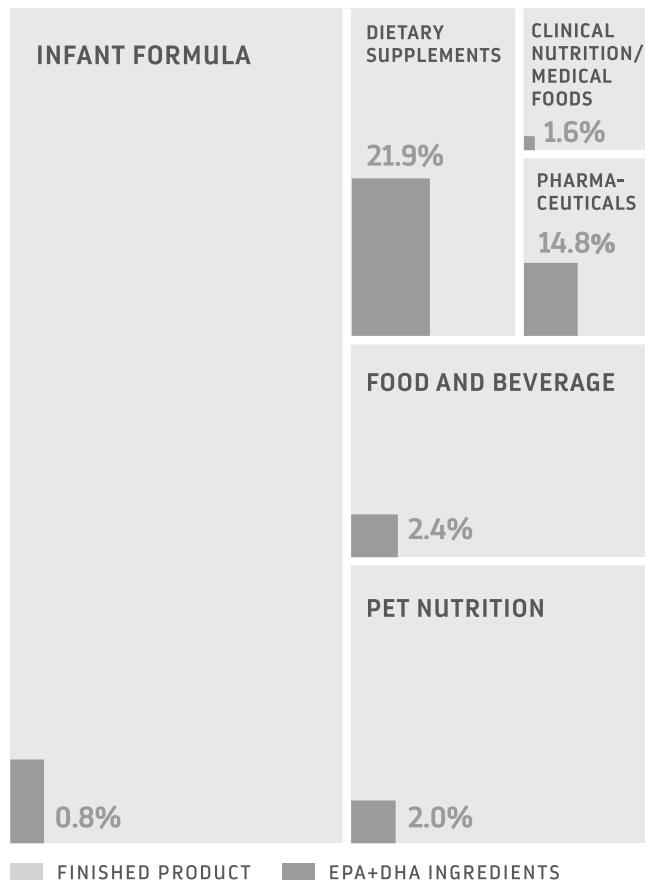


The objective of this report is to provide a detailed description of the volume and value of the omega-3 ingredient oils used in consumer products. For purposes of this document, an omega-3 oil is an oil containing EPA and/or DHA and used as an ingredient for inclusion in a consumer product. This specifically excludes oils used as ingredients for feed in aquaculture or livestock/poultry production, as well as products that contain only alpha-linolenic acid (ALA), an omega-3 fatty acid derived from plant sources. The market estimates in the report cover omega-3 oils only, and do not include other omega-3 delivery formats such as seafood or the fishmeal used as a source of both protein and omega-3s in some pet foods.

EPA and DHA-containing consumer products are used in a variety of applications. This report covers the volume and value of the omega-3 oils used in six dif-

Percentage of Total Finished Product Value Represented by Value of EPA+DHA Ingredients, by Application



The total volume of omega-3 ingredients used globally in 2023 was 124,480 metric tons (mT), representing a 1.4% increase from the 122,782 mT used in 2022.

The total market value of these ingredients was US\$2,093.9 MM, up 22.5% from the value in 2022 (US\$1,709.5 MM).

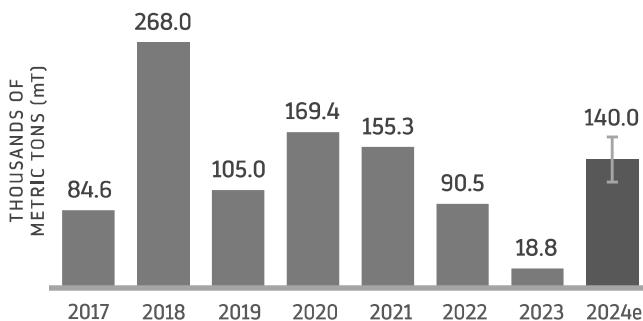
ferent categories—dietary supplements, fortified foods and beverages, infant formula, pharmaceuticals, medical foods/clinical nutrition and pet nutrition (foods and supplements). A separate biennial report, released by GOED in May 2024, details the value at the point of sale of these finished products.

The amount of EPA and/or DHA in a particular finished product application varies greatly depending on the category. For some applications, like dietary supplements and pharmaceuticals, for which omega-3 oils are the main active ingredient, the proportion is very high. For others, where other ingredients surpass omega-3 in value (like infant formula or fortified foods and beverages), the proportion is much smaller.

The growth in value in 2023 vastly surpassed the growth in volume. The global production of crude oil has remained stable for years, and the omega-3 industry relies on a relatively small but increasing share of this volume. However, the omega-3 market has historically depended on crude oils from only some specific sources, which makes it vulnerable to the variability in production volumes that is typical of natural ingredient sources.

In both 2022 and 2023, the Peruvian anchovy (*Engraulis ringens*) fishery, the largest contributor of crude oils for both aquaculture and omega-3 ingredients, was affected by climate-driven declines in catches and crude oil production was significantly lower than in the previous few years. This, combined with higher demand from aquaculture and the dietary supplement market, resulted in inventories being depleted and dramatic increases in prices. In addition to the Peruvian anchovy fishery, the price increases extended to several alternate sources as well.

Peruvian Production of Crude Oil



Source: Peru Ministry of Production (PRODUCE) and IFFO

It is important to point out that the increase in ingredient prices did not result in increased profits for the omega-3 industry in general, and ingredient manufacturers in particular. Most participants in the value chain saw the cost of doing business increased and reacted as needed to keep their businesses viable. Omega-3 products are backed by strong science and consumers have high awareness of their health benefits, so demand remains healthy, and short-term shortages will not result in the entire category (or segments of it) being phased out. The industry was able to react through several measures, including price management, the use of alternative crude oil sources and the depletion of existing strategic inventories of ingredients and finished products, technical improvements resulting in increased yield and changes in the balance of the types of products being sold. These actions maintained the integrity of the omega-3 product supply chain, and

products were kept on shelves. However, the scarcity of raw material resulted in slower growth in volume than in previous post-pandemic years.

In Peru there are two fishing seasons per year in the (larger) North Central region. Climatic conditions have normalized, and the first season of 2024 was successful, bringing a return to a more normal supply situation, and the industry is working at establishing practices to be better prepared and more resilient when, inevitably, significant production disruptions happen again.

REGIONAL OVERVIEW

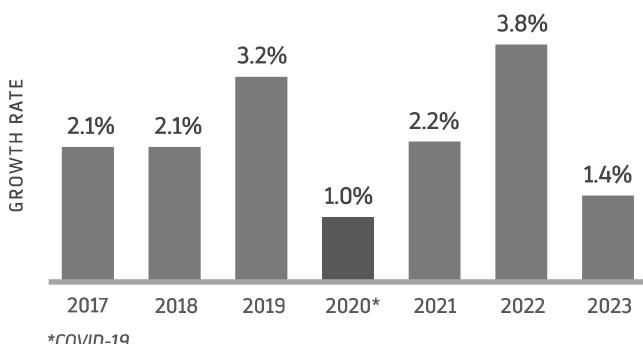
Some regions are home to a mature, stable market, while others continue to show strong growth potential. In terms of both volume and value, the largest markets are the USA, Europe, China and the Asia-Pacific region. These four markets combined represent 80.0% of the global volume and 80.1% of the value. The USA and Europe are well-established, mature markets and in a normal year only small changes in volume and value are to be expected, while the markets in China and the Asia-Pacific region are, while sophisticated, less established, so growth and changes in consumer preferences tend to be faster.

The US market by itself accounts for 35.2% of the volume and 39.1% of the global value. It remained flat in volume—in contrast, volume growth in 2022 was 4.4%—but due to higher ingredient prices, grew 22.2% in value. Growth in volume is expected to resume as oil availability returns to normal.

