Fish communities and habitat preferences: a case study from Northeastern Italy, useful data for habitat modelling

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Introduction

Freshwater ecosystems are among the most threatened environments, and inhabiting native fish fauna is very sensitive to anthropogenic impacts. However, there is a lack of information about ecological preferences of many fish species (Negro et al., 2021) and their life history stages, and therefore more studies and field research are needed to avoid unproper actions and management mistakes.

The present study was carried out in the Chiarò Creek, placed in the Italian Region of Friuli Venezia Giulia, (Fig. 1a,b), in the context of a project funded by the Italian Basin Authority of the Eastern Alps, with the aim to apply the hydrological/hydromorphological quality index MesoHABSIM (Vezza et al., 2012; 2014; 2017) in significant water bodies for the proper application of ecological fluxes measurements. The aim of the project was to collect data about ecological preferences for target species for which information are still lacking in literature. In this work we report the case study of the Chiarò Creek (Fig 1b), with particular regard for the species *Alburnus arborella*, *Barbus plebejus*, *Padogobius bonelli*, *Lampetra zanandreai*, *Protochondrostoma genei* and *Squalius squalus* (Fig. 2).

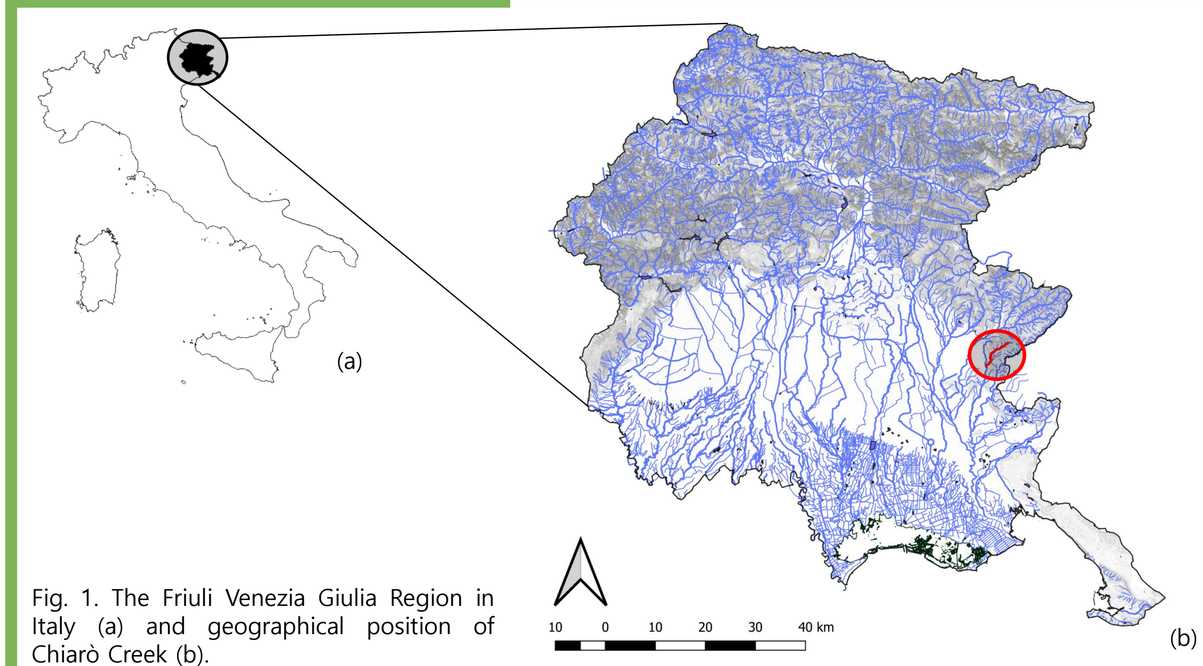

Fig. 1. The Friuli Venezia Giulia Region in Italy (a) and geographical position of Chiarò Creek (b).

Fig. 2. Main target species monitored in the Chiarò Creek (a: *Alburnus arborella*; b: *Barbus plebejus*; c: *Padogobius bonelli*; d: *Lampetra zanandreai;* e: *Protochondrostoma genei* ; f: *Squalius squalus*).

