

## NEW RECORDS OF *APHANIUS IBERUS* (PISCES: CYPRINODONTIDAE) AND REVIEW OF THE GEOGRAPHICAL DISTRIBUTION OF CYPRINODONTIFORM FISHES IN CATALONIA (NE-SPAIN)

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### RESUM

Hom ha revisat la distribució geogràfica a Catalunya dels peixos ciprinodontiformes citats a la península ibèrica: *Aphanius iberus*, *Valencia hispanica* i *Fundulus heteroclitus*. Es donen dues noves localitats de fartet, *Aphanius iberus*: la bassa del fra Ramon (llacuna litoral del Baix Empordà) i la sèquia de la Pineda (Vila-seca-Salou). Aquestes citacions estenen la distribució coneguda d'aquesta espècie a Catalunya, limitada fins ara al delta de l'Ebre i als aiguamolls de l'Alt Empordà. No hem detectat la població de samaruc, *Valencia hispanica*, del delta de l'Ebre citada anteriorment, i es proposa considerar aquesta espècie com a ja desapareguda a Catalunya. L'espècie nord-americana *Fundulus heteroclitus* introduïda a Andalusia i Portugal no ha estat trobada a Catalunya.

### RESUMEN

Se ha revisado la distribución geográfica en Cataluña de los peces ciprinodontiformes citados en la península ibérica: *Aphanius iberus*, *Valencia hispanica* y *Fundulus heteroclitus*. Se dan dos nuevas localidades de fartet, *Aphanius iberus*: Bassa del fra Ramon (laguna litoral del Bajo Ampurdán) y la acequia de La Pineda (Vila-seca-Salou). Estas citaciones amplían la distribución conocida de esta especie en Cataluña, limitada hasta ahora al delta del Ebro y a las marismas del Alto Ampurdán. No se ha detectado la población de samarugo, *Valencia hispanica*, del delta del Ebro citada anteriormente y se propone considerar esta especie como desaparecida en Cataluña. La especie americana *Fundulus heteroclitus* introducida en Andalucía y Portugal no ha sido hallada en Cataluña.

### ABSTRACT

We review the geographical distribution in Catalonia (NE-Spain) of the cyprinodontiform fishes recorded in the Iberian peninsula: *Aphanius iberus*, *Valencia hispanica* and *Fundulus heteroclitus*. We add two new records of *Aphanius iberus*: Fra Ramon lagoon (Baix Empordà marshes) and La Pineda channel (Vila-seca-Salou). This citation extends the known distribution of this species in Catalonia, previously limited to the Ebro delta and the salt marshes of the Alt Empordà. We have not found the population of *Valencia*

*hispanica* on Ebre delta previously recorded and propose that this species no longer exists in Catalonia. The North American species *Fundulus heteroclitus* introduced in SW-Spain (Andalusia) and Portugal has not been found in Catalonia.

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**Key words:** *Aphanius iberus*, Catalonia, Cyprinodontidae, cyprinodontiformes, fishes, *Fundulus heteroclitus*, geographical distribution, ichthyology, *Valencia hispanica*, Spain.

## INTRODUCTION

Three species of cyprinodontiform fishes have been reported in the Iberian peninsula: *Aphanius iberus* (Cuvier and Valenciennes, 1846) (Cyprinodontidae), *Valencia hispanica* Valenciennes, 1846 (Valenciidae, according to Parenti, 1981) and *Fundulus heteroclitus* (Linnaeus, 1758) (*Fundulidae*, according to Parenti, 1981).