Europe (24.9% of the volume and 20.5% of the value) remained essentially flat in volume (0.2% contraction). A long-term trend of replacing the refined oils used in dietary supplements with concentrates and other higher-value ingredients was accelerated by ingredient shortages. The increase in value (25.3%) is almost solely explained by higher ingredient prices.

The Chinese market (11.4% of the global volume and 10.8% of the value) underwent rapid growth. Demand in China is driven by socioeconomic factors, including a rapid expansion of the affluent middle class, and an increase of women in the workforce. Several Chinese ingredient manufacturers had built important raw

Growth Rate Before and After COVID-19



*COVID-19

For a non-pandemic year, growth in 2023 was disappointing.

material inventories in preparation for a pharmaceutical expansion that has so far failed to materialize. This, combined with lesser dependency on Peruvian oils, left China better prepared to endure raw material shortages than other regions, and helped keep local ingredient prices more stable. In 2023, this market grew at 10.1% in volume and 25.3% in value. This is faster growth than in the previous two years, marking a return to normal economic growth, as the country emerged from a post-pandemic economic slowdown.

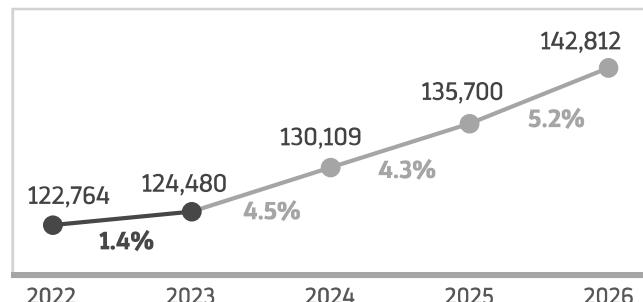
The Asia-Pacific region (8.6% of the volume and 9.7% of the global volume) contracted 4.4% in volume. The largest market in the region, South Korea, is home to a large and usually growing dietary supplement market, but economic challenges resulted in an important decline in demand. Higher prices resulted in a 12.3% increase in value.

The emerging economies of the Rest of Asia and Latin America and the Rest of the World continue to grow, while the omega-3 industry in Japan and Australasia grew more modestly in volume. All regions grew in value during 2023.

In terms of raw material sources, the largest volume continues to be attributed to common refined oils (31.9% of the total volume), followed by concentrates (20.9%), miscellaneous pet food oils (18.3%), menhaden (8.7%) and cod liver oil (5.5%). A larger share of the value (40.1%) is taken up by concentrates. Due to the additional processing required and their use in high-dose nutraceuticals and pharmaceuticals, these ingredients command a higher price. The following sources, in order of value, are refined oils (18.0%) algae (13.0%), tuna oil (6.8%) and miscellaneous pet food oils (5.7%).

The two largest ingredient categories, common refined and concentrated oils, which represent more

Forecasted Global Growth in Omega-3 Ingredient Volume to 2026 (in Metric Tons)



than half of the global volume demand, followed different dynamics during 2023. Refined oils are more directly affected by increased crude oil prices as there is less flexibility in their choice of raw materials and sales of refined oils, both as ingredients and finished products, produce lower margins. As a result, they declined globally in volume by 2.1%. Concentrates, more flexible and commanding higher margins, grew 2.4%. However, the price of refined oils followed more closely the prices of crude Peruvian oil, so these oils grew faster (56.0%) in global value than concentrates (17.1%). Additionally, pharmaceutical ingredients declined in price during 2023. These ingredients comprise a large part of the value of concentrates, and their price decline contributed to moderate the growth in value of these ingredients.

The largest share of the volume of omega-3 ingredient oils is used in dietary supplements (56.8%), followed by pet nutrition (29.4%) and infant formula (5.1%). Dietary supplements also command the largest share of the value (58.1%), but applications that require higher-value ingredients, like pharmaceuticals (13.8% of the value) and infant formula (10.6%), enjoy higher market share relative to their volume.

LOOKING AHEAD

If current demand trends were to persist and supply can meet them, the volume of ingredient oils used by the EPA and DHA omega-3 market could be expected to grow an additional 14.7% by 2026, at an average 4.7% annual growth rate.

However, because of a combination of increased competition, inflationary pressures and constraints in supply, the prices of several key oils have changed rapidly in the last few years, particularly during 2023. Production of the crude fish oils that comprise the major share of the raw ingredients is returning to normality, but it will take time to rebuild safe inventory levels, and prices remain volatile. The forecasts in this document assume that a sufficient volume of suitable crude fish oil will be produced in what remains of 2024 and the next two years, but whether this will be the case remains uncertain. If the tight supply situation is not resolved, these estimates will need considerable revision. Additional factors that may influence future growth include:

Fishery issues. As we have seen in the past—and was readily apparent during 2023—large changes in the production of any major fishery can slow the market. In the last few years, we have seen a lot of interest and development in sources that were not formerly used for

omega-3 oils, which lessens, but does not completely eliminate, this risk.

Regulatory changes. Regulatory actions can also have an effect on the accuracy of these forecasts.

Pharmaceutical approvals. The approval of omega-3 pharmaceutical products in China and the introduction of Vascepa in new geographies may alter the balance between supply and demand, although it is too soon to forecast how quickly a potential increase in demand will occur and whether the supply situation will impact the ability to fulfill the demand.

Pricing dynamics. High inflation and historically high prices for crude fish oils have resulted in higher ingredient prices and finished product brands have passed some of these price increases to the final consumer. Higher prices lead to lower discretionary spending, whose ultimate effect in dietary supplement demand remains unpredictable.

This section contains forward-looking estimates, and the volume forecasts presented throughout this report are based on the assumption that, except for corrections for foreseeable trends and events, annual growth rates for each market segment will remain more or less stable for the following three years. But unexpected events (and even some expected ones) can quickly modify these trends, and we are aware of several such events as noted above.

There is concern about whether supply will be able to meet demand in the short term. The first Peruvian anchovy

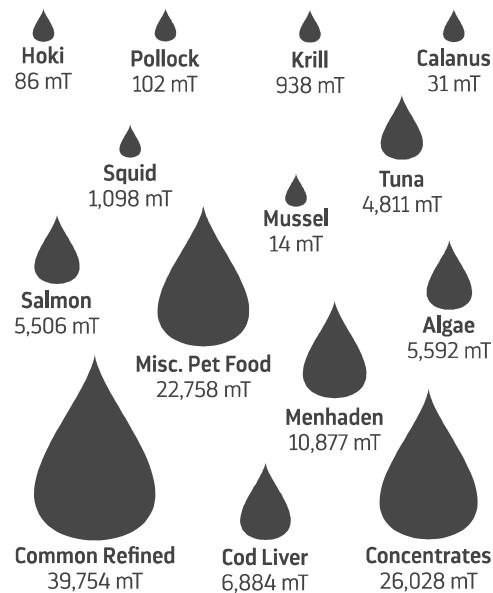
season of 2024 was normal, but existing inventories remain low, making adequate supply vulnerable. There is a real possibility that a low-production season in any important fishery may make it challenging for supply to meet demand, causing widespread, unpredictable changes in the market. Additionally, raw material prices are changing, which may affect the balance among ingredients.

Forecasts must always be interpreted with caution, but even more so under the current circumstances.

