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# Reviewing the Global Aquatic Food Production and Trade: A Review

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## ABSTRACT

Aquaculture has become an increasingly important factor in food security and economic development worldwide, providing cheap protein sources to people across continents. Countries like China, India and Vietnam have increasingly relied on aquaculture not only for food security but also for foreign currency. A targeted keyword search (aquaculture, aquatic trade, blue economy, sustainability and inland and marine aquaculture) was conducted to identify pertinent studies, alongside secondary data extraction. Statistics and trade data were obtained from the FAO, the UN Statistics Division and UN Comtrade. With the increasing adoption and emphasis on the Blue Economy, aquatic food systems have become closely associated with global trade and have consequently attracted diverse investment and technological improvements. Improvements in hatchery technology, feed and aquaculture farming techniques have enabled increased production and greater diversity in species supplied to markets around the world. On the flip side, changes in consumer demand for food sources worldwide have increasingly made it important to establish diverse supply chains. This paper discusses trends in aquatic food sources by examining trade flows in aquatic foods.


**Key words:** Aquaculture, Blue economy, Global trade, Sustainability, Technology.

Aquatic foods have been part of human societies for as long as people have settled near water (Mukhia *et al.*, 2025). Early communities living around rivers, lakes and coastlines depended on fish not just for their daily meals but also for trade (Costa, 2010). Even with such a long history, the global development of aquaculture and organised aquatic food systems is fairly recent. Most of the rapid expansion occurred only after the mid-1900s, when countries began to recognize the potential of fish farming and seafood markets (FAO, 2020). Part of the reason for this shift was that capture fisheries, which had been meeting most of the world's seafood needs, began to slow down. Wild stocks could not continue supplying more fish without risking depletion, which researchers have pointed out for decades (Pauly and Zeller, 2016). Meanwhile, aquaculture began to show what was possible as technology, hatchery practices and feed science continued to improve (Naylor *et al.,* 2021). At the same time, the global population increased sharply and eating habits changed as more people sought high-quality, affordable protein sources (Godfray *et al.,* 2010).

Today, aquatic foods come from a wide mix of environments and species, from small freshwater farms raising carp and catfish to coastal ponds growing shrimp and offshore cages producing salmon. One reason the sector is often highlighted is that it generally uses less land and fresh water than agriculture and livestock and yet can produce more edible food per unit of area (Abishag *et al.*, 2019; Boyd and McNevin, 2015). This matters especially with global population estimates suggesting nearly 10 billion people by 2050 (United Nations, 2019). Along with rising production, fish and other aquatic products have also become major trade commodities.

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In fact, seafood is one of the most widely traded foods in the world today and developing countries have emerged as key suppliers, while consumption remains high in wealthier markets (Anderson *et al.,* 2018). Export earnings support millions of jobs, especially in Asia, enabling rural areas to be direct participants in the global food chain. However, given the dynamic nature of the current landscape, this paper aims to discuss the evolution of international production of water-dwelling foods and the influence of current distribution patterns on the sector. Knowledge of these factors will be beneficial to countries as they prepare for the future, including food security, sustainability and economics.

## World scenario

International trade in aquatic products encompasses a wide range of products from both marine and freshwater habitats. These products, which range from fish and seafood to aquatic vegetation and other aquatic species, form the backbone of global food security by providing much-needed protein and nutrients (Simard *et al*., 2008; Teletchea and Fontaine, 2014; FAO, 2016). Nevertheless, it is important to ensure the sustainability of this trade to promote the ecological soundness of aquatic life and the future viability of these products (Metian *et al*., 2020; Kannan and Deb, 2022). Among the key challenges associated with the regulation and control of aquatic trade is obtaining relevant trade data analysis, given the wide range of products traded from capture fisheries and aquaculture. These products can differ in species type, source, form, packaging and final modes of conservation; hence, obtaining standardized, valid data can be very challenging. Governments responsible for trade data analysis and customs regulation in their respective countries engaged in aquatic trade collect such trade data in line with the HS code system outlined in Table 1.

