

INTRASPECIFIC VARIABILITY OF *GOBIO LOZANOI* BIOLOGICAL TRAITS BETWEEN DIFFERENT RIVER-TYPE SECTIONS IN A HIGHLY REGULATED MEDITERRANEAN BASIN

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INTRODUCTION & OBJECTIVES

The great plasticity in life history traits of invasive fish species has been proposed as an important factor to understand their invasion success. Moreover, these species usually thrive in modified aquatic ecosystems due to a series of processes which could enhance population fitness (e.g. through attenuation of natural disturbances).

Segura River Basin is an intensely regulated basin located in a semiarid climate region of the southeastern Iberian Peninsula. Its fish assemblage is characterised by low native species richness and the dominance of introduced species. The Pyrenean gudgeon *Gobio lozanoi* is one of the most widespread introduced species in the basin, reaching high densities in several sectors of the Segura and Mundo rivers.

The main objective of this study was to compare several biological traits of *G. lozanoi* populations inhabiting two different river-type sections in the Segura River Basin. Specifically, we compared length, age, growth and condition parameters between populations located upstream river sections in close proximity to reservoirs and those away from reservoirs, and between Segura and Mundo rivers.



STUDY AREA & SAMPLE COLLECTION

SEGURA RIVER BASIN

- Drainage area: 18 870 km².
- Semi-arid climate: annual mean rainfall of 400 mm.
- Superficial water resources: 871 hm³/year.
- Highly regulated basin: storage capacity 1 141 hm³ (30 big dams > 1 hm³).

TARGET SPECIES

Pyrenean gudgeon (*Gobio lozanoi*)

Location of sampling sites in the Segura River Basin. Red points indicate river sections close to reservoirs and blue points those away from reservoirs. The names of reservoirs are shown in blue.

- Sampling period: october-november 2009.
- > 4 sampling sites in each river: two located close to reservoirs and another two away from reservoirs.
- Fishes were captured by electrofishing (reach of 100 m).
- Sample of 20-30 fish per sampling site for biological analysis (anesthetized and fixed in neutralized formaldehyde).

LABORATORY & STATISTICAL METHODS

CONDITION INDICES

Morphological measures:

- Total length (± 1 mm)
- Eviscerated mass (± 0.1 g)
- Liver mass (± 0.01 g)
- Eviscerated mass-length relationship (log transformed)
- Liver mass-length relationship (log-transformed)

AGE & GROWTH PARAMETERS

Age determination:

- 6-8 scales from each fish were mounted in microscope slides
- Age was determined by counting annuli from scales, examined with a Leica MZ 9.5 stereomicroscope with an integrated digital camera
- Distances from focus to each annulus and total radius were measured with the LAS software v 3.5.0

Growth estimation:

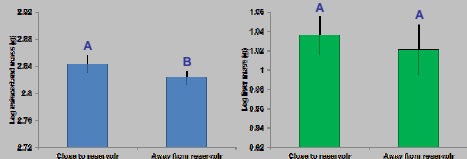
- Backcalculation according to Bagenal and Tesch (1978)
- Instantaneous growth rate according to Wootton (1998)

STATISTICAL TESTS

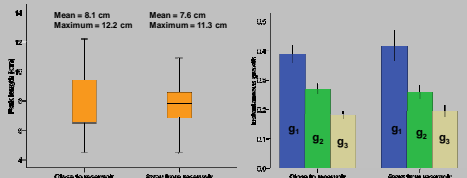
ANCOVA (estimated marginal means with Bonferroni correction) and two-way ANOVA; river-type section and river as factors (P<0.05)

RESULTS & DISCUSSION

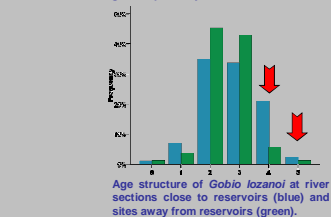
(1) COMPARISON BETWEEN RIVER-TYPE SECTIONS



Comparison of estimated marginal means ($\pm 95\%$ C.L.) for eviscerated and liver masses (using ANCOVA with fork length as covariate), between river-type sections. Unlike letters denote values that differed statistically from each other in Bonferroni test.

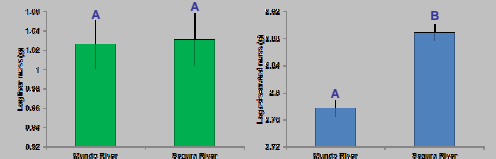


Comparison of *Gobio lozanoi* fork length (left) and instantaneous growth rates (right), between river-type sections. g_1 , g_2 and g_3 : growth rates between 1+ and 2+, 2+ and 3+, 3+ and 4+ ages, respectively.

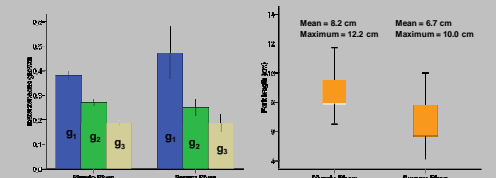


Age structure of *Gobio lozanoi* at river sections close to reservoirs (blue) and sites away from reservoirs (green).

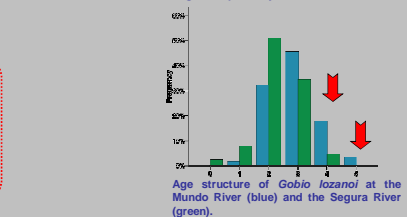
(2) COMPARISON BETWEEN RIVERS



Comparison of estimated marginal means ($\pm 95\%$ C.L.) for eviscerated and liver masses (using ANCOVA with fork length as covariate), between Mundo and Segura rivers. Unlike letters denote values that differed statistically from each other in Bonferroni test.



Comparison of *Gobio lozanoi* fork length (left) and instantaneous growth rates (right), between Mundo and Segura rivers. g_1 , g_2 and g_3 : growth rates between 1+ and 2+, 2+ and 3+, 3+ and 4+ ages, respectively.



Age structure of *Gobio lozanoi* at the Mundo River (blue) and the Segura River (green).

Results suggest the existence of positive effects on several biological traits of *Gobio lozanoi* populations inhabiting river sections close to reservoirs. This situation was probably related to the fact that reservoirs provide more stable habitat and the species could benefit from these favourable conditions during environmental disturbance periods (e.g. flood or overwintering refuge).