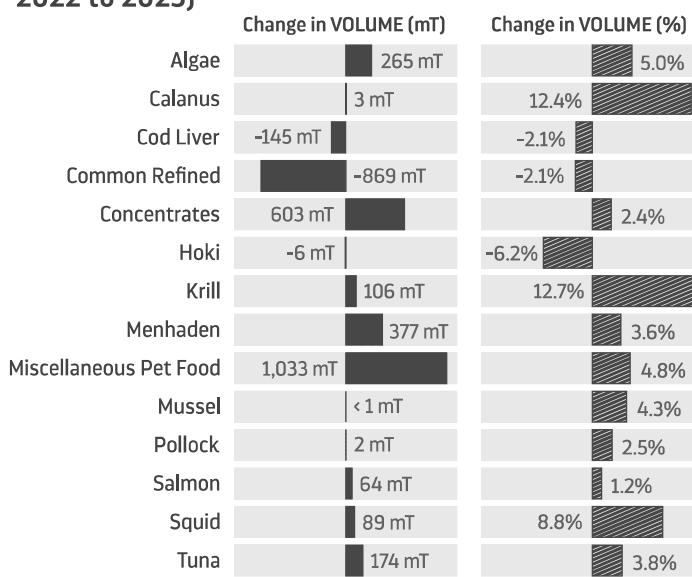
At a Glance: Omega-3 Oil Sources

The charts below detail all sources of omega-3 oil, by 2023 volume and value, as well as changes in volume and value, in absolute numbers and percentages, from 2022 to 2023.

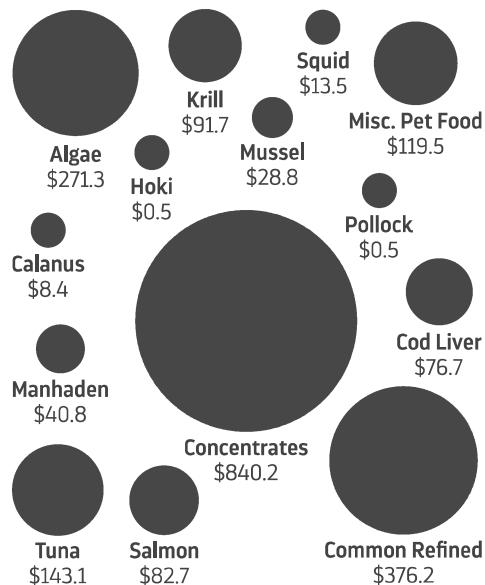
**2023 Global Omega-3 Volume by Source
(in Metric Tons)**



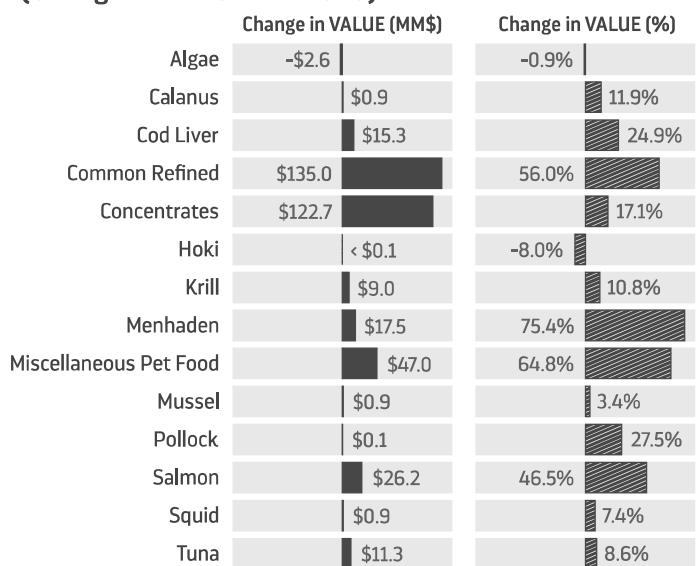
**2023 Global Omega-3 Volume Growth by Source
(in Metric Tons) and Percent Growth (Change from
2022 to 2023)**



**2023 Global Omega-3 Value by Source
(in Millions, U.S. Dollar)**



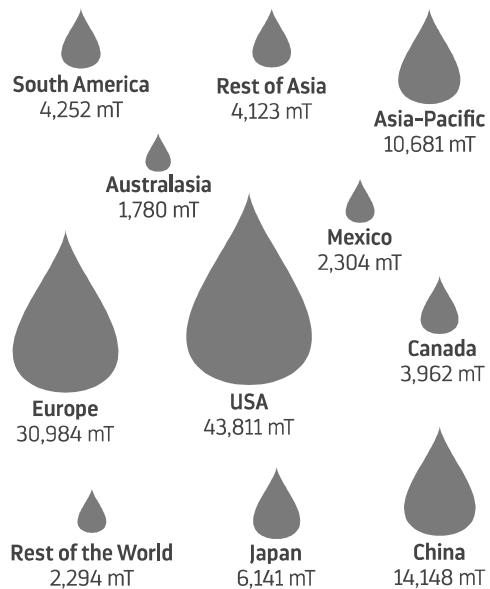
**2023 Global Omega-3 Value Growth by Source
(in Millions, U.S. Dollar) and Percent Growth
(Change from 2022 to 2023)**



At a Glance: Omega-3 Oil Regions

The charts below detail all regions where omega-3 oils are sold, by 2023 volume and value, as well as changes in volume and value, in absolute numbers and percentages, from 2022 to 2023.

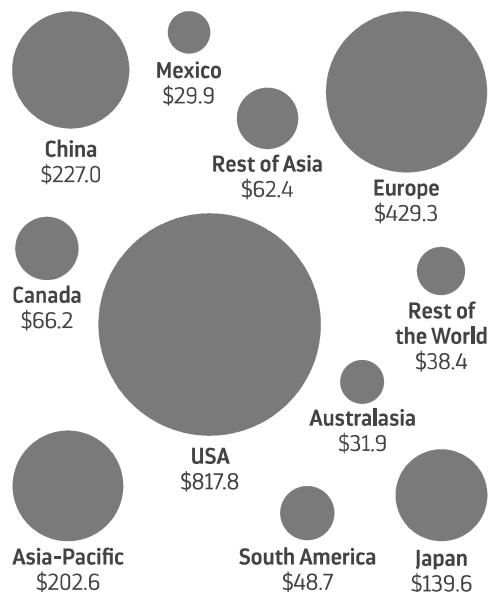
**2023 Global Omega-3 Volume by Region
(in Metric Tons)**



**2023 Global Omega-3 Volume Growth by Region
(in Metric Tons) and Percent Growth (Change from 2022 to 2023)**

	Change in VOLUME (mT)	Change in VOLUME (%)
Asia-Pacific	-492 mT	-4.4%
Australasia	37 mT	2.1%
Canada	67 mT	1.7%
China	1,294 mT	10.1%
Europe	-73 mT	-0.2%
Japan	145 mT	2.4%
Mexico	68 mT	3.0%
Rest of Asia	285 mT	7.4%
Rest of the World	202 mT	9.7%
South America	127 mT	3.1%
USA	38 mT	< 0.1%

**2023 Global Omega-3 Value by Region
(in Millions, U.S. Dollar)**



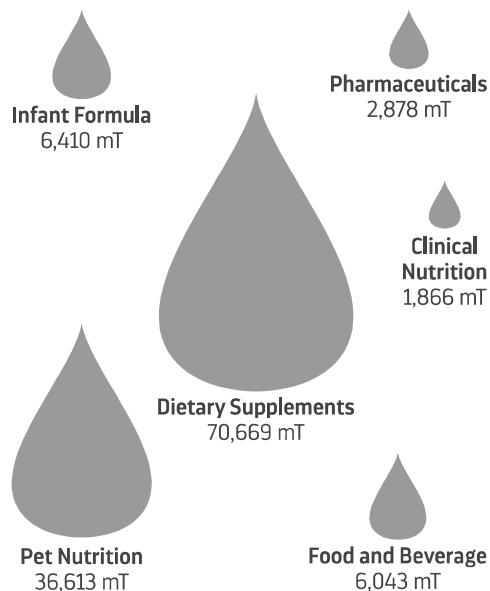
**2023 Global Omega-3 Value Growth by Region
(in Millions, U.S. Dollar) and Percent Growth
(Change from 2022 to 2023)**

	Change in VALUE (MM\$)	Change in VALUE (%)
Asia-Pacific	\$22.1	12.3%
Australasia	\$6.0	23.3%
Canada	\$15.8	31.3%
China	\$39.1	20.8%
Europe	\$86.8	25.3%
Japan	\$14.1	11.2%
Mexico	\$9.2	44.2%
Rest of Asia	\$16.8	36.8%
Rest of the World	\$9.2	31.2%
South America	\$16.5	51.2%
USA	\$148.8	22.2%

At a Glance: Omega-3 Oil Applications

The charts below detail all applications in which omega-3 oils are used, by 2023 volume and value, as well as changes in volume and value, in absolute numbers and percentages, from 2022 to 2023.

