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LATVIA CONCENTRATES ON ADDING VALUE TO COUNTER LOWER VOLUMES



Latvia's fisheries and aquaculture sector is highly diversified, combining Baltic and Gulf of Riga fisheries, coastal and inland fishing, aquaculture, processing, and trade. Pelagic species, especially herring

and sprat, remain central, while cod and salmon are constrained by stock conditions and regulation. The fleet is ageing and shrinking, pushing the sector to focus less on volume and more on value addition, processing, and market adaptation. Latvia's processing industry is a major strength, with strong exports and adaptation to changing markets. Aquaculture remains small, though recirculation systems offer promise. Coastal fishing retains cultural importance, while digital traceability increasingly supports control, transparency, and compliance.

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Net-cage aquaculture is evolving to support more sustainable fish production in fresh water, coastal areas, and offshore sites. Net cages are relatively inexpensive, offer good water

exchange and oxygen supply, and can use waters otherwise unsuitable for farming. Recent innovation focuses on stronger materials, better designs, and systems that can operate in harsher offshore conditions. Norway is leading the way with large semi-submersible and ship-like farms built for rough seas. Development is also moving towards submerged cages, automation, artificial intelligence-based monitoring, and renewable energy as a solar-powered cage in Chile demonstrates.

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The fourth edition of the GFCM and FEAP programme supporting **women in aquaculture**, was held in Izmir, Türkiye, in January 2026. The initiative brings together women from across the Mediterranean and Black

Sea region for study visits to farms, hatcheries, processors, universities, and suppliers, enabling exchange, learning, and network-building. In Izmir, participants visited hatcheries, a ready-meal producer, a net manufacturer founded by a woman, a processing plant, and Izmir University. The programme this year focused on female entrepreneurship and investment. It also highlighted the wider impact of the initiative, including the creation of NOWA, a network that supports women entering the aquaculture sector.

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Aquaculture has become the backbone of **Türkiye's aquatic food production** and a major contributor to food security, exports, and rural employment. In 2024, aquaculture accounted for 62% of total aquatic output, ahead of capture fisheries. The sector benefits from extensive natural resources, a strong institutional framework, hatchery capacity, and technological sophistication. Production focuses on trout, sea bream, sea bass, and increasingly Turkish Salmon, which has expanded rapidly. Türkiye is a leading European producer and a competitive exporter, with sales to 97 countries. The sector is focused on sustainability, planning, innovation, and environmental monitoring which it sees as essential to future growth.

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Electrofishing is a standard fisheries research method that temporarily stuns fish with an electric field so they can be captured, examined, tagged, relocated, and released. It is valued because it is less

harmful than many mechanical methods and works well in complex habitats where nets are less effective. Read the article to understand how fish react to electric current, why pulsed direct current is generally preferred, and how conductivity, temperature, substrate, and habitat structure affect results. The main components of the equipment are the power source, a transformer to convert AC to DC, and the electrodes. Electrofishing also carries risks to both the fish and the operator and therefore must be carried out only by trained professionals.

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The **EUMOFA Market Report 2025**, showed that EU fish and seafood consumption fell in 2023 to its lowest level in a decade, at 10.25 million tonnes or just under 23 kg per person. Consumption varies sharply between

countries, from under 6 kg in Hungary and Czechia to over 53 kg in Portugal, though even in Portugal consumption has declined. Retail remains the main sales channel in most countries, while foodservice has gradually recovered after COVID-19. Processed products are especially important, with shelf-stable items leading sales. Euromonitor expects out-of-home and processed consumption to keep rising although, in some countries, pre-pandemic levels may not return until 2029.

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CHINA

Yangtze river recovers after 5-year fishing ban

China's rapid economic development triggered a severe freshwater biodiversity crisis in the Yangtze River dating back to the 1950s. Despite significant investment in protected areas and restoration efforts over the past decade, biodiversity continued to decline. In response, the Chinese government implemented a basin-wide commercial fishing ban in 2021, a measure of extraordinary scale that required the recall of 111,000 fishing boats and the resettlement of 231,000 fishers, at a cost of more than 2.36 billion EUR across 11 provinces and municipalities.

A study published in *Science* evaluating the ban's early effects finds that it has successfully reversed the long-running

decline. Fish biomass, species richness, and overall biodiversity have all shown measurable improvement since the ban came into force. The results suggest that decisive, large-scale protection measures can bend the curve of biodiversity loss even in heavily pressured freshwater systems, an outcome that had previously proven elusive despite substantial conservation spending.

The findings carry broader implications for fisheries management worldwide, pointing to the potential effectiveness of comprehensive fishing restrictions where more targeted interventions have fallen short. The ban is set to remain in place for ten years.



A basin-wide ban on commercial fishing in the Yangtze River in 2021 led to 111,000 fishing boats being removed from service and about 231,000 fishers being relocated.

ITALY

Italy and Ghana sign aquaculture cooperation agreement



The agreement was signed by the Director of CIHEAM Bari, Biagio Di Terlizzi, and Ghana's Minister for Fisheries and Aquaculture, Emelia Arthur

The Mediterranean Agronomic Institute of Bari (CIHEAM Bari) and Ghana's Ministry of Fisheries and Aquaculture have signed a Memorandum of Understanding to strengthen bilateral cooperation in fisheries and aquaculture and advance international development initiatives.

The agreement was signed during a Ghanaian delegation visit to Italy in February 2026, organised under the AREA Africa Ghana project, which is co-financed by Italy's Ministry of Foreign Affairs and International Cooperation. The Italian agro-industrial conglomerate BF Group serves as private partner, with CIHEAM Bari leading the implementation of the public component. During the visit, the two sides also discussed a fisheries development project to be implemented in Ghana. The delegation toured CIHEAM Bari's facilities and met with researchers and Ghanaian students, before visiting Italian companies active in sustainable fisheries management, vocational training, and seafood production.

Germany's fisheries sector still employs around 30,000 people today.



GERMANY

New support centre for coastal fisheries launched

Germany has established a new coordination body to guide the transformation of its North Sea and Baltic Sea coastal fisheries. The Information and Coordination Centre for Fisheries Transformation (IKTF), based in Hamburg's HafenCity, officially opens on 13 March and operates under the Federal Ministry of Agriculture on behalf of the Thünen Institute.

The centre was created in response to mounting pressure on the sector. Baltic fish stocks such as cod and herring are suffering under poor environmental conditions, while North Sea fishers face growing competition for fishing grounds from offshore wind development and new protected areas. Ageing fleets, a lack of younger entrants, and rising numbers of closures add to the challenge.

The IKTF aims to connect fishers with policymakers, researchers and industry, while promoting sustainable fishing techniques, fleet innovation including climate-neutral vessels, and diversification into areas such as marine data collection and tourism.

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MONTENEGRO

Movement for the fisheries and agrifood sector in Montenegro

The World Bank has approved a €33 million loan to Montenegro to modernise its fisheries and agrifood sector in line with EU accession requirements. A central element of the project is the construction of Montenegro's first modern fishing port at Cape Đeran-Velika Plaža in Ulcinj Municipality, which will include cold storage, packaging and distribution facilities, ice supply systems, and maintenance services. This investment in infrastructure aims to support the reduction of post-harvest losses and improve access to higher-value markets.

The project also supports the establishment of a Paying Agency Regional Office to enable the implementation of EU Common Agricultural Policy requirements and improve the delivery of farm support payments. Another component addresses the development of comprehensive and sustainable practices in the management of animal by-products in accordance with EU regulations. The investments are accompanied by institutional capacity-building measures and align with Montenegro's national strategies for sustainable development and rural areas through 2030.



The port at Cape Đeran suffers currently from limited and outdated infrastructure and is used mainly for small fishing vessels. The project plans to provide a modern dock for both tourist and recreational vessels

FINLAND

Aquaculture sector seeks continued growth

Finland's aquaculture sector has shown modest but consistent growth in recent years, supported by a more positive regulatory climate and generational renewal within family-owned farming businesses. Around 200 fish farming companies currently operate across the country, producing approximately 16,600 tonnes of fish for human consumption annually—primarily rainbow trout—with a total value of around EUR 100 million. Production is split between marine environments, inland waters, and recirculating aquaculture systems. Finland also places considerable emphasis on fry production, with roughly 50 million juveniles raised each year to support wild stock restoration and recreational fisheries, an approach that reflects the sector's dual role in both commercial production and ecosystem management.



Finnish aquaculture producers like Paras Aqua see strong potential for the sector, backed by steady growth in recent years

Despite these foundations, the sector faces significant pressures. The permitting process remains costly and time-consuming, and production costs, which are driven largely by feed, labour, and services, are high compared

to competitors. Norwegian salmon, produced at far greater scale, sets the market price for large trout, limiting the margin available to Finnish producers. Attempts to diversify into species such as pikeperch, eel, and catfish have not yet achieved commercially viable results.

Despite these challenges, domestic demand for locally farmed fish is growing steadily, underpinned by consumer interest in traceable and sustainably produced food. Export opportunities in the Baltic region provide an additional avenue for growth, and the Finnish Fish Farmers' Association sees the sector as well positioned to contribute more meaningfully to national food security, provided regulatory conditions continue to improve.

Third global coral bleaching event caused unprecedented reef damage

Between 2014 and 2017, the world's coral reefs endured the most damaging bleaching event record to date. A study published in *Nature Communications*, drawing on data from over 15,000 reef surveys worldwide, estimates that more than half of all coral reefs experienced moderate or greater bleaching during this period, while 15% suffered significant coral mortality. These figures surpass both previous recorded global bleaching events in 1998 and 2010.

The event, driven by marine heatwaves associated with a strong El Niño, was also the first to last beyond a single year, with heat stress persisting across three

consecutive bleaching seasons. Bleaching sensitivity varied across ocean basins, with Caribbean and Atlantic reefs being more sensitive to heat stress than those in the Asia-Pacific, though the latter faced some of the most intense heat exposure overall.

The findings point to an accelerating pattern. With decreasing recovery time between successive events, many reefs are now caught in damaging cycles that may be quietly eroding their species diversity even when coral cover appears to be recovering. The heat stress thresholds recorded during this event were severe enough to prompt



Coral bleaching is becoming more common due to climate change and marine heatwaves.

NOAA to introduce new, more extreme bleaching alert categories, which are already being applied during the ongoing fourth global coral bleaching event.

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Congress 2026

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FAO

GFCM and FAO forum on generational renewal in the Mediterranean and Black Sea

Nearly half of all small-scale fishers across the Mediterranean and Black Sea are over 40, with just 17 percent being aged under 25, and the sector is struggling to reverse the trend of an aging demographic. At a forum in Athens organised by the General Fisheries Commission for the Mediterranean (GFCM) and FAO, young fishers from across the region described a profession increasingly difficult to enter and harder even to succeed in. Complex licensing, high start-up costs, shrinking margins and uneven digital training are among the barriers.

Women, who make up nearly 30 percent of the fisheries workforce, remain underrepresented in decision-making despite their essential role across the value chain. Unregulated fishing, including recreational activity, was also flagged as distorting markets and undercutting those who play by the rules. Participants called for clearer and more consistently enforced frameworks covering licensing, catch reporting and traceability across all fishing activities.

Small-scale fishing-vessels account for 58 percent of onboard employment in the region, sustaining coastal economies and preserving traditional ecological knowledge. Participants warned that without targeted reform including fairer regulations, better access to finance and inclusive digital transitions, the sector risks losing not just workers but coastal communities, traditional know-how and local food systems.

The fisheries sector in Europe is one of the industries most affected by demographic change and lack of generational renewal



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Aquaculture gets a dedicated platform at SEG

The Istanbul Exporters' Associations General Secretariat will organise Türkiye's participation for the twentieth time at Seafood Expo Global, widely recognized as the world's largest seafood trade fair.



Seafood Expo Global will reinforce its position as the world's most international seafood show when it opens on 21 April 2026.

An area exclusively for aquaculture technology, software and equipment will feature for the first time at Seafood Expo Global to be held in Barcelona 21-23 April 2026. Highlighting aquaculture this way reflects its growing importance for trade, economics, and food security. The pavilion features suppliers, startups and researchers involved in management

and monitoring, animal health and welfare and sustainable feed, among other areas. To give aquaculture professionals an opportunity to network and learn about the latest developments a meet-up will also be held at the venue.

Organisers of Seafood Expo Global, Diversified Business Communications, promise the show will be the biggest ever with almost 53,000 sq m of space sold. Exhibitors from over 80 countries

and 62 national and regional pavilions, including new ones from Bulgaria, Venezuela, Oman, Mexico, and Maldives, reinforce SEG's appeal as global seafood's most international show. Beyond the exhibition area, Seafood Expo Global will also feature a wide-ranging conference programme covering key topics such as aquaculture, sustainability, traceability, consumer trends, product innovation, and responsible management.

Danish equipment and services for the entire fish value chain

The Danish pavilion is once again set to be a prominent showcase for Danish innovation and expertise in the fish industry. Located in Hall 3, the pavilion will bring together over 35 companies this year, including several first-time participants, reflecting the growing international demand for Danish solutions. The exhibitors represent a broad range of competencies spanning aquaculture, fish processing, and traditional fisheries, with the majority focused on the aquaculture and processing sectors. Products and services on display include equipment for primary aquaculture production, filleting and processing lines, packaging, fish feed, and companies specialising in byproduct handling and rendering solutions.

A defining characteristic of the Danish pavilion is its cross-sector breadth. Rather than promoting a single theme, the pavilion will present a meeting point for the entire value chain, where suppliers of technology and equipment can connect directly with producers from around the world, including senior management from major Nordic and global companies. Collaboration is central to the pavilion's identity, with many Danish exhibitors actively seeking to develop joint solutions in partnership with producers, tailoring technology to specific operational needs. The social dimension of the pavilion will also play an important role, with a focus on networking to bring exhibitors, customers, and potential partners together on the show floor in Barcelona.



BioMar, one of the exhibiting companies at the Danish pavilion, is one of the world's leading producers of feed for farmed fish and shrimp.

Multiple pavilions will highlight Spanish participation at SEG

As the biggest seafood nation in the EU by several yardsticks and as host to the most important seafood show in Europe if not the world, Spain has every reason to be well represented at SEG in Barcelona. The Spanish Ministry of Agriculture, Fisheries and Food will reinforce Spain's strong position as a leading fisheries nation within the European Union. Spain is the leading producer of fisheries products in the European Union, accounting for around 20% of total EU production. It is also one of the countries with the highest seafood consumption, alongside Portugal and other Mediterranean nations. The ministry's presence at Seafood Expo Global reflects both the strategic importance of the fisheries sector for Spain and the need to



At SEG Spain will be represented with both regional and national pavilions signifying the importance of seafood across the country.

continue promoting seafood consumption and industry competitiveness. The ministry will participate through an institutional stand of approximately 250 square metres, hosting 21 co-exhibitors from across the Spanish fisheries sector. This format is designed to provide visibility and institutional support to companies, helping them strengthen their national and international projection, establish business contacts, and explore new opportunities with suppliers and buyers. Co-exhibitors have been selected through national sector associations invited by the General Secretariat for Fisheries.

Another pavilion, the Galician, is consolidating its position this year as a strategic space for the international promotion of the Galician seafood sector, with a clear focus on innovation, sustainability, and business. The Galician Ministry of the Sea is committed to strengthening the visibility of Galician companies in an increasingly competitive global market, integrating production, processing, and aquaculture under a single identity. Galicia is increasing its presence with a larger pavilion—768 m²—better located within the exhibition centre, and with a revamped design that incorporates recycled materials

and symbolic elements of the sea, reinforcing the Galicia Calidade brand. This evolution represents a significant leap forward compared to previous editions, both in size and visual impact, as well as in its capacity to accommodate companies, which now number around 44 participants. In terms of activities, the pavilion will feature meeting rooms for business meetings, spaces for product and project presentations, and a seafood cocktail reception is planned in collaboration with ANFACO-CYTMA, which will serve as a meeting point for the entire Galician sector present at the fair.

Sample Mediterranean seafood at the Turkish pavilion

The Turkish national pavilion at Seafood Expo Global 2026 marks the 20th anniversary of Turkish participation at this international fair. Organized by the Istanbul Exporters' Associations General Secretariat, the pavilion spans 657 m² in Hall 2 and will host 16 Turkish companies showcasing the country's diverse fishery and aquaculture sector—from Mediterranean and Black Sea capture fisheries to farmed salmon, seabass, and seabream.

Special promotional displays at the fair's main entrance and throughout the venue will mark this year's appearance, celebrating the 20th anniversary of participation at SEG. A signature tasting event, led by a professional seafood chef, will serve hundreds of daily portions to visiting buyers and others, putting the quality and freshness of Turkish seafood front and centre.

Among the biggest producers and exporters of seafood in Europe with the EU as their most important market, Turkish companies will use the event to strengthen their existing networks and forge connections to potential buyers.



At the Turkish pavilion visitors will be treated to portions of freshly prepared Turkish seafood during the three days of the show.

The barriers to scaling up aquaculture among the topics at AquaFarm

AquaFarm returned to Pordenone Fiere on 18–19 February with a ninth edition covering 6,000 square metres across exhibition and conference spaces. More than 120 exhibitors and represented brands took part, and a programme of 25 sessions featuring more than 100 speakers, including academics, associations, company managers, and international experts.

The event was organised around three areas—AquaFarm, AlgaeFarm, and the new AquaFishery—signalling an expanded perspective in which aquaculture, algae cultivation, and small-scale fisheries come together as interconnected components of the blue economy.

A market reality that is difficult to ignore

Seafood demand in Italy remains strong and continues to rise. Consumption was about 29 kg per person in 2022, and FAO data over a 25-year period show a steady increase from 21.4 kg per capita in 1997. After the inflation-driven disruption of 2022, national monitoring from ISMEA Mercati, indicates a clear rise in food spending among Italian families between 2023 and 2025, alongside higher purchases of fresh fish in the first six months of 2025 (+3.7% in volume and +10.2% in spending) compared with the same period in 2024.

Supply, however, has not kept pace with demand. Italy relies heavily on



AquaFarm combined events dedicated to fish farming, algae production and, for the first time, small-scale fishing.

imports to meet consumption. In 2024, imports of fishery and aquaculture products for human consumption reached 1.11 million tonnes, valued at €7.6 billion. Exports totalled 179,182 tonnes, worth €1.2 billion, resulting in a trade deficit of €6.4 billion¹.

Against these figures, domestic output remains limited. Fisheries landings amounted to 117,530 tonnes in 2024, valued at €636 million. Aquaculture production reached 129,719 tonnes in 2023, worth €616.3 million, with mussels, clams, and rainbow trout

¹ <https://eurofish.dk/member-countries/italy/>

accounting for the largest share¹. Because Italy's seafood market depends primarily on external supply, the sector's priorities are clear: strengthening domestic production to improve food security, retain more value in the country, and shorten supply chains. Achieving this will depend on easing constraints related to access to space, permitting processes, and the wider investment climate.

Efforts to implement AZAs need to improve across the EU

A first constraint is spatial and administrative. If new farms cannot secure suitable sites, and if permitting remains unpredictable, growth ambitions remain aspirational regardless of innovation on feed, genetics, or system design. In the opening sessions, the Research Director from ISPRA, focused on the process for allocating marine activities across space and time to reduce conflict in increasingly crowded coastal waters and shift decisions away from individual disputes towards a clearer framework for siting, licensing, monitoring, and periodic revision. In theory, this should translate into more predictable investment conditions, fewer conflict with other marine users, and stronger environmental commitment through a more consistent ecosystem-based approach. In practice, progress has been uneven. A 2025 assessment presented to the European Parliament and referenced in the session and concluded that spatial implementation remains incomplete across countries and has delivered only limited measurable impact for fisheries and aquaculture, with persistent obstacles including complex permitting, data gaps, and limited stakeholder involvement.