The trade in aquatic food products has grown significantly and expanded to many countries over the last few decades. Economic development is the primary driver of this growth, while socio-technological factors associated with globalization have also played a significant role. With the ongoing elimination of trade barriers and innovations in logistics and communication, the world has not only experienced greater economic interdependence but also a faster dissemination of cultural practices, including food habits, across borders. (Ababouch, 2023; Rowan, 2023). Globalization has added a new dimension to the seafood market for consumers, as producers can now sell to markets far away. We are no longer restricted to the aquatic products of the area where we live or where we can buy them. At the same time, factors such as rising incomes, the emergence of the middle class and urbanization, especially in developing countries, have driven market demand for imported seafood products. The seafood trade remains a major economic activity, accounting for significant export revenues, job creation and sectoral contributions to the economy. It is a crucial component of the global food system, which comprises a wide array of interconnected actors engaged throughout the value chain. (Kumar and Shivani, 2014; FAO, 2022a).

## Global production data for coastal, marine and inland aquaculture categorized by principal species group and region, 2020

Mariculture, also known as marine aquaculture, involves cultivating marine species in saltwater bodies, either across all stages of development or solely during the grow-out period. In the former case, species that depend on wild seeds carried by the sea, such as sea mussels, complete their life cycle entirely in marine environments. Conversely, marine aquaculture during the grow-out period involves producing species in land-based hatcheries, sometimes transitioning through freshwater, as seen with Atlantic salmon. Aquaculture in coastal areas is usually conducted in either land-based ponds or in intertidal areas, significantly contributing to the livelihoods, employment and economic growth of coastal communities, especially in developing Asian and Latin American countries. During 2020, world production from coastal and marine aquaculture reached sixty-eight (68.1) million tonnes, of which aquatic animals encompass thirty-five (35) million tonnes and algae encompass thirty-three (33.1) million tonnes. The breakdown of coastal and marine aquaculture production across principal species groups, categorized by region, is illustrated in Table 2.

Aquaculture production is divided into five groups: finfish, crustaceans, mollusks, other aquatic animals and algae, whereas the world is comprised of five regions: Africa, America, Asia, Europe and Oceania. Among all regions, Asia is the leading producer of Finfish and Finfish accounts for the major share of overall inland aquaculture production, at around 90.2 per cent. In coastal and marine aquaculture production, algae account for the largest share, at around 51.4 per cent, followed by molluscs and finfish, contributing 25.8 and 12.2 per cent, respectively. Finfish occupies a major share in overall aquaculture production, that is 46.9 per cent (Action 2020; Bartley, 2022).

## Global inland finfish aquaculture production in leading countries

There is a marked difference in the geographical distribution of production for various species groups within aquaculture. Marine shrimps are predominant in crustacean production from coastal aquaculture, particularly in brackish lagoons. They serve as a crucial source of export revenue for numerous developing Asian and Latin American countries. In terms of quantity, China leads the world in the production of marine mollusks, surpassing all other nations.

**Table 1:** HS code of aquaculture products (Harmonised commodity description).

| | |
|---|---|
| Live fish-0301 | Dried salted or inbrine, smoked fish-0305 |
| Fresh and chilled fish-0302 | Crustaceans, shrimps and prawns-0306 |
| Frozen fish-0303 | Molluscus-0307 |
| Fish fillets and other fish meat-0304 | Other invertebrates-0308 |

Source: UN Comtrade 2022.

**Table 2:** Global production data for coastal, marine and inland aquaculture categorized by principal species group and region, 2020.

