

Vitafoods™  
insights 

---

Special Report

---

January 2018

€36

# Diving Deep into Omega-3s

---

*by Jade Mitchell-Ross*

# Diving Deep into Omega-3s

by *Jade Mitchell-Ross*

**The omega-3 market has seen phenomenal** growth over the past two decades. The market today is worth an estimated €1.3 billion at the ingredient level and continues to grow globally.

While cod liver oil has been consumed for centuries, the modern omega-3 market dates to the early 1980s, with 18:12 'natural' fish oil products—named for the ratio of eicosapentaenoic acid (EPA) to docosahexaenoic acid (DHA) in the oil. Newer processing methods and studies into bioavailability have extended the market into different forms of omega-3s including traditional triglycerides, ethyl esters and phospholipids—both natural source like krill oil and processed forms. Krill products were non-existent 20 years ago, and there were no high-concentrate products on the market either, reflecting both technological developments and shifting consumer preferences.

'Growth in the omega-3 market was also influenced by the regulatory environment,' explains Ellen Schutt, communications director for the Global Organization for EPA and DHA Omega-3s (GOED). 'Twenty years ago, there were no government approved health claims, and no recommended daily intakes (RDIs) for EPA and DHA anywhere in the world.' Today, more than 30 countries have recommended intakes and various health claims have been approved around the world. Schutt says, 'This is primarily due to the large body of science that omega-3 enjoys for indications including cardiovascular, cognitive, prenatal and maternal health, among others.'

GOED estimates the market today is worth €1.3 billion at the ingredient level. While growth in more mature markets such as North America and Europe has slowed in recent years, the global market continues to grow, supported by increases in China, Southeast Asia and other developing countries.

As data from Markets and Markets Reports shows, the global nutritional lipids finished products market is projected to reach €9.5 billion by 2022—a growth of around 9.5 percent per year from 2016. The omega-3 sector is estimated to have formed the largest share in this market for 2017 as the most widely used nutritional lipid.

## The growing infant and women's nutrition markets in countries such as



along with diet diversification will see huge growth in the Asian markets, though China will continue to dominate due to its large infant nutrition and animal nutrition sectors.



GOED data shows the volume of oils used globally in products containing omega-3s was approximately 90,400 tonnes, an increase of 2 percent from 2015. Dr Aldo Bernasconi, director of information and research at GOED, explains this was valued at approximately €1 billion, and consumer spending in these products was around €27 billion. 'Most of the volume (78 percent) and ingredient value (56 percent) goes to dietary supplements,' says Dr Bernasconi. 'More than half the volume goes to the two largest markets: the United States (32 percent) and Europe (23 percent). Combined, the Asian markets use a volume more or less equivalent to that used in Europe, but it is in the emerging markets that volume growth is concentrated.'

## DEFINITION

Omega-3 fatty acids are a family of long chain highly unsaturated fatty acids defined by the position of the methyl terminal double bond on carbon number three counting from the methyl terminal carbon. These include stearidonic and docosapentaenoic acids, among the more familiar alpha linoleic (ALA), eicosapentaenoic (EPA) and docosahexaenoic (DHA) acids. These fatty acids have different dietary sources. ALA is synthesised in plants and is found in green leaves, and some seeds, nuts and plant oils, and can be converted in the body to the longer-chain EPA and DHA. However, most people cannot efficiently convert adequate amounts of ALA to EPA and DHA, making ingestion of these pre-formed long-chain omega-3s important.

The best source of EPA and DHA is seafood, especially fatty fish, but they are also found in various oils and supplements, and may be used in enriched functional foods. Prof Philip Calder, University of Southampton, explains a low omega-3 index level should be a concern for everyone, as EPA and DHA are vital components of cell membranes, affecting cell function in the heart, brain and nervous system. Having the right amount of EPA and DHA in the membranes of these cells determines how well they function.

## EUROPE

Awareness of omega-3s and their health benefits is strong across the EU, although usage levels are much lower, according to research from GOED.

