Fish biodiversity in the lower course of the Po River: a model for studying the effects of global change in large rivers

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The lower course of the Po River and its delta represent a highly complex ecosystem of outstanding ecological value, yet updated information on fish biodiversity and its response to anthropogenic pressures remains limited. This study addresses this gap by combining historical data, new field sampling, and integrative approaches from conservation genomics and comparative ethology to support effective monitoring and sustainable management of the fluvial system.

A meta-analysis of the literature, complemented by recent sampling at two sites in the province of Ferrara, allowed the construction of an updated database on fish communities. Results indicate a marked shift in species composition: 47 species were recorded, including 21 non-native taxa. Native species such as the European eel (*Anguilla anguilla*) and Adriatic sturgeon (*Acipenser naccarii*) are now severely reduced or locally extinct, while invasive species, notably the channel catfish (*Ictalurus punctatus*) and wels catfish (*Silurus glanis*), dominate in both abundance and biomass. Habitat degradation, particularly the loss of floodplain areas and reduced lateral connectivity, appears to be a key driver of these changes. Genomic analyses were conducted on selected species to investigate genetic variability, demographic structure, and invasion dynamics. High-quality whole-genome sequencing (19-22× coverage) was obtained for *A. Anguilla* and *I. punctatus*, and the tench *Tinca tinca*, enabling the reconstruction of evolutionary patterns and supporting future variant analyses. Behavioural and physiological investigations further revealed substantial intraspecific variability: eels exhibit differences in cognitive control affecting migration success, tench populations retain adaptive potential relevant for conservation actions, and invasive catfish display marked behavioural plasticity linked to invasion success.

Overall, this integrative approach provides novel insights into biodiversity change in the lower Po River and establishes a framework for conservation and management strategies at both national and international levels.