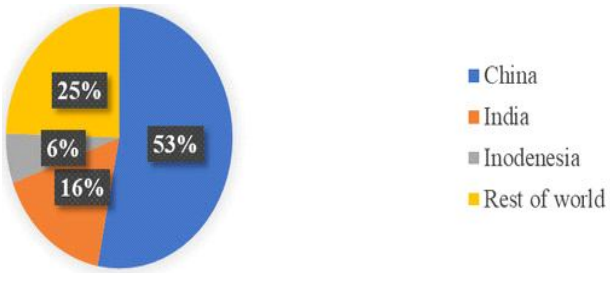
| | Finfish | Crustaceans | Molluscs | Other aquatic animal | Algae | Total |
|---|---|---|---|---|---|---|
| | | | **Inland aquaculture (Tonnes, live weight)** | | | |
| Africa | 1857209 | 2 | - | - | 150 | 1857361 |
| Americas | 1179727 | 72541 | - | 370 | 1321 | 1253959 |
| Asia | 45526599 | 4401336 | 192671 | 593161 | 62670 | 50776437 |
| Europe | 551802 | 3145 | - | 176 | 349 | 555472 |
| Oceania | 5124 | 177 | - | - | - | 5301 |
| World | 49120461 | 4477201 | 192671 | 593707 | 64490 | 54448530 |
| Share in world total (%) | 90.2 | 8.2 | 0.4 | 1.1 | 0.1 | 100 |
| | | | **Marine aquaculture (Tonnes, live weight)** | | | |
| Africa | 379322 | 7617 | 5994 | 60 | 103941 | 496934 |
| Americas | 1240969 | 1193549 | 688077 | - | 23994 | 3146589 |
| Asia | 450288 | 5549811 | 16158709 | 459185 | 34853646 | 61524239 |
| Europe | 2121867 | 418 | 578712 | 6495 | 21443 | 2728935 |
| Oceania | 95587 | 8420 | 116363 | 2844 | 10065 | 233279 |
| World | 8340633 | 6759815 | 17547855 | 468584 | 35013089 | 68129976 |
| Share in world total (%) | 12.2 | 9.9 | 25.8 | 0.7 | 51.4 | 100 |
| | | | **Total aquaculture** | | | |
| Africa | 2236531 | 7619 | 5994 | 60 | 104091 | 2354295 |
| Americas | 2420696 | 1266090 | 688077 | 370 | 25315 | 4400548 |
| Asia | 50029487 | 9951147 | 16351380 | 1052346 | 34916316 | 112300676 |
| Europe | 2673669 | 3563 | 578712 | 6671 | 21792 | 3284407 |
| Oceania | 100711 | 8597 | 116363 | 2844 | 10065 | 238580 |
| World | 57461094 | 11237016 | 17740526 | 1062291 | 35077579 | 122578506 |
| Share in world total (%) | 46.9 | 9.2 | 14.5 | 0.9 | 28.60 | 100 |

Source: UNSD (United Nations Statistics Division), 2022.

**Table 3:** Finfish aquaculture production in inland waters by leading countries.

| Country | Quantity (M.T-Million tonnes) |
|---|---|
| China | 26 M.T |
| India | 8 M.T |
| Indonesia | 3 M.T |
| Rest of world | 12 M.T |

Source: UNSD (United Nations Statistics Division), 2022.




Source: UNSD (United Nations Statistics Division), 2022.

**Fig 1:** Finfish aquaculture production in inland waters by leading countries.

Marine bivalve cultivation is a major contributor to aquaculture production in several key producer nations. Notably, New Zealand, France, Spain, South Korea, Italy and Japan have higher shares of marine bivalve aquaculture production than the world average. These countries rely heavily on marine bivalve cultivation in their aquaculture sectors. Among all nations, China ranks first in the production of finfish, crustaceans and mollusks from inland and coastal/marine aquaculture (Verdegem *et al*., 2023). In inland finfish production, China contributes 26 million tonnes, followed by India and Indonesia.

Table 3 and Fig 1 present inland finfish aquaculture production by leading countries. China is pioneering in Inland aquaculture, or freshwater aquaculture, due to its efficient use of water resources, integrated farming systems, long history of aquaculture and diverse production of aquatic species (Abishag *et al*., 2019). The major Inland finfish species grown in China and India are Carp, Tilapia and pangasius (Naylor *et al*., 2021).

Finfish aquaculture production in coastal and marine waters by leading countries is presented in Table 4 and Fig 2. In coastal and marine aquaculture production, Asia leads, followed by Europe and America. Among the Asian countries, China is leading because of its geographical diversity, large population and demand, rice and fish farming systems, government support and export-oriented production, whereas among European countries, Norway is leading because of its diverse aquaculture practices, well-established aquaculture industry backed up by research, technology and sustainable practices (Suzuki, 2021; Rocha *et al.,* 2022).

Major countries in crustacean aquaculture production are presented in Table 5 and Fig 3. Major species of coastal and marine aquaculture finfish grown are seabass, cobia and groupers in China. It produces twice as many crustaceans as India's production and the major species grown are shrimp and crab. The white-leg prawn, black tiger prawn and Chinese prawn are mainly produced. Chinese mitten crab, three-spotted swimming crab and mud crab species are produced mainly among crabs.