Mordor Intelligence data marks Europe as the second largest market for omega-3s globally, but suggests the market is experiencing 'a slow growth rate'. This is seconded by the Nutrition Business Journal's 2017 Global Supplements Report, naming Europe as 'sluggish' and 'sleepy'—this is due in part to the large and steady market omega-3s enjoy in Europe. Europe produces 20 percent of the world's fish oil, according to Mordor Intelligence, and this fish oil is widely used in the food, pharmaceutical, and animal and pet food markets across the region. The 'slow growth' experienced is the increased application in infant nutrition products, although private label brands in the animal

---

nutrition market are providing 'good opportunities' for omega-3 fortified animal feed products in the developing regions of Western Europe. The Mordor Intelligence data also shows 'new abundant raw material sources' such as krill and algae offer the potential for greater industrial production.

Growing consumer health awareness and the public burden of heart disease across Europe will drive the omega-3 market. Supplements continue to dominate—according to Innova Market Insights data, launches in the heart health category rose by 57 percent between 2015 and 2016—and foods fortified with omega-3s are showing growing strength. There are four health claims authorised for use by the European Food Safety Authority (EFSA) for DHA and heart health, so while product marketing with label claims is still a challenge in this stringent regulatory environment, there is real opportunity in the heart health market.



**Growing consumer health awareness and the public burden of heart disease across Europe will drive the omega-3 market.**

## Regulatory environment

EFSA has returned more positive opinions for the benefits of EPA and DHA than any other nutrient. So far, nine health claims have been authorised for use, including those referring to the reduction of disease risk and children's development and health. Peter Clough, honorary secretary of the International Society for the Study of Fatty Acids and Lipids (ISSFAL), says, 'Given the strict regulatory regime under which the evaluations have been conducted, this is a testament to the well-established benefits associated with EPA and DHA.' He expects to see more authorised health claims in the future, but it may take some time as the regulatory environment changes. 'It varies from region to region,' he says, 'not just in Europe, but around the world. Claims are not always dependent purely on the science behind them and the interpretation of this science may vary. It's a long and quite complex process to get these claims approved.'

Authorised claims for omega-3s include:

- DHA and EPA contribute to the normal function of the heart
- DHA and EPA contribute to the maintenance of normal blood pressure
- DHA and EPA contribute to the maintenance of normal blood triglyceride levels
- DHA contributes to the maintenance of normal blood triglyceride levels
- DHA maternal intake contributes to the normal brain development of the foetus and breastfed infants
- DHA maternal intake contributes to the normal development of the eye of the foetus and breastfed infants



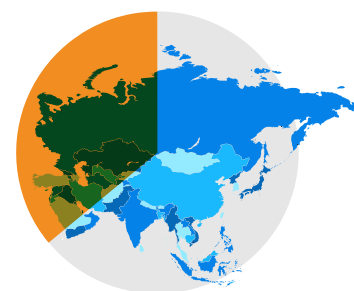
- DHA contributes to the maintenance of normal brain function
- DHA contributes to the maintenance of normal vision
- DHA intake contributes to the normal visual development of infants up to 12 months of age

Despite the many authorised health claims, it has traditionally been difficult to get recognition by regulatory authorities that EPA and DHA are important nutrients for human health, regardless of the number of studies published. However, 2017 saw success through the Codex Alimentarius Commission (CAC) process in which countries have agreed to continue working on establishing a Nutrient Reference Value (NRV) for EPA and DHA based on a reduction in coronary heart disease mortality risk. The Commission also adopted the fish oil standard during its July 2017 meeting, which, according to Dr Harry Rice, vice-president of regulatory and scientific affairs at GOED, will help to facilitate international fair trade practices. He continues, 'While the CAC is not a regulatory body, often its standards are adopted as regulations, in part or in full, by countries. That makes it important to pay attention to the activity of the CAC.'

## ASIA

Research from GOED shows Asia counts for 36 percent of the global omega-3 finished products market. Growth through 2017 is projected to have been 5 percent on a global basis, with double digit growth expected in Asia. Infant formula is the leading category for innovation in food and drink and Asia Pacific has the greatest opportunity due to strong rise in consumer spending.

