cycles: catastrophic winter floods and extended summer drought periods (Gasith and Resh 1999). For both reasons the actual distribution of the Asian clam in the Iberian Peninsula is related to human-impacted freshwater lentic sites like reservoirs and lotic habitats with permanent flow, like canalizations, irrigation tubes or docks (personal observations), but also to great rivers with permanent-deep sites. Both lentic and lotic sites provide the stable habitats in which the Asian clam can reduce the biotic stress related to the summer drought and so develop thriving populations.

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Corbicula fluminea in the Iberian Peninsula

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Annex 1Chronology of the invasions of *Corbicula fluminea* in the Iberian Peninsula (w/d: without data)

Map Ref. (Figure 2)	Location (Basin/River)	Record coordinates		Date of record	Reference
		Latitude, °N	Longitude, °W		
1	Tajo River basin				
	Tajo	38°55'	9°00'	1980*	Mouthon 1981
	Tajo	w/d	w/d	Before 2005	Marçal et al. 2005
2	Minho River basin				
	Minho	41°57'	8°44'	1989*	Araujo et al. 1991
	Minho	41°57'	8°44'	1989	Araujo et al. 1993
	Minho	41°58'	8°42'	1991	Antunes and Weber 1996
	Minho	42°01'	8°38'	2004	Sousa et al. 2007
3	Ebro River basin				
	Ebro	40°42'	0°42'	1997*	López and Altaba 1997
	Ebro	42°00'	0°20'	2004	Araujo 2004
	Ebro	41°16'	0°30'	1997	Oscoz et al. 2006
	Ebro	w/d	w/d	1997	Zapater et al. 2006
4	Guadiana River basin				
	Riv. Grande	37°27'	7°27'	1988*	Pérez-Quintero 1990
	Golondrina	37°29'	7°23'	1999	Pérez-Quintero et al. 2004
	Ronchona	37°31'	7°30'	1999	Pérez-Quintero et al. 2004
	Ayo. Grande	37°17'	7°25'	1999	Pérez-Quintero et al. 2004
	Piedras	37°18'	7°12'	1999	Pérez-Quintero et al. 2004
	Ardila	38°10'	7°03'	2001	Pérez-Quintero 2007
	Oeiras	37°31'	7°52'	2001	Pérez-Quintero 2007
	Cobres	37°39'	7°58'	2001	Pérez-Quintero 2007
	Vascão	37°31'	7°33'	2001	Pérez-Quintero 2007
	Cadavais	37°28'	7°29'	2001	Pérez-Quintero 2007
	Odeleite	37°19'	7°26'	2001	Pérez-Quintero 2007
	Lacarón	38°52'	6°26'	2006	Pérez-Bote and Fernández 2008
	Montijo reservoir	38°55'	6°25'	2006	Pérez-Bote and Fernández 2008
Lobón	38°51'	6°37'	2006	Pérez-Bote and Fernández 2008	
5	Guadalquivir River basin				
	Guadalquivir	37°22'	5°59'	Since 1993*	Escot et al. 2003
6	Duero River basin				
	Duero	41°08'	8°35'	1988*	Nagel 1989
	Duero	41°09'	7°47'	1989	Araujo et al. 1993
7	Catalonia basins	w/d	w/d	Before 2003*	Villeda et al. 2003

* - first record in the basin