The status quo on Europe's mussels

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Most of the world's mussel stocks are in decline and some species face extinction like the freshwater pearl mussel or so-called *Margaritifera margaritifera*. Credit: TUM/ Geist

Mussels are the natural treatment plants of bodies of water and,

therefore, just as important as bees. Unfortunately, they are equally threatened: most of the world's mussel stocks are in decline and some species face extinction. For this reason, scientists from 26 European countries have compiled the first comprehensive survey on the status quo of freshwater mussel species in Europe. TUM Professor Juergen Geist and two colleagues from Porto coordinated the project and can now provide recommendations for the future protection of the species.

It may not always be obvious due to their concealed way of life, but mussels are among the most endangered species in the world. Very little was known about the status quo of mussel fauna up to now, as there was no information available on the stock sizes of this underwater organism. The varying surveying methods used by different countries exacerbated the problem. A catalogue of the 16 freshwater mussel species found throughout Europe will now be published for the first time in the journal '*Biological Reviews*'. The project was coordinated by researchers from the University of Porto in Portugal and the Technical University of Munich (TUM).

A pivotal role bodies of water

The survey's three main authors, Manuel Lopes-Lima and Ronaldo Sousa from the Interdisciplinary Centre of Marine and Environmental Research (CIMAR) and Professor Jürgen Geist / Chair of Aquatic Systems Biology at TUM, describe how crucial mussels are for aquatic ecosystems: they form around 90 percent of the biomass in the bed of a water body. In addition, mussels filter the water and have a major influence on the water quality as a result. "Because a single mussel filters up to 40 liters of water per day," reports Professor Geist, "we humans also benefit from the ecosystem services provided by mussels." When the hard-shelled animals keep a body of water clean, more invertebrate organisms tend to join them there. Due to their crucial role in the aquatic habitat, the extinction of these small natural treatment plants in rivers

and lakes would have serious impacts on the aquatic habitat.

Catalogue of characteristics

So what do the freshwater mussels, some of which live for over a century, need to survive? The research network, comprising scientists from 26 countries, collected information about the requirements of European mussels vis-a -vis their habitat and began by answering the following questions:

- Where do which species arise?
- How big is the current stock?
- How are the species related to each other?
- What are their preferred habitats?
- What are the greatest threats to their survival?

"One result of the Europe-wide study is the extent of the gap between north and south," says Geist. "There are fewer species in the north of Europe, for example Scandinavia, but the populations there are bigger." In contrast, southern Europe has more species, but some of them are only found in a handful of waters. This can be due to the fact that they are specialized on one fish species and if this species only arises on the Iberian Peninsula, the mussels that depend on it can only survive in proximity to it. In addition, mountain ranges like the Alps and Pyrenees act as geographical barriers. "If a mussel population dies out in just one location in the south, this can represent half of the global population," the TUM scientist explains.

Which habitats do the mussels prefer?

The fact that some mussel species are dispersed all across Europe and have given rise to different strains could be related to the ice ages and

periods between them, on the one hand, but also to their fish hosts and the conquest of new habitats, on the other. In addition, the scientists established that less demanding mussel species can spread more successfully, as they can survive in different water bodies and quickly adapt to changes in the water quality. Similarly, like people, some species prefer warmer, stiller waters while other mussel strains are more tolerant and can survive just as well in cold rivers and streams as in lakes.

What are the threats to Europe's mussels?

The main authors also summarize the main threats to the species in their report:

- Barrages, weirs and dams
- Pearl fishing (for certain species)
- Pollution and over-fertilization
- Loss of fish hosts
- Invasive species
- Water extraction and climate change
- Other hitherto unknown stress factors

To ensure the long-term conservation of freshwater mussels for aquatic ecosystems and their functions, the authors recommend that detailed scientific plans with defined objectives be compiled. Targeted protection should be provided for populations that are important from an evolutionary perspective and whose stocks have already been reduced by 90 percent, water bodies with a high level of mussel species diversity, and also healthy mussel stocks in intact habitats. "Because a mussel is highly dependent on its fish host and these are in decline, particular attention should be paid to the fish stocks," says the TUM scientist, "even if some of these fish species do not have any particular economic value."

More information: Conservation status of freshwater mussels in Europe: state of the art and future challenges, *Biological Reviews* 4.1.2016.
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