Release of captive-bred native fish negatively impacts ecosystems, study finds

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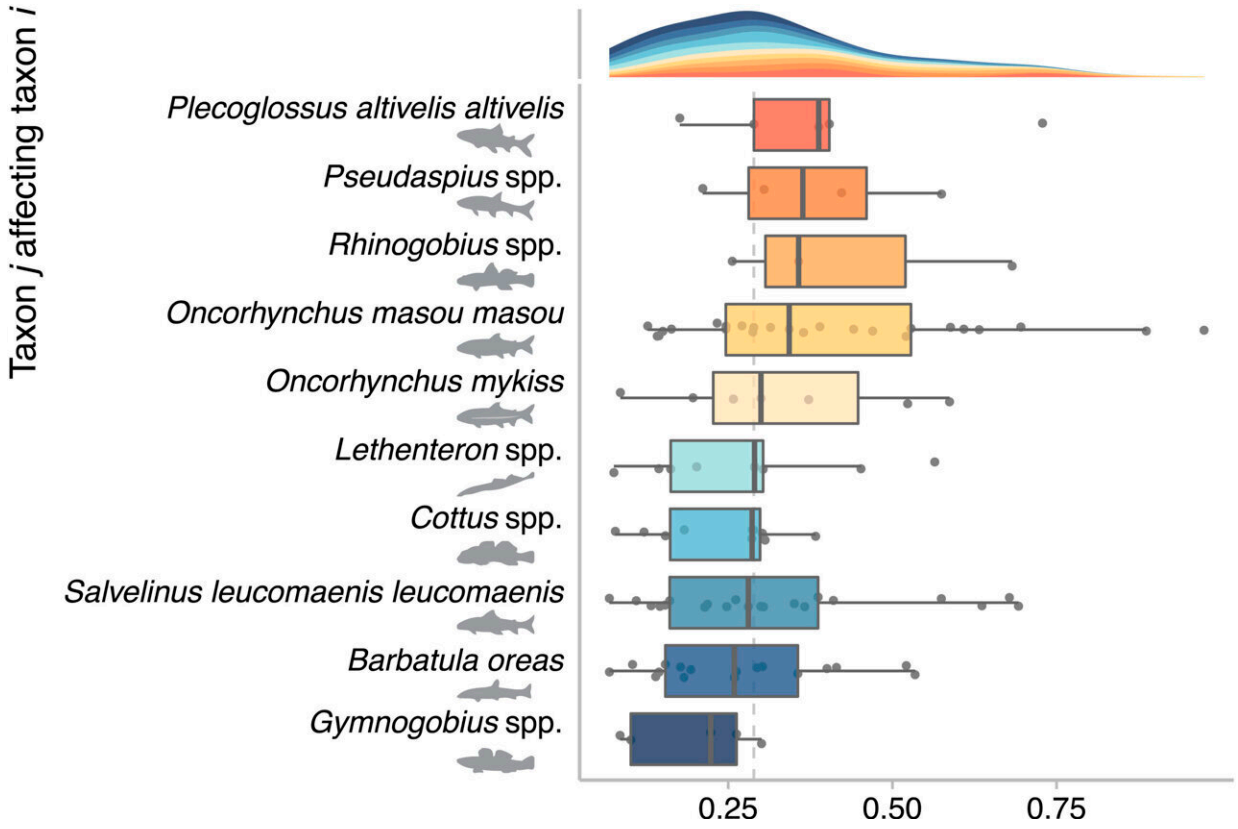

Estimated competition coefficients of the multi-species Ricker model. Dots represent a given pair of taxa, and box plots show median (vertical center line) and quartiles (box limits) with whiskers extending up to the most extreme data points that are within ±1.5 interquartile range. The density plot on the top shows the overall distribution of the competition coefficient. Colors distinguish taxa. The vertical broken line denotes the overall median value. Credit: *Proceedings of the National Academy of Sciences* (2023). DOI: 10.1073/pnas.2218044120

A new study in the *Proceedings of the National Academy of Sciences* finds that large-scale fish releases negatively impact ecosystems as a whole, while offering little benefit and some harm to the species they seek to support.

For over a century, fisheries and natural resource managers have bred native fish in captivity and then released them, en masse, into the wild. It's a popular method for supporting commercially important or threatened populations: More than 2 billion captive-bred Pacific salmon were released in the U.S. in 2016 alone.

Unfortunately, the 150-year-old practice may be doing more harm than good, say researchers at UNC Greensboro, Hokkaido Research Organization, Hokkaido University, and the National Institute of Polar Research in Japan.

UNCG freshwater ecologist Dr. Akira Terui, who led the study and whose research focuses on community ecology, was not surprised by his team's results. "Many resource managers believe that releasing captive-bred native species into the wild is always a good thing," he says. "However, ecosystems are delicately balanced with regards to resource availability, and releasing large numbers of new individuals can disrupt that. Imagine moving 100 people into a studio apartment—that's not a sustainable situation."

The researchers used mathematical modeling to predict how massive releases influence surrounding species of fish in the wild. They then tested and confirmed their model predictions using 21 years of stream monitoring data from 97 rivers in Japan.

"In an ecosystem, the balance that allows different species of fish with similar needs to coexist is fragile," Terui says. "When there is a massive release of members of one species in an ecosystem without the capacity

to support them, then the other species populations decline due to greater competition for resources."

Moreover, the native species that the releases are designed to aid were also negatively impacted. Over the last two decades, Terui says, studies have already shown that a major issue with releasing captive-bred fish is the spread of genes reducing the target species' survival in the wild.

"We found that competition with a vast number of captive-bred members of a species leads to reduced numbers of naturally-bred members of the same species. Replacing naturally occurring members of a species with captive-bred individuals has the potential to reduce genetic diversity and reproductive fitness."

The researchers observed that fish communities exposed to hatchery salmon releases had more fluctuations in population density across time—an unstable dynamic that increases the risk of various populations dying out entirely. As expected, these communities contained fewer species overall.

As evidence mounts that captive-bred releases negatively impact population health and ecosystem biodiversity, Terui says he hopes methods will change. "The U.S. Fish and Wildlife Service is currently spending hundreds of millions of dollars a year on fish hatcheries. Natural resource managers need to be considering alternate priorities like habitat conservation."

More information: Akira Terui et al, Intentional release of native species undermines ecological stability, *Proceedings of the National Academy of Sciences* (2023). DOI: 10.1073/pnas.2218044120