Italy's experience with Allocated Zones for Aquaculture (AZAs), highlights a gap between technical capacity and delivery. In fact, ISPRA has developed a technical guide together with a national portal containing 180 data layers to support competent authorities planning decisions. Yet only five out of 15 coastal Italian regions have developed these allocated zones, and they are all geographically concentrated in the Adriatic Sea. At the same time the surfaces dedicated to aquaculture in these regions is very limited. While shellfish extend for a larger area, the current total surface identified for finfish aquaculture is 665 hectares, a figure that appears modest against ambitions to strengthen domestic supply in a country heavily reliant on imports. Looking forward, offshore development and co-location models, potentially alongside renewable energy installations, were presented as realistic routes to easing spatial conflict and creating room for expansion. These approaches, however, were linked to a parallel requirement: stronger use of monitoring, sensors, automation, and data integration.

Mislabelling, accidental or deliberate, is a challenge in Ho.Re.Ca.

A central theme was the asymmetry of consumer information across sales channels. In retail, particularly for fresh or chilled, frozen and non-prepacked products, mandatory information requirements are extensive and compliance is routine. In restaurants and catering, by contrast, information is often limited, and the session referred to recurring non-compliance, including mistakes in species identification and uncertainty over whether seafood is wild or farmed.

As explained by the director of FED-EPESCA, roughly half of the seafood eaten in Europe is consumed outside home, in restaurants and catering. The consequence is that consumers can access detailed information in 50% of the cases when buying fish but frequently receive far less clarity when eating out, even though seafood remains the main ingredient. On this note, a recently published FAO report "*Food fraud in the fisheries and aquaculture sector*" estimates that up to 20% of seafood traded may be affected by fraud. Species substitution and mislabelling are among the most common practices, with consequences for consumer health, fair competition, and environmental sustainability.

The Italy-Spain session on Mediterranean aquaculture at Aquafarm reinforced this concern, identifying Ho.Re.Ca. as an increasingly weak link for transparency. With a substantial share of seafood in both countries originating outside the EU, longer and more complex supply chains raise the risk that mandatory information becomes diluted or lost before products reach consumers. Alongside limited awareness and training, more strategic behaviour was also flagged, such as keeping origin vague where "local" provide access to premium. In fact, selective wording and emphasis can still mislead, and eco-labels only build trust when consumers understand what the certification actually guarantees.

Communication and collective action to convey quality to the consumer

Trout is the main finfish produced in Italian aquaculture with 34.143 tonnes in 2023. However, as in other EU Member States, domestic consumption remains low compared with salmon. In a session with the

participation of the Directorate General for Maritime Fisheries and Aquaculture, speakers argued that Italian aquaculture suffers from a persistent mismatch between production reality and consumer perception, and that bridging it will require far stronger coordination across the value chain. Using the example of trout compared to salmon the speaker stressed that salmon is not inherently better, but it has benefited from continuous, well-funded promotion, while Italian aquaculture has rarely communicated its own strengths with the same consistency or visibility.

Several interventions stressed that Italy cannot compete on volume against global suppliers, so it must compete on identity, quality, and verified attributes, and then ensure these attributes survive all the way to the consumer. Here, the discussion returned to traceability and menus. Speakers argued that much of the value created through farming standards, certifications, and

sustainability efforts is lost as products move through wholesale and into food service, where information is often not displayed. They called for a stronger, shared push—across aquaculture and fisheries—for rules that ensure key information is not stripped out along the chain.

The round-table also highlighted the importance of cooperation. Individual farms can rarely fund research, certification, and promotion at the scale needed to change perceptions, whereas collective structures can pool resources and decide jointly where to invest. The sector also needs clearer messaging about species, origin, and production methods, backed by credible data. The discussion closed on a practical call to create structured dialogue with public authorities, not only on traceability, but also on promotion and support instruments, recognising that sustainability includes environmental, social, and economic dimensions.

AquaFishery demonstrates overlap with aquaculture in terms of gear

AquaFarm 2026 confirmed the fair's role as a practical meeting point for the sector, with strong participation across both the exhibition floor and the conference programme. The launch of the new AquaFishery strand broadened the event's perspective, bringing small-scale fisheries into a clearer dialogue with aquaculture and algae production. The sector recognises that 2026 will bring continued pressure from permitting constraints, energy and climate risks, and market challenges, yet the prevailing hope is that by working with all stakeholders the challenges can be surmounted.

Francesca Barazzetta, Eurofish, francesca@eurofish.dk

Science and socialising characterise XXXI Polish Carp Conference

On the banks of the frozen Vistula River in Toruń, the hometown of astronomer Nicolaus Copernicus, the 31st annual traditional national carp conference was held from 11 to 13 February 2026.

Traditionally organised in Poznań by the Polish Fisheries Association (PFA), an effective organisation with around 650 members, the XXXI Polish

Carp Conference drew over 250 participants (more than 70% of them fish farmers, as well as public officials, academics, and businesses), and 13 different companies presented their products. In recent

years, this annual event has been held in different locations in Poland and this year it came to Toruń. The subtitle of this year's conference was "carp as a market commodity" (*Karp jako produkt rynkowy*).

Status of European support mechanisms explained

This year's first three presentations focused on information about the draw-down and use of Eurofunds. The obligations of applicants after the completion of EU projects were mentioned, as well as alternative sources of financing for aquaculture (Dariusz Nieć). In his presentation, Jarosław Król introduced the concept of "One Health," which integrates the health of the environment, people, and animals. The current Eurofund programme for fisheries was also reviewed, including what still needs to be drawn down and, in particular, what can be expected in the new programming period after 2028 (Adam Sudyk). The second block of lectures was devoted to the popularisation of aquaculture, education and support mechanisms. Prof. Dorota Fopp-Bayat from UWM Olsztyn presented the "Edu Fish" project, which involves three Polish institutions providing fisheries education: West Pomeranian University of Technology in Szczecin (WPPTS – leader), University of Warmia and Mazury in Olsztyn, and a combined school in Sierakowo (secondary school). The project aims to make work in the fisheries sector more attractive to the younger generation. It provides material and financial support to schools and students during their studies and will run until the end of August 2029. This was followed by two lectures by guests from the Czech Republic. Ivan Šútovský from Rybníkářství Pohořelice, a.s. presented the company's activities in fish sales and focused on the ceremonial harvest of the Vrkoč pond. Ján Regenda from FFPW SBU described the subsidies and compensation paid to aquaculture sector in the Czech Republic.

Wednesday evening was devoted to a gala meeting. During a joint dinner, Adam Szarek from Stobno was crowned



With over 250 participants the XXXI Polish Carp Conference was very well attended. The event blends scientific discussion with social networking to great effect.

"Fisherman of the Year 2025." Since 1990, he has been building his own farm, which today operates over 60 hectares of ponds. He breeds a wide range of fish, which he also processes and sells as part of his family business. He received the award for his lifelong work respecting tradition, but also for his use of modern technologies and his contribution to the development of Polish aquaculture. After the award of prizes for photography and gastronomy came a long evening of social conversation, dancing, and tasting the fish specialties that had been presented in the gastronomic competition.

Speakers analyse different aspects of the market for carp

Thursday, the second day of the conference, began with the first block of lectures entitled "Carp Market Analysis." Marek Trella (IRS-PIB Olsztyn) presented statistical figures on Polish aquaculture for 2024. Tomasz Kulikowski (MIR

– PIB Gdynia) then spoke about the economic situation of carp aquaculture in 2024. This was followed by the eagerly awaited lecture by Andrzej Lirski, the doyen of Polish pond aquaculture. In his lecture, he sought to answer the question of whether carp is expensive or cheap. The last contribution in this section was presented by Grzegorz Mech (YouGov), who introduced six different market groups and types of people buying fish based on data from Polish YouGov. This was followed by a block of two legal lectures on poaching (Wojciech Radecki) and pond construction (Daria Danecka). After lunch, there were presentations devoted to climate change, the microbiome, and fish nutrition. The last contribution to Thursday's program was a presentation by Anna Prętka (Fundacja Jeden Uniwersytet), who addressed the issues and risks of presenting carp farming and sales on social media. This contribution was very important in view of the need to address the younger generation using platforms and a language that is familiar to them. It is necessary to effectively overcome the generation gap between the current generation of

fish farmers and young people (future fish consumers).

Carp can be prepared in ways that suit all tastes

The final discussion on the day's program was followed by a gastronomic show—cooking fish in public and with the involvement of the public! Chef Jakub Kuroń was not afraid to take on more than 10 volunteers, who, under his supervision, prepared modern and tasty dishes from such a traditional fish as carp. We tasted tortillas with smoked carp spread, Asian wok with carp meat, and carp soup with carp meatballs. A very powerful and tasty experience! This is the right way to the heart of today's consumer. People need to be shown that carp is not just a traditional Christmas dish but can be eaten all year round!

Friday morning's program consisted of three lectures, the first of which presented the sensory apparatus of carp and their method of food intake (Dobrochna Adamek-Urbańska

Thirty-first Polish carp conference conclusions to be presented to the authorities and the public

1. The carp farming sector in Poland is in a critical situation.
2. There is a lack of effective compensation for damage caused by protected water birds (cormorants, grey herons, white herons).
3. Fish farmers (in ponds) do not receive compensation for the ecological functions of fishponds, even though these areas support biodiversity and the water regime.
4. EU funding is unbalanced, favouring marine fisheries while inland aquaculture is underfunded.
5. The aquaculture sector is burdened by excessive bureaucracy and lengthy permitting and administrative processes.
6. There is a lack of systematic promotion of Polish carp as a traditional, ecological, and important product for food security.
7. Without systemic changes (management of protected bird populations, support for small farms, simplification of procedures, fair funding), many ponds are at risk of disappearing, which will negatively affect both the economy and biodiversity.

– SGGW). Piotr Eljasik (WPUTS) presented how aquaculture is perceived by people in different parts of the world, while Sławomir Lisiecki (WPUTS) concluded the conference with a presentation on ways to strengthen the resilience of pond aquaculture in the

context of climate change. Most of the 23 papers presented are also included in the conference proceedings, which were published in Polish.

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The Czech fish farming sector in the spotlight

A conference in the Czech Republic brought together fish farmers, administrators, political representatives, and scientists to discuss issues facing the aquaculture sector. Fish sales at Christmas and selective breeding of carp and burbot were among the topics generating the most interest.

The Czech Fish Farmers Association (CFFA) and the Faculty of Fisheries and Protection of Waters of the University of South Bohemia (FFPW SBU)

organised a conference for and with Czech fish farmers on 26 and 27 February 2026. The conference was supported by the Operational Programme Fisheries, an EU framework that supports

initiatives related to fisheries management and aquaculture. Around 170 representatives from fish farming companies were invited, mainly members of the CFFA, as well as state administration



Dr J. Potužák's lecture on the possibilities of application and further use of pond sediment attracted the most interest from the audience.

employees including veterinarians, conservationists, and water managers. A four-member delegation of associated Slovak fishermen was also invited.

Veteran researcher's contribution to aquaculture acknowledged

The programme commenced with the induction of the hydrobiologist, Dr Richard Faina—who, at the age of 80, continues to influence young generations of fishermen—into the Fisheries Hall of Honour. He spent most of his professional career at the Research Institute of Fisheries and Hydrobiology in Vodňany, and later, from the late 1990s on, worked for the ENKI organisation in Třeboň. Among his contributions to the Czech fisheries sector was the invention of a new method of carp-feed monitoring by flushing their intestines with water. He also developed

procedures for fish farming in ponds with high nutrient loads and facilitated the import of improved strains of the common carp to Czechoslovakia, whose genetic composition helped overcome problems with spring viraemia (SVC).

A total of 15 speeches on various topics of interest to fish farmers were presented at the conference. The three contributions that resonated most with participants included a report on the current and future possibilities for the use of pond sediments, insights into the status and future challenges of the selection programme for common carp and burbot, and an analysis of Christmas fish sales in the Czech Republic.

Useful mingling between old and new generations of fishers

The accompanying programme included an exhibition where several

companies offered various products and technologies for aquaculture. Thursday and Friday evening were dedicated to a social meeting of the fishermen's community, accompanied by a fish buffet prepared by the FFPW SBU Fish processing plant and shop. The event also facilitated exchange between young and old fishermen, presenting an intergenerational venue for industry deliberation.

As part of the conference, a collection of extended abstracts of individual lectures was published, which is available in Czech on the CFFA website. The event was also supported by the personal participation of political representatives, among them the chairwoman of the Agricultural Committee Ing. Monika Oborná, Member of Parliament and Member of the Agricultural Committee Ing. Josef Kott, and Governor of the South Bohemian Region MVDr Matrin Kuba.

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Fish international 2026 unites the seafood industry in Bremen once again

The most significant trade show for fish, seafood, and processing equipment in Germany brought together senior buyers and sellers and encouraged a healthy exchange between purveyors of traditional and novel products and services for the sector.

From 22 to 24 February 2026, Messe Bremen hosted the 20th edition of fish international, Germany's main trade fair for the fish and seafood sector. Running in parallel was the 7th GASTRO IVENT, the regional marketplace for the gastronomy, hotel, and catering industry. A combined ticket gave visitors access to both events across three halls, reflecting the organisers' view that food innovation and out-of-home consumption represent a growing area of overlap between the two sectors.

The fair covered the breadth of the seafood supply chain, from aquaculture and wild capture fisheries to processing, packaging, and retail. Sustainability featured prominently across many stands, both in terms of sourcing and in packaging solutions, the latter being increasingly shaped by incoming EU legislation. Algae-based products presented another visible theme, pointing to a category that is gradually moving from niche to mainstream in the German market. International pavilions from Galicia, Denmark and India, as well as a delegation from Fiji, reflected the global dimension of the German seafood import market.



Between 22 and 24 February 2026, fish international presented a hotspot for the seafood and processing industry.

Three days full of science, policy and industry input

The accompanying expert forum provided content that was of central importance to the industry. Structured around

three themes across the three days, it addressed questions that are currently front of mind for the German seafood industry. The first day focused on new EU regulatory requirements, with particular attention to packaging and packaging waste regulation and what it will mean in practice for companies operating in the sector. The second day turned

to the domestic market, examining how seafood consumption patterns in Germany are shifting and what this means for product development and retail strategy. The third day looked further ahead, exploring how fish supply chains can be made more resilient and reliable in the face of environmental and geopolitical pressures. Sessions were open to all ticket holders and built around

panel discussions, with active participation from the floor. At the Bremerhaven stand, the «Fischereihafenfunk» format offered a complementary series of conversations between researchers and industry practitioners on science-in-industry topics.

Eurofish attended with its own stand, hosting SIA VLAKON from Latvia, UAB Šalčininku Žuvininkystės

Ūkis from Lithuania, as well as Abramczyk and Seamor from Poland. Supporting member country companies at international trade fairs is one of the practical benefits Eurofish offers its members, helping producers connect with buyers and distributors in markets where they may not yet have an established presence. The next edition of fish international is expected in 2028.

Sustainable and resilient aquaculture for a warming Mediterranean

In the Mediterranean and Black Sea, sustainable aquaculture is increasingly defined by resilience. The sector faces mounting pressures: intensifying climate stress, more frequent and damaging extreme weather events, shifting disease risks, and rising societal demands related to environmental responsibility, animal welfare, and transparency. Meanwhile, regulatory hurdles and competition for coastal space are still holding back investment in certain countries. Yet demand for seafood shows no signs of slowing.

FAO's latest SOFIA report projects per-capita consumption of aquatic animal foods rising to about 21.3 kg in 2032¹, up from around 20.7 kg in 2022. Aquaculture expansion is an obvious route to meet this demand, but it requires licences and capital. Improving performance and reducing losses along value chains offers another lever to increase supply without equivalent increases in production footprint.

In this context, joint initiatives such as the Federation of European Aquaculture Producers (FEAP) – General Fisheries Commission for the Mediterranean (GFCM) Technical Consultation on Sustainable Aquaculture Practices play an important role. Held in Athens on 11–12 February 2026 and hosted by the Hellenic Aquaculture Producers Organization, the consultation brought together more than 130 participants. Farmers, companies, researchers and

technical experts shared their experience, priorities, and constraints, ensuring that discussions about sustainability remain anchored in operational reality. In a region with around 35,000 aquaculture enterprises² in the Mediterranean and Black Sea region, largely small and medium-sized producers across a diverse sector, sustainability efforts must be viable for farms without becoming a constantly growing reporting burden.

Climate stress is extending the risk season, and compressing the response time

The Mediterranean is widely regarded as a climate change hotspot, and warming is now influencing production in ways that are increasingly visible at farm level. According to the IPCC, sea surface temperature has been rising 0.29°C–0.44°C per decade since the early 1980s, driving more frequent and intense marine heatwaves. The eastern Mediterranean shows the strongest warming trend among sub-basins.

For fish farming, higher water temperatures reduce oxygen availability, alter metabolism, and can destabilise feeding behaviour. These changes can undermine growth performance and increase susceptibility to disease.

Climate impacts are not confined to what happens underwater. Infrastructure exposure is also changing, particularly through storm risk. Eduardo Soler from Avramar Spain, spoke about the “Gloria” storm in January 2020 on the Mediterranean coast near Castellón. The consequences were destructive for two farms in the area, the biomass loss was reported at 90%. Even less extreme storm conditions can overtop shorelines and flood parts of facilities, creating biosecurity problems even when physical damage is limited.

Stelios Karapanagiotis, representing Galaxidi Marine Farm, Greece described temperature patterns shifting upwards over time in the Corinthian Gulf, with farm-level evidence indicating that seabass and seabream begin to experience stress at around 28°C, making the upward drift in summer temperatures increasingly relevant for operations.

Speakers highlighted several adaptation pathways to move beyond short-term management changes. They have started working on new feed



The GFCM-FEAP technical consultation gathered more than 130 experts from the GFCM Technical Advisory Groups, Aquaculture Demonstration Centres, researchers and sector associations from across the Mediterranean and Black Sea region.

formulations to match fish metabolism under warmer, lower-oxygen conditions, including greater flexibility in ingredients as raw material supply becomes more volatile. Alongside this, genetic improvement was presented as a medium-term option to develop stock that is more resilient to heat stress and disease. These biological measures need to be paired with tighter biosecurity and stronger environmental monitoring, while investments in infrastructure and technology, such as improved mooring systems and, in some cases, oxygenation of cages during summer, can help maintain welfare and feeding capacity when conditions deteriorate.

AI and digital tools are becoming part of basic risk management

AI and digital tools can help farms maintain control of operations. The consultation aimed to demystify AI by focusing on how it can strengthen decision-making and improve day-to-day performance.

A central example was ActFast, a Horizon Europe project developing an AI-supported early warning system for Mediterranean aquaculture to fill a clear gap: farmers need simple, site-level tools to anticipate storms, heatwaves, and other climate-related hazards. The concept is a web interface

where producers enter farm coordinates and receive alerts, with forecasts up to five days ahead at high temporal and spatial resolution, covering a variety of parameters. ActFast also presented work on climate-smart diets tailored to different temperature ranges, and a webcam-based computer-vision tool to detect abnormal seabass behaviour and early signs of disease.

