

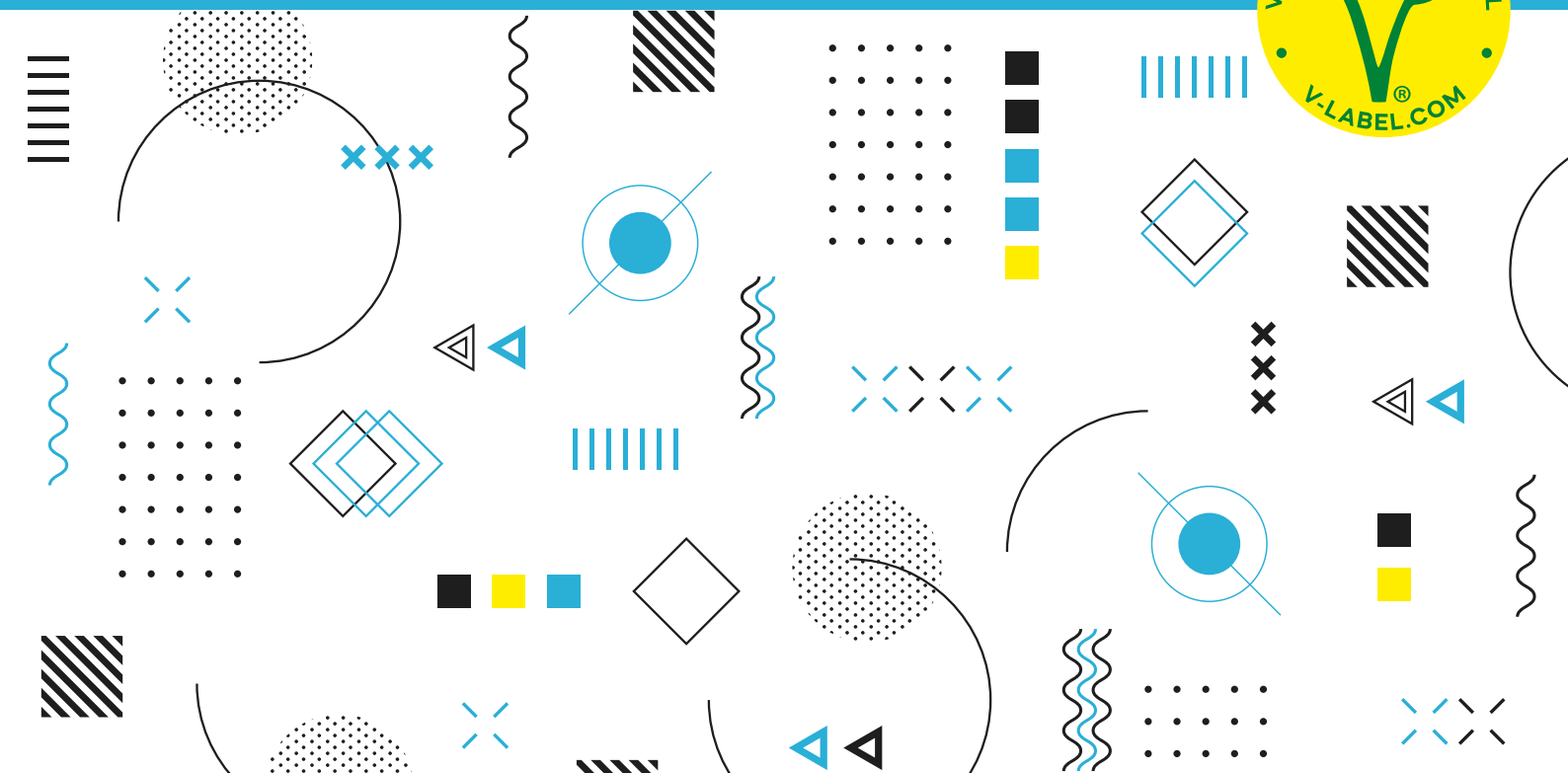


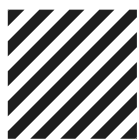
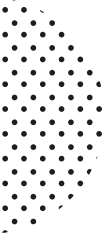
V-LABEL WHITE PAPER

The future is tasty (and fair!)