Understanding local market dynamics and regulations is extremely important in Asia, as there is no harmonised regulatory body. In Asia Pacific, there are no clear guidelines for recommended daily intakes of omega fatty acids, compared to Europe where approved health claims are closely linked to RDIs. Omega-3s are fortunate to have a large body of science to support their benefits, but some countries are reluctant to entertain claims in general. 'A lot of countries in Asia don't seem to like it when research comes from outside the country of origin of the health claim,' Dr Rice explains. 'This is a mixed concern—the feeling is, an American population, for example, wouldn't be the same as a Japanese population. The reality is, it's not clear whether the requirement for having research in a particular population where the health claim will be used is a genuine concern or if they're trying to dig their heels in and prevent a health claim being authorised. Applying for a health claim in Indonesia, for example, requires trials and studies conducted on an Indonesian population—there is almost no research on this particular population, so according to the restrictions, the health claim would not be approved.'



Research from GOED shows Asia counts for

**36 percent** of the **global omega-3 finished products market.**

This is compounded by the lack of a central, harmonised regulatory body—there’s no EFSA in Asia. Dr Rice is unsure whether this would be beneficial, but does believe ‘We’re making inroads to working with the different regulatory bodies in Asia. They’ve become a lot more transparent in recent years, but there’s still a lot to do to improve communication.’

However, this does mean there is a significant opportunity to develop omega-3 science in Asia, particularly if industry becomes more active in investing in high-quality research.

With huge potential for supplements and fortified food and drink products using omega-3s across Asia, this is a market to watch.

## CASE STUDY

Omega-3 supplement restrictions in Indonesia have been reversed following pressure from the Global Organization for EPA and DHA Omega-3s (GOED) and the local trade body, Asosiasi Pengusaha Suplemen Kesehatan Indonesia (APSKI). The original restrictions from Badan Pom, the National Agency of Drug and Food Control in Indonesia, required supplements with more than 300mg of EPA/DHA to have a health claim and include warnings for consumers.

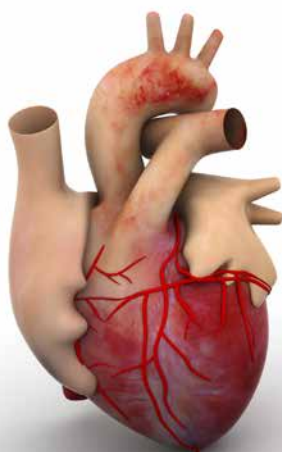
Dr Rice explains: ‘The restrictions were imposed on omega-3 supplements because the officials at Badan Pom were concerned about bleeding. It was their understanding bleeding was an issue with omega-3 consumption, citing literature suggesting potential issues. But it’s suggestive and there’s no tangible evidence this exists.’

GOED provided data for APSKI to present to Badan Pom countering the finding; the agency did change its position slightly. Badan Pom still requires health supplements with more EPA than DHA to carry a warning about consuming anti-coagulants alongside products high in EPA, as it believes this results in a significant blood-thinning effect. Badan Pom also advises those who consume such supplements to consult with their doctors on their intake, especially prior to undergoing any surgery, due to the agency’s belief patients might bleed excessively.

GOED and APSKI continue to lobby against the existing regulations.

## CONSUMER PROFILE

Statistics show people are becoming unhealthier due to their chosen lifestyles. A study in *Nutrients*<sup>1</sup> compared data from the United States and Germany and concluded despite adequate knowledge of the health benefits and food sources of omega-3s, 98 percent of the participants fell below the optimal range. Aker BioMarine’s chief scientist, Dr Nils Hoem, explains having insufficient omega-3 levels ‘increases the risk for chronic diseases—including heart disease and major depression—suboptimal brain function, and other health issues’. More than 80 percent of people globally have a



---

low or very low omega-3 index level, according to data from *Progress in Lipid Research*<sup>2</sup>; regions with low levels include, but are not limited to, North America, Europe, the Middle East, Southeast Asia, Australia and China. Katrin Berntsen, communications director at Aker BioMarine, says 'education is key to prevent these lifestyle diseases, and finding the right balance of healthy behaviours is the key to becoming healthier.'