Table 6 and Fig 4 present the major countries in mollusc aquaculture production. China leads in mollusc production, accounting for around 15 million tonnes, which is five times the world's total, due to its aquaculture industry and dietary habits (Newton, 2021). India and China stand out as dominant players in the global fisheries industry. China, in particular, plays a significant role in the production, consumption and trade of fish feed products (FAO, 2018). By producing and consuming more than any other country, it has crowned itself a major consumer of fish (Plamoottil and Kumar, 2022).

New statistics show that China is leading the world in fish eating, with a huge gap between it and the next consumers and hence, there are even predictions of such a consumption-production imbalance by 2030 (Crona, 2020). Research has consistently ranked China and India as the world's leading countries in fish catch yields. China is the first to achieve such a remarkable share of global fish production, accounting for around 33% of total production. The fisheries sector in China has consistently received government support for aquaculture, which has ultimately been the main driver of the sector's success. Besides, China's fish production is already well beyond India's, at six times higher. This large difference highlights China's significant role in the global fisheries market and its proactive stance in supporting the development of aquaculture.

## Global aquatic product exports by species group (2020)

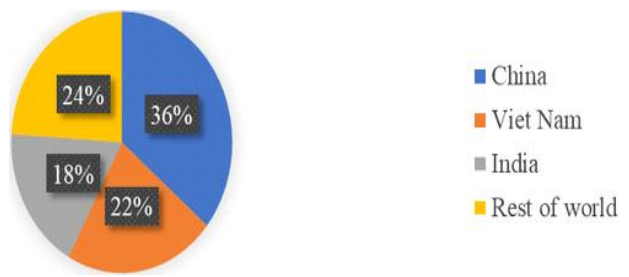
The distribution of global aquatic product exports by species group is presented in Table 7 and Fig 5. The data show the commercial value of fish and other aquatic products traded internationally, segmented by major species groups, for 2020. Finfish lead global aquatic exports, constituting 67 per cent, followed by crustaceans (22%) and molluscs (11%). Since 2013, salmonids have consistently accounted for a significant share of export revenue, reaching approximately 18 per cent in 2020. Beyond finfish, other major export groups include prawns and shrimps (16%), tunas and billfishes (10%), cods and haddocks (10%), squids and octopuses (7%) (Can *et al.,* 2020).

## Salmonoids

Salmon, particularly the farmed Atlantic variety, has become a key player in the global aquatic trade due to its remarkable growth over recent decades. Its versatility, high value and suitability for commercial aquaculture have secured its dominant position in the global market (Tveteraas *et al.,* 2021). The growing market demand for salmon exceeded that of other finfish categories in nearly all regions. Atlantic salmon aquaculture has become the most lucrative and technologically developed industry. Additionally, this sector has taken the lead in financing, organizing and implementing extensive international marketing campaigns. It has also effectively developed a logistical network to deliver fresh aquatic products to international markets through airfreight routes. Norway and


Source: UNSD (United Nations Statistics Division), 2022.

**Fig 2:** Finfish aquaculture production in coastal and marine waters by leading countries.




Source: UNSD (United Nations Statistics Division), 2022.

**Fig 3:** Major countries in crustacean aquaculture production (UNSD,2022).

**Table 4:** Finfish aquaculture production in coastal and marine waters by leading countries.

| Country | Quantity (M.T-Million tonnes) |
|---|---|
| China | 1.7 M.T |
| Norway | 1.5 M.T |
| Chile | 1.1 M.T |
| Rest of world | 4.0 M.T |

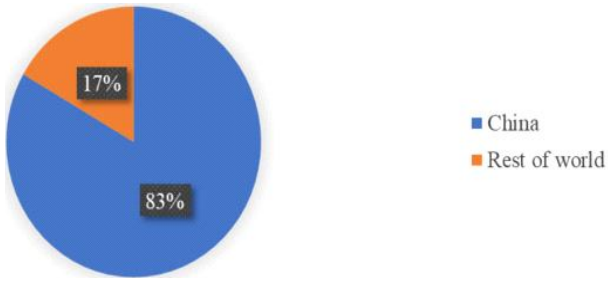
Source: UNSD (United Nations Statistics Division), 2022.