THE GREAT WAVE OF PLANT-BASED FISH AND SEAFOOD IS COMING

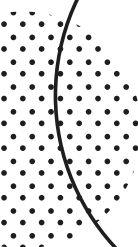
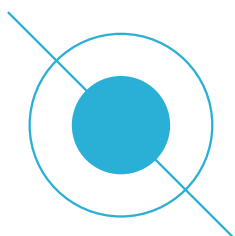
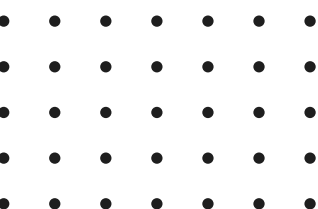
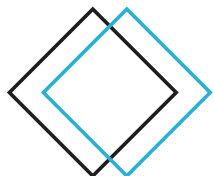
WORLD'S LEADING VEGAN & VEGETARIAN





What you'll find in this white paper...

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PART OF THE V-LABEL INSIDERS SERIES

In this day and age, we often look for that one piece of wisdom that quality social media or articles can provide. And maybe it's just us, but often, a nudge is not enough. As change-makers, hand in hand with our partner organizations such as ProVeg International, Swissveg or Fundación Vegetarianos Hoy, we want to roll up our sleeves and get into the specifics. If you seek such content, keep your eyes on our White Paper series: something that's written for experts, by experts, and takes you from A to Z in a given niche without losing an inch of your attention.

For more information about V-Label and additional business and consumer insights resources please visit our website.

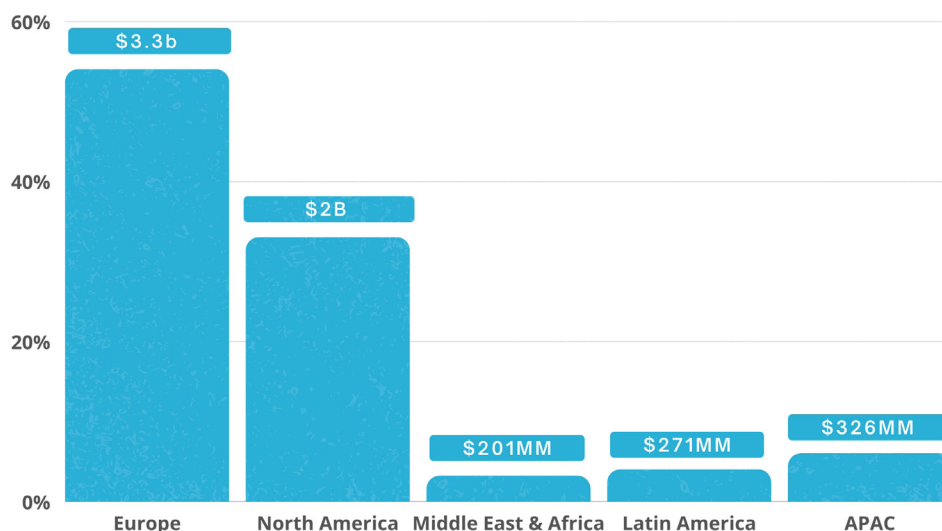
www.v-label.com/resources



HOW THE PLANT-BASED SEAFOOD SECTOR WENT FROM A NEGLECTED UNDERDOG TO REACHING TRIPLE-DIGIT GROWTH

The market for plant-based meat and seafood is experiencing meteoric growth: from 2017 to 2022, the global plant-based meat and seafood market grew 118 percent from \$2.8 billion to \$6.1 billion, being Europe the region with the most sales, according to Euromonitor data.

GLOBAL PLANT-BASED MEAT AND SEAFOOD RETAIL DOLLAR SALES



Source - Euromonitor International Limited, Fresh Food 2023, retail value RSP incl sales tax, US\$, fixed 2022 exchange rate, constant terms

The Plant-based Fish market specifically is expected to increase at a 5.8% CAGR from 2023 to 2033, **from \$804.6 million in 2023** to \$1.2 billion by 2033, according to Future Market Insights.

