

Plant-based prawns to protect the marine environment

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Algae-based prawns are made from this powder. Credit: Stefan Weiss

Around the world, people are consuming more and more fish and seafood, such as mussels and prawns. This includes Switzerland, where consumption has risen by 60 percent over the past quarter of a century to

reach 75,000 metric tons a year. Of this volume, 97 percent is imported, with predictable consequences for the environment: overfishing, along with permanently depleted stocks, and fish and prawn farms using fishmeal as feed, thereby exacerbating the problem of overfishing while also destroying ecosystems. Realizing that urgent action is required, ETH Zurich researchers Severin Eder and Lukas Böcker have turned their efforts towards developing seafood alternatives made from microalgae.

An underused superfood

Rich in protein, unsaturated fats and micronutrients, microalgae have long been recognized as a superfood. In certain species of algae, proteins make up as much as 70 percent of dry matter. What's more, they supply virtually all the [amino acids](#) essential for [human health](#), and they form the basis of many marine food chains. This is one of the key reasons why fish and seafood are prized as healthy foodstuffs—even though they also accumulate heavy metals and microplastics. Despite their many [nutritional benefits](#), microalgae are still not widely used in the food industry. This is because the requisite processing technology is very much in its infancy; white, non-pigmented microalgae have only recently become available in greater quantities.

Böcker and Eder are currently developing a platform for producing seafood that is based on microalgae plus the judicious admixture of other vegetable protein sources such as soya and peas. This is intended to replicate authentic seafood not only in taste but also nutritional qualities.

"We're focusing on seafood because better solutions have already been developed for plant-based fish and development there is more advanced," Eder explains. Their first product is to be microalgae-based prawns, for which there is huge market potential. Switzerland alone consumes 7,000 metric tons of prawns a year—meaning only tuna and pangasius are more popular. Later, the young entrepreneurs plan to add

further products such as scallops or crab meat.



A lot of development work is still needed to produce prawns with the right bite: Severin Eder and Lukas Böcker in the lab. Credit: Stefan Weiss

Two sets of knowledge

Eder and Böcker first met during their doctoral studies at ETH Zurich. They were in different research groups—Böcker with Alexander Mathys, Professor of Sustainable Food Processing, and Eder with Laura Nyström, Professor of Food Biochemistry—but on the same floor. Having collaborated during the doctoral program, they saw potential for a longer-term partnership. "Lukas had been looking into using microalgae for food production for quite a while, and I was working on the chemistry and alternative uses of waste in the food industry," Eder

explains. "We soon realized that these two knowledge sets might be an ideal combination for creating seafood analogs."

After completing their doctoral studies, the two submitted a joint application in August 2021 for one of ETH's coveted Pioneer Fellowships. These provide 150,000 Swiss francs of seed capital and coaching to help ETH start-ups take their business idea to market. Shortly before Christmas last year, the two researchers received notification of the award. By mid-March, work had begun in the lab headed by Professor Mathys, who continues to provide them with tips. "The best thing about the fellowship is everything else that comes with it—the infrastructure, the contacts, the support," Böcker says. "Everything we need to progress our business idea is already there."

In their present iteration, the analog prawns still look and taste a little like jellified, salty gummy bears, Böcker says. Right now, the biggest challenge is to recreate the sensation of biting into the firm, muscular flesh of a real prawn: "We're currently experimenting with various processing and biotech methods." He explains that while standard methods for processing plant-based feedstocks now exist, a lot of groundbreaking work is still required in the case of microalgae.

Piggybacking the market for meat alternatives

According to the two young entrepreneurs, once they have got the right flavor, texture and nutritional character—their stated aim for the end of the year—then production and market launch could follow pretty soon after. "The processes we use to form the algae mixture into the shape of a prawn are all standard," Eder says. Their favored option is an extrusion process featuring specially formed nozzles to structure and shape the mixture. As Eder explains, thanks to the boom in meat alternatives such as mince made of soya extract, there is already a market for seafood alternatives. What's more, the requisite supply chains and distribution

channels are also in place. "In two to three years, I'm pretty certain there's going to be a lot more plant-based fish and seafood around than there is today," Böcker predicts.

Meanwhile, Swiss retailers have already begin stocking alternative fish and seafood products. But won't [rival companies](#) be out of sight by the time they get to launch their own product line? Neither of them seems worried. "With the technology and the platform we've developed, we'll achieve not only an authentic taste and texture with a microalgae-based product but also the nutritional qualities you get with fish and [seafood](#)," Eder says. And that, he adds, will set their product apart for the foreseeable future.

Provided by ETH Zurich

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