

# EFFECTS OF HYDROLOGICAL ALTERATION AND RIPARIAN HABITAT QUALITY IN CONDITION OF *LUCIOBARBUS SCLATERI* (GÜNTHER) FROM A SEMIARID RIVER BASIN (SE, IBERIAN PENINSULA).

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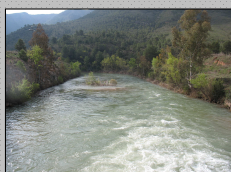
## INTRODUCTION & OBJECTIVES

The natural flow regimes of Mediterranean rivers have strong seasonal and inter-annual flow variations. In these environments, fish species have developed optimal life strategies for their survival over time in relation to the functional framework of the rivers.

Human-induced alterations in river flow regimes caused significant changes on aquatic ecosystems and may affect negatively fish populations through modification of stream habitat characteristics.

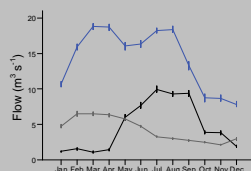
Fish condition indices are particularly useful for monitoring fish populations and to assess the effects of environmental conditions on individual or population health.

The objective of this study was to evaluate the possible differences in fish condition of southern Iberian barbel *Luciobarbus sclateri* populations, assessed through morphologic (length-weight relationships with ANCOVA procedure) and biochemical (whole-body crude lipid and crude protein) approaches, inhabiting three river sectors with different flow and riparian habitat conditions in the Segura river basin.

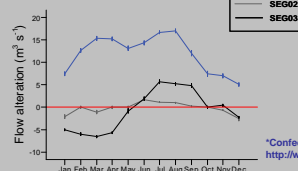


## RESULTS & DISCUSSION

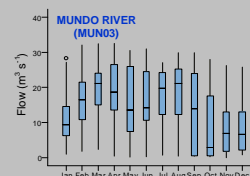
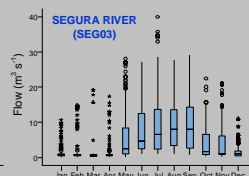
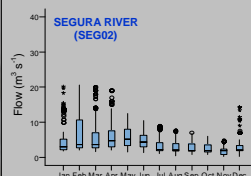
### (1) FLOW REGIME CHARACTERIZATION\*



Monthly flow average during the study period: 2000-2009, at the different sampling sectors.



Monthly flow alteration respect to natural values during the study period (2000-2009), at the different sampling sectors [(0: no flow alteration, (+): higher values, (-): lower values].  
\*Confederación Hidrográfica del Segura: <http://www.chsegura.es/cha/index.html>



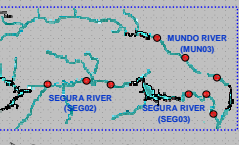
Box plots of the monthly flow values during the study period: 2000-2009, at the different sampling sectors.

- Mundo river (sector MUN03) showed the highest monthly flow alteration and variation during all year, due to increased flows from Tajo-Segura water transfer.
- SEG03 sector showed increased flows mainly during summer months and it has intermediate monthly flow variation.
- SEG02 sector showed the lowest altered hidrological regime, having slightly increased flows during summer and the lowest monthly flow variation.

## STUDY AREA & SAMPLE COLLECTION



- Drainage area: 18 870 km<sup>2</sup>.
- Semi-arid climate: annual mean rainfall of 400 mm.
- Superficial water resources: 871 hm<sup>3</sup>/year.
- Highly regulated basin: storage capacity 1 141 hm<sup>3</sup> (30 big dams > 1 hm<sup>3</sup>).



- Sampling period: october-november 2009.
- 3 sampling sites per sector.
- Fishes were captured by electrofishing (reach of 100 m).
- Sample of 20-30 fish per sampling site for morphological analysis (anesthetized and fixed in neutralized formaldehyde).
- Additional samples (8-10 individuals per sector) were frozen at -20° C for biochemical analysis.
- Application of RQI index (González del Tánago et al. 2006) in each sampling site.

### TARGET SPECIES



Southern Iberian barbel (*Luciobarbus sclateri*)

## LABORATORY & STATISTICAL METHODS

### MORPHOLOGICAL INDICES

- Morphological measures:
- Fork length ( $\pm 1$  mm).
  - Total and eviscerated weights ( $\pm 0.1$  g).
  - Liver weight ( $\pm 0.01$  g).
  - Total weight-length relationship (log-transformed).
  - Eviscerated weight-length relationship (log transformed).
  - Liver weight-length relationship (log-transformed).

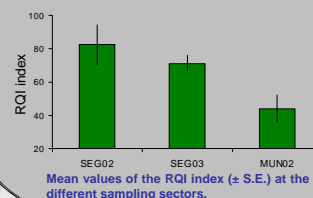
### BIOCHEMICAL INDICES

- Whole-body fish composition was determined after homogenisation as follows:
- Protein (3 replicates for each individual): Kjeldahl method with a 6.25 nitrogen to protein conversion factor.
  - Lipid (2 replicates for each individual): ethyl-ether extraction using a SOXTEC System HT6 extractor.
  - Moisture: drying to constant weight in an oven at  $105 \pm 1$  °C.
  - Total ash: incineration to constant weight in a muffle oven at  $450 \pm 2$  °C.

ANCOVA (estimated marginal means with Bonferroni correction; sector as factor) ( $P < 0.05$ )

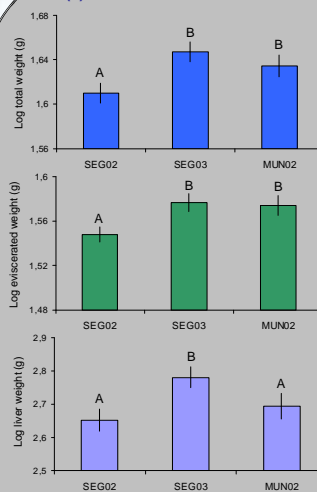
ANOVA & Tukey HSD test ( $P < 0.05$ )

### (2) RIPARIAN HABITAT QUALITY



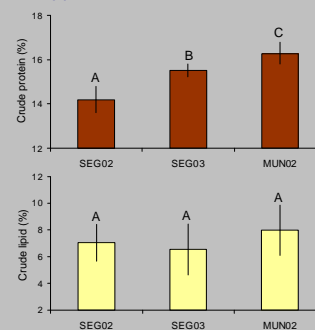
- RQI index values were lowest in the Mundo river sector (MUN02), mainly due to the alteration of bank conditions and the reduction of lateral connectivity.
- Riparian ecological conditions were higher in the Segura river, with SEG02 sector showing the best habitat conditions.

### (3) MORPHOLOGICAL INDICES



(3) Estimated marginal means ( $\pm 95\%$  C.L.) for total, eviscerated and liver weights (using ANCOVA with fork length as covariate) and (4) Mean values for crude protein and crude lipid contents (% wet weight  $\pm 95\%$  C.L.), at the different sampling sectors. Unlike letters denote values that differed statistically from each other in Bonferroni and Tukey HSD tests.

### (4) BIOCHEMICAL INDICES



- Total and eviscerated weights were significantly higher in SEG03 and MUN02 sectors, and liver weight was significantly higher in SEG03 sector.
- Crude protein content (% wet weight) was significantly higher in MUN02 sector, but the variation of crude lipid content (% wet weight) among sectors was not significant.

Condition values were significantly higher in the most altered river sectors, situation that is probably related to changes in the body-tissue composition of *Luciobarbus sclateri*, such as the increase of muscular tissue in populations subjected to higher water discharges.