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SYSTEMATIZATION OF PRODUCTION-EXPORT FLOWS AND CONSUMER PREFERENCES IN THE GLOBAL FISH PRODUCTS MARKET SEGMENT

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The article presents a comprehensive study of the global fish products market, emphasizing the systematization of production and export flows and the detailed analysis of consumer preferences across various world regions.

The research outlines the dynamics and trends in the development of the fish and seafood industry, identifying the leading producer and exporter countries such as China, Norway, Vietnam, Chile, and the United States. Their specialization, export strategies, market shares, and positions within regional and intercontinental trade flows are examined in depth. A typological classification of global regions is developed based on the prevailing forms of fish product consumption (fresh, frozen, canned, smoked), the dominance of certain species (salmon, tuna, whitefish, shrimp, etc.), pricing tiers, and culturally conditioned culinary practices.

The study also explores how globalization processes, supply chain digitalization, environmental challenges, and geopolitical instability are reshaping international fish trade logistics. Particular attention is paid to the growing influence of sustainability criteria on consumer behavior – including the demand for environmentally certified aquaculture products, traceability systems, and eco-labeling initiatives. The article introduces an analytical model for the systematization of the "producer–exporter–consumer" flow, providing a practical framework that can be adapted for developing and optimizing national strategies in the area of fish product foreign trade.

The findings may serve both as a conceptual basis for further academic research and as a tool for policymakers and market stakeholders involved in fishery economics and trade regulation.

Keywords: fish products, global market, production, export, consumer preferences, logistics, aquaculture, trade flows, sustainability.

Problem statement. The global fish products market demonstrates steady growth dynamics, driven by both demographic shifts and the structural transformation of the global agri-food sector. In the context of increasing competition

among producing countries, escalating environmental challenges, and shifting consumer priorities, the issue of a systematic analysis of production-export flows combined with the behavioral characteristics of end consumers becomes particularly relevant. Despite the significant economic potential of fish product trade, analytical fragmentation remains regarding the coordination of logistics routes, the evolution of product forms at the export stage, and the influence of cultural and price factors on the market demand structure. The lack of a unified model for summarizing such data complicates effective strategic planning at both national and international levels.

Analysis of recent research and publications. The issues of global fish product production and trade are actively studied on an interdisciplinary level. Reports by [1], [2], and reveal macroeconomic and environmental aspects of the market's functioning, but they mostly focus on specific countries or product groups. The works of authors such as [3], [4], and [10] provide important empirical assessments of price trends and consumer shifts, yet often overlook regional specifics and transformations in logistics systems. In Ukrainian academic discourse, applied publications dominate, focusing on aquaculture or food security issues, while global positioning in the fish products market has not been systematically addressed. This highlights the need for an analytical approach that combines production-export flows with the modeling of consumer preferences.

Objective. The aim of this study is to develop a conceptual model for systematizing production-export flows and consumer preferences in the global fish products market segment. To achieve this goal, the following tasks must be fulfilled: to analyze the current structure of global fish production and export by country and product group; to identify key types of consumer strategies in various regions of the world based on product form, price, and origin; to determine the links between production chains and logistics routes; and to propose a generalized model of interaction among the producer, exporter, and end consumer.

Research results. The global fish products market is shaped by dozens of countries that differ significantly in production scale, technological base, specialization, and orientation toward domestic or international demand. According to the latest [1] statistical reviews (2022), the total global production of fish and seafood exceeded 180 million tons, with more than 50 % coming from aquaculture.

The leading producer countries include (Table 1):

− China, the undisputed global leader in aquaculture, producing over 60 million tons annually. While the majority of products are consumed domestically, significant volumes are also exported to Southeast Asia, the EU, and the USA.

− Indonesia, which has a strong marine fishing sector and shrimp farming industry. Its export flows are directed toward Japan, China, the USA, and the Middle East.

– India, specializing in freshwater species (pangasius, rohu) and frozen shrimp. It is one of the largest suppliers to EU countries.