Disease pressure is rising, and climate change is a multiplier

With climate change reshaping the farming environment, disease is often where the impacts become most visible. Viral nervous necrosis was cited in relation to mass mortalities in wild fish across several locations, underlining that threats extend beyond farm boundaries. Lactococcosis, a re-emerging bacterial infection, was highlighted as another shifting pattern. Historically associated with freshwater systems, it is now increasingly observed in marine species such as seabass and seabream.

Co-infections were described as particularly challenging, complicating diagnosis and making it hard to trace where outbreaks begin. Vaccination was repeatedly presented as a key preventive tool. In Portugal, where complete programmes have not yet been



Attendees at the FEAP-GFCM technical consultation on sustainable aquaculture practices felt greater participation by policymakers would benefit the sector.

stronger participation by ministries and policymakers, because licensing, spatial planning, health governance, and investment conditions are shaped as much by public decision-making as by on-farm practice. Moved by a constructive attitude, the audience was positive about the value of the Athens consultation as a space to share experience and align priorities, and they called for continuity, with regular follow-up events to keep cooperation active and ensure that practical solutions continue to move from discussion into implementation.

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widely adopted, farms that have implemented comprehensive vaccination schemes report strong results. Cases of *Vibrio anguillarum* are now rare in farms that use IP (intraperitoneal) vaccinated fish, and one seabream farm with chronic phytobacteriosis reduced antimicrobial use by 87% after introducing IP vaccination in most batches. Limited access to veterinary medicines was also raised, with concerns that a narrow set of registered options can accelerate antimicrobial resistance, strengthening the case for prevention, antibiotic alternatives, and more workable regulatory pathways.

Pulling the threads together: resilience depends on practical integration

The consultation in Athens showcases that resilience is not delivered by a single technology or policy decision, but by a combination of several strategies into one coherent operating approach. Participants also stressed that this cannot be achieved by producers alone. Future consultations would benefit from

Hellenic Aquaculture Producers Organisation

Aquaculture has become a cornerstone of Greece's animal-production economy, with fish farming playing a particularly prominent role in supporting jobs, investment, and coastal communities. For more than two decades, farmed fish has contributed a larger share of domestic supply than capture fisheries, and aquaculture now represents roughly 69% of Greece's overall fish production. Within this landscape, Greece holds a leading position in the European Union for seabream and seabass production, and second largest globally.



Founded in 2016 and formally recognized as a Producer Organisation in 2018, the Hellenic Aquaculture Producers Organisation (HAPO) brings together 22 companies that together account for about 80% of Greece's fresh farmed fish output. Seabass and seabream are the dominant species, and the sector exports to around 40 markets. HAPO's supports collaboration among its members and helps companies address operational challenges, improve capabilities, and maintain strong links with public authorities. It also promotes responsible production, focusing on food safety, fish welfare, and environmental protection. HAPO's "Fish from Greece" brand identifies Greek farmed fish that meets minimum standards giving buyers and consumers greater confidence in the product's quality and the conditions under which it is produced.

HAPO emphasises continuous improvement across the value chain. It works closely with Greece's scientific and academic community to support applied research and sector-wide learning, including participation in EU-funded initiatives such as Interreg. The organisation subscribes to the Federation of European Aquaculture Producers' code of conduct which seeks to deliver nutritious seafood while reducing environmental impacts.

Eurofish study tour to Germany on freshwater fish processing

From 3–5 March, EUROFISH organised a study tour on freshwater fish processing in northern Germany, bringing together 11 producers and governmental officers from Latvia, Ukraine, and Hungary. The programme offered an excellent opportunity for participants to exchange experiences, explore innovative technologies, and strengthen cooperation across the freshwater aquaculture value chain.

The three-day programme included visits to farms, technology providers, research institutions, and industry partners in Germany. The tour demonstrated how cooperation between producers, technology developers, and researchers can help address the technological and market challenges faced by freshwater aquaculture in Europe.



The field trip brought together stakeholders from Hungary, Latvia and Ukraine, and facilitated an exchange of knowledge within the group as well as with the hosts.

A diverse group representing the freshwater sector

The study tour gathered participants representing commercial fish farms, sector organisations, and governmental bodies responsible for fisheries and aquaculture development. Participants from Hungary included Bajcsfal Ltd., which operates both African catfish recirculating aquaculture systems (RAS) and traditional pond production facilities; Szarvas-Fish Ltd., the largest African catfish producer in Hungary with an annual production of around 3,000 tonnes and operator of the country's largest freshwater fish processing plant; and Szabolcs Fish Ltd., a pond fish producer located in the north-eastern part of the country specialising in traditional freshwater species. The Hungarian delegation also included a representative from the Ministry of Agriculture of Hungary, responsible for fisheries and aquaculture policy and sector development.

The Latvian group included representatives of Blue Circle Ltd., a company engaged in the production and marketing of Arctic char in recirculating aquaculture systems (RAS), and Purvīni Fish Farm, which operates pond aquaculture alongside African catfish production in RAS. Moreover, the Latvian Aquaculture Association and the Ministry of Agriculture of Latvia were also represented.

From Ukraine, the delegation included representatives from the State Agency of Ukraine for the Development of Melioration, Fisheries and Food Programs, together with a representative from PJSC Khmelnytskykhosp, a private pond fish farm producing around 1,500 tonnes of common carp, bighead carp, and crucian carp. The diverse composition of the group led to discussions on practical production challenges, processing technology needs, policy frameworks supporting the development of freshwater aquaculture, technological innovation, and opportunities for international cooperation.

Visiting farms, technology providers, and research institutions

During the tour, the group visited several farms, research institutions, and industry partners. At Heidefisch GmbH, participants observed how large-scale trout farming and processing can successfully comply with very strict environmental regulations, enabling sustainable production and processing. The visit offered insights into integrated trout production, modern processing practices, and environmental management. Particular attention was given to water treatment and effluent management systems that allow the company to operate at a large scale while meeting strict environmental standards. At Baader, one of the world's leading fish processing technology providers, the group had the opportunity to discuss directly with company representatives the technological challenges arising from freshwater species which often require specialised equipment due to their anatomical characteristics and the typically smaller production volumes.

At the University of Rostock, Professor Harry Palm presented an excellent overview of the latest scientific developments related to circular economy approaches in freshwater aquaculture and fish processing. The presentation highlighted how research contributes to improving nutrient recycling, water reuse, and the utilisation of by-products in aquaculture systems. Participants also discussed the potential of new species such as giant gourami, which could support circular production systems due to their ability to utilise plant-based feed resources efficiently. The tour also included an in-depth technical exchange with the team of Nutrition&Food, where participants explored innovation pathways for African catfish

production, processing, and market development in Europe. The discussion focused on the development of new value-added products and strategies to strengthen the position of African catfish in European seafood markets.

Key discussions and lessons learned

The central focus of the study tour discussions was the processing of freshwater fish, which remains one of the main technological and economic bottlenecks limiting the growth of the sector in Europe. While freshwater aquaculture production is developing steadily, the processing segment often lags due to technological constraints and limited volumes. Participants emphasised that European consumers increasingly demand processed and convenient fish products, including fillets and ready-to-cook items. However, many freshwater fish species are still processed manually or with limited mechanisation, which increases production costs and limits the competitiveness of European products compared with imported fish.

This challenge is particularly evident in the processing of African catfish, a species that is rapidly expanding in European aquaculture due to its excellent growth performance and high product quality. Despite its strong production potential, efficient industrial processing technology, especially reliable filleting machines, are still under development. The relatively small size of the European freshwater aquaculture sector makes it difficult for equipment manufacturers to justify large investments in developing specialised processing technologies, an issue that was discussed at Baader. The company is currently working on processing solutions specifically designed for freshwater species, including automated filleting technology for African catfish, with promising initial results.

Alongside processing technologies, participants also discussed the importance of circular economy approaches in freshwater aquaculture. Fish processing generates by-products such as heads, frames, skins, and viscera, which are valuable biological resources rather than waste. These materials can be utilised in multiple ways, ranging from nutrient recycling in aquaculture systems and agriculture to the production of fish oils, protein ingredients, pet food and even innovative food products for human consumption. Better utilisation of these resources can significantly improve the economic performance and sustainability of freshwater aquaculture operations. By transforming by-products into valuable raw materials, producers can create additional revenue streams while reducing environmental impacts. At Heidefisch, participants observed how advanced effluent treatment systems allow large-scale trout production with strict environmental regulations, demonstrating how technological innovation can directly support environmentally responsible aquaculture development.

Cooperation for a stronger freshwater aquaculture sector

The study tour demonstrated production technologies and processing solutions in operation allowing stakeholders to better understand how innovations can be applied in their own production systems. In addition, participants learnt from each other and expanded their professional networks, thereby strengthening cooperation across the value chain and contributing to the long-term development of the European seafood industry.

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Net cages for aquaculture are being made fit for the future

In almost all areas of aquaculture there have recently been remarkable advances. These concern, for example, feed, disease prevention, and the technical equipment on farms. All this has made aquaculture more sustainable and environmentally compatible. Some improvements to floating net cages, which have been more closely adapted to their surroundings and the fish species kept in them, have also contributed to this.

In recent years, interest in net pens and cages has increased noticeably, because they offer opportunities for rapid increases in production in waters that have so far remained largely unused. Net cages are an inexpensive technology. With relatively little effort they make it possible to offer fish good living conditions, because the circulating water supplies the animals held in them, among other things, with a continuous supply of oxygen. The technology represents a sensible compromise between economic efficiency, and ecological and social responsibility. Net cages can make use of “idle” water resources such as lakes, reservoirs, pits, streams, and rivers, as well as extensive marine areas. Keeping fish in net cages is not an entirely new practice, because the method was already widespread in some regions of the world, especially in Asia, for many centuries. Norway, however, was the first country to prove that net-cage aquaculture can be used commercially on an industrial scale. The “professionalisation” of this sector of aquaculture included the development of practical net cages made



With floating farm units even flowing waters, which would otherwise offer hardly any opportunities for fish farming, can be used for aquaculture.

of robust materials such as high-density polyethylene (HDPE) or steel mesh that can withstand the forces of nature and prevent the escape of fish. Based on this basic model, which has proved its worth over many years of practice, such cages are now in use, often in

modified designs, both in fresh water and in marine environments.

However, this development alone does not explain the steadily growing worldwide interest in fish production in net cages. An equally important motive is the possibility of expanding



In Thailand, modern HDPE circular cages from Norway are being tested and optimised for the rearing of cobia.

aquaculture further than before into coastal and offshore areas at sea. This opens up enormous growth potential for the aquaculture sector, because the greatest part of its global production, in 2022 almost two thirds (62.2%) of the total volume, is produced in fresh water.

Using net cages to open up unused waters

In principle, attitudes towards aquaculture in the Asia-Pacific region are much more positive than in western industrialised nations. For this reason, the expansion of fish farming through the use of net cages encounters hardly any reservations. People tend to perceive the advantages of this technology, the growth opportunities in production, and the enormous potential of fish farming in marine areas. However, this important option for increasing fish production is still in its infancy in most Asian coastal countries. In India, whose coastline measures more than 7,500 km, the

number of net cages of various sizes is currently estimated at just about 1,500 units. Even if only 1% of the coast were used for net-cage farming, however, the



Turkish companies use the circular cages proven in salmon production also for rearing sea bass and sea bream in the Mediterranean.

ICAR-Central Marine Fisheries Research Institute (CMFRI) estimates that around 820,000 cages would be possible, with a production potential of 3.2 million tonnes. The Institute therefore recommends expanding cage farming at sea, and the Indian parliament has already cleared some legal hurdles in order to reduce the bureaucratic burden involved in expanding marine aquaculture.

The Indonesian government has recently decided to strengthen the country's aquaculture industry and in particular to promote tuna farming in several bays along the coast. The intention is not only to counteract the overfishing of these popular fish, which are in demand internationally, but also to improve the economic and social situation of the local population, which has suffered severely from the restrictions imposed during the corona pandemic. The Indonesian government aims to establish a network of dozens of villages with aquaculture farms and downstream processing plants that will be able to hold their own on the world market with tuna products.



The floating net cages of Open Blue off the Caribbean coast of Panama can be lowered completely below the sea surface.

Fresh ideas are driving development forward

Depending on local interests and economic conditions, net cages are a source of both hopes and fears. While critics emphasise above all the negative aspects of these “open” systems, such as escapes, nutrient inputs, and risks from parasites and diseases, advocates place greater emphasis on the economic opportunities and social benefits of this technology. In the heated debate it is often ignored that numerous variants of net cages have been developed for very different purposes, which have made considerable progress both in their construction and in the way they function. In aquaculture sustainability strategies, improvements to animal husbandry systems play an equally important role as the optimisation of feeding strategies, disease prevention, or animal welfare. Other drivers of these developments include both changing environmental conditions as a result of climate change, which is leading to an

increase in extreme weather events, and the wish to give aquaculture a more sustainable orientation with better living conditions for fish and less environmental impact. Interactions with parasites, jellyfish, and toxic algae, and conflicts with other user groups of coastal waters, also play a part. However, the relocation of surface-based net cages to more distant offshore areas has once again increased the pressure to improve equipment design. Far out at sea, where conditions are dictated by wind, waves, and currents, what is needed are not only materials that are as robust as possible, but also new farm designs that can withstand the immense energy of these waters. Offshore, on stormy days, net cages are difficult or even impossible to reach, which calls for completely new technologies for monitoring, feeding, and managing the fish stocks. Offshore farms must, if necessary, be able to operate for longer periods autonomously, that is, without direct intervention by personnel.

Researchers and developers are faced therefore with enormous

challenges. How, for example, can floating cages be anchored in place offshore. For normal mooring systems the sites are usually far too deep. Anchor lines of the necessary length would probably exceed the carrying capacity of the structures. What net materials are stable enough to prevent deformation of the cage, or even tearing, in strong currents. There is also the question of which farm design is most likely to withstand possible wave heights of 10 metres and more in stormy areas. Designers must take into account that the harsh conditions cause considerable wear and tear on the structures. It also remains unclear how offshore conditions affect the fish.

Offshore farms need completely new technologies

Despite the unresolved issues, the first offshore fish farms have already been planned and tested in practice. Such projects are realised mainly in countries where aquaculture is of great importance and where investors with strong financial resources are available. Norway, for example, can draw on its experience with technologies from the offshore oil and gas industry in developing offshore fish farms. With the two offshore fish farms Ocean Farm 1 and Havfarm, which have been in full operation off the Norwegian coast since 2017 and 2020 respectively, two different design concepts for offshore sites are being tested. Ocean Farm 1 resembles the familiar circular cages that have so far been used for salmon farming at nearshore sites, but on closer inspection shows significant differences. Unlike collar cages, Ocean Farm 1 is a dodecagonal, semi-submersible unit with a rigid frame structure designed to withstand rough sea conditions and significant wave heights of around 5 metres. The stiff netting material is

attached to the frame structure to prevent deformation of the cage. With a diameter of 110 metres and a volume of 250,000 m³, the unit offers space for more than one million salmon.

Havfarm, by contrast, has a ship-like shape. The 385-metre-long steel structure consists of six separate net cages, which

are attached at the top to the stable frame structure. Their total volume amounts to 414,000 m³ and provides space for 10,000 tonnes of salmon. The farm is designed to withstand significant wave heights of up to 10 metres. Work is also focusing intensively on the development of net cages that can operate underwater,

either when required or permanently. The development of such technologies has received further impetus from the rapid advances in artificial intelligence and modern sensor technology. The progress towards a more sustainable orientation of cage aquaculture is unmistakable... *Manfred Klinkhardt*

WOMEN IN AQUACULTURE PROGRAMME ADVANCES LEADERSHIP AND ENTREPRENEURSHIP IN TÜRKİYE

Izmir aquaculture sector hosts women's group

The General Fisheries Commission for the Mediterranean (GFCM) with the support of the Federation of European Aquaculture Producers (FEAP), has over the last four years implemented a programme to promote the role of women in aquaculture.

Each edition of the programme is supported by an aquaculture association from the host country. The fourth edition took place in January 2026 in Izmir, Türkiye thanks to the support of the Aegean Exporters Association. This organisation brings

together 12 sectoral associations (fruits, cereals, fisheries products, olive oil, textiles, etc.), representing more than 7,500 producing and exporting companies, facilitating their access to and growth in international markets.

Study tour programme builds a lasting network for women in aquaculture

Türkiye is one of Europe's leading agricultural and livestock producing countries and the continent's largest aquaculture producer. In addition, the country's culture, gastronomy and the hospitality of its people made it an extraordinary location to develop this programme for women.

For those wondering what an aquaculture programme that brings together women from different countries consists of, it can be broadly summarised as a 3 to 7 day study tour with scheduled visits to companies,

research centres and service providers related to aquaculture—in short, businesses involved in the farming of fish, molluscs, and algae. During these visits, women with different background, context, and culture share their stories: how they developed their business ideas, what their university research focuses on, and what their professional experiences have been as women in the sector. This enables participants to broaden their perspectives, discover new aquaculture-related activities, gain tangible examples of professional pathways, and feel empowered to turn their own projects into reality—just as others have done. It also creates an atmosphere of trust and mutual support. Following the experience, participants become part of an international network that includes members of the institutions that have organised the four programmes so far, more than 50 participants, and a wide range of contacts across different aquaculture fields in nearly all GFCM member countries—that is, throughout the Mediterranean and Black Sea region. This network helps them pursue their future goals and share their concerns and aspirations.



A net-manufacturing company, Emel, founded by a woman, supplies high-quality nets to fish farmers around the world. The lady in the picture is a staff member.

Three-day immersion in Türkiye's aquaculture sector

During the three-day programme, participants visited the Ilknak and

Akvatek hatcheries, where seabass and seabream are reared in the earliest stages of life. They also visited Marex, a company producing high-quality frozen ready meals based on traditional family recipes originally served in their restaurant—naturally centred around fish. They toured

Emel, a net manufacturing company whose founder supplies high-quality nets, in collaboration with Norway, to countless marine farms not only in Türkiye but worldwide, becoming a true driving force for the net industry in her country.

Participants also visited the Ertug processing plant, where women work to exceptionally high quality standards; Izmir University, whose researchers generate important knowledge for the sustainability of the sector; and the headquarters of the Exporters' Association, a powerful example of collective work leading to global export success. Access to these experts and facilities was, in itself, a privilege the participants will never forget—nor will they forget the generosity and hospitality with which they were welcomed. The learning and exchange environment was truly exceptional.

Focus on female entrepreneurship

Each edition of the programme has had a specific focus. In this case, it was oriented towards investment and business creation, with the aim of championing women entrepreneurship. While women account for around 30% of aquaculture jobs overall, the percentage of women business owners or in top management positions is below 5%. For this reason, the organisers held a competition during the programme in which participants, working in groups, developed a cross-border business idea led by women—one that we hope to see brought to life under their leadership in the future.

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Measuring environmental footprints, impacts, and ecosystem services

Meaningful comparisons of the environmental impacts, both positive and negative, of different aquaculture production technologies call for standardised indicators and systems of measurement.

approaches. What do they actually measure? How are they connected? And in which situations is each method most relevant? While the terminology may seem complex, the logic behind these tools is straightforward once the differences are clear.

