Scientists discover key to easing aquaculture's reliance on wild-caught fish

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For the first time scientists Dr. Allen Place and Dr. Aaron Watson of the University of Maryland Center for Environmental Science have been able to develop a completely vegetarian diet that works for marine fish raised in aquaculture. It could be the key to making aquaculture a sustainable industry as the world's need for protein increases. Credit: University of Maryland Center for Environmental Science/Cheryl Nemazie

For the first time scientists have been able to develop a completely vegetarian diet that works for marine fish raised in aquaculture, the key

to making aquaculture a sustainable industry as the world's need for protein increases. The findings led by Aaron Watson and Allen Place at the University of Maryland Center for Environmental Science's Institute for Marine and Environmental Technology, are published in the August issue of the journal *Lipids*.

"Aquaculture isn't sustainable because it takes more fish to feed fish than are being produced," said Dr. Aaron Watson. "But a new vegetarian diet might change everything."

Supported by another paper published in the *Journal of Fisheries and Aquaculture*, the team has proven that a completely plant-based food combination can support fast-growing marine carnivores like cobia and gilthead sea bream in reaching maturity just as well as—and sometimes better than—conventional diets of fish meal and fish oil made from wild-caught fish.

Nearly half of the world's fish and shellfish supply is supplied by aquaculture—growing fish in tanks or ponds instead of catching them from the oceans or streams—and scientists have been trying to figure out how to make growing fish sustainable. Many high-value fish such as cobia, sea bream, and striped bass are predators and eat other fish to survive and grow. As a result, their food in captivity is made of a combination of fishmeal and fish oil, and must be caught from the wild to feed them. This is expensive (for example, it can take 5 pounds of wild fish to produce one pound of fish), and it further depletes the world's fisheries.

"This makes aquaculture completely sustainable," said Dr. Allen Place. "The pressure on natural fisheries in terms of food fish can be relieved. We can now sustain a good protein source without harvesting fish to feed fish."

The replacement of fishmeal and fish oil in aquaculture diets has been a goal for researchers for decades but has met with limited success. The team's research centered on replacing fishmeal with a blend of plant protein sources to completely eliminate the need for fishmeal and fish oil in diets for cobia and other high-value marine carnivores.

Fish meal was replaced with a food made of corn, wheat, and soy. Fish oil—expensive and scarce thanks in part to its popularity as a health supplement for people—was replaced with soybean or canola oil, supplemental lipids from algae sources, and amino acid supplements, such as taurine. An amino acid used in energy drinks, taurine plays a critical role in the metabolism of fats, stress responses, and muscle growth, and is found in high levels in carnivorous fish and their prey.

In addition to the potential to turn aquaculture into a more profitable enterprise and ease the pressure on catching wild fish, raising fish on a vegetarian diet also means cleaner fish to eat, with levels of PCBs and mercury as much as 100-fold lower.

"Right now, you are only supposed to eat striped bass once every two weeks," said Place. "You can eat aquaculture-raised fish twice a week because levels are so low."

Provided by University of Maryland Center for Environmental Science