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## First record of Siamese twins in Eastern Mosquitofish, *Gambusia holbrooki* (Girard 1859)

Raquel Moreno-Valcárcel\*, Ana Ruiz-Navarro, Mar Torralva and Francisco José Oliva-Paterna

Department of Zoology, University of Murcia, 30100 Murcia, Spain.

\* Corresponding author: [raquelmoreno@um.es](mailto:raquelmoreno@um.es)

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### ABSTRACT

#### First record of Siamese twins in Eastern Mosquitofish, *Gambusia holbrooki* (Girard 1859)

Siamese twins at the late eyed stage of development (*sensu* Reznick, 1981) have been found in a brood of young fish in a wild population of *Gambusia holbrooki*. The female containing the brood was collected in a temporal hypersaline watercourse located in the most arid zone of Europe, an area highly polluted by agrochemical and urban inputs. Extreme salinity and water pollution, along with other environmental factors, could be related to abnormalities in the embryo's development.

**Key words:** *Gambusia holbrooki*, embryos, Siamese twins.

### RESUMEN

#### Primera cita de gemelos siameses en *Gambusia holbrooki* (Girard 1859)

Ha sido detectada la presencia de gemelos siameses de *Gambusia holbrooki* en el quinto estadio de desarrollo embrionario ("late-eyed" *sensu* Reznick, 1981). La hembra que albergaba esta camada fue recogida en un curso de agua hipersalino localizado en la zona más árida de Europa, que se encuentra altamente contaminada por influjos urbanos y agrícolas. La extrema salinidad y contaminación del agua junto con otros factores ambientales podrían estar relacionadas con las anomalías en el desarrollo del embrión.

**Palabras clave:** *Gambusia holbrooki*, embriones, siameses.

### INTRODUCTION

*Gambusia holbrooki*, a poeciliid, is among the most invasive fish worldwide and is considered the most widely-distributed freshwater fish in the world (Pyke, 2005). This introduced species is considered as one of the 20 most damaging for natural species with similar habitat in Spain (GEIB, 2006) and is widely distributed in Iberian aquatic systems. Its reproduction is viviparous. The maximum brood size reported from the

Iberian Peninsula is 181 embryos (Vargas & de Sostoa, 1996; Pérez-Bote & López, 2005).

Siamese twins result from an anomalous pregnancy in which monozygotic twins do not separate completely (Gilbert, 2005). Siamese twins in fish have been reported several times (Jawad, 2004; Al-Jufaily *et al.*, 2005). They have already been reported from other viviparous fish, e.g., *Poecilia sp.* (Hulata & Rothbard, 1978 *cf.* Reichenbach-Klinke & Elkan, 1965), but conjoined twins have never been reported in *G. holbrooki* (Pyke, 2005).

## MATERIALS AND METHODS

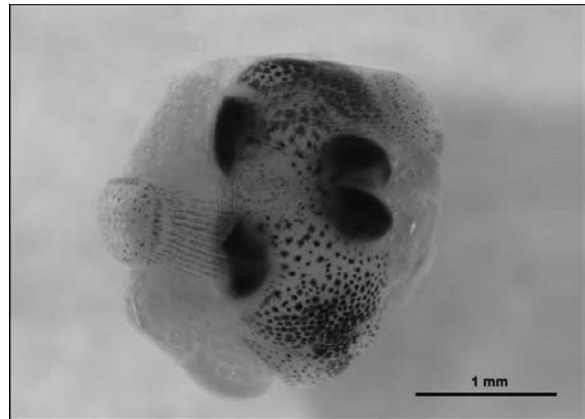
The present work is part of a research project whose aim is to describe the life-history and ecological attributes of *G. holbrooki* from intermittent aquatic systems in the most arid zone of the Iberian Peninsula. The study site is a hypersaline stream, Rambla Salada (Segura River basin, SE Spain), where regular sampling has been conducted. The main environmental characteristics of the sampled stream result from water salinity. The stream's salinity is characterised by high absolute values and considerable temporal variability (from November of 2005 to February of 2007, the minimum salinity was 6.8 g/l, the maximum 73.0 g/l) and by inputs of pollution from stockbreeding, agriculture and urban development. During a longitudinal study from April of 2003 to February of 2005, the following water quality data were obtained for the stream: 30.44 mg/l mean value of nitrate, 639.1 µg/l mean value of nitrite, 1.59 mg/l mean value of ammonium (Gutiérrez-Cánovas *et al.*, 2009).

A total of 14 034 fish were captured from the stream. The total length of each fish was measured. From this total sample, 2731 fish were preserved in 40 % formaldehyde and processed to obtain gonad weight, eviscerated weight and number of embryos.

## RESULTS AND DISCUSSION

A total of 347 females with embryos in development were thoroughly dissected. Only one of these females was found with a pair of Siamese twins in the embryonic sac (caught on 19 July of 2007). The Siamese twins belonged to a brood at the late eyed stage of development (*sensu* Reznick, 1981). The Siamese twins were connected at their head. One eye and the tissue of part of their heads overlapped (Fig. 1). It is not known whether the embryos shared other tissues such as cranium or brain.

Several studies have found a relationship between water pollution and developmental abnormalities in embryos. Occurrence of conjoined twins is a direct consequence of water pollution



**Figure 1.** Siamese twins of *Gambusia holbrooki* at the embryo stage collected in a hypersaline stream. *Gemelos siameses de un embrión de Gambusia holbrooki recogida en un arroyo hipersalino.*

(Longwell *et al.*, 1992; Owusu-Frimpong & Hargreaves, 2000; Gilbert, 2005). Possible impacts of nitrate exposure on morphological and reproductive traits in females and males of *G. holbrooki* have been indicated by the results of other studies (Edwards *et al.*, 2006; Edwards & Guillete, 2007).

Furthermore, water salinity has been shown to be an important factor affecting the density and life-history traits of *G. holbrooki*. The density of populations in saline water decrease although the individuals exhibit higher reproductive effort (Alcaraz & García-Berthou, 2007).

The sampling site receives chemical pollution from surrounding agricultural areas and nearby farms. In view of the known effects of contamination and extreme salinity on the biology of *G. holbrooki* and other species, the particular conditions present in Rambla Salada could contribute to the induction of ontogenetic variations related to the presence of conjoined twins. However, these hypothetical relations should be tested.

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