



PRESS RELEASE

Geneva | 16 November 2023

The quagga mussel threatens to upset Lake Geneva ecosystem

A team from UNIGE, Eawag and the University of Konstanz has compared the spread of this invasive species in Switzerland and the United States. The result is a better understanding of the threats facing Lake Geneva.

Invasive species are one of the main causes of human induced changes to ecosystems. The quagga mussel (*Dreissena rostriformis*) is one of them. Originally from the Black Sea area, it has been spreading to North America and Europe, including Switzerland. A team from Eawag, in collaboration with the universities of Geneva (UNIGE) and Konstanz, has compared three Swiss lakes with four large lakes in North America. This study shows for the first time that the quagga mussel is spreading across the two continents with similar dynamics, and that Lake Geneva could see its ecosystem profoundly changed. These results, published in the journal *Environmental Research Letters*, will make it better possible to anticipate the future.

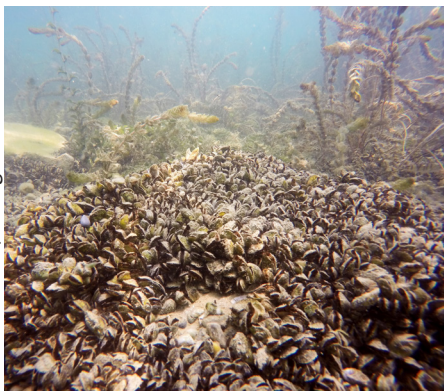
Since it was first detected in Switzerland in 2014, in the Rhine at Basel, the quagga mussel has spread very quickly in many Swiss rivers as well as in Lakes Biel, Constance and Geneva. This invasive species poses threats for the ecosystem of deep lakes, even more so than the closely related zebra mussel that has been present for much longer, but is now being displaced by the quaggas.

A team from the University of Konstanz, Eawag and UNIGE has, for the first time, predicted the spread of the quagga mussel in the three Swiss lakes concerned. It was based on the knowledge gained from three decades of monitoring the quagga population in four of the five Great Lakes in North America (Huron, Ontario, Michigan and Erie). According to the results of the study, the biomass of quagga mussels in Lake Geneva and Lakes Biel and Constance could increase by a factor of 9 to 22 between now and 2045.

“As in North America, this increase could be accompanied by an evolution towards larger individual mussels and greater colonisation depths, as the population matures. If this rapid expansion occurs, it will lead to the greatest change in the aquatic ecosystem of Lake Geneva since eutrophication - an excessive accumulation of nutrients in the water - occurred in the middle of the 20th century,” explains Bastiaan Ibelings, full professor in the F.-A. Forel Department of Environmental and Water Sciences in the Faculty of Science at the UNIGE, who took part in the study.

Changes to the Lake Geneva ecosystem

The filtering activity of quagga mussels increases the clarity of the water, resulting in deeper and stronger light penetration. This phenomenon can lead to more stable and longer-lasting thermal stratification of the water, through mechanisms similar to the effects of climate change. In the case of Lake Geneva, this could lead to a



© Linda Haltiner/Eawag

Quagga mussels have spread massively in just a few years in Lake Biel, Lake Geneva (image) and Lake Constance.

High resolution pictures

decrease in the amount of oxygen in the deepest part of the lake and a release of phosphorus from the sediments, increasing the risk of toxic blue-green algae blooms.

Quagga mussels also take some of the energy and food needed by the pelagic food chain, adversely affecting the production of whitefish, also known as “fêras”, one of the two main targets of the Lake Geneva fisheries. They also threaten to cause millions of euros of damage to water supply systems by clogging pipes. On the other hand, benthic communities that live near and on the lake sediment, like much valued macrophytes and macrofauna, could actually benefit from the increase in lake transparency, a result known as lake benthification.

A recent study by Salomé Boudet, a student on the MUSE (Master’s degree in environmental sciences), has shown that quaggas have spread massively in just six years in Lake Geneva, and can even be found at depths of up to 250 metres. They have completely replaced zebra mussels. They are more tolerant of lower oxygen concentrations, colder temperatures and less food availability. They can also reproduce at lower water temperatures in autumn and winter.

Overall, quaggas could still have the following possible impacts on Lake Geneva: a decrease in phyto- and zooplankton, as quagga mussels filter out large amounts of phytoplankton, the food for zooplankton like water fleas; changes in the lake’s foodweb; changes in fish “stocks”; an increase in the maintenance and costs of water infrastructure; more mussel shells washing up on the lake shore.

Reducing the impact in already infested lakes

In lakes that are already invaded, it is no longer possible to stop the spread of the quagga mussels. “This is bad news for those lakes,” says Piet Spaak, a Swiss specialist in the quagga mussel and group leader at the Eawag water research institute, who led the study with first author of the paper, Ben Kraemer, a researcher at the University of Konstanz. “But it is still possible to reduce its impact by designing infrastructures - primarily water pipes - in such a way that mussels and their larvae cannot penetrate them. This is also a wake-up call for lakes where the quagga mussel has not yet been detected, such as Lake Zurich and Lake Lucerne. With appropriate measures, such as compulsory cleaning of boats and targeted information campaigns, it might be possible to prevent the invasion.” Lake Geneva CIPEL, the International Commission for the Protection of the Waters of Lake Geneva, will start an awareness campaign in ports around the lake to better inform the public.

The research team points out that comparisons between Swiss and American lakes should be made every 2-5 years or so, to keep a constant record of the dynamics at work. In collaboration with the federal government and the cantons, Eawag will also be encouraging the monitoring of quagga mussels in other Swiss lakes over the next

few years. Researchers will be assisted in this by new methods such as environmental DNA. These will make it possible to detect new infestations in previously unaffected lakes as early as possible, and to study propagation patterns more closely.

For Lake Geneva, two new studies will be launched in 2024 and 2026, in collaboration with CIPEL - Research is also underway in collaboration with Dr Stephan Jacquet of INRAE, in Thonon-les-Bains, to better understand how the lake's foodweb might be impacted by the expansion of the mussels.

contact

Bastiaan Ibelings

Full Professor

Department F.-A. Forel for environmental and aquatic sciences

Faculty of Science

UNIGE

+41 22 379 03 13

Bastiaan.Ibelings@unige.ch

Piet Spaak

Group Leader

Department Aquatic Ecology

Eawag

+41 58 765 56 17

Piet.Spaak@eawag.ch

DOI: [10.1088/1748-9326/ado59f](https://doi.org/10.1088/1748-9326/ado59f)

UNIVERSITÉ DE GENÈVE
Communication Department

24 rue du Général-Dufour
CH-1211 Geneva 4

Tel. +41 22 379 77 17

media@unige.ch
www.unige.ch