Sales in Europe are also experiencing incredible growth. According to GFI, just in 2022, plant-based seafood achieved **€43 million in sales**, a significant increase from the €10 million sales in 2020. In terms of units sold, 14 million units were sold in 2022, representing a **growth of 343% between 2020 and 2022**.

Germany alone witnessed an incredible 623% growth between 2018 and 2020, with plant-based fish showing the highest growth rate among all categories and sales, having grown from €261,000 EUR to €1.9 million



INVESTMENT IN THE INDUSTRY

In 2022, companies in the plant-based meat, seafood, eggs, and dairy industry secured a total investment of \$1.2 billion, bringing the cumulative investments to \$7.8 billion.

In 2021, **alternative seafood companies raised \$175 million in funding**, which is nearly twice the amount raised in 2020. These funds were acquired through 15 disclosed deals, contributing to a total investment of \$313 million from 2013 to 2021. Over the span of eight years, a cumulative investment of \$313 million has been made in this industry. Investors like Big Idea Ventures, Sand Hill Angels, Alwyn Capital, CPT Capital, and E2JDJ are some of the most active within this industry.

8 OUT OF 10 MILLENNIALS EAT ALT MEAT, BUT FISH HAS BEEN MISSING ON THEIR PLATES

According to market research by the Plant-Based Foods Association, 79% of millennials already consume plant-based meats, and plant-based seafood producers expect the same popularity for fish-less products.

A BLUE OCEAN INDEED

In contrast to the plant-based meat industry with more than 1,000 brands, alternative fish brands have been popping up at a slower pace, with more than 120 active alternative seafood brands globally in total. Maiko Van Der Meer, an ex-meat and seafood executive and currently a co-founder of a plant-based company, explains possible reasons: “People have heard about the health issues, animal welfare, methane and CO2, and antibiotics surrounding meat consumption.



What you see around seafood is that there are a lot of issues, like overfishing and heavy metals, but they are less known to people and it will take a while until people realize it would be a good idea to also eat less fish and maybe look at some alternatives.” And while alt meat penetrates 1% of the total meat industry and **vegan dairy already makes up 10% of the total dairy industry**, vegan fish so far has reached only 0.06% of total fish consumption, the Good Food Institute states. You know what this means, right? A huge potential for those bridging the gap.

FROM OCEAN AWARENESS TO HIGH SHELF PRICE OF ANIMAL-BASED FISH – CHANGE IS ANCHORED IN THESE FACTORS:

Why such sudden demand? Apart from ethics ([did you know](#) dolphins get high recreationally and shrimps are super smart?), in the post-[Seaspiracy](#) era, the awareness of how unsustainable the status quo of traditional meat production is, definitely played a role.

9 indicators that the traditional fish sector is bound to change:

OVERFISHING

According to the FAO, a third of the world’s fish stocks (33%) are fished at unsustainable levels, which may make consumers concerned about the impact of their food choices on marine biodiversity, but more practically – it is bound to raise the price of traditional fish meat for the end consumer.

CLIMATE CHANGE

The energy content of the fuel burned by global fisheries is 12.5 times greater than the edible protein energy content of the resulting catch, according to *The Future of Plant Protein* by Givaudan. Plus, bottom trawling, an industrial fishing technique that accounts for 25% of the total wild-caught seafood production nowadays, results in the emission of 1.5 billion kilograms of carbon dioxide into the atmosphere annually, according to GFI. This is likely to lead to an increased consumer interest in plant-based fish



POLLUTION

The plastic debate highlighted the fishing industry's major contribution to marine plastics, mainly through abandoned, lost, or discarded fishing gear. Fish farming or aquaculture are also seen as a major polluter of water courses through excess feed, fertilizers, pesticides, hormones, effluent, and other pollutants. It is also fresh water, energy, and land intensive, putting pressure on local populations.