The genus *Aphanius* Nardo (1827) is represented by several species throughout the Mediterranean region and in the Middle and Near East (Coad, 1988; Kessel et al., 1985a; Scholl et al., 1978; Villwock, 1970 & 1982; Villwock & Scholl, 1982). *A. iberus* is often considered endemic to the Iberian peninsula (Fernández-Delgado et al., 1988; Moreno-Amich, 1989; Sostoa, 1983; Sostoa, 1984), although there are records of populations of uncertain taxonomic position in Morocco and Algeria (Kessel et al., 1985a; Pellegrin, 1921; Villwock, 1970 and 1982; Villwock & Scholl, 1982). In the Iberian peninsula this species is distributed primarily on the E and SE coast (Anonymus, 1952; Kessel et al., 1985a; Lozano, 1935; Pardo, 1945; Sostoa, 1984; Vidal Celma, 1963), although it has also been reported on SW (Atlantic) coast (W-Andalusia) (Fernández-Delgado et al., 1988; Hernando, 1975a; Lozano, 1935; Sostoa, 1984), and on the NE coast (Catalonia) (Gibert, 1913; Lozano, 1919; Moreno-Amich, 1989; Sostoa, 1983; Sostoa, 1984; Vidal Celma, 1963).

The genus *Valencia* Myers (1928) is represented by two allopatric species: *Valencia letourneuxi* (Sauvage, 1880) in Western-Greece, and *Valencia hispanica* in the Iberian Peninsula (Bianco & Miller, 1989; Kessel et al., 1985b). The distribution of *V. hispanica* in the Iberian peninsula is unclear (Bianco & Miller, 1989). Fernández-Delgado et al. (1986) pointed out that the presence in Andalusia and Portugal is very doubtful, because the recent reports of this species by Arias & Drake (1986), Coelho et al. (1976), and Hernando (1975b, 1978) as well as the description of a new species *Valencia lozanoi* (Gómez Caruana et al., 1984) are misidentifications of *Fundulus heteroclitus*. This opinion has been confirmed by Drake et al. (1987) for the same population studied by Arias & Drake (1986). Likewise Zee (1988, quoted by Bianco & Miller, 1989) suggests that *V. lozanoi* is a junior synonym for *F. heteroclitus*. In NE and E-Spain *V. hispanica* has been reported by Buen (1933), Kessel et al. (1985a, 1985b), Lozano (1919, 1935), Pardo (1921, quoted by San Miguel, 1979), Pardo (1945), Sostoa (1983), Sostoa et al. (1984), Steindachner (1866, quoted by San Miguel, 1979) and Vidal Celma (1963).

The genus *Fundulus* Lacépède is originally North American, but *Fundulus heteroclitus* has been introduced in Spain and Portugal. The first records of *F. heteroclitus* in Spain were from Andalusia (Kessel et al. 1985a, 1985b). The population of *F. heteroclitus* studied by Drake et al. (1987) is also from Andalusia. Also, as indicated above, reports of *V. hispanica* in Andalusia and Portugal have subsequently been considered by other workers to be observations of *F. heteroclitus*.

The goal of this study was to establish the present status of the three species in Catalonia. *A. iberus* and *V. hispanica* are endangered species according to ICONA (1986). They are protected species by the laws of the Catalan and Valencian governments. We hope this study will assist in their management.

## SURVEYS

Samples were taken during 1988 and 1989 with a 9 mm mesh dipnet, and sometimes concentrated with seines from areas including:

*The Alt Empordà wetlands* several brackishwater lagoons between the mouths of the Fluvià and Muga rivers: Massona, Llarga, Fonda, Serpa, Rogera and Estany d'en Túries, two coastal lagoons and three freshwater ponds in the Rubina area, the channel Riu Vell and the coastal lagoon Llacuna de la Devesa near Empúries, the lagoon Fanguera de les Goles near the Fluvià mouth.

*The Baix Empordà wetlands* three coastal lagoons: Basses d'en Coll, Fra Ramon lagoon and Ter Vell.

*Near the Tordera mouth* the ponds Bassa de Can Rave and Bassa de Ca l'Estany and the coastal stream Els Pins.

*Vila-seca-Salou* the coastal stream of La Pineda.

*The Ebre delta* (the largest wetland in Catalonia) several points on coastal lagoons including: Tancada, Alfacada, Canal Vell and Encanyissada, several irrigation ditches all over the Delta, and the freshwater ponds Ullals de Baltasar.

