



Food and Agriculture
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THE RISE OF PLANT-BASED SEAFOOD

Plant-based seafood is evolving at a rapid rate – in terms of volume, as well as the variety and sophistication of the products on offer. While some see it as a threat to the traditional seafood sector, including those relying on capture fisheries for their livelihoods, others feel it will help reduce pressure on wild seafood stocks and therefore improve global food security.

Plant-based substitutes for seafood are being produced using a range of ingredients and processes. The two main groups are either largely made up of proteins from conventional crops – such as pea, wheat or soy – or from mycelium, a form of fungus with a high protein and fibre content that is generated through fermentation. These ingredients can then be processed into products akin to their seafood equivalents. Initially plant-based products largely resembled processed seafood products, such as fish fingers, but companies are increasingly looking to develop offerings that both have the appearance and texture of more valuable cuts, such as fish fillets or whole shrimp tails.

Although plant-based seafood has been available for decades, in the last five years the sector has evolved and expanded significantly. As of June 2021, according to the Good Food Institute (GFI), there were 87 alternative seafood-producing companies – up from 29 in 2017 – and most were producing plant-based (as opposed to laboratory-grown) products (GFI, 2021).

The growth of the sector has largely been spearheaded by start-ups, many of which claim to be providing an ethical and sustainable alternative to farmed and wild-caught seafood. Its producers point to the lack of animal welfare issues, the fact that some conventional seafood products – in particular those derived from carnivorous high trophic species such as tunas – can be tainted with toxic chemicals such as mercury and the fragility of aquatic ecosystems.

Start-ups that are developing products from mycelium also underscore the limited land and water resources required to produce their proteins in fermenters – they require a quarter of the land use compared to that needed for chicken farming (Filho *et al.*, 2019), for example, although studies comparing it to seafood are still scarce. Both parts of the sector argue that they can help to reduce transport-related carbon emissions by siting their production systems close to their markets, compared to traditional seafood. The latter is one of the most widely traded



commodities on the planet, with many products being sent long distances to be processed and travelling even further before they reach their market (Gephart and Pace, 2015).

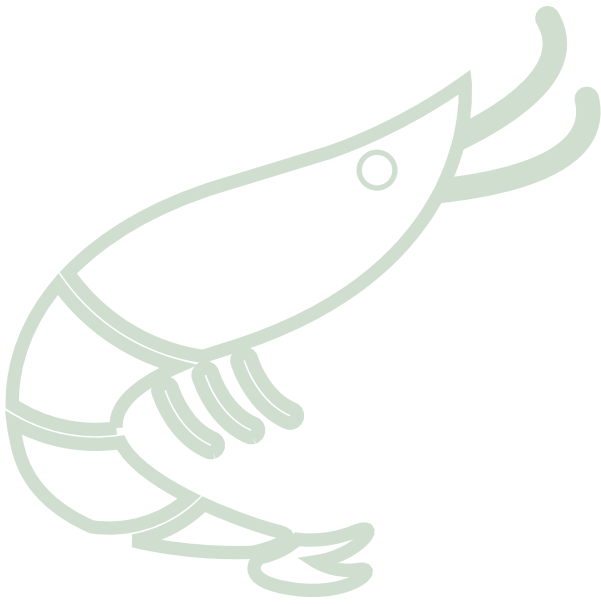
As the sector evolves, it is now also beginning to attract the attention of corporate food producers. Many of these companies hope alternative seafood can emulate the success of the plant-based meat sector. This was valued by the GFI at USD 1.4 billion in 2020 and it has established a foothold in mainstream markets, with plant-based alternatives to meat products, such as burger patties, now found in some of the most famous fast-food franchises in the world.



Fermented mycelium to create Rhiza, a protein and fibre-rich meat and seafood alternative

SCOPE AND SCALE OF APPLICATION

Currently, plant-based alternatives to seafood are largely made from commodity crops, such as soy and legumes, which are relatively easy to source in most parts of the world. Equally, these crops are already dietary components of a significant part of the global population, so there are few cultural barriers to the consumption of plant-based seafood. There is also scope for them to be consumed by vegans, vegetarians and those who suffer from seafood allergies.



ACCESSIBILITY

Currently, plant-based seafood is not widespread globally, with the bulk of producers being based in high-income countries, while plant-based products currently account for less than 1 percent of global seafood sales, according to the GFI. Equally most of the sales currently take place in either very large or very specialized retail outlets in high-income nations. Moreover, most consumers can source traditional seafood at lower prices than plant-based products – which tend to aim for high-end retail at the moment. If this business model does not change, plant-based seafood may struggle to penetrate the mass market.



Plant-based scallops



Replicated taste and texture of shrimp with plant-based ingredients



OUTCOME AND BENEFITS

Plant-based seafood can provide an alternative protein option for people who question the ethics of killing and eating aquatic animals. However, there are also sustainability issues around some of the ingredients, such as soy, that are used in some seafood substitutes, as soy production has been one of the major drivers of deforestation in Amazonia.

While supporters of the sector argue that there is scope for plant-based products to reduce demand for the traditional seafoods that they are aiming to replace, whether this is likely to happen is debatable.

This might disappoint some players in the plant-based sector. However, it should be welcome news to conventional seafood producers – either those engaged in capture fisheries or aquaculture – as it suggests that their livelihoods are not threatened by the rise of this niche sector.

Some aquaculture producers might even benefit directly. As a growing number of plant-based seafood producers are researching the potential of using seaweed and algae in their products, so the plant-based sector could provide a market for farmers of aquatic plants. This could in turn help to develop the market for one of the most environmentally benign forms of aquaculture production. Given that many seaweed producers – particularly in the West – find it more challenging to sell their produce than to grow it, then perhaps some of these companies should consider developing their own lines of seaweed-based seafood.

While some plant-based seafood companies market their products as being more nutritious than conventional seafood, this is not always the case. A Big Fish webinar organized by the University of Stirling in late 2020, included panellists who questioned the sustainability and health credentials of plant-based seafood. One concern was that most plant-based seafood products are currently heavily processed and lack some of the key nutrients inherent in most aquatic organisms. Another was that the sector is currently dominated by companies from high-income countries, so there could be scope for widening regional disparities should this continue.

Equally, the manufacture of these products is limited to parties with sophisticated processing facilities, so the production of plant-based alternatives to seafood is unlikely to provide employment or improve food security for coastal communities in the same way that artisanal fisheries and aquaculture sectors do. While increased consumption of plant-based seafoods has the potential for lower environmental impact compared to traditional seafoods – particularly by reducing transport-linked carbon emissions – the few life-cycle analyses that have taken place to date suggest that mycoprotein production has an environmental impact similar to that of chicken and pork production (Filho *et al.*, 2019).

Plant-based seafood tends to polarize opinions and there is currently a lack of objective analysis of its potential impact. However, it does not appear to pose a threat to the livelihoods of those involved in capture fisheries and aquaculture. Moreover, diversification of human diets also has the potential to improve global food security in the long term.



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Rhiza can be flavoured or blended with other products to create a sustainable seafood alternative.

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