MICROPLASTIC CONTAMINATION

Microplastics damage marine ecosystems and are more and more often found in the gut of fish and seafood. Whilst this is not a major concern for larger species, generally consumed as filets, it is a growing issue in crustaceans, molluscs, and smaller fish that are eaten whole.

MERCURY LEVELS IN FISH

Fish are the predominant source of human exposure to methylmercury, a potent neurotoxin. In predatory fish species such as tuna and Atlantic cod, mercury levels are higher than ever – a result of shifts of what fish consume in overfished areas and increases in sea temperatures.

FISH FARMING

Fish farming or aquaculture has been growing significantly and now represents around 50% of the world's total fish and seafood production, with continued expansion expected in Africa and Asia. And while this has helped mitigate the reduction in wild catches, its negative environmental impacts are significant. Then we have aquaculture's use of wild fish for feed, a practice that, according to Givaudan, exacerbates pressure on marine ecosystems, while also reducing the amount of wild fish available for direct human consumption, thus making the problem worse. As a matter of fact, according to GFI, if fish populations and local catches continue to decline, more than 800 million people face the risk of malnutrition.

CHILD LABOR AND UNDERPAID WORKERS

According to the United Nations Food and Agriculture Organisation (FAO), [around 60%](#) of all children engaged in child labour globally are active within the agriculture sector, including in shrimperies and aquaculture. In addition to



that, a report by the Human Rights Watch confirmed the embeddedness of forced labor and [human rights abuses](#) in the Thai fishing industry, the 4th largest seafood exporter in the world. A 2017 study by the Issara Institute and the International Justice Mission found that 76% of migrant workers in the Thai fishing industry, mainly from Cambodia and Myanmar, have been held in debt bondage.

HIGHER SHELF PRICE

Seafood consumption has been growing worldwide with a 22% global average increase in per capita consumption from 1997 to 2017. As a result, fish prices are rising, and this trend is expected to continue as demand outstrips supply for several key species of fish and seafood.

CULINARY ISSUES

Vegan fish being easy to store and prepare, and especially its **absence of bones**, are very attractive qualities for consumers.

Fish consumption grew by 22% in 10 years. In this decade, plant-based fish will need to compensate for part of the demand for “animal-based” fish.

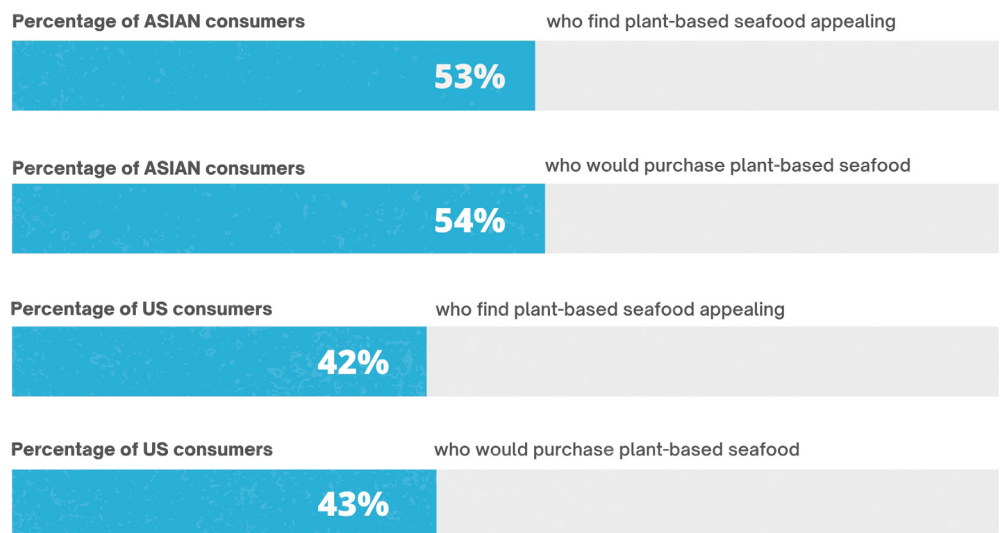
Animal-based fish consumption is projected to grow in the next 5–10 years. Portugal and Spain are some of the biggest fish consumers in Europe: In Portugal, 56.8 kg of fish and seafood are eaten per capita in a year. In the UK, which is still rather high, it is 22.9 kg. In order to be able to meet the growing population’s cravings, some of those kilograms definitely have to come from some super tasty fish and seafood alternatives. Luckily, research shows the current generations are very open to such scenarios! **Did you know that 90% of plant-based food consumers are not vegetarians or vegans but flexitarians?**