## NEW RECORDS

Two new localities with *A. iberus* populations were found: Fra Ramon lagoon (Baix Empordà marshes) and La Pineda channel (Vila-seca-Salou) (Fig. 1). This work extends the distribution of *A. iberus* in Catalonia which had been previously limited to the Ebre delta and the salt marshes of the Alt Empordà (Fig. 1). Fra Ramon lagoon (42°01'40" N 3°11'30" E; U.T.M. 532160) is a 1,5-ha coastal lagoon placed in the salt marsh of the Baix Empordà between the Ter river's mouth and the lagoon Ter Vell. We have found no other populations in this area.

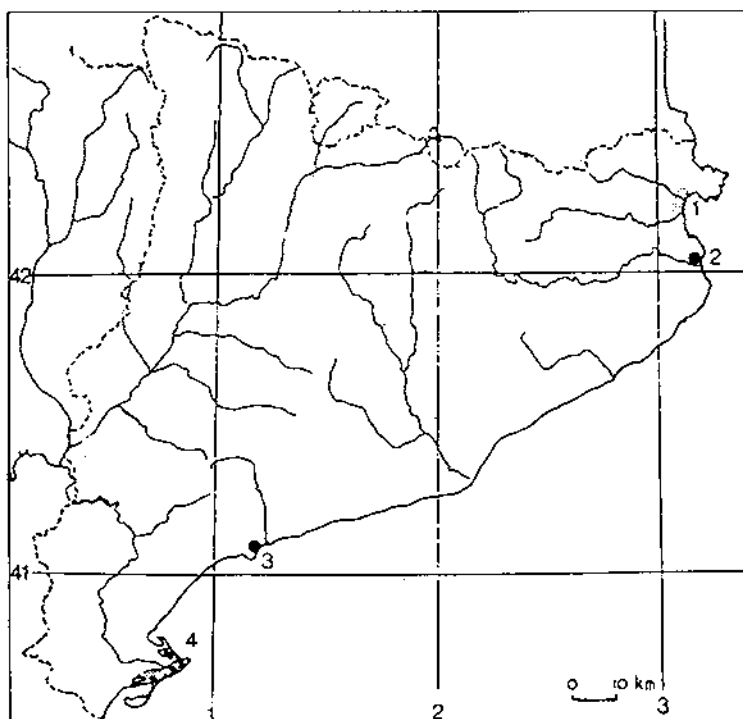


Figure 1. Geographical distribution of *Aphantius iberus* in Catalonia. (1) Alt Empordà marshes, (2) Fra Ramon lagoon (Baix Empordà marshes), (3) La Pineda stream (Vila-seca-Salou) and (4) Ebre delta.

The population of La Pineda was already known, but not well recorded by the government of Catalonia, and corresponds to a small channel with *Gambusia affinis* (Baird & Girard, 1853) (Poeciliidae) in the upper section and *A. iberus* confined near the sea (41°04'00" N 1°10'00" E; U.T.M. 31TCF471479).

## GEOGRAPHICAL DISTRIBUTION

### *A. iberus*

Although the results of this study represent the most complete record of the presently known natural distribution of *A. iberus* in Catalonia, reports for two other Catalonian areas should be mentioned. Gibert (1913) recorded *A. iberus* in the Llobregat delta. Maluquer (1916) also recorded *Fundulus hispanicus*, a synonym of *A. iberus*, there. However Sostoa (1983, 1984) pointed out that *A. iberus* disappeared from the Llobregat delta in the sixties. Vidal Celma (1963) also

recorded this species in Can Borrell reservoir (Barcelona), which Sostoa (1984) interpreted to be an introduction.

On the Ebre delta we have found *A. iberus* in several brackishwater lagoons: Tancada, Canal Vell and Alfacada. These results confirm the observations of Demestre et al. (1977) and Sostoa (1983), showing a distribution pattern of *A. iberus* along the outlines of the delta in the brackishwaters, and confined by *Gambusia affinis* which is common in freshwater areas all over the delta. The Alt Empordà wetlands show a very similar pattern. We have found *A. iberus* there on several brackishwater lagoons between Fluvià and Muga rivers' mouths: Fonda, Serpa, Rogera and Estany d'en Túries (as reported in Moreno-Amich 1989). In addition, we found an isolated population in two small coastal lagoons northward, in the Rubina zone (between the Salins and El Grau channels).

