THE IMPACT OF INTRODUCED CENTRARCHIDS ON NATIVE FISH FAUNA DISTRIBUTION AND OTTER DIET IN A MEDITERRANEAN RIVER BASIN

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INTRODUCTION

The impact of exotic fish species is a worldwide ecological problem that has been frequently cited as an important threat to native freshwater fauna. There is an impressive record sucessful of fish invasions that have contributed to the loss of native fish species.

In this work we analyse the effects of centrarchids, an introduced fish family widespread in Iberian rivers, on native fish fauna distribution and otter diet in the Guadiana river basin, the fourth largest Iberian catchment and the most importatnt in terms of coservation value

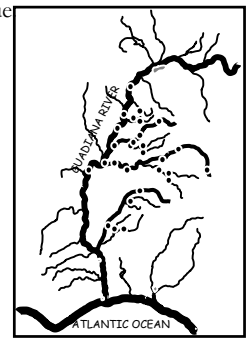


Figure 1. Location of sampling sites on the middle-lower guadiana basin

METHODS

Twenty-eigth sites were electrofished during April and June 2001 in some watercourse of the middle-lower Guadiana basin (southwest of Iberian Peninsula) (figure 1). After collection of the fishes some habitat characteristics were measured. Diet of the otter was carried out by spraint analysis (n=560).

From fish data we created one matrix of frequency of occurrence of each species x sampling sites, that was submitted to correspondence analysis (CA). This analysis generated two dimensions (DIM1 and DIM2) which were correlated with habitat and fish community variables. To search the effect of centrarchids on otter diet we studied prey selection on fish. Fish species were grouped in genera (n=6) and Jacobs index of preference (*D*) was used to illustrate the degree of preference for a prey category. T-test were used to assess differences between mean value of *D* obtained for each prey item and *D*=0 (no preference). Whenever multiple t-tests were performed, significance levels were corrected using the Bonferroni method.

RESULTS

The CA analysis generated 2 dimensions (DIM1 and DIM2) (figure 2). DIM1 produced an ordination of sites dominated by *M. salmoides* and others dominated by other species. DIM2 defined a gradient running from high occurrence of native species to high occurrence of *Lepomis gibbosus*. Locations with dominance of *Lepomis gibbosus* showed lower values of abundance, total richness and richness of authoctonous species than those with dominance of native species (figure 3).

Mean value of *D*, applied to biomass of each item consumed in diet and available in the environment was significantly different to *D*=0 in the cases of *Squalius*, *Barbus* and *Lepomis* (t-test=-3.3; 4.61; -6.25, p<0.005 respectively) (figure 4A). Otters seemed to prefer *Barbus* (mean value of *D*=0.49) and illustrated a negative selection for *Squalius* (m. v. of *D*=-0.41) and *Lepomis* (m. v. of *D*=-0.66). An apparent avoidance was observed for *Micropterus* (m. v. of *D*=-0.57), but significance level was not reached. Mean value of *D*, applied to individuals observed in diet and available in environment was significantly different to *D*=0 in the case of *Barbus* (t-test=5.26, p<0.001) (figure 4B). Otters seemed to prefer *Barbus* (m. v. of *D*=0.49) and an apparent avoidance was observed for *Lepomis*, *Micropterus* and *Squalius* (m.v. of *D*=-0.38; -0.41; -0.25, respectively), though signification.

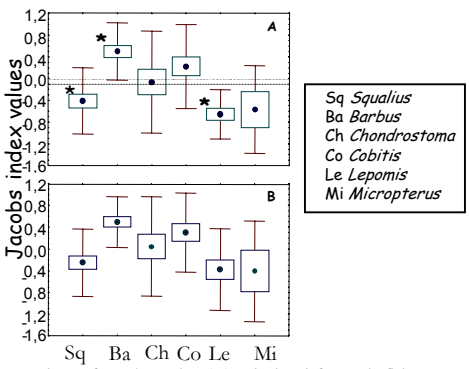
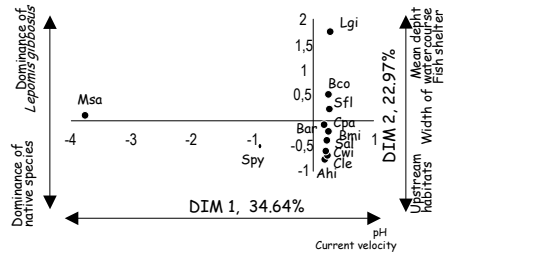


Figure 4. Mean values of Jacobs Index (D) calculated for each fish genera considered. Boxes are standar error and whiskers are standar desviation. Those genera wich were significantly different to D=0 (no selection) are noted (*). A) D applied to biomass consumed by the otter and available in the environment. B) The same for individuals.



Species	Code	Species	Code	Species	Code
Anaecypris hispanica	Ahi	*Squalius pyrenaicus*	Spy	*Cobitis paludica*	Cpa
Chondrostoma lemmingii	Cle	*Barbus microcephalus*	Bar	*Salaria fluviatilis*	Sfl
Chondrostoma willkommii	Cwi	*Barbus comizo*	Bco	*Lepomis gibbosus*	Lgi
Squalius alburnoides	Sal	*Barbus sp.*	Bar	*Micropterus salmoides*	Msa

Figure 2. Distribution of fish species in the space defined by the two dimensions generated in the correspondence analysis (CA) applied to a matrix of frequency of occurrence of each species x sampling sites. Those habitat variables which were significantly correlated with the dimensions are included. Codes of fish species are included too.

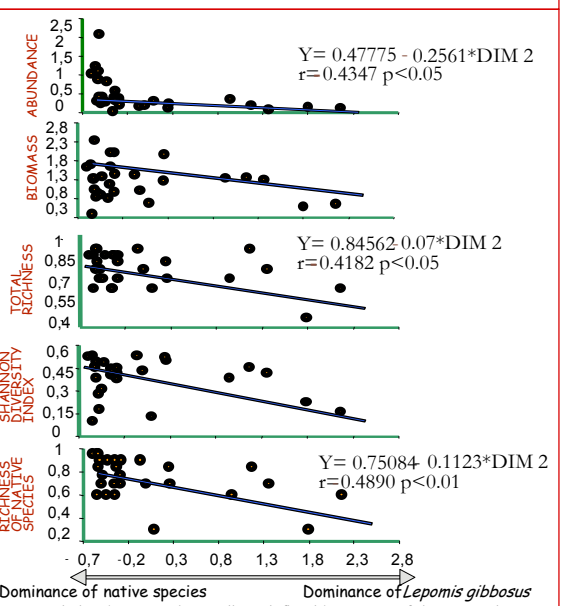


Figure 3. Relation between the gradient defined by DIM2 of the CA and some fish community variables. Those variables which were significantly correlated with this gradient are noted. Circles represent sampling sites.

DISCUSSION

Centrarchids, mainly pumpkinseed sunfish (*Lepomis gibbosus*), display a complementary distribution with native fish community in Guadiana basin. Fish abundance, total richness and native species richness significantly decreased as pumpkinseed occurrence increased. This introduced species used mostly downstream habitats characterized by high volume and large flows, usually the preferred habitat of native fish in absence of centrarchids. Moreover, the otter did not consume this new fish resource as it was available and on the contrary, usually rejected it. Thus, the consequences of this fish introduction on river communities are twofold: 1) the introduced species limit the total habitat available for the native ones; and 2) the new species, at the moment, do not represent and additional food resource for a threatened acuatic predator as the otter , which result in a net loss of carrying capacity of the freswater habitats.