CONVINCING TASTE, NUTRITIOUS PROFILE, ENVIRONMENTAL CONCERNS, AND FLEXITARIANS: SEE HOW CONSUMERS ARE DRIVING THE SHIFT

Environmental concerns such as ocean perseverance and climate change were key drivers to grow the industry in the first place, and the rising number of flexitarians (42% of global consumers as of 2021, according to Euromonitor latest study) alongside other factors like health issues has led to a great deal of consumer interest on seafood alternatives, according to GFI:

SEAFOOD CONSUMER PERCEPTION



Source - GFI 2020 - 2021 seafood reports

As stated, environmental and health concerns play a big role in making consumers purchase plant-based seafood. Plant-based products are heavily associated with being environmentally friendly, so brands can look to capitalize on this by actively addressing social issues deemed important to consumers.



PLANT-BASED SEAFOOD

MOST IMPORTANT ENVIRONMENTAL FACTORS	ASIA	US
Reducing plastic waste in the ocean	72%	67%
Saving ocean habitats	73%	66%
Reducing harm towards marine animal	70%	64%
Reducing overfishing	71%	61%

Source - GFI 2020 - 2021 seafood reports

PLANT-BASED SEAFOOD

MOST IMPORTANT HEALTH FACTORS	ASIA	US
No mercury	78%	45%
No microplastics	75%	36%
Low risk of foodborne illness	72%	37%
High in protein	71%	36%
Rich in omega-3s	70%	34%

Source - GFI 2020 - 2021 seafood reports

Consumers also fear missing out on vital nutrients; thus, fortification, which works amazingly with flexitarians, answers these consumers' concerns. But the main important factor for consumers is taste and texture:



PLANT-BASED SEAFOOD

MOST IMPORTANT FUNCTIONALITY FACTORS	ASIA	US
Has good flavor	78%	52%
Has good texture	77%	40%
Less or no “fishy” smell	75%	31%
Tastes like wild-caught or farm-raised seafood	76%	40%
Filling and satisfying	73%	38%

Source - GFI 2020 - 2021 seafood reports

Once taste and texture are achieved, consumers will find it easier to become familiar with and accept plant-based fish. Hence, the focus for food producers shall be first on flavor and texture and then appealing to the health and environmental drivers described.

In Europe, consumers' demands are very similar: According to the Consumer Advice Center in Germany a typical marine flavor is essential, as well as convincing mouthfeel.

Based on a recent ProVeg International's survey conducted on nearly 8,000 European consumers, flexitarians prefer ingredients that are familiar, such as rice, potatoes, lentils, almond, and chickpeas. Freshness, no additives, and affordable price then follow as key factors in shopping decisions.

Providing the market demand with a product combining the aforementioned, as well as a rich nutrient profile, from omega 3 to iodine, B12 and D3, and free from high mercury levels, hormones, and microplastics found in animal-based fish, is a challenge manufacturers and companies worldwide are tackling, one launch at a time.



THE WORLD'S MOST WANTED TYPES OF FISH

According to [Forbes](#), plant-based tuna, salmon, caviar, scallops, squid, crab, and shrimp have already entered the market. Vegan fish burgers, patés, and filets are most widespread at the moment. “European consumers responded that they would like to see far more plant-based salmon as well as smoked salmon, tuna, and white fish in supermarkets. Globally, shrimp and crab alternatives are also favored,” Lucas Huber said at a recent event [hosted by V-Label](#), sharing data Givaudan conducted together with the University of Berkeley. According to GFI, between 41% - 47% of Asian consumers desire plant-based versions of shrimp/prawns, salmon, crab, and tuna.