Aquaculture's environmental impact depends on several factors

Sustainability in food production is commonly defined by the Food and Agriculture Organization of the United Nations as meeting the needs of the present without compromising the ability of future generations to meet their own needs. In aquaculture, this means producing nutritious aquatic food while safeguarding water resources, biodiversity, climate stability, and surrounding ecosystems. Research has shown that aquaculture can contribute significantly to food security and human health and often has lower greenhouse gas emissions than many terrestrially bred animal proteins. However, environmental performance can vary considerably depending on the species farmed, the production system used, feed composition, and management practices. This diversity makes reliable and robust environmental assessment essential.

At the most immediate level, environmental performance concerns what happens around the farm itself. This is



T. Bardocz

RAS technology can greatly reduce local environmental impacts through efficient water reuse and discharge treatment, and when powered by renewable energy it can also lower greenhouse gas emissions.

Fish farmers today are exposed to an ever-growing vocabulary of sustainability—carbon footprints, life cycle assessment, product environmental footprint, ecosystem services, carrying capacity, environmental impact assessment, and so on. Each term appears in funding calls, certification schemes, retailer requirements, and policy documents. For many producers,

whether operating ponds, cages, recirculating aquaculture systems (RAS), shellfish farms, or seaweed lines, the challenge is not just meeting and maintaining increasingly demanding environmental sustainability standards, but how to understand and navigate the different methods used to measure them.

This article aims to guide aquaculture professionals through the most important environmental assessment



T. Bardocz

Closed containment systems used for high-value species can reduce local environmental impacts while supporting the economic sustainability of fish farming through efficient and controlled production.

the domain of Environmental Impact Assessment, or EIA. An EIA evaluates the local effects of aquaculture operations on water quality, nutrient discharge, sediment accumulation, habitats, and biodiversity. It addresses questions such as whether a lake, river, coastal zone, or groundwater body can absorb nutrient inputs without ecological degradation. The concept of carrying capacity and especially ecological carrying capacity, plays a central role here. Every ecosystem has physical and ecological limits, and sustainable production must remain within them. Different farming systems, stocking densities, feeding strategies, and water management approaches can significantly influence how much production an ecosystem can sustain without environmental harm.

EIA provides a site-specific picture of environmental impacts

For example, in case of pond aquaculture, the picture is very complex. Extensive

and semi-intensive ponds often retain nutrients in sediments and biomass, and in some cases function as managed wetlands that support birds, amphibians, and other wildlife. Cage farming in open waters depends strongly on hydrodynamics and stocking densities, while RAS facilities minimise water discharge but concentrate waste streams that must be treated effectively. Shellfish and seaweed systems may even remove nutrients from surrounding waters. EIA therefore provides a site-specific, locally focused evaluation of impacts, forming the basis for licensing and regulatory compliance. What it does not capture, however, is the full global footprint of producing feed, energy, and infrastructure.

To understand that broader picture, the aquaculture sector increasingly relies on Life Cycle Assessments, or LCAs. Whereas EIA looks outward from the farm into its immediate environment, LCA looks both upstream and downstream across the entire value chain. It examines environmental impacts from feed ingredient production, hatchery operations, energy use, farm infrastructure, grow-out, processing, transport, and sometimes even retail

and consumption. Because it follows the product from “cradle to grave,” an LCA provides a comprehensive picture of the total environmental burden.

An LCA measures the environmental impact of a product over its lifespan

In practice, an LCA typically measures impacts per functional unit, often one kilogram of live or processed fish. It quantifies environmental impacts like greenhouse gas emissions, eutrophication potential, water consumption, land use, acidification, and ecotoxicity. This allows comparison between production systems and even between aquaculture and other animal protein farming. For example, a RAS facility may perform very well in terms of local nutrient discharge but show higher carbon emissions if electricity demand is significant. Conversely, pond systems may emit methane from sediments yet also store carbon and provide nutrient retention services.

Feed production frequently emerges as one of the largest contributors to life cycle impacts across all systems. An LCA thus helps avoid “problem shifting,” where solving a local issue inadvertently increases global impacts.

Within the European Union, the Product Environmental Footprint, or PEF, represents a further step in harmonising life cycle thinking. PEF builds on LCA principles but introduces strict methodological rules to ensure comparability between products. Its development is closely linked to European environmental policy objectives, including the European Green Deal. For aquaculture producers, PEF may increasingly influence environmental claims, eco-labels, and market access. So far, Product Environmental Footprint Category Rules (PEFCRs) have been developed mainly for marine fish products, providing a



T. Bardocz

Ecosystem services provided by aquaculture can also be valorized economically, for example through eco-tourism activities on multifunctional fish farms.

standardised framework for assessing their environmental performance. Similar rules for freshwater fish and other aquatic products would allow more consistent and comparable environmental assessments across the full diversity of the aquaculture sector.

Ecosystem services are valuable contributions to the environment

Yet focusing only on impacts risks overlooking an important dimension of aquaculture: its potential contributions to ecosystems and society. This is where the concept of ecosystem services becomes relevant. Ecosystem services describe the benefits that ecosystems provide to humans. These services include not only the provision of food and biological resources, but also ecological functions that regulate and maintain environmental quality. Many ecosystem services actively improve environmental conditions or help reduce human pollution. In aquaculture, these can

include water storage, nutrient cycling, carbon sequestration, habitat provision, and cultural values such as recreation and education. Extensive fishpond systems in Europe illustrate this particularly well. Many have evolved over centuries into valuable wetland habitats that support biodiversity and contribute to regional landscape identity.

Shellfish farms can enhance water clarity through filtration, while integrated systems can recycle nutrients between trophic levels. Such services are rarely fully captured in traditional environmental impact metrics. As a result, a production system might appear burdensome in a narrow footprint analysis while simultaneously providing important regulating or cultural services.

The integration of ecosystem services into Life Cycle Assessment (LCA) is still at an early stage of development. Traditional LCA focuses mainly on quantifying negative environmental impacts, such as greenhouse gas emissions, eutrophication, or resource use, while positive contributions from ecosystems are rarely captured. In recent years, researchers have begun developing frameworks that link ecosystem

services to LCA, particularly within the impact assessment and interpretation phases. These approaches attempt to account for services such as carbon sequestration, nutrient retention, water purification, and habitat provision. However, standardised indicators, consistent datasets, and widely accepted methodologies are still lacking. As a result, ecosystem services are currently considered mostly in a qualitative way or through supplementary analyses rather than being fully integrated into standard LCA results. Further methodological development is needed before ecosystem services can be systematically and quantitatively included in LCA-based sustainability assessments.

APIs take environmental, economic, and social impacts into account

Aquaculture Performance Indicators (APIs) also provide a practical framework that links scientific assessment tools with a broader concept of sustainability in aquaculture. APIs combine environmental, economic, and social indicators into a unified performance framework. The API methodology is based on a set of standardised indicators that measure key aspects of aquaculture systems, including resource use efficiency, environmental pressures, productivity, and socio-economic performance. These indicators are typically derived from farm-level data and can incorporate results from EIA and LCA analyses where available. By translating complex sustainability information into measurable and comparable metrics, APIs make it easier to assess and benchmark the performance of different aquaculture systems.

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Latvia's multifaceted fisheries sector adapts to change

The Latvian fisheries and aquaculture sector includes fish production from the Baltic Sea and the Gulf of Riga, a long-distance fleet that targets small pelagics off the coast of Africa, a coastal fishery, inland fishing, recreational fisheries, and an aquaculture industry. It also includes a long-established processing industry and significant trade in fish products. It is, in short, a highly diversified sector. Moreover, it is an important provider of employment opportunities in coastal communities and contributor to food security more generally.

The Latvian fisheries fleet is dominated numerically by small coastal vessels under 12 metres, which account for more than 93% of all vessels. The offshore Baltic fleet makes up just over 6%, while the high seas fleet represents a little more than 1%. Thus, in vessel numbers, Latvia is overwhelmingly a small-scale fishing country, even though a smaller number of larger vessels generate an important share of landings and industrial activity. The fleet has shrunk significantly since EU accession, reflecting both structural adjustment and pressure on resources. In 2004 Latvia had 942 fishing vessels; by 2024, this had come down to 663 while gross tonnage halved to 21,700, according to the Latvian National Statistics Portal. Over 2025 and 2026 a further nine vessels have been removed from the fleet with support from the EU to bring capacity in line with the resource.

Pelagic fisheries dominate volumes and value

Latvia's marine fisheries are concentrated above all on pelagic species,



Normunds Riekstins, Director, Fisheries Department, Ministry of Agriculture

especially herring and sprat. These species are central to the economics of the offshore fleet and to the supply of raw material for processors. The biological picture, however, is uneven. Some stocks important to Latvia remain in reasonable condition, while others continue to pose serious concern. Gulf of Riga herring is

still considered an important resource for both coastal and offshore fisheries, and sprat also remains a crucial commercial species. Stock performance depends heavily on the strength of incoming year classes. Normunds Riekstīns, Director of Fisheries in the Ministry of Agriculture agrees that there has been a

reduction in fishing opportunities for pelagics from some 60,000 tonnes to 50,000 over the years but says that for 2026 there is an increase of 15% for herring in the Baltic Sea (to 2,700 tonnes) and of 45% for sprat in the Baltic Sea (to 28,000 tonnes). While the overall trajectory is downwards, such fluctuations are common within the falling trend. The sector, he says, is doing fairly well in terms of metrics such as catch per unit effort, profitability etc. However, the fleet is ageing and this affects safety, fuel efficiency, labour attractiveness, and the feasibility of the energy transition.

Regarding cod, formerly an iconic species in the Baltic Sea, scientific advice continues to support the prohibition of targeted cod fishing as the stocks suffer from environmental conditions, weak recruitment, prey availability, and parasite pressure. In practical terms, cod has become a choke species, especially for coastal fishers and for any mixed fishery where cod appears as bycatch. Salmon also remains tightly constrained, with conservation measures and very limited fishing opportunities. By contrast, plaice currently appears to be in better biological condition, though Latvia has no quota for that stock and changes in the combined assessment of plaice may yet reduce wider fishing opportunities in the Baltic. These stock dynamics help explain the broader direction of Latvian fisheries policy and industry strategy. Mr Riekstiņš, makes clear that the main challenge is no longer how to extract more volume from the sea, but how to obtain more value from limited and fluctuating resources. Latvia's pelagic fisheries may still deliver substantial landings in good years, but the sector cannot rely on raw volume growth. Biological ceilings, quota fluctuations, and environmental pressures make that unrealistic. Instead, the economic emphasis has shifted towards value addition, better utilisation, product development, and maintaining markets even when catch opportunities are volatile. This can be seen in the off-shore Baltic fleet which is catching and

freezing herring and sprat and sending it for further processing to Latvian companies or for export. Ukraine is a major customer for these frozen blocks, and they are also sent to some African countries. This trade cushions the impact of falling quotas as value does not fall to the same extent. To achieve the best price fishers also restrict their activities to the spring and the fall, when the quality of the fish is the highest.

Fish processing has a long tradition

Latvia has a long tradition of fish preservation, canning, and smoking, with sprats in oil as the best-known emblem of the industry. The processing sector is represented by more than 90 companies producing fish products worth EUR308m (2023) for local and export markets.

Processing depends partly on domestic landings, but also very importantly on imported raw material. The largest share of imported fish products, excluding preserved products, consists of frozen and chilled fish used as raw material for producing prepared or preserved fish in Latvia much of it for export. In 2024, the export value of fish products, including prepared or preserved fish, reached EUR 356 million, up 11.5% on 2023. The overall external trade balance for fish products remained positive at EUR 83.9 million. While the trade balance for prepared or preserved fish was strongly positive, at EUR 114.3 million. In 2024, Latvia exported 39.9 thousand tonnes of prepared or preserved fish and seafood worth EUR 158.8 million. The sector's performance is especially significant because processors have had to adapt to market loss and redirection in recent years. Firms have diversified destinations and product mixes. Fish products were exported to 76 countries in 2024, while prepared or preserved fish and seafood reached 71 countries. Companies are adapting to the challenge of

finding labour by using contractors who bring in people from remote countries, as local labour is not available or not interested in the work. Automation is generally not feasible as the tasks, such as packaging smoked sprats in cans or jars, are best performed by hand.

Processors also face a changing regulatory and technical environment. Stricter limits for polycyclic aromatic hydrocarbons in smoked products, including canned sprats, are being considered by the EU. Armands Krauze, Latvian Minister of Agriculture, states that a revision to the limits would render 14% of Latvian canned sprat production non-compliant. He firmly believes in waiting for the results of a risk assessment being conducted by the European Food Safety Authority on the safety of smoked products. If standards do tighten, firms may need to invest in technology, modify production methods, or reformulate products without undermining the sensory qualities that give traditional items their market appeal. These products are exported to countries around the world, says Mr Riekstiņš, and it is necessary to adapt to maintain consumer trust in these products.

Aquaculture using recirculation systems a potential growth area

Aquaculture occupies a much smaller place in Latvia than marine fisheries and processing, yet it remains strategically interesting. The sector consists of about 65 companies and markets around 750 tonnes annually. Carp farming dominates, accounting for more than 70% of the industry, with smaller volumes of trout and other species. Mr Riekstiņš describes aquaculture as stable at a low base level of production. Carp remains the main species, yet the market for carp is limited, and Latvian producers face competition from neighbouring

countries. Many pond farms therefore focus on local or regional markets rather than large-scale expansion. There is some room for incremental growth, but not for a dramatic increase under the current model. More promising, in principle, are recirculation systems and possibly marine aquaculture. Mr Riekstins points to Arctic char production as one of the more successful examples of the former. Marine aquaculture could offer a larger increase in output, but faces environmental concerns, particularly over nutrient and organic pollution. Mr Riekstins refers to ideas for planned pilot projects that seek to prevent the pollution from cages from entering the sea. He emphasises however that while the ministry is generally supportive of such projects for the economic benefits they are likely to bring, this is only on condition that all the environmental requirements are met.

Coastal fishers' PO is highly active

Small-scale coastal fisheries are valued not only as commercial activity, but as part of the social and cultural fabric of Latvia's coastline. The government sees coastal fishing as a form of cultural and historical heritage, while fishing communities themselves are trying to strengthen economic resilience by increasing value-added, improving storage and freezing capacity, and linking fish sales more closely to tourism and hospitality. Coastal fisheries are unlikely to grow dramatically in volume, but stability in the sector is desirable. Their long-term viability will depend on access to quotas, local branding, direct sales, and diversified income. Generation renewal remains a concern. Younger fishers do enter the sector, often through family succession, but there is uncertainty about whether this will continue into the next generation. The work is physically demanding, incomes are limited, and children today may be less willing to take on such labour-intensive

occupations. The government is highly supportive of the sector for its historical value and has therefore encouraged sector promotion, training, school outreach, and organisational development among coastal fishers. But long-term renewal ultimately depends on whether fisheries can still offer a credible livelihood. The fishers themselves are getting organised. The first producer organisation for coastal fishers, which has members from all along the Latvian coast, has been established and is now considering investments in freezing and storage capacity to be able to sell fish when prices are high. The PO is also working on processing the fish and putting up small shops where freshly processed fish can be sold in the

summer to tourists. It also organises events such as fish days, promotes the use of coastal fish species, and maintains a website where fishers can communicate with the public.

Latvia has a major strength in processing, where it combines local landings with imported raw material to generate value-added output for export. Trade results in 2024 confirm that this model remains effective. Latvia's fisheries economy is therefore not defined by expansion in catch volume, but by resilience, processing capability, market reach, and the search for higher value from limited resources. That is the core of the sector's current position and, most likely, of its future direction as well.

Fisheries control extends to inland fishers and aquaculture producers

Across the sector, one theme links fishing, aquaculture, processing, and trade: control and traceability are becoming more detailed and more digital. Fishers must comply with the revised EU fisheries control framework, new obligations for operators throughout the supply chain, and extended requirements for reporting, traceability, and catch registration. Latvia already has an electronic

traceability system for fisheries batches, says Artis Aboltins, Senior Expert in the Strategy Division of the Fisheries Department, and this will be extended and updated in line with new EU rules, including provisions relating to inland waters and aquaculture products. He explains that inland fishers and fish farmers can sell their products to any buyer—an individual or a company (buying from marine fishers requires the buyer to be registered as a First Buyer). The volume of fish is entered into the system which automatically generates the lot numbers which they use to sell the fish to different buyers (or take it out of the system for personal use). The number will follow the fish along all the links in the chain. Since the system for offshore, inshore, and coastal fishers was already in place, the same principles were used for inland fishers and for fish farmers. For buyers that work with fish from all the different sources, this meant there was little difference in the recording procedure whether they were buying marine, freshwater, or farmed fish. Ultimately, says Mr Aboltins, the point is to trace where the fish came from and where does it end up. In case of a recall of a product from the market, the system is invaluable. But it also prevents illegal fish from unregulated catches from appearing on the market because it will not have the lot numbers. In Latvia's case this is mainly theoretical as IUU fish on the market is hardly an issue.



Traceability now covers all segments in the Latvian fisheries and aquaculture sector.

Arctic char producer eyes major expansion

Blue Circle is a Latvian land-based aquaculture business producing premium, cold-water fish close to market, in a tightly controlled environment. The company farms Arctic char in a recirculation aquaculture system (RAS) and sells it in the Baltic region under the name Zivs uz ledus (Fish on Ice).

The farm was conceived and executed as a pilot project with construction completed in December 2019, and operations beginning immediately afterwards, just ahead of the covid-19 disruption that closed hospitality channels across Europe. Lauris Apsis, the founder of the company, describes the pandemic in retrospect as a concentrated lesson in timing, risk, and resilience: pandemic shocks, energy price volatility, and a market shaped by low salmon prices all arrived before the business had fully stabilised. Despite the rough start, by 2025 the company was producing just over 100 tonnes of head-on, gutted fish annually, while running the site with a team of four people, including harvest and dispatch. These achievements may be modest by global salmon standards but are substantial in Latvian terms, and Mr Apsis has now started to design a much larger second phase.

A salmonid that is not salmon

Mr Apsis feels that competing head-to-head with mainstream salmon or trout producers, particularly those supplying large volumes from sea-cage

systems, was a “guaranteed loss”. Instead, the company selected Arctic char as a niche salmonid with a milder flavour, a tender texture, and a story that retailers and chefs can use to distinguish the fish from salmon and trout. The decision was also shaped by place. The farm is located in the Ropaži area, where groundwater is around 7°C, naturally steering the decision towards cold-water species. Mr Apsis describes the facility as the largest and most advanced recirculation fish farm in the Baltic States, built on family land, and designed around high standards of fish

care, and environmental responsibility. That the fish is a high quality product is not in question. Low-density stocking and high levels of tank hygiene mean that the fish suffer none of the damage to fins and heads that is visible in fish in more densely packed enclosures. My job, Mr Apsis avers, is to persuade people to try it, the fish will do the rest.

In its daily operations the farm manager attempts to reduce variability, because small deviations in feeding, cleaning, or water management can show up months later as uneven growth, welfare, or quality issues.



Lauris Apsis, the founder of Blue Circle, a company farming Arctic char for the Baltic market.



Blue Circle

Arctic char is a salmonid which Blue Circle markets as a high quality niche product to distinguish it from salmon.



Blue Circle

A versatile fish, Arctic char can be made into fillets, portions, or steaks. It also lends itself to be marinated or smoked.