'There has been a significant amount of research conducted in the past decade,' Berntsen says, 'and thousands of studies published on omega-3s alone, according to GOED.' Several papers support the findings that have identified omega-3 deficiency as a risk factor for heart disease. 'Given these findings, it has been suggested low omega-3 status is as much a public health issue as vitamin D deficiency,' Berntsen continues, 'and it is imperative to get these nutrients into the hands of as many people as possible.'



**As global fish consumption isn't high enough to ensure a high omega-3 index level, consumers need to be encouraged to turn to supplements.**

As such, it appears more than 80 percent of people globally represent the target consumer for omega-3 supplements and fortified products. Shai Karlinski, vice president sales and marketing at Anlit, points out 'people may know the term "omega-3" but have less knowledge of their benefits or dietary sources. As global fish consumption isn't high enough to ensure a high omega-3 index level, consumers need to be encouraged to turn to supplements.' For many people, increasing their omega-3 intake doesn't factor as a lifestyle change they should make to improve their health—despite studies showing the myriad health benefits. Dr Hoem believes this is something seen across all ingredient categories: health outcomes are transient and often invisible to the consumer. It's difficult to convince a consumer to continue taking a supplement to help prevent a disease or protect their health if they feel healthy already. Matts Johansen, CEO at Aker BioMarine, believes education is key to preventing the lifestyle diseases associated with a low omega-3 level, and 'finding the right balance will put us all on track to becoming healthier.' Aker BioMarine launched a 'health awareness film' in 2017 as part of their campaign to 'educate the world', starring Maria, who despite her seemingly very healthy lifestyle, gets a real surprise when she returns to her roots in Greenland and discovers her omega-3 level isn't quite enough to maintain a 'truly healthy and balanced life'. Consumer education was echoed by Karlinski, Dr Calder, and Clough as vital to encouraging omega-3 consumption.

## WHERE'S THE BUSINESS?

The volume of health benefits means the omega-3 market is expected to continue its growth trend for the foreseeable future. 'As global expendable income rises, particularly in Asia, people will want to avail themselves of these health benefits, so we can expect the market to continue growing,' Clough says. Innovation in

---

formulation, delivery formats and applications will see companies stand out from the crowd, with consumers also focusing on upcoming trends like personalised nutrition, and sustainability.

## Consumer trends

With the modern consumer seeing clean label as the new face of health and wellness, and authentic, all natural products in high demand, businesses and manufacturers need to keep innovating to keep up. Schutt points out, 'Despite the popularity of high-concentrate products, there has been a resurgence of "natural" fish oils—with pollock oil and virgin salmon oil, for example, emerging as new categories.' This also ties into the demand for sustainability and ethical sourcing. One company flexing its muscles in this space is Aker BioMarine. Aker provides fishing coordinates on every product bottle to show consumers where its krill was harvested. 'This is the ultimate example of taking consumers to the source of their products,' attests Cilia Indahl, sustainability director for Aker BioMarine. 'In a world with scarce resources, responsible management of marine resources has never been more important. Going forward, the sea will play an important role in meeting global needs—but only if we utilise it in a manner that supports both a healthy planet and a healthy lifestyle.'



**Encouraging consumers to increase their omega-3 consumption could be a key component of another rising consumer trend: personalised nutrition.**



Encouraging consumers to increase their omega-3 consumption could be a key component of another rising consumer trend: personalised nutrition. Personalised nutrition focuses on the importance of meeting individual requirements, and a simple blood test can tell users what percentage of their red blood cells contain EPA and DHA. 'The Omega-3 Index Test is an initiative from Aker BioMarine' Berntsen says. 'The desired index level is 8 percent or above, but most consumers globally have a very low level at 4 percent or lower, putting them at significantly increased risk for serious heart and brain-related diseases.' Having a percentage as a tangible result could be the answer for the consumer apathy seen in the omega-3 market. As Berntsen comments: 'In most cases, once consumers know their omega-3 index level, they are motivated to do something about it.'



