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Preface: Neotropical streams in changing landscapes

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The Neotropical Region holds the richest diversity in the world in both terrestrial and aquatic ecosystems. The biodiversity of freshwater fish in this region is also the highest in the world (Lévêque et al., 2008). However, the aquatic ecosystems have been drastically changed by a myriad of impacts, including pollution, deforestation and dam constructions, to cite only a few examples (Agostinho et al., 2005, 2008). Such impacts can compromise the conservation of the biodiversity and hamper the ecosystem services provided by fish (Pelicice et al., 2022), particularly in these highly biodiverse Neotropical freshwater ecosystems.

The present special issue on "Neotropical Streams in Changing Landscapes" covers topics analyzing how fish communities change in the face of human interference in landscapes. The research reported on in the 10 papers published here was conducted in a variety of habitats and in different regions in South and Central America, ranging from the south of Brazil to Nicaragua in the north. The streams studied are located in different biomes, from grasslands to forests, and from low altitudes to the high Andes. Therefore, these papers provide a broad perspective about the impacts that stream fish communities suffer in Neotropics and suggest possibilities to enhance fish conservation in this region.

In a research project conducted in the Pampas (south Brazil), Camana et al. (2022) found that present day fish species richness and community composition were more related to past than to current vegetation cover. They concluded that present fish community characteristics may respond not only to past watershed conditions but also to how watershed conditions have changed over the time. Their results highlight the importance to explore land use trajectories to improve our understanding of landscape effects on stream ecosystems.

Roa-Fuentes et al. (2022) investigated agroecosystems and highlighted the importance of local drivers for maintaining stream fish biodiversity in these ecosystems. According to these authors, aspects of land-use were not directly influencing fish assemblages, because their study area was situated in a relatively homogeneous landscape severely impacted by anthropogenic activities. Homogenization process and/or spatial scales considered in their study may explain the non-significant effects of spatial structure on ichthyofauna.

Larentis et al. (2022) investigated the correlation between land use and local environmental variables,

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and the functional structure of fish assemblages in streams of the Upper Paraná and Iguaçu ecoregions in Brazil. Forested streams had the most functionally distinct and unique species, compared to the other investigated habitats. In contrast, urban cover was negatively correlated with functional dispersion and functional diversity of fish assemblages, and urban streams had an increase in generalist functional groups of fish. These results show clearly the importance to preserve near-natural streams to maintain the functional diversity of fish.

Almeida et al. (2022) investigated fish in the Paranapanema basin streams (Upper Paraná River in Brazil) at three different spatial scales. Their conceptual hierarchical model was corroborated by their data, which showed that stream fish composition at different spatial scales was correlated with river basin abiotic features, spatial factors, local environmental variables, land use and land cover. Their findings indicate that catchment-scale management is highly important for the conservation of stream fishes.

Another study conducted in the Iguaçu River (Brazil) evaluated the environmental conditions of this river through a set of biomarkers measured in fish (Ghisi et al., 2022). Alterations in several biomarkers were higher in agricultural and urban sites as compared to more pristine reference sites. The multi-biomarker approach used was considered an appropriate method to measure the effects of human activities on environmental quality.

Three papers addressed fish assemblages in the Amazon region streams. Benone et al. (2022) investigated how rare and common fish species respond to environmental and spatial variables. They found that common and rare species respond differently to impacts and that they are affected by different assemblage rules. While dispersal is key to understand intermediate and rare species distributions, niche processes and land use changes are more important for dominant species. Their findings highlight the importance to focus on rare species to explain fish assemblage responses to changes as well as to improve their conservation. The partitioning of the functional beta diversity of stream fish along a gradient of environmental impacts and the determination of which functional traits are associated with this gradient were investigated by Seabra et al. (2022). Modification of forest cover changed local abiotic and landscape conditions, which in turn influenced the functional beta diversity and functional replacement of fish assemblages. Their findings support the importance to preserve adequate riparian vegetation buffers to guarantee long-term conservation of stream fish assemblages. De Paula et al. (2022) compared fish assemblage attributes in streams of reference forests, abandoned pastures and riparian secondary forests in the Amazon. They found small differences in assemblage attributes among the three groups of streams, but species richness and Shannon diversity were higher in pastures while functional evenness was higher in the reference sites compared to streams in pastures and secondary forests. Some sensitive species that are lost after deforestation may take longer to return and thus the best strategy to conserve fish diversity in these streams is to avoid riparian deforestation.

In a study conducted inside a Biological Reserve in Nicaragua, Betts et al. (2022) showed that the deforestation history was a good predictor of stream habitat and biotic responses. Delayed effects of land-use change included decrease in input of allochthonous material and alterations in physical aspects of the stream habitat, which in turn decreased invertebrate density and richness, and changed the composition of fish and invertebrate assemblage communities. The authors concluded that understudied rainforests in Nicaragua should be prioritized for research and biodiversity conservation.

Miranda et al. (2022), finally, studied the fish assemblages in streams situated along an altitudinal gradient (500–2692 m a.s.l.) in the Andes. They found that human impacts were less significant to explain the assemblage structure than hydro-morphological variables. Their results indicate that habitat heterogeneity on a regional scale is key to conservation of tropical Andean fishes.

The papers in this special issue will certainly contribute to reduce the paucity of knowledge on fish communities in Neotropical streams. They also provide highly needed information, necessary for scientifically underpinned management plans, aiming at the conservation of the astonishing aquatic biodiversity in this zoogeographical region.

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