The introduced species *G. affinis* and (in Andalusia) *F. heteroclitus* cause the regression of native cyprinodontiform fishes (Bianco & Miller, 1989; Brown, 1989; Fernández-Delgado et al., 1988; San Miguel, 1979; Sostoa, 1984 and Vidal Celma, 1963). *G. affinis* has spread all over Catalonia since its introduction early in the century. However, *G. affinis* has not generally spread into brackishwaters of Catalonia that are inhabited by *A. iberus* populations. While it is true that *G. affinis* is present everywhere on the Ebro delta, and some coastal lagoons are inhabited by both species (e.g. Canal Vell), most saltwater lagoons contain only *A. iberus*. Likewise, the Massona and Llarga lagoons, on the Alt Empordà marshes, with superficial freshwater, are inhabited by *G. affinis* while the neighbouring coastal lagoons, with brackishwater, have *A. iberus*. La Pineda channel has *G. affinis* in the upper reaches and *A. iberus* mostly on the lower reaches. Similar spatial segregation related to salinity has been described for other cyprinodontids (Haas, 1982; Martin, 1972), and extreme physiological tolerances are common in cyprinodontiforms.

Some of these coastal lagoons also occasionally dry, e.g. Estany d'en Túries in the Alt Empordà marshes. At such times, *A. iberus* colonizes these lagoons from other ones, probably during floodings that join the lagoons. Thus the *A. iberus* ecology is similar to that described for American cyprinodonts with a habitat strongly changing from a densely populated to a rarefied environment by virtue of increases in area, nutrient inflow, mortality, etc. (Garret, 1982).

### *V. hispanica*

The present distribution of *V. hispanica* in Iberian peninsula appears to be very restricted. The study of Rincón et al. (1986) on specimens from Andalusia could be based on a misidentification of *F. heteroclitus*, as explained above.

In Catalonia *V. hispanica* was first reported in the Ebre delta by Lozano (1919), and afterwards by Buen (1933). Vidal Celma (1963) recorded it in Can Borrell reservoir (Barcelona) (interpreted as an introduction by San Miguel, 1979). San Miguel (1979) referred to Gibert (1913) noting *V. hispanica* in Prat de Llobregat, but Vidal Celma (1963) and Sostoa (1983) did not. We have not surveyed this

area, but Gibert (1913) did not distinguish between *A. iberus* and *V. hispanica* and his description and photograph corresponds clearly to *A. iberus*. San Miguel (1979) also refers to a personal communication of the presence of *V. hispanica* in Alt Empordà marshes, which we consider to be unreliable. Thus the only area in Catalonia with certain records of *V. hispanica* is the Ebro delta.

Although San Miguel (1979) did not observe *V. hispanica* in the Ebre delta, Sostoa (1983) and Sostoa et al. (1984) considered it to be present in this area. During our surveys we have found no populations of *V. hispanica* in any of the Catalan wetlands studied. *V. hispanica* was not present on the freshwater ponds Ullals de Baltasar (Ebre delta) where it was referred by Sostoa (1983) and Sostoa et al. (1984), where we found only *G. affinis*. Therefore we propose that *V. hispanica* no longer exists in Catalonia.

Thus, based on our results and the observations in SW-Spain *V. hispanica* appears to be present only in E-Spain. An extensive assessment of this region should be done for both *V. hispanica* and *A. iberus*.

### *F. heteroclitus*

We did not observe *F. heteroclitus*, and consider this species as not yet introduced into Catalonia.

The limited and disjoint distributions of *V. hispanica* and *A. iberus* call for urgent management for their conservation because of the potential introduction of a new possible competitor *F. heteroclitus*, the abundance of *G. affinis*, and the potential for continued degradations of fragile habitats. According to U.I.C.N. (1986) this attention should be particularly necessary for *V. hispanica*, because it belongs to a monogeneric family with only two species.

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