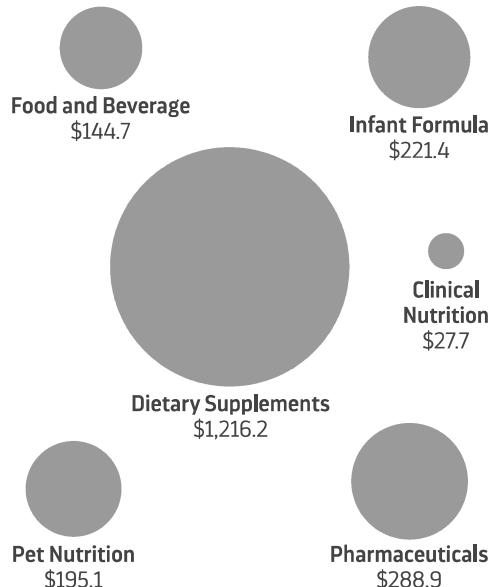
2023 Global Omega-3 Volume by Application (in Metric Tons)



2023 Global Omega-3 Volume Growth by Application (in Metric Tons) and Percent Growth (Change from 2022 to 2023)

	Change in VOLUME (mT)	Change in VOLUME (%)
Clinical Nutrition	79 mT	4.4%
Dietary Supplements	-191 mT	-0.3%
Food and Beverage	158 mT	2.7%
Infant Formula	248 mT	4.0%
Pet Nutrition	1,417 mT	4.0%
Pharmaceuticals	-12 mT	-0.4%

2023 Global Omega-3 Value by Application (in Millions, U.S. Dollar)



2023 Global Omega-3 Value Growth by Application (in Millions, U.S. Dollar) and Percent Growth (Change from 2022 to 2023)

	Change in VALUE (MM\$)	Change in VALUE (%)
Clinical Nutrition	\$6.0	27.7%
Dietary Supplements	\$286.5	30.8%
Food and Beverage	\$13.0	9.9%
Infant Formula	\$10.1	4.8%
Pet Nutrition	\$77.4	65.8%
Pharmaceuticals	-\$8.7	-2.9%

REPORT SCOPE, METHODS AND DEFINITIONS

This section details the methodology used to gather data for this report as well as the covered sources and geographies.

For the purposes of this report, an omega-3 oil is an oil containing EPA and/or DHA, used as an ingredient for consumer products, including dietary supplements, food and beverage additives, pharmaceuticals, medical foods or pet food/supplements. This specifically excludes oils used for feed in aquaculture or livestock/poultry production.

This report provides a detailed description of the size and value of the global market for EPA (eicosapentaenoic acid) and/or DHA (docosahexaenoic acid) omega-3 oils. Volume figures are provided in metric tons (mT), values in millions of US dollars (US\$ MM). The years covered with historical data are 2022 and 2023, and data are separated by source and oil type, geographic region and application.

Forecasts for the years of 2024, 2025 and 2026 are also included.

A full list of tables including numbers for all regions, sources and applications is included in the Appendix and accompanying Excel spreadsheet. The Excel document also contains a forecast generator and a user interface for analyzing individual data points.

Sources of information:

- › International trade and customs data
- › National and international catch and production statistics—Bills of Lading
- › Financial statements of public companies
- › Company financial and credit data
- › Reports and databases from national and international agencies (Eurostat, FAO, NOAA, etc.)
- › Sales data
- › Business intelligence collected from GOED members
- › GOED member interviews and feedback

Data was gathered and categorized according to the following criteria:

- › Oil type (algae, krill, cod liver oil, etc.)
- › Product category: (refined, virgin, concentrate, etc.)
- › Form (ethyl ester, triglyceride), concentration
- › World region
- › Application

CHANGES FROM PREVIOUS REPORTS

While gathering data for this report, GOED interviewed member companies whose business intelligence and feedback have been fundamental to improve our estimates. More complete information resulted in a review and adjustments to some of the 2022 estimates reported in the last Ingredient Market Report. As a result, figures for 2022 in this and the last report may differ for some market segments. We are confident that the newer estimates are more accurate.

The terminology used to describe some segments, both in the report and the accompanying data file, has been modified to better reflect market changes, or for clarity:

OMEGA-3 OIL SOURCES

Algae oil. Oil obtained from any of several species of single cell organisms

Calanus oil. Oil extracted from calanus, the common name for several species in a genus of small crustaceans

Common refined oil. Crude oil from Peruvian anchoveta and other anchovy species that has been further processed or “refined”; this is often blended with sardine and/or mackerel oils as well

Cod liver oil. Oil extracted from the liver of the Atlantic cod and other European cod species

Concentrates. Oil obtained by chemical modification to increase the level of EPA and/or DHA in the resulting oil. Concentration is defined as the amount of EPA+DHA contained in the oil, expressed as a percentage of the mass

Green-lipped mussel oil. Oil obtained from green-lipped mussel, a mollusk

Hoki oil. Refined oil obtained from hoki (blue grenadier)

Krill oil. Virgin oil extracted from Antarctic krill

Menhaden oil. Oil (crude or refined) extracted from Gulf menhaden or Atlantic menhaden

Miscellaneous pet food oil. Oil obtained from various sources, often partially refined, used specifically for pet foods and pet supplements

Pollock oil. Refined or concentrated oil extracted from the liver of Alaska pollock

Salmon oil. Virgin or refined oil extracted from any of several species of salmon

Squid oil. Refined or concentrated oil obtained from any of several species of squid

Tuna oil. Refined oil extracted from any of several commercially caught species of tuna

- › Reesterified triglycerides, a form of concentrates, were formerly described as *Triglycerides* (TG), creating confusion with the natural form of most refined oils. Starting this year, they are referred to as *Reesterified Triglycerides* (*r*TG).
- › Historically, algal oils contained DHA but not EPA. The development of newer algal strains changed that, and these oils are now available in a wider range of compositions. The labelling of algal oils, formerly described as *Algal DHA Oil*, has been changed to Algal Oil, except those used for Infant Formula, an application that requires only DHA.
- › The rapid growth of dietary supplements for pets makes it more appropriate to change the name of the application from *Pet Foods* to *Pet Nutrition*.

Geographic Regions



The global market has been divided into 11 countries and world regions



USA

Canada

Mexico

Europe

All European countries, both Eastern and Western, including Russia and Turkey

South America

All countries in South America

China

All regions under the current jurisdiction of the General Administration of Customs of the Peoples Republic of China and the China Food and Drug Administration, including Hong Kong and Macau

Japan

Asia Pacific

All Asian countries with a coast to the Pacific Ocean, except for Japan and China. Includes Korea, Vietnam, Indonesia, Malaysia, Thailand and Singapore

Rest of Asia

All Asian countries, except China, Japan, and the countries in the APAC region

Australasia

Australia and New Zealand

Rest of the World

All countries throughout the world not specifically addressed above

OMEGA-3 OIL SOURCES*

This section provides information about 14 sources of EPA and DHA omega-3 oil, as well as including an At a Glance section highlighting each source according to region and end use market, where applicable.