Disease-free eggs are sourced from Canada; the eggs are disinfected before shipment to reduce biosecurity risk, and batches of about 50,000 eggs arrive four times a year. Larval stages are treated as the most sensitive, when the fish are kept in cooler water to support slower, steadier organ formation. Juvenile fish are moved into warmer grow-out conditions. As the fish develop, Mr Apsis aims for year-round deliveries by structuring production into multiple batches. In the current pilot, weekly deliveries amount to around three tonnes. Harvesting is tied closely to confirmed orders, so that fish can stay in the system if demand softens. The company's focuses heavily on freshness and speed: harvest starts early, and product can reach retail distribution the same day, with a conservatively set shelf life of ten days.

Creating value from waste

The farm's freshwater intake reaches about 5.5 litres per second at peak, with the expectation that it can be reduced further as additional treatment steps, such as denitrification, are introduced

in future designs. Stocking density is described at around 50–60 kg per cubic metre, notably below the upper range often seen in high-intensity cage systems. The fish are housed in large circular tanks where they must constantly fight the current and this combination of sustained swimming and lower crowding supports fish health and reduces reliance on medicines. While energy is treated as a strategic issue, Mr Apsis is keen to stabilise production and sales first before embarking on an energy plan that will include solar power. He also sketches a circular model in which sludge and processing by-products could be used to generate biogas. If the carbon dioxide could be stripped from the gas it would contribute to making the operation carbon neutral. Other ideas in play are to sell excess energy back to the grid or to add value to the processing waste by using it as a source of ingredients such as collagen, fish oil, and calcium or other minerals.

If production discipline is one pillar, market education is the other key factor to sell a species that many consumers are unfamiliar with. The company's strategy, forged in the urgency of early 2020, was to build a brand quickly. When the Finnish market closed during

covid-19 and initial sales assumptions collapsed, Mr Apsis created the *Zivs uz ledus* identity "overnight", packaging whole fish on ice, and moving aggressively into Latvian retail as well as selling directly to consumers. The strategy worked because it combined availability with a recognisable name. The brand is now stocked in major retail chains, and the website shows a strong consumer-facing emphasis on recipes and usage ideas. Mr Apsis is acutely aware of the importance of consumer-friendly ready-to-cook products such as portions, fillets, and steaks, as well as ready-to-eat items such as smoked and cured fish. That is the only way to keep consumers, especially younger buyers on board, he says, in an age where fish consumption is declining across the EU.

Expansion plans will create an Arctic char behemoth

Blue Circle's pilot was built in close cooperation with Nordic expertise from early on. Mr Apsis also mentions his Finnish partner, the Salmela family of

Finland, associated with the Hesburger fast-food chain, who will also play a major role in the company's ambitious expansion plans. The agency, Invest in Latvia, reported in December 2025 that Blue Circle was preparing an investment plan exceeding €30 million, targeting an output of roughly 3,000 tonnes per year (from 120 tonnes currently), alongside a full processing operation and a broader product range. Mr Apsis envisages using the lessons learned from the current facility to optimise production in the expanded operation to make it leaner and more efficient. Some tasks, such as grading, could be fully automated, an option not viable with the current volumes. If

realised, the expansion would be transformational for Latvian aquaculture (increasing national farmed seafood output by a factor of four) and would create significant global player with in cultured Arctic char production. It would allow the company to negotiate with potential buyers in countries like Germany where the ability to reliably deliver large volumes is critical. Whether the brand *Zivs uz ledus* will continue remains to be seen. Even for Finns it is difficult to pronounce, says Mr Apsis, so this is something we need to discuss with our marketing experts.

Blue Circle is still small enough that the founder's philosophy is visible in day-to-day decisions: build routines,

protect biosecurity, keep quality consistent, and treat the market as a long term partner rather than a single sales push. The pilot farm is, by design, a learning platform. It has already delivered proof of stable production, and it has validated a Baltic retail route to market for Arctic char, but it has also exposed the constraints of operating without processing, and without the volumes needed to serve larger export buyers. The next stage will test whether those lessons can be translated into a scaled industrial facility without losing the brand's core promise: fish produced carefully, in a controlled environment, with a transparent identity that retailers can stand behind, and consumers can learn to trust.

An ancient fishing tradition thrives in Latvia

The river lamprey (*Lampetra fluviatilis*) is an anadromous, jawless vertebrate that spends its adult life in the sea, then migrates into fresh water to spawn. In Latvia, this migration is not only a biological event but also the basis for a seasonal fishery for a small group of specialist fishers. Processed, the fish is regarded by many Latvians as a delicacy.

Latvia's lamprey fishery is concentrated in rivers that drain into the Baltic Sea and the Gulf of Riga including the rivers Salaca, Gauja (including the Carnikava area), Daugava, Irbe, and Venta, plus tributaries where lampreys stage and move upstream. On the Salaca, the fishery still uses a distinctive,

labour-intensive method that Uldis Rozensteins, a lamprey fisher and small-scale processor, describes as essentially unchanged in principle for more than a century. Fishers work from small wooden bridge-like structures built across part of the river each year, with traps fixed to the structure so migrating lampreys are funnelled into them by the current.

Catches depend on several environmental factors

The fishing season runs from 1 August to 1 February, but the actual fishing can be far shorter because catches depend on environmental factors such as river conditions, rainfall, temperature, and the strength and direction of the wind. On the Salaca, Mr Rozensteins explains that they do not fish around the clock for six straight months: high water and debris can force them to pull traps ashore for days at a time to prevent the whole structure acting like a dam and breaking under pressure. At the other extreme, under-ice fishing is possible but is usually limited because only part of the width of the river can be worked without repeatedly breaking large areas of ice. This reduces effort, and, as



Uldis Rozensteins holds up a fish trap of the kind used in olden times. Modern traps (right) use nylon mesh making them more durable.

fishers themselves acknowledge, allows many lampreys to pass upstream.

How and where the gear is set reflects both tradition and regulation. In Latvia, specialised lamprey fishing is permitted in 16 rivers, using either lamprey traps or lamprey weirs. The classic weir fishery, described as a unique and ancient technique, now survives in only a few places, notably on the Salaca, Svētupe, and Venta rivers, where fishers rebuild weirs before each season. The Salaca bridges are rebuilt from scratch each year, largely from wood, partly because the structures are too fragile to survive ice and spring floods, and partly because the river's status and restrictions mean fishers cannot simply replace wood with concrete and steel. Even so, fishers have adapted, for example by, replacing older bindings such as bark with steel wire for durability, and switching from cane basket-like traps to nylon net traps.

Restocking programme contributes to sustainability of fishery

Fishers using the bridge-and-trap method are allowed to block roughly

two thirds of the river width with traps, while one third must remain open to permit the passage of other species, and, inevitably, some lampreys. This is important for the sustainability of the fishery, says Mr Rozensteins, who firmly believes that catching everything would quickly undermine future seasons and the activity for future generations. The design of the gear also keeps bycatch low. On the Salaca, the trap opening is small, larger fish can see and avoid the gear, and any occasional bycatch is easy to release because the fish are alive and can be removed by hand. Latvia's approach to managing the resource combines fishing regulations with restocking. River lamprey is protected under EU and national legislation, and the country has maintained a state restocking programme since 1991, run through the Scientific Institute of Food Safety, Animal Health and Environment (BIOR) and implemented via state fish farms. Each year, Latvia releases around 10 million river lamprey larvae (ammocoetes) into rivers and millions of juveniles of other species as part of its restocking efforts. The programme depends on collaboration with fishers, who catch migrating spawners in autumn; these are held over winter in flow-through systems so they mature naturally, and larvae are

later released over kilometres of suitable habitat. In addition to stocking, Latvia has used translocation, moving spawners past barriers such as waterfalls that block migration.

Monitoring is an equally important pillar, not least because lamprey biology complicates standard fish stock assessment. Lampreys spend years as larvae buried in fine sediments, which makes larval surveys a practical way to track populations. BIOR has carried out regular monitoring of ammocoetes since 1998, and it compiles data from fishers' logbooks to understand trends in catches and the characteristics of the fish taken. BIOR has also used tagging and recapture surveys to estimate population size and fishing gear efficiency. For fishers, however, management is experienced most immediately as weather, water, and timing. Mr Rozensteins describes river levels that can rise dramatically in days, forcing traps to be removed to protect the bridge and to prevent leaf-and-debris build-up that chokes flow through the traps. He also links catch success to wind direction. West and south-west winds blowing from the sea help lampreys sense the river and enter it, while dry autumns, low flow, and more frequent easterlies can suppress runs and push more migration into spring.

Grilled lamprey is highly popular

Economically, the lamprey fishery is small in volume but outsized in importance for those who depend on it. National catches vary year to year and even at the river level, Mr Rozensteins says, on one bridge a bad season might bring three to four tonnes while a very good season around ten tonnes. According to Mr Rozensteins, the number of people involved in the fishery is limited to perhaps 30 to 40 individuals across Latvia, many of them combining it with processing activities and with fishing for other species. The value generated is supported by strong domestic demand around celebrations, such as Christmas, when consumers look for traditional foods. Processing is often close to the fishing grounds. Along the Vidzeme coast, especially the Carnikava area, small family businesses process lamprey using recipes and skills passed down through generations. Carnikava lamprey, baked on charcoal, has won

use the EU's Protected Geographical Indication label since 2015, a recognition of both origin and processing method in the marketplace. After landing, lampreys are typically left for 12 to 24 hours before grilling, with timing adjusted by season and temperature, partly to let the flesh relax so the texture and taste meet expectations. Grilling is commonly done over real charcoal in wood-fired stoves; attempts to replicate the flavour with electricity, he says, do not satisfy customers. Products range from ready-to-eat portions in plastic containers through to lamprey preserved in glass jars. The latter have a longer shelf life making it possible spread sales over a period even when catches arrive in peaks.

Domestic market vies with Latvian diaspora to buy lamprey

One reason lamprey can be processed with comparatively little cleaning is

biological timing. Fishers target lamprey during the upstream migration when the animals have stopped feeding, and, as Mr Rozensteins explains, the gut and organs have largely regressed, so the fish do not need to be gutted like eels or larger lamprey species elsewhere. For products in jars, the heads may be retained to add fat during preparation but may then be removed before packaging. Trading patterns reflect both history and current geopolitics. In Soviet times, Mr Rozensteins states, much of the lamprey went to markets such as Moscow and St Petersburg, reinforcing its reputation as a premium product. Today, the market is primarily in Latvia, with some exports to the Latvian diaspora in other parts of the world. In terms of price, his product averages around EUR 34 per kilogram when sold directly, while at retail stores it can reach EUR 44–45 per kilogram, creating incentives both to expand production and to sell through channels such as festivals and on-site tourism. Lamprey festivals in places such as Carnikava and Salacgrīva showcase preparation methods, attract visitors to fishing sites, and keep knowledge alive. Mr Rozensteins has also organised visits where tourists learn the history, see the gear, and taste freshly grilled lamprey, and he notes that the fishing method and related production have received additional recognition as national heritage, adding another layer of protection for the practice. Today, a lamprey fishery alone is insufficient to generate the income necessary to support a small business, but combined with processing and tourism-related activities it is economically viable, says Mr Rozensteins. This ancient tradition has managed to thwart the pressures of changing weather, labour constraints, and the loss of traditional markets to prove that it still has a sustainable future.



The bridge to which the lamprey traps are attached. Made of wooden stakes tied together with steel wire, the bridge is rebuilt each season.

Latvia plays an active role in Interreg RoundGoby project

RoundGoby is an Interreg Baltic Sea Region project that aims to help authorities improve the legal framework for round goby fisheries and to guide enterprises in developing appropriate fishing gear and products for local markets. It runs from November 2023 to October 2026.

Interreg
Baltic Sea Region



Co-funded by
the European Union

BLUE ECONOMY
RoundGoby



Dr Eriks Kruze and Loreta Rozenfelde, scientists at the Latvian Institute of Food Safety, Animal Health, and Environment (BIOR), represent the institute in the Interreg project, RoundGoby.

On parts of Latvia's coast, the invasive round goby has moved from being an ecological concern to becoming a resource for small-scale fishers. This shift can be

attributed to Latvia's willingness to experiment, adapt, and, in practical terms, learn how to fish round goby in a selective way so that other species are not caught as by-catch. The Interreg project RoundGoby starts from this

Latvian experience and attempts to answer a question of relevance to the entire region: if the invasion cannot be reversed, how can the region reduce harm while creating value?

A significant part of coastal landings

Round goby was first recorded in Latvian waters in the Gulf of Riga in 2002 and near Liepāja in 2004, after which it became established along the coastline. The species appeared in commercial catch statistics in 2006 at a negligible level, then climbed year on year until 2018, when landings peaked at 1,113 tonnes. Loreta Rozenfelde and Eriks Kruze, scientists at the Latvian Institute of Food Safety, Animal Health, and Environment (BIOR), describe recent annual catches as in the 500–700 tonne range, making it the second most important coastal species after herring. In many places, the round goby is primarily considered a threat because it destroys features such as mussel banks, altering the ecosystem both physically and biologically

as species that feed on mussels move away. On the other hand, as the round goby has become more established, other carnivorous species have adapted to it. In coastal areas, cod, turbot, perch, and pike perch prey on it, as do cormorants. There is also evidence to suggest that they make up a significant part of grey seals' diets. Importantly, in Latvia, it is also an established component of coastal landings. The project's purpose is therefore not simply to remove but to manage the species under conditions where some livelihoods now depend on it. Dr Kruze calls it a "bio-economic paradox": the same fish is both an invasive predator and a business opportunity.

Latvia's coastal fishery is small-scale, generally operating to around 20 metres depth, and using passive gears such as gillnets and trap nets. A key feature is that fishers and scientists have co-developed gear that targets round goby more selectively, including specialised gillnets and trap nets. In some of the countries involved in the project, gill nets are not encouraged because of the risk of trapping birds. In Latvia, Dr Kruze states, few studies have been done on the effect of gill nets on marine birds, but their popularity among fishers is declining because they attract seals, which feed on the catch and destroy the gear. Increasing the catches in a bid to exterminate the fish is not an option as—now that the fish has proven to be of commercial value—it needs to be managed like any other resource rather than be overfished, says Dr Kruze. Besides, if fishing pressure rises without control, the risk of by-catch rises too, including undersized fish of commercially desirable species. The fishery is regulated through limitations on the number of gears per municipality and with temporal restrictions rather than through a catch quota. Ms Rozenfelde explains that the cleanest fishing window is the spring-summer spawning period, when round gobies are active and easier to catch,



Round gobies captured in a trap.

and unwanted bycatch is lower. Autumn fishing was curtailed, she adds, after test activity showed unacceptable bycatch of other species, such as small-sized cod, flounder, and vimba bream.

More selective fishing gear being tested

A Latvian-specific complication is that the peak round goby season overlaps with herring spawning in the Gulf of Riga, creating mixed catches that reduce value because of the labour needed to separate the fish. This has an impact on prices and provides an incentive to develop more selective trap nets that reduce herring by-catch. Even if there is a by-catch it can still be released alive from the trap net. The project's test fishing work is designed to provide recommendations for cost-efficient fisher-



Among the possible uses of round goby being investigated by project partners is as snacks for pets.

ies that fit national legislation, rather than pushing a single method across the region.

Latvia does not have a domestic market for round goby, so catches are exported. The main sales channels in the Baltic Sea region are Latvian and Estonian processors, who freeze whole fish and sell it onward. Prices vary from €0.70 per kilogram for smaller fish, and around €1.20 per kilogram for larger fish, suggesting the importance of adding greater value to the raw material. Latvian landings are also exported frozen at around €0.70/kg, mainly to Ukraine. Round goby has in recent years become a key species for Latvian coastal fishers, partly because Eastern Baltic cod stocks have declined. At BIOR, Ms Rozenfelde says, chemical analyses of the fish flesh revealed a protein content of 15-20%, a fat content of 1%, and no toxins such as heavy metals. The latter can partly be attributed to its relatively short lifespan of 6-8 years. This nutrient profile makes it a potentially valuable species for human consumption as well as for pets. The lack of toxins in the flesh should also mitigate concerns about a species that feeds on mussels or lives near ports. A review of products and processing methods across the Baltic Sea Region found that round goby products are rare in regional retail, with no locally produced human-food products identified, and only one locally produced pet product found during the market observation period. The few round goby products available are seasonal, and even the prominent canned product sold in several countries is produced outside the region. Latvia's experience shows that catching the fish needs to be followed by creating a stable demand that pays for handling and processing. Without that, the fishery risks becoming dependent on commodity exports that are price-sensitive and do not reward quality differentiation.

Products for humans and their pets

Processing round goby is challenging because of the large size of the head. The small size round gobies do not lend themselves to filleting by machine, while manual filleting is difficult because the flesh is fragile and the fish is small and slimy. One way of treating the fish is to therefore mince it and use the mincemeat to develop patties and other formed items. Project partners have also discovered that round goby meat can lose its integrity in canned products, which consumers may find unpleasant, and that consumers appreciated fried round goby most in the products assessed. A commercially available fried round goby in tomato sauce was perceived as mushy, implying that preparation or packaging methods may need adjustment if that product type is to succeed.

Work in the project has determined that the pet food market is structurally similar across Baltic Sea Region countries, and that demand trends support growth. Dr Kruze feels that smaller fish sizes that are impractical to fillet could be turned into pet snacks, where processing can focus on drying or other formats that do not require delicate filleting. Partners are carrying out consumer research on dog snacks made with round goby, even as they trial round goby in public kitchens and among chefs to build familiarity with the species, which may, over time, lead to the creation of a domestic market for the fish.

Lessons from the Latvian experience

The round goby project has produced valuable results. Latvia was among



BIOR

Tests carried out in the RoundGoby project to identify consumer preferences revealed that fried round goby was the most popular choice.

the first countries in the region to experience the depredation wrought by the fish, to develop a management strategy, to experiment with selective gears, and to build a market for it, says Dr Kruze. This knowledge can be shared with the other participating countries through the round goby project. The Latvian partners in the project have also discovered that moving up the value chain calls for a sustained effort to promote the fish to consumers and to develop products that meet their requirements. Without this, the fish will be treated as a commodity sold in bulk for a low unit price. While round goby catches in Latvia seem to have plateaued, the fish is spreading northwards in the Baltic sea and other countries can therefore learn from the Latvian experience.

Turkish aquaculture contributes significantly to economy, food security

Today, aquaculture has become the backbone of Türkiye's aquatic food production, transforming the country into one of Europe's leading producers and exporters of farmed fish. Supported by strong governance, abundant natural resources, and a rapidly modernising industry, the sector continues to expand in line with global sustainability and food security goals.

Globally, capture fisheries have reached their biological limits, so aquaculture has emerged as the main driver of growth in seafood supply. Global fisheries and aquaculture production surged to 223.2 million tonnes, with 185.4 million tonnes of aquatic animals and 37.8 million tonnes of algae, according to FAO's State of World Fisheries and Aquaculture 2024. Türkiye closely follows this global trend, with aquaculture now surpassing capture fisheries as the country's primary source of aquatic food.

In 2024, Türkiye's total aquatic products output reached approximately 933,000 tonnes, of which around 577,000 tonnes (62%) originated from aquaculture and 356,000 tonnes (38%) from capture fisheries. This structural shift reflects not only global dynamics but also deliberate policy choices aimed at ensuring food security, export competitiveness, and sustainable resource use.

Natural resource base and institutional framework

Türkiye possesses a highly diversified and favourable natural resource base for aquaculture. Surrounded by three seas, having four seas in total and endowed with extensive inland water resources, the country benefits from, dam reservoirs, ponds and river systems. These ecosystems host more than 900 aquatic species, over 100 of which are commercially exploited in marine and inland waters.