**Table 5:** Major countries in crustacean aquaculture production.

| Country | Quantity (M.T-Million tonnes) |
|---|---|
| China | 1.8 M.T |
| Vietnam | 1.1 M.T |
| India | 0.9 M.T |
| Rest of world | 2.9 M.T |

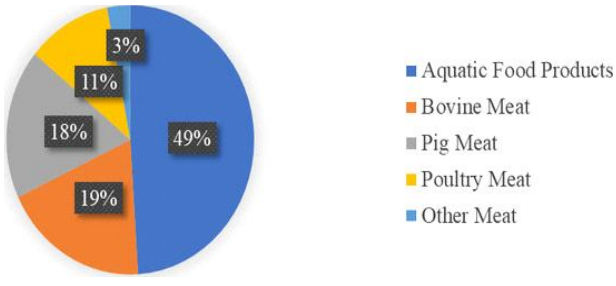
Source: UNSD (United Nations Statistics Division), 2022.

Chile dominated the global salmon export market, generating 27.6 billion USD in 2020. Salmon and trout exports accounted for 18% of all aquatic products, a substantial increase from 5.1% in 1976. Norway is the leading player in the market with its Atlantic salmon. At the same time, Chile is also a player, supplying both Atlantic salmon (mainly to the US and Brazil) and Coho salmon (primarily to Japan). The global aquatic trade also encompasses wild Pacific salmon, which we catch in the North Pacific. The salmon trade, despite the difficulties brought about by the COVID crisis, like the initial price dips and transportation problems, has shown resilience. This resilience is indicative of the constant market demand for salmon and of the industry's ability to adapt to changing conditions (Eisenberg, 2023).




Source: UNSD (United Nations Statistics Division), 2022.

**Fig 4:** Major countries in molluscs aquaculture production (UNSD, 2022)




Source: UNSD (United Nations Statistics Division), 2022.

**Fig 5:** The value of global aquatic and meat exports in 2020 (Miao and Wang, 2020).

**Table 6:** Major countries in molluscs aquaculture production.

| Country | Quantity (M.T-Million tonnes) |
|---|---|
| China | 15 M.T |
| Rest of world | 3 M.T |

Source: UNSD (United Nations Statistics Division), 2022.

### Tunas and bill fishes

The worldwide trade of tunas, bonitos and billfishes amounted to 14.6 billion USD, accounting for 10% of the overall value of aquatic product exports during 2020. The share in global trade remained steady for years due to enduring consumer demand for tuna (Sinaga *et al*., 2026). The tuna trade encompasses two main categories of commodities. Processed and preserved variety for conventional meals and fresh, high-quality tuna sought for sashimi and sushi dishes. Sashimi and sushi dishes use bigeye and bluefin tuna, whereas yellowfin, skipjack and albacore are used as primary materials in processed product manufacturing. Thailand is a global leader in tuna processing as its industry is fueled by procuring raw materials from fishing fleets and delivering them directly to Thai ports. This robust processing sector significantly contributes to international trade (Jeffery *et al.*, 2023). While the United States remains the top importer of processed tuna from Thai ports, tuna processing industries also thrive in other regions of Asia, Africa and Latin America. The market for raw materials and processed tuna products in Europe was a special opportunity for Ecuador (Sasidharan *et al*., 2023). The tariff structures and duty exemptions of the dominant markets, along with import limitations, have a major impact on trade patterns in the processed tuna sector. These issues are still most essential in international trade negotiations. When it comes to sushi and sashimi, Japan remains the king. It usually depends on the fishing vessels of Taiwan and South Korea to get loins and tuna. The supply of Taiwan and South Korea is bolstered by re-exported imports from Thailand (Telesca, 2020).