1. Salmon (smoked and slices)

...has almost universal appeal with demand growing across markets globally – consumption is three times higher worldwide than it was in 1980. The key markets are the US, Japan, and the core EU28 countries, with demand from emerging markets growing rapidly, too. As a result, salmon prices are rising steadily year on year. Farmed salmon accounts for 70% of the entire salmon market but is at risk from diseases and environmental events, such as algal blooms. Consequently, supply is vulnerable. Wild catch is limited and remains a small percentage of the overall supply (although previously depleted wild salmon stock is bouncing back to sustainable levels). Apart from the traditional fish industry, the plant-based fish industry is also facing challenges – these revolve mostly around getting the right texture, which we'll examine closely in the next part.

2. Tuna (canned and steaks)

...ranges amongst the most commercially valuable fish in the world, with high demand and high prices in sushi markets, especially when it comes to highly prized bigeye tuna. Overfishing is a particular issue for tuna with around 30% of stocks classed as overfished – this is particularly true for Pacific bluefin tuna, as well as Atlantic bigeye and Indian Ocean yellowfin populations. Just like salmon, for vegan alternatives, texture is still a work in progress. In addition to that, some of today's canned plant-based tuna selection has yet to successfully replicate the fresh fishy taste of the real deal. In the very last part, we will highlight some of the ones who are definitely on the right track, though!

Latvian-based company Karavela has recently launched its own vegan brand, Fish Peas.



3. Shrimp (nuggets)

Shrimp fishing is a highly specialized activity that produces large amounts of bycatch and destroys important habitats for many species of juvenile fish. An increasing amount of supply then comes from farmed shrimp, which accounts for 55% of global production. This production method adds other environmental impacts, causing wetland destruction and damaging biodiverse habitats. With rising levels of microplastics found in wild shrimp and since both wild and farmed shrimp are vulnerable to a wide range of pathogens and parasites, cleaner, more sustainable options are highly desirable.

The key gap to bridge is nutrition, as many plant-based shrimp ingredients are often much lower in protein content compared to other fish alternatives. Molding the more jelly-like structure of plant-based shrimps also presents challenges, the Givaudan report states.

Following the top 3 are crab (in the form of meat or cakes) and white fish, ranging from fish fingers to coated fish filets.



THE CHALLENGES VEGAN FISH PRODUCERS FACE

Not too long ago, there were only 50 vegan seafood brands in the market. However, according to the latest GFI study, in 2021 there were already 120 vegan seafood brands in the market. In that same year alone, 21 new brands entered the alternative seafood industry. Therefore, considering the growth rate, it can be anticipated that by 2023 the number of companies in this sector will have nearly reached 200. It is worth noting that out of the initial 120 brands, 20 specifically specialize in selling cultivated seafood, accentuating one of the trends in the plant based sector.

This growth did not appear out of nowhere. It has been a journey for plant-based companies to come up with products that would match all consumers' criteria. What, in particular, have been some of the biggest quests?

#1 Finding the ultimate protein source

Soy is one of the top choices for manufacturers in the plant-based fish space due to its high nutritional content, functional flexibility, established supply and consequent low cost, as well as a favorable fibrous structure that performs well in the texturising process, according to Givaudan research. The key drawback is that soy is also an allergen, making it unsuitable for some consumers.

Pea is the next most popular choice, as its protein contains few or no allergens with only slightly lower protein levels than soy. On the other hand, it shows lower functionality and is high in off-taste. The cost is also slightly higher, with a slightly less well-developed supply chain.

Wheat is no less popular – with good sourcing options, low cost, clean taste, and good functionality. However, it performs lower in terms of nutritional content and comes with allergen issues when it comes to gluten.

Other protein choices include **chickpea, lentil, flaxseed, faba, and navy bean**.

Vegetables such as **jackfruit, carrot, tomato, and eggplant** are being used in innovative ways to successfully mimic textural properties in alternatives for sushi or tuna slices.



Seaweed and algae have become increasingly looked into as manufacturers realize their strong associations with a 'sea' taste. The gel-like properties also closely match the texture of shrimp or other fish.