The sector is governed by the General Directorate of Fisheries and Aquaculture under the Ministry of Agriculture and Forestry. The Directorate operates through specialised departments responsible for aquaculture, fisheries control, resource management, infrastructure, statistics and information systems, enabling integrated planning,

effective monitoring and alignment with international standards. Producer representation is organised through the Aquaculture Producers' Central Union with 23 provincial-level unions, ensuring close coordination between policymakers and producers across the country.

Beyond its economic role, aquaculture is a significant driver of employment and rural development, particularly in coastal regions. The expansion of farming, processing, logistics and export-oriented activities supports thousands of jobs and offers new opportunities for young people and women in many regions.

Production structure, capacity and technology

As of 2024, Türkiye hosts 2,471 aquaculture facilities, (557 marine farms and 1,914 inland water facilities). The total approved project capacity of these farms is close to 931,000 tonnes per year, underlining the sector's readiness for further expansion. In addition, Türkiye operates 146 hatchery facilities (95 freshwater and 51 marine) providing a strong foundation for fry supply. This vertically integrated structure supports biosecurity, genetic quality and production efficiency across the value chain. There is an increasing number of integrated companies combining hatcheries, feed production, grow-out, processing and marketing under one roof. The sector is rapidly adopting



modern technologies such as offshore cage systems, improved feed formulations, digital monitoring tools and, increasingly, recirculating aquaculture systems (RAS) for high-value species. These investments enhance productivity and resilience while helping to address environmental sensitivities in coastal areas.

Species composition and flagship products

Aquaculture production in Türkiye is concentrated on high-value species, reflecting both ecological suitability and strong market demand. The main species are rainbow trout (*Oncorhynchus mykiss*), sea bream (*Sparus aurata*) and

sea bass (*Dicentrarchus labrax*). Türkiye is the world's largest producer for these three species. Over the past decade, Türkiye has also achieved remarkable success with "Turkish Salmon" (as a brand) farmed in sea cages that has rapidly gained international recognition. Production of Turkish Salmon increased from around 18,000 tonnes in 2020 to 60,000 tonnes in 2024, driven by strong export demand and investments in offshore farming technologies. Turkish Salmon has become one of the fastest-growing export items and an important symbol of the sector's innovation capacity.

In recent years, diversification efforts have also accelerated, with growing interest in meagre (*Argyrosomus regius*), Mediterranean mussels and other emerging species. This development

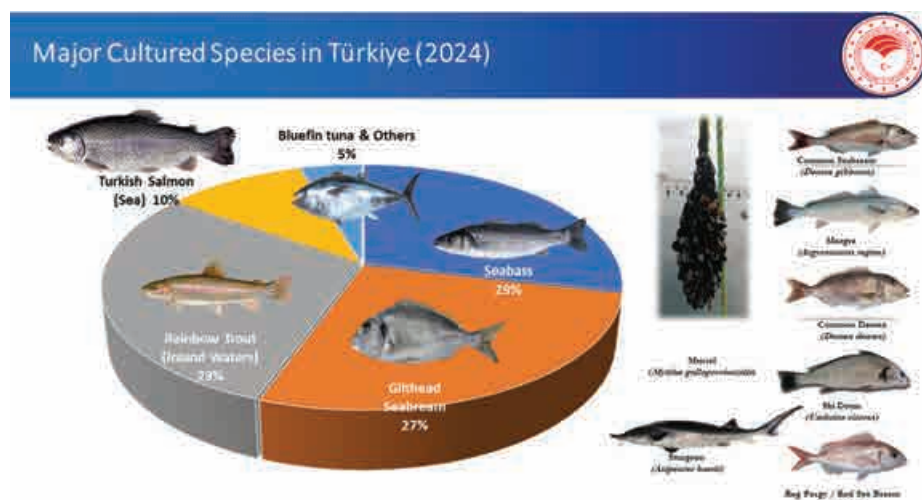
supports resilience and market flexibility. Value-added products, including fillets, smoked products and ready-to-cook items, are gaining importance in response to evolving consumer preferences in both domestic and export markets.

International competitiveness and trade performance

Türkiye has emerged as a key player in global aquaculture markets. It ranks 17th among the top 20 producers worldwide and is Europe's leading producer of sea bass, sea bream, and trout. Turkish farmed fish enjoy a strong market position thanks to quality, food safety and competitive pricing. Export performance has mirrored production growth. In 2025, Türkiye's total fisheries and aquaculture exports increased by almost 12% year on year to reach USD2.24 billion and 290,000 tonnes. The majority of these exports originate from aquaculture products such as sea bass, sea bream, trout, Turkish Salmon and tuna. Exports in 2024 went to 97 countries including the European Union, United Kingdom, Russian Federation, Japan, South Korea and an expanding range of markets in the Middle East and North America. This success is underpinned by a modern processing industry aligned with international food safety, traceability and sustainability standards. The sector's export target for the coming years is to reach USD 3 billion.

Sustainability, planning and future priorities

Sustainability lies at the core of Türkiye's aquaculture policy. In recent years, the Ministry of Agriculture and Forestry has introduced an approach designed to optimise resource use and



The chart reflects 2024 production share according to cultivated species and alternative and potential aquaculture production species in Türkiye

Trade



Export has exceeded 2 billion dollars in 2024



enhance long-term sectoral stability. Key species such as sea bream, sea bass, Turkish Salmon, mussels and trout are produced under a planned framework that now covers the vast majority of total aquaculture output. In addition, sturgeon, a fish of considerable economic value due to its valuable caviar and high-quality meat yield, and included in the Convention on International Trade in Endangered Species of Wild Animals and Plants (CITES), is developing in Turkey. Considering Turkey's geographical location and the suitability of its water resources for cultivation, sturgeon farming is seen as a promising sector in terms of both domestic market and export potential.

At the international level, Türkiye's governance performance has been formally recognised. Within the framework of the General Fisheries Commission for the Mediterranean (GFCM), Türkiye has achieved full compliance assessments for four consecutive years, providing a concrete demonstration of its commitment to international governance principles and science-based resource management. Environmental monitoring, spatial planning, offshore aquaculture technologies and improved feed efficiency are central elements of this approach. Together with digital monitoring systems and enhanced data

collection, these measures contribute to transparent governance and adaptive management. Ongoing efforts to refine carrying capacity assessments, reduce nutrient emissions and improve feed conversion ratios aim to minimise environmental footprints while supporting continued growth.

At the same time, policymakers and industry are working to address emerging challenges such as climate change impacts, disease risks, input costs and competition for coastal space. Strengthening research and innovation, expanding training opportunities and deepening collaboration between

public institutions, universities and the private sector are seen as essential to maintaining the sector's competitiveness and resilience.

Building a resilient and sustainable aquaculture future

Türkiye's aquaculture sector is a dynamic industry with continued growth potential, combining a strong institutional framework, competitive production and export-oriented structure with an increasing emphasis on sustainability. The sector is well positioned to respond to global demand for healthful, low-carbon animal protein and to contribute to national goals on food security, rural development and green growth. Looking ahead, continued investments in innovation, diversification, environmental performance and human capital will be key to maintaining growth while safeguarding aquatic ecosystems. In this context, Türkiye's experience offers valuable insights for countries seeking to balance economic development with responsible aquaculture practices and to harness the full potential of aquaculture as a pillar of the blue economy.

Planned Production Period in Aquaculture



98% of aquaculture production in the production planning scope.

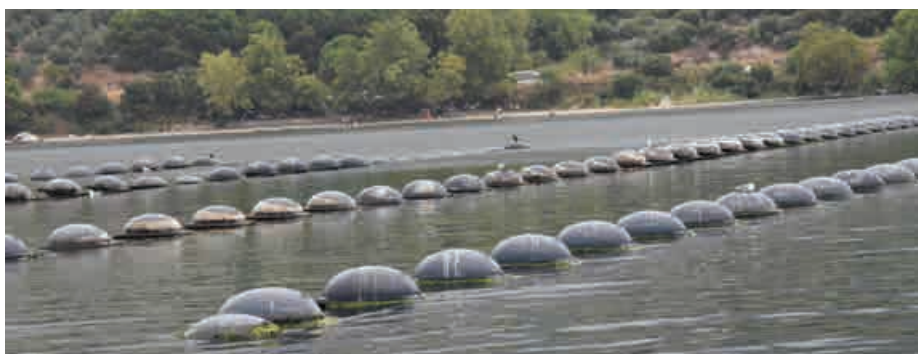
Mussel farming in Türkiye shows explosive growth

Aquaculture continues to expand globally, and the environmental sustainability of production systems, resource efficiency, and their contribution to food security have become increasingly prominent. Within this transformation process, bivalve species occupying low trophic levels, requiring no external feed inputs, and capable of being produced within the natural food web have gained growing attention.

In Türkiye, mussel farming represents one of the most noteworthy national examples of this international focus on low trophic level production. Mussels are not merely an alternative production commodity; rather, they constitute a strategic production field characterised by high environmental compatibility, a relatively low carbon footprint, economic scalability, and significant socio-economic contributions to coastal regions. Considering Türkiye's experience in marine aquaculture, its technical capacity, and its investment infrastructure, the mussel sector holds substantial development potential when supported by planned and strategic growth policies.

Sectoral development process and current capacity

Mussel farming in Türkiye has gained remarkable momentum over the past decade. Production, which stood at only 3 tons in 2015, reached 11,320 tons by 2024. This growth has progressed in parallel with the clarification of licensing



Longlines running parallel to the water surface have collector ropes suspended from them to which the mussel spat attach and grow into adults.

procedures, the strengthening of the investment climate, and the standardisation of production techniques. Today, there are approximately 60 mussel farming facilities across Türkiye with a combined annual production capacity of around 70,000 tons. Although actual production remains below projected capacity, this indicates a significant growth margin for the sector. Through area-based planning and gradual production increases, existing capacity can be utilised more efficiently. Considering that total aquaculture production has exceeded 577,000 tons, mussels still represent a relatively small share of overall output. However, their low input requirements,

comparatively manageable investment costs, and growing market demand position mussels as a scalable and strategically important sub-sector within the broader aquaculture industry.

In Türkiye, mussel farming is largely carried out along the Marmara and Aegean coasts. The majority of production takes place in the Sea of Marmara, particularly in the provinces of Balıkesir, Bursa, Çanakkale, and Yalova. In the Aegean Sea, facilities are located in İzmir, Muğla, and Balıkesir, while in the Black Sea region, production is carried out in Sinop province. These regions provide favorable conditions for mussel farming in terms of salinity, current regimes,

plankton productivity, and logistical accessibility. The coastal areas of the Sea of Marmara, in particular, possess characteristics that support production within the natural food web. During site selection, factors such as water circulation, depth, suspended solids concentration, and environmental sensitivities are carefully considered.

Longlines are the most common method of production

Mussel farming in Türkiye is entirely based on the Mediterranean mussel (*Mytilus galloprovincialis*). Production is predominantly carried out using longline systems. In this system, mussels attach and grow on collector ropes suspended from main lines positioned parallel to the sea surface. The harvesting period generally ranges between 12 and 18 months, depending on environmental conditions. Once mussels reach the appropriate market size and meat yield, they are harvested using mechanical or semi-mechanical systems and subsequently transferred to depuration and packaging processes.

As filter-feeding organisms, mussels feed by filtering suspended particles from the water column. Thanks to this characteristic, the production process is directly integrated into the natural nutrient cycle. When implemented through controlled and science-based planning, mussel farming represents a production model that is fully compatible with the ecosystem. Proper site selection, regular environmental monitoring, and strict adherence to carrying capacity limits constitute fundamental principles. In production areas, parameters such as temperature, salinity, dissolved oxygen, and chlorophyll levels are systematically monitored, and planning is carried out accordingly. This approach ensures that production

continues within the framework of environmental sustainability principles.

Although climate variability affects marine production systems, mussel farming demonstrates flexibility through an adaptive management approach. Increases in temperature, sudden salinity fluctuations, or changes in plankton composition may influence production performance; however, through regular monitoring and flexible harvesting schedules, risks can be maintained at manageable levels. The adoption of environmentally data-driven decision-making processes enhances the resilience of the sector. Particularly in the Sea of Marmara, a planned approach to production supported by scientific data is gaining increasing importance.

Regular analyses of mussels and water ensure food safety

Food safety is central to mussel farming. In Türkiye, harvesting areas are regularly monitored and classified as A, B, or C. Microbiological and chemical analyses are conducted periodically, and products intended for human consumption undergo depuration processes before being placed on the market. This robust control mechanism strengthens consumer confidence and contributes to the development of the domestic market. At the same time, it establishes a reliable foundation for expanding export potential.

Securing seed supply is critical for the sustainable growth of the sector. In this context, a bivalve hatchery is planned in the Bandırma district of Balıkesir province. This will:

- Ensure the supply of high-quality, disease-free seed,
- Reduce dependence on natural spat collection,
- Improve predictability in production planning,



Once they reach the desired size the mussels are harvested using mechanical or semi-mechanical methods.

- Enhance genetic quality and growth performance,
- Strengthen technical knowledge and sectoral expertise.

Through this investment, the production chain will become more controlled and structured, thereby reinforcing supply continuity.

Mussels are a rich source of high-quality protein, omega-3 fatty acids, vitamins, and minerals. Owing to their feed-free production model, they demonstrate high resource efficiency. With these characteristics, mussels support access to affordable and sustainable marine protein. From Türkiye's perspective, mussel farming contributes to economic vitality in coastal regions, creates new employment opportunities, and supports the blue economy approach. Its low-carbon production structure and environmental compatibility align the sector with national sustainable development objectives.

Mussel farming in Turkey serves as an important example of how aquaculture can evolve into environmentally responsible and economically viable production models. The sector's rapid development over the past decade demonstrates that mussel farming can grow in a controlled and sustainable

manner when supported by clear and predictable regulatory frameworks, appropriate site selection, and science-based management approaches. When evaluated within the perspective of sustainable food systems and the blue economy, mussel farming offers a strategic area of development for Turkey that

diversifies aquaculture production and considers environmental responsibility. With proper planning and adaptive management approaches, the sector is expected to make significant contributions to both the development of coastal regions and the sustainable supply of marine protein in the coming years.

Aquaculture Türkiye 2026, the country's largest aquaculture event

The Aquaculture Workshop, which has been successfully organized for many years by the Central Union of Aquaculture Producers of Türkiye (SUYMERBİR), joined forces for the first time with the Aquaculture Fair under the name “Aquaculture Türkiye 2026.” The event was one of the most comprehensive and highly attended sectoral events ever held in Türkiye.

As one of the key pillars of sustainable food production and economic development, Türkiye's aquaculture sector aims to reach a leading position worldwide. In line with this vision, the 11th Aquaculture Workshop—now a traditional event—together with the 1st Aquaculture Fair, brought together all the sector's stakeholders between 4 and 8 February 2026 in Antalya. Nearly 2,000 participants from many different countries attended the workshop sessions, while more than 50 companies promoted their products and solutions in the exhibition area. Participation extended from Europe to Asia and from Africa to the Americas and included representatives from Japan, the Netherlands, Denmark,

Norway, Russia, Spain, Belgium, Germany, the United States of America, Poland, and the Czech Republic, as well as from Central Asian countries, the Caucasus region, and Ukraine. The event reinforced Türkiye's regional leadership in aquaculture and highlighted its growing global influence.

Senior figures from the administration mingle with exhibitors for mutual benefit

At the opening ceremony of the event, Ahmet Sermed, President of Suymerbir, Turgay Türkyılmaz, Director General of

Fisheries and Aquaculture, and Hulusi Şahin, Governor of Antalya, outlined the general framework of the event. In his address, Deputy Minister of Agriculture and Forestry, Ebubekir Gizligider, emphasised the strategic importance of aquaculture in terms of national food security and export capacity. After the opening ceremony, high-level authorities visited the exhibition area and held one-on-one meetings with producers, suppliers, technology providers, and sector representatives. These engagements created a valuable platform for strengthening cooperation between the public and private sectors.

On the first day of the three-day workshop, presentations on aquaculture policies were delivered by the relevant department heads from the Ministry of

Agriculture and Forestry. During this session, comprehensive information was shared on Türkiye's future production projections, sustainability strategies, and allocation zones for aquaculture. As part of the workshop, Business Futurist Ufuk Tarhan delivered a presentation titled "From Fish to Data: The T-Transformation of Aquaculture," highlighting the importance of digitalisation and data-driven management in aquaculture. Later in the day, the Technology and Finance Session addressed recirculating aquaculture systems, innovative production technologies, and financing models for the aquaculture sector. Participants had the opportunity to review successful international case studies and exchange views on models that could be adapted to Türkiye. The Feed and Feed Additives Session focused on sustainable fish feed production, fish health, and the impact of climate change on the sector.

Sales and marketing are as important as production

The second day of the event began with sessions focusing not only on technological developments in aquaculture but also on sales, marketing, and export strategies. The commercial value chain in aquaculture, the process from marketing to export, and the rising position of Turkish salmon in global markets were thoroughly evaluated. Within the Fish Health Session, topics such as disease prevention, gut health management, and biotechnological solutions were discussed in detail. Scientific presentations also addressed practical approaches to the challenges faced by producers in the field. One of the highlights of the day was the Turkish Salmon Session, which focused on future offshore farming systems, fish health management, and the reliability of Turkish salmon in terms of human health. In



Turgay Türkyılmaz, Director General of Fisheries and Aquaculture, gave an opening speech at the event.

addition, a presentation on artificial intelligence and robots highlighted the sector's digital transformation process.

Cooperation across the region will boost the aquaculture sector

The third day of the event featured the FAOSEC-Türkiye Joint Session was held with participants from Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Ukraine, and Türkiye. This session created a strategic platform for strengthening regional cooperation in aquaculture across the Black Sea, Central Asia, and Caucasus regions. In another session, the Presidents of Producers' Associations Meeting, the experiences, expectations, and solution proposals of producer associations from across Türkiye were discussed. At the end of the day, the Panel and Evaluation Session provided an overall summary of the topics discussed throughout the three-day programme contributing

to the development of a shared roadmap for the future of the sector.

Aquaculture Türkiye 2026 has successfully become a showcase for Türkiye's aquaculture sector with its high-quality content, diverse participation, and strong international visibility. It has also established itself as a key reference point for sustainable growth and global cooperation within the industry. Bringing together public authorities, private sector representatives, suppliers, academics, and international organisations under one roof, this major event delivered strong messages regarding sustainable growth, innovative technologies, climate change adaptation, and regional cooperation in aquaculture.

With its high level of participation and growing international recognition, the event has clearly signalled that it will continue to expand in the coming years and build a strong institutional brand.

*Buket Yazicioglu Altintas,
Ph. D Secretary General
Central Union of Aquaculture Producers
of Türkiye*

Electrofishing as a valuable research tool

The ingenious idea of using electric current to stun and temporarily remove fish from water bodies has become a routine method in fisheries research. Electrofishing allows for the non-selective capture of fish with minimal harm, enabling species identification, examination, tagging, and release. Thus, the method contributes to answering many scientific and practical questions.

Reportedly, a coincidence sparked the development of this groundbreaking fishing technology. In 1910 Germany, when a 110-volt power line broke and both cable ends fell into the water below, masses of fish suddenly floated motionless at the site—only to miraculously revive when the power was switched off. This gave birth to the idea of using electricity for fishing, or ‘electrofishing.’ It took several more years



With the appropriate safeguards, the equipment used for electrofishing for research purposes is generally safe for both the operator and the fish.

before the first practical electrofishing devices came to market, but by the 1950s and 60s they had become the preferred method for many fisheries routines, conservation studies, and fish research applications. Since then, the technology has been continuously refined and made more user-friendly through modern electronics. Compared to mechanical netting methods, it is gentler on fish and—when all regulations are followed—safe for operators. Today, electrofishing is a standard fisheries biology technique, primarily used for qualitative and quantitative analysis of fish populations.