### Codes and haddocks

Whitefish is a term applied to many species that are either ocean-caught or farmed and the oceans are mainly harvested by fleets from Russia, the European Union, the US, Iceland and Norway. The total share of these countries in the global catch is the biggest. (Witteveen 2021; Apenten and Vieira, 2022). The European Union is the leading player in the import business of ocean-caught groundfish. China, however, has taken a different approach in the global

**Table 7:** Global aquatic product exports by species group (2020).

| Finfish (67%) | | Crustaceans (22%) | | Molluscs (11%) | |
|---|---|---|---|---|---|
| Other finfish | 22% | Shrimp, prawns | 16% | Squids, cuttle fishes, octopuses | 7% |
| Salmons, trouts, smelts | 18% | | | | |
| Tunas, bonitos, billfishes | 10% | | | | |
| Codes, hakes, haddocks | 10% | Other crustaceans | 6% | Other molluscs and aquatic invertebrates | 4% |
| Other palagics | 7% | | | | |

Source: UNSD (United Nations Statistics Division), 2022.

market, processing and re-exporting this raw material. Although groundfish and other whitefish exports account for only about 10% of the total value of aquatic product exports, a large part of this figure remains buried in trade statistics, classified under the general term "miscellaneous species". This obscurity hampers the attainment of a fully accurate global picture of whitefish trade (Matschiner *et al*., 2022). The southern provinces of China have emerged as the most important areas for tilapia farming, making them the largest suppliers to the global market. However, their leading position is not unchallenged. Southeast Asian and Latin American producers are gradually capturing the US market, which has been among the toughest for them. Furthermore, factors such as US import tariffs, pandemic-related disruptions and changes in land use are expected to lead to a considerable reduction in China's tilapia market share. On the other hand, Vietnam is the undisputed king of pangasius production and export. Although the US was its largest customer, China has recently become Vietnam's leading market for pangasius exports. (Miao and Wang 2020).

### Pelagics

Small fish, however, make a big difference: Among these, sardines, herring and mackerel, along with anchovies, are the underwater giants of global capture fisheries always to be found on top of the lists for exporters and catch amounts in the leading fishing countries like Morocco, the European Union, the UK, China, Russia, Norway and Japan. Individually, these fish might not be that expensive; however, together, they accounted for a huge 7% of the total value of the aquatic products trade in 2020 (Gardic *et al*., 2022). Since stocks of small pelagic fish can flow from one country to another, their presence in a given area largely depends on weather conditions, leading to unstable supply and price fluctuations. Nevertheless, the fish remain very important to markets such as Nigeria, China, the US, the European Union, Japan and Egypt, where they are transported *via* various trade routes. Besides, fish consumption is not the only way; small pelagic fish are also processed into fish oil and fishmeal, which are then exported. The anchoveta, a seabird-like anchovy from Peru, is the primary raw material for these products. In fact, the demand for fishmeal is largely driven by China, as the country, being a major player in aquaculture, accounts for most of it (Sekadende *et al*., 2020).

## Prawns and shrimp

For millennia, shrimp and prawns have been very important in the international aquatic trade. However, in modern times, shrimp is mainly produced on a large scale, primarily in Latin America, East Asia and Southeast Asia. Most of this production is exported to wealthy markets in North America, Europe and Japan for consumption (Miao and Wang, 2020; Yang *et al*., 2021). Warm-water shrimp has become the main seafood served in the USA and Japan. The supply chain of these markets is dominated by Indian, Thai, Indonesian and Vietnamese producers (Khanal and Deb, 2022). The demand for shrimp in Europe is met by a combination of warm-water species from Asia and Latin America, cold-water catches mainly from Greenland's fisheries also contributing. Although the US and Japan remain the major markets for shrimp, growth will be limited, while new Asian economies like China are increasing their demand for shrimp. This will most likely be a trend that continues and perhaps even takes a larger share of the global shrimp supply (Shuquan and Buiad, 2020). From $1.2 billion in 1976, shrimp and prawn exports have reached an astronomical $24.7 billion by 2020. Despite this significant rise in value, their share in the global aquatic product export market has changed little, remaining around 15-16% for decades, indicating that the market for aquaculture products has grown alongside the increased acceptance of shrimp and prawns.

## Squids and octopus

Cephalopods, a molluscan class comprising octopus, squid and cuttlefish, are predominantly sourced from wild catches. China, Morocco, Peru and India are the major suppliers of cephalopods. The primary markets for imported cephalopods are located in East Asia (China, Japan and South Korea) and Europe (particularly Italy and Spain). Cuttlefish and squid remain retail staples often sold as processed or preserved items. At the same time, octopus has become a trendy restaurant ingredient, fuelled by the rise of Hawaiian poke and Spanish tapas. (Alvarez, 2021; Alvarez, 2022). These are significant contributors to global aquatic exports (7%) with an export value of 10.2 billion USD. Over time, demand for cephalopods in international trade has steadily increased; however, the sustainability of cephalopod supplies is jeopardized by inadequate management practices, which have fuelled price increases over the past few years (Pita *et al*., 2021).