– Norway, a leading European exporter, especially in the salmon segment, supplying over 50 % of the world's salmon exports. Strong logistics and branding strategies have enabled Norwegian companies to hold prominent positions in the EU, Chinese, and US markets.

– Chile and Peru, leaders in the production of fishmeal and canned seafood, with export-oriented models.

– The USA and Canada, which combine the development of oceanic fisheries (cod, tuna, salmon) with large-scale processing and domestic consumption.

Table 1. **Leading Countries by Fish and Seafood Production Volume ([1], 2022)**

Country	Total Production Volume (million tons)	Main Specialization	Export Destinations
China	60+	Aquaculture (carp, seafood)	Southeast Asia, EU, USA
Indonesia	15–17	Marine fishing, shrimp	Japan, China, USA, Middle East
India	12–14	Freshwater fish, frozen shrimp	EU, USA, China
Norway	4–5	Salmon, cod, cold-water fish	EU, China, USA
Chile	3–4	Salmon, fishmeal, canned products	Japan, USA, Brazil
Peru	3–4	Anchovy, fishmeal, feed products	China, EU, Latin America
USA	5–6	Tuna, cod, salmon, oceanic fisheries	Canada, Japan, South Korea
Canada	1.5–2	Marine fish, mollusks, processing	USA, China, Japan

The presented data highlight the high concentration of fish production in Asian countries, which account for more than half of global output thanks to large-scale aquaculture and favorable natural and climatic conditions. At the same time, countries in Europe, North and Latin America form specialized export niches – from salmon to fishmeal – focusing on added value, processing, and certification. This confirms that success in the global market is determined not only by volume but also by the quality characteristics of the product, the ability to meet standards, and an effective marketing strategy.

At the regional level, several models can be distinguished (Figure 1), namely:

– The European model, based on high added value (eco-certification, quality control, labeling);

– The Asian model, focused on production scale, price competitiveness, and diversified logistics routes;

– Latin America, as an example of effective raw material export specialization with an emphasis on primary processing products;

– North America, a mixed-profile market combining high domestic demand with active participation in export markets.

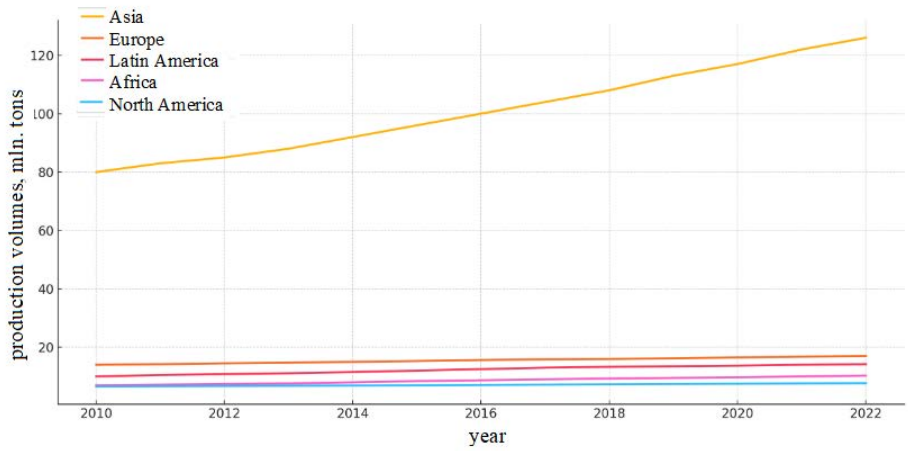

Fig. 1. **Dynamics of Fish Product Production by Region, 2010–2022**

Thus, the structure of the global fish production market is dynamic and geographically heterogeneous. For successful integration into the global supply chain, countries must consider not only production volumes but also their ability to adapt logistically, implement certification, build recognizable brands, and comply with international standards.

Consumer demand for fish products is shaped by a number of factors: income levels, the state of logistics infrastructure, dietary habits, degree of urbanization, environmental awareness, and more. Taking into account current market transformations, it is appropriate to distinguish several types of consumer preferences based on key criteria:

1. By product form. In developed countries with efficient logistics infrastructure (European Union, Japan, the USA), there is a prevailing demand for fresh and chilled fish, which is primarily distributed through retail chains and the HoReCa channel (Figure 2). In contrast, countries with limited access to refrigeration or unstable transport systems (Eastern Europe, Latin America, some regions of Africa) show a predominance of frozen fish, which is more suitable for long-term storage.