The basic principle of electrofishing is quite simple: An electric field is created in the water between two electrodes—a positive anode and a negative cathode. Within its effective range (averaging about 5 meters depending on current strength and waterbody type), fish are temporarily stunned, allowing them to be netted for examination or used for tagging and relocation purposes. When applied correctly, electrofishing causes no irreversible harm to fish; they recover fully after the ‘galvanonarcosis’ wears off, remaining lively and healthy. The advantages of this method are compelling. It yields viable catch results even in highly structured waterbodies with dense submerged vegetation and hiding spots that are largely inaccessible to traditional fishing gear. Fish of all locally present species and age groups can be captured and examined on-site for attributes like species, weight, length, and general health and nutritional condition. The captured specimens can be tagged, relocated to other waterbodies, or used for breeding purposes. The proportions of native versus non-native (potentially invasive) species provide insights into their habitat preferences and changes in aquatic ecosystems. Such data significantly contribute to a better understanding of the ecology of local fish communities. Results from electrofishing analyses are highly informative, particularly when they involve “time series” conducted regularly at the same time in



Electrofishing is a useful method for researchers to better understand the ecology of local fish communities and to relocate fish to other water bodies.

the same water section. This allows immediate detection of changes in species composition or the absence of offspring.

Known fish reaction patterns

The effects of the electric field generated in water between the two electrodes are now well understood. Once the voltage gradient along the fish’s body from head to tail reaches a critical threshold, the fish becomes immobilized and enters a state of “electro-narcosis.” Determining this exact critical value requires knowledge and experience, as it is influenced not only by the species and size of the fish but also by water conditions, particularly conductivity. While the stunning zone of the field should ideally be as large as possible, excessively high voltages can kill the fish, while voltages too low may trigger a fright response and scare them away. The catch efficiency for

larger fish is often higher because their greater body length typically results in a stronger voltage gradient. This can introduce a degree of size selectivity, especially since different fish species vary in their “internal conductivity” and escape behavior. Particularly “electrosensitive” species often flee upon merely sensing the electric field from a distance. However, once they enter the field, they too exhibit typical reactions. In the electric field, they are directed purposefully toward the anode (“anode taxis”) and become anesthetized upon approach (“galvano-narcosis”). They swim erratically toward the anode (“oscillotaxis”—a disoriented, twitching motion), occasionally losing balance and gradually becoming immobile. This electrically induced paralysis caused by overstimulation of nerves and muscles is termed “tetanus.” Despite their unconscious state, the fish are drawn almost magnetically toward the anode (“pseudo-taxis,” forced swimming), often even belly-up. In this condition, they can be easily netted and

transferred to a holding tank, where they “awaken” within minutes.

In electrofishing, direct current (DC) is generally preferred over alternating current (AC) because it creates a strong “attraction zone” that draws fish both actively and passively toward the anode (galvanotaxis). Additionally, DC is less harmful to fish and poses fewer risks to the operator. Direct current is typically applied in pulses, meaning it cycles on and off at high frequency, conserving power and extending battery life in portable devices. While AC produces a larger anesthesia zone, it frequently injures or even kills fish and is therefore used primarily when catch efficiency takes precedence over avoiding harm. AC devices are typically operated from boats when harvesting lakes and larger rivers.

Catch efficiency depends on many factors

Catch efficiency depends on temperature but primarily on water conductivity, which measures a waterbody's ion content and determines how effectively electricity is conducted through the water as well as the electric field's strength. In water bodies with high electrical conductivity, the electric charge disperses more widely, reducing electrofishing efficiency. For optimal catch results, conductivity should therefore be neither too high nor too low. This is why electrofishing in seawater—with its high salt and ion content—is possible but requires highly powerful equipment. The same applies to very hard water, though the power requirements here are significantly lower compared to marine environments. The best catch results in electrofishing are achieved in water bodies with conductivities around 70 to 75 $\mu\text{S}/\text{cm}$, typical of small streams and oligotrophic freshwater lakes. Here, small generators or backpack-mounted batteries often provide enough energy to

generate sufficiently strong voltages for electrofishing. Here, small generators or backpack-mounted batteries often provide enough energy to generate sufficiently strong voltages for electrofishing. However, conductivity must not be too low, as this would result in insufficient charge carriers for current conduction and a stable electric field.

In addition to water conductivity and temperature, factors such as turbidity, aquatic vegetation, and the complexity of waterbody structures—like the width and depth of the sampled area—also influence electrofishing efficiency. The composition and texture of the substrate can also alter the electric field. Soft substrates reduce catch efficiency more than coarse ones. To achieve comparable results, the current must be adjusted to local conditions, typically by fine-tuning the voltage. The current must not be too low, as some fish may escape, nor too high, as it could harm the fish. Experienced electrofishers recognize the optimal setting by observing fish behavior in the electric field.

Electrofishing requires specialized qualifications

Electrofishing equipment consists of three main components: the power source (either a generator, typically producing alternating current, or a battery/accumulator), the transformer (which converts AC to DC and regulates voltage), and the electrodes (anode and cathode), which conduct current into the water and generate the electric field. Typically, the cathode is a simple probe passively suspended from the device. In backpack units, this can be a simple trailing cable, colloquially called a “rat-tail cathode.” In larger setups operated from boats or rafts, the cathodes are often fixed. For boats with metal hulls, the hull itself can serve

as the cathode. Since stunned fish are drawn to the anode (a phenomenon called “galvanotaxis”), this electrode is often integrated into the metal hoop of the dip net for easier fish retrieval.

The reliability of scientific studies using electrofishing naturally depends on the type of waterbody and other factors. In flowing waters, for example, it hinges on the length of the selected river or stream section, which should ideally be representative and encompass diverse habitats—pools, riparian zones, sediments, rapids, and flowing stretches. While specific conditions vary based on study objectives, sampling typically covers a minimum of 100–150 m and a maximum of 300–1,000 m of flowing water. A common rule of thumb for electrofishing in streams suggests that the sampled stretch should equal roughly 30–35 times the average stream width to reliably estimate population sizes. Sometimes, multiple fishing passes may be necessary for this purpose.

Electrofishing is an effective and relatively harmless sampling technique, but it may only be conducted by trained professionals and is prohibited for unqualified individuals. When all regulations are followed, no serious harm to fish populations is expected. A U.S. study found that while fish experience stress from the electric current, they rarely sustain injuries that fail to heal or prove fatal. Fatalities mostly occur due to convulsive muscle spasms caused by sudden voltage changes, which can result in severe spinal injuries. Salmonids are considered particularly susceptible in this regard, whereas cyprinids are less so. However, when low-frequency pulsed DC (<30 Hz) is used, spinal injuries occur significantly less frequently. Whether electrofishing immediately before spawning adversely affects reproductive success is still disputed. However, it is suspected that electric currents may harm embryos. Therefore, electrofishing should be avoided in spawning areas.

Manfred Klinkhardt

Reviving traditional Danube fisheries through gastronomy and strategic storytelling

In Romania's Dobruja region, between the Danube and the Black Sea, small-scale fishing has shaped local economies and food cultures for centuries. A local restaurant is building on this heritage to encourage the consumption of fresh locally-sourced fish.

The identity of communities such as Ghindărești, a village on the lower Danube with a predominantly Russian-Lipovan population is shaped by the water, and they have developed culinary traditions closely linked to fishing practices. In recent decades, however, this way of life has come under pressure. Imported fish products, changing consumer preferences, and environmental pressure affecting fish stocks have reduced both the economic viability of traditional fisheries and the visibility of local fish in modern gastronomy. While Romania possesses extensive inland and coastal aquatic resources, local fish is increasingly absent from everyday consumption.

La Grisha, a family-run Local Gastronomic Point established in Ghindărești in 2022, was created as a practical response to this challenge. The project combines traditional fishing, local gastronomy, and professional communication strategies to restore value to Danube fish and to the communities that depend on it. Its experience offers a relevant case study for how strategic storytelling and direct-to-consumer models can support small-scale fisheries, rural development, and sustainable gastro-tourism.



Ioana Matei

The author's ancestral home, over a century old, was renovated to host the restaurant.

Fine dining in a renovated ancestral home

La Grisha operates under Romania's Local Gastronomic Point (LGP) framework, a relatively recent legal model

that features short supply chains, and supports rural entrepreneurship, and culinary heritage. Unlike conventional restaurants, LGPs are small-scale units located in private homes or farms, serving limited numbers of guests and relying primarily on local, seasonal ingredients.



Ioana Matei

Much of the fish served is caught by small-scale fishers using traditional gears.

For the Matei family, this meant restoring their ancestral home – a century-old house with iconic blue-and-white lace woodwork – and opening it to visitors. They operate strictly by reservation and are open only on weekends. This creates an environment that feels more like a private invitation than a commercial transaction. With a rotating daily menu dictated by the day's catch and staffed almost entirely by the family, guests are welcomed not as customers, but as old friends. This intimacy is the foundation of the brand. It allows the story, the food, and the people behind it to remain

inseparable, and creates “scarcity value” that a traditional high-volume restaurant can never achieve.

Traditional recipes made with fresh ingredients

The menu draws on the robust culinary heritage of Dobruja, a region defined by the confluence of the Danube and the Black Sea, on family recipes and the fresh fish brought in by the village

fishermen. Many consumers, particularly those from urban centers, are wary of river fish. They are often intimidated by their complex bone structures or hold prejudices about the flavour profile. At La Grisha, the kitchen serves as a laboratory to disprove these myths, elevating species like common carp (*Cyprinus carpio*), catfish (*Silurus glanis*), pike (*Esox lucius*), Pontic shad (*Alosa pontica*) and smaller white fish into rich delicacies. For example, guests may begin with an assortment from the family pantry: hand-whipped fish roe, smoked and marinated fish, preserved using techniques passed down through generations. They

might continue with *saramură*, a rustic dish of grilled fish served with polenta or *storcean*, a creamy sturgeon soup. While wild Danube sturgeon is strictly protected, La Grisha uses legally sourced aquaculture sturgeon, preserving culinary tradition while communicating the importance of conservation measures. Other dishes, like *spadlivka*, a slow-cooked catfish stew or *malasolka*, a winter specialty of salt-cured pike are often favourites even for Romanian guests.

Making a remote village visible

The founders quickly realised that serving exceptional food was only the first step. Ghindăreşti is a village of only 2,000 inhabitants, far from established routes and with no tourist infrastructure. From the outset, visibility was the primary barrier. La Grisha approached communication not as promotion, but as business strategy. The restaurant was marketed as a family home where three generations lived, and where the youngest son, Grisha, restored the house and inherited its legacy. Social media and press materials focus on continuity, on fishing techniques, family rituals, and the life of the river.

Fresh Danube fish, ethnic Lipovan heritage, family history, and the surrounding natural landscape form the core identity. By consistently reinforcing these elements across all channels (website, social media, PR engagements etc), La Grisha positioned itself as a destination rather than a venue. Moreover, the project does not aim to attract everyone. The ideal guests are educated, urban consumers with the means and curiosity to seek authentic experiences. This strategy determined the tone, visuals, and digital marketing, drawing visitors from hundreds of kilometres away. In addition, the communication strategy explicitly shares the stories of the local fishermen, beekeeper, vegetable farmer,



Ioana Matei

Traditional recipes using freshly caught fish characterise the food at La Grisha.

or baker the restaurant sources from. Besides the day to day service, La Grisha also organises special events like wine tastings, fine dining menus with guest chefs, and themed cultural evenings.

The result is a steady flow of visitors, national media coverage, conference invitations, and even a documentary film, all emerging from a village that few Romanians could locate on a map just a few years ago.

What began as a small family project has evolved into a driver for local development. Fish is sourced from local fishermen who rely on low-impact, artisanal fishing methods and traditional wooden *lotca* boats. When a species is spawning, it disappears from the menu and guests are told why. In a world where traditional fishing is in decline and younger generations are reluctant to join the profession, the restaurant demonstrates that gastro-tourism can provide a viable economic future and could thereby inspire young people to stay rather than migrate from their communities.

Encouraging the consumption of local fish

While Romania possesses a significant aquatic surface across its extensive river network, the Danube Delta, numerous lakes, and the Black Sea coastline, statistics indicate that approximately 70-80% of the fish consumed in Romania is imported. Recent industry analyses highlight that while consumption is growing, it is largely driven by frozen white fish fillets and salmon. Local fish is often overlooked due to a lack of processing infrastructure and a perception that local fish are bony and difficult to clean and cook. By focusing on freshness, local origin, and unique recipes, restaurants like La Grisha may be able to revive interest in fish from the region.

Ioana Matei, senior communications consultant and co-founder of La Grisha, hello@ioanamatei.info, www.ioanamatei.info, www.lagrisha.ro

Refining flavour, enhancing aromas, upgrading food

Herbs and spices help unlock worlds of enjoyment

You do not have to be a vegetarian or vegan to enjoy consuming plants or parts of them. We use them daily in the form of herbs and spices, without which our diet would be rather dull, bland, and unimaginative. Our ancestors already knew that spices taste good and have health-promoting effects. The history of “seasoning” is full of true stories and unproven legends.

Spices inspired people to undertake bold adventures long before Christopher Columbus and Vasco da Gama. In search of pepper, nutmeg, and cinnamon, oceans were crossed, distant lands discovered, and bloody wars fought. Because exotic spices were so valuable, they served as status symbols for rulers and became the source of legends. One such legend claims that Nero allegedly scattered vast amounts of precious saffron on the streets of Rome to celebrate his entry into the city “appropriately.” Pepper was at times so valuable that it was even used as currency. It is said that corrupt judges were occasionally bribed with spices in court. That would be difficult today, as spices are now ubiquitous and most are quite affordable. Their value today is assessed less in financial terms and more in culinary ones, as salt and pepper alone are rarely enough in many kitchens. Seasoning correctly is a key skill in cooking, both for amateurs and professionals. Even boring home cooking can be elevated with spices and transformed into aromatic dishes. Those unfamiliar with the field can turn to spice blends, which can enable even



Spices were once associated with the Orient, exotic markets, and bazaars. Spice traders, like those in Oman, still offer a wide selection today.

talentless but ambitious hobby cooks to recreate popular classics from Italian or Asian cuisines.

Well-seasoned dishes stimulate our taste buds and sometimes even fire up the imagination. With spices, anyone can travel the world without setting foot outside their kitchen. The idea of enhancing the taste of food through seasoning appears to go back a long way. Historians believe that, as early as the Stone Age—certainly since the Neolithic Revolution that began in our regions six to eight thousand years ago—food was refined with salt and pungent

mustard spices. According to an accepted theory, early humans wrapped pieces of fish and meat in leaves for protection and later discovered that the wrapping positively altered the aroma and taste of the contents. If true, hunters and gatherers may have been greater gourmets than we imagine. It was not a big leap from such accidental discoveries to the deliberate use of herbs and spices. Over time, people learned which herbs and spices best suited which foods. Initially, local spices were understandably used. In what is now Turkey, capers were already in use



Unlike in northern Europe, spices in Asia are often freshly prepared as pastes or pre-mixed for cooking and spread an intoxicating aroma in the markets.

6,750 years ago. In the tomb of Pharaoh Amenhotep II, traces of dill have been found; in Tutankhamun's, garlic. In the western Baltic region, garlic mustard likely flavoured fish and game three to four thousand years ago, as evidenced by residues of the slightly peppery, garlic-tasting herb. Sumerian clay tablets from the 3rd millennium BC list several aromatic spice plants, including thyme.

Access to spices brought power and wealth

Spices were not only used to season food, but also frequently served as medicinal remedies and religious offerings. The New Testament mentions the "religious tithe," which includes "a tenth of your spices—mint, dill, and cumin" (Matthew 23:23). Today, spices are absolutely ubiquitous—even in space: in 1982, spices were integrated

into the astronaut diet of the US Space Shuttle programme.

Etymologically, the word "Gewürz" (spice) is said to derive from the Middle High German "wurz," meaning root. This is plausible, as spices are almost exclusively of botanical origin. However, it is also a simplification, since the flavouring effect often does not come from the root alone but from other plant parts that contain the essential oils responsible for their characteristic taste and smell. They are used fresh, dried, or otherwise processed, either pure or in spice blends. In some plants, such as caraway, cinnamon, and nutmeg, multiple parts may be used as spices.

Classification of common spices by plant origin

Plant part – Spices (selection):
Roots, rhizomes, bulbs – Onion, garlic, turmeric, ginger, galangal, horseradish, wasabi

Bark – Cinnamon, cassia
Leaves – Bay leaf, lime leaves
Buds, flowers, floral parts – Cloves, saffron, capers
Seeds – Fennel, mustard, nutmeg, black pepper, caraway, anise, juniper berries
Fruits – Cayenne pepper, Chimayo pepper
Resin – Asafoetida (devil's dung)

The bold claim that the demand for and trade in spices significantly influenced the course of history is not at all exaggerated. Spices were valuable, and the search for their sources led to the creation of the first international trade routes. There was fierce competition for dominance in the global spice trade, which changed hands multiple times. Initially dominated by Arab merchants, the trade was taken over by Venetian intermediaries, who held a monopoly from the 8th to the 15th century. The Portuguese later assumed control, with Vasco da Gama's 1498 voyage opening the direct sea route to India's spice riches. This marked the start of direct trade between Europe and Southeast Asia. The Portuguese reign was short-lived, as the Dutch took over at the end of the century. With outposts on the Moluccas, Java, Mauritius, and other "Spice Islands," the Dutch East India Company controlled markets for cloves and nutmeg. The Portuguese retained dominance only in the cinnamon trade. In the mid-17th century, the British East India Company gained exclusive control of trade with India, which remains the world's main spice supplier, meeting nearly three-quarters of global demand.

Price drop through expansion of cultivation areas

Black pepper (*Piper nigrum*), once considered the "king" or "mother" of all

trade and markets



Even at market stalls and small street-side food stands, spices are an essential element of every proper dish.

spices, is still a standard seasoning used in almost every dish. The derogatory nickname “Pfeffersack” for wealthy Hanseatic spice traders dates from the 13th century. Although many new spices have emerged since, pepper has remained significant. Columbus’s discovery of the “New World” introduced allspice, chilli,

and especially vanilla to Europe. Colonial powers jealously guarded their monopolies on valuable spices like pepper, nutmeg, cloves, and cardamom. Export of seeds and cuttings was strictly forbidden, often punishable by death. Nonetheless, smuggling occurred, and cultivation spread to other regions with similar

climates. As production increased, so did supply, and prices fell. In the late Middle Ages, when the Portuguese took over trade from the Arabs, only about 1,000 tonnes of pepper and the same amount of cinnamon, ginger, and other spices reached Western Europe annually. By 2019, EU countries imported 379,000 tonnes from non-EU states. The global spice trade exceeded two million tonnes, with India still the main supplier, followed by Bangladesh, Turkey, China, Pakistan, Iran, and Nepal.