Starch-based ingredients, with the konjac plant as the go-to product, are often used for shellfish alternatives. "When thickened and mixed with gum, they closely mimic the texture of real shrimp and can also be applied to lobster, crab, prawn, and calamari alternatives. Other starch powders include vegetable root starch and yam flour," the Givaudan research adds.

#2 Colors not only have to look natural but also need to be natural

With consumer drivers focusing on health, wellbeing, and the environment, natural colors are a must, but they should also appear as close to the real fish colors at the same time. In the case of vegan white fish, for example, it is necessary to whiten the plant protein base, which is usually beige to yellow depending on the formulation. "Salmon and crustaceans require orange to pink/red colors with good stability across processes," the Givaudan research continues, "while for tuna, it is important to realistically replicate the color change that happens during cooking – when raw tuna turns from a deep red color to brown.

#3 The typical 'fishy' texture is especially hard to mimic

Texture remains the biggest challenge for any plant-based seafood alternative. Currently, a texturising process is used to create a dense fibrous structure which delivers both the 'meaty' bite and appearance that consumers are looking for in fish alternatives.

"This is much easier to achieve through a wet-textured vegetable protein (TVP) than a dry one," the Givaudan paper explains, "while wet TVP is more difficult to shape than dry, flavors can be incorporated into it throughout the whole process, which is a clear advantage." TVP is well suited to processed fish products such as breaded filets and fish fingers, but does not recreate the flaky texture of whole fish. This is still the biggest challenge for fish alternatives and has yet to be perfected.



#4 From jellyfish to filets, the irreplaceable bite & mouthfeel matter

Replicating mouthfeel sensations, such as the right resistance in the mouth, a creamy sensation on the tongue, or elastic bite when chewing are also important, according to the Givaudan findings. This is usually achieved through a mix of agents – gels, protein isolates, and starches – which are incorporated into the recipe along with protein during the production process.



Onami Foods
Vegan Fish and Seafood



THE LATEST INNOVATION TAKING PLACE

Single Cell Proteins (SCP). These ingredients derived from algae, fungi, and other microbes are created using fermentation processes similar to that used in making bread and beer. Bacteria proteins are grown through fermentation of optimized strains of microbes and offer high protein content. The current downsides include high production cost and potential negative consumer perception; however, this could be a viable alternative in the near future.



Brands and Products: Plant-based salmon cravings, as well as bridging the tuna and filet gap

Latvian-based company [Karavela](#) has recently launched its own vegan brand, [Fish Peas](#). Their products are made from yellow pea protein. They're gluten-free, high in iron, and rich in amino acids - all qualities that help to lower your cholesterol level and can be digested easily.

Unfished by Romanian company Prefera Foods, the winner of the International V-Label Awards 2021 (Best in Positive Impact category) has been serving European customers with PlanTuna, a product portfolio perfect for the previously untapped canned tuna market. It includes juicy chunks infused with herbs and spices in a can, salmon spread in a tube, or vegan mayonnaise. "When most producers were launching vegan fish fingers, we decided to develop a distinctly unique portfolio," Prefera Food's CEO Raul Ciurtin [said recently](#).



From fish fingers to filets and burgers, [Moving Mountains](#) is no beginner in the alt meat scene. “It all started after a routine blood test at the GP, which revealed for Simeon, now founder and CEO, high cholesterol results,” the [company story reads](#).

[Garden Gourmet’s](#) love for plants was born out of a garden back in 1986 and a sheer passion for plant-based food. From meat and sausage alternatives to newly released Vuna (plant-based tuna), they are a staple in many vegan and flexitarian households in Europe.

Straight from the fish-loving Great Britain, [Zalmon’s](#) smoked salmon made of marinated carrots has been named the [top plant-based fish product of 2021](#) by BBC Good Food.

[The Plant Based Seafood Co.](#) is an industry staple from the USA. After Mind Blown Dusted Scallops and Lobster Crab Cakes, their recent release has been gaining quite a bit of traction of its own – Mind Blown Coconut Shrimp was named the most disruptive product of 2020 at Prepared Foods’ Spirit of Innovation awards.