## Molluscus and others

Globally traded bivalve molluscs, such as clams, oysters, scallops and mussels, are primarily cultivated in Europe, North America, China and Chile, with Chile leading in production. These aquatic foods are most desired by the European Union, the United States, China and South Korea (Tan *et al*., 2020). The demand for bivalves remained consistent over time, with these species enjoying a favorable view as consumers value them for their health and sustainability credentials. Bivalve mollusks, like scallops, oysters, mussels and clams, were a significant contributor to global aquatic trade in 2020, with exports reaching USD 4.3 billion (4%) (FAO, 2022b).

## The value of global aquatic and meat exports in 2020

This shows the dominance of aquatic exports, which accounted for almost half (49%) of total trade value, underscoring the role of seafood in international trade. It also exposes changing

trade scenarios worldwide, such as the rise in demand for aquatic exports over terrestrial meats. Furthermore, it points out the possible consequences of aquatic trade to the food security of the world population, economic changes and the sustainability of both aquatic and terrestrial food production systems (Boyd *et al*., 2022; Miao and Wang, 2020).

### Blue transformation

The blue transformation project, which has the backing of the FAO's strategic framework and the 2021 fisheries and fish farming declaration for food security, shall enhance the impact of aquatic food production, thereby enabling achievement of the SDGs. Blue Transformation strives to provide.

#### An equitable future

Producing aquatic food sustainably can support the rights and livelihoods of communities that rely on it, thereby achieving fairer outcomes for everyone.

#### A pledge for resilience

Sustainable aquatic food production helps address socio-ecological impacts on aquatic resources, such as biodiversity loss or the climate crisis.

#### A practical solution

Sustainable Harvesting and aquatic food production not only give people access to affordable, nutritious food but also result in very low emissions and relatively minor environmental impacts.

#### A healthy solution and a lifestyle choice

They are also a major source of vitamins and minerals and healthy diets, all at the same time, with very low environmental impact and a very low environmental footprint.

The blue transformation is the tactic of aquatic systems to produce food, improve diets and perform other roles in the environment and human life. It recognizes the pivotal position of the fish supply sectors, as they are the source of jobs, the main economic force, a social elevator and a driver of nature restoration, all of which together account for the Sustainable Development Goals (SDGs) (Garlock, 2020; Ahern, 2021; Naylor, 2021).

## CONCLUSION

In conclusion, the exploration and utilization of underutilized wetlands to sustainably increase fish production and, hence, economic growth, along with tackling farmers' socio-economic issues, are necessary steps. The implementation of modern aquaculture systems, their promotion and adoption, along with the provision of improved management policies and upgraded infrastructures, are all very important factors in the sustainable development of aquaculture. There are numerous instances of how China, India and Vietnam successfully fused aquaculture development with poor people's growth strategies; these experiences also show that international trade in aquaculture products can be highly beneficial. On the other hand, it is very important to acknowledge the major contribution of small-scale extensive farmers to maintaining local food security and to support export-oriented production so that economic opportunities can be further enhanced. If these strategies are followed, it will be possible to achieve sustainable growth in the aquaculture sector while simultaneously tackling food security and poverty reduction.

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#### Ethics and permit approval statement

This study did not involve any experiments on human participants or animals. Therefore, ethics approval and permits were not required.

#### Permission to reproduce material from other sources

This manuscript builds on previous research and literature, but no direct reproduction of material from other sources has been used. Proper citations and references have been provided to acknowledge the original works.

#### Author contributions

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Writing-review and editing: Shaik Reshma Sulthana, Snehal Mishra, Ganeshkumar D. Rede.

#### Data availability statement

The data supporting the findings of this review are derived from publicly available sources as detailed in the reference section of this manuscript. Specific datasets can be accessed through the following means: https://doi.org/10.4060/cc0459en; https://www.fao.org/documents/card/en?details=cc0461en.

#### Conflict of interest

The authors declare there are no competing interests.

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