*Omega-3 oil sources presented in order of descending value.



CONCENTRATES

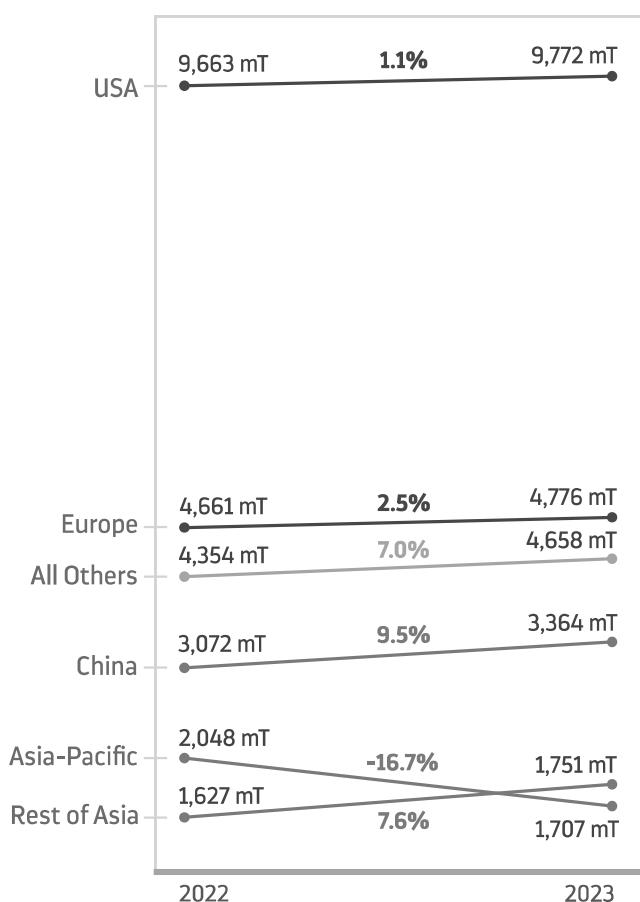
Concentrates are omega-3 oils obtained by chemical modification to increase the level of EPA and/or DHA. The starting point is usually anchovy oil, sardine oil, tuna oil and/or a mixture, although recent developments include the introduction of concentrates from sources such as algae, pollock and squid oils.

Concentrates are characterized by concentration and by form. Concentration is the amount of EPA+DHA contained in the oil, expressed as a percentage of the mass (mg/g or weight/weight). Concentrates are more commonly found in the form of ethyl esters (EE) or reesterified triglycerides (rTG), depending on the process

The total volume of concentrates in 2023 was **26,028 metric tons (mT)**, a 2.4% increase from 25,425 mT in 2022.

Value increased 17.1% to **US\$840.2 MM**.

Growth in Volume of Concentrates, by Geography (in Metric Tons)



Demand for concentrates grew in all markets, except for Asia-Pacific.

used for concentrating. Free fatty acids and other concentrate forms, sold in small volumes, are not covered in this report.

The ratio of EPA and DHA to volume can be adjusted as needed, which allows concentrates to be used in the development of applications that need either to conform to specific compositions or to deliver higher doses of EPA and DHA in fewer or smaller capsules. This makes them particularly in demand for dietary supplements and pharmaceuticals—concentrates are the only type of oil used for pharmaceutical ingredients.

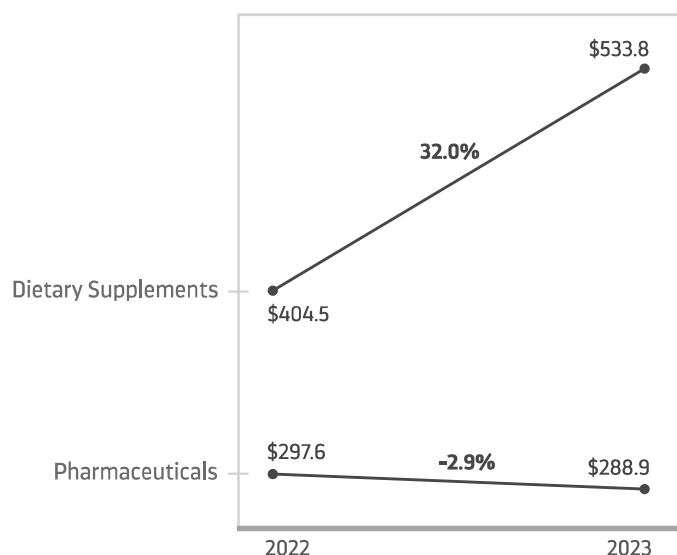
In most established markets, there is a long-term trend of switching from common refined oils to products that offer a different value proposition, particularly concentrates. The production of both refined oils and concentrates is heavily dependent on crude oils from reduction fisheries, particularly Peruvian anchovy. Both sources were affected by shortages in production and higher prices during 2023, and ingredient prices for both increased significantly. However, concentrate producers were better able to incorporate crude oils of different origins and to optimize production processes to better utilize the limited crude oil available. These changes often increased production costs, but concentrators were able to remain viable by raising prices less than refiners. Additionally, dietary supplements containing concentrates are sold with higher margins than those using

common refined oils, and brands in the largest markets, facing the possibility of shortages, often chose to protect their concentrate lines. This accelerated the transfer of market share from common refined oils to concentrates.

Demand for concentrates grew in both volume and value in all regions covered except for Asia-Pacific, whose dominant market, South Korea, was particularly affected by economic weakness during 2023.

The largest market for concentrates is the USA (37.5% of the global volume and 49.4% of the value). This market grew 1.1% in volume, as demand for dietary supplements to meet an enduring interest in natural prevention was slowed by limited supply. Due to higher prices, concentrates in the USA grew 15.8%, a lower rate than in other markets. Pharmaceuticals command a large portion of the value in this market. In previous years, growth in this segment was driven by increased demand of Vascepa. However, because of the effect of the introduction of Vascepa generics, the pharmaceutical sector in the USA contracted modestly in volume in 2023, and weakening demand and large inventories put downward pressure in ingredient pricing.

Growth in Value of Concentrates in Dietary Supplements and Pharmaceuticals (in Millions, U.S. Dollar)



Growing demand and higher pricing for dietary supplements and weakness in the pharmaceutical market are the main drivers of concentrate value.

Europe is the second largest market (18.4% of the volume and 16.6% of the value). The demand for concentrates in this market grew 2.5% in volume and 22.1% in value in 2023. These rates are lower than those observed in the previous year, but healthy for a well-established market. The growth observed in 2023 indicates that demand for concentrates in the European markets is likely driven by solid consumer interest, partially offset by a temporary correction to an abnormal supply situation.

In 2023, China (12.9% of the volume, 7.1% of the value), grew in volume at 9.5%. This is typically a fast-growing market, whose growth is fueled by socio-economic factors, the main of which is a rapid growth of an affluent middle class. This is faster than in 2022, when growth was dampened by economic uncertainty. Chinese ingredient producers built a significant inventory of raw materials, to prepare for a rapid expansion of the pharmaceutical sector that has still not materialized. As a result, China entered 2023 in a better position to face shortages than most other markets which, combined with its greater reliance on crude fish oil sources from geographies other than Peru, helped maintain this growth and kept prices more stable than in other regions. The Chinese concentrate segment grew 18.4% in value in 2023.

Concentrates in Japan, a stable market that relies on local sources and is therefore less vulnerable to fluctuations in production in other parts of the world, grew 1.5% in volume and 7.3% in value.

Demand for concentrates in the Asia-Pacific region contracted by 16.7% in volume and 7.6% in value. The dominant market in the region, South Korea, suffered economic challenges that significantly reduced its important dietary supplement category. Other markets in the region grew, but their smaller volumes were insufficient to offset the weakness in South Korea.