Canned fish (tuna, sardines, mackerel) maintains steady popularity among all consumer groups due to its long shelf life. Smoked, dried, and fermented products are characteristic of the culinary traditions of East Asia, Scandinavia, and parts of Eastern Europe.

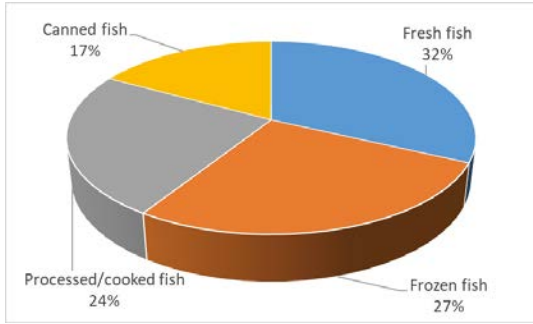

Fig. 2. **Demand Distribution for Main Fish Product Formats in EU Countries, %**

2. By price segment. The premium segment includes live or chilled high-quality fish (salmon, sea bass, black caviar), marketed in countries with high standards of living (EU, South Korea, Gulf countries) (Table 2). The mid-range segment consists of moderately priced products–fillets, frozen tilapia, pangasius, cod–popular in the USA, China, and countries of Eastern and Central Europe.

Table 2. **Typical Consumer Preferences for Fish Products by Region**

Region	Predominant Product Form	Price Segment	Key Consumer Expectations	Market Characteristics
European Union	Fresh, chilled, smoked	Mid – premium	Quality, certification (MSC, ASC), local origin, traceability	Developed logistics, retail dominance, strong regulatory framework
North America	Fresh, filleted, frozen	Mid – premium	Convenience, high nutritional value, ready-to-eat	High demand for protein-rich fish (salmon, tuna), active HoReCa segment
Southeast Asia	Dried, fermented, live, seafood	Economy – mid	Affordability, national culinary tradition, fish as a staple food	High per capita consumption, dominance of local markets
China	Frozen, fresh, filleted	Mid	Affordable price, safety, eco-friendliness, growing focus on certification	Largest domestic market, rapid growth in aquaculture demand
Japan	Sushi-grade, live, chilled	Premium	Reliable supply, freshness, suitability for raw consumption	Strict quality standards, large seafood import volumes
Middle East (UAE, Saudi Arabia)	Chilled, frozen, filleted	Premium	Halal, quality, branded labeling, imported products	Highly import-dependent, strict certification requirements
Latin America	Frozen, canned	Economy – mid	Price, long shelf life, accessibility	Local production presence, unstable logistics
Sub-Saharan Africa	Frozen, canned	Economy	Cheap, nutritious, long shelf life	High import dependence, limited cold chain coverage
Scandinavia	Smoked, fermented, chilled	Mid – premium	Local origin, traditionality, ecological purity	Emphasis on national traditions, active support for sustainable consumption

Note: Based on aggregated data from [1], [5], [5], and marketing reviews from 2020–2023.

Economy-segment products (canned fish, offal, mince, semi-processed items) dominate in the diets of populations with limited financial resources, particularly in South Asia, Africa, and certain regions of Latin America.

3. By Origin and Ethical Consumption Criteria. In countries with high levels of social and environmental responsibility, demand is growing for fish products that comply with the principles of sustainable development. Consumers prioritize certifications of sustainable origin (MSC, ASC), absence of antibiotics, adherence to bioethical principles in aquaculture (especially for farmed products), and local sourcing that reduces environmental footprint and supports local communities.

4. By Consumer Type. For households, key decision factors include affordability, shelf life, and cooking convenience. The food service sector (HoReCa) prioritizes standardized quality, appealing presentation, and reliable supply. Health-conscious consumers seek high nutritional value, low fat content, and high protein (mainly tuna and cod). Meanwhile, flexitarians, vegetarians, and eco-consumers increasingly focus on eco-labeling, product traceability, and the social responsibility of producers.