[Onami Foods](#) from France aims to widen the pool with frozen fish products made from rice, chickpea, and potato protein, with algae such as wakame and chlorella. “We developed an all-natural formula based on only 12 ingredients, including salt and water,” co-founder and CEO Charles Fouquet hints.



[BettaFish](#) has recently joined the club with another exciting release: TU-NAH, the first seaweed and fava bean-based vegan alternative to tuna for pizzas.

[New Wave Foods](#) from the US started with shrimp made from seaweed and plant protein, and are following its success in 2022 with lobster, scallops, and crab.

[Good Catch](#): Seafood, Evolved offers plant-based fish sticks, fish filets, fish burgers, crab cakes and fish cakes, as well as the first US-based vegan salmon burger. Their blend of peas, chickpeas, lentils, soy, and fava beans deliver rich flavors and flaky textures.

Vegan salmon sashimi or lemon plant-based shrimp? [Vegan Zeastar](#) capitalized on the seafood and sushi segment, and never looked back. In January 2022, [Plantish](#) revealed the world's first plant-based whole-cut salmon filet. According to [GreenQueen](#), "the successful development is a result of proprietary patent-pending manufacturing technology."



Plantish
Vegan salmon filet



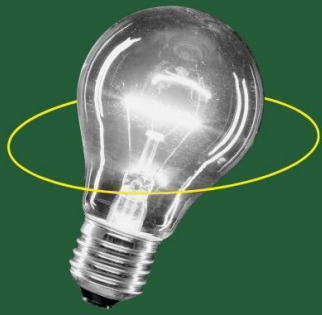
[Vegan Visboer](#), or Vegan Fisherman, took over 3 years to create the ideal fish substitute, but it was worth it: the authentic, true taste, and structure of their fish replacements try to give consumers the experience of eating real fish. Their range includes shrimp, fish sticks, burgers, nuggets, and filets.

From “Vish” bites to chunks, filets, and burgers, The Netherlands-based [Novish](#) aims to restore balance in the oceans as well as on people’s plates. In January 2020, they launched plant-based fish substitutes at the Horecava trade fair, making it the first vegan fish company in Europe. Novish focuses entirely on plant-based fish substitutes that are 100% soy-free.

[BeLeaf's](#) vegan shrimp, commonly served in restaurants, is made from konjac, a starchy Japanese root vegetable that’s full of fiber. The other few natural ingredients are brown sugar, paprika, vegetable gum and root starch, salt, and seasonings.



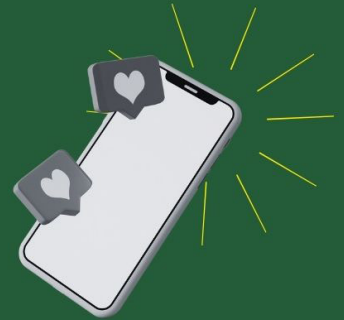
Vegan Visboer
Vegan Fisherman



INTERNATIONAL V-Label Awards

Celebrating positive impact in the
plant-based industry

awards.v-label.com



ABOUT V-LABEL

Across the globe, more than 50,000 products from more than 4,300 licensees now carry V-Label.

V-Label is an internationally recognised, registered seal for labelling vegan and vegetarian products and services established in Switzerland in 1996. It is a reliable, go-to shopping guide for consumers.

With more than 25 years of experience labelling products and engaging experts in quality management, food technology, chemistry, cosmetology and marketing, we are the frontrunners of a global movement. As such, we cooperate with businesses, retailers, consumers, and campaigners.

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GET IN TOUCH TODAY

Transparency is in our DNA. If you have any questions about V-Label, schedule a free call now.



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Sales & Business
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[SCHEDULE A FREE CALL](#)

GET CERTIFIED

Ready to increase the visibility of your vegan and vegetarian products? With V-Label, customers will be able to identify your products as vegan or vegetarian at a glance – thus earning their trust without hesitation, double-checking or second guessing the product's quality.