The developing markets all grew rapidly, particularly those of Latin America, but out of small volumes.

Most of the concentrate volume (85.0%) is used for dietary supplements, and most of the rest for pharmaceuticals, but because of their higher concentration and more precise composition specifications, ingredients

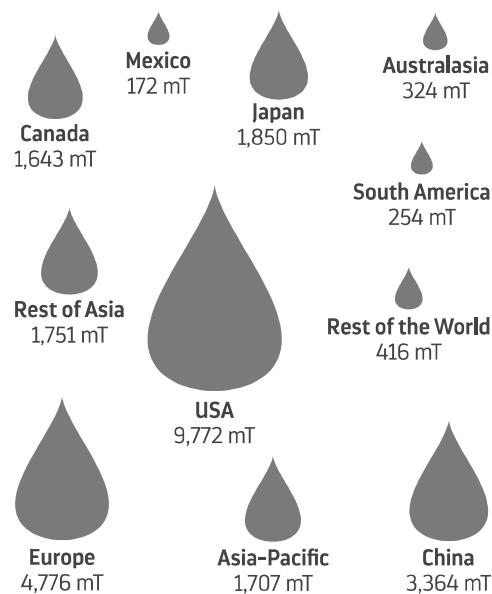
for the latter have higher prices. Dietary supplements command 63.5% of the global concentrate value, and pharmaceuticals 34.4%. Pharmaceuticals, particularly in the USA, which is the largest market, entered 2023 with sufficient inventory, and pharmaceutical ingredi-

ent prices did drop slightly during the year. Concentrates for dietary supplements grew 2.7% in volume and 32.0% in value, while concentrates for pharmaceuticals remained essentially flat (a 0.4% contraction) and declined 2.9% in value.

At a Glance: Concentrates Market

Below and on the next page are market figures for Concentrates by region and application.

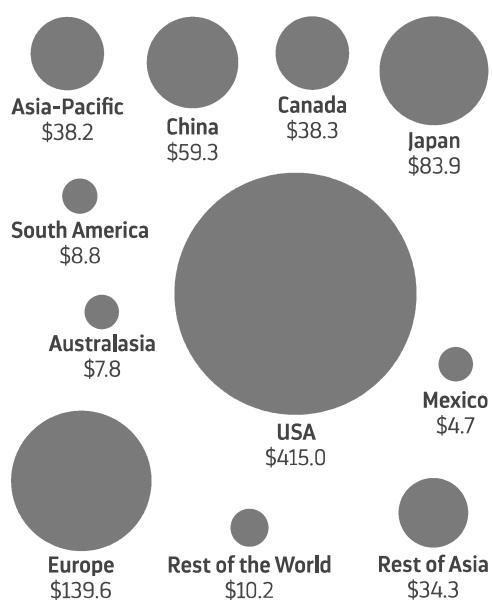
2023 Concentrates Market by Region (in Metric Tons)



Concentrates Market Volume Growth by Region (in Metric Tons) and Percent Growth (Change from 2022 to 2023)

	Change in VOLUME (mT)	Change in VOLUME (%)
Asia-Pacific	-341 mT	-16.7%
Australasia	9 mT	2.9%
Canada	68 mT	4.3%
China	292 mT	9.5%
Europe	116 mT	2.5%
Japan	26 mT	1.5%
Mexico	68 mT	65.3%
Rest of Asia	124 mT	7.6%
Rest of the World	31 mT	8.1%
South America	102 mT	66.8%
USA	109 mT	1.1%

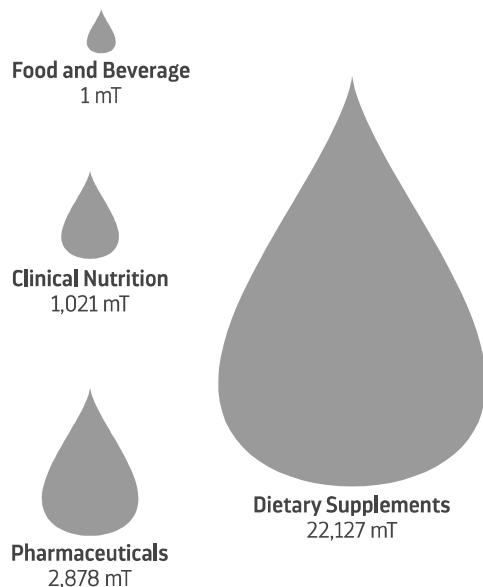
2023 Concentrates Market by Region (in Millions, U.S. Dollar)



Concentrates Market Value Growth by Region (in Millions, U.S. Dollar) and Percent Growth (Change from 2022 to 2023)

	Change in VALUE (MM\$)	Change in VALUE (%)
Asia-Pacific	-\$3.2	-7.6%
Australasia	\$1.9	31.2%
Canada	\$8.9	30.4%
China	\$9.2	18.4%
Europe	\$25.3	22.1%
Japan	\$5.7	7.3%
Mexico	\$2.0	73.7%
Rest of Asia	\$8.9	35.1%
Rest of the World	\$2.1	26.2%
South America	\$5.4	158.5%
USA	\$56.5	15.8%

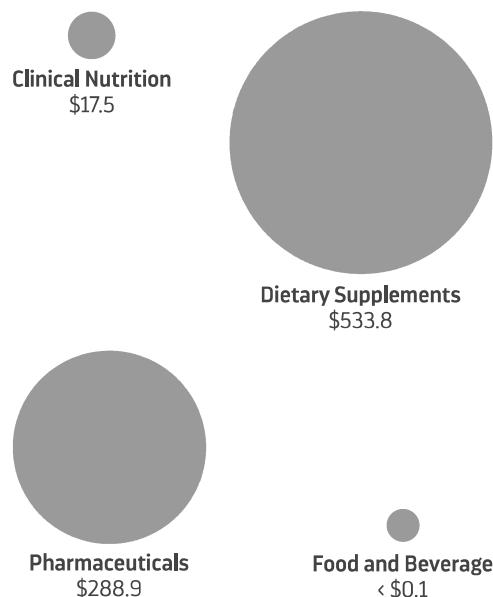
2023 Concentrates Market by Application (in Metric Tons)



Concentrates Market Volume Growth by Application (in Metric Tons) and Percent Growth (Change from 2022 to 2023)

	Change in VOLUME (mT)	Change in VOLUME (%)
Clinical Nutrition	41 mT	4.2%
Dietary Supplements	574 mT	2.7%
Food and Beverage	< 0.1 mT	-3.2%
Pharmaceuticals	-12 mT	-0.4%

2023 Concentrates Market by Application (in Millions, U.S. Dollar)



Concentrates Market Value Growth by Application (in Millions, U.S. Dollar) and Percent Growth (Change from 2022 to 2023)

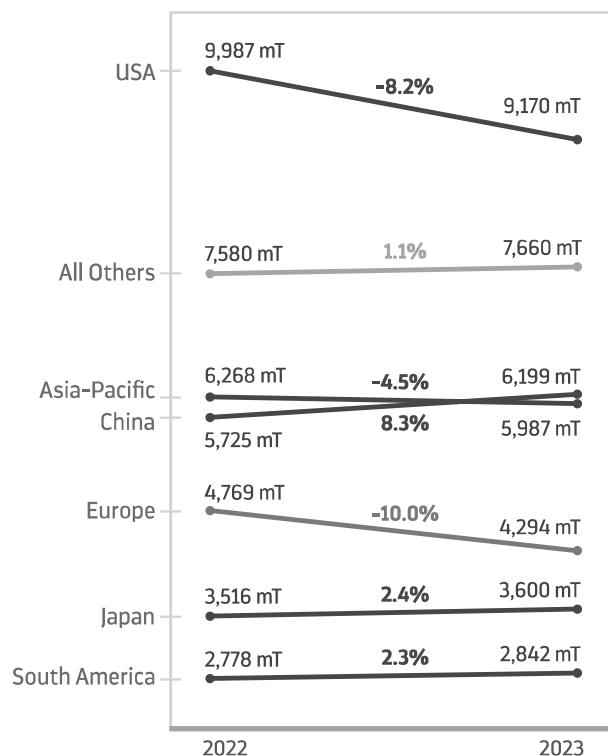
	Change in VALUE (MM\$)	Change in VALUE (%)
Clinical Nutrition	\$2.1	13.9%
Dietary Supplements	\$129.3	32.0%
Food and Beverage	< \$0.1	< 0.1%
Pharmaceuticals	-\$8.7	-2.9%

COMMON REFINED OILS

Common refined oil is defined as crude oil from Peruvian anchoveta and other anchovy species that has been further processed or “refined”; this is often blended with sardine and/or mackerel oils, among others. The common refined oil market is the backbone of the omega-3 industry and is the starting raw material for many supplement products and fortified foods.