Thus, the segmentation of consumer preferences in the fish product market is a crucial precondition for effective trade and marketing strategies. Understanding consumption specifics in target regions enables producers and exporters to tailor relevant offerings, improve price competitiveness, and promote their products in a globalized and diversified market.

Structure of Production-Export Flows and Logistics Models in the Global Fish Market.

Global production and export flows of fish products are shaped within globalized agri-food chains that cover all stages–from farming and harvesting to primary processing, transportation, value-added processing, storage, and distribution. A key feature of the fish industry is its high sensitivity to temperature regimes, shelf life, and storage conditions, which heavily influence logistics solutions and infrastructure requirements.

Table 3 illustrates two key models of international fish trade.

The "South → North" model represents a traditional division of labor, where countries of the Global South supply raw materials to developed nations. In contrast, the "East ↔ West" model highlights China's growing role not only as a producer but also as a re-exporter that processes products for other markets.

Table 3. **Geographical Structure of Global Export-Logistics Flows of Fish Products**

Main Model	Flow Direction	Exporting Countries	Importing Countries	Description
South → North	One-way	Indonesia, India, Peru, Vietnam	EU, USA, Japan	Dominated by supply of raw materials and semi-processed goods
East ↔ West	Two-way	China, USA, EU, Japan	China, USA, EU, Japan	Active redistribution, including re-exporting

The type of product determines the logistics: fresh fish requires short, fast routes, while frozen or processed products can be transported intercontinentally (Table 4). Fishmeal and by-products are highly specialized and serve as raw materials for other agricultural sectors.

Table 4. **Main Product Types in Global Fish Trade Flows**

Product Type	Logistical Characteristics	Main Routes
Fresh/chilled fish	Short-distance transport	Norway → Germany, Canada → USA
Frozen fish and seafood	Suitable for intercontinental transport	India → EU, Vietnam → USA
Fishmeal, oils, by-products	Bulk shipments	Chile, Peru → EU, China

Logistics hubs play a critical role in ensuring the smooth movement of fish products (Table 5). Ports in Asia, North America, and Europe function not only as transshipment points but also as centers for primary processing and storage. Rotterdam holds a special place as the gateway to the European market.

Modern logistics models are focused on preserving product quality, minimizing losses, and ensuring supply chain transparency (Table 6). Cold chain technologies and digital monitoring systems are becoming standard in global fish trade, especially for premium segments.

Table 5. **Key Logistics Hubs in Global Fish Exports**

Port/City	Country	Main Function
Qingdao, Shanghai	China	Export of frozen fish and shrimp
Rotterdam	Netherlands	Main import hub to the EU
Los Angeles, Seattle	USA	Receiving goods from Asia and Latin America
Oslo, Bergen	Norway	Export of salmon to the EU, USA, and Asia

Table 6. **Characteristics of Logistics Models in the Fish Industry**

Model	Description	Advantages
Cold chain logistics	Continuous refrigeration throughout the chain	Ensures product safety and quality
Temperature-controlled containers	0 to –18°C	Intercontinental delivery with minimal losses
Digital technologies	GPS, RFID, blockchain	Traceability, batch control, loss reduction

In recent years, the vulnerability of supply chains in the fish products sector has become increasingly evident. The COVID-19 pandemic, disruptions in maritime transport, rising fuel costs, and geopolitical tensions–particularly the conflict in the Black Sea–have led to delays, reduced shipment volumes, and the need to regionalize supply chains. In response to these challenges, leading

countries have intensified investments in local processing facilities, process digitalization, and expanded cooperation with regional partners.

An analysis of the structure of global production and logistics flows in the fish industry reveals a high degree of globalization and interdependence between exporting countries and consumer markets. Geographic asymmetry–where raw materials are mainly sourced from Southern countries while processing and consumption are concentrated in the Northern Hemisphere–adds complexity to logistical operations and increases demands on infrastructure.

