Use of neonicotinoids on rice paddies linked to fishery collapse in Japan

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A team of researchers with members affiliated with several institutions in Japan has found what they describe as compelling evidence of two fisheries collapsing due to use of neonicotinoid pesticides by nearby rice

farmers. In their paper published in the journal *Science*, the team describes their study of fishery water quality data over two decades and what they learned from it. Olaf Jensen with Rutgers University has published a Perspective piece discussing the work by the team in the same journal issue.

As Jensen notes, it is easy to test the toxicity of chemicals directly on plants or animals. Simply applying them and watching what happens lets researchers know the impact it has. Much more difficult is nailing down the indirect effects of chemicals such as those that are used in neonicotinoid pesticides. In this new effort, the researchers started with the notion that it was likely the use of such pesticides that had led to sudden fishery collapse in Lake Shinji, Japan.

Back in 1993, fishermen working at two fisheries on the lake found that yields had suddenly dropped dramatically. The reason for it was not known but many suspected it was tied to the use of neonicotinoid pesticides by nearby farmers—a new practice. To find out if that was indeed the case, the researchers gathered data obtained by other teams studying the lake over a period ten years before and after the collapse of the fisheries.

In looking at the results, the researchers found that the year following the first use of neonicotinoid pesticides in the local area, the amount of zooplankton in the lake nosedived. This was followed by a very swift drop in population of the fish that fed on them. More specifically, they found that zooplankton biomass shrank by approximately 83 percent. That year the smelt harvest was just 22 tons, a dramatic drop from an average haul of 240 tons each year.

The researchers note that they also studied other factors that might have led to fishery collapse, such as nutrient depletion or changes in oxygen or salt concentrations. They report that they were not able to find any

evidence showing that there might have been something other than pesticides killing the food fish ate leaving them to starve. They conclude that the evidence strongly suggests it was the introduction of neonicotinoid pesticides into the lake environment that led to the die-offs.

More information: Masumi Yamamuro et al. Neonicotinoids disrupt aquatic food webs and decrease fishery yields, *Science* (2019). DOI: 10.1126/science.aax3442