Common refined oils originally contained 18% EPA and 12% DHA but over the years, as fishing conditions and oil compositions have changed, this fatty acid profile has evolved and these oils are now blended to contain approximately 30% total EPA+DHA in varying ratios, except in countries where the precise ratio is required by law. Refined oils from reduction fisheries are also the primary starting point in the production of concentrates.

Growth by Region (in Metric Tons)



Common refined oils, used mainly for dietary supplements, either contracted or grew slowly in all markets, except for China, where they grew significantly.

The total volume of refined in 2023 was **39,754 metric tons (mT)**, a 2.1% decrease from 40,662 mT in 2022.

Value increased 56.0% to US\$376.2 MM.

The decline in volume and growth in value are attributable to the declines in crude oil production and availability triggered by low Peruvian anchovy catches during 2022 and 2023. Pricing for crude fish oils—the raw ingredient needed for producing refined oils—from reduction fisheries are correlated, and as the supply declined, the price of crude oils from multiple sources skyrocketed. Refiners were forced to pass part of their increased costs to their clients, resulting in increased value. The increase in value should not be understood to have resulted in record profits for ingredient producers. Instead, they reflect the actions taken by refiners to keep their businesses afloat during a challenging period.

Higher prices resulted in a contraction in the demand, in several important markets. Dietary supplement brands often found it necessary to prioritize the use of the scarce oils available for products with a higher profit margin, like concentrates, instead of refined oils. Consumer interest appears to be stable, and it is to be expected that normal growth will return when the supply situation returns to normal.

The majority (88.9% of the volume and 87.3% of the value) of refined oils are used in the dietary supplement sector, for which they constitute 50.0% of the volume and 26.9% of the value, making them the first and second most important sources in volume and value

respectively. In recent years, most of the growth has been concentrated in the emerging markets, particularly in Asia where economic expansion has resulted in the emergence of a growing middle class, with disposable income and positive sentiment toward omega-3s.

In 2023, the two largest Asian markets, China and the Asia-Pacific region behaved in opposite ways. China, which has extensive refining capacity, relies on crude oils from multiple sources and started the year with large inventories built in preparation for a possible expansion of the pharmaceutical market. Because of this the country was able to maintain a growth rate of 8.3% in volume. The Asia-Pacific region saw a contraction of 4.5% in volume, due to weakness in the important South Korean dietary supplement sector triggered by inflation and a cooling in economic growth.

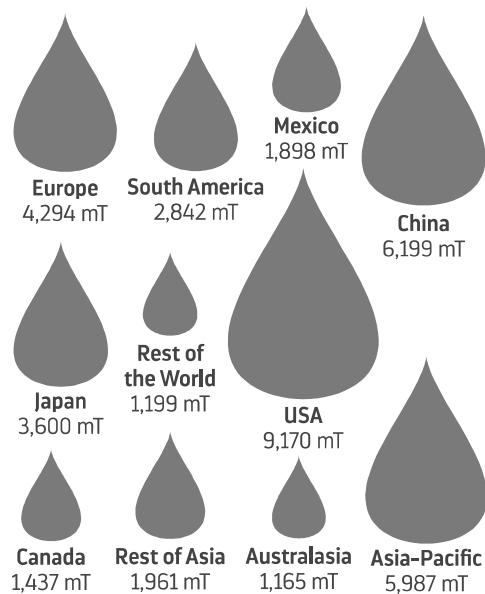
In the more established markets of the USA and Europe, the reduced supply accelerated the long-term trend of consumers transitioning from common refined oils to concentrates, resulting in contractions of 8.2% and 10.0%, respectively. Significantly higher ingredient prices resulted in important gains in value but, as mentioned previously, not in profits for ingredient manufacturers.

Canada and Australasia, two well established markets contracted slowly in volume (1.7% and 0.3% respectively). Japan, a market that depends largely on local fisheries, grew 2.4%. The emerging markets of Latin America, Rest of Asia and Rest of the World grew slowly in volume, unusual for these markets whose growth is usually faster, although out of comparatively small volumes.

At a Glance: Common Refined Oils Market

Below and on the next page are market figures for Common Refined Oils by region and application.

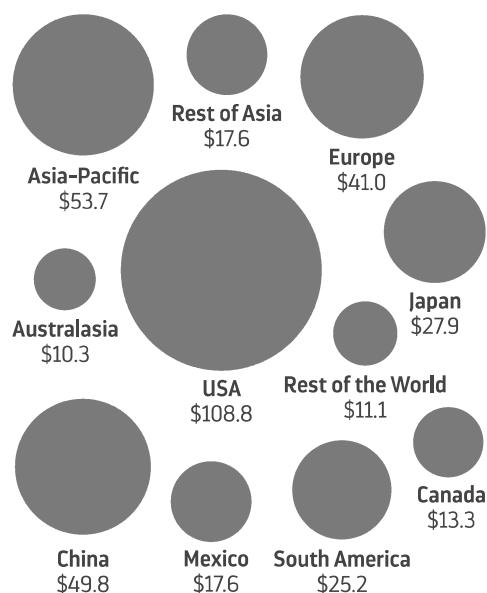
2023 Common Refined Oils Market by Region (in Metric Tons)



Common Refined Oils Market Volume Growth by Region (in Metric Tons) and Percent Growth (Change from 2022 to 2023)

	Change in VOLUME (mT)	Change in VOLUME (%)
Asia-Pacific	-281 mT	-4.5%
Australasia	-3 mT	-0.3%
Canada	-25 mT	-1.7%
China	474 mT	8.3%
Europe	-475 mT	-10.0%
Japan	83 mT	2.4%
Mexico	33 mT	1.7%
Rest of Asia	58 mT	3.1%
Rest of the World	18 mT	1.5%
South America	65 mT	2.3%
USA	-816 mT	-8.2%

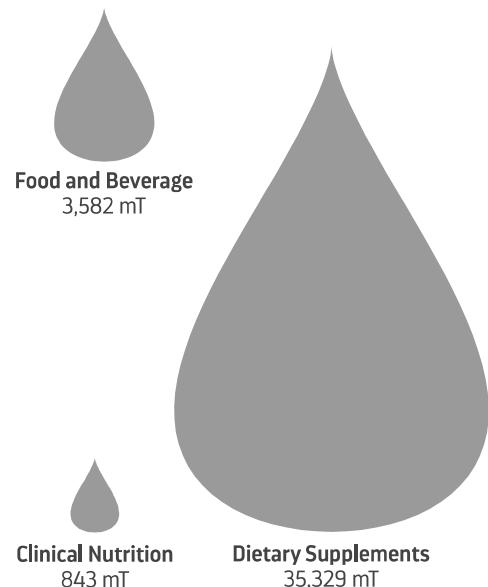
2023 Common Refined Oils Market by Region (in Millions, U.S. Dollar)