Even though market prices have dropped significantly over the centuries, the spice trade remains profitable. A 1393 document states that a pound of nutmeg was worth “seven fat oxen.” In the early Middle Ages, before the Crusades, only the wealthy could afford exotic flavours. A pound of saffron equalled the price of a horse; two pounds of mace, a cow; and a pound of ginger, a sheep. Today, prices are far lower, although some spices still command high prices. Saffron, often cited as the world’s most expensive spice, costs €10,000 to €15,000/kg. The Aji Charapita, a rare, pea-sized chilli from the Amazon, can reach \$25,000/kg.

Black pepper, once worth its weight in gold—equivalent today to about €80,000/kg—is now far cheaper. As of



Despite the wide variety, pepper still tops the list of the most popular spices. Europe imported some 88,000 tonnes of pepper in 2024.



Mace, cinnabar red when fresh, impresses with its fine, spicy scent and aroma. However, it is not a flower but the seed covering that encases the nutmeg.



Chillies come in various levels of pungency (Scoville scale) worldwide. While Europeans are sparing in their use of chilli, the pods are an inevitable element in Asian cuisines.



The highly aromatic vanillin in vanilla is found in some varieties not only in the pulp but also in the pod. Fish fillet with vanilla sauce may sound unusual, but it is recommended online.

September 2024, black pepper from Vietnam, the world's top producer at over 220,000 tonnes annually, cost just over \$6,500 per tonne. Complaints about supermarket prices of €30–€40/kg seem almost understandable. However, global and retail prices depend not only on the product, quantity, freshness, or processing but also on standards defined by the International Organization for Standardization. ISO series 67.220.10 covers spices and seasonings, while 67.220.20 applies to food additives. These standards are important because spices are sold fresh or dried, whole, crushed, chopped, rubbed, ground, and sometimes as concentrates or extracts. Their flavour depends not only on their chemical composition but especially on their volatile organic compounds (VOCs), which define their specific aroma.

Spices often credited with miraculous healing powers

VOCs can oxidise upon air contact, altering their properties. Grinding increases surface area, leading to faster evaporation

and oxidation. To preserve flavour, spices are best stored whole and protected from light, to be ground as needed. Whole dried spices usually last around two years, while ground ones often lose potency after six months. Some flavour compounds are water-soluble, others fat-soluble, so spices should be added early during cooking to fully develop their aromas. Whether a spice is added at the beginning, near the end, or only during serving indicates the cook's knowledge and culinary finesse. In contrast, herbs are usually added late or sprinkled over the finished dish, like parsley.

Many theories circulate about the functions and effects of spices, some supported by evidence, others not. A common but doubtful claim is that spices preserved meat or masked spoiled flavours in the Middle Ages. Spices' preservative effect is minor compared to salt, which was widely used. Those who could afford expensive spices likely did not need to eat spoiled meat. However, spices were believed to have healing properties. Juniper and rosemary were burned to ward off plague and other diseases. While it is unclear how effective this was, it is now proven that cinnamon, oregano, garlic, and other spices have antimicrobial effects.

Fish is hard to imagine without spices

This does not protect them from microbial contamination. A 2007–2009 FDA study found about 7% of spice shipments to the USA were contaminated with salmonella. However, the FDA saw no urgency, as spices are usually cooked at temperatures that kill pathogens. Between 2018 and 2022, Germany's LAVES tested 118 samples of frozen herbs and found some contaminated with harmful bacteria, leading to product recalls. As frozen herbs are often used raw in salads and dressings, they are now routinely tested.

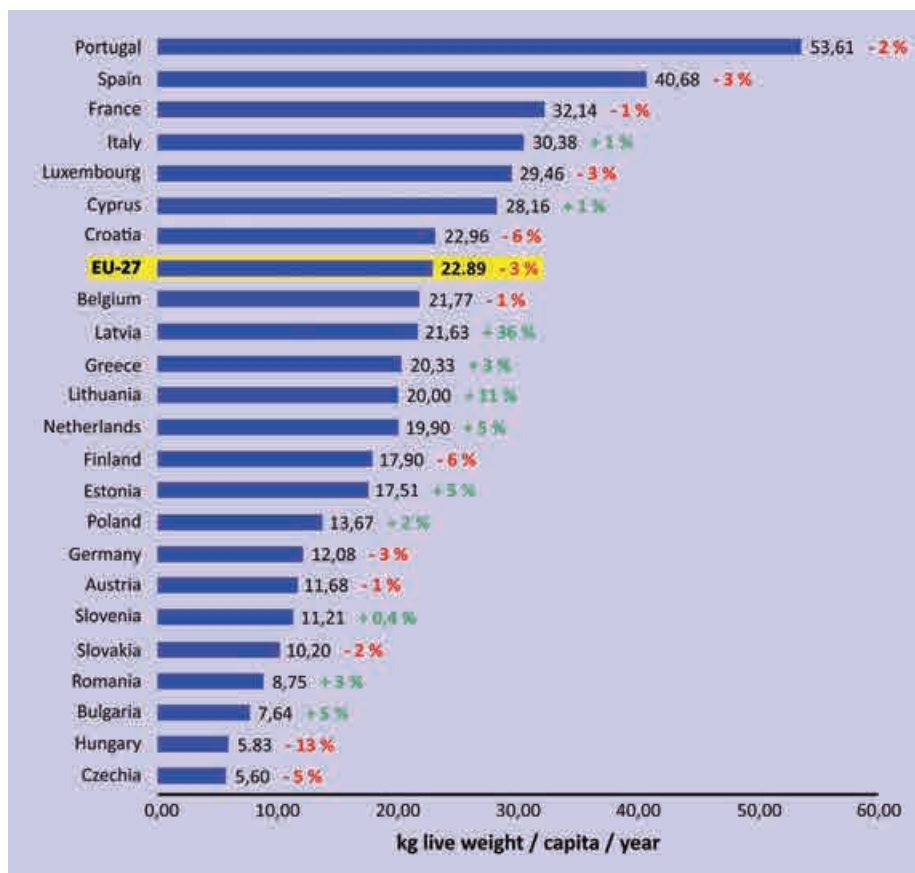
Although not all spices suit fish and seafood, they have always been used in such dishes. Mild options include parsley, tarragon, dill, and thyme. Stronger flavours include garlic, onions, celery, cayenne pepper, smoked paprika, ginger, or lemon. Regardless of taste preference, spices should be used sparingly to avoid overpowering the delicate flavour of fish. The same applies to marinades, which typically consist of an acid (e.g., vinegar, wine, citrus), oil (e.g., olive or sesame), and an aromatic agent such as herbs and spices. *Manfred Klinkhardt*

Fish consumption at lowest level of the past decade

The EUMOFA Market Report 2025 estimates EU fish and seafood consumption for 2023 at 10.25 million tonnes (live-weight equivalent), the lowest figure since 2014. This corresponds to a drop in average per capita consumption from 24.6 kg/year to 22.89 kg in 2023. Fisheries products accounted for 7.32 million tonnes and aquaculture products for 2.92 million tonnes of supply, corresponding to per capita consumption of 16.36 kg and 6.53 kg, respectively.

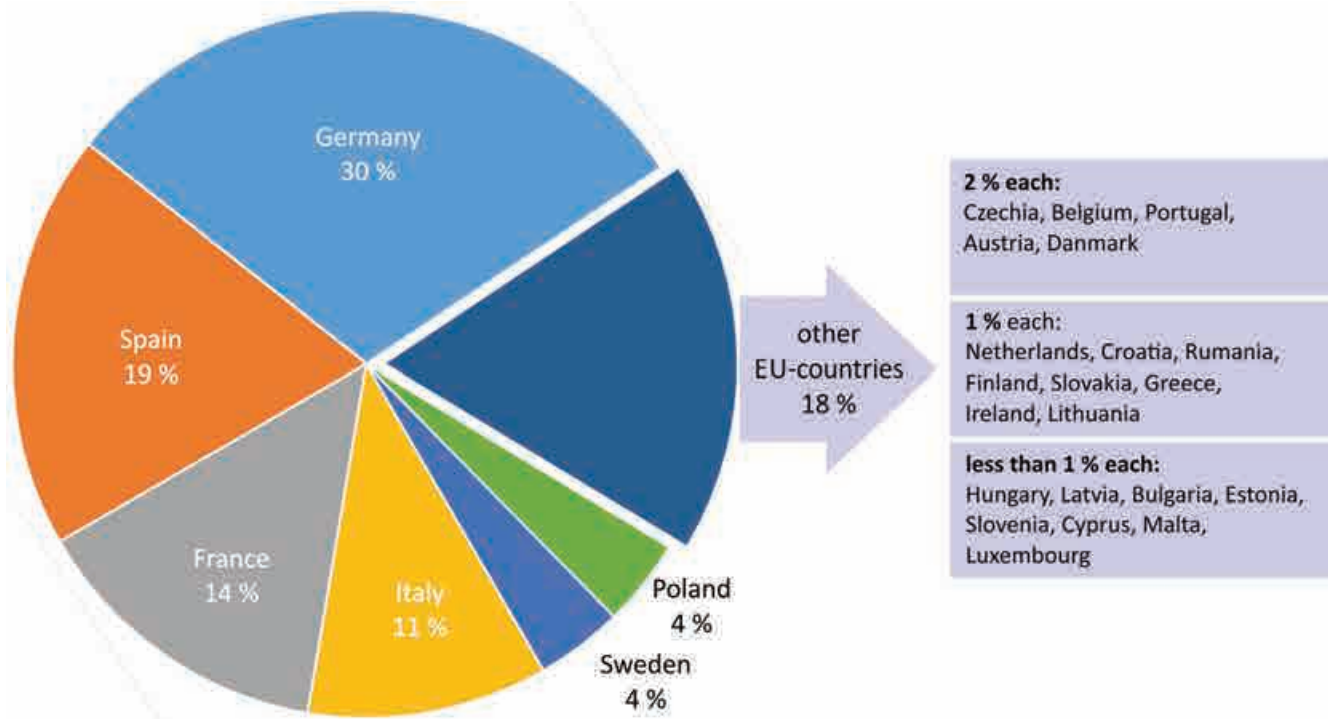
EU countries undoubtedly rank among the world's leaders in terms of average purchasing power. Educational levels and knowledge about healthy diets can also be regarded as high. Nevertheless, average annual per capita consumption of these healthy foods, at 22.89 kg, was only slightly above the global average, which the FAO puts at just under 21 kg for 2023. One weakness of such mean-value calculations, which, strictly speaking, are estimates, is that they smooth out differences between individual countries. Within the EU, the range runs from Hungary and Czechia, which do not even reach 6 kg of fish per person per year, to 53.61 kg in Portugal. Yet even this impressive amount, the highest in the EU, is actually a sharp decline within only a few years: in 2018, the average Portuguese citizen still consumed around 61 kg of fish and seafood per year.

In almost all EU countries, retail accounts for the largest share of total sales of fisheries and aquaculture products, with processed products dominating in particular. The retail share ranges from at least 60% in Germany to a maximum of 90% in Romania. The only country where sales in foodservice were higher than in retail was Greece, with 44%



Apparent per capita consumption of fisheries and aquaculture products in EU Member States in 2023, and percentage change 2023/2022.

Source: EUMOFA estimates and national sources for a selection of countries.



Largest EU consumer countries for processed products in 2024 (share of total sales volume in retail and foodservice).

Source: Euromonitor International, Packaged Food, Industry Edition 2025.

in retail and 56% in foodservice. Across Europe, the impact of the COVID-19 pandemic is clearly visible in this analysis, as foodservice revenues fell sharply almost everywhere in 2020. Since restaurants reopened, they have been recovering gradually, while retail volumes slowly fell from their 2020 peak to their low point in 2024 (around 1.5 million tonnes). In most EU countries, retail volumes remained approximately stable in 2023 and 2024, according to the EUMOFA Market Report, but in Italy and Germany, two of the six largest consuming countries, the retail sector had to absorb painful declines of 7.5% and 4.1%, respectively, pulling the overall EU trend downwards.

Processed fish products are especially popular

Out-of-home consumption in the HORECA sector, which fell to its EU-wide low

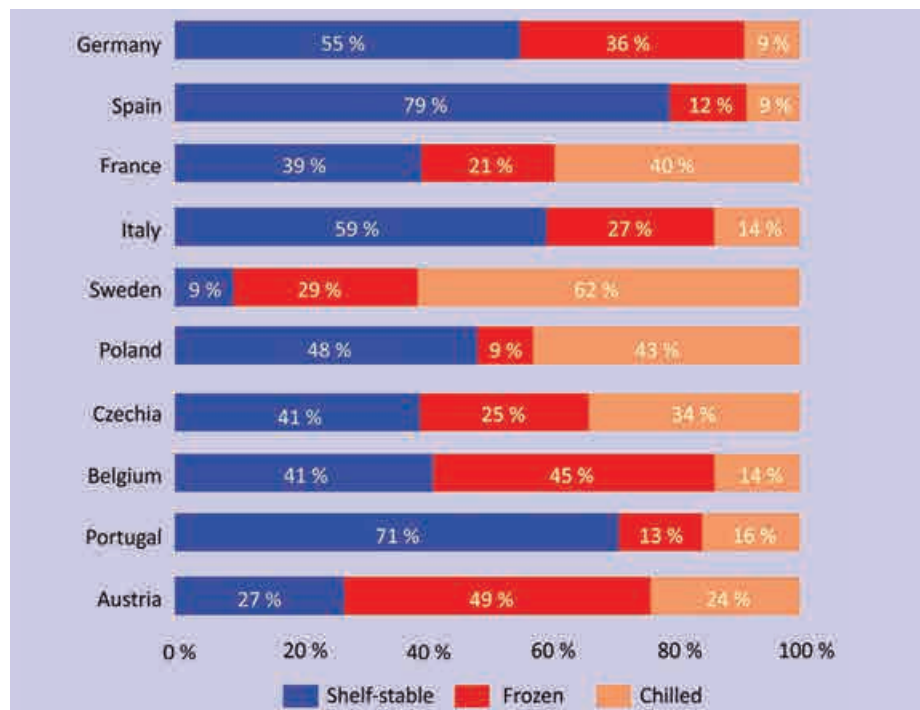
of around 370,000 tonnes in 2020, recovered again from 2021 onwards. Most recently, it exceeded 587,000 tonnes in 2023–2024, an increase of 4.7%. Nearly all countries recorded growth in out-of-home consumption, led by Germany which, with an increase of 13,100 tonnes (+5.4%), even surpassed pre-pandemic levels. Euromonitor estimates that out-of-home consumption will continue to rise over the next five years and could reach more than 660,000 tonnes by 2029.

Traditionally, processed fisheries and aquaculture products play a particularly important role in the EU market. Consumption of such products in foodservice and retail reached just over 2.1 million tonnes in 2024, a rise of 1% compared with 2023. This continues the recovery that began in 2021 following the COVID-19-related decline in 2020. According to Euromonitor's forecast, this upward trend is expected to continue, with an average annual growth rate of 0.7% through to 2029. The development is

concentrated mainly in Germany, Spain, Italy, and France, the four largest consumer countries, which together accounted for 74% of total consumption in 2024. Germany alone contributed 30% of total consumption, followed by Spain with 19%, France with 14%, and Italy with 11%. However, looking at per capita consumption of these products reveals a more diverse picture. The largest consumers were Spain (just over 8 kg), Sweden (almost 8 kg), and Germany (just under 7.5 kg), followed by Denmark (just over 6 kg) and Croatia (just over 5 kg). France ranked sixth (just under 4.5 kg), ahead of Italy (just over 4 kg), and, at a considerable distance, Poland (around 2 kg).

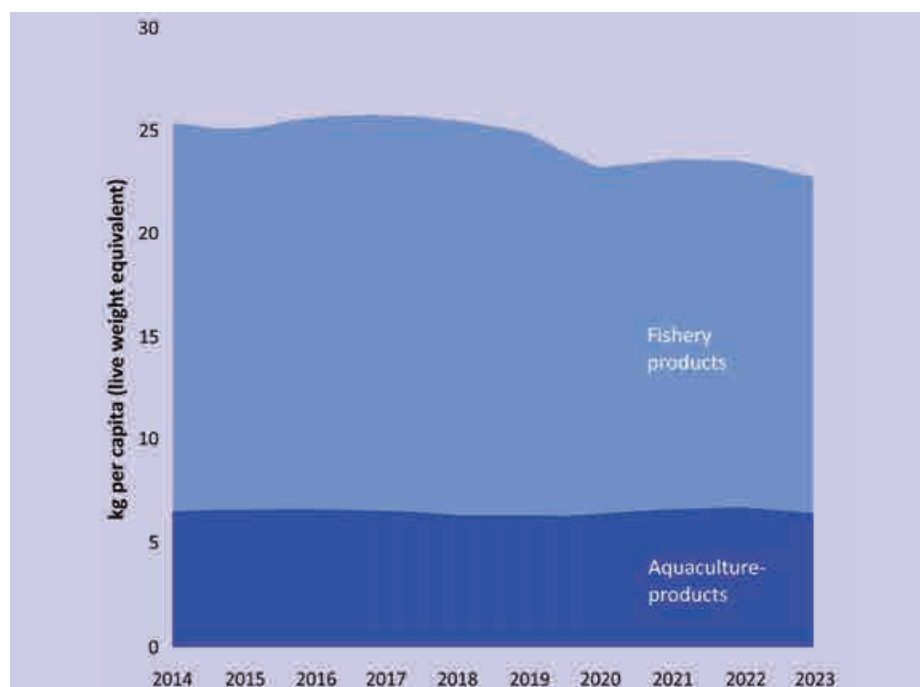
Will Pre-COVID levels only be reached again in 2029?

Shelf-stable (preserved) products are the most important category among



Main categories of processed products sold in retail and foodservice in 2024 (as % of total volume in the 10 EU countries with the highest total consumption).

Source: Euromonitor International, Packaged Food, Industry Edition 2025.



Per capita consumption of fisheries and aquaculture products.

Source: EUMOFA, based on EUROSTAT and FAO data.

processed fisheries and aquaculture products in retail and foodservice. In 2024, they achieved EU-wide sales of more than 1.1 million tonnes. They were followed by frozen products with more than 565,000 tonnes, and chilled products with more than 400,000 tonnes. In 2024, the average share of shelf-stable products in total sales across EU countries was 40%, indicating strong demand for these products. In five of the 27 EU countries, shelf-stable products accounted for more than half of retail sales and out-of-home consumption of processed fish and seafood products. In Spain, this share was 79%, in Portugal 71%, in Slovenia 63%, in Italy 59%, and in Germany 55%. In three of the 27 EU countries (Sweden, Croatia, and Latvia), shelf-stable products were less popular, accounting for 9%, 11%, and 29% of sales, respectively. The average share of frozen and chilled products was 30% each. Croatia, at 69%, was the only EU country where consumption of frozen products accounted for more than half of retail sales and out-of-home consumption of processed fish products. For chilled products, this applied to Estonia (69%), Lithuania (65%), Sweden (62%), and Slovakia (51%).

Total out-of-home consumption of unprocessed products in the countries analysed reached only 665,000 tonnes by the end of 2024. In the view of Euromonitor experts, the pre-pandemic level of more than 736,000 tonnes will probably only be reached again in 2029. Here too, however, there are differences between EU countries. In Italy, consumption in 2024 was already almost 110,000 tonnes, which was even higher than the 107,000 tonnes recorded in 2019. France is expected to slightly exceed the pre-pandemic level by the end of 2025, Spain by the end of 2026, and Poland by the end of 2027. However, Germany and the United Kingdom are also expected to remain below pre-pandemic levels over the next four years.

Manfred Klinkhardt



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