First recovery, then stagnation: The state of biodiversity in European bodies of water

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In the scientific journal Nature, an international team including a member of Eawag published a study on the state and development of biodiversity in European inland waters, based on invertebrates. In their study, appearing today, they show that biodiversity in river systems from 22 countries has increased significantly since 1968. However, this positive trend has stagnated since 2010 and many river systems have not been able to regenerate fully. The team therefore recommends additional measures to revive the recovery of biodiversity in inland waters, as freshwater ecosystems still face, and will continue to face, serious pressures including pollution, climate change and invasive species.

Even though mayflies, stoneflies and caddisflies are flying insects, they spend most of their lives in the water as larvae. "These and many other invertebrates contribute to important ecosystem processes in freshwater bodies. They decompose organic matter, filter water and transport nutrients between aquatic and terrestrial environments. In addition, such invertebrates have long been a cornerstone for monitoring water quality", explains the first author of the study, Prof. Peter Haase of the Senckenberg Research Institute and Natural History Museum in Frankfurt.

Inland waters are exposed to various anthropogenic pressures due to agricultural and urban land use. They accumulate pollutants, organically contaminated runoff, fine sediments and pesticides, and are also threatened by changes such as the construction of dams, water withfrawal, invasive species and climate change. In response to the poor condition of bodies of water in the 1950s and 1960s, countermeasures were implemented to restore freshwater habitats. "In Switzerland, the widespread incorporation of wastewater treatment plants and the precipitation of phosphorus in sewage treatment plants led to a significant decrease in organic pollution starting around 1980", explains Florian Altermatt.

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A group leader at the aquatic research institute Eawag and Professor at the University of Zurich, Altermatt was the lone representative of a Swiss research institution involved in the study, contributing data on Swiss insect diversity.

Over the past 50 years, these steps have contributed to the containment of wastewater pollution and thus to improvements in freshwater biodiversity. Nevertheless, the number and impact of stressors threatening these ecosystems continue to increase worldwide and the biological quality of rivers remains inadequate in many places.

Invertebrates, such as this mayfly, are excellent indicators for monitoring water quality. (Photo: Senckenberg)

Measures have been exhausted – also in Switzerland

Together with a large international team, a comprehensive data set was investigated consisting of 1,816 time series collected between 1968 and 2020 in river systems in 22 European countries, comprising 714,698 observations of 2,648 species from 26,668 samples. The analyses show that, starting from low levels in the 2nd half of the 20th century, species diversity increased significantly at 0.73 percent per year, as did functional diversity at an annual 2.4 percent and species abundance at 1.17 percent per year over the 53-year period.

"However, these increases mainly occurred prior to 2010 and, unfortunately, have remained at more or less contant levels ever since. While this increase in biodiversity in the 1990s and 2000s presumably reflects the effectiveness of water quality improvements and restoration projects, the stagnant trend that followed suggests that past actions have been exhausted", says Peter Haase.

According to the study results, freshwater communities downstream of dams, urban areas and farmland recovered less rapidly. Fauna at sites with faster warming also recorded lower increases in species diversity, abundance of individuals and functional diversity.

"Communities have not reached the biodiversity they originally had, and species of free-flowing large rivers in particular have become extinct or highly endangered across Europe", says Florian Altermatt. "We conclude from this that some of the efforts to protect biodiversity have been useful, but they have not yet been sufficient, especially since there are currently new challenges, such as climate change."

In principle, these findings also apply to Switzerland, he says. "However, there may be other patterns locally. For example, in Switzerland land use is often more intensive, which is due to agriculture and urbanisation." Switzerland's Alpine waters are another big difference to many other countries. These are more strongly influenced by electricity production and the warming of the climate, for example, than rivers in lowlands.

The research team analysed 714,698 observations of 2,648 species from 26,668 samples. (Photo: Senckenberg)

Possibilities for action

Among other things, the research team recommends reducing the input of fertilisers and pesticides from agricultural land, connecting floodplains to reduce destructive flooding, and adapting river systems to future climatic and hydrological conditions.

"In future, biodiversity monitoring should also be coupled with the concurrent collection of environmental data. This is the only way we can effectively describe temporal changes within biodiversity, identify environmental drivers and high-risk areas, and maximise biodiversity protection", concludes Haase.

Cover picture: Biodiversity in river systems from 22 European countries increased significantly from 1968, but this development has stagnated since the 2010s. (Photo: Senckenberg)

Original publication

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