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SHORT REPORT

First data on the movements of *Iberochondrostoma almacai* (Coelho, Mesquita & Collares-Pereira, 2005) out of dry-season pools in a Mediterranean stream

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Resumen

Primeros datos de los movimientos de Iberochondrostoma almacai *(Coelho, Mesquita & Collares-Pereira, 2005) desde de los refugios de estación seca, en un arroyo temporal mediterráneo*

La salida de los refugios durante la estación seca puede ser fundamental para la persistencia de los peces que habitan en arroyos temporales, aunque es un proceso poco conocido. En el presente trabajo, cuantificamos los movimientos desde refugios de *Iberochondrostoma almacai* en un arroyo mediterráneo mediante técnicas de marcaje-recaptura. Aunque algunos individuos permanecieron sedentarios, también se detectaron ejemplares con movimientos superiores a 200 m desde los refugios, tanto aguas arriba como aguas abajo y ocupando hábitats más o menos persistentes. Estos resultados sugieren que la especie tiende a redistribuirse tras la recuperacion de los caudales y a colonizar sitios anteriormente secos.

Palabras clave: Ciprinidae; Dispersión de peces; Recolonización de hábitats; Arroyos temporales; Sequía estival.

Abstract

Movement out of dry-season refugia may be critical to fish persistence in temporary streams, though it remains poorly understood. Here we quantify the movements by the Southwestern arched-mouth nase out of dry-season pools in a mediterranean stream, using a mark-recapture design. Although some nase were sedentary, some individuals moving out of dry-season pools displaced more than 200m, both upstream and downstream, and into persistent and ephemeral sites. This suggests that nase may redistribute after flow resumption and colonize sites that were previously dry.

Key words: Cyprinidae, Fish dispersal, Habitat recolonization, Temporary streams, Drought.

Introduction

Movement underlies many ecological patterns and processes in stream fish including the colonization of unoccupied habitats and recovery of populations after local extinction. Intuitively, this should be particularly important in temporary streams in promoting population persistence in the face of drought. Droughts in temporary streams disrupt hydrological connectivity and reduce habitat to a few, patchy refugia (Larned et al. 2010). Individuals in refugia survive drought, and may provide recruits or colonists for the entire system after flow resumption. Although population persistence may strictly dependent on this, movements of fish out of refugia and its ability to redistribute and colonize previously dewatered habitats remain unclear.

This study examines the movements out of dry-season pools by the Southwestern arched-mouth nase *Iberochondrostoma almacai* in a seasonally-drying mediterranean stream. This recently described species is endemic to small drainages in SW Portugal (Coelho et al. 2005) and currently listed as *Endangered* (Rogado et al. 2005).

Materials and Methods

Our study was conducted in a 3.6 km reach in the Torgal stream (37º38'N, 8º 39'W) in September 2007. The Torgal is a small (28.0 km), relatively undisturbed, and highly seasonal stream, where large floods may occur in winter but large sections of the channel dry up to disconnected pools in summer-early fall (Magalhães et al. 2002). During our study the average nearest-distance between disconnected pools was 98 m (±56; 19-196).

We sampled for fish in 10 wadeable pools, using electrofishing (Hans Grassl EL62 IIGI, 300 V, 4-6 A, pulsed D.C). We tagged nases with Visual Implant Elastomers (VIE, Northwest Marine Technology INC) and Passive Integrated Transponder tags (PIT, Trovan ID-100A, 2.12x11.5 mm), which are both considered suitable for small fishes (e.g. Pires et al. 2010, Roberts & Angermeier 2007). VIE were subcutaneously inserted with a needle in the ventral part of and at the base of pectoral fin of fish. PIT tags were inserted into the body cavity through an incision using a sharpened needle. All fish were anaesthetized with clove oil prior to marking and allowed to recover and regain balance and swimming before release.

We conducted four recapture surveys after flow resumption, between December 2007 and June 2008. In each survey, we electrofished 60 stretches, 15 m long, spread across the study reach at least 20 m apart. All fish were examined for marks and recaptures measured for fork length.

We classified as movement those instances when a fish was recaptured in a location other than the pool in which it had been marked and assumed that the net displacement distance between the marking and recapture locations represents the total distance the fish had moved. Fish recaptured in their marking pools were thus considered stayers and attributed a movement distance of zero; fish recaptured beyond their marking pools were considered movers and attributed the distance along the stream between the midpoints of mark and recapture, measured in a GIS using 1:25,000 digital cartography (http://www.igeoe.pt).

Results

We tagged 385 nases (342 VIE, 43 PIT) but only recaptured 11 (9 VIE, 2 PIT). The numbers of nase moving out and remaining in dry-season pools were similar (6 vs. 5; Chi-Square test: χ^2=0.09, df=1, p=0.763). Also, there were no differences in body size between movers and stayers (74.6 ± 4.5 mm vs. 72.2 ± 5.5 mm; U=10.0, P=0.411). Nase moved mostly downstream (5 vs. 1) although this variation in directionality was not significant (Chi-Square test: χ^2=2.67, df=1, p=0.102). Downstream displacements ranged between 236 and 604 m and were to both persistent and ephemeral sites, whereas the only upstream displacement targeted an ephemeral site at 209 m from the pool of marking.

Discussion

We obtained low recapture rates which may be partially related to tag loss, fish mortality and movement to unsampled areas (Roberts & Angermeier 2007). Nevertheless, our study provides some insight on nase movements out of dry-season pools. Although some nase showed fidelity to dry-season pools, other individuals moved out and displayed long displacements (>200m), up and downstream, that surpassed the average nearest-distance between pools. These displacements were similar to those recorded for other small bodied stream fishes (Breen et al. 2009, Pires 2012, Roberts & Angermeier 2007), and targeted both ephemeral and persistent sites. This suggests that at least some nase sheltering in dry-season pools in mediterranean streams may redistribute and colonize previously dewatered habitats after flow resumption, as found in other temporary streams (Walker et al., 2012). However, further studies are required to fully characterize nase movement patterns and abiotic and biotic factors driving such patterns. Ultimately, clarifying whether variation in mobility may translate into differences in individual fitness and viability will be critical to inform conservation efforts in the face of increasing intermittency of riverscapes.

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