

Key ocean fish can prevail with changes to farmed fish, livestock diets

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Anchovies, herring, sardines and other forage fish play an essential role in the food web as prey for seabirds, marine mammals and larger fish like salmon. When ground into fishmeal and oil, they are also a key food source for farmed seafood and land-based livestock such as pigs and poultry.

As seafood consumption outpaces the growth of other food sectors and continues to grow worldwide, farmed seafood—also called

aquaculture—has increased rapidly to meet consumer demand. That means aquatic farming now puts the most pressure on the smaller [forage](#) fish harvested to feed their larger farmed counterparts such as salmon, carp and tilapia.

A new study appearing online June 14 in *Nature Sustainability* shows that if current aquaculture and agriculture practices remain unchanged into the future, wild forage fish populations likely will be overextended by the year 2050, and possibly sooner—even if all stocks were fished sustainably. But the team, which includes researchers from the University of California, Santa Barbara, and the University of Washington, found that making sensible changes in aquaculture and agriculture production would avoid reaching that threshold.

"Aquaculture has a lot of potential to keep feeding the future planet, but we do probably need to make some changes for sustainability," said co-author Tim Essington, a UW professor of aquatic and fishery sciences. "We are in a position to start thinking about different scenarios and how we want to invest in technological advances to shape how the aquaculture field is run."

The aquaculture industry is growing by about 6 percent each year, currently producing 75 million metric tons of seafood worldwide. The researchers believe this is the first attempt to measure the projected demands on forage fish for aquaculture and livestock, while considering what measures could be taken to maintain healthy, stable wild fish populations across multiple sectors.

Anchovies, sardines and other palm-sized, schooling fish are caught in the ocean and processed into fishmeal and oil to feed to other fishes and crustaceans that are raised in aquatic farms around the world. But, livestock animals still eat them too, and have been since at least the 1960s. In aquaculture, carps are some of the biggest forage fish

customers, even though they are not as dependent on them to grow as are salmon and shrimp.

"Aquaculture is the fastest-growing food sector in the world and has already surpassed beef, as well as wild fisheries seafood production. There's a lot of concern about forage fish use and whether or not what we're doing—feeding fish to fish—is sustainable," said lead author Halley Froehlich, a postdoctoral researcher at the National Center for Ecological Analysis and Synthesis at UC Santa Barbara. Froehlich completed her doctorate at the UW in 2015.

The study authors used computer simulations to examine five different ways the aquaculture, fisheries and agricultural sectors could change to take the strain off forage fish. They found that eliminating their use in food for farmed carp and other freshwater fishes produced the most savings of forage fish over time, compared with a business-as-usual model. Those fish do not have to eat other fish in the wild to survive, but producers feed them fishmeal and oil simply because it helps them grow better and faster.

Also beneficial was a scenario that removed forage fish from feed for pigs and poultry—a trend that has been occurring over the last few decades already. Additionally, their projections indicated that salvaging the unused parts from farmed and wild fish in China and processing these trimmings into fishmeal and oil would help sustainably stretch, but not completely solve, the protein content of forage fish.

When modeling the various scenarios, the researchers looked at the biggest consumers of forage fish, while also considering the practicality of removing this food source from the diets of various species. For example, cutting forage fish from farmed salmon and tuna diets is harder because these fish hunt other fish in the wild and rely on more animal protein to survive. Taking it out of carp and pig diets, though, is less

detrimental to the growth of these animals.

The big unknown, the authors said, is how much fish humans will eat in the future if diets increasingly favor seafood over other meat—what is termed a pescetarian diet. This upward trend would require an even larger aquaculture market, which will in turn demand more forage fish for use as feed.

"There are very clear steps that can be taken to mitigate the pressure from aquaculture, but if the whole world ate a little more [fish](#), then that degrades the savings you get from these mitigating measures at the levels we assessed," Froehlich said. "These unknowns really emphasize how important alternative feed sources are for the long-term sustainability of aquaculture."

Growing and harvesting algae, insects and seaweed are all options being tested and considered as alternative feed sources for [aquaculture](#) and livestock animals, reducing the strain on [forage fish](#). Crops such as soy are among the largest alternatives right now for both livestock and farmed seafood.

Provided by University of Washington

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