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Editorial

Editorial: New Trends in Freshwater Fishes

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Global changes represent one of the main environmental threats of the Anthropocene and have a strong impact on the biosphere. Freshwater environments are particularly affected by global changes [1] due to their connections with other compartments of the biosphere, as surface freshwater bodies are strictly related to both the land and sea. For example, changing temperatures and rainfall regimes have significant consequences on freshwater environments; they affect riverine flow rates [2], have considerable effects on alpine lakes (which are very sensitive to local and global alterations and are considered early warnings in the mountain area) [3] and cause a loss of seasonality that could alter biotic compartments and ecosystem services [4,5]. Moreover, hydrologic modifications affect freshwater species distribution patterns [6], and freshwater organisms must adapt to survive and avoid extinction [7]. Therefore, the conservation of freshwater environments has become a central issue requiring proper policies and strategies. However, correct management of this issue requires deep knowledge.

Animal and vegetal organisms inhabiting freshwater systems are often used as bioindicators, providing useful information about the factors affecting water bodies, including global changes. Among these organisms, fishes are of particular interest in relation to commercial and recreational fishing, because they are both bioindicators and a resource. In fact, fisheries are one of the most vulnerable sectors to climate change because of their sensitivity to environmental conditions and their pivotal role in feeding people and supporting livelihoods [8]. Climate change has many effects on freshwater fishes [9–11], and fish biologists must respond to global changes in order to maintain commercial, recreational, and subsistence fisheries, and to protect species of conservation concern [12].

One of the main issues concerns the distribution areas of native species. Investigations are necessary to understand the correct distribution zones and to understand how they evolve, change, and overlap. Improving this knowledge is crucial to detecting and preserving conservation areas where these species might undergo their whole life cycle. Knowledge about the evolution of fish communities is also important, as it is important to understand how assemblages evolve in relation to global changes. The use of new monitoring methods should be considered to obtain precise data. In this context, environmental DNA (eDNA) could be used and may become an essential technique. eDNA analysis has become an established tool for ecologists, particularly for monitoring rare, elusive, and cryptic species or those for which traditional methods may be ineffective, labor-intensive, or dangerous [13–15]. eDNA could also be useful in the monitoring of alien and invasive species, the detection of which must be included in all investigations. The expansion of allochthonous organisms can be accelerated by global changes [16–20], and alien fish often take advantage of conditions that compromise the survival of native ones [6,21]. In such cases, alien species can become invasive and dominant, representing a strong threat to autochthonous organisms due to trophic and habitat competition. Hybridization is also a critical factor [22], increasing danger for both for native fish and their ecosystems. Eradication projects are often difficult or impossible to perform, or they lead to unsatisfying results; therefore, analyses and regular monitoring activities are fundamental to improving knowledge and continuously following the evolution of fish communities for the preparation of population control against alien fishes.

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Another critical issue is that climate change reduces habitat availability for fish fauna and other freshwater organisms; moreover, it favors water quality degradation and hinders natural autodepuration processes (with particular reference to riverine ecosystems), the dynamics of which are regulated by natural discharges. It is essential to enhance resilience and adaptive capacity by improving connectivity among habitats, identifying and protecting refugia, and mitigating other stressors such as physical habitat degradation [11,23,24]. Connections among water bodies must be kept within the basins as continuity is often interrupted by weirs or other hydraulic works, which are among the main causes of decline for many fish populations and communities.

Finally, the quality degradation of water bodies implies a higher concentration of pollutants (such as heavy metals, rare earth elements, antibiotics, and microplastics) than in pristine ecosystems, the effects of which are increasingly worrying. Among these pollutants, microplastics have recently been studied in freshwater environments, and their presence has been detected in marine and freshwater fishes [25–27]. Microplastics are a major threat to aquatic organisms, together with pollution arising from other anthropogenic activities carried out close to water bodies. Regarding fishes, the ecological and human health impacts across the food-webs are also of concern [28,29].

The issues described herein are building blocks of a critical situation and have led National Red List organizations to classify more and more freshwater fish species as threatened or critically endangered. Therefore, new perspectives regarding ichthyological research in freshwater environments are of pivotal importance, leading to improved knowledge and the provision of tools for obtaining useful data and information for the conservation of habitats and their biodiversity; this is especially important for freshwater ecosystems, as humankind strictly depends on them.

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