The type of product directly influences logistics routes: fresh products are typically circulated within regions, while frozen products are distributed globally. Logistics hubs–ports with a high level of specialization and technological capacity–play a vital role in facilitating efficient product movement within the constraints of limited shelf life.

The implementation of cold chain technologies, digital monitoring, and blockchain solutions has become a key factor in increasing the reliability of supply. At the same time, recent global challenges–such as the COVID-19 pandemic, logistics crises, and geopolitical conflicts–have highlighted the growing need for the regionalization of logistics schemes, development of local processing centers, and adaptation to the volatile conditions of the global market.

Thus, a country's success in participating in the global fish supply chain depends not only on the volume of production but also on its level of technological integration, logistical flexibility, and capacity to respond to external risks.

When analyzing the interaction model of «producer – exporter – consumer» in the fish product segment, it is important to note that the effective functioning of the global fish market hinges on the alignment of interaction among three key links: the producer, the exporter (as the logistical and trade link), and the final consumer. Each of these components has its own priorities, operational logic, and expectations; however, their synchronization determines the resilience and efficiency of the supply chain.

1. Producer. This may be either a fishing enterprise or an aquaculture farm. The main objectives of the producer are to ensure a stable volume of production; comply with safety and quality standards; reduce seasonal or environmental dependence; and adapt to market requirements (certification, packaging formats, cooling).

In countries with developed aquaculture sectors (e.g., China, Norway, Vietnam), producers focus on continuous technological upgrades, biosecurity measures, and the rational use of feed and water resources.

2. Exporter / Intermediary Link. This segment functions as a bridge between the producer and the target market. Key responsibilities include: logistics (domestic transport, export channels, cold chain); certification procedures (ecological, veterinary, customs); product adaptation to market requirements

(labeling, translation, packaging format); and ensuring compliance with the importer's legal framework.

An effective intermediary link not only reduces costs and delivery time but also tailors the product to meet the expectations of the target consumer.

3. Consumer. The end consumer determines demand, making understanding their preferences critically important. Global best practices highlight several key consumer expectations: assurance of product safety and freshness; traceability and origin; environmental sustainability (e.g., MSC or ASC certification); convenience in preparation or consumption; and good value for money. In the "producer – exporter – consumer" model, feedback plays a crucial role: data on consumer preferences and behavior must reach the producer to support adaptive production.

4. Relevance for Ukraine. The proposed model has practical value for countries with growing export potential, including Ukraine. To apply it effectively, it is necessary to systematize national export statistics; formalize the demands of key markets (EU, Middle East, Asia); ensure that products comply with export requirements; and establish mechanisms for market communication through digital and institutional tools.

The conducted research shows that current global trends in fish product consumption–particularly the growing importance of aquaculture, the development of digital sales channels, and the rising demand for eco-certified products–create potential opportunities for Ukrainian producers to integrate into global supply chains.

Successfully positioning Ukrainian fish products in international markets will require a comprehensive transformation of production, logistics, and marketing processes in line with the expectations of targeted consumer groups.

Ukraine possesses a range of prerequisites for the development of the aquaculture segment as a source of competitive, high value-added fish raw materials. Favorable natural and climatic conditions, along with a long-standing tradition of farming species such as carp, silver carp, and grass carp, create strong potential for export expansion to markets in the European Union, the Middle East, and the Asia-Pacific region. At the same time, integration into international trade chains is only possible if product quality and safety standards are met (in particular, compliance with HACCP, MSC, and ASC standards) and an efficient cold chain logistics infrastructure is in place.

A focus on consumers who value sustainable production, environmental responsibility, and traceability requires Ukrainian enterprises not only to modernize technically but also to rethink their marketing strategies. In particular, promising approaches include the implementation of digital tools and services (such as marketplaces, mobile applications, and QR-based product batch identification), active participation in international industry exhibitions, and lever-

aging the potential of social media and influencer marketing to build a positive image and global brand recognition.

In light of the above, the following strategic steps are advisable:

1. Development of a national export brand for fish products based on geographic identification, authentic production technologies, and local cultural uniqueness.