---

## Infant nutrition

GOED data suggests the infant formula market is now a 3.3 million metric ton market, fuelled primarily by growth in South America and the Southeast Asian markets. In 2008, international experts in the *Journal of Perinatal Medicine*<sup>3</sup> stated infant formula should include DHA to guarantee 'correct eye and brain development.' The team emphasised infant formula should contain DHA at the recommended levels of between 0.2 and 0.5 percent. 'Over the past decade, many research studies have highlighted the importance of DHA omega-3 and AA omega-6 in infant development,' explains Dr Cristina Campoy, of the Department of Paediatrics at the University of Granada. 'It is therefore vital pregnant and nursing mothers consume adequate amounts of DHA in their own diet and, if using an infant formula, provide their infants with a formula containing DHA and AA at recommended levels.'

A study in the *American Journal of Clinical Nutrition*<sup>4</sup> found consumption of a DHA-enriched formula in infancy may be linked to 'positive cognitive outcomes in childhood' as infants fed this formula from birth to 12 months scored 'significantly better' than a control group on several measures of intelligence conducted between the ages of 3 and 6 years. The British Nutrition Foundation recognises omega-3 and omega-6 as 'of critical importance during infancy' and in 2016, European law requires infant and follow-on formula to include DHA and AA at 0.4 percent of the overall fat content.

Worldwide promotion of infant formula is leading to increased use of these products with China experiencing a growth rate of 20 percent in 2013. Markets are developing in Asia, Eastern Europe, the Middle East and Latin America, driven by economic growth and the growing number of working women. In 2013, €34 billion was spent on milk formula globally.

## From nutraceutical to pharmaceutical

Clough thinks we will see an increasing number of pure pharmaceutical applications approved over the next five to ten years: 'pharma companies are heavily involved in research in this field, across a whole range of therapeutic areas, investigating omega-3s both as first-line or adjuvant therapies.' Schutt agrees, 'there was only one omega-3 based pharmaceutical on the market in 1996—Epadel in Japan. While now there are still only four approved pharma products, global sales exceed \$1.2 billion, and there are more than 80 new omega-3 pharmaceuticals in the drug discovery pipeline.'



**Over the past decade**, many research studies have highlighted the importance of **DHA omega-3** and **AA omega-6** in infant development.

— Dr Cristina Campoy, of the Department of Paediatrics at the University of Granada.

---

## Delivery forms

‘Many of today’s omega-3 products have new delivery forms,’ says Jan Haakonsen, director of sales and marketing at ArcticSource<sup>1</sup>. Schutt notes several developments are appealing to consumers like the emulsions and gummies offering convenience and respite from pill fatigue. As Karlinski says, ‘It’s far easier to tempt people into enjoying a functional food than a more traditional pill.’

Dr Bernesconi says, ‘In the US and Europe and, to some extent in other markets, there is an ongoing trend towards products that offer a different value proposition.’ He explains as markets become more mature, consumers have started to move away from ‘standard’ refined fish oils and towards other products, particularly concentrates. ‘Concentrates have the advantage of being able to deliver the same dosage of EPA and DHA from smaller or fewer capsules. In emerging markets, most of the growth in omega-3 is in the more traditional refined fish oil, but in the US, in particular, there has been much interest in easier-to-use forms of delivery—smaller capsules, tablets, emulsions and liquid forms. The proportion of omega-3s used in those forms has doubled since 2010—from 13 percent to 27 percent.’

### CASE STUDY

Innovation abounds in the omega-3 category, with novel applications and delivery formats appearing. Bethan Till, a PhD student at Harper Adams University, Newport, included microalgae in the feed for Holstein Friesian dairy cows and successfully increased the level of omega-3 fatty acids in the cheese produced from the cows’ milk. Adding microalgae saw no effect on the cow’s milk yield, body condition score or live weight, and taste testers found there were ‘no negative effects on taste’ according to Till. She explained increasing the levels of omega-3s in the cheese reduced the level of saturated fatty acids and believes ‘by increasing the level of omega-3 in cheese, which is already in many people’s diets, they can obtain a health benefit without having to alter their eating and shopping habits.’

