

Conservation of freshwater fish biodiversity: a challenge for the countries of the South

Humans have regularly been introducing exotic species into natural environments in order to provide for their nutritional necessities or meet less indispensable purposes such as horticulture, fishing or hunting. However, the particular environments are not always adapted for hosting new arrivals. Past introduction attempts, such as that of wild rabbit into Australia or brown fario trout into Southern hemisphere water courses, led to an awareness that these different species, qualified by scientists as none-native, have the power to upset an ecosystem.

The 2002 Convention on Biodiversity recognized that the species introductions can cause regression of biological diversity, following destruction of natural habitats. Although it has long seemed likely that human activity plays a major role in such effects, no scientific study had yet yielded measurements of its involvement at planetary scale for a given group of species.

An international research team comprising IRD, CNRS and University of Toulouse scientists recently published a study that gave the first real demonstration that human activity is the main driving factor behind the establishment of exotic fish species populations in river ecosystems. Examination of data on presence of around 10 000 freshwater fish in 1055 river basins covering both 80% immersed lands and 80% of globally recorded freshwater fish species allowed identification of seven species-invasion hot-spots: the Pacific coast of North America and Central America, Patagonia, southern and western Europe, South Africa and Madagascar, central Asia, the South of Australia and New Zealand.

These regions are characterized by river basins where non-native species make up more than one quarter of the freshwater fish species recorded. Moreover, they are superimposed on biodiversity hot-spots which correspond to geographical zones a strong endemism rate and a very high total number of species.

The team also sought to determine the extent of the relative influence of the particular characteristics of each ecosystem and human activities on the diversity of the non-native fish species. Three hypotheses were tested: the “biotic resistance”, “biotic acceptance” and “human activity”. The first suggests that a high diversity of freshwater fish in the host ecosystem acts as a barrier to the establishment of non-native fish specie populations.

The second postulates conversely that, for a given ecosystem, non-native species diversity follows that of native species because favourable ecological conditions for the latter are also suitable for the newly arrived species. As for the third, it takes account of the different indicators at river-basin scale (gross domestic product, percentage of land urbanized, population density), that can yield determination of the relation between anthropic pressure and non-native species diversity.

The three hypotheses’ relative weight was measured using statistical methods. For the whole set of river basins investigated, the environmental conditions of fluvial ecosystems were found to have practically no influence on the exotic species diversity. On the contrary, it is the human factors, and especially the intensity of economic activities –measured by the GDP, which determine the number of non-native species present in a river basin.

These results thus suggest that the economic development foreseen in the developing countries should be accompanied by a rise in the number of non-native freshwater fish species. Given that biological invasions are considered as one of the main causes of biodiversity loss, such a scenario would probably be detrimental to the aquatic biodiversity conservation of these regions. This study indicates that exceptional

river ecosystems, like the Amazon Basin in South America or that of the Congo in central Africa, are still hardly affected by species introduction. For example, no more than 1% of the 3000 species of fish recorded in the River Amazon are non-native species.

Just as a considerable number of countries of the South are seeing their economic growth take off, this kind of study should be useful in the future for setting up an effective watch system for the surveillance of the exotic species colonizing the most biodiversity-rich natural environments and make it possible to apply the principle of precaution before they become invasive.

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