Common Refined Oils Market Value Growth by Region (in Millions, U.S. Dollar) and Percent Growth (Change from 2022 to 2023)

	Change in VALUE (MM\$)	Change in VALUE (%)
Asia-Pacific	\$18.3	51.9%
Australasia	\$3.6	53.1%
Canada	\$4.9	58.3%
China	\$15.4	44.6%
Europe	\$11.7	39.8%
Japan	\$5.9	27.0%
Mexico	\$6.3	56.0%
Rest of Asia	\$6.5	59.1%
Rest of the World	\$4.0	56.2%
South America	\$9.3	58.1%
USA	\$49.1	82.3%

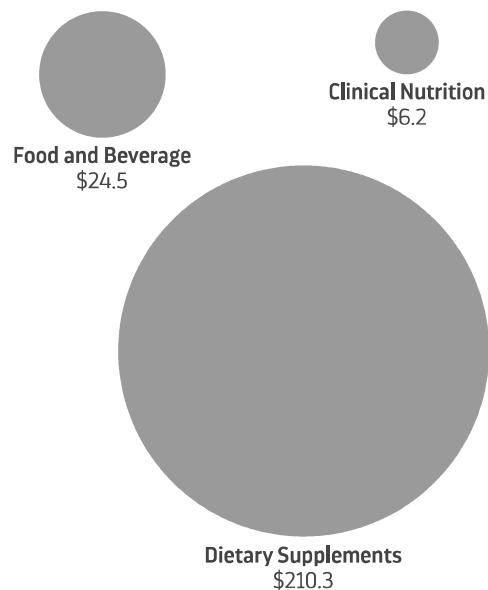
2023 Common Refined Oils Market by Application (in Metric Tons)



Common Refined Oils Market Volume Growth by Application (in Metric Tons) and Percent Growth (Change from 2022 to 2023)

	Change in VOLUME (mT)	Change in VOLUME (%)
Clinical Nutrition	37 mT	4.7%
Dietary Supplements	-979 mT	-2.7%
Food and Beverage	73 mT	2.1%

2023 Common Refined Oils Market by Application (in Millions, U.S. Dollar)



Common Refined Oils Market Value Growth by Application (in Millions, U.S. Dollar) and Percent Growth (Change from 2022 to 2023)

	Change in VALUE (MM\$)	Change in VALUE (%)
Clinical Nutrition	\$3.9	62.7%
Dietary Supplements	\$118.2	56.2%
Food and Beverage	\$12.9	52.1%

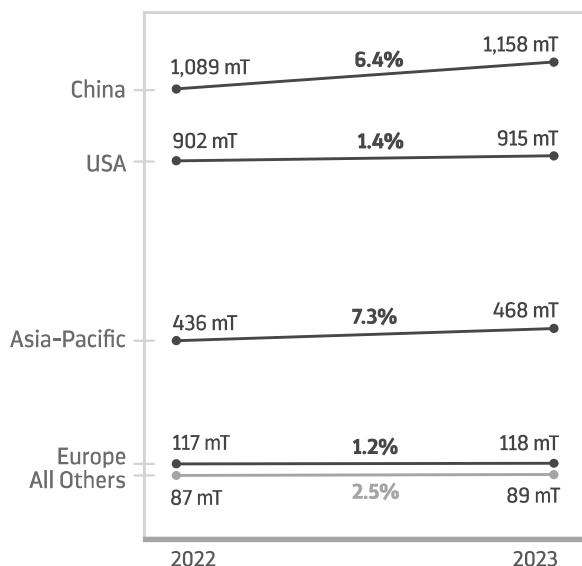
ALGAE OIL

Algal omega-3 oils are extracted from microalgal single cell organisms, which produce lipids within their cellular structure. These oils are produced mainly from *Schizochytrium*, *Cryptocodinium* and *Euglena* strains, as well as *Nannochloropsis*. Algae strains are optimized to produce a certain type of omega-3 (high EPA, high DHA, etc.), so even oils produced from the same species of algae can vary in composition. Algae can be grown in open ponds or fermented in tanks and both processes are used in the manufacture of omega-3 oils.

Because of their higher price, algal oils have historically been used for segments where the higher prices are justified: fortified infant formula and foods, and specialized dietary supplements. Until recently, interest in algal oils in dietary supplements had been restricted to specific groups of users (such as vegetarians and vegans, or people allergic to fish). However, increased production efficiency, a wider selection of algal oil options and increased consumer interest in plant-based nutrition, coupled with fish oil availability issues in 2023, have changed market dynamics for these oils.

Infant formula remains the largest application for

Growth of Algal Oil for Infant Formula (in Metric Tons)



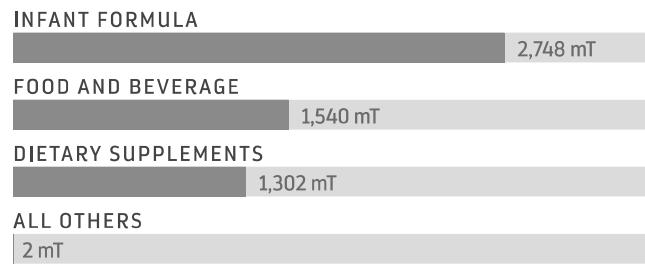
The demand for algal oils used in infant formula grew in all markets.

The total volume of algae in 2023 was **5,592 metric tons (mT)**, a 5.0% increase from 5,327 mT in 2022.

Value decreased 0.9% to US\$271.3 MM.

microalgal oils and uses 49.1% of algal oil volume, growing at an annual rate of 4.5%. Two markets that use large volumes of algal oil for infant formula are China and the Asia-Pacific region. These markets, despite declining birth rates, still have a growing infant formula segment and socioeconomic factors, including the growth of an affluent middle class and higher participation of women in the labor market, make it likely that growth will continue in the future. In recent years, algal oils have been steadily gaining market share from tuna oil, the only other source of DHA for infant formula, and it is likely that this trend will accelerate as Chinese algal oil producers enter the market. The next largest markets, the USA and Europe, where birth and breastfeeding rates are

Use of Algal Oil by Application (in Metric Tons)



The largest algal oil volume is used by infant formula, followed by food and beverage and dietary supplements.

stable, grew slowly. Demand for algal oils used for infant formula grew in all markets, but price pressures resulted in a small contraction in value.

Food and beverage, the next largest application, commands 27.5% of the global volume of algal oils, and grew 4.0% in 2023, driven in part by continued growth in the large European market, where typical products include milk and yogurt as well as spreads. An increased focus on prevention has resulted in the demand for healthy foods, including those fortified with omega-3s. Demand in the US market and the Asia-Pacific region also grew at a rapid pace, as did demand in the emerging markets of Latin America.

Algal oils have traditionally represented a small fraction of the oil volumes used in dietary supplements and have been used only for some specific market segments. In 2023, these oils comprised less than 2% of the volume (but a more significant 6.8% of the value) of omega-3

ingredients used in this sector. The major obstacle to larger representation has been their higher cost, but the introduction of more algal manufacturing capacity has led to some economies of scale and resulted in more competitive pricing. Additionally, consumer interest in plant-based ingredients and a growing variety of compositions have increased interest in algal oil dietary supplements.

Additionally, the recent shortage and higher prices of crude fish oils have accelerated interest in finding alternative sources of EPA and DHA for human consumption. Algal oils are expected to play an increasingly important role once current production limitations ease and further cost reductions are implemented to make algal oils more competitive.

This sector grew 7.3% in volume during 2023. A long-term trend towards lower prices resulted global value remaining essentially flat.