Samplings

Samplings were performed between September 2021 and May 2022, in different discharge conditions, along three stretches of the Chiarò Creek, chosen on the basis of site accessibility and naturality. Mesohabitats and substrate types were recorded via MesoHABSIM methodology (Vezza et al., 2017), while values of main chemico-physical parameters were recorded with field probes. Fishes were sampled via electrofishing (Fig. 3) and the composition of the whole community was investigated; specimens were measured to obtain information about population structure and were then immediately released without consequences for their vitality. Ecological preferences were investigated via Redundancy Analysis (ter Braak & Smilauer, 1998; Legendre & Legendre, 1998), as Detrended Correspondence Analysis indicated gradient lengths <4 standard deviations (ter Braak & Smilauer, 2012). To avoid multicollinearity, correlations among variables was investigated with Pearson coefficient *r*, if $r<|0.7|$ variable were excluded from the analysis (Dorman et al., 2013).

Fig. 3. Sampling operations in the Chiarò Creek performed for the present study.

Results

2080 fish specimens belonging to 12 species were captured and 55 mesohabitats were investigated (Fig. 4), covering an area equal to 1578.2 m^2. Pools were the most recorded mesohabitat (31-62%), followed by glides and riffles. First two RDA axes were significant and explained 29.3% (RDA1) and 23.7% (RDA2) of the observed variability (Fig. 5). *S. squalus* and *A. arborella* were mainly associated to some refugia (roots and overhanging vegetation), while *P. bonelli* showed preferences for substrates made by cobbles and rocks, which are necessary to its behavior and reproduction (Kottelat & Freyhof, 2007). *P. genei* was clearly separated from the other species, and associated to pools and backwaters, characterized by higher depth, low current speed and presence of organic matter. Moreover, *P. genei* was found in habitats characterized by many types of refugia (shallow margins, bank erosion, boulders, roots and woody debris). These conditions are necessary for the trophic phase of juveniles, in agreement with recent findings (Puzzi et al., 2021). *L. zanandreai* was mainly associated to fine substrates (sand and/or clay), in the riparian zones, where current was low. The species requires good environmental quality (Kottelat & Freyhof, 2007). Other species did not show specific preferences, taking place in the central portion of the figure.

