

Freshwater fish biodiversity in highly fragmented catchments by acid mine drainage in Southern Spain: The Tinto and Odiel rivers.

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INTRODUCTION

Habitat disturbance is an important cause of freshwater fish extinction. Dams generate transversal barriers in rivers obstructing fish movements and modifying their distribution. However, longitudinal barriers are not common in rivers. The Tinto and Odiel basins are two singular cases in which we can find this type of barriers. Their waters present extreme acidity and high concentrations of heavy metals, being an hostile habitat for macroscopic organisms such as fishes that are forced to survive in unpolluted tributaries. Thus, these rivers act as an insurmountable barrier for fish dispersal.

STUDY AREA

The Tinto and Odiel rivers (SW Iberian Peninsula) drain the largest pyritic belt in the world, which has been mined for at least 5000 years. The natural alteration of these mineral masses, together with the mining activity, have long been a source of pollution of these two rivers. The water of the Tinto river presents a constant pH (≈ 2.5) from the source to near the mouth acting as a longitudinal barrier (Fig. 1), and isolating fish assemblages in its tributaries. The Odiel river begins as a typical unpolluted river, but in a few kilometers its waters become polluted by heavy metals and acid mine drainage. Moreover, sections of some of its tributaries are affected by mine drainage, resulting even in a much more fragmented basin than in the case of Tinto river (Fig. 1).

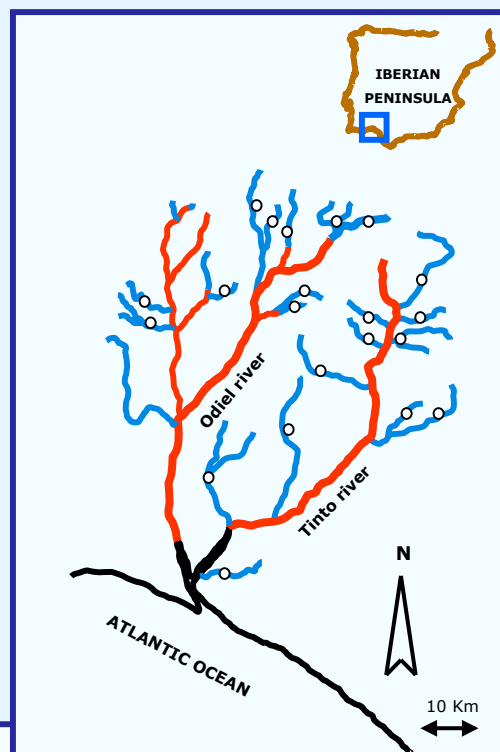


Figure 1. Sampled points located in Tinto and Odiel river catchments. Those stretches in red colour represent polluted waters by heavy metals and acidity. The blue stretches represented unpolluted ones.

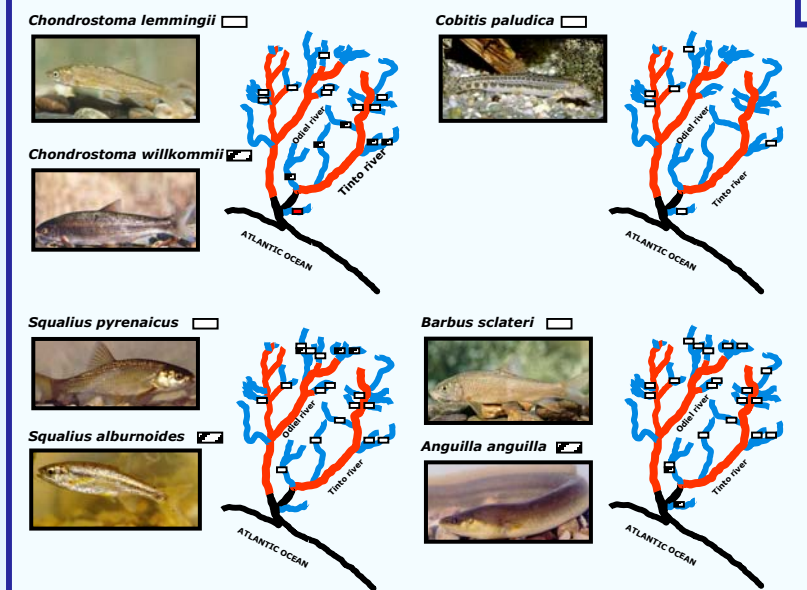


Figure 2. Native fish species distribution in Tinto and Odiel river catchment.

METHODS

Twenty one locations of Tinto and Odiel river catchment were sampled (Fig. 1). Fish were collected using an electrofishing apparatus jointly with fyke and trammel nets. In only one location (site 1, Fig. 1) electrofishing could not be used, so fish collection were carry out using nets and completed identifying fish remains in otter (*Lutra lutra*) scats. The captured fishes were identified and measured for total length. After collection of the fishes some physico-chemical and environmental characteristics were measured to define fish habitat.

RESULTS AND DISCUSSION

Altogether seven native fish species were identified in the Tinto and Odiel river basins (Fig. 2). Two species, *B. sclateri* and *S. pyrenaicus* presented a wide distribution inhabiting most tributaries. Some species as *S. alburnoides*, *C. paludica* or the eel (*A. anguilla*), were present only in a few tributaries (Fig. 2). Migratory fishes as the eel can not colonise tributaries of the middle or upper zone of both basins, cause the acid water of the Tinto and Odiel river. This species was found only in two tributaries of the Tinto river that flow into the estuary zone. This area is invaded by seawater, resulting in a normalisation of pH level and allowing the colonisation of migratory or estuarine species. Two congeneric species *C. willkommii* and *C. lemmingii* presented a complementary distribution. *C. willkommii* inhabits larger tributaries while *C. lemmingii* appears in smaller ones, showing an apparent competitive exclusion between this two species (see Fig. 2). On the other hand, studies based on genetic of fish population can help to make clear the history of the pollution in both catchments, dating back the isolation of these fish species. The results presented in this work may be seen as a starting point for further studies in these singular and unique catchments at a global scale.