## Blending Categories

As the nutraceutical and functional food industries continue to see lines blurring between categories, the same can be expected for omega-3s. Prominently, a study published in *Nature’s Scientific Reports*<sup>5</sup>, indicates supplementation with omega-3 could help improve the diversity of the gut microbiome, independent of fibre and prebiotics. The study found women who had a higher intake of omega-3s had a more diverse gut microbiome, which is associated with several health benefits—the team concluded measures of omega-3 index and intake are significantly associated with microbiome composition.

---

A further study in the *Journal of Lipids*<sup>6</sup> suggests supplementation of omega-3 and omega-6 fatty acids may support lowered doses of psychopharmacologic medications for attention deficit hyperactive disorder (ADHD).

As increasing science emerges highlighting further health benefits associated with omega-3s, the market can expect to see more products tailored to specific health conditions, and products combining omega-3 ingredients in their formulations. The applications include protein powders fortified with algal oils, and—as Dan Murray, vice president of business development at Xsto Solutions, believes—beverages as the next frontier.

Clough agrees the market will continue to grow: ‘After many years of research, there are now many established claims for these products, and not only is the science established—it continues to develop. Whereas for other nutrients, there was a flurry of activity scientifically and academically ten years ago—and a rise in products commercially before it tailed away—this is not the case for omega-3s. The science continues to develop every year and new findings come out, which provide a boost to the market—perhaps strengthening the evidence in a certain area, perhaps opening up a new area.’

## SUSTAINABILITY

The vast majority of omega-3s are derived from fish oil, which Clough explains, is a primarily a by-product. ‘The amount of fish oil used in supplements is only a small proportion of the global production—a large percentage is considered unsuitable for supplements. This will change,’ he says, ‘as we see increases in production and new processing and recovery techniques to see a greater proportion of fish oil produced available for use in human nutrition.’



**One of the world’s largest single stock fisheries is found in the waters around Peru and Chile; the Peruvian anchoveta is also the largest single source of marine omega-3s.**



One of the world’s largest single stock fisheries is found in the waters around Peru and Chile; the Peruvian anchoveta is also the largest single source of marine omega-3s. Until recently, the Peruvian anchoveta fishery was open access, which saw rampant overfishing, putting significant pressure on fish stocks. Compounded by changes in ocean currents, supply was threatened. In 2009, the Peruvian government introduced measures to allow the fish stock to recover. The anchoveta live in an ecosystem of ‘high climatic variability’ according to the World Bank<sup>7</sup>, and is affected by changes in sea temperature, meaning the size of the population and how much can be sustainably caught fluctuates significantly from year to year. The stock needs constant monitoring and measures to combat overfishing include catch limits per ship and specific fishing seasons.

‘With a growing world population, it has never been more important to make healthy food and nutrients available while maintaining the health of our planet’s ecosystems,’ Indahl says. ‘While health benefits are a major factor in determining which omega-3 options are best, sustainability and traceability are also key elements for consideration. More and more consumers care deeply about where their ingredients come from, especially for marine omega-3s.’ She points out Antarctic krill is considered one of the most environmentally friendly sources by organisations including Friend of the Sea<sup>8</sup> and the Marine Stewardship Council<sup>9</sup>.

‘Krill is one of the planet’s largest biomasses,’ Indahl says. ‘It represents a vital part of the food chain and plays a very important role in the overall ecosystem. This is why the krill biomass and the ecosystem that depends on it is so closely managed, monitored and regulated.’ All Antarctic krill catches are reported to the Commission on the Conservation of Antarctic Marine Living Resources (CCAMLR) which uses a precautionary approach to prevent overfishing. The annual quota for Antarctic krill is set to 1 percent of the total krill biomass, which Indahl explains ‘amounts to 620,000 metric tons.’ For the 2015 to 2016 season, the recorded krill catch for all vessels harvesting krill was 225,646 tons, ‘which is about 0.3 percent of the total biomass.’



