

Additional records of eastern mosquitofish *Gambusia holbrooki* (Girard, 1859) for the River Ebro basin (Spain)

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Received 7 December 2007; accepted in revised form 14 February 2008; published online 23 March 2008

Abstract

Since the first authorised introductions to Spain in 1921 of the Eastern mosquitofish *Gambusia holbrooki* (Girard, 1859), this North American freshwater fish species has invaded large parts of several Iberian basins. For the River Ebro basin, we report 24 new records of this exotic species between 2005 and 2007 which represents a considerable expansion. Potential negative implications for aquatic invertebrate and fish communities are discussed.

Key words: aquatic invasive species, biological invasion, range expansion, Iberian Peninsula

Eastern mosquitofish *Gambusia holbrooki* (Girard, 1859) is one of many small-bodied fish species of the family Poeciliidae. Native to North America, it inhabits still or slow-flowing waters, preferably with dense aquatic vegetation and may survive in very polluted waters by taking oxygen from uppermost water layers. Its native North American distribution extends from the Delaware drainage in the North to Florida and Alabama in the South, but it has been introduced to many countries world-wide. In Europe, it was first introduced in Spain 1921 by health authorities in the hope that it would control mosquitoes (vectors of various diseases such as malaria) by preying on their larvae (De Sostoa and Lobón-Cervia 1989; Doadrio 2001; Kottelat and Freyhof 2007). However, there is no evidence that it has had any impact on mosquitoes. Presently, mosquitofish is establi-

shed in many warmwater systems throughout southern Europe, including the Atlantic coast of France as far north as the Loire estuary, and it is locally present in the southern Caspian basin as well as coastal areas of Black Sea basin (Kottelat and Freyhof 2007).

In Spain, Eastern mosquitofish is widely established (Elvira 1998), and in the River Ebro basin it had been recorded for some Catalanian and Basque rivers (Doadrio 2001) as well as in the lower- and upper extents of the Ebro's drainage but not between them. More recently, its presence and distributions was reported (Zaldivar 2006) from rivers of La Rioja province (Figure 1), although this species was not found in a previous study from the same author (Zaldivar 1994). In different monitoring studies (fish community surveys by electrofishing and biological water quality assessment by macro-

opportunities along with increasing the public's awareness about the negative and unpredictable consequences of releasing exotic species (Elvira and Almodóvar 2001; Rahel 2007) are recommended measures to avoid the spread of exotic fish species. However, such measures unlikely will suffice with highly successful invaders such as Eastern mosquitofish. Unfortunately, biological population control of Eastern mosquitofish is well beyond present capabilities and therefore future research should focus on the most efficient, species-selective and cost-effective tools to conduct mass removals.

Acknowledgements

Authors are grateful to Carlos Zaldivar (Dirección General de Medio Natural, Gobierno de La Rioja) and Ignacio Doadrio (Museo Nacional de Ciencias Naturales, CSIC) for their kindness to provide us their data about Eastern mosquitofish presence in Ebro river basin. We are also grateful to the two anonymous reviewers and to Dr. Vadim Panov who provided valuable comments and corrections of the manuscript.

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Records of *Gambusia holbrooki* for the River Ebro basin

Annex 1

Records of *Gambusia holbrooki* in River Ebro basin (Spain)

