Relationship between freshwater fish distribution and habitat characteristics in SW iberian river basins using a GIS approach: implications for fish conservation

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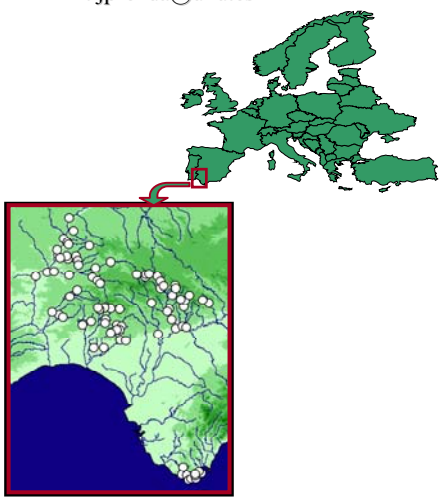
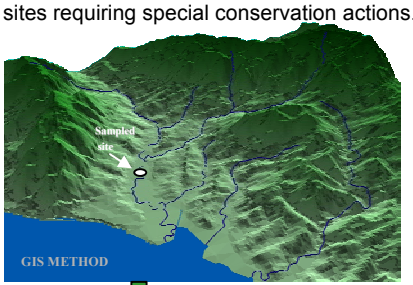


INTRODUCTION

Geographic Information Systems (GIS) are recently developed techniques that have demonstrated to be an useful tool in ecological analysis. Notwithstanding they only have had a limited application in aquatic faunal studies. In this work, we analyse the relationship between freshwater fish distribution and habitat features in 80 sites of two large basins from SW Iberian Peninsula, Guadiana basin and Guadalquivir basin (fig. 1). In order to get models to explain species distribution we have related environmental variables to presence-absence of them using a logistic regression method. This approach has a direct implication on freshwater fish conservation, to anticipate changes in fish community related to human disturbances or to identify sites requiring special conservation actions.



METHODOLOGY

Fish communities were sampled using electrofishing. Fish habitat was characterised at two different spatial scales. First, we measured or estimated *in situ* 6 habitat (local scale variables). Secondly, we recorded a set of physiographic variables obtained from a GIS with ArcGis software (GIS variables). Both variables were analysed like independents variables in binomial logistic regression while presence-absence of fish species was dependents variables. With this method we obtained models which allowed us to explain the presences and absences of the six different species.

GIS VARIABLES

CAR	Cathchment Area
AOR	Stream Order
REV	Real Evapotrasnpiracion
RAI	Rainfall
ALT	Altitude
MAT	Mean Air Temperature
SSL	Stream Slope
PDA	Presence of Dams
DUD	Distance to nearest Upstreams Dam
DDD	Distance to earest Downstreams Dam
DFS	Distance from Source
DTM	Distance to Mouth
RPO	Relative Positión on Basin

LOCAL SCALE VARIABLES

CON	Conductivity
WID	Width
DEP	Depth
DSU	Dominant Substrate
RCA	Riparian Canopy
PEX	Presence of Exotic Species

PRESENCE-ABSENCE DATA OF FISH SPECIES

Chondrostoma lemmingii
Chondrostoma willkommii
Squalius pyrenaicus
Squalius alburnoides
Cobitis paludica
Barbus sp.

Independents variables

Independents variables

Dependents variables

BINOMIAL LOGISTIC REGRESSION

$y = (\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_n x_n)$

SPECIES DISTRIBUTION MODELS

PREDICTIVE MODELS

	Variables in the model	sign	β Value
C. willkommii	RAI	+	0.015
	SSL	-	0.240
	DDD	+	0.625
	CON	+	0.116
	DSU	-	0.583
C. lemmingii	REV	+	0.229
	RAI	-	4.735
	DSU	+	1.051
S. pyrenaicus	PEX	-	1.052
	REV	+	0.016
S. alburnoides	CAR	-	0.071
	RAI	+	0.008
C. paludica	RAI	-	0.005
	ALT	+	0.004
Barbus sp.	RAI	+	0.045
	MAT	+	1.335
	RPO	+	18.619
	DSU	+	2.272

INTERPRETATION OF THE MODELS

GIS variables were incorporated more frequently than the local scale variables in the models. Rainfall and substrate granulometry were the variables that best explained the occurrence of the species

C. willcommii presence was conditionated principally by presence of downstream dams (DDD) and dominant substrate (DSU). The probability to find this specie increase in low slope stretch, fine granulometry, distant downstream dams, more saline water and high rainfall.

C. lemimgii appeared in more unstables stretch (less rainfall "RAI" and high real evapotranspiration "REV"), and upstream reaches how it preference to gross substrate indicate.

S. pyrenaicus presented a negative association with exotic species, while C paludica used upstream stretch with high rainfall.