**Flaxseed offers the health benefits of ALA, without any concerns about contamination or sustainability.**



‘Today’s consumers, especially millennials, are increasingly concerned about the sustainability of their food supply,’ says Julie Faber, director of marketing and compliance at Pizzezy Ingredients. ‘Flaxseed offers the health benefits of ALA, without any concerns about contamination or sustainability.’ She adds 2014 SPINS U.S. data named flaxseed and flaxseed oil the most popular form of omega-3 in the natural channel, and the second most popular form of omega-3 in the conventional channel—ranking only behind DHA. Another plant-source for omega-3s is chia seed, which banks on the claims the products are organic, vegan, non-GMO and contain no heavy metals—tapping into the demand for clean label. Contributing to the diversity of the market are purely vegetal sources of omega-3 from microalgae, which have created new possibilities in reaching vegetarian consumers. Murray believes vegetarian sources are resonating with consumers and hold great potential, as market demand is ‘actually outstripping supply.’

Looking forward, Clough expects ‘new sources that are more sustainable with better environmental credentials’, citing algal oils as an example. Algae have long been seen as a potential source of functional ingredients and bioactive compounds, including

---

omega-3s—microalgae are the primary source of omega-3s for the fish and krill the industry currently utilises. They represent a sustainable and vegetarian source of EPA and DHA, and are widely regarded by consumers as safe and free of side effects. So far, high production costs coupled with low volumes have restricted algae to the ‘high value’ sectors—such as nutraceuticals—with microalgae having real potential as a sustainable source if production costs can be lowered. The Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA) estimates the global market for products with microalga is valued at €6.4 billion per year, with China and Indonesia dominating the market, while European sales comprise 5 percent of the global market.

Despite regulatory issues, Clough believes modified crops will be another excellent low-cost source of omega-3s and these crops will ‘play a role in different countries at different times with different regulatory requirements.’

‘The omega-3 market has been an industry darling for much of the last 20 years,’ says Schutt, ‘but we must prepare for the 20 years ahead.’ Negative media stories questioning neutral science have affected industry growth, and consumer trust has been eroded by irresponsible claims and a lack of transparency. She states: ‘Our industry needs to band together to reaffirm the quality of omega-3 products for consumers and continue to educate people about the strong body of science behind omega-3s for health.’

#### References:

- 1 <http://www.mdpi.com/2072-6643/9/9/930/htm>
- 2 <http://www.omega3indexproject.com/wp-content/uploads/2016/09/Global-Omega-3-Index-Levels-Progress-in-Lipid-Research-May-2016.pdf>
- 3 <https://www.ncbi.nlm.nih.gov/pubmed/18184094>
- 4 <http://ajcn.nutrition.org/content/98/2/403.abstract>
- 5 <https://www.nature.com/articles/s41598-017-10382-2>
- 6 <https://www.hindawi.com/journals/jl/2017/6285218/>
- 7 <http://www.worldbank.org/en/news/feature/2017/03/06/peru-anchoveta-pescadores>
- 8 <https://thefishsite.com/articles/friend-of-the-sea-leading-international-omega3-sustainability-efforts>
- 9 <https://www.msc.org>

Copyright © 2018 Informa Exhibitions LLC. All rights reserved. The publisher reserves the right to accept or reject any advertising or editorial material. Advertisers, and/or their agents, assume the responsibility for all content of published advertisements and assume responsibility for any claims against the publisher based on the advertisement. Editorial contributors assume responsibility for their published works and assume responsibility for any claims against the publisher based on the published work. Editorial content may not necessarily reflect the views of the publisher. Materials contained on this site may not be reproduced, modified, distributed, republished or hosted (either directly or by linking) without our prior written permission. You may not alter or remove any trademark, copyright or other notice from copies of content. You may, however, download material from the site (one machine readable copy and one print copy per page) for your personal, noncommercial use only. We reserve all rights in and title to all material downloaded. All items submitted to Natural Products INSIDER become the sole property of Informa Exhibitions LLC.