Record No. (map ref.)	River	Sample Station	Record coordinates		Elevation, m	Record date	Reference
			Latitude	Longitude			
1	Alcanadre	Ontiñena	41°40'47"N	00°05'33"E	158	29 August 2005 2 August 2007	This study
2	Arba de Luesia	Tauste	41°54'49"N	01°16'45"W	232	13 July 2005	This study
3	Cinca	Las Pilas Bridge	42°03'56"N	00°12'59"E	334	20 August 2007	This study
4		Fraga	41°31'23"N	00°20'52"E	95	2 August 2007	This study
5	Ebro	Tudela	42°03'59"N	01°35'57"W	246	11 July 2007	This study
6		Zaragoza	41°39'09"N	00°51'05"W	190	20 July 2006	This study
7		Pina de Ebro	41°28'49"N	00°32'10"W	157	4 August 2005 26 July 2007	This study
8		Azud de Rueda	41°17'43"N	00°19'07"W	125	1 August 2005 24 July 2007	This study
9		Flix	41°14'02"N	00°32'53"E	35	20 September 2005	This study
10		Mora de Ebro	41°05'21"N	00°38'55"E	30	20 September 2005	This study
11		Tortosa	40°48'45"N	00°31'06"E	10	20 September 2005	This study
12	Flumen	Barbues	41°58'56"N	00°25'22"W	338	17 August 2005	This study
13		Sariñena	41°45'24"N	00°10'59"W	243	29 August 2005	This study
14	Gallego	Villanueva de Gállego	41°49'23"N	00°47'04"W	245	29 August 2007	This study
15	Guadalope	Salto de la Cierva	41°10'12"N	00°01'47"E	155	14 October 2005	This study
16		Km 64 (A-221)	41°11'54"N	00°02'23"E	145	14 October 2005	This study
17		Mequinenza Reservoir	41°15'08"N	00°00'23"E	135	12 October 2005	This study
18		Caspe	41°12'30"N	00°00'40"W	88	27 July 2005	This study
19		Palanca – Caspe	41°14'33"N	00°02'34"W	85	27 July 2005	This study
20	Matarraña	Fabara	41°12'11"N	00°11'45"E	215	13 October 2005	This study
21		Nonaspe	41°12'41"N	00°15'48"E	140	13 October 2005	This study
22	Zadorra	Villodas	42°50'02"N	02°46'56"W	490	19 June 2007	This study
23		Nanclares de la Oca	42°48'45"N	02°48'50"W	475	6 September 2005	This study
24		La Puebla de Arganzón	42°45'59"N	02°49'57"W	470	6 September 2005	This study
25	Ebro	Cenicero	42°29'04"N	02°38'27"W	410	16 September 2002	Zaldivar (2006)
26	Tirón	Cihuri	42°34'12"N	02°55'01"W	480	21 September 2002	Zaldivar (2006)
27		Haro	42°34'52"N	02°52'37"W	450	21 September 2002	Zaldivar (2006)
28	Highway Pond	Near A-68 Highway	42°17'18"N	01°57'16"W	330	18 August 2004	Zaldivar (2006)

Annex 1 (continued)

Record No. (map ref.)	River	Sample Station	Record coordinates		Elevation, m	Record date	Reference
			Latitude	Longitude			
29*	Segre	Lower Segre	41°28'37"N	00°25'30"E	-	16 November 1950	Doadrio (2001)
30*	Noguera Ribagorzana	Sta. Ana Reservoir	41°50'22"N	00°31'51"E	500	Before 1989	De Sostoa and Lobón-Cervia (1989) Doadrio (2001)
31*	Matarraña	Near Nonaspe	41°12'05"N	00°11'50"E	-	Before 2001	Doadrio (2001)
32*		Fayón	41°12'15"N	00°18'59"E	95	Before 1989	De Sostoa and Lobón-Cervia (1989) Doadrio (2001)
33*	Ebro	Upstream Tortosa	40°56'22"N	00°33'53"E	-	Before 2001	Doadrio (2001)
34*		Ebro River Delta	40°40'10"N	00°34'29"E	-	Before 1984	De Sostoa et al (1984) Doadrio (2001)
35*		Ebro River Delta	40°45'35"N	00°34'17"E	-	Before 1984	De Sostoa et al (1984) Doadrio (2001)
36*		Ebro River Delta	40°40'19"N	00°41'34"E	-	Before 1984	De Sostoa et al (1984) Doadrio (2001)
37*		Ebro River Delta	40°45'43"N	00°41'23"E	-	Before 1984	De Sostoa et al (1984) Doadrio (2001)
38*		Ebro River Delta	40°40'27"N	00°48'40"E	-	Before 1984	De Sostoa et al (1984) Doadrio (2001)
39*		Ebro River Delta	40°45'52"N	00°48'29"E	-	Before 1984	De Sostoa et al (1984) Doadrio (2001)
40*		Ebro River Delta	40°45'59"N	00°55'35"E	-	Before 2001	Doadrio (2001)
41*		Buda Island (Ebro Delta)	40°40'35"N	00°55'46"E	-	22 January 1972	Doadrio (2001)
42*	Cinca	Lower Cinca	41°33'51"N	00°18'06"E	-	Before 2001	Doadrio (2001)
43*	Zadorra	Downstream Vitoria	42°51'24"N	02°48'59"W	-	Before 2001	Doadrio (2001)

*Record coordinates calculated in the center of the UTM square of 10x10 km given by the reference authors