2. Provision of government support for certification processes in accordance with international environmental and trade standards (through mechanisms such as partial cost reimbursement, grant incentives, etc.).

3. Institutional support for Ukrainian producers' access to foreign markets by creating industry platforms, participating in technical assistance programs, and engaging in European Union integration initiatives (e.g., EU4Business, Eastern Partnership Trade Helpdesk).

4. Improving the competencies of fishery sector specialists in international marketing, logistics, and regulatory requirements through training programs, workshops, and webinars.

Overall, Ukraine's effective integration into the global fish product market is only possible through strategic cooperation between public institutions, the business community, and international partners. An export-oriented development model should become a key component in the modernization of Ukraine's fisheries sector within the broader context of sustainable economic growth.

Conclusions. As a result of the conducted research, the current structure of the global fish product market was systematized, the main production and export flows were identified, and key consumer preferences across different world regions were outlined. It has been demonstrated that the global fish market is shaped by a variety of factors – from the geography of production and the state of logistics to socio-cultural consumption models and environmental responsibility.

The analysis showed that countries with well-developed export-oriented fisheries sectors (such as Norway, China, Indonesia, and India) demonstrate high efficiency due to a combination of technological capacity, adaptive logistics solutions, and responsiveness to shifting consumer trends. The typology of consumer models made it possible to distinguish target markets for different product formats: fresh fish, semi-processed products, canned goods, and premium segment products.

The proposed analytical model of interaction – "producer – exporter – consumer" – outlines the logic for building sustainable export chains, in which feedback mechanisms, digital traceability, compliance with standards, and institutional support are critically important components.

For Ukraine, the development of its own specialization in the global fish product market is highly relevant. This includes the advancement of competitive

production (both in capture fisheries and aquaculture); institutional support for accessing international markets; implementation of certification and traceability systems; adaptation of products to target consumer models; and the development of logistics infrastructure and digital trade platforms.

СИСТЕМАТИЗАЦІЯ ВИРОБНИЧО-ЕКСПОРТНИХ ПОТОКІВ І СПОЖИВЧИХ ВПОДОБАНЬ У СЕГМЕНТІ РИБНОЇ ПРОДУКЦІЇ СВІТОВОГО РИНКУ

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У статті представлено комплексне дослідження світового ринку рибної продукції з акцентом на систематизацію виробничих та експортних потоків і детальний аналіз споживчих переваг у різних регіонах світу.

У дослідженні окреслено динаміку та тенденції розвитку рибної та морепродуктової галузі, визначено провідні країни-виробники та країни-експортери, такі як Китай, Норвегія, В'єтнам, Чилі та США. Поглиблено досліджено їхню спеціалізацію, експортні стратегії, ринкові частки та позиції в регіональних і міжконтинентальних торговельних потоках. Розроблено типологічну класифікацію глобальних регіонів на основі переважаючих форм споживання рибної продукції (свіжа, заморожена, консервована, копчена), домінування певних видів (лосось, тунець, сиг, креветки тощо), рівнів ціноутворення та культурно обумовлених кулінарних практик.

У дослідженні також аналізується, як процеси глобалізації, діджиталізація ланцюгів поставок, екологічні виклики та геополітична нестабільність змінюють логістику міжнародної торгівлі рибою. Особливу увагу приділено зростаючому впливу критеріїв сталості на поведінку споживачів, зокрема попиту на екологічно сертифіковану продукцію аквакультури, системи простежуваності та ініціативи з екологічного маркування. У статті представлено аналітичну модель для систематизації потоку «виробник-експортер-споживач», що забезпечує практичну основу, яка може бути адаптована для розробки та оптимізації національних стратегій у сфері зовнішньої торгівлі рибною продукцією.

Отримані результати можуть слугувати як концептуальною основою для подальших наукових досліджень, так і інструментом для політиків та учасників ринку, які займаються питаннями економіки рибного господарства та регулюванням торгівлі.

Ключові слова: рибна продукція, світовий ринок, виробництво, експорт, споживчі переваги, логістика, аквакультура, торговельні потоки, сталість.

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