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Next Food Frontier: Fish Made From Plants, or in a Lab

Sophisticated, plant-based alternatives that mimic seafood are cropping up at restaurants and grocery stores around the world. And “cultivated” seafood, grown in labs from real cells, is on the horizon.





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The chef Tsang Chiu King is preparing a subtle-but-significant change to his menu: He's replacing the fish in some dishes with a plant-based alternative.

"Its flavor is light and bland and the texture, like grouper, is a bit tougher," Mr. Tsang said, referring to the alternative fish varieties he has been testing at Ming Court Wanchai, a restaurant in Hong Kong. To boost the flavor, he adds ingredients like dates and goji berries.

"This may give our customers a new experience or surprise, and that will help our business," he said.

[Plant-based](#) products have been breaking into the foodie mainstream in the United States, after years in which vegan burgers and milk alternatives hovered on the market's periphery. That is partly because more companies are targeting omnivores who seek to reduce the amount of meat they eat, rather than forswear it altogether.

Now, as sophisticated fish alternatives begin to attract investment and land at restaurants in the United States and beyond, people who track the fishless fish sector say that it could be on the cusp of significant growth.

One reason, they say, is that consumers in rich countries are becoming more aware of the seafood industry's environmental problems, including overfishing and the health risks of some seafood. Another is that today's plant-based start-ups do a better job of approximating fish flavor and texture than earlier ones did — an important consideration for non-vegetarians.

“This isn't your grandfather's alternative fish stick,” said Joshua Katz, an analyst at the consulting firm McKinsey who has studied the alt-protein industry.

“There are a number of people already looking at alternative hamburgers,” he added. “You might actually say, ‘I should work on something else,’ and seafood is still a massive market with compelling reasons to work on it.”

‘Smarter’ seafood

People who scale back their consumption of animal proteins for environmental reasons often [stop eating red meat](#), which requires enormous amounts of land and water to cultivate and belches a lot of methane as a byproduct.

But alt-fish advocates say that seafood also comes with environmental problems. Unsustainable fishing practices have decimated fisheries in recent decades, a problem both for biodiversity and the [millions of people who depend on the sea](#) for income and food.

“It’s simply a smarter way to make seafood,” said Mirte Gosker, the acting managing director of the Good Food Institute Asia Pacific, a nonprofit advocacy group that promotes alternative proteins. “Full stop.”

So far plant-based seafood products in the United States account for only 0.1 percent of the country’s seafood sales, less than the 1.4 percent of the U.S. meat market occupied by plant-based meat alternatives, according to the Good Food Institute.

But alt-seafood ventures worldwide received at least \$83 million from investors in 2020, compared with \$1 million three years earlier, according to the institute’s data. As of this June, 83 companies were producing alt-seafood products around the world, a nearly threefold rise since 2017.

All but 18 of those 83 companies focus on plant-based products. Six others, including a French start-up that [makes smoked salmon from microalgae](#), specialize in proteins derived from fermentation. A dozen others are developing lab-grown seafood, which is not yet commercially available in any country.

Plant-based moves

Impossible Foods, a [dominant force](#) in the alternative protein industry, has been [developing a fishless fish project for years](#). Jessica Appel, a spokeswoman for company, said that it was not yet manufacturing alternative fish products.

Other big companies are. The California seafood giant Bumble Bee Foods, for instance, said last year that it was [partnering with Good Catch](#), a plant-based seafood company in Pennsylvania that sells products like fake fish sticks and crab cakes at Whole Foods and other retailers.

Some start-ups are developing alternative fish protein designed to mimic raw fish. One of them, Kuleana, sells a plant-based version of sushi-grade tuna at markets in Los Angeles and nationally through the Poké Bar restaurant chain.



Kuleana sells a plant-based tuna that is sushi-grade at markets in Los Angeles. Jorge Vidal Orga

Even though breaded fake fish sticks have done well so far, products that try to approximate raw fish will need to improve further if the industry wants to woo non-vegetarians, said Jacek Prus, Kuleana's chief executive.

"Fundamentally we still need to make the product better," he said. "That's the biggest challenge: How to recreate structure in really, really convincing ways, and mouth feel?"

Eyes on Asia

Of the 65 companies currently producing plant-based seafood products, 47 are outside the United States, according to the Good Food Institute. People in the industry say the Asia Pacific region is a logical place to anticipate significant growth because it already consumes more than two-thirds of the world's fish, according to a United Nations estimate.

Thai Union, one of the world's largest processors of conventional canned tuna, said in March that it had created [OMG Meat](#), an alt-protein brand targeting "flexitarians" who want to reduce their carbon footprint. And the start-up New Singularity has been selling algae-based, fermented alt-fish products since last year in mainland China.

In Hong Kong, the company Green Monday has been rolling out alternative fish at several venues since June. That will soon include Ming Court Wanchai, where Mr. Tsang is creating a dish that flavors fake grouper with his kung pao sauce.

Green Monday sells its fake pork brand, OmniPork, at roughly 40,000 places around the world, including in Britain, the United States and most of the Asia Pacific region. David Yeung, the company's chief executive, said that he expected OmniSeafood to be in most, if not all, of the same markets within six months.

Mr. Yeung said his company designed its fake fish products to cater to various tastes and cooking methods. Americans like to grill or pan-fry fish, for example, while people in China often boil it in a hot pot.

"You cannot tell consumers that you can only fry but you cannot steam, or you can only steam but you cannot put in a hot pot," he said. "You cannot do that because to them, fish is fish."

A lab-grown future?



A dish made with lab-grown cultured chicken developed by Eat Just. Inc Eat Just, via Reuters

The next frontier is [lab-grown seafood](#), in which edible products are grown from real cells in a lab. That technology is still a ways off from retail sales and broad commercialization, though perhaps not as far as many consumers would assume.

So far the only company selling cultivated protein of any kind is Eat Just, a San Francisco start-up whose cultured chicken nuggets were [approved for sale in Singapore late last year](#). The city-state's Food Agency said in a brief statement that it had not yet approved "any other cultured meat products."

Ms. Gosker of the Good Food Institute said that more cultivated protein start-ups could receive regulatory approval later this year in the United States. The Food and Drug Administration [said last October](#) that products containing cultured seafood cells “may soon enter the U.S. marketplace.”

At least two cultivated fish companies in California — [BlueNalu](#) of San Diego and [Wildtype](#) of San Francisco — have already announced plans to start selling commercially in the near future. [Shiok Meats](#), a cell-based meat and seafood company in Singapore, has also said that it plans to “commercialize” next year.

Freya Mehta, a scientist in Germany who specializes in cellular agriculture, said that whatever cultivated seafood hits the market would almost certainly be a hybrid of lab-grown and plant-based technologies. That is because companies will need to encase cells in a plant-based “scaffolding” to give them structure, at least until the science of cellular agriculture improves.

Ms. Mehta, who works for the cultivated seafood company [Bluu Biosciences](#), said one challenge to developing lab-grown seafood products was that scientists generally don’t know as much about marine species as they do about mammals.

It won’t help, she added, that animals defined as “seafood” are often far away from one another in the classification system for organisms. That means it would be a challenge to switch from producing cell-based fish to, say, lobster, a marine invertebrate.

“From a cuisine perspective it makes sense,” she said. “From a biological perspective, it doesn’t at all because they are wildly, wildly different.”

Correction: Sept. 9, 2021

An earlier version of this article misidentified the Hong Kong restaurant where Mr. Tsang is the culinary director. It is Ming Court Wanchai, in the Wanchai district, not Ming Court, the Michelin-starred restaurant at the Cordis Hotel where he was the chef for many years.