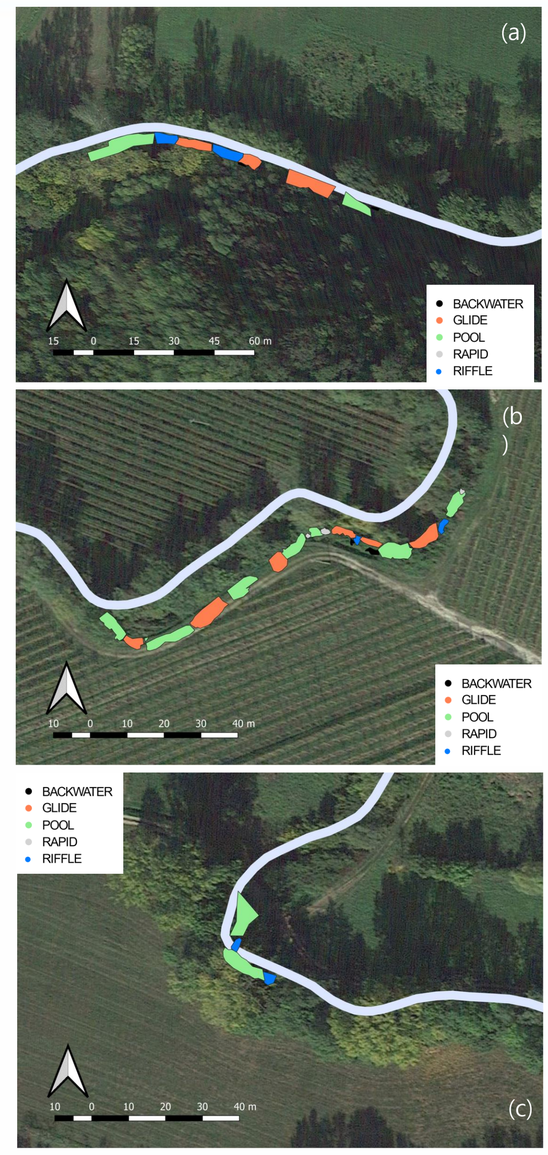

Fig. 4. Watercourse stretches and main mesohabitat monitored in the Chiarò Creek

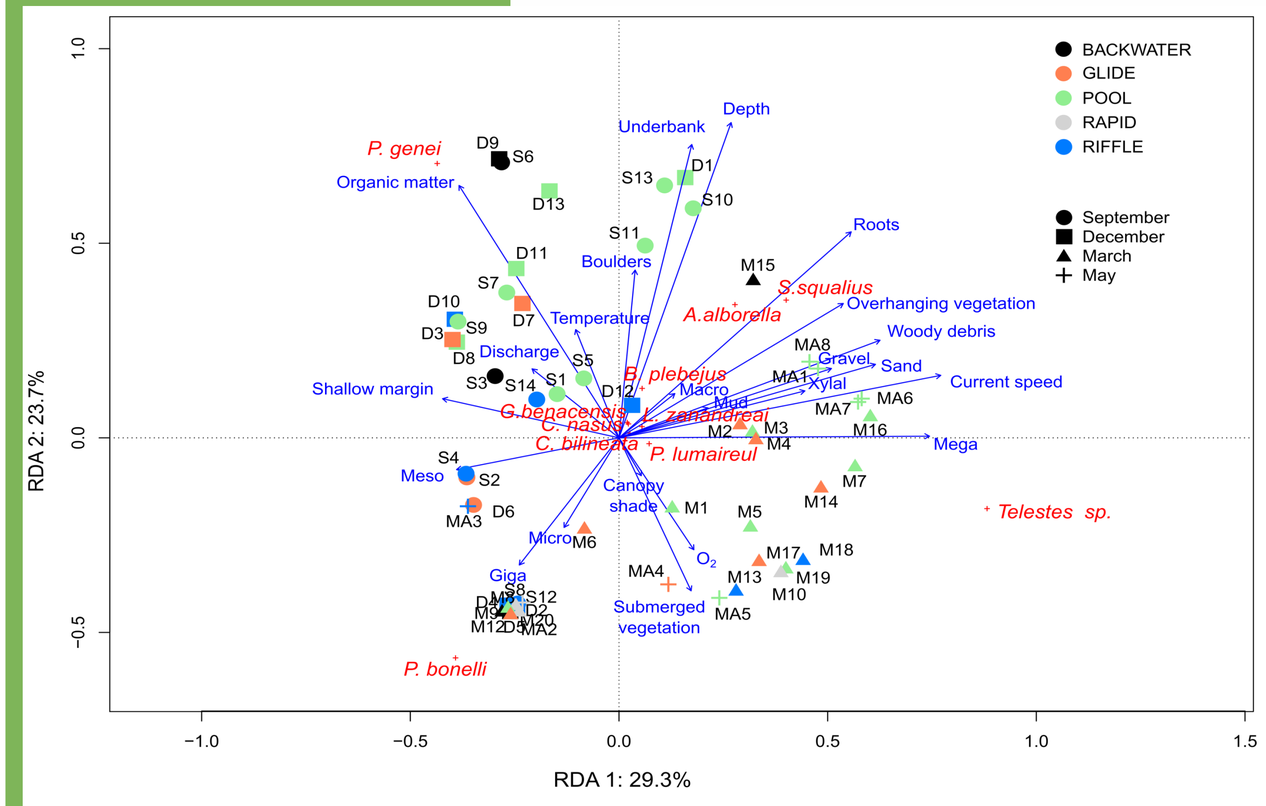

Fig. 5. RDA regarding chemico-physical parameters, hydromorphological features and fish community in the Chiarò Creek.

Conclusions

The present work provides some useful information that now will be used to develop habitat models for the target species, considering different life history stages (juveniles and adults). Several target species, such as *B. plebejus*, *P. genei* and *L. zanandreai* are of particular interest, as they listed in Annexes of European Directive 92/42/EC. Moreover, some of these species are endemic and require conservation actions. In particular, findings regarding *P. genei and L. zanandreai* are of pivotal interest, as few is known about their ecological preferences (Negro et al., 2021) and they are respectively listed as Vulnerable and Endangered in the Italian Red List of the Italian Vertebrates (Rondinini et al., 2022).

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